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MIL-V-24109A(SHIPS)  
31 August 1971  
~~SUPERSEDING~~  
MIL-V-24109(SHIPS)  
12 November 1964  
(See 6.3)

#### MILITARY SPECIFICATION

VALVES, GLOBE, ANGLE, QUICK CHANGE CARTRIDGE TRIM,  
HIGH PRESSURE (H.P.) HYDRAULIC AND PNEUMATIC  
(SIZES 1/8 - 1-1/4 INCHES)

#### 1. SCOPE

1.1 This specification covers the design, construction, test and operating requirements for manually operated quick change cartridge trim globe and angle valves with a nominal pressure rating of 6000 pounds per square inch gage (psig) for use in H.P. hydraulic and pneumatic systems.

#### 2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

#### SPECIFICATIONS

##### FEDERAL

PPP-P-40 - Packaging and Packing of the Hand Tools.

##### MILITARY

MIL-P-116 - Preservation, Methods of.

MIL-R-196 - Repair Parts of Internal Combustion Engine, Packaging of.

MIL-S-901 - Shock Tests, H.I. (High-Impact); Shipboard Machinery, Equipment and Systems, Requirements for.

MIL-D-1000 - Drawings, Engineering and Associated Lists.

MIL-D-1000/2 - Drawings, Engineering and Associated Lists.

MIL-C-15726 - Copper-Nickel Alloy, Rod, Flat Products (Flat Wire, Strip, Sheet, Bar and Plate) and Forgings.

MIL-B-23921 - Bronze, Nickel Aluminum Castings for Seawater Service.

MIL-B-24059 - Bronze, Nickel Aluminum, Rod, Flat Products with Finished Edges, Shapes and Forgings.

#### STANDARDS

##### MILITARY

MIL-STD-167 - Mechanical Vibrations of Shipboard Equipment.

MS28775 - Packing Preformed, Hydraulic, +275°F. ("O" Ring).

(Copies of specifications, standards, drawings, and publications required by suppliers 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 or request for proposal shall apply.

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

B-26 - Aluminum-Base Alloy Sand Castings.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.)

##### UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules.

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(Application for copies should be addressed to the Uniform Classification Committee, 202 Union Station, 516 West Jackson Boulevard, Chicago, Illinois 60606.)

## NATIONAL BUREAU OF STANDARDS

Handbook H28 - Screw Thread Standards for Federal Service.

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

## 3. REQUIREMENTS

3.1 Qualification. The valves furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at time set for opening of bids (see 4.2 and 6.3).

3.2 Design concept. Valves furnished under this specification shall utilize the cartridge concept where all working parts are removable as an assembly. All valves shall utilize the standard bodies shown in the appendix to this specification thus permitting full interchangeability between cartridge assemblies regardless of the manufacturer.

3.3 Design features.

3.3.1 Standard parts. The following parts shall be made in accordance with the drawings in the appendix to the specification.

- (a) Valve bodies.
- (b) Valve seats.
- (c) Seat "O" rings.
- (d) Lower disc construction.
- (e) Lower bonnet cartridge construction.
- (f) Bonnet cartridge "O" rings and backup rings.
- (g) Vent valve stems.
- (h) Handwheels.

3.3.2 Valve disc. The valve disc shall be adequately guided in the bonnet to assure alignment of the disc seating surface with the valve seat. A swivel joint which permits removal of the disc shall be used between the disc and stem for sizes 3/8 through 1-1/4. Threaded retainers shall utilize a prevailing torque locking feature or other suitable means to prevent accidental loosening. The disc-stem connection shall be designed so that the maximum pressure rating can be applied in either direction and the valve opened against (or with) full pressure across the disc.

3.3.3 Rising stem construction. A rising stem-outside screw construction shall be utilized. The stem threads shall be acme or modified acme form and shall be isolated from the operating media by the stem seal.

3.4 Materials of construction. Materials shall be as specified in table I. All materials shall be selected to prevent corrosion and galling.

Table I - List of materials.

Name of parts	Material
Body	Aluminum } Cast: MIL-B-23921 Bronze } Forged: MIL-B-24059
Bonnet	Aluminum } Cast: MIL-B-23921 Bronze } Forged: MIL-B-24059
Seat	70-30 nickel-copper CRES (300 series)
Stem	70-30 nickel-copper CRES (300 series)
Disc	70-30 copper-nickel: wrought: MIL-C-15726
Handwheels	Aluminum-cast: ASTM B-26, alloy 2661
Seals and back-up rings	Buna, butyl, viton, teflon, polyurethane or other materials when specifically approved by the Naval Ship Engineering Center.

3.5 Size. Size shall be as specified (see 6.2).

3.6 Body configuration. Body configuration globe or angle shall be as specified (see 6.2).

3.7 Handwheel rotation. All valves shall close by clockwise rotation of the handwheel when facing the handwheel.

3.8 Valve disc lift. Minimum internal lift of the disc off the seat shall be as given in table II.

Table II - Minimum disc lift.

Valve size IPS	Minimum lift, inches
1/8	0.125
1/4	.300
3/8	.360
1/2	.375
3/4	.410
1	.460
1-1/4	.500

3.9 Handwheel torques. Maximum seating, unseating and running torques shall be as given in table III when pressurized with air at 6000 psig.

Table III - Maximum torques.

Valve size IPS	Torque (inch-pounds)	
	Running	Seating and unseating
1/8	15	30
1/4	25	50
3/8	35	70
1/2	50	100
3/4	80	160
1	150	300
1-1/4	250	500

3.10 Mechanical shock and vibration. All valves shall be designed to meet mechanical shock requirements of MIL-S-901 and vibration requirements of MIL-STD-167.

3.11 Body markings. Valve bodies shall be permanently marked to show the following information:

- (a) Size.
- (b) Rating (6000 psig).
- (c) Manufacturer's name or trade-mark.
- (d) Flow arrow.

3.11.1 Special markings. The words "LEFT-HAND THREADS" shall be permanently marked at three locations on the bonnet periphery 120 degrees apart.

3.11.2 The following information shall also be permanently marked on the valve assembly or on an identification plate, made of a corrosion-resistant material, securely attached to the bonnet:

- (a) MIL-V-24109
- (b) Manufacturer's drawing or parts list number.
- (c) Manufacturer's model and part number or catalog number.
- (d) Space for nine-digit CID number.

3.12 Drawings. Drawings shall be in accordance with categories A, G or H of MIL-D-1000 as applicable.

3.12.1 Preliminary drawings. Preliminary drawings which are sufficient to permit evaluation of the design and approval of materials, shall be submitted with bids to the procuring activity. These drawings shall show the following

- (a) Accurately scaled sectional assembly which clearly depicts the design and construction of the valve.

