

MIL-H-24146

2 June 1965

MILITARY SPECIFICATION

HEADS, SPRINKLER, FIRE PROTECTION, FOAM WATER

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope.- This specification covers foam-water fire extinguishing sprinkler heads for upright or pendant installation in overhead sprinkler 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

QQ-B-613	Brass, Leaded and Non-Leaded; Flat Products (Plate, Bar, Sheet, and Strip).
QQ-B-626	Brass, Leaded and Non-Leaded; Rod, Shapes, Forgings and Flat Products with Finished Edges (Bar, Flat Wire, and Strip).
QQ-B-639	Brass, Naval: (Flat Products) Plate, Bar, Sheet and Strip.
QQ-S-781	Steel Strapping, Flat.
PPP-B-566	Boxes, Folding, Paperboard.
PPP-B-601	Boxes, Wood, Cleated-Plywood
PPP-B-621	Boxes, Wood, Nailed and Lock-Corner
PPP-B-636	Boxes, Fiberboard
PPP-B-640	Boxes, Fiberboard, Corrugated, Triple Wall
PPP-B-665	Boxes, Paperboard, Metal Stayed (Including Stay Material).
PPP-B-676	Boxes, Set-up, Paperboard

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MIL-P-116	Preservation, Methods of
MIL-S-901	Shock Test, H. I. (High Impact); Shipboard Machinery, Equipment and Systems, Requirements for (Navy)
MIL-D-963	Drawings, Electrical, Hull and Mechanical Equipment for Naval Shipboard Use.

FSC 4210

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MIL-B-16444 Bronze, Hydraulic (Ounce Metal): Castings.
 MIL-B-16541 Bronze, Valve: Castings.

STANDARDS

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MIL-STD-105 Sampling Procedures and Tables for Inspection
 by attributes.
 MIL-STD-129 Marking for Shipment and Storage

(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 document forms 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.

OFFICIAL CLASSIFICATION COMMITTEE
 Uniform Freight Classification Rules.

(Application for copies should be addressed to the Official Classification Committee, 1 Park Avenue at 33rd Street, New York, N. Y. 10016.)

3. REQUIREMENTS

3.1 Preproduction sample. - Prior to beginning production four samples shall be inspected as specified in 4.4 and 4.5 (see 6.4).

3.2 Material. - Sprinkler head bodies shall be made of bronze conforming to QQ-B-626, MIL-B-16444 or MIL-B-16541. Deflector plates and other fabricated parts shall be Naval brass conforming to QQ-B-639 or QQ-B-613. Supporting arms shall be of corresponding or other suitable materials resistant to corrosion and high temperature.

3.3. Construction. - The foam-water sprinkler shall have a single, open orifice and a deflector plate firmly supported. The deflector plate shall be supported by one cross yoke of 5/32-inch maximum thickness designed to produce a homogeneous conical spray which will not impinge on the overhead. The body shall be designed to introduce and mix air into foam-liquid solution in order to produce foam (see 6.2.2). Unless otherwise specified (see 6.1), the sprinkler head shall incorporate a 1/2-inch National Pipe Threads (NPT) male threaded inlet for installation in galvanized steel fittings. Flat surfaces shall be provided for a wrench to be used during installation. The maximum overall length of the sprinkler shall be 6-1/2 inches; the maximum width or diameter shall be 2-1/4 inches. The orifice shall be greater than 1/4 inch diameter.

3.3.1 Shock and vibration. - Sprinkler heads shall be designed for shock and vibration.

3.4 Drawings. -

3.4.1 Detail assembly drawings. - The contractor shall submit class A drawings in accordance with MIL-D-963. These drawings shall be certified dimensional drawings of a sprinkler head which has passed the qualification test. All sprinkler heads shall be manufactured in accordance with these drawings.

3.5 Marking. -

3.5.1 Body marking. - Each sprinkler head shall be clearly marked with the manufacturer's name or trade mark, the manufacturer's number and the number of this specification.

