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FEDERAL SPECIFICATION

FILTERS, FLUID, PRESSURE, FEEDWATER

This specification is approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers filter units which will separate and remove oil, organics, chlorine, and suspended solids from boiler feedwater, including the raw make-up water.

1.2 Classification. Filters covered by this specification, as applicable, are of the following types, groups, and styles, as specified (see 6.2).

Type I - Precoat type

Group 1 - Vertical tank

Style A - Vertical leaf or tubular element
Style B - Horizontal tray

Group 2 - Horizontal tank

Style C - Vertical leaf
Style D - Horizontal plate

Type II - Chemical type

Type III - Disk-cartridge type

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*Beneficial comments (recommendations, additions, deletions) and any *
*pertinent data which may be of use in improving this document should be *
*addressed to: Commanding Officer (Code 156), Naval Construction Battalion *
*Center, 1000 23rd Avenue, Port Hueneme, CA 93043-4301, by using the *
*Standardization Document Improvement Proposal (DD Form 1426) appearing at *
*the end of this document or by letter. *
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2. APPLICABLE DOCUMENTS

2.1 Government documents. The following documents 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).

Federal Specifications

TT-P-664 - Primer Coating, Alkyd, Corrosion-Inhibiting, Lead and Chromate Free, VOC Compliant
PPP-C-2020 - Chemicals, Liquid, Dry, and Paste; Packaging of
PPP-P-40 - Packaging and Packing of Hand Tools; Tools and Tool Accessories for Power Driven, Metal and Woodworking Machinery

Federal Standard

FED-STD-123 - Marking for Shipment (Civil Agencies)

Military Specifications

MIL-V-3 - Valves, Fittings, and Flanges (Except for Systems Indicated Herein); Packaging of
MIL-P-116 - Preservation, Methods of
MIL-V-173 - Varnish, Moisture-and-Fungus-Resistant (For Treatment of Communications, Electronics and Associated Equipment)
MIL-E-16298 - Electric Machines Having Rotating Parts, Accessories and Associated Support Items; Packaging of
MIL-E-17555 - Electronic and Electrical Equipment, Accessories, and Provisioned Items (Repair Parts); Packaging of
MIL-L-53074 - Lubricating Oil, Steam-Cylinder, Mineral

Military Standards

MIL-STD-129 - Marking for Shipment and Storage
MIL-STD-209 - Slinging and Tiedown Provisions for Lifting and Tying Down Military Equipment
MIL-STD-2073-1 - DoD Materiel Procedures for Development and Application of Packaging Requirements

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

2.2 Other publications. The following documents form a part of this document to the extent specified herein. Unless a specific issue is identified (see 6.2), the issue in effect on date of invitation for bids or request for proposal shall apply.

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American Society of Mechanical Engineers (ASME):

ASME B1.20.1 - Pipe Threads, General Purpose (Inch)
ASME B15.1 - Safety Standard for Mechanical Power Transmission Apparatus
ASME B31.1 - Power Piping
ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element

ASME Boiler and Pressure Vessel Code
Section VIII, Division 1 - Rules for Construction of Pressure Vessels

(Application for copies should be addressed to the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, NY 10017.)

ASTM:

ASTM A48 - Gray Iron Castings
ASTM A167 - Stainless and Heating-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM D1253 - Test Method for Residual Chlorine in Water
ASTM D1889 - Test Method for Turbidity of Water
ASTM D3370 - Practices for Sampling Water
ASTM D3921 - Test Method for Oil and Grease for Petroleum Hydrocarbons in Water
ASTM D3951 - Practice for Commercial Packaging

(Application for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103.)

National Electrical Manufacturers Association (NEMA):

NEMA ICS 2 - Industrial Control Devices, Controllers and Assemblies
NEMA ICS 6 - Enclosures for Industrial Controls and Systems
NEMA MG 1 - Motors and Generators

(Application for copies should be addressed to the National Electrical Manufacturers Association, 2101 L Street, N.W., Washington, DC 20037.)

National Fire Protection Association (NFPA):

NFPA 70 - National Electrical Code

(Application for copies should be addressed to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.)

Society of Automotive Engineers, Inc. (SAE):

SAE J534 - Lubrication Fittings

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

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(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this specification takes precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 First article. When specified (see 6.2), the contractor shall furnish a complete filter assembly for first article inspection and approval (see 4.2.1 and 6.4).

3.2 Standard commercial product. The filters shall, as a minimum, be in accordance with the requirements of this specification and may be the manufacturer's standard commercial product. Additional or better features which are not specifically prohibited by this specification but which are a part of the manufacturer's standard commercial product, shall be included in the filters being furnished. A standard commercial product is a product which has been sold or is being currently offered for sale on the commercial market through advertisements or manufacturer's catalogs, or brochures, and represents the latest production model.

3.3 Materials. Materials used shall be free from defects which would adversely affect the performance or maintainability of individual components or of the overall assembly. Materials not specified herein shall be of the same quality used for the intended purpose in commercial practice. Unless otherwise specified herein, all equipment, material, and articles incorporated in the work covered by this specification are to be new and fabricated using materials produced from recovered materials to the maximum extent possible without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. Unless otherwise specified, none of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification.

3.3.1 Corrosion-resistant steel. Corrosion-resistant steel shall conform to the requirements of ASTM A167.

3.4 Design and construction. The complete filter system components required shall be as specified (see 6.2). The filter system shall be complete so that when installed and connected to the specified source of electricity (see 3.22) and piping system, it accomplishes the operation for which it was designed. Unless otherwise specified (see 6.2), two or more filter tanks shall be required for a single application and shall be arranged for a parallel operation. The equipment shall be designed to withstand strains, jars, vibrations, and other conditions incidental to shipping, storage, and installation. The equipment shall be so designed and arranged that operating, cleaning, and maintenance procedures shall be facilitated. The design shall be such as to prevent conditions hazardous to personnel or deleterious to equipment.