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- (b) Bill of material listing specification, grade, condition and any other data required to fully identify the properties of the materials proposed.
- (c) Outline dimensions, disassembly space, location and size of end connections and mounts.
- (d) Estimated weight and limitations on installation.
- (e) Reference previous shock and vibration approval for valve and test report numbers.

3.12.2 Final drawings. Final drawings and certification data sheets shall be submitted to the procuring activity for approval within 60 days after date of contract. These drawings shall be in accordance with types II and III of MIL-D-1000/2 except for extent of detail. Only the information required in 3.12.1 need be furnished for the type II drawings. The following data shall be furnished for the type III drawings:

- (a) Ship identification.
- (b) Applicable assembly drawing number(s).
- (c) CID (APL) number.
- (d) Application description.
- (e) Valve description.
- (f) Any deviations from referenced assembly drawing(s).

3.12.3 Limited rights legend. When the Government has only limited rights in the data shown on the drawings, as determined by the contractual provisions regarding rights in technical data, the drawings furnished may be marked with the following restrictive legend:

"Furnished under United States Government Contract No. \_\_\_\_\_. Shall not be either released outside the Government, or used, duplicated, or disclosed in whole or in part for manufacture or procurement, without the written permission of \_\_\_\_\_, except for: (a) emergency repairs or overhaul work by or for the Government, where the item or process concerned is not otherwise reasonably available to enable timely performance of the work; or (b) release to a foreign government, as the interests of the United States may require; provided that in either case the release, use, duplication or disclosure hereof shall be subject to the foregoing limitations. This legend shall be marked on any reproduction hereof in whole or in part."

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Qualification tests.<sup>1/</sup> Qualification tests shall be conducted at a laboratory satisfactory to the Naval Ship Engineering Center. Qualification shall consist of the examination and tests specified in 4.2.2 through 4.2.8.

4.2.1 Qualification test samples. The following size valves shall be submitted for qualification examination and testing:

- (a) 1/4 inch ips to qualify sizes 1/8 and 1/4 inch ips.
- (b) 1/2 inch ips to qualify sizes 3/8 and 1/2 inch ips.
- (c) 1 inch ips to qualify sizes 3/4 and 1 inch ips.
- (d) 1-1/4 inch ips to qualify size 1-1/4 inch ips.

The test valve may be of either globe or angle body configuration and approval will apply to both. Detailed engineering drawings shall be submitted with the valve(s) to be tested in addition to 100 percent spare trim and gaskets.

<sup>1/</sup> Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6" (see 6.3 and 6.4).

**4.2.2 Examination prior to testing.** Upon receipt of the qualification test sample, the sample valve(s) shall be disassembled and visually examined to determine conformance with the requirements of this specification and the manufacturer's engineering drawings. In addition the valve shall be examined as follows:

- (a) With respect to accuracy of dimensions.
- (b) Quality of workmanship.
- (c) Weight.
- (d) Identification and markings..
- (e) Visible defects.

**4.2.2.1** Upon satisfactory completion of the examination specified in 4.2.2, the valve(s) shall then be tested as specified in 4.2.3 through 4.2.8.

**4.2.3 Proof test.** With the valve open and the outlet port closed off, the valve shall be pressurized hydrostatically to 9000 psig for 2 minutes, depressurized, and again pressurized to 9000 psig for 2 minutes. There shall be no evidence of external leakage or structural failure during this test. At completion of the proof test the valve shall be examined in accordance with 4.2.4.

**4.2.4 Disassembly and examination.** The valve shall be disassembled and visually and dimensionally examined for damage, wear, and operation of parts. Particular attention should be given to the condition of the seals.

**4.2.5 Seat tightness test.** Seat tightness test shall be conducted as follows: Seat the valve with a torque not exceeding that specified in 3.9. Apply 6000 psig air or nitrogen under the seat and check for leakage at the outlet port. Also check for external leakage. There shall be no visible leakage over a 5-minute period.

**4.2.6 Operational test.** The valve shall be attached to a 6000 psig air or nitrogen source with flow through the valve over the seat. A needle valve shall be installed downstream to limit flow during cycling tests. The valve shall be cycled as follows:

- (a) Cycle 50 times and then seat valve with the maximum seating force as specified in 3.9. One cycle shall consist of one complete opening and closing.
- (b) Allow valve to remain pressurized for one hour in the seated condition.
- (c) Repeat (a) and (b) above until valve has undergone 2500 cycles.
- (d) After each 50 cycles, stem and seat leakage shall be checked.
- (e) Seating, unseating and running torques shall be noted during this test. Maximum valves should be within those listed in 3.9.

At the completion of the 2500 cycle test, the valve shall be examined in accordance with 4.2.4 with particular attention to migration or damage to the stem seal. No lubrication shall be applied to the stem seal either before or during these tests.

**4.2.7 High impact shock test.** The valve shall be subjected to and meet the high-impact shock requirements for grade A, class I of MIL-S-901.

**4.2.8 Vibration test.** The valve shall be vibration tested in accordance with type I of MIL-STD-167.

### **4.3 Sampling for quality conformance inspection.**

**4.3.1 Lot.** All valves of the same size offered for delivery at one time, shall be considered a lot for the purpose of sampling.

**4.3.2 Sampling for visual and dimensional examination.** A random sample of valves shall be selected from each lot in accordance with table IV and shall be examined as specified in 4.4.1.1 and 4.4.1.2. Failure of any valve in the sample to pass the examination specified in 4.4.1.1 and 4.4.1.2 shall be cause for rejection of the lot.

Table IV - Sampling for visual and dimensional examination.

Lot size	Sample quantity
2 to 25	1
26 to 65	2
66 to 180	3
Over 180	4

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4.4 Quality conformance inspection.4.4.1 Examination.

4.4.1.1 Visual examination. A visual examination shall be made of the sample valves selected in accordance with 4.3.2 to verify conformance to the requirements of this specification.

4.4.1.2 Dimensional examination. A dimensional examination shall be made on the sample valves selected in accordance with 4.3.2 to verify conformance with the approved master drawing.

4.4.2 Tests.

4.4.2.1 Proof test. Each valve shall be pressurized hydrostatically to 9000 psig for 2 minutes, depressurized, and again pressurized to 9000 psig for 2 minutes with valve open and the outlet port closed off. There shall be no evidence of external leakage or structural failure during this test.

4.4.2.2 Seat tightness test. Each valve shall be seated with a torque not exceeding that specified in 3.9. Apply 6000 psig air or nitrogen under the seat and check for leakage at the outlet port. Also check for external leakage. There shall be no visible leakage over a 2-minute period.

4.5 Inspection of preparation for delivery. The packaging, packing and marking shall be inspected for compliance with section 5 of this document.

5. PREPARATION FOR DELIVERY

5.1 Domestic shipment and early equipment installation and for storage of onboard repair parts.

5.1.1 Valves.

5.1.1.1 Preservation and packaging. Preservation and packaging shall be sufficient to afford adequate protection against corrosion, deterioration and physical damage during shipment from the supply source to the using activity and until early installation and may conform to the supplier's commercial practice when such meets these requirements.

