INCH-POUND

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SUPERSEDING
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PERFORMANCE SPECIFICATION

FILTER AND DISPOSABLE ELEMENT, FLUID PRESSURE, HYDRAULIC, 3 MICRON ABSOLUTE, GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers hydraulic fluid pressure filters and disposable filter elements which retain all particles larger than three microns absolute.

1.2 Classification. Hydraulic filters and elements will be of the following types and classes as specified (see 6.2).

1.2.1 Types:

Type A - Mechanical indicator
Type B - Electrical indicator

1.2.2 Classes:

Class 5000 - up to 5,000 psi system operating pressure
Class 8000 - up to 8,000 psi system operating pressure

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division, Code 414100B120-3, Highway 547, Lakehurst, NJ 08733-5100, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 4920

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

DEPARTMENT OF DEFENSE

MIL-H-46170	-	Hydraulic Fluid, Rust Inhibited, Fire Resistant, Synthetic Hydrocarbon Base.
MIL-PRF-83282	-	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Metric, NATO Code Number H-537.
MIL-P-83461/1	-	Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Improved Performance at 275 °F (135 °C) Higher and Tolerances.
MIL-PRF-87257	-	Hydraulic Fluid, Fire Resistant, Low Temperature, Synthetic Hydrocarbon Base, Aircraft and Missile.

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-810	-	Environmental Test Methods and Engineering Guidelines.
MS3452	-	Connector, Receptacle, Electric, Box Mounting, Rear Release, Crimp Contact, AN Type with.

(See supplement 1 for list of specification sheets.)

(Unless otherwise indicated, copies of the above specifications and standards are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents, which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR QUALITY CONTROL (ASQC)

ASQC-Z1.4	-	Sampling Procedures and Tables for Inspection by Attributes. (DoD adopted)

(Application for copies should be addressed to the American Society for Quality Control, P.O. Box 3005, 611 East Wisconsin Avenue, Milwaukee, WI 53201-4606.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE-ARP598	-	Liquids, Particulate Contamination in, by the Particle Count Method, in the Determination of. (DoD adopted)
SAE-AS4395	-	Tube Connection, Fitting end-Flared Design Standard. (DoD adopted)
SAE-AS4716	-	Gland Design, O-Ring and other Elastomeric Seals. (DoD adopted)
SAE-ARP1383	-	Actuators, Hydraulic, Valves, Pressure Containers and Similar Fluid Systems Components, Impulse Testing of. (DoD adopted)

(Application for copies should be addressed to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale PA 15096.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related specification sheets or MS standards), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between requirements of this specification and the specification sheet, the latter shall govern.

3.2 Qualification. The filter and element furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3).

3.3 Materials. The contractor shall select the materials, but the materials shall be capable of meeting all of the operational and environmental requirements specified herein (see 6.4 and 6.4.1).

3.3.1 Compatibility. The filter and element shall be constructed of materials that are not adversely affected by or affect the hydraulic fluids and the test fluid specified herein.

3.3.2 Metals. Metals shall be of the corrosion-resistant type or shall be protected to resist corrosion from the environmental conditions (see 3.6.6) encountered in storage and during normal service life.

3.3.2.1 Dissimilar metals. Where dissimilar metals are used in contact with each other, protection against galvanic corrosion shall be provided (see 6.5).

3.3.3 Nonmetals.

3.3.3.1 Seals. All seals, packing, and back-up-rings shall be those listed in MIL-P-83461/1 and SAE-AS4716.

3.3.3.2 Fungus resistance. Fungus resistant materials shall be used. When the fungus resistant materials are not used, the material shall be treated with an anti-fungal agent.

3.3.4 Lubrication. O-rings and back-up-rings shall be lubricated with hydraulic fluid while in service. No additional lubricant shall be required.

3.3.5 Protective treatment. Materials used to protect the filter element against environmental conditions (see 3.6.6) shall not crack, chip, or scale.

3.4 Interface characteristics.

3.4.1 Filter element removal. Filter element removal shall not require disconnecting fittings, mountings, differential pressure indicators, or removing inlet or outlet tubing. The filter assembly shall be designed so that fluid entering the filter housing cannot impinge directly upon the element

filter medium. The filter assembly shall pass 1,000 hours of operation with the fluid and ambient temperature at 160 °F.

3.4.2 Type of filter assembly. The filter assembly shall be of the full flow type. The flow through the filter element shall be from outside-in.

3.4.3 Interchangeability. The filter bowls, filter heads, and differential pressure indicators shall not be interchangeable if the sizes of filter elements or the operating pressure classes (see 1.2.2) are not the same.

3.4.4 Surface finishes. All sealing surfaces, O-ring grooves including chamfers, and all mating surfaces in contact with O-rings shall conform to the applicable specification sheet.

3.4.5 Protective cover. The element shall be provided with a permanent woven or perforated cover, or similar device to minimize handling damage of the element. The protective cover shall not interfere with the performance of the element.

3.4.6 Structural integrity. The filter assembly, housing, mounting, and element shall pass all the structural loads imposed by the wrench torque, high operation pressure, and vibrations encountered during shipping, storage, installation, and service.

3.4.7 Handle. A filter housing which weighs more than 20 pounds when filled with fluid shall be provided with a handle or similar device (see 6.6).

3.4.8 Alignment of ports. The horizontal and vertical axes of inlet and outlet ports of the filter housing shall be aligned with the tubing.

3.4.9 Installed. The configuration of filter assembly shall be such that the filter element cannot be installed in the reversed position. The mounting shall be designed such that the filter assembly can only be installed in the operating position.

3.4.10 Dimensions. The dimensions for the filter assembly and filter element shall be in accordance with the applicable specification sheets.

3.5 Indicator.

3.5.1 Differential pressure indicator. The filter housing shall incorporate an integral device to indicate when the differential pressure across the filter element exceeds the table I actuation pressure for longer than one second. The indicating device shall be mechanical or electrical and shall conform to the applicable specification sheet. The two types of indicators shall be mechanically interchangeable for any one filter manufacturer's assembly. It shall be possible to change the indicating device with ordinary tools while the filter unit is mounted on a bulkhead by

its standard mounting bracket. The devices shall be changeable while the system is filled with fluid but not under pressure. The device shall not activate when the filter and fluid temperature is below the table I lockout temperature. Once actuated, the indicator shall continue to indicate until manually reset. The reset device shall be external, readily visible, and easily accessible.

3.5.2 Mechanical indicator. A differential pressure indicator shall provide a visual warning by raising a red anodized pin when actuated. For adaptation to night operations, the indicator shall be readily apparent when illuminated by a low intensity red light (two-cell flashlight with red lens). The view of the indicator shall be unobstructed. Once actuated, the indicator shall remain extended until manually reset. The indicator shall be readily accessible for reset. When the indicator is in the reset position, it shall be hidden from view.

3.5.3 Electrical indicator. An electrical differential pressure indicator shall actuate either a 24 vdc or 110 vac electrical signal. To interface with the existing receptacle, the indicator shall accept a MS3452WS10SL-3P connector with pin arrangement as follows:

Pin A - normally open
Pin B - common
Pin C - normally closed

The switch current rating shall be five amperes at 110 vac, 28 vdc (resistive) or three amperes at 110 vac, 28 vdc (inductive).

3.5.4 Indicator bleed and drain ports. Filter assemblies, sizes 16 and larger, shall include parts to bleed entrapped air and to drain fluid.

3.6 Performance.

3.6.1 Filter assembly. Filter assembly, housing, and element shall meet the performance requirements in table I and shall pass the qualification tests in table II.

3.6.2 Bubble point. The manufacturer shall determine the initial bubble point occurring in the filter elements. The bubble point shall be correlated against the minimum particle passed. For qualification the initial bubble point value shall meet the value the established by the qualifying activity (see 6.3) and shall be determined as specified in 4.4.2.1. No element shall be accepted without passing the conformance test (see 4.4.2.1.3).

3.6.3 Examination of product. The filter assembly and element shall conform to the requirements of this specification when visually examined. All items, including differential pressure indicators and other accessory components, shall be examined for compliance with the appropriate manufacturer’s drawings.

TABLE I. Performance requirements.

ITEMS	REQUIREMENTS	
	CLASS 5000	CLASS 8000
Absolute rating	3 micron	3 micron
Operating pressure	5,000 psi	8,000 psi
Operating temperature	-40 to 160 °F	-40 to 160 °F
Proof pressure	7,500 psi	12,000 psi
Burst pressure	12,500 psi	20,000 psi
Differential pressure indicator actuation pressure	105 psid	180 psid
Lockout temperature	70 °F	100 °F
Degree of filtration	99.5 percent	99.5 percent
Pressure drop housing -8,-16 sizes -24 size	(psid max) 10 20	(psid max) 10 20
Differential pressure element For all sizes	(psid max) 20	(psid max) 40
Dirt holding capacity at 100 psid -8 sizes -16 sizes -24 sizes	(grams) 9 45 80	(grams) 8 40 76.5
Terminal differential pressure	100 psid	180 psid
Impulse (cycles)	25,000 at 160 °F 75,000 at 135 °F	25,000 at 160 °F 75,000 at 135 °F

3.6.4 Cleanliness.

3.6.4.1 Filter element. To ensure that the filter elements and housing are being cleaned properly, and to ensure that the parts are not contaminated during packaging, sample filter elements or assemblies shall be unpacked and tested for cleanliness. The filter elements shall be installed in a pre-cleaned housing. The migration test of 4.4.2.9.2 shall be passed except that the weight of contaminant collected shall be not greater than five mg.