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3.4.1 Type I, precoat type. The precoat type filters shall use a deposited absorbent filter cake for removal of oil and suspended solids from the boiler feedwater, including condensate and raw makeup water. The filter system shall consist principally of: (1) a series of metal screen, plates, tubular elements, or filter leaves arranged in parallel in a tank, vertically or horizontally; (2) a support for holding the leaves and for stripping filter cake; and (3) separate tanks for precoat and slurry feed material. Additional components, accessories, pumps, agitators, piping, and fittings required for satisfactory operation of the filter system shall also be furnished.

3.4.2 Type II, chemical type. The chemical type filter shall remove oil from the boiler feedwater, including condensate and raw makeup water, by means of chemicals. These chemicals react with oil to form solid particles which, in turn, coagulate into a floc and are deposited on a granular bed. The granular bed also filters out the suspended solids. The filter system shall consist of a filter tank, filter bed, chemical tank, chemical feed pump, means for cleaning the filter bed, and necessary interconnecting piping and fittings of suitable size and characteristics. Additional equipment required for the satisfactory operation of the unit shall be included.

3.4.3 Type III, disk-cartridge type. The disk-cartridge type filter shall use an assembly of disposable disk-cartridges for removal of oil, suspended solids, chlorine or organics, as specified (see 6.2), from the boiler feedwater, including condensate and raw makeup water. The filter shall consist of a pressure tank for holding the disk-cartridges and additional components, accessories, piping, and fittings required for the satisfactory operation of the filter system. The feedwater enters the housing and flows over and through each disk-cartridge cell. It is discharged at the inside diameter of the cartridge and then passes down through the center support and out of the filter housing.

3.5 Interchangeability. All units of the same classification furnished with similar options under a specific contract shall be identical to the extent necessary to insure interchangeability of component parts, assemblies, accessories, and spare parts.

3.6 Operating conditions. The filter system shall operate at the conditions specified herein.

3.6.1 Feedwater temperature and flow. The normal operating temperature of the incoming feedwater, in degrees Fahrenheit (oF) (degrees Celsius (oC)) and feedwater flow in gallons per minute (gpm) (liters per second (L/s)), shall be as specified (see 6.2).

3.6.2 Operating pressure. The normal operating pressure of the incoming feedwater to the filter unit, in pounds per square inch gage (psig) (kilopascals (kPa)), shall be as specified (see 6.2).

3.6.3 Feedwater impurities. The feedwater impurities and level of concentration shall be as specified (see 6.2 and 6.8).

3.7 Capacity. Filter capacity for type I units shall be based on a flow of feedwater through the filter of not greater than 1 gpm per square foot (0.063 L/s per square meter) of filter leaf or element area. Filter capacity for type II units shall be based on a flow of feedwater of not greater than

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1/2 gpm per square foot (0.032 L/s per square meter) of filter bed area. Filter capacity for type III units shall be based on a flow of feedwater of not greater than 1 gpm per square foot (0.063 L/s per square meter) of effective filter media area.

3.8 Performance. When operating at the conditions specified in 3.6, the feedwater effluent quality from the filter system shall not exceed the maximum concentration indicated in table I. The oil content and suspended solids and free residual chlorine content of the boiler feedwater shall be expressed in milligrams per liter (mg/L). The turbidity shall be expressed in nephelometric turbidity units (NTU) as defined in ASTM D1889. Nephelometric turbidity measuring methods shall be used for feedwater with less than 40 NTU. When operating with feedwater impurity levels specified (see 3.6.3), the cleaning operation shall be not more than once every 24 hours for type I and type II units. The filter bed for type II units shall require replacement not more than once every 6 months. The disk-cartridge for type III units shall require replacement not more than once every 3 months. The operating hours shall be based on the filter unit not exceeding a 15 psi (100 kPa) pressure differential.

TABLE I. Effluent quality of filtered feedwater.

Filter type	Oil content maximum	Suspended solids maximum	Turbidity maximum	Free residual chlorine
All types	1 mg/L	1 mg/L	1 NTU	--
Type III	--	--	--	0.05 mg/L

3.9 Dimensional requirements. The layout of the equipment shall be in such manner that all components shall be located within the boundaries of the plot dimension (length x width), as specified (see 6.2), with provisions for adequate room for installation, operation, and maintenance of each individual component.

3.10 Type I components.

3.10.1 Filter tank. The filter tank shall be welded carbon steel, equipped with supports for the filter leaves or elements. Division members between compartments shall be tightly attached to the shell so that no fluid can be bypassed. The tank shall have a feedwater inlet, feedwater discharge, sludge drain, vent, pressure relief device, and gage connections. The filter inlet shall be so baffled that the filter layers shall not be disturbed by incoming feedwater. The interior arrangement of the tank shall permit cleaning operations and removal of interior components with ease. The tank shall be equipped with a quick opening and closing head. A support designed so that the head may be withdrawn or swung out of the way for leaf removal shall be provided. A support or fixture shall be provided to facilitate handling the leaves when they are removed and returned to the tank. The design and construction of the filter tank shall conform to ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and shall be furnished with the ASME Code stamp. The filter tank shall be securely mounted on support legs or cradles. When specified (see 6.2), the tank shall be equipped with a filter element so that the used precoat can be separated from the flushing water when the flushing water is discharged to the floor drain.