5.1.1.2 Packing. Packing shall be accomplished in a manner which will insure acceptance by common carrier at the lowest rate and will afford protection against physical or mechanical damage during direct shipment from the supply source to the using activity for early installation. The shipping containers or method of packing shall conform to the Uniform Freight Classification Rules or other carrier regulations as applicable to the mode of transportation and may conform to the supplier's commercial practice when such meets these requirements. Prior to packing for shipment, all parts of each valve shall be capped with a polyethylene (plastic) cap, or other approved material, to prevent entry of moisture and other foreign material, and to provide some degree of protection to the valve ends.

5.1.1.3 Marking. Shipment marking information shall be provided on interior packages and exterior shipping containers in accordance with the supplier's commercial practice. The information shall include nomenclature, Federal stock number or manufacturer's part number, contract or order number, manufacturer's name and destination.

5.1.2 Onboard repair parts. Repair parts shall be preserved, packaged and packed as specified in the contract or order in accordance with MIL-R-196 and PPP-P-40, as applicable. Repair parts (and special tools, if required) not covered therein shall be processed in accordance with the guidelines of MIL-P-116. Repair parts shall be individually packaged unless used in sets or quantities greater than one.

5.2 Domestic shipment and storage or overseas shipment requirements. The requirements and levels of preservation, packaging, packing and marking for shipment shall be specified by the procuring activity (see 6.2).

6. NOTES

6.1 Intended use. These valves are intended for use in H.P. hydraulic and pneumatic systems.

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6.2 Ordering data. Procurement documents shall specify the following:

- (a) Title, number and date of this specification.
- (b) Size required (see 3.5).
- (c) Body configuration (see 3.6).
- (d) Hydraulic service: specify hydraulic fluid.
- (e) Air service: specify compressor lubricant.
- (f) Preservation, packaging and packing requirements other than those required by 5.1 (see 5.2).
- (g) With or without vents (see appendix, note F, 1.).

6.3 With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in applicable Qualified Products List QPL 24109, whether or not such products have actually been so listed by that date. The attention of the 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. The activity responsibility for the Qualified Products List is the Naval Ship Engineering Center, Prince George's Center, Center Building, Hyattsville, Maryland 20782, and information pertaining to qualification of products may be obtained from that activity. Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6" (see 6.4).

6.4 Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5301 Tabor Avenue, Philadelphia, Pennsylvania 19120.

6.5 CHANGES FROM PREVIOUS ISSUE. THE OUTSIDE MARGINS OF THIS DOCUMENT HAVE BEEN MARKED "\*" TO INDICATE WHERE CHANGES (DELETIONS, ADDITIONS, ETC.) FROM THE PREVIOUS ISSUE HAVE BEEN MADE. THIS HAS BEEN DONE AS A CONVENIENCE ONLY AND THE GOVERNMENT ASSUMES NO LIABILITY WHATSOEVER FOR ANY INACCURACIES IN THESE NOTATIONS. BIDDERS AND CONTRACTORS ARE CAUTIONED TO EVALUATE THE REQUIREMENTS OF THIS DOCUMENT BASED ON THE ENTIRE CONTENT AS WRITTEN IRRESPECTIVE OF THE MARGINAL NOTATIONS AND RELATIONSHIP TO THE LAST PREVIOUS ISSUE.

Preparing activity:  
Navy - SH  
(Project 4820-N263)





## APPENDIX

10. This appendix includes the following:

- (a) Notes
- (b) Drawings (figures 1 through 10)
- (c) Table of dimensions

## NOTES

## A. GENERAL

1. Unless otherwise specified, tolerances are as follows:

Fractions:  $\pm 1/64$   
 Decimals:  $\pm 0.010$

- 2. Break all sharp edges: 0.005R.
- 3. Threads shall conform to Handbook H28.

## B. NOTES ON BODY DRAWINGS

- 1. Dimension A21 and A22 are for drilled passages only.
- 2. Diameters A1, A2, A3 thread and A6 to be concentric within 0.002 T.I.R.
- 3. Surface Y to be square with diameters A1, A2, A3 thread and A6 within 0.002 T.I.R. measured between diameters A5 and A17.
- 4. A26 threads on both ends to be concentric within 0.002 T.I.R.
- 5. Faces of union ends to be parallel within 0.002 T.I.R. in 6 inches.
- 6. Faces of union ends to be square with threads within 0.003 T.I.R. measured at A26 diameter.
- 7. Inlet and outlet ports of 1-1/4 inch ips valves shall be stepped from 1-3/16 inch diameter to 1 inch diameter. Depth of 1-3/16 inch diameters shall be as follows:
  - Globe inlet port - 2-1/2 inches
  - Globe outlet port - 1-1/2 inches
  - Angle inlet port - 2 inches
  - Angle outlet port - 1-1/2 inches
- 8. Tolerance on cored flow holes shall be plus or minus 1/32 inch. Cored flow holes to be smooth as cast, free of fins.
- 9. Dimension A4, for valve sizes 1/8 to 1/2 inch shall be replaced by a single 45 degree chamfer blending with the chamfer at the end of the thread and ending at diameter A5 in one continuous smooth surface.

## C. NOTES ON LOWER DISC CONSTRUCTION

- 1. Swage disc and insert to dimensions shown.
- 2. Machine insert to B6 dimension after assembly.

## D. NOTES ON SEAT

- 1. Dimensions C1, C2 and C3 shall be concentric within 0.001 T.I.R.
- 2. Surfaces X and Z shall be parallel within 0.002 T.I.R. when measured at C2.

## E. NOTES ON LOWER BONNET CARTRIDGE CONSTRUCTION

- 1. Diameters E1, E2 and threads E3 to be concentric within 0.002 T.I.R.

## F. NOTES ON VENT VALVE DETAILS

- 1. Vent stems and pins shall be supplied only when specified (see 6.2).

## G. NOTES ON SEAT INSERT

- 1. Diameters B12 and B13 to be concentric within 0.002 T.I.R.