3.6.4.2 Fluid. Contamination (see 6.7.1) shall be less than 0.4 mg per 2,000 mL of hydraulic fluid.

3.6.5 Mean-time-to-repair time. The total time to perform all of the operations listed in 4.4.1.7 three times shall be not greater than 45 minutes.

3.6.6 Environmental conditions. The filter assembly, housing, and element shall operate without leakage, cracking, or failure when subjected to the following environmental conditions:

3.6.6.1 Salt fog. The filter assembly without the element shall pass the salt fog test specified in 4.4.1.5.4.

3.6.6.2 Sand and dust. The filter assembly without the element shall pass the sand and dust test specified in 4.4.1.5.5.

3.6.6.3 Fungus. The filter assembly, housing, and element shall pass the fungus test specified in 4.4.1.5.6.

3.6.6.4 Extreme temperature. The filter assembly, housing, and element shall pass the extreme temperature operation test specified in 4.4.1.5.7.

3.6.7 Operation. The filter assembly, housing, and element shall operate without leakage, cracking, or failure when subjected to the following tests.

3.6.7.1 Vibration. The filter assembly, housing, and element shall pass the vibration test specified in 4.4.1.5.8.

3.6.7.2 Endurance. The filter assembly, housing, and element, shall pass the endurance test specified in 4.4.1.5.2.

3.6.7.3 Cold start. The filter element shall pass the cold start test specified in 4.4.2.8.

3.6.7.4 Maximum particle passed. The filter element shall pass the maximum particle pass test specified in 4.4.2.5.

3.6.7.5 Flow fatigue. The filter element shall pass the flow fatigue test specified in 4.4.2.4.

3.6.7.6 Media and abrasion migration. The filter element shall be constructed such that the filtering media shall not be affected by thermal cycling and pressure flow cycling, and shall be able to pass the vibration test specified in 4.4.2.9.1.

3.6.7.7 Fluid degradation. The filter element shall pass the fluid degradation test specified in 4.4.2.6.

3.6.7.8 Pressure buildup and collapse. The filter element shall pass the maximum operating pressure specified herein and shall pass the differential pressure test specified in 4.4.2.7.

3.6.7.9 Surge. The filter shall be tested for inadvertent differential pressure indicator operation due to a temporary flow surge specified in 4.4.1.5.3. The differential pressure indicator shall not actuate during the first 0.1 second of pressure application. The differential pressure indicator shall actuate within one second from the start of pressure application.

3.7 Maintainability of the filter. The filter assembly shall meet the test requirements specified in 4.4.1.6 with no special tools and equipment required.

3.8 Operational markings.

3.8.1 Direction of flow. The direction of flow shall be clearly and permanently indicated by at least two arrows marked on opposite sides of the housing.

3.8.2 Instruction plate. Each filter unit shall be provided with a permanently mounted instruction plate. The plate shall show location and part number of all O-rings, seals, and back-up-rings.

3.9 Identification of product.

3.9.1 Filter housing. The filter housing shall be clearly and permanently marked with the following information:

FILTER, FLUID PRESSURE, HYDRAULIC, 5000 OR 8,000 PSI
3 MICRON ABSOLUTE, MAXIMUM TEMPERATURE 160 ^{o}F
The specification sheet number
Manufacturer's part number and serial number
Manufacturer's name or trade mark
Rated flow in gallons per minute
Replacement element (identify by specification sheet number.)

3.9.2 Filter element. Each filter element shall be clearly and permanently marked with the following information.

The military part number with dash size
Manufacturer's part number.
Manufacturer lot number.
Manufacturer's name or trademark
NONCLEANABLE
Element rating 3 micron absolute

If placed on a sealing surface, the markings shall not affect the sealing of the element.

3.9.3 Filter element adapter. The filter element adapter shall be clearly and permanently marked with the following information:

MIL-PRF-81836/5-XX
Manufacturer's name or trademark

3.9.4 Manufacturer part number. The manufacturer's part number on the part and the part number shown on the manufacturer’s drawing shall be the same.

3.10 Workmanship. The filter and element shall meet all interface, design dimensions, and interchangeability requirements, and shall be free of nicks, burrs, and sharp edges.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Conformance inspection (see 4.3).

4.2 Qualification inspection.

4.2.1 Samples.

4.2.1.1 Filter housing. Two samples of each size shall be submitted for qualification. The samples shall be assembled in accordance with the manufacturer’s drawings. Tests shall not have been performed on the samples.

4.2.1.2 Filter element. Six samples shall be submitted for qualification. Tests shall not have been performed on the samples.

4.2.2 Test conditions.

4.2.2.1 Immersion. Prior to performing the qualification tests, filters shall be immersed in hydraulic fluid (see 4.2.2.2) for a period of 100 hours at a fluid temperature of 300 ^{o}F. All internal parts shall be in contact with the test fluid during this period. After immersion, the filter shall remain in this fluid at room temperature until further tests are conducted.

4.2.2.2 Test fluids. The hydraulic fluid used for qualification tests shall be in accordance with MIL-PRF-87257 and MIL-PRF-83282. Fluids shall contain no free water.

4.2.2.3 Test fluid filtration. The test fluid shall be continuously filtered through a three micron absolute filter conforming to this specification during testing.

4.2.2.4 Test fluid temperature. The temperature of the test fluid shall be 100 $\pm$10 ^{o}F.

4.2.2.5 Room temperature. The tests shall be conducted at a room temperature of 70 to 90 ^{o}F, measured within 12 inches of the test sample.

4.2.2.6 Pneumatic air as test fluid. The pneumatic air used to pressurize the test apparatus shall be filtered through a 0.45-micron membrane filter (type HA Millipore, or equivalent).

4.2.2.7 Weight measurement. Weight shall be measured within 0.1 percent.

4.2.2.7.1 Static electricity, elimination of. A device to eliminate static electricity shall be in proximity to the filter membrane disc, or to the pan on which it rests, whenever any object or material is being weighed to a precision of 0.1 gram or finer. The age of the device shall be not greater than the value stated by the manufacturer as its rated service life.

4.2.3 Individual qualification inspection. The individual qualification inspection shall consist of the tests specified in table II, conducted on each filter housing and filter element in the order listed on the table. Any filter housing or filter element containing a defect shall be rejected.

4.3 Conformance inspection.

4.3.1 Individual inspection. The individual inspection shall consist of the tests specified in table III, conducted on each filter housing and filter element in that order. Any filter housing or filter element containing a defect shall be rejected.

4.3.2 Sampling inspection. Sampling of filter assemblies and elements shall be in accordance with ASQC-Z1.4, inspection level S-3. Sampling inspection shall consist of the pressure buildup and collapse tests of 4.4.2.7 and the migration test of 4.4.2.9.2, conducted on the same test sample.

4.3.3 Failure of sampling test. When a filter assembly or filter element fails to pass a sampling test, the entire lot represented shall be rejected.

4.4 Test methods.

4.4.1 Filter assembly.

TABLE II. Qualification tests.

PART	REQUIREMENT	TEST
FILTER ASSEMBLY		
Examination of product	3.6.3	4.4.3
Proof pressure	Table I	4.4.1.2
Pressure drop housing	Table I	4.4.1.4
Differential pressure indicator operation	Table I	4.4.1.5.1
Endurance	3.6.7.2	4.4.1.5.2
Surge test	3.6.7.9	4.4.1.5.3
Salt fog test	3.6.6.1	4.4.1.5.4
Sand and dust test	3.6.6.2	4.4.1.5.5
Fungus	3.6.6.3	4.4.1.5.6
Extreme temperature test	3.6.6.4	4.4.1.5.7
Vibration	3.6.7.1	4.4.1.5.8
Maintainability Demonstration	3.7	4.4.1.6
Impulse	Table I	4.4.1.8
Differential pressure indicator operation	Table I	4.4.1.5.1
Burst pressure	Table I	4.4.1.9
FILTER ELEMENT		
Element No. 1 (2^{nd} lowest bubble point)		
Examination of product	3.6.3	4.4.3
Bubble point	3.6.2	4.4.2.1
Cold start	3.6.7.3	4.4.2.8
Degree of filtration	Table I	4.4.2.4
Bubble point	3.6.2	4.4.2.1
Flow fatigue	3.6.7.5	4.4.2.4
Bubble point	3.6.2	4.4.2.1
Element No. 2 (lowest bubble point)		
Examination of product	3.6.3	4.4.3
Bubble point	3.6.2	4.4.2.1
Cold start	3.6.7.3	4.4.2.8
Maximum particle passed	3.6.7.4	4.4.2.5
Bubble point	3.6.2	4.4.2.1
Fluid degradation	3.6.7.7	4.4.2.6
Bubble point	3.6.2	4.4.2.1

TABLE II. Qualification tests – continued.

