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SUPERSEDING
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FEDERAL SPECIFICATION

FILTERS AND FILTER ELEMENTS, FLUID
PRESSURE: LUBRICATING OIL,
BYPASS AND FULL FLOW

This specification was approved by the Assistant Administrator, Office of Federal Supply and Services, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers oil filters and oil filter elements of bypass design; and also oil filters and oil filter elements of the outside-to-inside flow-path type of full-flow design for installation on internal combustion engines to remove contaminants from lubricating oil (see 6.1).

1.2 Classification. Oil filters and oil filter elements shall be of the following types, classes, and styles, as specified (see 6.2):

- | | |
|----------|--------------------------------------------------------------|
| Type I | - Oil filters (with elements), bypass design. |
| Class 1 | - Light duty, regular size. |
| Style A | - With replaceable element. |
| Style B | - Throw-away design. |
| Class 2 | - Heavy duty, junior size. |
| Class 3 | - Heavy duty, senior size. |
| Type II | - Oil filter elements (bypass design). |
| Class 1 | - Light duty, regular size. |
| Class 2 | - Heavy duty, junior size. |
| Class 3 | - Heavy duty, senior size. |
| Type III | - Oil filters (with elements), full-flow, throw away design. |
| Type IV | - Oil filter elements, full-flow design. |

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Class	Nominal diameter	Nominal installed length
	(inches)	(inches)
1	3	4
2	4	4 - 7/8
3	4 - 9/16	9
4	7 - 5/16	18 - 1/16

2. APPLICABLE DOCUMENTS

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

Federal Specifications:

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	- Box, Shipping, Fiberboard
PPP-B-665	- Boxes: Paperboard, Metal Edged and Components
PPP-B-676	- Boxes, Setup

Federal Standard

FED-STD-123	- Marking for Shipment (Civil Agencies)
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(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and commercial item descriptions as outlined under General Information in the Index of Federal Specifications, Standards and Commercial Item Descriptions. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification and other Federal specifications required by activities outside the Federal Government for bidding purposes are available without charge from the General Services Administration, Business service Centers in Boston, MA; New York, NY; Philadelphia, PA; Washington, DC; Atlanta, GA; Chicago, IL; Kansas City, MO; Forth Worth, TX; Houston, TX; Denver, CO; San Francisco, CA; Los Angeles, CA; and Seattle, WA.

(Federal Government activities may obtain copies of Federal standardization documents and the Index of Federal Specifications, Standards, and Commercial Item Descriptions from established distribution points in their agencies.)

Military Specifications:

- MIL-P-116 - Preservation, Methods of.
- MIL-L-2104 - Lubricating Oil, Internal-combustion Engine, Tactical Service.
- MIL-L-9000 - Lubricating Oil, Shipboard, Internal-combustion, High Output Diesel.
- MIL-C-112803 - Gasket Material, Non-Metallic.

Military standards:

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking for Shipment and Storage.
- MIL-STD-130 - Identification Marking of US Military Property.
- MS35341 - Filter, Fluid, Pressure-oil, Heavy Duty, Bypass Type, Senior Size (Non Base Mounted).
- MS35342 - Filter, Fluid Pressure-Oil, Heavy Duty, Bypass Type, Senior (Base Mounted).
- MS35343 - Filter, Fluid, Pressure-Oil, Heavy Duty, Bypass Type, Junior Size.
- MS35345 - Filter Element, Fluid Pressure for Senior Size Filter.
- MS35346 - Filter Element, Fluid, Pressure for Junior Size Filter.
- MS35347 - Gasket, Filter, Fluid, Pressure.
- MS35802 - Filter Elements, Fluid, Pressure-oil, Full-flow.

(Copies of military specifications and standards required by contractors in connection with specific acquisition functions should be obtained from the acquisition 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)

- D874-79 - Sulfated Ash from Lubricating Oils and Additives.
- D893-80 - Insolubles in Used Lubricating Oils.
- D3699-78 - Kerosine.

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

3. REQUIREMENTS

3.1 Qualification. Filters and filter elements furnished under this specification shall be products which have been tested and have passed the qualifications tests specified herein and have been listed on, or approved for listing on the applicable Qualified Products List (QPL) (see 4.3 and 6.3).

3.2 Materials. Materials shall be as specified herein and in referenced specifications, standards and drawings. Material shall be free of defects which adversely affect performance, serviceability, or appearance of the finished product (see 6.5).

3.3 Description.

3.3.1 Type I.

3.3.1.1 Type I, class 1.

3.3.1.1.1 Style A. Filter shall be the manufacturer's current standard filter which meets or exceeds the requirements specified herein. It shall consist of one or more metal bodies, body cover, cover gasket, replaceable element with pullout device, necessary fastening and mounting arrangements, and product markings as required for satisfactory service in the intended application (see 6.2). Body shall be equipped with reinforced inlet and outlet openings, threaded to receive standard oil-line fittings. Body design shall facilitate cleaning of the body interior and permit removal and replacement of the oil filter element, without disconnecting any attached oil lines or fittings. Unless otherwise specified (see 6.2), exterior surfaces of body and cover shall be given the manufacturer's standard commercial finish.

3.3.1.1.2 Style B. Filter shall consist of a metal body inclosing a filter element. The body shall be equipped with necessary fastening and mounting arrangements and product markings as specified and as required for satisfactory service in the intended application (see 6.2). Exterior surfaces shall conform to 3.3.1.1.1.

3.3.1.2 Type I, class 2. Oil filter shall be in conformance with 3.3.1.1.1. Design and general arrangement shall be as shown in figure 1 or, for military usage, shall conform to MS35343.

3.3.1.3 Type I, class 3.

3.3.1.3.1 Bracket-mounted. Filter shall be in conformance with 3.3.1.1.1. Design shall be as shown in figure 2, or for military usage shall conform to MS35341.

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3.3.1.3.2 Base-mounted. Filter shall be in conformance with 3.3.1.1.1. Design shall be as shown in figure 3, or for military usage shall conform to MS35342.

3.3.2 Type II. When specified (see 6.2), filter elements shall be furnished as separate replacement items, including gasket for sealing the filter cover to the filter body. Filter element for type I, class 1, style B filter shall be supplied as part of the filter assembly including a gasket for sealing filter to mounting plate, and not separately.

3.3.2.1 Class 1. Element for type I, style A filter shall be suitable for use in the specified filter (see 6.2), have a pullout device, meet the performance requirements of 3.5 and be designed for ready installation in, or removal from, its applicable filter. The element for type I, class 1, style B filter shall meet the performance characteristics of 3.5.

3.5.2.2 Class 2. Element for type I, class 2 filter shall conform to the design and arrangement shown in figure 1, or for military requirements, shall conform to MS35346. It shall be suitable for field installation in any type I, class 2 filter body without the use of any kind of adapters. It shall be provided with a pullout device and sealing members as specified in 3.3.2.2.1 and 3.3.2.2.2, respectively.

3.3.2.2.1 Pullout device. A pullout device shall be incorporated in the upper side (top) of each type II filter element.

3.3.2.2.2 Sealing members. Top and bottom seals and a spring bearing plate, or equivalent, shall be furnished for the element of each type I, class 2 filter. The seals shall be permanently attached (mechanically secured, not bonded with cement) to the element and shall be capable of sealing around the center tube (see fig. 1). The spring bearing plate, or equivalent, shall be either mechanically attached to, or constructed integrally with, the element.

3.3.2.3 Class 3. The element, including a pullout device and sealing members, for the type I, class 3 oil filter shall conform to 3.3.2.2 through 3.3.2.2.2 inclusive; except its design and general arrangement shall be in accordance with figures 2 and 3, or for military usage shall conform to MS35345.

3.3.3 Type III. Filters, with elements, shall conform to the requirements of 3.3.1.1.2. Filter element for the type III filters shall be supplied as part of the filter assembly, including a gasket for sealing filter to mounting plate, and not separately. These elements shall meet the applicable performance requirements of 3.5.

3.3.3.1 Antidrain-back device. TYPE I bypass flow and type III full-flow system filters (base mounted spin-on design), with integral elements, shall be provided with an antidrain-back device (valve), as applicable.

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3.3.4 Type IV.

3.3.4.1 Description. Filter elements shall conform to the design and dimensions shown on MS35802. Filters shall be provided with sealing members and furnished with one of each type of filter cover gasket appropriate for the class shown on MS35802. Elements shall not contain built-in relief valves, orifices or bleeding devices.

3.3.4.1.1 Pullout device. Not required on type IV, class 1, 2 or 3 elements. Type IV, class 4 elements shall be equipped with a pullout device accessible at the top.

3.4 Installation arrangements.

3.4.1 Type I, class 1. As specified (see 6.2), straps, brackets or other means for installation on or near the engine to be served shall be furnished with each filter; or be incorporated in its design, as in the case of the type I, class 1, style B filter. Unless otherwise specified (see 6.2), oil lines and oil line fittings will not be required as part of the complete filter assembly.

3.4.2 Type I, class 2. Filter shall be arranged for strap or bracket mounting on, or near, the engine. Straps or brackets, when furnished, shall be of the adjustable type and shall not be attached permanently to the filter body.

3.4.3 Type I, class 3. Filter shall be arranged for bracket mounting in accordance with figure 2; for base-mounting in accordance with figure 3: or, for military use, in accordance with MS35341 (bracket-mounted) or MS35342 (base-mounted).