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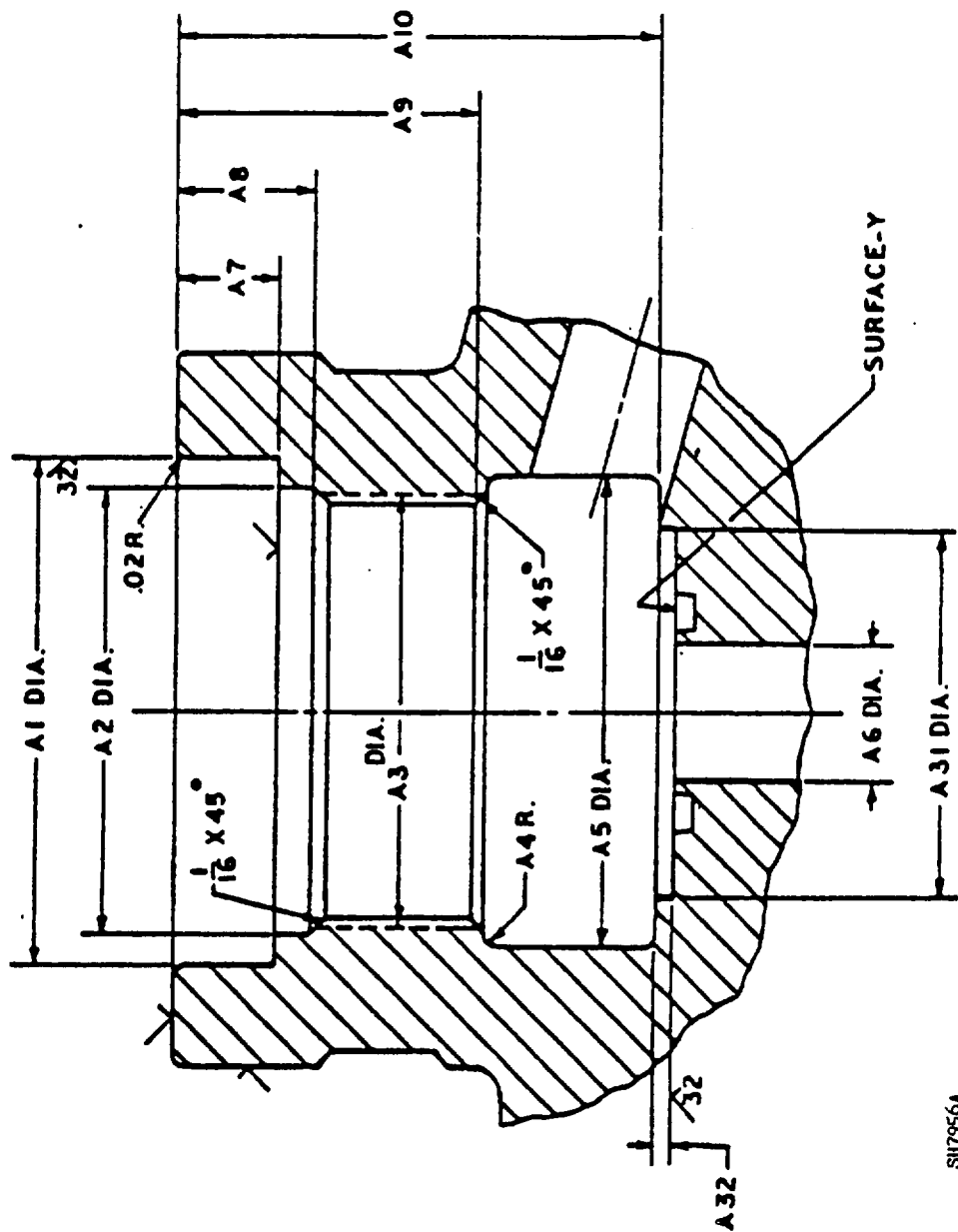


Figure 1 - Cavity detail.

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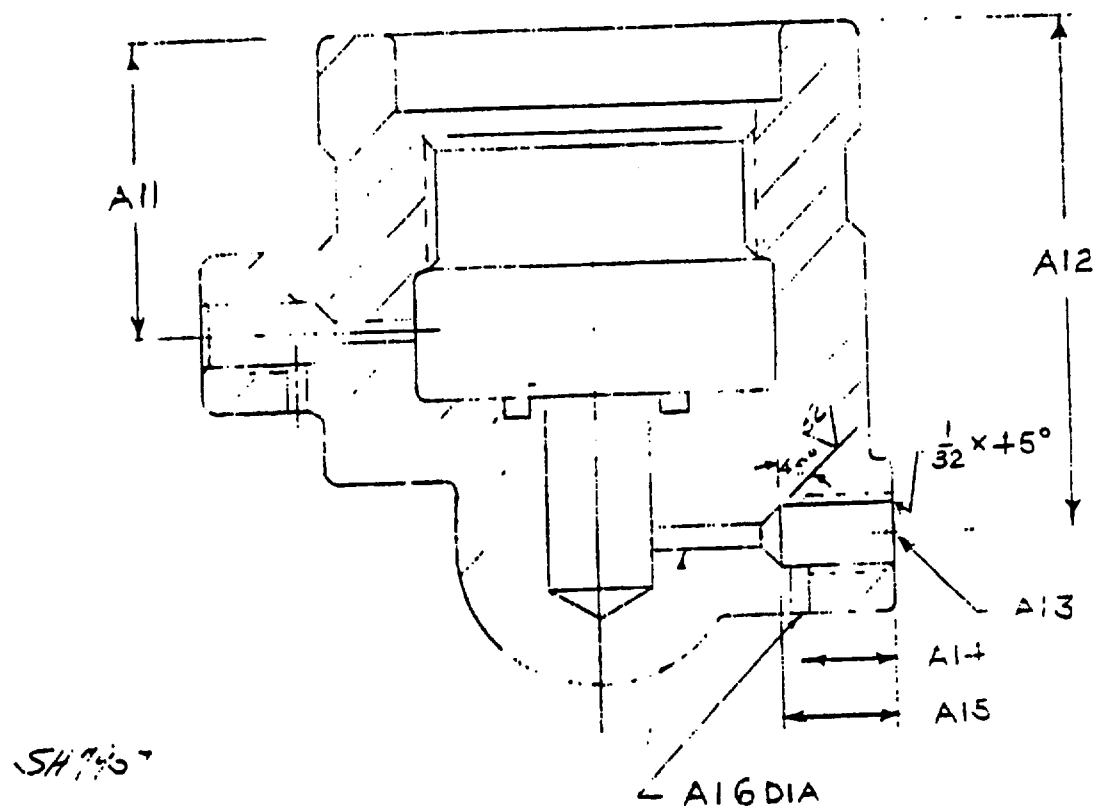


Figure 2 - Vent valve boss detail.