PART	REQUIREMENT	TEST
FILTER ELEMENT		
Element No. 3 (highest bubble point)		
Examination of product	3.6.3	4.4.3
Bubble point	3.6.2	4.4.2.1
Cold start	3.6.7.3	4.4.2.8
Pressure buildup and collapse	3.6.7.8	4.4.2.7
Bubble point	3.6.2	4.4.2.1
Element No. 4		
Examination of product	3.6.3	4.4.3
Bubble point	3.6.2	4.4.2.1
Cold start	3.6.7.3	4.4.2.8
Bubble point	3.6.2	4.4.2.1
Media and abrasion migration	3.6.7.6	4.4.2.9
Bubble point	3.6.2	4.4.2.1

TABLE III. Individual inspection.

PART	REQUIREMENT	TEST
FILTER HOUSING		
Examination of product	3.6.3	4.4.3
Proof pressure	Table I	4.4.1.3
Differential pressure indicator operation	Table I	4.4.1.5.1
FILTER ELEMENT		
Examination of product	3.6.3	4.4.3
Bubble point	3.6.2	4.4.2.1.3

4.4.1.2 Proof pressure (qualification). The filter shall be assembled with the outlet port plugged. The filter shall then be filled with clean test fluid and maintained at 160 $\pm$ 5 ^{o}F for 72 hours. The proof pressure specified in table II shall be applied twice at 160 ^{o}F and held for two minutes at each application. The pressure shall be reduced to zero between applications. Any evidence of permanent deformation, malfunction, or leakage shall be cause for rejection.

4.4.1.3 Proof pressure (conformance). The proof pressure specified in table I shall be applied at least twice at room temperature and held for two minutes at each application. The pressure shall be reduced to zero between pressure applications. There shall be no evidence of permanent deformation, malfunction, or external leakage.

4.4.1.4 Pressure drop housing. The plug in the outlet end of the filter housing shall be removed and the unit installed in a setup similar to that on figure 1.

a. A differential pressure gage or manometer shall be connected between the inlet and outlet lines and shall be provided with protective cut off valves.

b. The differential pressure gage reading shall be not greater than 200 psid and the indicated accuracy shall be $\pm$1.0 psid or better.

c. Elements, which have passed the proof pressure (see 4.4.1.2) and examination (see 4.4.3) tests, shall be installed.

d. Fluid shall be run through the filter at rated flow and at the temperature of 100 $\pm$ 5 ^{o}F.

e. The viscosity of the fluid shall be a minimum of 13 centistokes.

f. The pressure drop test shall be repeated without a filter element installed. The housing pressure drop and element pressure drop shall be in accordance with table I.

4.4.1.5 Differential pressure indicator tests.

4.4.1.5.1 Operation. Each type of filter housing shall be tested for differential pressure indicator operation with the element port plugged. The pressure shall be slowly increased at the inlet port of the filter housing until the pressure indicator actuates fully and locks. This shall be considered the indicator operating pressure. The indicator operating pressure shall occur at the table I value (see 3.5.1). The pressure shall then be raised to the operating pressure and dropped to zero psid. The indicator shall stay locked in the extended position. The indicator shall then be manually reset. For electrical type indicators, a 24 vdc and a 110 vac power supply and test light shall be wired through the indicator to determine actuation pressure.

4.4.1.5.2 Endurance. Indicators shall be subjected to the following tests.

4.4.1.5.2.1 Low system pressure. With the filter element port plugged and the outlet port vented to atmosphere, the pressure shall be increased at a rate of 20 psi per minute at the inlet port of the filter housing, until the pressure indicator actuates fully. This shall be considered the indicator operating pressure and shall occur at the table I value. The inlet pressure shall then be reduced to zero and the indicator manually reset. The pressure shall then be cycled 1,000 times at any cycling rate from zero to ten psid above the table I value and back to zero psid. The indicator shall actuate and shall be reset at the end of each cycle. The indicator operating pressure shall be checked following cycling and shall occur at the table I value. For type B indicators a 110 vac power supply and test light shall be wired through the indicator to determine actuation pressure.

4.4.1.5.2.2 High system pressure. The filter element port shall be blocked with a plug containing an orifice designed to provide rated flow at ten psid above the table I value across the orifice. The outlet port of the filter housing shall be throttled to provide rated flow through the orifice at 5,000 psi inlet pressure for a class 5000 system and 8,000 inlet pressure for a class 8000 system. The flow shall be cycled from zero to rated flow and the differential pressure at which the indicator actuates fully shall be noted. This shall occur at the table I differential pressure. The inlet pressure shall then be raised to the operating pressure and dropped to zero psi. After actuation, the indicator shall remain in the extended position. The indicator shall then be manually reset. This cycle shall be repeated 1,000 times. The differential pressure indicator operating pressure at 5,000 and 8,000 psi inlet pressure shall then be rechecked and shall occur at the table I value. For the electrical type indicator a 24 vdc or a 110 vac power supply and test light shall be wired through the indicator to determine actuation pressure.

4.4.1.5.3 Surge test. The filter element port shall be blocked. The pressure shall be rapidly raised from 0 to 115 psid. The differential pressure indicator shall not actuate during the first 0.1 second of pressure application. The differential pressure indicator shall actuate within one second from the start of pressure application. The test shall be repeated at 200, 300, 400, and 500 psid and the differential pressure indicator shall actuate within 0.1 to 1 second.

4.4.1.5.4 Salt fog test. The filter shall be subjected to a salt fog test in accordance with MIL-STD-810, method 509, for 48 hours. The filter shall be mounted and operated at 5,000 or 8,000 psi at the rated flow. The indicator shall be checked in accordance with 4.4.1.5.1 following the test.

4.4.1.5.5 Sand and dust test. The filter shall be subjected to a sand and dust test in accordance with MIL-STD-810, method 510, for eight hours. The relative humidity shall be 95 percent. The dust composition shall be Red China clay. The filter shall be mounted and operated at 5,000 or 8,000 psi at the rated flow. The indicator shall be checked in accordance with 4.4.1.5.1 following the test.

4.4.1.5.6 Fungus test. The filter shall be subjected to a fungus test in accordance with MIL-STD-810, method 508, for 28 days. The filter shall be mounted and operated at 5,000 or 8,000 psi at the rated flow. The indicator shall be checked in accordance with 4.4.1.5.1 following the test.

4.4.1.5.7 Extreme temperature test. With the element port blocked, the filter housing shall be subjected to a temperature of -40 to -45 ^{o}F for 24 hours. During this period, pressure applied shall not exceed ten psi. At the end of this period, a pressure of 115 psi shall be applied to the inlet port of the unit and held for ten minutes, with the outlet port vented to atmosphere. Proof pressure shall then be applied to the inlet port for two minutes. The temperature of the hydraulic fluid used for these tests shall be -40 to -45 ^{o}F. Within 20 minutes, the filter housing shall be removed from the cold box and placed in an ambient temperature of 160 ^{o}F. A pressure of

TABLE IV. Contaminants.

Operating pressure (psi)	Filter element part number	Flow rate (gpm)	Degree of filtration add rate		Maximum particle add rate		Pressure buildup			Media migration
			APM F-9 beads (g)	AC dust (g)	F-9 beads (g)	Carbonyl Iron E (g)	Add rate AC dust (g)	Minimum AC dust to 100 psid (g)	Terminal Differential pressure (psid)	Maximum allowable (mg)
5,000	M81836/4-8	6	0.30	0.30	0.036	0.036	1.8	9.0	100	5
5,000	M81836/4-16	30	1.70	1.70	0.200	0.200	9.0	45	100	30
5,000	M81836/4-24	60	3.40	3.40	0.400	0.400	8.0	80	100	80
8,000	M81836/4-8	6	0.30	0.30	0.036	0.036	1.6	8.0	180	5
8,000	M81836/4-16	30	1.70	1.70	0.200	0.200	9.0	40	180	30
8,000	M81836/4-24	60	3.40	3.40	0.400	0.400	8.0	76.5	180	60

115 psi shall be applied to the inlet port of the unit with the outlet port vented to atmosphere. The fluid temperature at which the differential pressure indicator actuates shall be measured and shall be 70 °F. The indicator operating pressure shall be checked at 5, 10, and 60 minutes, and 24 hours after the first indicator actuation. Indicator operating pressure and gage reading shall be within the range specified in 4.4.1.5.1.

4.4.1.5.8 Vibration. Each type of filter assembly shall be subjected to the vibration test of 4.4.2.9.1 and the media migration test of 4.4.2.9.2. There shall be no damage to any part of the filter unit, including appurtenances, such as the differential pressure indicator. There shall be no migration identifiable as coming from the filter media. The weight of the contaminant emitted shall be not greater than the value listed in table IV.