3.6 Workmanship. -

3.6.1 All sprinkler heads shall be sound, smoothly cored, true to form, uniform in texture, and free from cold shunts, porosity, or any other defects which may affect their serviceability. They shall be thoroughly cleaned, both inside and outside, and all fins and roughness shall be removed.

3.6.2 Castings shall not be repaired, plugged, or welded without permission from the inspector, which shall be given only when the defects are small (less than 10 percent of a size which would be cause for rejection of the heads) and do not adversely affect the strength, use, or machinability of the castings.

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, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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 Preproduction inspection. - Preproduction inspection shall consist of the examination and tests specified in 4.4 and 4.5.

4.3 Sampling. -

4.3.1 Lot. - All sprinkler heads offered for delivery at one time shall be considered a lot.

4.3.2 Sampling for visual and dimensional examination. - A random sample of sprinkler heads shall be selected from each lot offered for examination of visual and dimensional characteristics in accordance with MIL-STD-105, at Inspection Level II and shall be examined as specified in 4.4. The Acceptable Quality Level shall be 1.5 percent defective.

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4.4 Visual and dimensional examination. - Each of the sample sprinkler heads selected in accordance with 4.3.2 shall be visually and dimensionally examined to verify compliance with this specification. Any sprinkler head in the sample containing one or more visual or dimensional defects shall not be offered for delivery, and if the number of defective heads in any sample exceeds the acceptance number for the sample, this shall be cause for rejection of the lot represented by the sample.

4.5 Test procedures. -

4.5.1 Rate of discharge-The sprinkler shall discharge either foam (see 6.2.3) , or water in a dispersed pattern at a liquid flow rate of 16 to 19 gpm at 35 psig and 20 to 22 gpm at 50 psig.

4.5.2 Discharge characteristics. - The sprinkler head shall discharge foam-liquid solution and water in accordance with the following tests:

4.5.2.1 Average foam distribution. - Foam-liquid solution (see 6.2.2) shall be discharged for one minute through the head rotating at $3/4$ to 1 revolution per minute. The rotating head shall be located 7-1/2 feet directly above the top of a single row of 12 by 12 -inch open-top collecting containers. At a distance of 7-1/2 feet below the sprinkler, the average foam distribution shall be not less than 0.4 inch high in each of 6 feet of a 7 foot radius at pressures of 30 psig and 60 psig.

4.5.2.2 Average water distribution. - Water shall be discharged through the head rotating at $3/4$ to 1 revolution per minute. The rotating head shall be located 7-1/2 feet directly above the top of a single row of 12 by 12-inch open-top collecting containers. At a distance of 7-1/2 feet below the sprinkler the average water distribution shall be not less than 0.06 gpm/sq ft in each of 7 feet of an 8 ft radius at pressure of 30 psig and 0.07 gpm/sq ft in each of 7 feet of an 8 ft radius at pressure of 50 psig.

4.5.3 Foam characteristics. - The foam discharged shall be of the quality specified in 4.5.3.1.

4.5.3.1 Foam expansion and drainage. - The expansion (see 6.2.4) and drainage shall be determined using the drainage equipment shown on figure 1 and two heads placed 8 feet apart. The foam collector shall be positioned so that the top of the receiver is midway and 8 feet below the bottom of the heads. Two pans shall be used to collect the draining liquid. The standard sieve receiving pan shall be used to collect the liquid draining during the foam application and prior to the weighing operation; the drainage pan, a metal pan at least 9 inches in diameter and about 1 inch high, shall be used to collect the liquid draining during the weighing operation. Prior to test, (a) the total weight (W_1) of the sieve plus drainage pan shall be determined, (b) the weight of the receiving pan (W_3) shall be determined and (c) the drainage pan shall be positioned on the laboratory balance and the balance weights then set to indicate the weight of the drainage pan. Before the foam-application, the sieve shall be wetted with water and then shaken to remove excess water. The sieve shall be nested in the receiving pan and both placed below the funnel. Foam generation shall be started and after