3.5 Performance requirements.

3.5.1 Pressure resistance. Type I, class 1, style A filter assembly (less element); type I, class 1, style B filter assembly (with elements and type III filter assembly (with element shall withstand a pressure of not less than 100 pounds per square inch (psi). Type I, class 2 and 3 filter assemblies (less element) shall withstand a pressure of 150 psi without leakage, permanent deformation, or other visible damage.

3.5.2 Media migration (see 4.6.2).

3.5.2.1 Type II elements and elements for types I and III filters. Media migration shall be not greater than 10 milligrams (mg).

3.5.2.2 Type IV elements. Media migration shall be not greater than the following:

Class	Allowable media migration in milligrams
1	3
2	5
3	10
4	15

3.5.3 Antidrain-back device. Device shall prevent oil leakage back through inlet ports or holes when in an inverted or partially inverted position. The leakage test of the antidrain-back valve shall be based on the total capacity for each filter unit (see 4.6.3).

3.5.4 Additive removal. Type I, class 2 and 3 filters; type II, class 2 and 3 filter elements; type III filters; and type IV filter elements shall be tested for additive removal. The lubricating oil used in testing shall retain not less than 90 percent of its original additive content (see 4.6.4).

3.5.5 Filtering ability (see 4.6.5).

3.5.5.1 Types I, II and III. Applicable filters and elements shall be tested for filtering ability as specified in 4.6.5. For type I, class 1 and 3 filters, and type III filters, the normal pentane insoluble content of the oil samples taken at the end of the test shall be not greater than 0.50 percent by weight; for class 2 it shall be not greater than 0.30 percent by weight. The cumulative filtering efficiency at the end of 22, 44, 66 and 88 hours of operation, as applicable (see tables IV and V), shall be not less than 85 percent.

3.5.5.2 Type IV filter elements. Elements shall be tested for filtering ability as specified in 4.6.5. Differential pressure of class 1, 2 and 4 filter elements shall not exceed 3 psi initially, nor exceed 12 psi before completion of the 66 hours of testing. Differential pressure of the class 3 element shall not exceed 1 psi initially, nor exceed 12 psi before completion of the 66 hours of testing. The normal pentane insoluble content of the oil samples shall not be greater than the following:

Class	22 hrs	44 hrs	66 hrs
1	.120	.240	.272
2	.120	.240	.272
3	.188	.376	.456
4	.087	.174	.202

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3.5.6 Shock resistance (see 4.6.6).

3.5.6.1 Types I and II, class 2 and 3. Type I, class 2 and 3 filters and type II, class 2 and 3 filter elements shall evidence no mechanical or other damage after being subjected to the shock test specified in 4.6.6.1. Flow rates at the end of the test shall be not less than 90 percent nor more than 110 percent of their original flow rates.

3.5.6.2 Type IV elements. Elements shall meet the filtering ability requirements of 3.5.5.2 after being subjected to the shock test specified in 4.6.6.2.

3.5.7 End-load strength. Type IV filter elements shall withstand end loads as specified below without evidence of permanent deformation or other visible damage (see 4.6.7):

Class	End load in pounds
1	35
2	50
3	75
4	100

3.5.8 Differential pressure. Type IV elements shall withstand a pressure differential of 100 psi without evidence of deformation or other damage (see 4.6.8).

3.6 Design and construction.

3.6.1 Body (shell).

3.6.1.1 Type I, class 1. Body shall be in accordance with 3.3.1.1.

3.6.1.2 Type I, class 2. Body, with center tube welded or permanently attached thereto, shall include the outlet and inlet connections as shown in figure 1 and shall provide a sump below the element for the collection of sediment and water. The structural strength of the body and the tensile strength of the center tube shall be sufficient to operate safely with a tightening torque of 25 foot-pounds (see 4.6.1). The body with its permanently attached center tube shall be arranged for assembly and operation with the element and cover assembly specified herein and in figure 1. In lieu of figure 1, the design and general arrangement for military usage shall conform to MS35343.

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3.6.1.2.1 Cover assembly. Cover assembly shall consist of a cover, cover screw, cover screw gasket, and element hold-down spring in accordance with figure 1 or MS35343.

3.6.1.2.1.1 Cover screw and spring. When in place on cover, cover screw shall carry a spring, either cylindrical or conical, so attached that it may be removed from the screw when desired. Spring force shall not be less than 15 nor more than 35 pounds (see 4.6.9).

3.6.1.2.1.2 Gasket. Gasket shall be as specified in figure 1 or MS35343.

3.6.1.2.1.3 Cover. Cover shall be constructed to provide space for the element hold-down spring and shall conform to figure 1 or MS35343 with respect to the gasket retaining diameter and the cover-screw hole. Cover shall have sufficient structural strength to operate safely with a tightening torque of 25 foot pounds.

3.6.1.2.2 Center tube. A steel tube (outlet tube for type I, class 2 filter shall be provided, free of burrs, with a collar or stop to position and support the lower end of the filter element. Tube shall be provided with an orifice drilled through one side of the wall of the center tube to serve as an outlet passage for filtered oil. It shall conform to figure 1 or MS35343.

3.6.1.2.3 Top gasket. Top gasket shall be as specified in figure 1 or MS35347.

3.6.1.3 Type I, class 3 (bracket-mounted). Filter body shall conform to 3.6.1.2, except as otherwise specified in figure 2 or MS35341. Cover assembly and top gasket shall be as specified in 3.6.1.2.1 and 3.6.1.2.3 respectively. Center tube shall be as specified in 3.6.1.2.2, except that it shall conform dimensionally to figure 2 or MS35341.

3.6.1.4 Type I, class 3 (base-mounted). Type I, class 3, base-mounted filter body shall be as specified in figure 3 or MS35342.

3.6.1.4.1 Base. Base shall conform to figure 3 or MS35342. Design and arrangement of inlet and outlet passages are at the manufacturer's option. A check valve, for the prevention of oil drainback, shall be provided and shall conform to the dimensional limitations as shown in figure 3 or MS35342; otherwise, design and method of installation is optional. A drain passage shall be provided to facilitate element replacement and shall have a plug not smaller than 1/4 NPTF, dry seal.

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3.6.1.4.2 Body and tube assembly. Body and center tube shall be in accordance with figure 3 or MS35342. Structural strength of the body and tensile strength of center tube must be sufficient to operate safely with a tightening torque of 25 foot pounds. Spring shall conform to figure 3 or MS35342 and its force shall be as specified in 3.6.1.2.1.1.

3.6.1.4.3 Body gaskets. Top and bottom gaskets shall conform to figure 3 or MS35347.

3.6.2 Pullout device.

3.6.2.1 Type II elements. Pullout device shall withstand a direct pull of 25 pounds without showing any evidence of failure or injury to the element.

3.6.2.2 Type IV, class 4 elements. Pullout device shall withstand a direct pull of 100 pounds without showing any evidence of failure or injury to the element. Pullout devices are not required on type IV, class 1, 2 or 3 elements.

3.7 Product identification.

3.7.1.2 Type I, class 1. Each filter shall be plainly and permanently marked in accordance with MIL-STD-130. Marking shall include manufacturer's name or trademark, model or part number, and any instructions deemed necessary by the manufacturer for servicing. The word "INLET" or "OUTLET" shall be marked in the same manner near the appropriate opening on the filter. Decalcomania transfers, when used, shall be legible after the final finish or treatment has been applied (see 3.3.1.1.1).

3.7.1.2 Type I, class 2. Marking shall be as specified in 3.7.1.1 and in addition each filter shall include in its marking, the following:

- a. On the body. Manufacturer's name or trademark, model and part number, and the words "HEAVY DUTY JUNIOR SIZE FILTER-USE HEAVY DUTY JUNIOR SIZE ELEMENT." Optional-manufacturer's element model or type number.
- b. On the cover. Manufacturer's name or trademark, the words "HEAVY DUTY FILTER" and any additional information deemed necessary by the supplier.

3.7.1.3 Type I, class 3 (bracket-mounted). Marking shall be as specified in 3.7.1.1 and in addition each filter shall include the following in its marking:

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- a. On the body. Manufacturer's name or trademark, model or part number, and the words "HEAVY DUTY SENIOR SIZE FILTER-USE WITH HEAVY DUTY SENIOR SIZE ELEMENT." Optional-manufacturer's element model or type number.
- b. On the cover. Manufacturer's name or trademark, the words "HEAVY DUTY FILTER" and any additional information deemed necessary by the supplier.

3.7.1.4 Type I, class 3 (base-mounted). Marking shall be as specified in 3.7.1.1 and in addition each filter shall include in its marking on the cylindrical portion of the body, manufacturer's name or trademark, model or part number, and the words "HEAVY DUTY SENIOR SIZE FILTER-USE WITH HEAVY DUTY SENIOR SIZE ELEMENT." Optional-manufacturer's element model or type number. Additional markings deemed necessary by the supplier shall also be included in the marking.

3.7.2 Type II.

3.7.2.1 Class 1. Element shall be plainly and permanently marked on its upper (cover) end or on its side with the manufacturer's name or trademark, and the model or part number. If the marking is placed on the side, the word "TOP," together with one or more arrows pointing to the top of the element shall be added.

3.7.2.2 Class 2. Element shall be plainly and permanently marked on its upper (cover) end or on its side with the manufacturer's name or trademark, model or part number, and with the words "HEAVY DUTY JUNIOR SIZE FILTER ELEMENT." If the marking is placed on the side, the word "TOP," together with one or more arrows pointing to the top of the element shall be added.