4.4.1.6 Maintainability demonstration. The maintainability requirements of 3.7 shall be demonstrated as follows:

a. The filter unit shall be attached by its normal mounting bolts to a vertical bulkhead so that no part of a person or tool can extend behind the plane of the bulkhead.

b. A horizontal top shall be provided over the bulkhead, not more than 48 inches above the level floor, so that no part of a person or tool can extend above it.

c. If the highest point on the filter housing (including dial gage) is more than four inches below the top described above, a horizontal baffle shall be installed four inches above the highest point of the filter. This baffle shall extend at least six inches horizontally beyond all parts of the filter housing.

d. A straight piece of hydraulic tubing at least one foot in length shall be attached to each port (inlet and outlet) of the filter housing.

e. The filter unit, shall be mounted on the bulkhead at a height so that no more than two inches clearance exists between the bottom of the fully installed filter element and the top of the bowl which rests on the floor.

f. The bowl containing a filter element shall be filled with hydraulic fluid (filter unit and tubing need not be filled).

g. Only two people at the same time may touch any part of the filter unit, directly or by means of tools, except during the mounting and dismounting demonstration. At that time, a third person may be allowed working access to the back of the bulkhead.

4.4.1.7 Operation. The demonstration shall consist of performing each operation, three times, within the time specified in 3.6.5, as follows:

a. Removing and replacing drain plug.

b. Draining and removing bowl.

c. Removing and reinstalling element.

d. Replacing all O-rings and back-up-rings.

e. Replacing bowl, full of fluid.

f. Removing and replacing bleed plug (filling to displace air is not required).

g. Removing and replacing inlet and outlet tubing.

h. Removing and replacing differential pressure indicator (if two or more are mounted, time each one and each type separately).

i. Dismounting (from the bulkhead with the filter assembled, no oil, and tubing in position and attached to the bulkhead).

j. Mounting (same as dismounting).

4.4.1.8 Impulse. The filter shall be subjected to 100,000 impulse cycles; 25,000 at a fluid temperature of 160 ^{o}F and 75,000 at a fluid temperature of 135 ^{o}F. The SAE-ARP1383 figure 2 impulse curve shall be used.. Each impulse cycle shall consist of a pressure rise from zero to operating pressures and drop to zero. During each pressure increase, a peak surge pressure of 1.43 to 1.57 times the working pressure, as shown by an oscillograph, shall be obtained. Cycling shall be performed at a rate of 300 cycles per minute (cpm) maximum. There shall be no evidence of external leakage or structural failure during the performance of this test. Types A and B differential pressure indicators shall not actuate during the impulse test. The actual impulse pattern shall be recorded. The indicator shall be checked for conformance to 4.4.1.5.1.

4.4.1.9 Burst pressure. The burst pressure test shall be conducted at a fluid and ambient temperature of 160 ^{o}F after a five-hour soak at 160 ^{o}F with the filter unit filled with test fluid. Pressure shall be applied at a maximum rate of increase of 25,000 psi per minute until it reaches the specified burst pressure of table I. Filter units shall show no leakage in the form of drops or rupture of internal or external parts at this pressure when held for two minutes.

4.4.2 Filter element. (see 6.9).

4.4.2.1 Bubble point (qualification). Filter elements shall be tested to determine the initial bubble point. The filter element, containing no fluid, shall be installed in a setup similar to figure 2. The fluid level shall be maintained 0.5 inch above the top of the filter element. The air pressure as indicated in inches of water on the manometer, shall be slowly raised by small increments. The filter element shall be rotated 360 degrees about its longitudinal axis at each increment of air pressure so that the entire filter area can be observed for the appearance of the first bubble. The area of greatest porosity is determined by observing the first bubble on the surface of the filter element, and the manometer reading in inches of water at which this bubble emits from the filter element shall be recorded. This test shall be accomplished within a period of ten minutes after immersion in the fixture. The fluid used shall be proprietary solvent #3 (U. S. Industrial Chemicals), at a temperature of 70 $\pm$ 5 °F filtered through 0.45-micron membrane Millipore filter, or equivalent.

4.4.2.1.1 Test point values. The initial bubble point value shall be the lowest initial bubble point of the four qualification test elements of each dash size and shall be determined prior to further testing. The initial filter element media bubble point shall be not less than three inches of water.

4.4.2.1.2 Test elements. The maximum particle passed test (see 4.4.2.5) shall be performed on the element with the lowest bubble point. The degree of filtration test (see 4.4.2.3) shall be performed on the element with the second lowest bubble point, and the pressure buildup and collapse test (see 4.4.2.7) shall be performed on the element with the highest bubble point.

4.4.2.1.3 Bubble point (conformance). The filter element, containing no fluid, shall be installed in a setup similar to figure 2. The fluid level shall be maintained at 0.5 inch above the top of the filter element. The air pressure shall be preset to 0.1 inch of water less than the minimum initial bubble point. The filter element shall be rotated 360 degrees about its longitudinal axis and the entire filter area observed for the appearance of any bubbles. There shall be no bubbles emerging from the filter. The fluid used shall be proprietary solvent #3, at a temperature of 70 ± 5 °F filtered through 0.45-micron membrane Millipore filter, or equivalent.

4.4.2.1.3.1 Test fluids. For conformance test, hydraulic fluid conforming to MIL-PRF-46170, MIL-PRF-83282, or MIL-PRF-87257 with no free water, shall be used.

4.4.2.2 Determination of hydraulic fluid cleanliness. The cleanliness of the hydraulic fluid shall be determined by the following method:

a. The clean-up apparatus shall be similar to the setup shown on figure 3 without the filter element installed in the test housing.

b. Fluid shall be circulated through the system at a flow rate equal to the flow rate of the filter to be tested. The fluid in the contaminant mixing chamber shall be agitated periodically until the sample of fluid is clean as stated in 4.4.2.2.c.

c. In order to ensure cleanliness (see 3.6.4.2), a 2,000 mL of hydraulic fluid sample shall be passed through the filter housing at rated flow equal to the rated flow of the element to be tested. For -24 size filter elements, use 4,000 mL of hydraulic fluid. Contamination (see 6.7.1) shall be less than 0.4 mg per 2,000 mL of hydraulic fluid.

4.4.2.3 Degree of filtration (filter element efficiency). The degree of element filtration shall be determined. The hydraulic fluid and air used in the degree of filtration test shall be clean and filtered prior to test. Figure 3 shows the filtration test setup with a cleanup device attached. The test shall be conducted as follows:

a. A setup shall be made as shown on figure 3 without installing the filter element in the test housing.

b. Flush 2,000 mL of pre-filtered hydraulic fluid through the contaminant mixing chamber and the filter housings and discard. For -24 size filter element, use 4,000 mL of fluid. This operation shall be repeated.

c. The hydraulic fluid shall be checked in accordance with 4.4.2.2.

d. Add 2,000 mL of previously filtered hydraulic fluid through plug valve A. For -24 size filter element, use 4,000 mL of fluid. The element shall be installed in the filter housing.

e. Close valve B.

f. A five-mL slurry containing the contaminants in accordance with table IV, shall be added to the hydraulic fluid through a small funnel, inserted in the plug valve A. The contaminants shall be APM F-9 beads, in accordance with figure 4 and air cleaner (AC) test dust (see 6.8) in accordance with table IV.

g. The contaminant shall be distributed uniformly by churning the hydraulic fluid with an agitator for three minutes.

h. Plug valve A shall be closed and the glass chamber containing the hydraulic fluid and contaminant shall be pressurized using the air regulator. The air regulator is used to maintain rated flow.

i. The valve B shall be opened to force the hydraulic fluid containing the contaminant through the sample filter assembly. The filtrate shall be collected in a clean beaker. Using a wash

bottle, 150 mL of petroleum ether (see 6.10) (boiling point 95 to 130 ^{o}F) shall then be washed through the contaminant mixing chamber and test filter assembly. The wash fluid shall be collected in the same beaker.

j. A membrane filter, 47-mm diameter disk, absolute 0.8 micron type AA Millipore, or equivalent, shall be washed with 400 mL of pre-filtered petroleum ether and dried to constant weight at 125 ^{o}F. The weight shall be accurate to 0.1 mg. The disk shall be heated at 125 ^{o}F for 30 minutes and then cooled 30 minutes in a desiccator.

k. The weighed filter membrane shall be assembled into the filter holder assembly (see figure 5) and fitted to a vacuum flask connected to a vacuum (minimum 25 inches of Hg vacuum).

l. All hydraulic fluid passed through the test filter is filtered through the membrane disk. The beaker shall be washed with 1,000 mL of pre-filtered naphtha and 1,000 mL of pre-filtered petroleum ether and fluid from the washed beaker shall be passed through the membrane. The filter funnel shall also be washed down with 100 mL of pre-filtered naphtha and 100 mL of pre-filtered petroleum ether.

m. Maintaining vacuum, the top half of the filter funnel assembly shall be removed. The membrane filter shall now be exposed for further washing.

n. With a wash bottle of pre-filtered petroleum ether the rim of the membrane filter shall be gently washed to remove traces of hydraulic fluid, being careful not to disturb the residue. Vacuum shall be maintained during this operation.

o. The vacuum shall be shut off and the membrane filter removed. It shall be dried to a constant weight at 125 ^{o}F and weighed to the nearest 0.1 mg. The difference between the membrane filter weights before and after the above procedure is the weight of contaminant passing through the test filter, B in the formula specified in 4.4.2.3.1.