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steady flow has been obtained the sliding cover shall be removed. When the sieve has been filled with foam, flow to the sieve shall be cut off by means of moving the funnel so that the foam shield covers the sieve. Timing shall be started at this point. The sieve and the receiving pan shall then be separated. The receiving pan shall be placed aside for later weighing, and the sieve shall be supported on a slope of 1 to 14 above the drainage pan which was previously positioned on the balance. The sliding weight of the balance shall be advanced in 10 gram increments and the times noted at which the beam balances. The weighing shall continue until the total weight of the drained liquid, in the drainage and receiving pans, shall be at least 25 percent of the total weight of the foam sample. Calculate the total weight of the foam sample (W_F) as follows:

$$W_F = (W_2 - W_1) + (W_4 - W_3)$$

Where W_1 = weight of sieve plus drainage pan, gms.

W_2 = weight of sieve with foam, plus drainage pan with drained liquid, gms.

W_3 = weight of receiving pan, gms.

W_4 = weight of receiving pan with drained liquid, gms.

The total weight of the drained liquid is equal to the sums of the weights of the liquid in the receiving pan and the drainage pan. The 25 percent drainage time (see 6.2.5) is the time required for drainage of a weight of liquid equal to 25 percent of the total weight of the foam sample ($W_F/4$). Calculate the 25 percent drainage time by interpolation of the weight-time data obtained. Calculate the expansion as follows:

$$\text{Expansion} = \frac{V}{W_F}$$

where: V = volume of foam sample collected in sieve = 1650 ml.

With foam generated from a 6 percent premixed solution of the foam-forming liquid in fresh water at 68° F. (20° C.) and 35 psig, the expansion of the foam shall be at least 5.5 and the 25 percent drainage time of the foam shall be at least 55 seconds.

4.5.4 Fire test. - The sprinkler heads shall be capable of extinguishing and controlling a gasoline fire as described in 4.5.4.1.

4.5.4.1 The tank used for the fire tests shall be of steel construction measuring 10-foot square by 3-foot deep. Four heads shall be positioned in their intended installed position (see 6.1) in an overhead piping system so that the discharge from the head shall be 8 feet above the fuel surface. The heads shall be 8 feet apart, each head above and adjacent to a tank corner. One hundred gallons of commercial grade gasoline shall be floated on a sufficient quantity of water so that the fuel surface is 2 feet below the top edge of the tank. The fire shall be permitted to burn freely for 30 seconds before foam application.

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The foam shall be applied for 90 seconds. Record the periods after start of foam application as required for the foam to spread over the tank, for the fire to be extinguished except for licks of flame at the edges of the foam blanket, and for complete extinguishment, as "coverage", "control", and "extinguishment", respectively. Foam from the sprinkler (using 6 percent fresh water solution at 35 psig) shall have a time of coverage of not more than 20 seconds, control in not more than 50 seconds and shall completely extinguish the fire in not more than 75 seconds. The foam blanket shall average not less than 2-1/2 inches in thickness after the 90-second period of application. The fire test shall be conducted when the wind velocity is below 5 miles per hour. After completion of the tests described in 4.5.4.2 and 4.5.4.3, the pressure shall be increased to 100 psig and the test repeated. Extinguishment time shall not exceed 75 seconds.

4.5.4.2. Sealability. - A lighted torch shall be passed over the 90 second foam application of 4.5.4.1 continuously for 15 minutes without touching or penetrating the foam. The foam blanket shall prevent reignition of the fuel.

4.5.4.3 Burnback test. - Immediately after completion of the sealability test, an opening, 6 inches square, shall be made in the approximate center of the foam blanket and the exposed fuel shall be reignited with a torch. The reignited fire shall be permitted to burn for 5 minutes. After the 5-minute burning period, the burnback area shall be determined. The foam blanket shall prevent spread of the fire beyond an area approximately 20 inches square.