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3.10.2 Filter leaves and elements. The leaf assemblies and elements shall be designed to retain their shape with an operating pressure of up to 60 psig (415 kPa). All arrangements specified in style A through D shall fit into the discharge pipe without leakage to the feedwater effluent. All parts shall be of corrosion-resistant steel construction suitable for the feedwater specified herein.

3.10.2.1 Style A. Vertical filter leaves in group 1 tanks shall consist of heavy-duty metal screens made up with frames. Vertical, tubular elements shall consist of helically wound wedge-wire screens, circular woven metal screens held together by longitudinal stiffeners of metal rods, or constructed of circular sintered metal elements. Vertical filter leaves shall be assembled to a manifold discharge pipe. Vertical tubular elements shall fit into a common horizontal header or tube sheet.

3.10.2.2 Style B. Horizontal filter trays in group 1 tanks shall consist of circular, heavy-duty metal screens supported by perforated/reinforced metal plates located about a central discharge pipe. The assemblage of leaves and the discharge pipe shall be held in correct relation to each other by a tiebolt or equivalent means independent of the fastening means for any other component.

3.10.2.3 Style C. Vertical filter leaves in group 2 tanks shall consist of heavy-duty metal screens made up with frames. They are assembled either to a centrally located discharge pipe or to a manifold discharge pipe, normally located at the bottom of the tank.

3.10.2.4 Style D. Horizontal filter plates in group 2 tanks shall consist of rectangular, heavy-duty metal screens, supported by perforated/reinforced metal plates and assembled to a manifold discharge pipe.

3.10.3 Precoat tank. A precoat supply tank of welded carbon steel shall be furnished for mixing of the precoat and feedwater. Unless otherwise specified (see 6.2), the volume shall be at least 50 percent greater than the volume of the filter tank. The tank shall be provided with a cover to protect the tank contents from contamination. The tank shall be painted or treated to resist corrosion from chemicals specified (see 3.6.3), used in treating the feedwater. The tank shall be equipped with a feedwater inlet, precoat mixture discharge, precoat mixture inlet, drain, and liquid level gage connections. Unless otherwise specified (see 6.2), a motor-driven, propeller-type agitator shall be provided, securely attached to, and arranged for ready removal from the tank. When specified (see 6.2), in lieu of a propeller-type agitator, the precoat mixture shall be agitated by circulating it with the feedwater through one or more nozzles. In either case, the agitating means shall provide ample mixing at all times. The propeller and shaft of the agitator shall be constructed of corrosion-resistant steel. Unless otherwise specified (see 6.2), the agitator motor shall be a totally enclosed, nonventilated type, capable of operating on a system of 208 volts, single phase, 60 Hertz (Hz).

3.10.4 Precoat pump. The precoat pump shall be the electric-motor-driven, centrifugal type. All parts in contact with the precoat material and feedwater shall be of corrosion-resistant steel. The pump shall be designed to operate without vapor lock or cavitation and so located that priming will not be necessary. The pump shall be equipped with a pressure-operated bypass. The pump shall be designed to handle at least 10 percent more than the maximum

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operating pressure at the specified feedwater flow in 3.6.1. The pump supports shall withstand the strains imposed by the designed operation and size of piping.

3.10.5 Slurry feed tank. A slurry feed tank of welded steel shall be furnished for the mixing of filter-aid material and water. The capacity of the tank shall be sufficient for 2 day's operation under operating conditions specified. The tank shall be painted or treated to resist corrosion by the required filter-aid material and specified feedwater in 3.6.3. A motor-driven, propeller-type agitator shall be provided and arranged so that it can be securely attached to and readily removed from the tank. The propeller and shaft shall be constructed of corrosion-resistant metal. The agitator shall at all times provide ample mixing of the filter-aid material and feedwater. A cover shall be provided to protect the tank contents from contamination. The tank shall be equipped with a feedwater inlet, slurry discharge, drain, and liquid level gage connections and suitable supports so that it can be secured to foundations. Unless otherwise specified (see 6.2), the agitator motor shall be a totally enclosed, nonventilated type and capable of operating on a system of 208 volts, single phase, 60 Hz.

3.10.6 Slurry feed pump. The slurry feed pump shall be of the positive displacement type, adjustable for volume discharge. The pump body shall be of corrosion-resistant steel or of cast iron, meeting the requirements of ASTM A48, class 40. All other parts in contact with the chemicals shall be of corrosion-resistant steel of a type impervious to the chemicals used, filter-aid, water, and air. The pump, complete with motor, shall be mounted on a bedplate adequate to maintain alinement. The pump shall be self-priming and have a built-in bypass valve. Pump capacity shall be at least 10 percent greater than for the maximum operating condition required to meet the specified performance.

3.10.7 Slurry feed pump controls. The slurry feed pump shall be provided with means to permit adjusting the volume pumped. Pump control shall be manual (independent of feedwater flow) or automatic, as specified (see 6.2). Automatic control shall be one of the following methods, as specified (see 6.2):

a. Flow - A preset adjustable relation between the slurry feed volume pumped and the volume of feedwater to the filter and maintain this relationship over a flow variation, as specified (see 6.2).
b. Speed - A preset adjustable relation between the slurry pump speed and the feedwater pump speed and maintain this relationship over a feedwater pump speed range, as specified (see 6.2).
c. On/Off - A preset adjustable relation between the slurry feed volume pumped and volume of feedwater flowing. The slurry feed pump shall start and stop corresponding to each start and stop of the feedwater pump. The slurry feed pump shall operate at constant speed.