4.4.2.3.1 System add and blank values. The test specified in 4.4.2.3, with the filter element removed shall be repeated four times for four separate contaminant-add values (A in the following formula). Hydraulic fluid cleaned to a level that conforms to 4.4.2.2 shall be used for each test. The contaminant collected shall be the add value and shall be used in the calculation of degree of efficiency (see 6.7.2). It shall be the average of these four runs. None of the four add values shall be less than 95 percent by weight of the contaminant introduced. To ensure cleanliness of the system and the filter assembly, a system blank value shall be obtained by repeating 4.4.2.3a through 4.4.2.3c with the filter element installed and no contaminant added. This blank value shall be the value C in the following efficiency formula and shall be less than 0.7 mg.

$$\text{Percent removal} = \frac{A - (B - C)}{A} \text{ X } 100$$

Where A = Amount of test contaminant passed through the system when there is no filter element in the filter housing.

B = Amount of test contaminant passed through the test filter assembly (element installed).

C = Amount of contaminant attributed to the test system and test filter assembly when no test contaminant has been added.

4.4.2.4 Flow fatigue. Filter elements shall be installed in filter housings and shall be subjected to pressure flow cycles with hydraulic fluid at a minimum flow of 6 gpm and at 160 ± 5 °F. A cycle shall consist of increasing the differential pressure across the filter element from zero to the maximum specified and back to zero by first increasing, then decreasing. The flow through the test filter element shall be loaded with AC fine test dust, carbonyl iron E and APM F-9 beads.

4.4.2.4.1 Cycle rate. The cycling rate shall not exceed 300 cpm. The number of cycles at each differential pressure shall be as follows:

a. 90,000 cycles at 60 psi pressure drop

b. 8,000 cycles at 80 psi pressure drop

c. 2,000 cycles at 120 psi pressure drop

d. 100 cycles at 5,000 psi pressure drop

There shall be no evidence of damage as a result of the test.

4.4.2.4.2 Particles released (passed). Near the completion of each series of tests 4.4.2.4.1a through d tests, a 2,000 mL sample of effluent fluid shall be collected while maintaining the specified differential pressure. The fluid sample shall be passed through an absolute 0.80 micron type AA Millipore filter, or equivalent. The disk shall be scanned in accordance with SAE-ARP598. Any test contaminant found larger than three microns shall be cause for rejection.

4.4.2.5 Maximum particle passed. In order to produce an absolute test result, the test set up downstream of the filter element and all glassware shall not have been previously used with carbonyl iron E or glass beads. A filtration test shall be conducted as follows:

a. A degree of filtration test shall be conducted in accordance with the procedure specified in 4.4.2.3a through 4.4.2.3i except that the contaminant shall be APM F-9 beads and carbonyl iron E in the amounts specified in table IV. The particle size distribution for carbonyl iron E shall conform to figure 6.

b. The effluent fluid shall be passed through an absolute 0.8-micron membrane disk, type M Millipore filter paper, or equivalent

c. The entire disk shall be scanned in accordance with SAE-ARP598. The largest bead or carbonyl iron E particle shall be no greater than three microns.

4.4.2.6 Fluid degradation test. The cleanup filter shall be removed from the setup shown on figure 1. The reservoir and circuit shall be filled with unfiltered hydraulic fluid. Two one-quart samples of the unfiltered fluid shall be collected. The fluid shall then be circulated through the circuit at rated flow for one hour and two one-quart samples of the effluent fluid taken. Test dust shall be added through the dust valve until the differential pressure across the filter reaches 100 psi. Two quarts of the sample effluent fluid shall then be collected. One each of the three sample sets shall be subjected to all the tests of MIL-PRF-87257. The three remaining samples shall be forwarded to the qualifying activity. Any change to the composition of the hydraulic fluid as a result of passing through the filter shall be cause for rejection.

4.4.2.7 Pressure buildup and collapse test. A pressure buildup and collapse test shall be conducted as follows:

a. The test fluid used in the system shown on figure 1 shall be pre-cleaned by flowing through the cleanup filter to the level specified in 4.4.2.2. The cleanup filter shall be bypassed throughout the remainder of this test.

b. The element under test shall be installed in the housing.

c. The pump shall be started, valves A and B opened, and rated flow attained.

d. Standardized fine AC test dust shall be added in increments as specified in table IV at four minute intervals through the dust valve, in a slurry. Test dust shall have the composition as specified in table V.

e. Two minutes after each dust addition, pressure differential, flow rate, and temperature shall be recorded. Dust shall be added until the minimum weight of dust specified in table IV is added. The differential pressure across the filter assembly shall be not greater than 100 psid. The pump shall not stop during the test. Additional dust and carbonyl iron E (1 to 12 microns) in equal quantities shall be added until a differential pressure of 5,000 psid is obtained across the element. The dust capacity at 5,000 psid shall be recorded. The effluent fluid shall be sampled

and tested in accordance with 4.4.2.5b and 4.4.2.5c as the differential reaches 100, 150, 1,000, 2,000, 3,000, and 5,000 psid. The samples collected shall show a maximum carbonyl iron E particle of three microns. For conformance tests, the test shall be stopped at 100 psid.

4.4.2.8 Cold start. The filter element shall be installed in housing filled with oil and subjected to a temperature of -40 °F for 72 hours. The element shall then be subjected to ten flow cycles at 3,000 psid pressure across the element with fluid held at -40 °F or lower. The flow shall be not greater than 150 percent of rated flow and shall be not greater than 0.5 gpm. Each fluid cycle shall be 1.5 to 5 seconds in duration. There shall be no evidence of filter media damage as evidenced by completion of the bubble point, media migration, largest particle passed pressure drop, pressure buildup, and collapse tests.

TABLE V. Composition of test dust.

Size of Particle	Percent by Weight of Total
0 to 5 microns	39 ± 2
5 to 10 microns	18 ± 3
10 to 20 microns	16 ± 3
20 to 40 microns	18 ± 3
Over 40 microns	9 ± 3

4.4.2.9 Media and abrasion migration. The filter housing and element shall be mounted on a test stand and flushed at rated flow with oil pre-cleaned to the level specified in 4.4.2.2. The filter, filled to the top of the element with fluid, shall be maintained at 300 °F for 100 hours.

4.4.2.9.1 Vibration test. The filter unit shall be cooled to room temperature (70 to 90 °F) and vibrated in three mutually perpendicular planes, while mounted in normal position (bowl at the bottom). The frequency of vibration shall be varied from 50 to 500 Hz, with one pass of scanning to be at least 15 minutes, at an acceleration of 10g in each plane with any resonating frequencies noted. The filter unit shall be vibrated for one hour at each of these resonant frequencies. If no resonance is encountered, the vibrating frequency shall be 500 Hz for one hour at an acceleration of 10g in each plane. The differential pressure indicator shall not actuate during this test. Following the migration analysis test of 4.4.2.9.2, the differential pressure indicator shall be tested for and meet the operational requirements of 4.4.1.5.1.

4.4.2.9.2 Migration test. The filter assembly shall be taken from the vibration test and, without loss of oil, installed inverted in a test set up similar to that shown on figure 3. A degree of filtration test shall be conducted without contaminant (see 4.4.2.3d through 4.4.2.3o). The analysis membrane shall be microscopically examined using the procedure in accordance with SAE-ARP598. The membrane filter shall be of contrasting color to the filter element medium. There shall be no migration identifiable as coming from the filter media. The weight of the contaminant collected shall not exceed the value listed in table IV.

4.4.3 Examination of product. The filter and element shall be examined to determine compliance with manufacturer drawings (see 3.6.3), markings (see 3.9), workmanship (see 3.10), and the dimensional data on the applicable specification sheet.

5. PREPARATION FOR DELIVERY

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended use. The filter and filter element covered by this specification are intended for use in aircraft hydraulic ground support test equipment. The filter and element operate with MIL-PRF-87257 or MIL-PRF-83282 hydraulic fluid at operating pressures of 5,000 or 8,000 psi. There are no commercial filters that meet this high pressure and three micron requirement.

6.2 Ordering data. Procurement documents must specify the following:

a. Title, number, and date of this specification.

b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1 and 2.3).

c. Specification sheet numbers.

d. Types and classes (see 1.2).

e. Packaging requirements (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL-81836B, whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, 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 purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from the Commander, Naval Air Warfare Center Aircraft Division, Attn: Code 4.3.5, Building 3197, Suite D, 22347 Cedar Point Road, Unit 6, Patuxent River, MD 20670-1161.

6.4 Process controls limitations. If the filter element is of the type where resinous or other material is used for elimination of imperfections, not more than five percent of the filtering area should be covered by the applied material. Filter element media having an initial bubble point less than three inches of water before repair should be cause for rejection. The manufacturer's qualification test report should define the resin employed for joining or patching, application techniques, curing cycle, and procedures followed to ensure adhesion of the resin. The manufacturer's drawings should specify the limitation or process controls that will govern manufacturing variation and in media obstruction due to braze wicking, seam width, and crimp length, in addition to the existing limits on repair.