3.7.2.3 Class 3. Element shall be plainly marked on its upper (cover) end or on its side with the manufacturer's name or trademark, model or part number, and with the words "HEAVY DUTY SENIOR SIZE FILTER ELEMENT." If the marking is placed on the side, the word "TOP," together with one or more arrows pointing to the top of the element shall be added.

3.7.3 Type III. Marking shall conform to the requirements of 3.7.1.1. Marking shall include the words "FULL FLOW DESIGN."

3.7.4 Type IV. Elements shall be plainly and permanently marked in accordance with MIL-STD-130. Marking shall include the words "MILITARY STANDARD FULL FLOW OIL FILTER ELEMENT" as well as the element class, MS part number, National stock number, manufacturer's name or trademark, and the manufacturer's part number.

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3.8 Workmanship. Workmanship shall be of such to produce types I and III oil filters and types II and IV oil filter elements of the design and operating characteristics specified herein.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor 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 that supplies and services conform to prescribed requirements.

4.1.1 Contractor's quality control system. Unless otherwise specified by the procuring activity, the contractor shall provide and maintain an effective inspection or quality control system acceptable to the Government covering the supplies under the contract. A current written description of the system shall be submitted to the contracting officer prior to initiation of production. The contractor will not be restricted to the inspection station or to the method of inspection listed provided that an equivalent control is included in the approved quality control procedure. The contractor shall notify the Government of and obtain approval for any change to the written procedure that might affect the degree of control required by this specification or other applicable documents referenced therein.

4.1.2 Government verification. All quality assurance operations performed by the contractor will be subject to Government verification at unscheduled intervals. Verification will consist of surveillance of the operations to determine that practices, methods, and procedures of the written inspection plan are being properly applied. Deviation from the prescribed or agreed upon procedures, or instances of poor practices which might have an effect upon the quality of the product will immediately be called to the attention of the contractor. Failure of the contractor to promptly correct product deficiencies discovered shall be cause for suspension of acceptance until corrective action has been taken or until conformance of product to prescribed criteria has been demonstrated.

4.1.3 Materials. The contractor shall provide the Government with evidence that materials (see 3.2) used are as specified in the applicable specifications and drawings.

4.2 Classification of inspections. Inspections specified herein are classified as follows:

- a. Qualification inspection (see 4.3).
- b. Quality conformance inspection (see 4.4).

4.3 Qualification inspection. A qualification sample as specified in table I shall be utilized for qualification testing. The oil filter assemblies and elements shall be representative of the units proposed to be furnished under the contract. Qualification testing shall be conducted under Government surveillance, by the contractor, or by an authorized testing facility, at a site approved by the Government. Inspection shall consist of examination for the defects specified in 4.4.2 and testing as specified in table II in the order listed (see 6.3.1).

TABLE 1. Qualification test samples.

Type	Class	Style	Complete assemblies	Mounting plates	Elements
I	1	A	4		10
I	1	B	14	4	
I	2		4		10
I	3		4		10
II	1		4		14
II	2				14
II	3				14
III			14	4	
IV	1				10
IV	2				10
IV	3				10
IV	4				10

4.3.1 Retention of qualification. Certification shall be requested every two years from each manufacturer listed on the QPL to retain listing on the QPL. This certification shall be forwarded to the preparing activity and shall be signed by a responsible official of management, attesting that the listed product still meets the requirements of the current issue of the specification, is available from the listed plant, and can be produced under the same conditions as originally qualified; i.e., same process, materials, construction, design, and manufacturer's part number or designation. Failure to provide certification shall be cause for removal from the QPL.

TABLE II. Qualification tests.

Title	Requirements	Qualification tests	Type I			Type II			Type III	Type IV			
			Class			Class				Class			
			1	2	3	1	2	3		1	2	3	4
Pressure resistance	3.5.1	4.6.1	X	X	X				X				
Media migration	3.5.2	4.6.2	X	X	X	X	X	X	X	X	X	X	X
Antidrain-back device	3.5.3	4.6.3	X	X	X				X				
Additive removal	3.5.4	4.6.4		X	X		X	X	X	X	X	X	X
Filtering ability	3.5.5	4.6.5	X	X	X	X	X	X	X	X	X	X	X
Shock resistance	3.5.6	4.6.6		X	X		X	X		X	X	X	X
End load strength	3.5.7	4.6.7								X	X	X	X
Differential pressure	3.5.8	4.6.8								X	X	X	X
Force-cover spring	3.6.1.2.1.1	4.6.9		X	X								
Pull-out device tension	3.6.2	4.6.10				X	X	X					X

4.4 Quality conformance inspection.

4.4.1 Sampling.

4.4.1.1 Lot formation. A lot shall consist of all filter assemblies or filter elements, or both, of one type, class, and style (when applicable), from one manufacturer, from an identifiable production period, submitted at one time for acceptance.

4.4.1.2 Sampling for examination. Sampling for quality conformance examination shall be selected in accordance with inspection level II of MIL-STD-105.

4.4.1.3 Sampling for acceptance tests. Sampling for quality conformance tests shall be in accordance with MIL-STD-105, inspection level S-3.

4.4.2 Quality conformance examination.

4.4.2.1 Acceptable quality level. Each sample selected in accordance with 4.4.1.2 shall be examined for conformance to the following acceptable quality levels (AQLs), on the basis of percent defective:

<u>Classification</u>	<u>AQL</u>
Major	2.5
Minor	2.5

4.4.2.2 Classification of defects. For examination purposes, defects shall be classified as follows:

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Category	Defect	Method of inspection
Major:		
101	Dimensions not within specified tolerance for proper installation or operation (see figures 1, 2, 3, and 4 and applicable MS standards).	Standard Inspection Equipment (SIE)
102	Installation arrangements (fastening or mounting) missing, defective, or not as specified (see 3.3.1 and 3.4).	Visual
103	Pullout device, gasket, or sealing member as applicable) missing, defective, or not as specified (see 3.3.1, 3.3.2, 3.3.3 and 3.3.4 as applicable).	Visual
104	Design not as specified. Any component or part missing, damaged, deformed, or not as specified.	Visual
Minor:		
201	Finish missing, improper, or not as specified (see 3.3.1).	Visual
202	Product identification missing, illegible, incomplete, incorrect, not permanent, or not as specified (see 3.7).	Visual
203	Poor workmanship (see 3.8).	Visual

4.4.3 Acceptance tests. Type I filters selected in accordance with 4.4.1.3 shall be subjected to the tests for pressure resistance and filtering ability (see 4.6.1 and 4.6.5). Types II and IV filter elements and type III filters selected in accordance with 4.4.1.3 shall be subjected to the test for filtering ability (see 4.6.5). Additional tests may be specified at the discretion of the procuring activity. An AQL of 2.5 on the basis of percent defective shall apply.

4.5 Test conditions.

4.5.1 Applicable methods. The tests shall be conducted as specified herein or in accordance with the applicable methods of ASTM D 874.

4.5.2 Test tolerances. Unless otherwise specified (see 6.2), test tolerances for pressure and temperature shall be as follows:

- a. Pressure +/- 1 psi for types I and II; +/- 5 percent for types III and IV.
- b. Temperature +/- 5 deg. F for types II, III and IV.
- c. Flow rate +/- 5 percent for types III and IV.

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4.5.3 Test filters. Where the use of a standard filter or a standard filter body is required in the test methods specified hereinafter, such filter or filter body shall be in accordance with the applicable provisions of section 3 and figures 1 through 4; or MS35341, MS35342, or MS35343.

4.5.4 Reference test oils. Unless otherwise specified (see 6.2), reference test oils required in the test methods specified herein shall conform to the following specifications:

- a. Straight mineral oil shall conform to MIL-L-2104, grade 10.
- b. Additive oil is designated as series 3 diesel engine oil, reference RF0-3 (see 6.4.5), MIL-L-2104 and MIL-L-9000, symbol 9250.

4.5.5 Constituents in standardized oil filter test contaminant (SOFTC-2A). The composition of the standardized contaminant slurry required (see 6.4), for the test methods specified herein, shall be as follows:

- a. Sixteen parts by weight of carbon black; average particle size, 85 millicrons.
- b. Two parts by weight of ferric oxide-95 percent of the particles in the range from 0 to 5 microns.
- c. Four parts by weight of polyvinyl (PV) resin (see 6.4.3).
- d. Seventy-eight parts by weight of the test oil (see 4.5.4 and 6.4.5).

4.5.5.1 Preparation of SOFTC-2A.

- a. All of the carbon black and 20 to 25 percent of the test oil required by the above formula shall be placed in a mechanical mixer and mixed thoroughly at slow speed.
- b. The mixture from (a) above shall be milled over a conventional paint roller mill. The resultant paste shall be collected directly from the mill into a container having an additional 25 percent of the original quantity of oil. The milled slurry and the oil shall be mixed until a homogeneous mixture is obtained.
- c. A dry-mix of the remaining solid constituents, i.e., the PV resin and ferric oxide, shall be prepared. To this dry-mix, the slurry from (b) above shall be slowly added under agitation until a stiff paste is obtained. The balance of the slurry and the remainder of the lubricating oil shall be added to this paste and mixed until homogeneous.

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4. Methods of inspection.