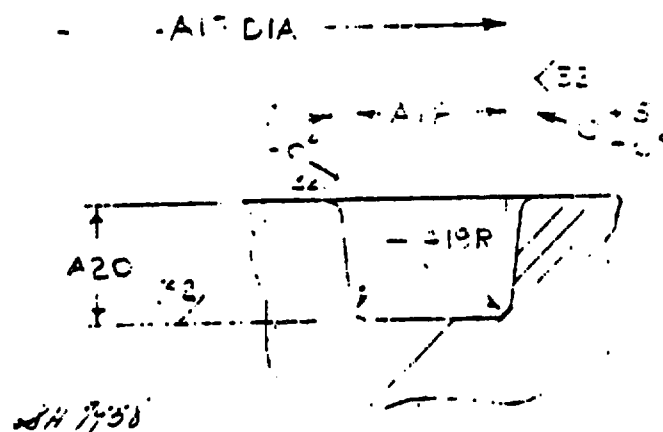
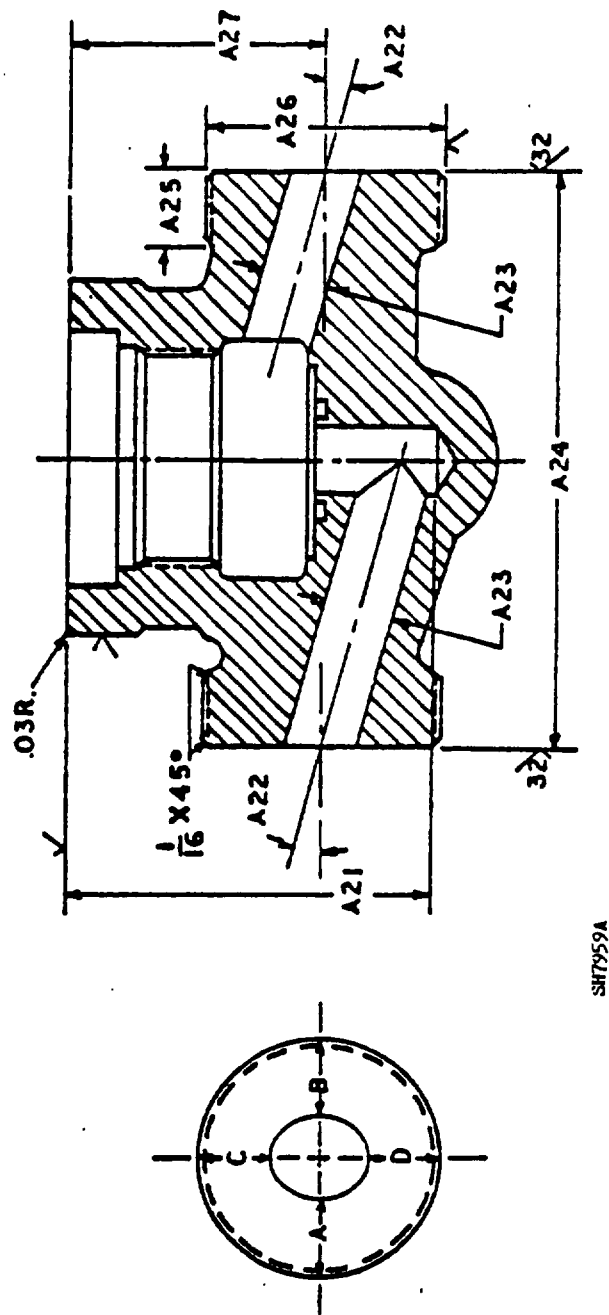


Figure 3 - "O" ring groove detail.

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Figure 4 - Body details.