6.4.1 Filter element repair procedure. The repair procedures should specify the resin employed for joining or patching, curing cycle, and application techniques to be followed to ensure adhesion of the resin. The approved repair procedures should be furnished to the contracting activity with each procurement.

6.5 Dissimilar metals. MIL-STD-889 provides methods for protecting joined dissimilar metals.

6.6 Handle. Filter housings weighing more than 20 pounds should have a handle so that the element can be changed without power tools, lift jacks, or hoists.

6.7 Definitions.

6.7.1 Contamination. Contamination is any substance in a fluid system which is foreign to that system.

6.7.2 Filter efficiency rating. The efficiency rating of a filter is the efficiency with which it will remove particles above a certain size from a fluid stream carrying a certain type of contaminant.

6.8 Test dust source of supply. All test dust used for qualification tests should be obtained from the qualifying activity (see 6.3).

6.9 Test equipment housings for elements submitted without housing. Manufacturers may submit elements without housings. If required by the qualifying activity, filter housings used as test equipment should be provided by the manufacturer.

a. Tests housings should be in accordance with the dimensional requirements of this specification and the applicable specification sheet.

b. The differential pressure indicators are not required.

6.10 Material Safety Data Sheets. Contracting Officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313; and 29 CFR 1910.1200 requires that the Material Safety Data Sheet for each hazardous chemical used in an operation must be readily available to personnel using the material. Contracting officers will identify the activities requiring copies of the Material Safety data Sheet.

6.11 Part or identifying number (PIN). The part numbering system is shown in tables VI and VII. The PIN to be used for filter and filter elements acquired to this specification are created as follows:

M	81836	/X	-XX
Prefix for military specification	Specification number	Specification sheet number	Part size (see table I of the applicable Specification sheet)

TABLE VI. Class 5000 filter and filter element types and dash numbers.

Operating pressure (psi)	Filter assembly part number		Element part number	Element adapter part number
	Type A mechanical indicator	Type B electrical indicator		
5,000	M81836/1-8	M81836/2-8	M81836/4-8	
	M81836/1-16	M81836/2-16	M81836/4-16	M81836/4-16
	M81836/1-24	M81836/2-24	M81836/4-24	

TABLE VII. Class 8000 filter and filter element types and dash numbers.

Operating pressure (psi)	Filter assembly part number		Element part number
	Type A mechanical indicator	Type B electrical indicator	
8,000	M81836/6-8	M81836/7-8	M81836/9-8
	M81836/7-16	M81836/7-16	M81836/9-16
	M81836/7-24	M81836/7-24	M81836/9-24

6.12 Subject term (key word) listing.

Filtration
Fluid systems
Petroleum ether
Support equipment

6.13 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

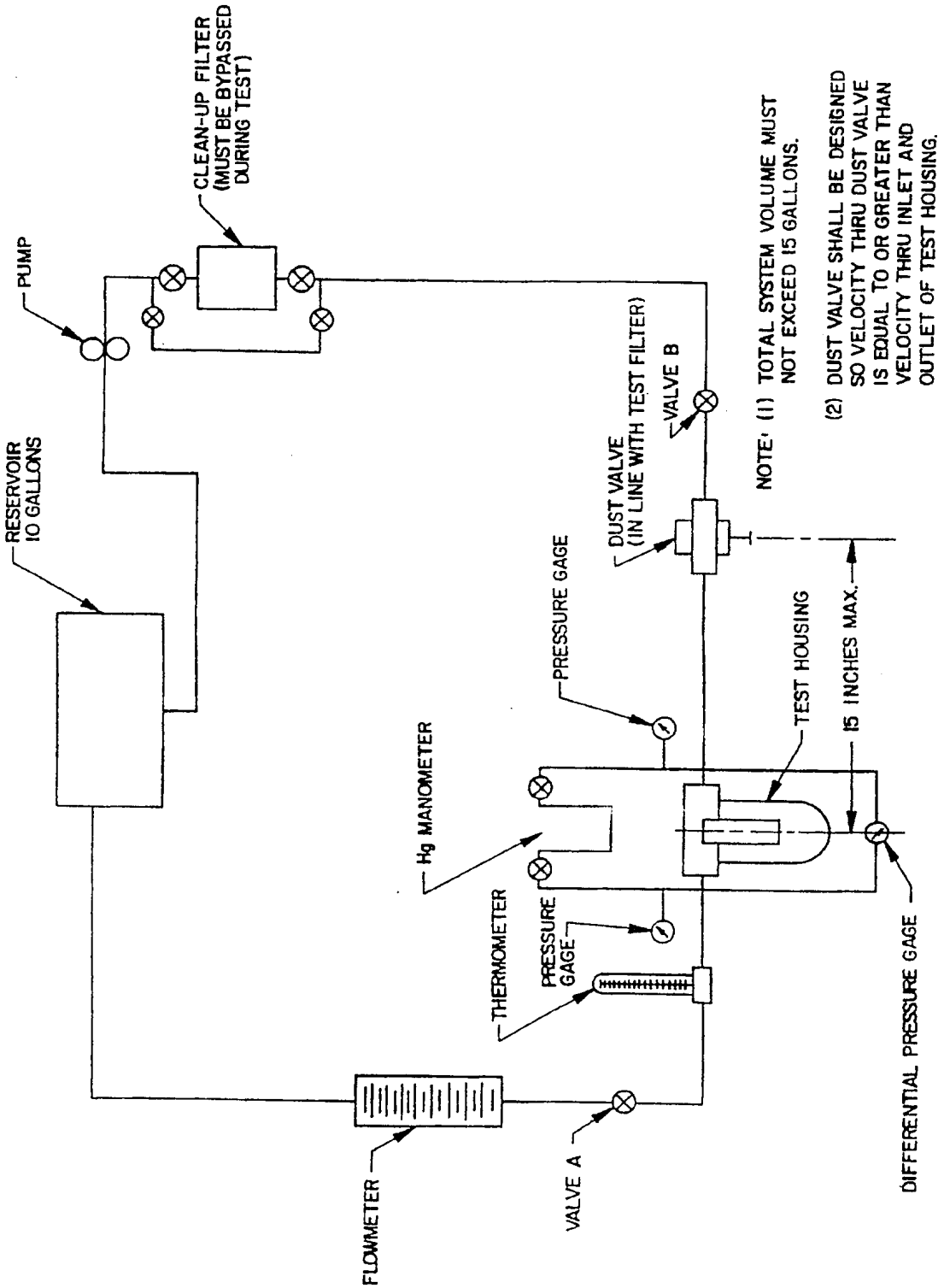


FIGURE 1. Typical setup for determining pressure buildup and collapse pressure characteristics