3.10.8 Piping and operating accessories. Piping, fittings, strainers, valves, and accessories shall be furnished to facilitate the operations of cleaning, draining, depositing and recirculating the precoat, establishing and maintaining feedwater flow and slurry feed, and all other operations required for proper performance of the equipment. A sight glass shall be provided for viewing the discharge from the filter. Precoat and slurry lines shall be as short and straight as possible and arranged to drain the pumps by gravity. Automatic vents shall be provided for the relief of air from the filter tank.

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Pressure rated sampling cocks shall be provided for feedwater inlet and discharge. Pump suction connections from tanks shall be designed for a velocity not exceeding 5 feet per second (ft/s) (1.5 meters per second (m/s)). Pump discharge connections to tanks shall be designed for a velocity not exceeding 10 ft/s (3.0 m/s). Slurry pump inlet and discharge lines shall be designed for a velocity not less than 1 ft/s (0.3 m/s). Piping shall be designed to avoid surges in feed that might alternately dislodge filter cake from the leaves or increase the pressure drop by compacting the filter cake. Tank drains shall be located to drain all pockets. The filter tank drain shall be so connected that the feedwater may be drained either by gravity or by means of the precoat pump. Piping construction shall conform to ASME B31.1. All pipe threads shall conform to ASME B1.20.1. Pressure gages shall conform to ASME B40.1.

3.10.9 Filter material. Filter material shall be as specified (see 6.2 and 6.6). Sufficient precoat and filter-aid material for two operating cycles shall be furnished with the equipment.

3.10.10 Flow control. When specified (see 6.2), controls and bypass piping shall be provided to insure a minimum flow of feedwater through the filter at all times. This prevents possible dislodging of the filter cake when feedwater is not supplied to the boiler. A means shall be provided to balance the flow through each filter so that the alternate filters will maintain staggered cleaning cycles.

3.10.11 Cleaning without disassembly. When specified (see 6.2), filters shall be provided with means for cleaning the leaves or screens without disassembly. Filters so specified shall have the cleaning means arranged for manual operation or automatic control of cleaning cycle, as specified (see 6.2). One of the following means of disengaging the filter cake shall be as specified (see 6.2).

a. Water sprays directed against the cake.
b. A wiper contacting the surface of the plates followed by water working, if required.
c. Backwashing by pneumatic pressure.

3.10.11.1 Manual operation. Filters designed for cleaning by manual operation without disassembly shall be equipped to manually perform the operations of shutting off the feedwater flow to the filter, cleaning the plates, draining or removing the dislodge filter cake from the filter tank, depositing of precoat, reestablishing the flow of slurry, feedwater, and any other necessary operations.

3.10.11.2 Automatic control of cleaning. Filters designed for automatic control of the cleaning cycle without disassembly shall be motor-operated. The controls required for automatic operation shall be mounted directly on the control panel of the filter. The filter system shall be equipped to automatically perform the operations of shutting off the feedwater flow to the filter, cleaning of the plates, draining or removing the dislodged filter cake from the filter tank, depositing of precoat, reestablishing the flow of slurry, feedwater, and any other necessary operations. When two or more filters are operating in parallel, a controller shall cause the filters to operate through their cleaning cycle at separate times. When a single filter tank is used, the cleaning cycle shall be completed with the time limit as specified (see 6.2),

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which is governed by the condensate storage and surge tank capacity of the boiler plant.

3.10.12 Filter handling rack. A steel filter rack or support, designed to permit quick and easy transfer of the filter leaves from the filter tank to the handling rack for cleaning, shall be furnished. The rack or support shall be mobile, and so designed that the leaves will be positioned for easy accessibility for hand peeling of filter cake and cleaning of the leaves.

3.10.13 Mobile cart. When specified (see 6.2), a mobile cart, constructed of carbon steel, shall be provided to receive the filter cake peeled from the leaves. The width and length of the cart shall be not less than one and one-half times the diameter of the filter leaf so as to catch the filter cake when peeled by ordinary methods. The depth shall be such that the cake from a complete assembly of leaves can be handled without filling the cart more than 50 percent. The cart shall be equipped with casters and a handle for pulling. The body shall be watertight in construction, and the surfaces shall be painted or treated to resist corrosion.

3.11 Type II components.

3.11.1 Tanks. Filter tanks and chemical tanks shall be welded steel construction and equipped with removable covers to provide easy access for operation and maintenance. The interior of the tanks shall be accessible for cleaning and removal of components without disengaging connections or fittings. Division members between compartments shall be tight with the shell so that no fluid can be bypassed. The filter tank shall conform to ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and shall be furnished with the ASME Code stamp.

3.11.1.1 Filter tank. Filter tanks may be vertical or horizontal, and shall provide for feedwater inlet and discharge, filter bed support, sand valve (if required), filter bed wash inlet, filter bed agitation, filter bed cleaning, a means for draining the tank, and filter bed pressure-drop measurement.

3.11.1.2 Chemical tank. The chemical tank shall be provided with a means for easy charging of chemicals and with storage capacity for a minimum 48-hour operation. A mechanical agitator shall be provided to maintain the chemicals in correct consistency. The parts in contact with the chemical shall be of corrosion-resistant metal. A level gage shall be provided to indicate the amount of chemicals in the chemical tank.