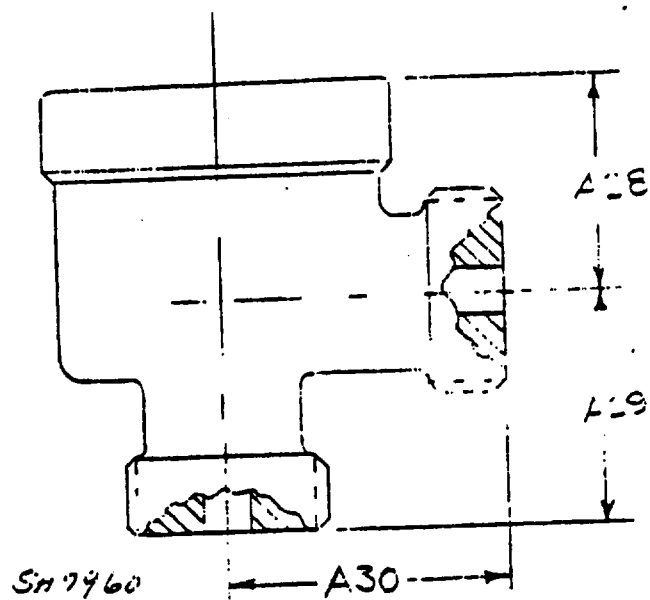
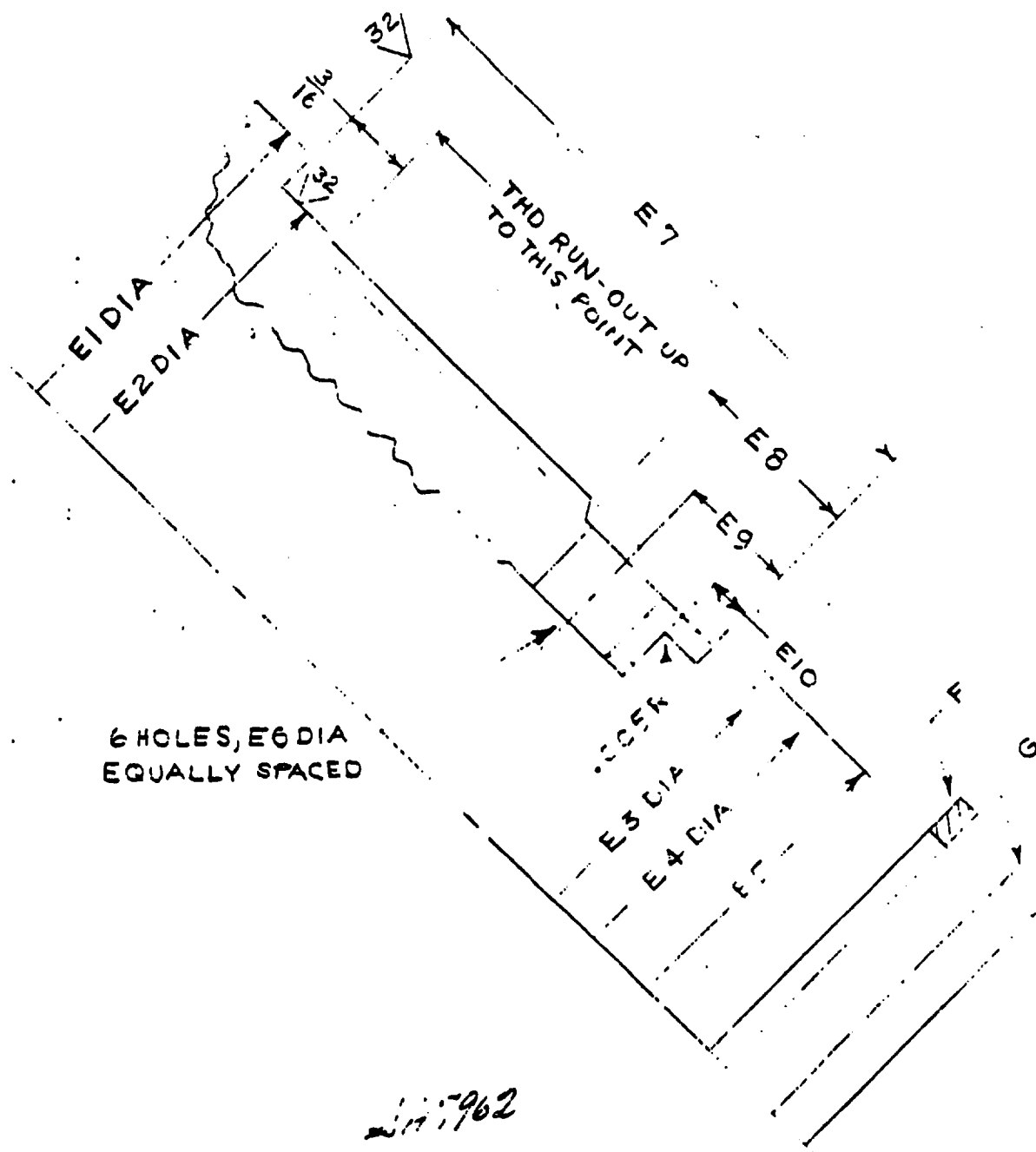
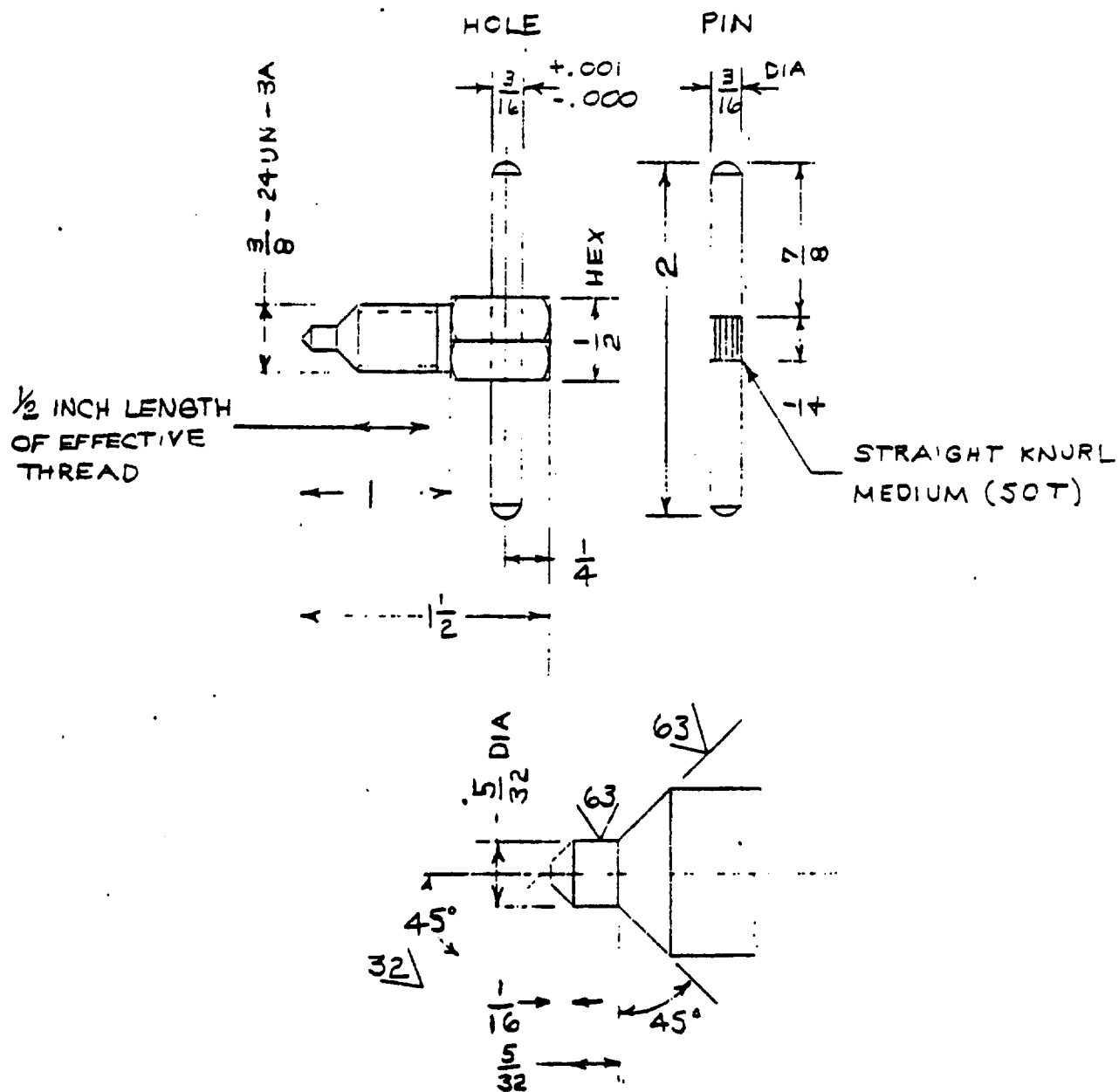


Figure 5 - Installation dimensions  
for angle valves.





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Figure 8 - Detail of vent valve for sizes  $\frac{1}{8}$  through  $\frac{1}{2}$  inch.