4.5.5 Heat tests. -

4.5.5.1 Quench test. - Two heads shall be placed in a furnace maintained at 900° F. When the heads reach this temperature, one head shall be immediately quenched in water at 70° F. and the other head shall be cooled in air to 70° F. The head shall not be deformed when heated to 900° F and quenched in water or air.

4.5.5.2 Destructive test. - The head shall be subjected to increasing temperatures in 100° F. increments and held at each temperature for 15 minutes until failure occurs. At each temperature, the head shall be struck with a 1/8 inch diameter steel rod to determine its structural strength. The head shall not fail structurally when heated to 1500° F.

4.5.6 Mechanical shock test. - Two sprinklers, one as received, and one water-quenched after heating to 900° F shall be sufficiently rugged to withstand the following shock blows: Each head in turn shall be mounted on an internally threaded boss welded to an angle section which shall be bolted to the mounting plate of the 2000 ft-lb shock machine described in MIL-S-901. The head shall be in the pendant position and shock blows of 400, 1200 and 2000 ft-lb intensity shall be applied so that the direction of the blows will be parallel to each of the three principal axes of the head.

4.6 Examination of preparation for delivery. - An examination shall be made to determine that preservation, packaging, packing and marking requirements of section 5 of this specification are complied with. Defects shall be

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scored in accordance with table I. The lot size shall be the number of shipping containers fully prepared for delivery, with the exceptions that containers need not be sealed or closed, nor interior containers or case liners sealed (if applicable). Examination shall be made in two phases; first an interior examination, in process of packaging, and second an examination of containers fully prepared for delivery. The sample unit for each of the two phases shall be one container prepared for delivery as specified herein. The inspection level shall be S-2 of MIL-STD-105, with an acceptable quality level (AQL) of 4.0 defects per 100 units.

Table I- Examination of preparation for delivery.

Examine	Defects
Marking (interior package or container and exterior container as applicable)	Omitted, incorrect, illegible, improper size, location, sequence or method of application.
Materials	Component missing, damaged, defective or not as specified.
Workmanship (as applicable)	Inadequate or improper packaging or packing, such as closure of interior packages, or containers, Closure of case liners or container flaps, taping of seams, corners, and manufacturer's joints, closure of alternate containers; loose strapping or tape banding; inadequate stapling; bulging or distortion of containers.
Contents (interior and exterior container as applicable)	Number per container not as specified.
Weight (exterior container)	Weight per container exceeds maximum specified.
Preservation (as applicable)	Preservation missing, improperly applied or incorrect type.

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5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. - Preservation and packaging shall be Level A or C, as specified (see 6.1).

5.1.1 Level A. -

5.1.1.1 Unit packaging. - Unless otherwise specified (see 6.1), the sprinkler heads shall be packaged method III of MIL-P-116. Each Sprinkler head shall be individually packaged in a snug-fitting box conforming to PPP-B-566, PPP-B-665, or PPP-B-676. Box closures shall be as specified in the applicable box specification or appendix thereto.

5.1.1.2 Intermediate packaging. - When specified (see 6.1), the sprinkler heads shall be packaged in intermediate containers conforming to PPP-B-636, class domestic, and shall not exceed 20 pounds gross weight and 1.5 cubic feet in size. Intermediate container quantities shall be in multiples of 10 or 5 unit packages.

5.1.2 Level C. - The sprinkler heads shall be packaged in accordance with the manufacturer's commercial practice.

5.2 Packing. - Packing shall be Level A, B, or C, as specified (see 6.1).

5.2.1 Level A. - The packaged sprinkler heads shall be packed in overseas-type containers conforming to PPP-B-601, PPP-B-621, and weather-resistant boxes in accordance with PPP-B-636 or PPP-B-640. The gross weight shall not exceed the weight limitation specified in the applicable container specification. The containers shall be closed in accordance with the applicable box specification or appendix thereto. Metal strapping shall be zinc coated in accordance with QQ-S-781;

5.2.2 Level B. - The packaged sprinkler heads shall be packed in domestic-type containers conforming to PPP-B-601, PPP-B-621, PPP-B-636, or PPP-B-640. The gross weight shall not exceed the weight limitations specified in the applicable container specification. The containers shall be closed and strapped in accordance with the applicable container specification, or appendix thereto.