3.11.2 Filter bed. The filter bed shall be a minimum of 36 inches (90 centimeters (cm)) in depth. It shall consist of no less than 18 inches (45 cm) of granular material approximately 0.016 inch (0.4 millimeters (mm)) in diameter, supported by granules of increasing size for the remainder of the depth. The design shall prevent the feedwater from bypassing the bed by flow at the sides of the tank. Feedwater shall not channel through the bed under any operative condition. The filter bed shall support the granules and prevent their passage with the feedwater discharge, but shall permit cleaning.

3.11.3 Filter bed cleaning. Mechanical, air, steam, or water agitation and water-wash apparatus shall be provided, as specified (see 6.2). The apparatus shall be complete with motors, valves, nozzles, strainers, and all other

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necessary components and accessories. Connections for clean water rinse shall be provided to follow the agitation or water-wash.

3.11.4 Controls. The filter tank shall be provided with controls for the following sequence of manual operations: (1) feedwater shut-off to permit cleaning of filter bed; (2) bed-cleaning by agitation or backwash; and (3) resumption of feedwater flow with injection of proper proportion of chemicals. Means for periodic scouring of the filter bed, in addition to regular backwashing or agitation, shall also be provided. When specified (see 6.2), automatic operation shall be furnished and shall be initiated by any one of the following methods:

a. Pressure - by a preset adjustable pressure drop across the filter bed.
b. Flow - by a preset adjustable feedwater volume through the filter.
c. Elapsed time - by a preset adjustable operating period.

3.11.5 Chemical pump. The chemical pump shall be of the positive displacement type. The pump body shall be of corrosion-resistant steel or cast iron conforming to ASTM A48, class 40. All other parts in contact with the chemicals shall be of corrosion-resistant steel. The pump, complete with motor, shall be mounted on a rigid bedplate adequate to maintain alinement. Pump bearings shall be provided with lubricating fittings of the sealed-inlet type. The pump shall be self-priming and have a built-in bypass valve. Capacity shall be at least 10 percent greater than that required for the maximum operating condition specified. The chemical pump shall be provided with means to permit adjusting the volume pumped. Pump control shall be manual (independent of feedwater flow) or automatic, as specified (see 6.2). Automatic control shall be by one of the following methods, as specified, (see 6.2):

a. Flow - an adjustable, preset relation between the chemical feed volume pumped and the volume of feedwater flowing to the filter and to maintain this relationship over a flow variation, as specified (see 6.2).
b. Speed - a preset adjustable relation between the chemical pump speed and the feedwater pump speed and to maintain this relationship over a feedwater pump speed range, as specified (see 6.2).
c. On-Off - a preset adjustable relation between the chemical feed volume pumped and the volume of feedwater flowing. The chemical feed pump shall start and stop corresponding to each start and stop of the feedwater pump. The chemical feed pump shall operate at constant speed.

3.11.6 Piping and operating accessories. Piping, fittings, strainers, valves, and accessories shall be furnished to facilitate the operations of cleaning, draining, replacement of filter media, establishing and maintaining feedwater flow, and all other operations required for proper performance of the equipment. A sight glass shall be provided for viewing the discharge from the filter. Piping shall conform to ASME B31.1. All pipe-thread connections shall conform to ASME B1.20.1. Pressure gages shall conform to ASME B40.1.

3.12 Type III components.

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3.12.1 Filter tank. The filter tank shall be vertical and constructed with a cast-iron base and cover with a steel, cylindrical shell. The base shall be furnished with an inlet and outlet permitting 90 degrees or parallel piping. Unused connections shall be plugged and used as drains. The base shall be provided with means for mounting the filter. A center post shall provide a means to assemble the disk-cartridge and provide leak-free means for the discharge of the filtered effluent. The filter tanks shall conform to ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, and shall be furnished with the ASME Code stamp. The tank shall be equipped with quick opening and closing head to permit the easy removal and replacement of the cartridge(s). Gaskets, vents, and pressure gages shall be furnished.

3.12.2 Disk-cartridge. The disposable disk-cartridge shall be an assembly of individual cells. Each cell shall consist of two disks edge-sealed with a wet-strength, resin binder around a rigid separator. The center of each cell shall be supported by a spacer to prevent collapse and assure free flow of the filtered feedwater.

3.12.3 Piping and operating accessories. Piping, fittings, valves, and accessories shall be furnished to facilitate the operations of cleaning, draining, replacement of filters, establishing and maintaining the feedwater flow, and all other operations required for the performance of the equipment. A sight glass shall be provided for viewing the discharge from the filter. Piping construction shall conform to ASME B31.1. All pipe-thread connections shall conform to ASME B1.20.1.

3.12.4 Controls. Controls shall permit adjustment of the volume flowing through the filter. A means shall be provided to balance the flow through each filter so that the alternate filters will maintain staggered cleaning cycles. Control of the filtration operation shall be manual or automatic, as specified (see 6.2). Control by automatic operation shall be initiated by a preset adjustable pressure drop across the filter elements.

3.13 Feedwater pump. When specified (see 6.2), a feedwater pump shall be provided. The pump shall be the electric-motor-driven, centrifugal type. Location of the pump within the filtration unit shall be at the option of the manufacturer.

3.14 Turbidity indicator. Unless otherwise specified (see 6.2), a photo-electric type turbidity indicator shall be provided to detect the presence of oil and suspended solids in the feedwater discharge from the filter. It shall operate an electric alarm circuit when the preset value is exceeded. The instrument shall use nephelometric measuring methods, as defined in ASTM D1889. It shall have at least one scale that measures between 0 and 5 NTU. A suitable set of standards and calibration curves shall be furnished. The detector or measuring element shall be capable of mounting in the discharge line of the filter. Unless otherwise specified (see 6.2), the turbidity indicator shall operate on a 208 volt, single phase, 60 Hz system with ground wire. When specified (see 6.2), a battery-operated, portable, turbidity indicator, without an alarm, shall be furnished.