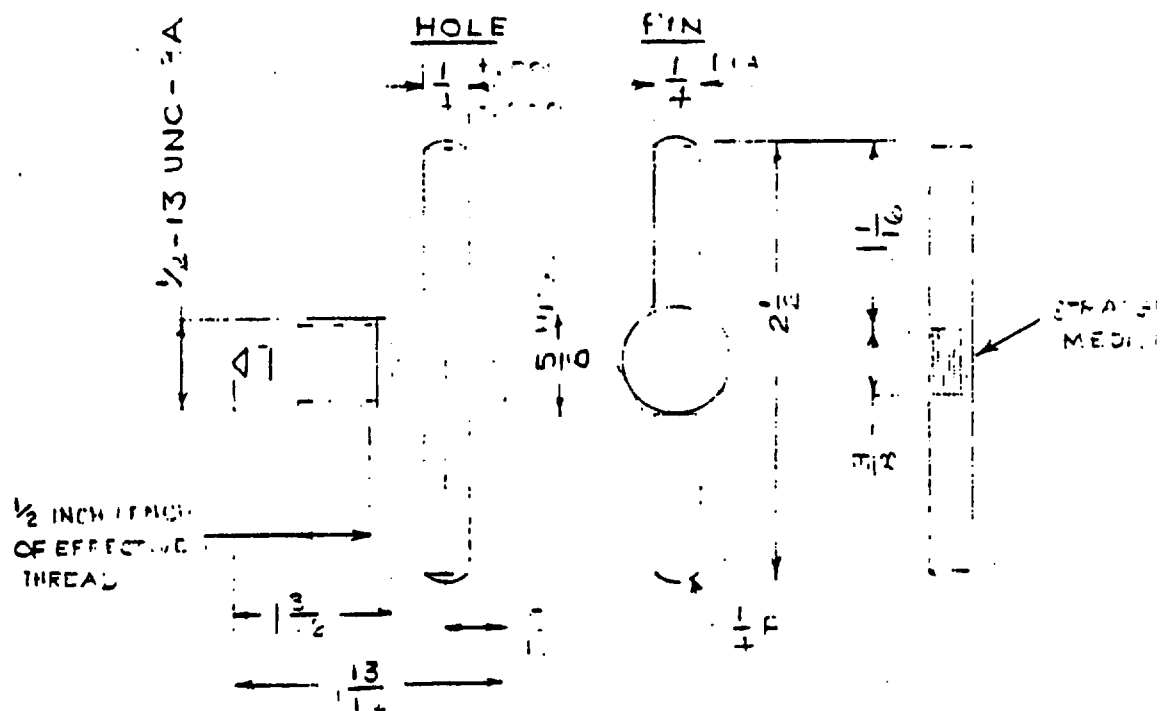
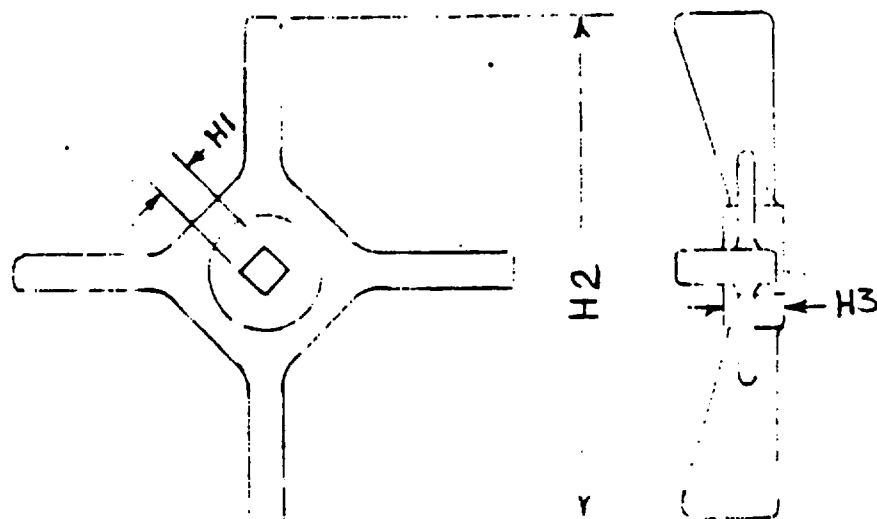
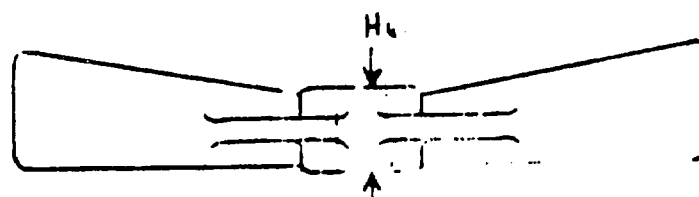
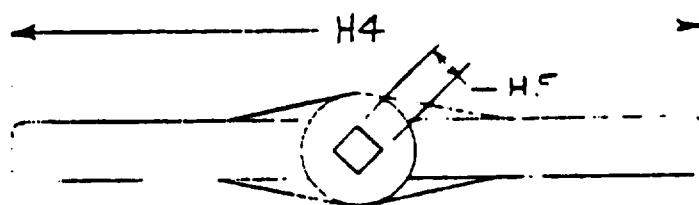


Figure 9 - Detail of vent valve stem for sizes 3/4 through 1-1/4 inches.

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SIZES  $\frac{1}{8}$  THRU  $\frac{3}{4}$  INCH



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SIZES 1 THRU  $1\frac{1}{4}$  INCH

Figure 10 - Handwheels.

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Table V - Table of dimensions.

IPS	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
	Inches +0.003 - .000	Inches +0.010 - .000		Inch	Inches $\pm 1/32$	Inch $\pm 0.005$	Inch $+0.010$ - .000	Inch	Inches $+1/3$ - 0	Inches
1/8	1.187	1.031	1-14NS - 3B P.D.=0.9588-.9536 L.H. thread	--	1-1/8 $\pm 1/32$	0.219	0.281	13/32	27/32	1-7/32
1/4	1.375	1.156	1-1/8-12UNF-3B L.H. thread	--	1-1/4 $\pm 1/32$	.313	.375	1/2	1-1/16	1-1/2
3/8	1.750	1.531	1-1/2-12UNF-3B L.H. thread	--	1-5/8 $\pm 1/32$	.439	.375	1/2	1-1/16	1-5/3
1/2	1.875	1.656	1-5/8-14NS-3B P.D.=1.584-1.579 L.H. thread	--	1-3/4 $\pm 1/32$	.500	.375	1/2	1-1/8	1-3/4
3/4	2.000	1.781	1-3/4-12UN-3B L.H. thread	0.06	1-7/8 $\pm 1/16$	.625	.375	1/2	1-1/4	2
1	2.250	2.031	2-12UN-3B L.H. thread	.13	2-1/4 $\pm 1/16$	.813	.375	1/2	1-7/16	2-3/3
1-1/4	2.500	2.281	2-1/4-12UN-3B L.H. thread	.13	2-11/16 $\pm 1/16$	1.000	.375	1/2	1-9/16	2-11/16

IPS	A11	A12	A13	A14	A15	A16	A17	A18
		Inches		Inch	Inch	Inch	Inches $+0.005$ - .000	Inch $+0.005$ - 0.005
1/8	31/32 - 1-3/32	1-1/2- 1-5/8	0.332 tap drill 3/8-24UNF - 3B 1/2 length of full thread	1/2	9/16	3/32	0.500	0.390
1/4	1-3/16 - 1-3/8	1-15/16- 2-1/16	0.332 tap drill 3/8 - 24 UNF - 3B 1/2 length of full thread	1/2	9/16	3/32	.625	.090
3/8	1-3/16 - 1-1/2	2-1/8- 2-1/4	0.332 tap drill 3/8 - 24UNF - 3B 1/2 length of full thread	1/2	9/16	3/32	.812	.140
1/2	1-1/4 - 1-5/8	2-7/16- 2-9/16	0.332 tap drill 3/8 - 24UNF - 3B 1/2 length of full thread	1/2	9/16	3/32	.875	.140
3/4	1-3/8 - 1-7/8	2-11/16 3-1/16	27/64 tap drill 1/2 - 13UNC - 3B 1/2 length of full thread	9/16	11/16	1/8	1.127	.190
1	1-9/16 - 2-1/4	3-1/4- 3-1/2	27/64 tap drill 1/2 - 13UNC - 3B 1/2 length of full thread	9/16	11/16	1/8	1.313	.190
1-1/4	1-11/16-2-9/16	3-7/16- 4	27/64 tap drill 1/2 - 13UNC - 3B 1/2 length of full thread	9/16	11/16	1/8	1.500	.190

## MIL-V-24109A (SHIPS)

Table V - Table of dimensions (Cont'd).