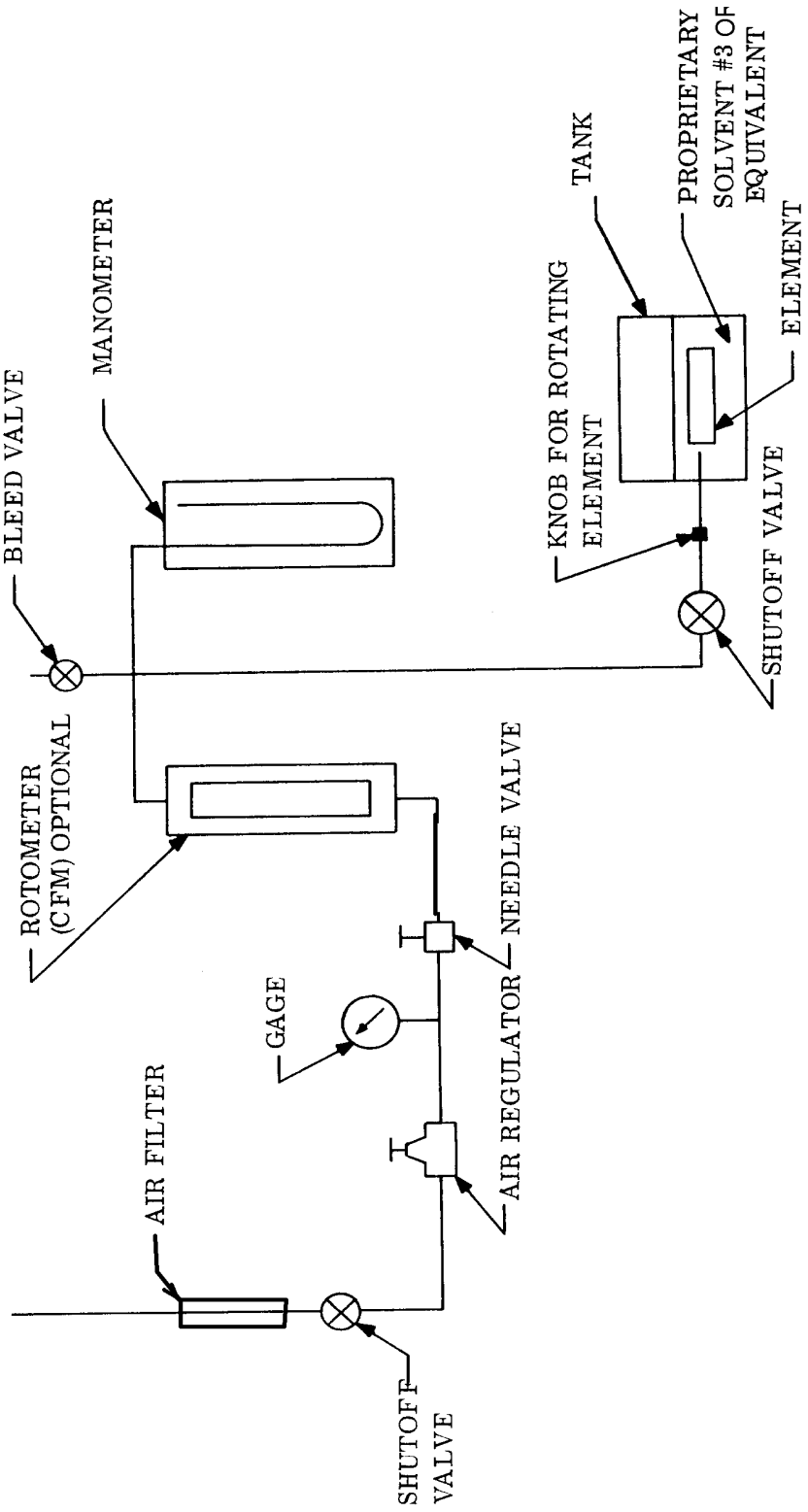


FIGURE 2. Typical schematic diagram for air bubble test

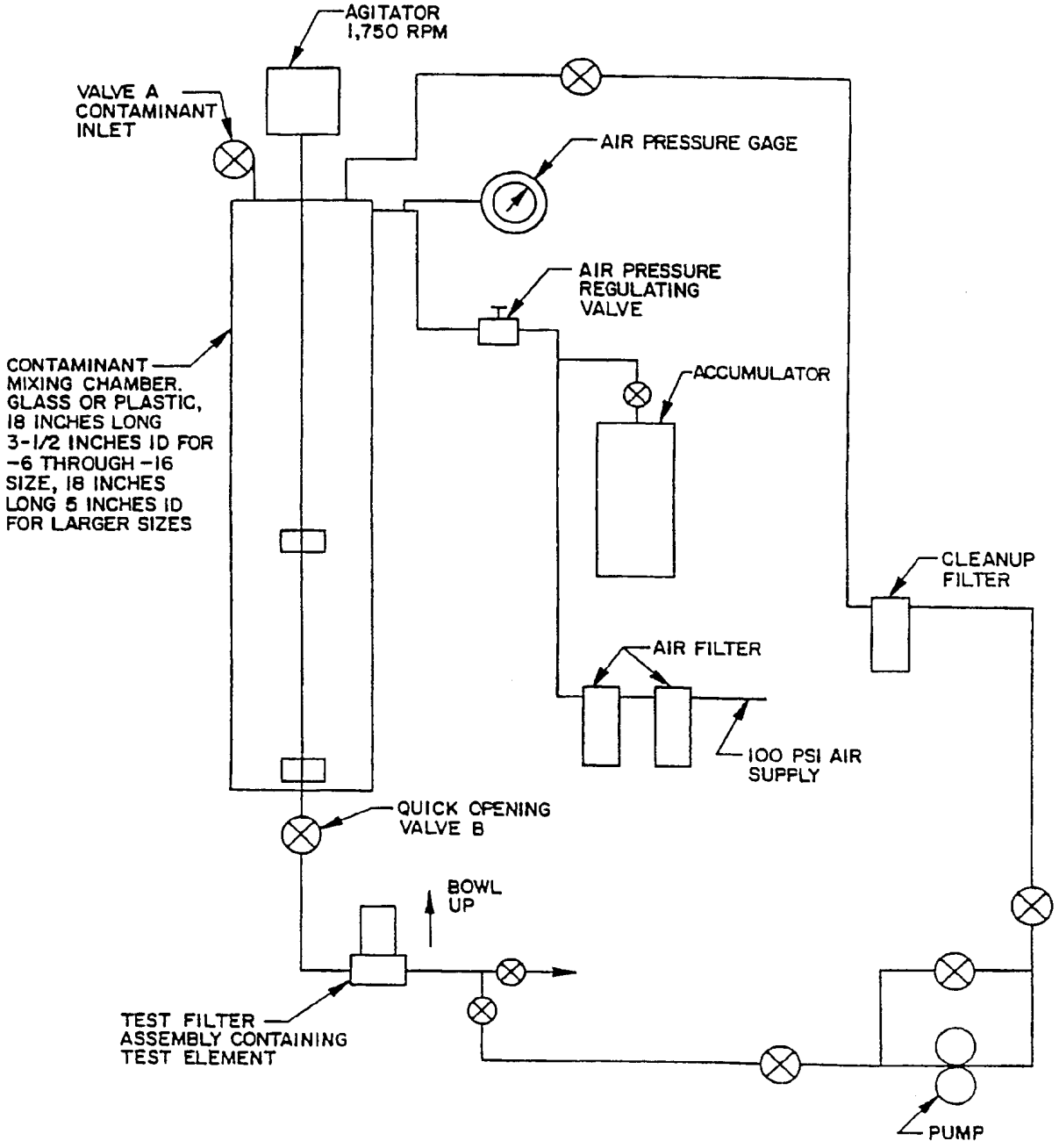
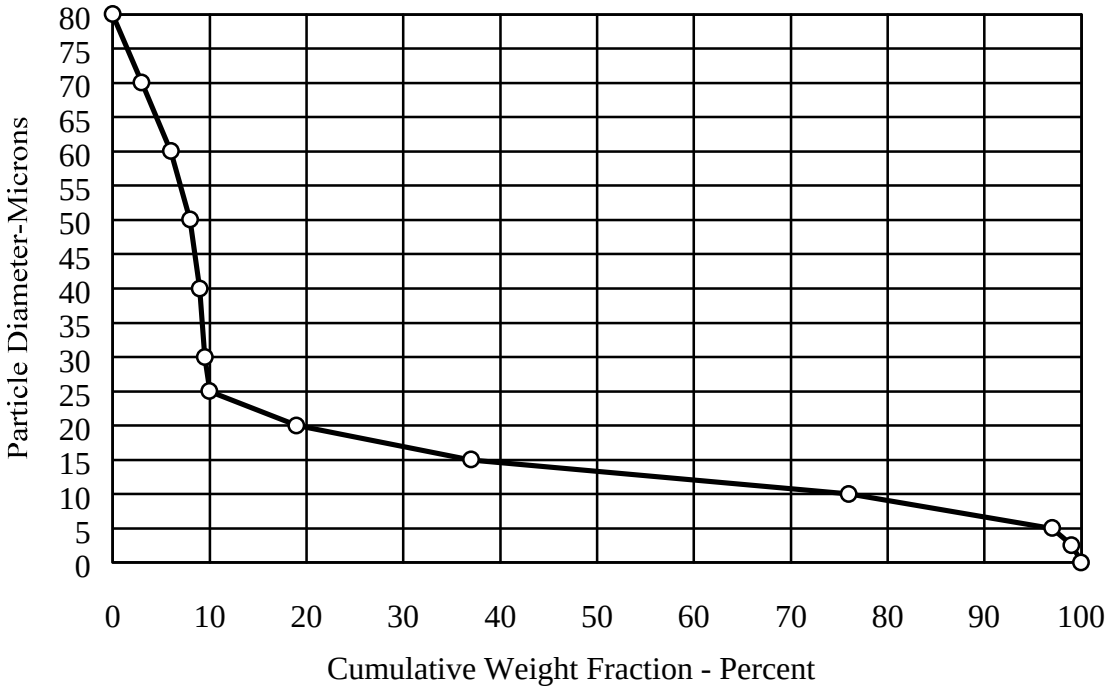


FIGURE 3. Typical schematic for determining filtration efficiency of elements.



Points on the Line Indicate Portions of Particles
With Sizes Greater Than Diameter Noted

Size Range (Microns)	Number (by count)	Weight (mg)	Percent (by weight)
0 - 2	76×10^6	0.2	0.04
2 - 5	190×10^6	11.5	2.3
5 - 10	225×10^6	110.5	22.1
10 - 15	101×10^6	187.4	37.4
15 - 20	17×10^6	95.2	19.0
20 - 25	38×10^6	46.3	9.3
25 - 30	120×10^3	2.8	0.6
30 - 40	85×10^3	4.2	0.8
40 - 50	70×10^3	7.5	1.5
50 - 60	50×10^3	9.6	1.9
60 - 70	40×10^3	12.8	2.6
70 - 80	25×10^3	12.0	2.4
		500.0	100.0

FIGURE 4. Particle size distribution curve APM F-9 glass beads.