4.6.1 Pressure resistance. To determine conformance to 3.5.1, one type I, class 1, style A or type I, class 2 or 3 filter (without filter element), assembled with the cover tightened to 25 foot-pounds with a torque indicating wrench, shall be subjected for a period of 5 minutes to an internal pressure of 100 psi for type I, class 1 filters and 150 psi for type I, class 2 or 3 filters. Lacking a detachable cover, the test procedure for the type I, class 1, style B filter and the type III filter shall consist of subjecting filter, installed on applicable mounting plate, to an internal pressure of 100 psi for a period of 5 minutes. Testing shall be made with test oil (see 4.5.4) held at a temperature of 200 deg. F, or, if air pressure is used, filter shall be immersed in a suitable bath at 200 deg. F. During and after the test, the sample assembly shall be examined for conformance to 3.5.1.

4.6.2 Media migration.

4.6.2.1 Elements for type I, class 1, style A and classes 2 and 3 filters. To determine conformance to 3.5.2.1, applicable elements shall be tested for media migration in a standard filter body mounted in front of, and in series with, a 0.0015 inch spacing metal edge strainer (Purolator Type D-21WM-20 or equal, with fabric element removed). Ten quarts of test oil (see 4.5.4) shall be circulated through filter (without filter element installed) and through the metal edge strainer for a 4-hour period at 30 psi inlet pressure to the filter body and with the oil held at a temperature of 180 deg. F. At the end of this 4-hour period, the strainer shall be removed and placed over a clean glass beaker to collect the oil drainings. The strainer shall be rinsed into the beaker with ASTM precipitation naphtha which has been filtered through a Gooch crucible (Selas #28-080XF, or equal, fitted or sintered integral bottom) using a rubber policeman to clean all strainer surfaces. All remaining oil in the strainer body shall be drained, the strainer body shall be rinsed with filtered naphtha, and both the oil and washings shall be collected in the same beaker used for the washings from the strainer. The oil and washing shall be diluted (to assist filtration and filtered through a tared Gooch crucible as noted previously. The crucible shall be washed with filtered naphtha, dried on an oven at 212 deg. F, cooled in a desiccator, and weighed to the nearest 0.5 mg. This 4-hour circulation, without element shall be repeated until a run shows a removal of foreign matter from the oil not to exceed 5 mg. A sample oil filter element shall then be installed in the standard filter body and the test oil circulated through the assembly for a period of 8 hours at 30 psi inlet pressure to the filter assembly and with the oil held at a temperature of 180 deg. F. This 8-hour circulation period shall be repeated on additional test elements until a total of four have been flowed in the same manner, without a change or

addition to the sump oil. Each element removed from the filter assembly shall be allowed to drain back into the filter body for a period of 5 minutes prior to starting a subsequent run. At completion of the fourth 8-hour circulation period, the strainer and the strainer body shall be cleaned as prescribed for the 4-hour circulation periods without element and the amount of foreign matter determined to the nearest 0.5 mg. The total weight of foreign matter collected shall be divided by four and the value reported as media migration.

4.6.2.2 Elements for type I, class 1, style B and type III filters. To determine conformance to 3.5.2.1, test procedure shall be the same as that specified in 4.6.2.1 except (a) a piece of tubing shall replace the filter body during the system-cleaning process, and (b) for each 8-hour circulation of test oil, following the system-cleaning process, new, type I, class 1, style B or new type III filters shall be used for testing the media migration.

4.6.2.3 Type IV filter elements. To determine conformance to 3.5.2.2, each element to be tested shall be installed in its applicable test filter body (see figure 4) and tested as specified in 4.6.2.2, except that test conditions of table III shall be in effect.

TABLE III. Media migration test conditions for type IV filter elements.

Element	Flow	Volume of oil in system	Strainer housing volume	Slot area of strainer
class	gpm	gallons	cubic inches	square inches
1	1.5	1	15.5	1.6
2	3	2	31	3.2
3	6	5	62	6.4
4	30	25	310	32.1

4.6.3 Antidrain-back leakage test. To determine conformance to 3.5.3, the following test has been designed to evaluate the performance of the built-in antidrain valve in new and used spin-on type filters with respect to leak back drainage during a period of engine shut down. Basically, the test consists of installing a filter on its base and applying a given static head to the system through a pipe fastened onto the base outlet and measuring any leakage passing the valve device in a specified period of time.

4.6.3.1 Test conditions. The following are conditions under which antidrain-back leakage tests shall be conducted: Test oil shall be a mixture of 60 percent SAE 20 oil conforming to API Service Designation SA and 40 percent kerosine conforming to ASTM D 3699. The mixture shall be a 38-45 viscosity, saybolt universal seconds (SUS) rating at 70 deg. F, and be equivalent in flow characteristics to SAE 10 at 180 deg. F. During test period the test oil shall be maintained at a temperature of 70 deg. +/- 5 deg. F.

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4.6.3.2 Test apparatus and preparation. The apparatus shown in figure 6 shall be used for this test. The filter shall be base mounted by screwing proper thread sized insert into filter head base until the "O" ring is firmly seated and the filter gasket compressed to its recommended torque.

4.6.3.3 Test procedure. Purge the filter by opening valves "A" and "B" to pump test oil through the filter until it is free of air bubbles and then return the test oil collected back into the reservoir. If a used filter is being tested and the test oil was excessively contaminated, discard and replace with clean test oil. The antidrain-back valve (device) must be actuated a minimum of five times during purging cycles. After purging, close valve "B", then open valve "C", and fill the pressure head column using the pump. Fill the column slightly above the 24 inch mark and shut off pump and close valve "A". Remove the cap on the leakage drain tube and allow the trapped test oil to drain for 2 minutes. Then adjust the pressure head to maintain a 24 inch level throughout the test period. At the end of the 2 minute period, place a graduate under the drain tube and record the leakage rate. The pressure head column should be filled from the top to maintain the necessary 24 inch level. Record the leakage rate in milliliters at 10 minute intervals for the first hour and hourly thereafter. Acceptable leakage shall not exceed 10 ml. per hour, nor more than 20 ml. per 12 hour period.

4.6.4 Additive removal. To determine conformance to 3.5.4, type I, classes 2 and 3 filters; type II, classes 2 and 3 filter elements; type III filters; and type IV filter elements shall be tested for oil additive removal by use of a testing apparatus consisting of an oil reservoir, a suitable filter body, and an oil circulating system provided with oil pressure, temperature, and flow-rate in indicators and controls. For types I and III filters and type II filter elements; five quarts of new (unused) additive test oil (see 4.5.4), plus sufficient test oil to fill the filter body; and for type IV filter elements, the volume of new (unused) additive test oil specified in table III, shall be circulated for 20 hours through the filter (without element). Inlet pressure to the filter body for type I filter and type II filter element testing shall be 30 psi. The circulation of oil for type IV element testing shall be at the rate specified in table III. Oil temperature shall be held at 180 deg. F. At the end of this 20 hour period, the additive content of the oil shall be determined by the sulphated residue method (average of three determinations) conforming to ASTM D874. This 20 hour circulation through the test apparatus without filter element shall be repeated until two consecutive runs show an additive retention by the oil of not less than 95 percent of its original value. During each 20 hour circulation, five quarts of new oil, plus sufficient oil to fill the filter body, shall be used for each run when testing types I and III filters and type II

filter elements. The quality of new oil used when testing the type IV filter element shall be as specified in table III. The second of the two consecutive readings showing an additive retention by the oil of not less than 95 percent of the original content shall be considered as the blank. A sample filter element shall be installed in the filter body and this complete filter assembly shall be substituted for the standard filter body in the oil circulating system. New test oil, in the applicable amount specified above, shall be added to the test apparatus and circulated through the element for 20 hours at an inlet pressure to types II and III filter elements of 30 psi and at the applicable rated flow for the type IV elements (see table III), with the oil being held at a temperature of 180 deg. F. At the end of this 20 hour period, the oil shall be examined for its additive content by the sulphated residue method (average of three determinations) conforming to ASTM D874. Correct for the blank and express as percent of original additive content of the new oil.

4.6.5 Filtering ability. To determine conformance to 3.5.5, a type I or III filter; or a type II or IV filter element, assembled in a filter body for which the filter element is intended, shall be tested for filtering ability by use of a testing apparatus consisting of an oil reservoir with oil level indicator, and a suitable oil circulating system provided with oil pressure and temperature indicators and controls. The capacity of this system, exclusive of the filter under test, shall be adequate for an oil change of five quarts for type I filters and type II filter elements, and the applicable quantity specified in table V for type IV elements, plus the contaminant added during a 22 hour period. Test conditions for the type III filters shall be the same as those for the type IV, class 2 filter elements specified in table V. A device shall be provided for adding contaminant to the oil in the reservoir. The addition shall be made in small, drop-sized increments at a substantially uniform rate. A weighed quantity of contaminant, appropriate for the add period employed, which has been conditioned in an agitator for at least one hour, shall be blended at 30 psi pressure for 30 minutes with oil taken from the filter test system in preparation for charging the quadrant. The blending process is started 30 minutes before the quadrant is ready for its charge. Quadrant add periods of 4 or 5 hours are recommended for test purposes. Longer add periods may be used, provided a continuous mixing system is employed to keep the contaminant mixed. Additional test conditions and procedure shall be as specified in tables IV and V. Curves of pressure drop and normal pentane insolubles shall be plotted versus hours of operation. Smooth curves shall be faired through the plotted data points.