3.15 Shafts and rods. Operating shafts, rods, and valve stems shall be effectively sealed against leakage and made of corrosion-resistant metal.

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3.16 Guards. Guards shall be provided for all moving parts that are dangerous to personnel. Guards shall conform to ASME B15.1.

3.17 Seals. Seals for shafts, rods, and valve stems shall be of a type that will not permit sticking to the shaft or rod or react chemically with the shaft or rod. Packings shall be easily adjustable and removable without disassembly of any part except the seal retainer. Seals shall be inert to air, water, oil, and the chemicals handled.

3.18 Control valves. Control valves shall have disks and seats of corrosion-resistant metal. Rubbing and seating surfaces shall be designed to operate without sticking, pitting, or galling.

3.19 Strainers. When specified (see 6.2), strainers shall be provided, including where required. The piping shall be so arranged that two or more strainers may be operated in parallel. Pressure drop through any one strainer at rated flow, with specified feedwater, shall not exceed 2 psi (15 kPa).

3.20 Gages. Gages, including a shutoff valve for each gage, shall be supplied to indicate the pressure drop over the filter, suction, and discharge pressure of pumps, and whenever required for proper operation and maintenance of equipment. Gages shall be 4.5 inch (115 mm) nominal diameter conforming to ASME B40.1.

3.21 Control panel. A NEMA control panel shall be furnished for wall mounting or for mounting on the equipment, as specified (see 6.2). The panel shall contain gages, switches, turbidity indicator, motor controls, alarms, and other controls for the proper operation of the equipment. All control components shall be flush mounted. Each device on the face of the panel shall be identified by a label made of a material which is durable, corrosion-resistant, and will remain legible for the life of the equipment. All components inside the cabinet shall have permanent type labels. Cabinets shall be of steel construction, welded, and gasketed so as to be dustproof in accordance with NEMA ICS 6, type 12. The panel shall not be subject to being splashed with water during operation or cleaning of the filter.

3.22 Electric motors. Electric motors shall be rated and constructed for continuous duty in accordance with the applicable provisions of NEMA MG 1. Unless otherwise specified (see 6.2), motors shall be totally enclosed, watertight, and ready for operation on a system of 208 volts, single phase, 60 Hz. The horsepower rating of each pump motor shall not be exceeded when the pump is delivering the volume of water specified against the total dynamic head of the intended installation.

3.23 Motor starter. Unless otherwise specified (see 6.2), the across-the-line starter shall include thermal overload protection with a hand/off/automatic switch in its cover and a NEMA ICS 6, type 4 enclosure. The starter shall be in accordance with NEMA ICS 2 and furnished with capacity and electrical characteristics suitable for the motor.

3.24 Automatic control. All control and float switches shall bear the UL label or listing mark. Controls shall have the required capacities and electrical characteristics to operate the pumps. All automatic controls and control circuits shall be in accordance with NFPA 70.

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3.25 Wiring. Wiring shall be in accordance with NFPA 70. Provisions shall be made to ground all electrical equipment.

3.26 Skid bases. When specified (see 6.2), components of the filter system shall be mounted on steel skid bases. The number of bases shall be as determined by the manufacturer. The base construction shall consist of two steel skid runners with an integrally formed, welded, or bolted baseplate for mounting components of the system. The skid runners shall be upturned or beveled at each end to permit skidding the unit into place. The skid runners shall be furnished with mounting holes for anchoring the units of the system to a concrete foundation or wooden deck. The number and size of holes shall be sufficient to anchor the unit under the most severe condition of vibration or thrust likely to develop during operation. The skid runners shall be of sufficient height to provide ready access to any connections located under the units and of sufficient width to provide adequate bearing surface on a flat, gravel base. Individual mountings shall be furnished, as required, on the baseplates for supporting motors, pumps, and other components in vertical alinement. Other components requiring removal for service, adjustment, or horizontal alinement shall be mounted in a manner to permit such removal or alinement.

3.27 Lifting and tiedown attachments. The filter shall be equipped with lifting and tiedown attachments. Lifting and tiedown attachments shall conform to type II or type III of MIL-STD-209. A nonferrous transportation plate shall be provided and mechanically attached to the filter. Transportation plates shall be inscribed with a diagram showing the lifting attachments and lifting slings, the capacity of each attachment, and the required length and size of each sling cable. A silhouette of the item furnished showing the center of gravity shall be provided on the transportation plate. Tiedown attachments may be identified by stenciling or other suitable marking. Tiedown marking shall clearly indicate that the attachments are intended for the tiedown of the filter on the carrier when shipped.

3.28 Fungus resistance. When specified (see 6.2), electrical components and circuit elements, including terminal and circuit connections, shall be coated with varnish conforming to MIL-V-173, except that:

a. Components and elements inherently inert to fungi or in hermetically sealed enclosures need not be coated
b. Current-carrying contact surfaces, such as relay contact points, shall not be coated

3.29 Lubrication. Unless otherwise specified (see 6.2), means for lubrication shall be in accordance with the manufacturer's standard practice. The lubricating points shall be easily visible and accessible. All parts requiring lubrication shall be lubricated as specified in section 5. Hydraulic lubrication fittings shall be in accordance with SAE J534. Where use of high pressure lubricating equipment (1,000 psi (6,900 kPa) or higher) will damage grease seals or other parts, a suitable warning shall be affixed to the equipment in a conspicuous location.