5.2.3 Level C. - The packaged sprinkler heads shall be packed in a manner to insure carrier acceptance and safe delivery at destination. Containers shall be in accordance with Uniform Freight Classification Rules or regulations of other carriers applicable to the mode of transportation.

5.3 Marking. - In addition to any special marking required by the contract or order (see 6.1), unit packages, intermediate packages, and shipping containers shall be marked in accordance with the requirements of MIL-STD-129.

6. NOTES

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

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- (a) Title, number, and date of this specification.
- (b) Inlet connection of other than 1/2 inch NPT (see 3.3).
- (c) Installed position, whether upright or pendant (see 4.5.4.1).
- (d) Selection of applicable levels of preservation, packaging, and packing (see 5.1 and 5.2).
- (e) Whether unit packaging is other than specified (see 5.1.1).
- (f) Intermediate packaging, if required (see 5.1.1.2).
- (g) Marking, if different (see 5.3).

6.2 Definition of terms. - The terms utilized in the requirements for design and performance of the sprinkler are defined herein. All pressures referred to are the gage pressures at the inlet to the sprinkler.

6.2.1 Foam-forming liquid. - The foam-forming liquid referred to in this specification shall be a protein base mechanical foam-forming liquid conforming to O-F-555.

6.2.2 Foam-liquid solution. - When foam-forming liquid is mixed with water for use as a fire extinguishing agent, the solution thus formed shall be termed a foam-liquid solution for the purpose of this specification. The solution used for test shall consist of six parts of foam-forming liquid to 94 parts of water and shall be designated a 6 percent foam-liquid solution.

6.2.3 Foam. - Foam as referred to in this specification shall be understood to denote mechanical foam produced for fire fighting purposes by the mechanical agitation of air with foam-liquid solution. It is aggregation of small air filled bubbles of lower specific gravity than oil or water and readily covers and clings to vertical or horizontal surfaces. Due to its high water retention ability it cools hot surfaces and retains its properties for long periods of time. A fire fighting foam of good quality forms an air-excluding continuous blanket to seal off volatile combustible vapors from access to air or oxygen and thereby extinguishes the fire. This foam cover is long lasting and resists disruption due to wind and draft or heat and flame attack.

6.2.4 Expansion. - The expansion of the foam is the ratio of the volume of the foam to the volume of foam-liquid solution contained in the foam.

6.2.5 Drainage time. - The time required for 25 percent of the liquid contained in the foam to drain out shall be denoted as drainage time.

6.3 The installation of silver brazing fittings, is intended to be accomplished by silver brazing without exceeding a temperature of 1400° F. The fittings are intended for use with copper-nickel tubing, MIL-T-16420.

6.4 Preproduction. -

6.4.1 Invitations for bids should provide that the Government reserves the right to waive the requirement for preproduction samples as to those bidders offering a product which has been previously procured or tested by the Government and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is

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presently appropriate for the pending procurement.