TABLE IV. Filtering ability test conditions and procedure for type I filters and type II filter elements.

Class	Oil at filter inlet		Test oil		Contaminant		Total hours of filter <u>1/</u> operation (hours)	Oil sample to be <u>2/</u> analyzed	Cumulative filtering efficiency <u>4/</u> (percent minimum)
	Temp-erature (°F)	Pressure (psi)	Type	Quantity	Designation	Rate of addition of solids (grams per hour)			
1	180 + 5	30 + 1	Mineral	5 Quarts	SOFTC-A2	2.2	88	Normal	85
2	180 + 5	30 + 1	Additive	plus	SOFTC-A2	2.2	88	pentane <u>3/</u>	85
3	180 + 5	30 + 1	Additive	suffi- cient oil to fill assembly	SOFTC-A2	4.4	88	insolubles	85

- 1/ To be accumulated in successive units of 22 hour periods of continuous filter operation and contaminant addition, separated by 2 hour shutdown periods during which the oil bypasses the filter completely and no contaminant is added.
- 2/ Immediately after each 22 hour period, oil shall be withdrawn from the system to reestablish the initial oil level in the reservoir. The portion of oil so withdrawn shall constitute the sample for analysis.
- 3/ Normal pentane insolubles shall be determined by ASTM method D893-80, except that a 10,000 relative centrifugal force (rcf) centrifuge shall be used.
- 4/ Cumulative filtering efficiency (expressed in percent):

$$\frac{\text{Total weight of contaminant solids added} - \text{Weight of contaminant solids in total test oil}^*}{\text{Total weight of contaminant solids added}} \times 100$$

* Weight of total test oil X percentage normal pentane insolubles.

TABLE V. Filtering ability test conditions and procedure for type IV filter elements.

Class	Oil	Test oil*		Contaminant		
	Temperature at filter inlet (°F)	Oil in system (gallons)	Flow rate (gpm)	Designation	Rate of addition of solids (grams per hour)	Total hours of filter operation <u>1/</u>
1	180 + 5	1	2	SOFTC-2A	0.4	66
2**	180 + 5	2	6	SOFTC-2A	0.8	66
3	180 + 5	5	12	SOFTC-2A	2.6	66
4	180 + 5	25	40	SOFCT-2A	7.4	66

1/ To be accumulated in successive units of 22 hour periods of continuous filter operation and contaminant addition, separated by 2 hour shutdown periods during which the oil bypasses the filter completely and no contaminant is added. Immediately after each 22 hour period, oil shall be withdrawn from the system to reestablish the initial oil level in the reservoir. The portion of oil so withdrawn shall constitute the sample for analysis. Normal pentane insolubles shall be determined by ASTM method D893-80, except that a 10,000 rcf centrifuge shall be used.

* Additive oil shall be used.

**Type IV, class 2 filtering ability test conditions shall also apply to type III filters.

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4.6.6 Shock resistance.

4.6.6.1 Type I, classes 2 and 3 filters, and type II, classes 2 and 3 filter elements.

4.6.6.1.1 Filter body modification. Filter body shall be modified for use in the shock test so that the flow area of any oil passage in the filter body shall be not less than the cross sectional area of the inlet or outlet connection pipe size, whichever is the smaller. This may be accomplished by drilling out the restricting orifice in the inlet or outlet connection, or the center tube, or both.

4.6.6.1.2 Filter body calibration. A flow rate calibration of the modified filter assembly (without element) shall be determined when circulating new, straight mineral oil at 145 deg. F.

4.6.6.1.3 Flow rate test procedure. Install a filter element in the modified filter body and circulate new, straight mineral oil at 145 deg. F throughout the filter assembly at a flow rate of 10 gpm, or a pressure drop of 30 psi, whichever is attained first. Record pressure drop of 10 gpm flow, or flow in gpm at 30 psi pressure drop. This data will be required to evaluate the test in 4.6.6.1.6.[1]

4.6.6.1.4 Element mounting. The same sample type II, class 2 or 3 element, for which the flow rate has been determined (see 4.6.6.1.3), shall be installed over a 9/16 inch diameter center tube and secured in place by a lower stop and upper spring similar in construction to that specified for the cover and center tube (see 3.3.2.2.2 and 3.3.2.3).

4.6.6.1.5 Shock test procedure. The center tube, with filter element assembled thereon, shall be rigidly mounted at each end at the center of panel, on a shock testing mechanism (see figure 5), or as approved by the procuring activity. Element shall be struck 20 times at 10 second intervals, alternating the blows on front and back of the panel. Each blow (shock) shall have an acceleration value of 20 gravity units (g), or approximately 300 foot-pounds.

4.6.6.1.6 After-shock flow rate. After completing shock test procedure, to determine conformance to 3.5.6.1, the elements shall be examined for any evidence of surface failure or other injury, then reassembled in the modified filter body (see 4.6.6.1.1) and the flow rate through the element determined at the pressure drop obtained in 4.6.6.1.3. The flow rate, after shock, shall be reported as percent of the original flow rate value.

[1] The pressure drop across the element is equal to the pressure drop across the filter body and element minus the pressure drop across the body (see 4.6.6.1.2 at the same flow rate.

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4.6.6.2 TYPe IV filter elements. each filter element for the shock test shall be one used in the media migration test, or one that has been subjected to 180 deg. F clean oil flow for not less than eight hours and allowed to drain for not less than one hour. The element shall be installed over a center tube of appropriate diameter and length and secured in place by a lower stop and upper spring and spring bearing plate to simulate installation in a test filter body. the center tube with filter element assembled thereon shall be then rigidly mounted in a vertical position, supported at each end, and located at the center of the panel on a shock-testing mechanism (see figure 5). The panel shall be struck 20 times at 10 second intervals, alternating the blows on front and back of the panel. Each blow (shock) shall have an acceleration value of 20 g or approximately 300 foot pounds. After completing shock procedure, the filter element shall be visually examined for evidence of damage or failure. If the element appears satisfactory, it shall be installed in a test case and filtering ability test made in accordance with 4.6.5. After completion of the filtering ability test, element shall be disassembled and examined for evidence of damage or failure, to determine conformance to 3.5.6.2.

4.6.7 End-load strength. To determine conformance to 3.5.7, type IV filter elements shall be tested for resistance to static end loading by installing the element over a center tube of appropriate diameter, supporting one end of the element on a plain concentric surface of at least "F" diameter of MS35802. Pressure shall be applied to the opposite end of the element by means of a flat surfaced annular ring, 1/16 inch width, within the element-sealing surface of "E" diameter minimum to "F" diameter maximum. Constant pressure shall be applied for a period of 30 minutes, after which the element shall be examined for evidence of damage.

4.6.8 Differential pressure. To determine conformance to 3.5.8, all type IV filter elements assembled in filter body (see figure 4) shall be tested for resistance to differential pressure by means of a test apparatus similar to that employed for the filtering ability test. The same filter element tested for filtering ability may be used in this test. Otherwise, a new, unused element which has been subjected to 180 deg. F clean oil at rated flow for a period of 66 hours shall be selected for test. With the element installed in the appropriate filter body, a viscous oil (see 6.4.6) shall be circulated through the system at room temperature. The system shall be started with the pump bypass valve in the open position. The bypass valve shall then be slowly and uniformly closed, causing the element differential pressure to rise gradually until element failure occurs, or until 100 psi is observed. The psi differential pressure shall be held for 30 seconds. The bypass valve shall then be opened, the element shall be removed from the filter body, and a disassembly inspection shall be made for evidence of damage or failure.

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4.6.9 Cover-spring force. To determine conformance to 3.6.1.2.1.1, each holddown spring of the four sample type I, class 2 or 3 filters shall be tested to determine the force required to compress each spring to its assembled height.

4.6.10 Pullout device tension.

4.6.10.1 Type II element. To determine conformance to 3.6.2.1, with the media container of a sample type II element held stationary, the pullout device shall be subjected to a straight tension pull gradually increased to a minimum of 25 pounds. During this test, the element, the device, and its attaching means shall be observed for any evidence of failure.

4.6.10.2 Type IV, class 4 elements. To determine conformance to 3.6.2.2, type IV, class 4 filter elements shall be tested as in 4.6.10.1 except that the straight tension pull shall be gradually increased to a minimum of 100 pounds. During and after this test, the device and its attaching means shall be observed for any evidence of failure.

4.7 Examination of preparation for delivery. An examination shall be made to determine that preservation, packaging, packing, and marking requirements of the applicable contract have been met. Defects shall be scored in accordance with the following list. The lot size shall be the number of shipping containers fully prepared for delivery, with the exception 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. The inspection level shall be S-2 of MIL-STD-105, with an AQL of 4.0 defects per 100 units.

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.

5. PACKAGING

5.1 For Army use.

5.1.1 Preservation, packaging, packing, and marking. Cleaning, preservation, packaging, packing, and marking shall be in accordance with the applicable packaging standard or data sheet for the level of protection specified (see 6.2).

5.2 Other activities.

5.2.1 Preservation and packaging. Preservation and packaging shall be level A, B, or commercial, as specified (see 6.2).

5.2.1.1 Level A. The type I filter shall be cleaned by process C-1 and the interior of the filter shall be coated with type P-10 preservative in accordance with MIL-P-116. Nonmetallic filter elements require no cleaning or preservative.