3.30 Treatment and painting. Unless otherwise specified (see 6.2), the equipment shall be treated and painted in accordance with the manufacturer's

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standard practice. All surfaces of the equipment other than corrosion-resisting steel shall be protected against corrosion and present a neat appearance.

3.31 Identification marking. Identification shall be permanently and legibly marked directly on the equipment or on a corrosion-resisting metal plate securely attached to the equipment at the source of manufacture. Identification shall include the manufacturer's model and serial number, name, and trademark to be readily identifiable to the manufacturer.

3.32 Instruction plates. The filter assembly shall be equipped with instruction plates suitably located, describing any special or important procedures to be followed in operating and servicing the equipment. Plates shall be of a material which will last and remain for the life of the equipment, and shall be securely affixed thereto with nonferrous screws or bolts of not less than 0.125 inch (3.2 mm) in diameter.

3.33 Workmanship.

3.33.1 Steel fabrication. The steel used in fabrication shall be free from kinks, sharp bends, and other conditions which would be deleterious to the finished product. Manufacturing processes shall not reduce the strength of the steel to a value less than intended by the design. Manufacturing processes shall be done neatly and accurately. All bends shall be made by controlled means to insure uniformity of size and shape.

3.33.2 Bolted connections. Bolt holes shall be accurately punched or drilled and shall have the burrs removed. Washers or lockwashers shall be provided in accordance with good commercial practice, and all bolts, nuts, and screws shall be tight.

3.33.3 Riveted connections. Rivet holes shall be accurately punched or drilled and shall have the burrs removed. Rivets shall be driven with pressure tools and shall completely fill the holes. Rivet heads, when not countersunk or flattened, shall be of approved shape and uniform size for the same diameter of rivet. Rivet heads shall be full, neatly made, concentric with the rivet holes, and in full contact with the surface of the member.

3.33.4 Welding. Welding procedures shall be in accordance with a nationally recognized welding code. The surface of parts to be welded shall be free from rust, scale, paint, grease, or other foreign matter. Welds shall be of sufficient size and shape to develop the full strength of the parts connected by the welds. Welds shall transmit stress without permanent deformation or failure when the parts connected by the weld are subjected to proof and service loadings.

3.33.5 Castings. All castings shall be sound and free from patching, misplaced coring, warping, or any other defect which reduces the casting's ability to perform its intended function.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein.

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Except as otherwise specified in the contract or purchase order, 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 ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Component and material inspection. Components and materials shall be inspected in accordance with all the requirements specified herein and in applicable referenced documents.

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

a. First article inspection (see 4.2.1)
b. Quality conformance inspection (see 4.2.2)
c. On-site testing (see 4.2.3)

4.2.1 First article inspection. The first article inspection shall be performed on one unit when a first article is required (see 3.1). This inspection shall include the examination of 4.3 and the tests of 4.4.

4.2.2 Quality conformance inspection. The quality conformance inspection shall include the examination of 4.3, the tests of 4.4.1 and 4.4.2, and the packaging inspection of 4.5. This inspection shall be performed on each unit at the manufacturer's factory facility prior to packaging and shipping. A certified inspection certificate indicating no defects or test failures shall be provided by the manufacturer.

4.2.3 On-site testing. When specified (see 6.2), testing shall be performed on the filter system at the site of the installation. This testing shall be in addition to quality conformance inspection performed at the factory and supplemental to first article inspection, if such inspection is specified. On-site testing shall consist of all tests deemed necessary by the procuring activity to verify compliance with the requirements of this specification. On-site testing shall be performed either by the filter manufacturer or by the installing contractor, as specified (see 6.2). The manufacturer shall have the privilege of representation at tests performed by others. When the manufacturer is responsible for on-site tests, the detailed requirements and schedule for the test program will be as specified in the contract (see 6.2). In all cases, deficiencies revealed by on-site testing shall be corrected at the filter manufacturer's expense and any required retesting shall also be at the manufacturer's expense.

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4.3 Examination. Each filter unit shall be examined for compliance with the requirements specified in section 3 of this specification. Any redesign or modification of the contractor's standard product to comply with specified requirements, or any necessary redesign or modification following failure to meet specified requirements shall receive particular attention for adequacy and suitability. This element of inspection shall encompass all visual examinations and dimensional measurements. Noncompliance with any specified requirements or presence of one or more defects preventing or lessening maximum efficiency shall constitute cause for rejection.

4.4 Tests. Failure to pass any test shall constitute cause for rejection.

4.4.1 Hydrostatic tests. All pressure tanks of the filter system shall be hydrostatically tested in accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. The ASME stamp may be accepted as evidence of this test.

4.4.2 Relief valve test. The relief valves shall be tested to determine if their relieving capacity and pressure are in accordance with the requirements of ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. The ASME stamp may be accepted as evidence of this test.

4.4.3 Performance test. The pressure filter unit shall be operated in accordance with the manufacturer's instructions at maximum capacity using water not exceeding the suspended solids, oil-free residual chlorine content specified in 3.6. The operation for type I or type II filters shall continue until one filter passes through a cleaning cycle and is put back into operation. The type III filters shall have a minimum operating period of 24 hours. When the type I or type II filter goes back into operation or following the minimum operating period for type III filters, an 8-hour test run shall be made. During the test run, oil conforming to Military Symbol 5190 of MIL-L-53074 shall be fed by a chemical-type feed pump to the upstream side of the filter tank or, if applicable, to the throat of a steam ejector furnishing steam to a steam condenser so there will be 10 mg/L of oil in the feedwater. Samples of the filtered feedwater discharge shall be withdrawn at the beginning and at approximately 1-hour intervals and consolidated. Sampling and consolidation of the water samples shall be in accordance with ASTM D3370.