IPS	A19	A20	A21	A22	A23	A24	A25	A26	A27
	Inch	Inch +0.000 - .005	Inches	Degrees +2	Inch	Inch +1/64	Inch		Inches
1/8	0.02	0.056	1-11/16	12	7/32	2.750	3/8	1-14NS-3A P.D.=0.9536-0.9496	1-1/4
1/4	.02	.056	2-3/16	15	5/16	3.375	1/2	1-3/16-12UN-3A	1-9/16
3/8	.02	.083	2-1/2	15	7/16	4.000	9/16	1-3/8-12UNF-3A	1-5/4
1/2	.02	.083	2-11/16	15	1/2	4.250	9/16	1-3/4-12UN-3A	1-7/8
3/4	.03	.113	3-5/16	20	5/8	4.625	5/8	2-12UN-3A	2-3/16
1	.03	.113	3-13/16	20	13/16	5.250	5/8	2-5/16-12NS-3A P.D.=2.258-2.254	2-9/16
1-1/4	.03	.113	4-9/16	20	--	6.500	5/8	2-3/4-12UN-3A	2-15/16

IPS	A28	A29	A30	A31 Minimum	A32 Maximum	B1	B2	B3	B4	B5	B7	B8
	Inches	Inches	Inches	Inches	Inches	Inch	Inch	Inch	Inch +0.000 - .001	Inches +0.005	Inch +0.010	Inch
1/8	1-1/32	1-1/8	1-3/8	7/8	1/16	--	--	1/32	0.217	0.440	0.062	5/32
1/4	1-9/32	1-1/2	1-11/16	1	1/8	0.045	0.045	1/32	.312	.580	.218	3/16
3/8	1-11/32	1-5/8	2	1-1/4	1/8	.045	.060	1/16	.437	.740	.250	3/16
1/2	1-7/16	1-3/4	2-1/8	1-3/8	1/8	.045	.093	1/16	.500	.810	.250	1/4
3/4	1-5/8	2-3/8	2-5/16	1-5/8	3/16	.045	.093	1/16	.625	.945	.250	1/4
1	1-29/32	2-3/4	2-5/8	1-7/8	3/16	.045	.093	1/16	.813	1.190	.250	1/4
1-1/4	2-1/8	3	3-1/4	2-1/8	3/16	.045	.093	1/16	.999	1.395	.250	1/4

IPS	B9	B10	B11	B12	B13	C1	C2	C3	C4	C5	C6
	Inches +0.002 - .000	Inches +0.000 - .002	Inch	Inch +0.002 - .000	Inches +0.000 - .002	Inches +0.000 - .001	Inches +0.000 - .005	Inches +0.001 - .000	Inches +0.010 - .000	Inch +0.015 - .000	Inch +0.010 - .005
1/8	0.391	0.480	5/32	0.217	0.385	0.749	0.318	0.221	0.812	0.190	0.125
1/4	.528	.637	3/16	.312	.520	.874	.450	.316	.937	.250	.156
3/8	.685	.805	3/16	.437	.680	1.124	.600	.442	1.187	.280	.187
1/2	.748	.875	1/4	.500	.740	1.249	.665	.505	1.312	.280	.187
3/4	.888	1.010	1/4	.625	.880	1.499	.800	.630	1.562	.312	.250
1	1.125	1.252	1/4	.813	1.120	1.749	.990	.818	1.812	.375	.312
1-1/4	1.310	1.460	1/4	.999	1.305	1.999	1.175	1.005	2.062	.375	.312

MIL-V-24109A (SHIPS)

Table V - Table of dimensions (Cont'd).

IPS	D	E1	E2	E3	E4	E5	E6	E7	E8
	MS28775 dash number (size only)	Inches	Inches	Inches +0.001 - .000	Inches +0.000 - .010		Inch	Inches +0.015 - .000	Inch
1/8	012	1.186 +0.000 - .001	1.012 +0.000 - .002	0.747	0.875	1-14NS-3A P.D.=0.9536-0.9496 L.H. thread	1/8	1.093	9/32
1/4	014	1.373 +0.000 - .002	1.135 +0.000 - .003	.872	1.000	1-1/8-12UNF-3A L.H. thread	3/16	1.281	11/32
3/8	114	1.748 +0.000 - .002	1.510 +0.000 - .003	1.122	1.250	1-1/2-12UNF-3A L.H. thread	7/32	1.375	3/8
1/2	115	1.873 +0.000 - .002	1.635 +0.000 - .003	1.247	1.375	1-5/8-14NS-3A P.D.=1.579-1.595 L.H. thread	1/4	1.500	3/8
3/4	213	1.998 +0.000 - .002	1.760 +0.000 - .003	1.497	1.625	1-3/4-12UN-3A L.H. thread	9/32	1.750	1/2
1	215	2.248 +0.000 - .002	2.010 +0.000 - .003	1.747	1.875	2-12UN-3A L.H. thread	11/32	2.062	22/32
1-1/4	218	2.498 +0.000 - .002	2.263 +0.000 - .003	1.997	2.125	2-1/4-12UN-3A L.H. thread	7/16	2.375	3/4

IPS	E9	E10	F	G	H1	H2	H3	H4	H5	H6
	Inch	Inches +0.000 - .010	MS28775 dash number (size only)	MS28775 dash number (size only)	Inch	Inches +1/16	Inch	Inches +1/16	Inch	Inch
1/8	3/16	0.062	120	120	1/4	3-1/2	3/8	--	--	--
1/4	7/32	.062	216	216	1/4	3-1/2	3/8	--	--	--
3/8	1/4	.062	222	222	1/4	3-1/2	3/8	--	--	--
1/2	1/4	.062	223	223	3/8	4-1/2	5/8	--	--	--
3/4	11/32	.125	224	224	3/8	5-1/4	5/8	--	--	--
1	3/8	.125	226	226	--	--	--	7-1/4	7/16	7/8
1-1/4	11/32	.125	228	228	--	--	--	9	7/16	7/8

Table VI - Maximum permissible off-set of flow passages  
(refer to figure 4-A).

IPS	A-B (+) inches	C-D (+) inches
1/8	0.030	0.030
1/4	.030	.030
3/8	.030	.030
1/2	.030	.030
3/4	.060	.060
1	.060	.060
1-1/4	.060	.060



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