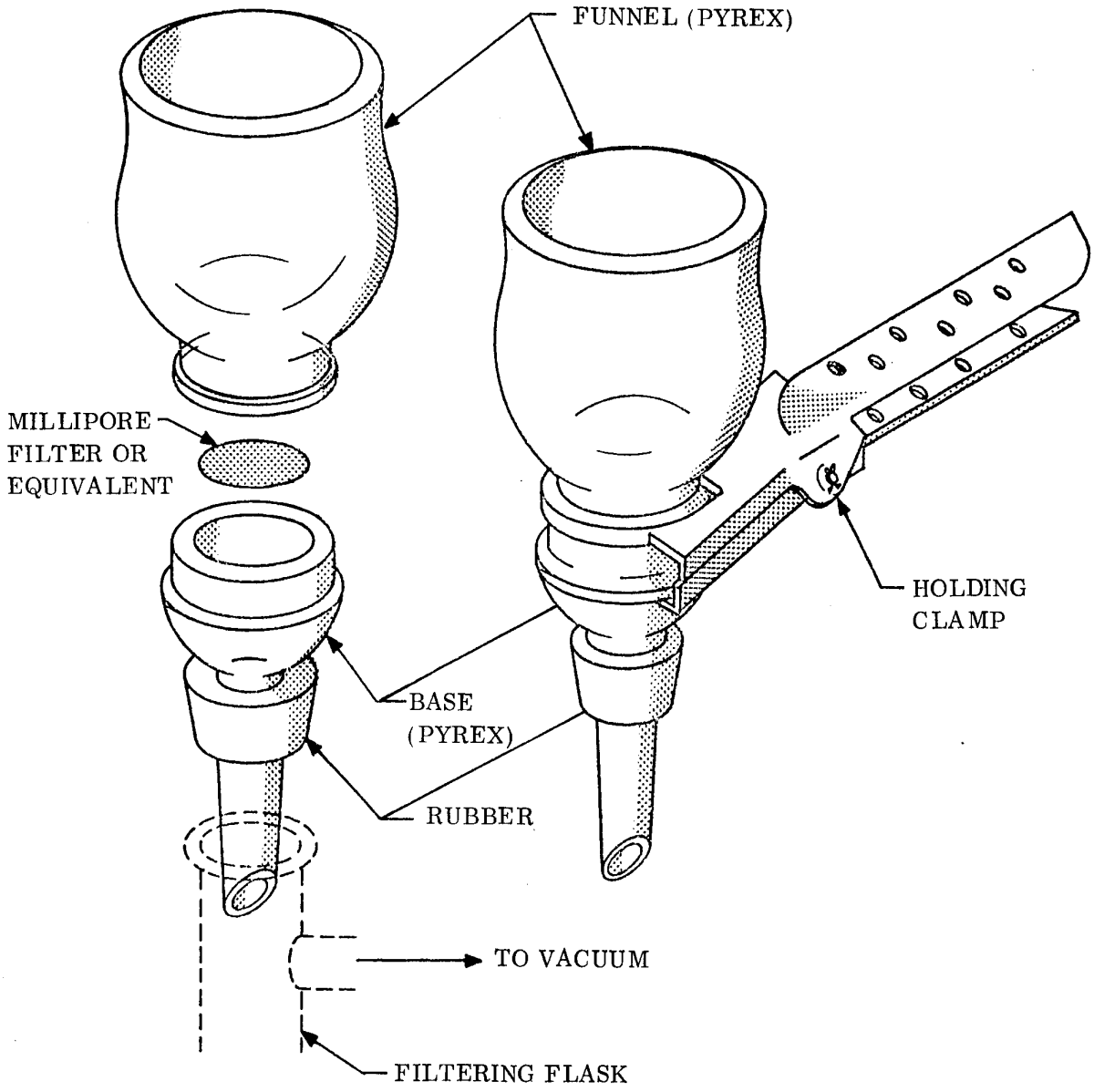


FIGURE 5. Diagram of effluent filtration setup.

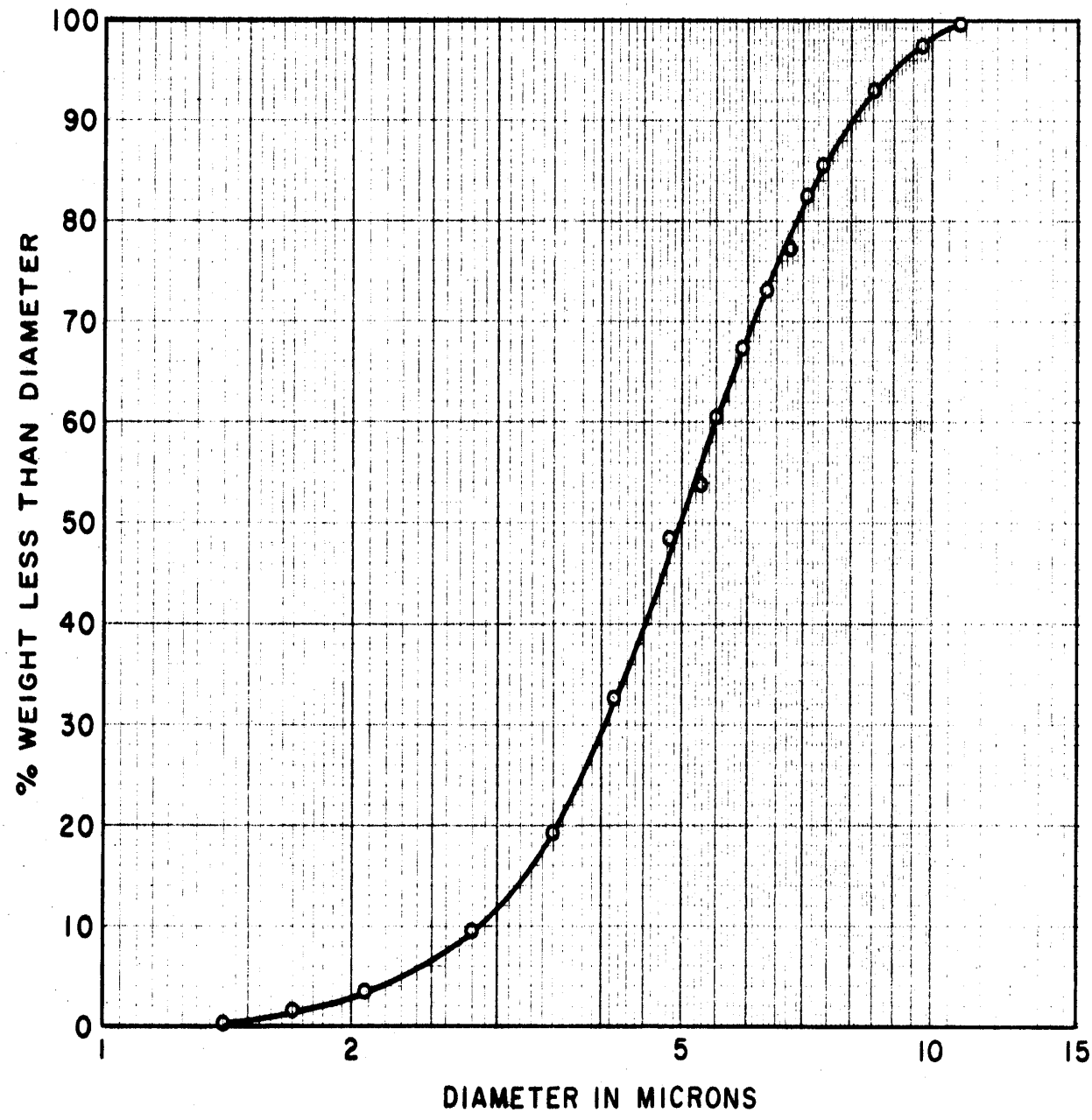


FIGURE 6. Particle size distribution, carbonyl iron E.

CONCLUDING MATERIAL

Custodians:
Navy - AS
DLA - CC

Preparing activity:
Navy - AS
(Project 4920-0923)

Review activity:
Navy - MC, SA, SH

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing activity must provide a reply within 30 days from receipt of the form.
   NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-81836B	2. DOCUMENT DATE (*YYMMDD*) 981001

3. DOCUMENT TITLE
FILTER AND DISPOSABLE ELEMENT, FLUID PRESSURE, HYDRAULIC, 3 MICRON ABSOLUTE

4. NATURE OF CHANGE (*Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.*)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (*Last, First, Middle Initial*)	b. ORGANIZATION	
c. ADDRESS (*Include Zip Code*)	d. TELEPHONE (*Include Area Code*) (1) Commercial: (2) DSN: (*If Applicable*)	7. DATE SUBMITTED (*YYMMDD*)

8. PREPARING ACTIVITY

a. NAME COMMANDER NAVAL AIR WARFARE CENTER AIRCRAFT DIVISION	b. TELEPHONE NUMBER (*Include Area Code*) (1) Commercial: (732) 323-2947 (2) DSN: 624-2947
c. ADDRESS (*Include Zip Code*) CODE 414100B120-3 HIGHWAY 547 LAKEHURST, NJ 08733-5100	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Logistics Agency (DLSC-LM), Attn: Carla Jenkins/John Tascher 8725 John J. Kingman Road, Ste 2533 Fort Belvoir, VA 22060-6221 Telephone (703) 767-6874