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Each type I and III filter with element and types II and IV filter elements shall be unit packaged in accordance with MIL-P-116, method 1A-15, using a container conforming to PPP-B-566, PPP-B-636, PPP-B-676, or the vendor's commercial carton.

5.2.1.2 Level B (civil agencies). Each type I and III filter and each type II and IV filter element shall be packaged in a close-fitting box conforming to PPP-B-566, PPP-B-665, or PPP-B-676.

5.2.1.3 Commercial. Types I and III filters, with elements, and types II and IV filter elements shall be preserved and packaged in accordance with the manufacturer's standard practice to afford adequate protection against deterioration and damage.

5.2.2 Packing. Packing shall be level A, B, or Commercial; as specified (see 6.2).

5.2.2.1 Level A. Types I and III filters, with elements and types II and IV filter elements shall be packed in close fitting, overseas type, style optional, grade B wood boxes conforming to PPP-B-601 or PPP-B-621. Closure and strapping shall be in accordance with the box specification.

5.2.2.2 Level B. Type I and II filters, with elements and type II and IV filter elements shall be packed as specified for level A except domestic type may be used or packed in weather-resistant, style optional fiberboard boxes conforming to PPP-B-636.

5.2.2.3 Commercial. Types I and III filters with elements and type II and IV filter elements shall be packed in fiberboard boxes to assure carrier acceptance and safe delivery to destination in shipping containers conforming to rules and regulations of carriers applicable to the mode of transportation.

5.3 Marking (see 6.2).

5.3.1 Civil agencies. In addition to markings required by the contract or order, the packages and shipping containers shall be marked in accordance with FED-STD-123.

5.3.7 Military activities. In addition to markings required by the contract or order, packages and shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Bypass type filters and filter elements, and full-flow type filters and filter elements covered by this specification are intended primarily for application to the crankcase lubrication system of engines

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installed in passenger cars, trucks and similar commercially built ground vehicles as well as on military combat and transport vehicles.

6.1.1 Other applications. Appropriate provisions of this specification may be used in the procurement of filters and filter elements required for installation on industrial or marine engines.

6.1.2 Federal specification coverage. This specification covers only the types and classes of oil filters and oil filter elements generally purchased by the Federal Government and is not intended to include all types, classes, and styles which are commercially available.

6.2 Ordering data. Purchasers should select the preferred options permitted herein and include the following information in acquisition documents:

- a. Title, number, and date of this specification.
- b. Class and style (if applicable), of filter, type, and class of filter element (see 1.2, 3.3.1, 3.3.2, 3.3.3 and 3.3.4).
- c. Intended application (when available), including make, type, and year of vehicle or similar data for engine or filter (see 3.3.1 through 3.3.4).
- d. Color of exterior finish, if different from standard commercial finish (see 3.3.1.1.1 and 3.3.1.1.2)
- e. When type II filter elements are for replacement usage (see 3.3.2).
- f. Type of mounting, i.e., straps, brackets, or other suitable means (see 3.4.1).
- g. When oil lines and fittings are required (see 3.4.1).
- h. When test tolerances are to be other than specified (see 4.5.2).
- i. Whether additive oil to be used shall be other than as specified (see 4.5.4).
- j. Levels of preservation, packaging, and packing, or selection of packaging standard or packaging data sheet (see 5.1.1, 5.2.1, and 5.2.2).
- k. Any additional marking requirements (see 5.3).

6.3 Qualification. 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 the applicable qualified products list whether or not such products have actually been so listed by that date. The attention of the supplier is called to this requirement, and manufacturers are urged to arrange to have the products 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 responsible

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for the Qualified Products List is: Commanding General, US Army Tank-Automotive Command, ATTN: DRSTA-GSS, Warren, MI 48090. Information pertaining to qualification of products may be obtained from that installation.

6.3.1 Qualification of multiple sizes. Type I, class 1, and type III filters, and type II, class 1 filter elements, made by the same manufacturer, which are of the same basic design, including direction of flow, materials, workmanship, and structural integrity, and which are equal to, or larger than, the unit qualified, will be qualified without further test, except for the types I and III filter bodies which must be pressure tested (see 4.6.1). The unit "equal to or larger than" shall be determined by the activity responsible for qualification and is defined as one in which the density and quantity of filtering media is equal to, or greater than, that of the element tested within good commercial manufacturing tolerances. Sizes smaller than that qualified shall require a filtering-ability test (see 4.6.5).

6.4 Standardized contaminant. For use in blending the standardized contaminant (see 4.5.5), the materials described in 6.4.1 through 6.4.5 have been found satisfactory.

6.4.1 Carbon black. This material is designated as Molacco carbon black, advertised particle size 85 millimicrons, offered by Binney and Smith, Inc., 380 Madison Ave., New York, NY 10017.

6.4.2 Ferric oxide. This material is designated "Chemically Pure Ferric Oxide" and is offered by the J. T. Baker Chemical Company, 223 Red School Lane, Phillipsburg, NJ 08865. It has been found that 95 percent of the particles are in the range from 0 to 5 microns.

6.4.3 Chloroform soluble PV resin. This material is designated as "Item No. 514" and is offered in particle size as follows:

- a. 100 percent to pass through a 30-mesh sieve;
- b. 90 percent to pass through an 80-mesh sieve; and
- c. 60 percent to pass through a 200-mesh sieve.

This material is offered by the National Bio-Chemical Company, 3127 West Lake St., Chicago, IL 60612.

6.4.4 Standardized oil filter test contaminant (SOFTC-2A). SOFTC-2A which contains solid constituents (see 4.5.5), milled with straight mineral oil (see 4.5.4)(a), may be obtained from Baltimore Paint and Chemical Corporation, 2325 Hollins Ferry Rd., Baltimore, MD 21230.

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6.4.5 Additive test oil (RFO.3). Further information on this oil (see 4.5.4), may be obtained from Society of Automotive Engineers, Oil Filter Test Method Subcommittee, Two Pennsylvania Plaza, New York, NY 10001.

6.4.6 Viscous oil. Any type of viscous oil or lubricant may be used for the differential pressure test described in 4.6.8. A SAE 140 transmission lubricant and No. 6 boiler fuel have been found satisfactory.

6.5 Recycled materials. The use of recycled materials which meet the requirements of the applicable material specifications without jeopardizing the intended use of the item shall be encouraged (see 3.2).

6.6 International standardization agreements. Certain documents, MS35341, MS35341, MS35343, MS35345, MS35346 and MS35347, listed in this specification (see 2.1), are the subject of international standardization agreements, NATO STANAG 4016 and ABC-ARMY-STD-138. When amendment, revision, or cancellation of this specification is proposed which affects or violates the international agreement concerned, the preparing activity will inform GSA so that appropriate reconciliation action may be taken through international standardization channels.

6.7 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

MILITARY INTERESTS:

Custodians:

Army - AT
Navy - SH
Air Force - 99

Review activities

Army - ME
Navy - YD
DLA - CS

CIVIL AGENCY COORDINATING ACTIVITY:

GSA - FSS

CIVIL AGENCY REVIEWING ACTIVITIES:

DOT - ACO
HHS - NIH

PREPARING ACTIVITY:

Army - AT

DoD Project 2940-0125

FIG. 1-351D

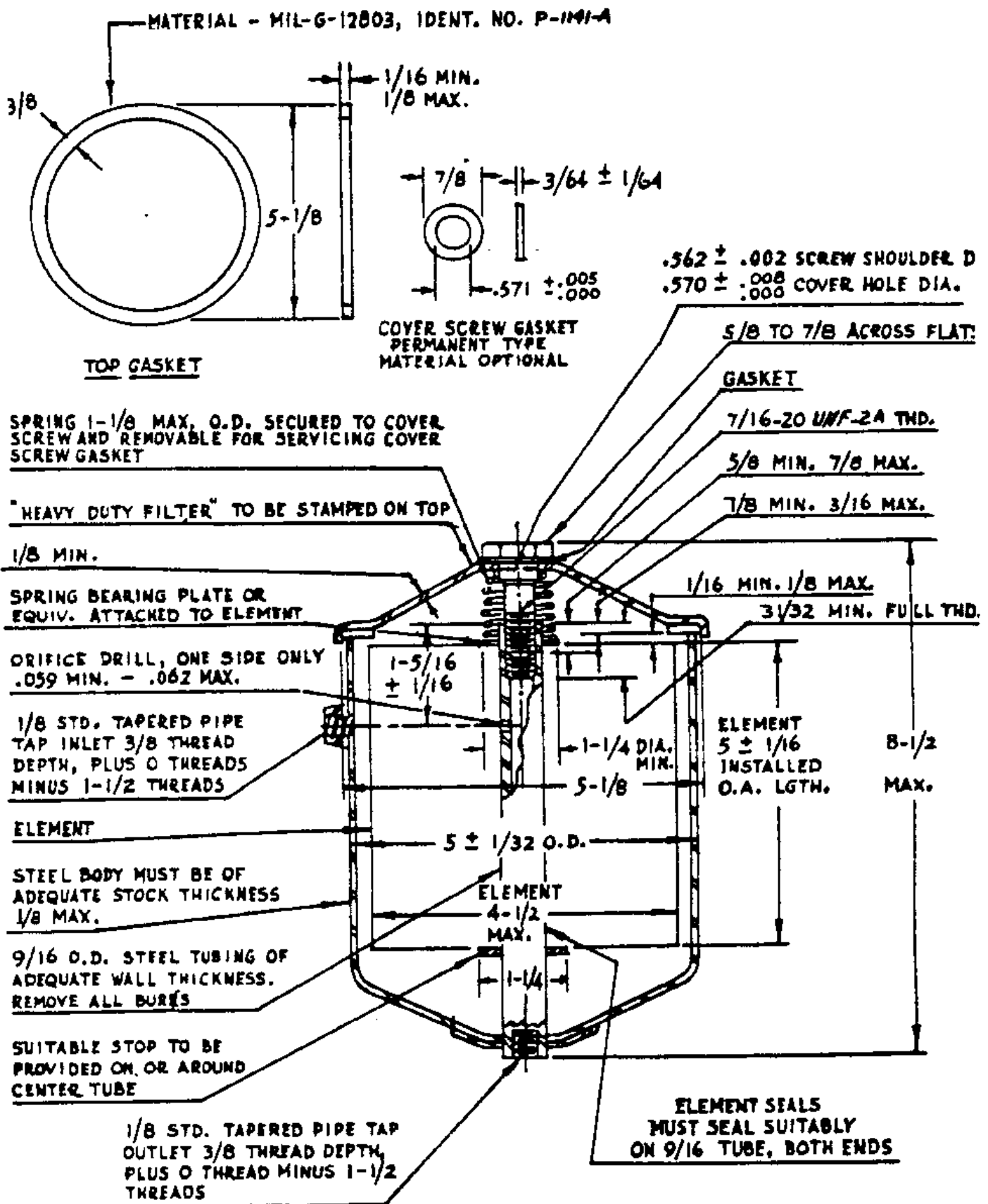


FIGURE 1. Type I, class 2, oil filter, heavy duty, junior size.

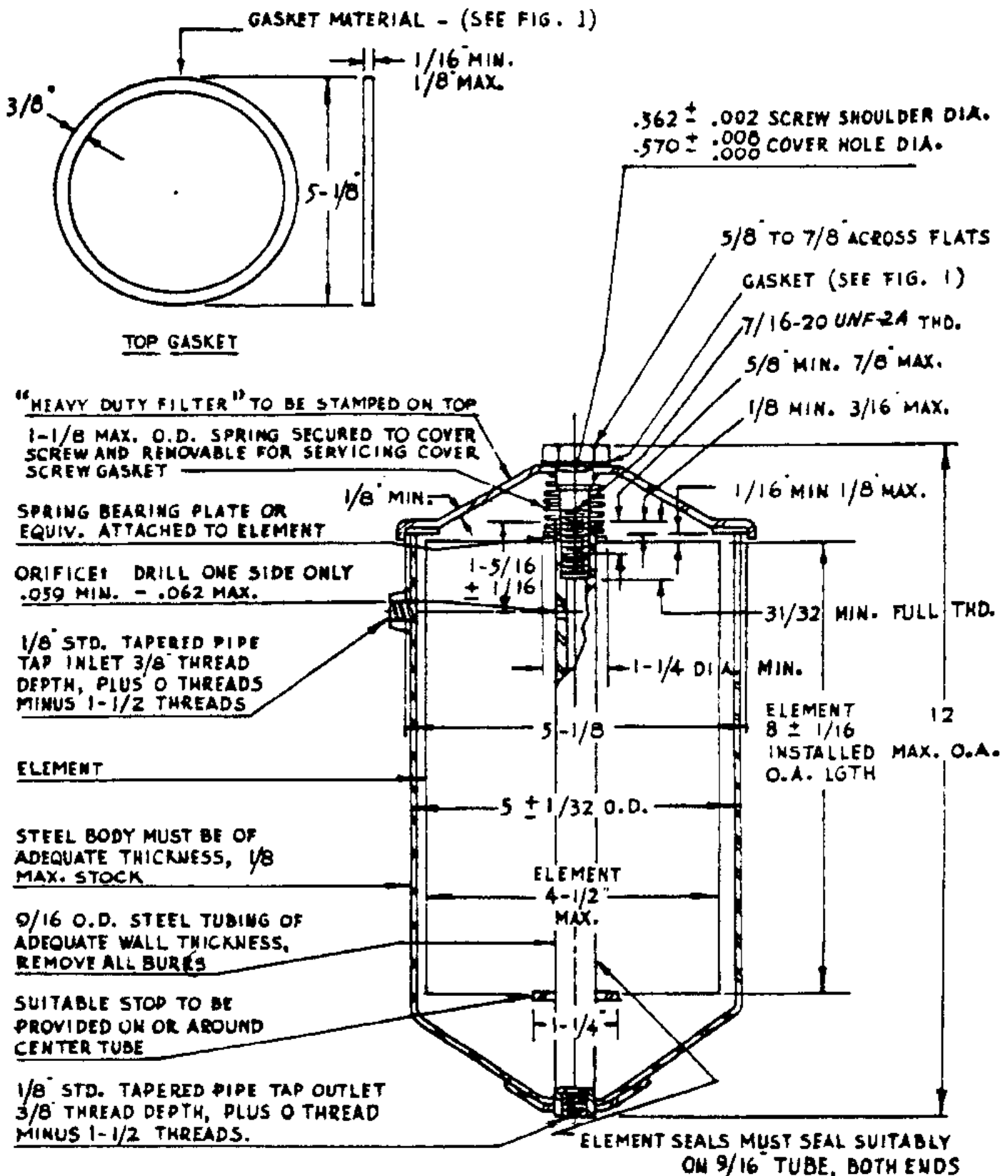


FIGURE 2. Type I, class 3, oil filter, heavy duty, senior size.

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BODY MAY BE INTEGRAL PART OF BASE PROVIDED DESIGN DRAWINGS ARE SUBMITTED FOR APPROVAL BEFORE FILTER IS PRODUCED IN QUANTITY