Custodian:

Army - MO
Navy - SH
Air Force - 11

Preparing activity:

Navy - SH
(Project 4210-0097)

Review activity:

Navy - SH

User activities:

Navy - MC
Air Force - 11

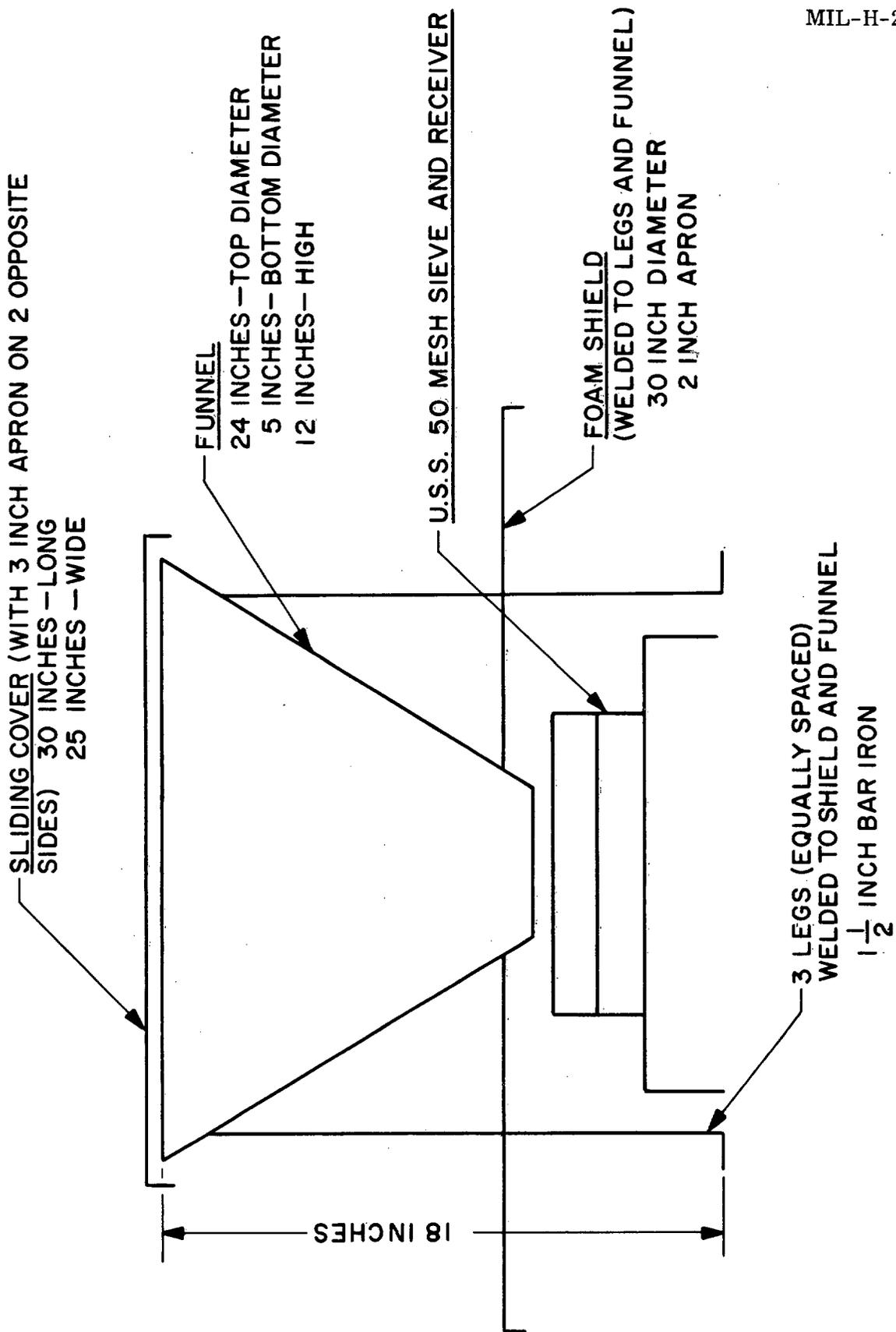


Figure 1 - Foam collector

SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 119-R004INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).

SPECIFICATION

ORGANIZATION (Of submitter)

CITY AND STATE

CONTRACT NO.

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

\$

MATERIAL PROCURED UNDER A

DIRECT GOVERNMENT CONTRACT

SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

YES

NO IF "YES", IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)

SUBMITTED BY (Printed or typed name and activity)

DATE