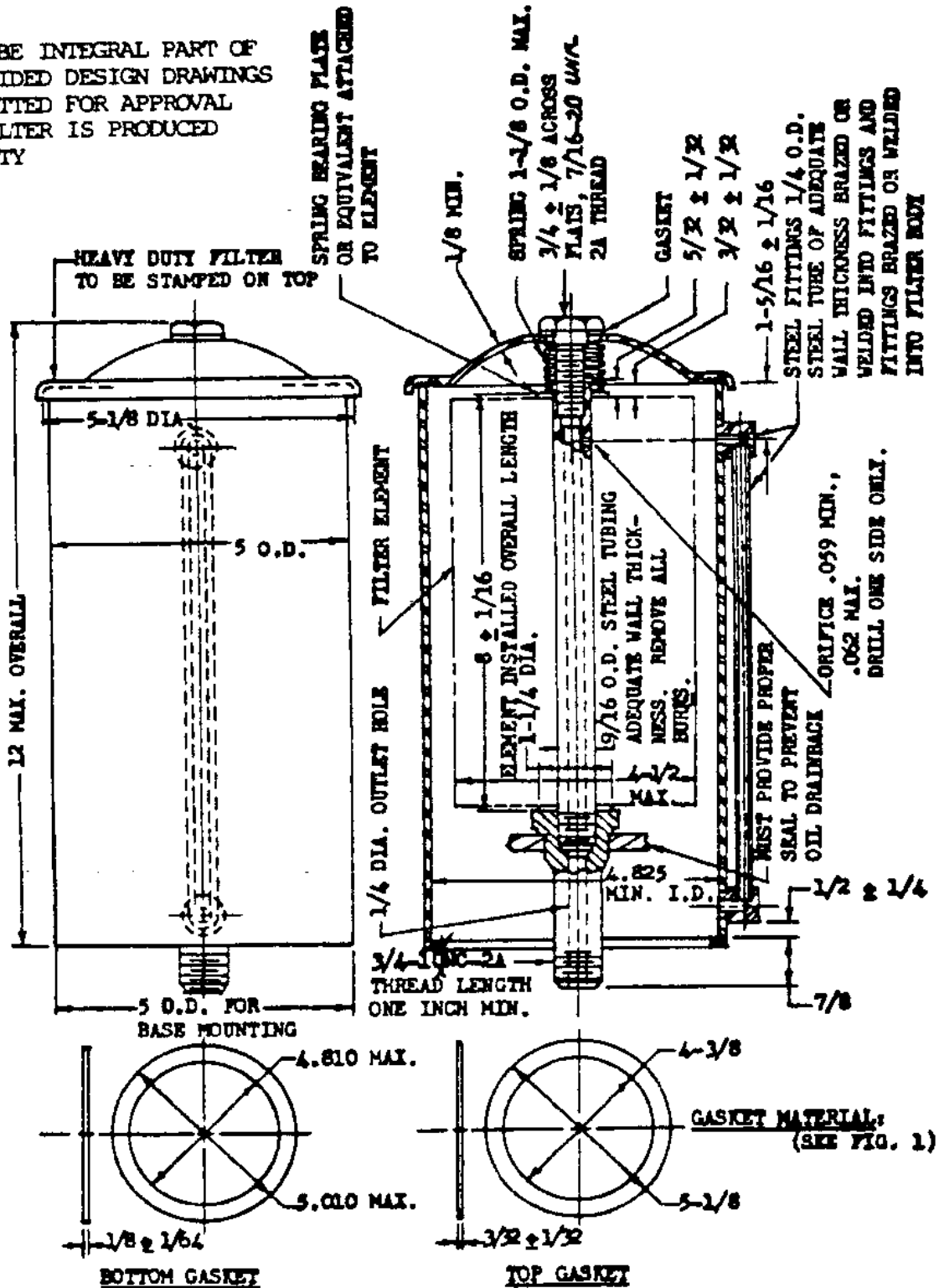
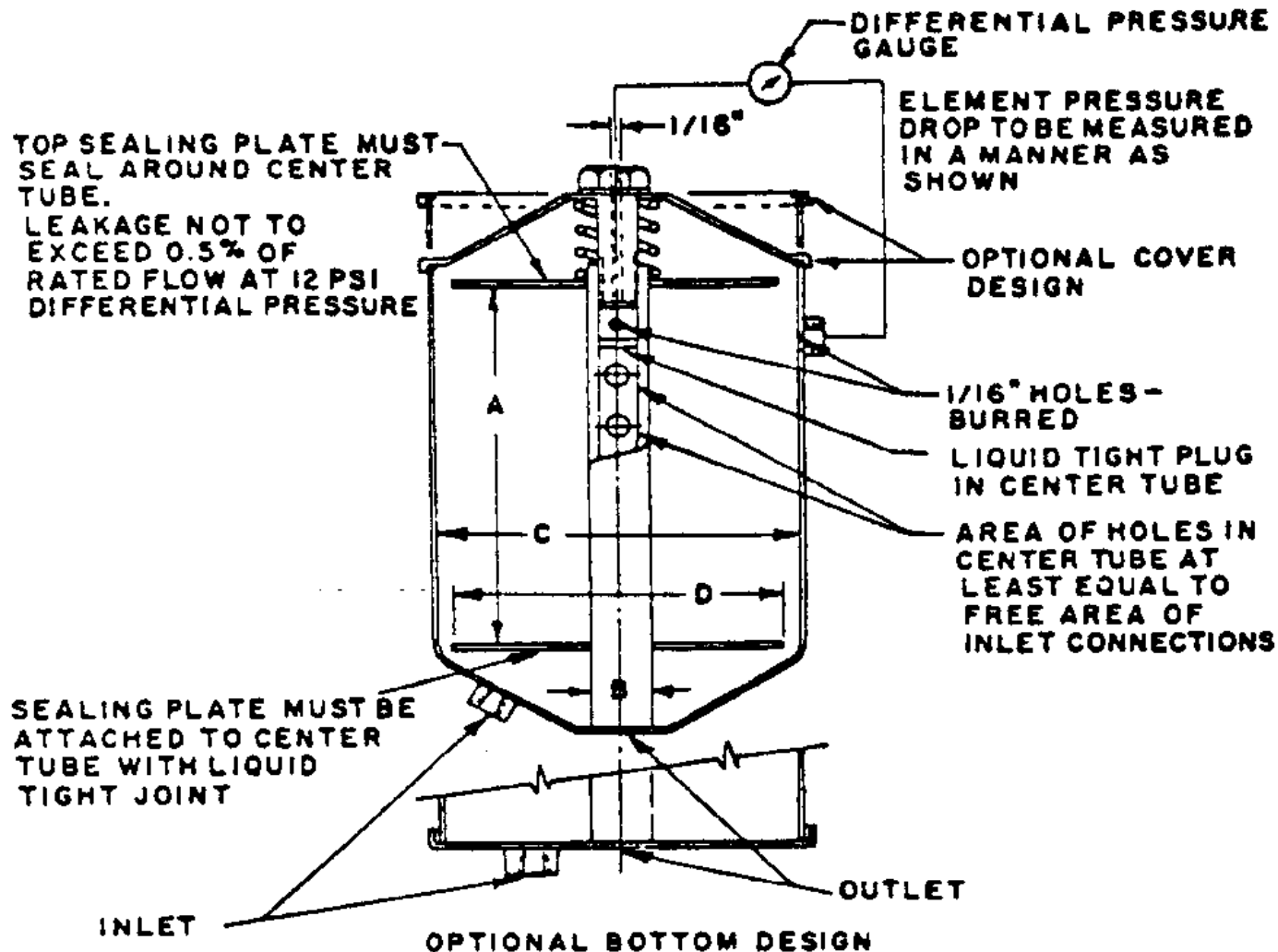


FIGURE 3. Type I, class 3, oil filter, heavy duty, senior size (base mounted).

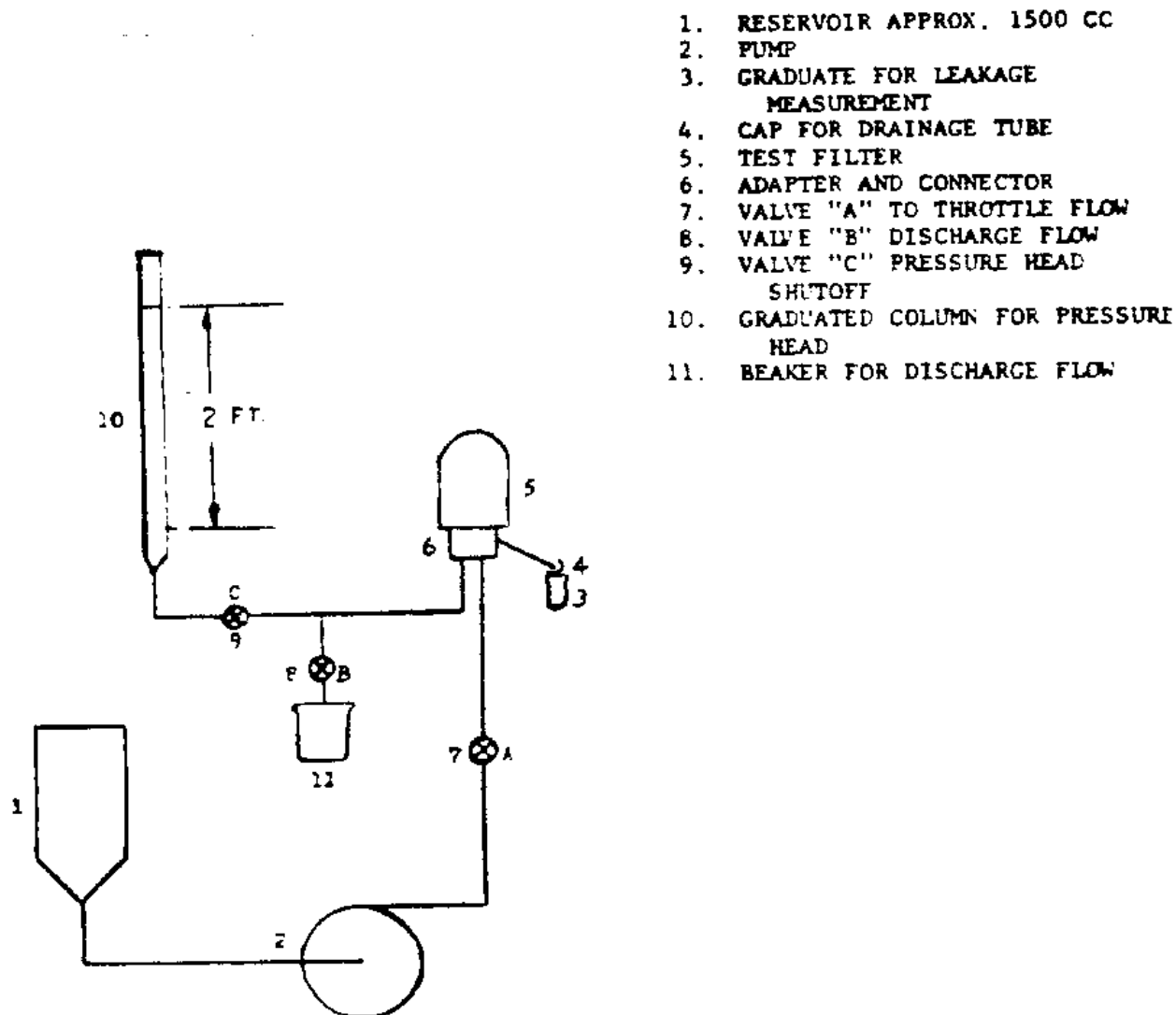


CLASS	DIMENSIONS IN INCHES					HOUSING VOLUME CU. IN. MAX.	SPRING PRESSURE TOTAL LOAD IN POUNDS
	A	B ($\pm 1\%$)	C MIN.	D MIN.	MIN. PIPE SIZE		
1	3.94	0.75	3.38	2.00	1/4	80	35
2	4.81	0.75	4.38	2.50	3/8	120	50
3	9.06	1.38	5.25	2.25	3/4	290	75
4	18.00	2.38	8.50	4.00	1-1/2	1500	100

NOTE:

SPRING PRESSURE TOLERANCE $\pm 5\%$ WHEN SEALING PLATES ARE SPACED PER DIMENSION A.

FIGURE 4. Test filter body for type IV filter elements.



1. RESERVOIR APPROX. 1500 CC
2. PUMP
3. GRADUATE FOR LEAKAGE MEASUREMENT
4. CAP FOR DRAINAGE TUBE
5. TEST FILTER
6. ADAPTER AND CONNECTOR
7. VALVE "A" TO THROTTLE FLOW
8. VALVE "B" DISCHARGE FLOW
9. VALVE "C" PRESSURE HEAD SHUTOFF
10. GRADUATED COLUMN FOR PRESSURE HEAD
11. BEAKER FOR DISCHARGE FLOW

Figure 6. Schematic for antidrain back valve test equipment.