4.4.3.1 Oil in feedwater discharge. The required water sample for determination of oil in the feedwater discharge of the filter unit shall be tested in accordance with ASTM D3921. The combined extracts when weighted shall not exceed 1 mg/L of the water sample.

4.4.3.2 Free available chlorine in feedwater discharge. The required water sample for determination of chlorine in the feedwater discharge of the filter unit shall be tested in accordance with ASTM D1253. The measured free residual chlorine content of the treated water sample shall not exceed 0.05 mg/L.

4.5 Preparation for delivery inspection. The preservation, packaging, packing, and marking of the item shall be inspected to verify conformance to the requirements of section 5.

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5. PREPARATION FOR DELIVERY

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

5.1.1 Level A.

5.1.1.1 Methods of preservation. Cleaning processes, drying procedures, preservatives, and methods of preservation specified in the following paragraphs are listed in MIL-P-116 and shall conform to the requirements of MIL-P-116 and any applicable specifications.

5.1.1.2 Cleaning and drying. Prior to the application of preservative compounds or paint, surfaces shall be cleaned by process C-1 and dried by any applicable procedure of MIL-P-116.

5.1.1.3 Disassembly. Disassembly shall be the minimum necessary to protect parts subject to damage or loss, and to accomplish reduction in cube. Removed bolts, nuts, pins, screws, and washers shall be reinstalled in mating parts and secured to prevent their loss.

5.1.1.4 Unprotected surfaces. Uncoated ferrous metal surfaces, including threaded connections and surfaces exposed by disassembly, shall be coated with type P-1 preservative. Preservatives are not required on painted surfaces and shall not be applied to rubber or rubber-impregnated parts. All threaded connections shall be plugged or capped.

5.1.1.5 Valves and fittings. Valves and fittings, if removed from the equipment, shall be preserved and packaged in accordance with level A requirements on MIL-V-3.

5.1.1.6 Gages. Gages subject to physical damage shall be wrapped with non-corrosive barrier material and shall have dials and tubes protected with fiberboard or plywood.

5.1.1.7 Piping. Piping, if removed from the equipment, shall be preserved and packaged in accordance with the level A requirements as specified for fittings in MIL-V-3.

5.1.1.8 Electrical equipment. Motor, starter, and electrical controls shall be cleaned, preserved, and packaged in accordance with the applicable level A requirements of MIL-E-17555 and MIL-E-16298.

5.1.1.9 Drive belts. Drive belts shall have tension relieved.

5.1.1.10 Pulleys. Pulleys shall have unpainted surfaces coated with primer conforming to TT-P-664.

5.1.1.11 Exposed chain. Chain shall be immersed in type P-9 preservative, thoroughly drained, and coated with type P-1 preservative. Sprockets shall be coated with type P-1 preservative.

5.1.1.12 Chemicals. Dry chemicals shall be packaged in accordance with the applicable level A requirements of PPP-C-2020.

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5.1.1.13 Enclosed gears. Housings shall be fitted to the proper level with operating lubricant. Gears shall be operated sufficiently to coat all internal surfaces. Openings into the housing interior shall be sealed with waterproof tape.

5.1.1.14 Pumps. Interior surfaces shall be coated with type P-3 preservative. When practicable, pump interiors shall be coated by flushing while the impeller is rotated.

5.1.1.15 Tools and accessories. Tools and accessories shall be preserved and packaged in accordance with applicable requirements of PPP-P-40, MIL-V-3, MIL-E-17555, MIL-E-16298, and the applicable methods described in MIL-P-116 for parts not specifically covered in the aforementioned specifications.

5.2 Packing. Packing shall be level A or commercial as specified (see 6.2).

5.2.1 Level A. Packing shall be in accordance with MIL-STD-2073-1. Containers shall be selected from appendix C, table VII for level A requirements.

5.2.2 Commercial. The equipment shall be preserved in accordance with ASTM D3951.

5.3 Marking.

5.3.1 Military agencies. Shipments to military agencies shall be marked in accordance with MIL-STD-129.

5.3.2 Civil agencies. Shipments to civil agencies shall be marked in accordance with FED-STD-123.

6. NOTES

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

6.1 Intended use. The filters are intended for use in power or heating plants that operate up to 800 psig (5,500 kPa) to remove oil and suspended solids (metal oxide and organic matter), chlorine, and dissolved organics from the boiler feedwater, including condensate and raw makeup water.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification
b. Type, group, and style of unit required (see 1.2)
c. Issue of DODISS to be cited in the solicitation and if required, the specific issue of individual documents referenced (see 2.1 and 2.2)
d. When first article is required (see 3.1)
e. The complete filter system components required (see 3.4)
f. When two or more filter tanks are not required for parallel operation (see 3.4)
g. Type of materials type III filter should remove from feedwater (see 3.4.3)

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h. Incoming feedwater temperature required; the rate of incoming feedwater flow through the filter unit required (see 3.6.1)
i. Operating pressure required (see 3.6.2)
j. Type of impurities and level of concentrations of incoming feedwater (see 3.6.3)
k. Dimensional requirements for location of the filter system (see 3.9)
l. These items apply only to type I components:

(1) When the filter tank is to be equipped with a filter element for separating the used precoat from the feedwater when draining (see 3.10.1)
(2) Volume of the precoat tank required, if different (see 3.10.3)
(3) Type of chemicals used for feedwater treatment (see 3.10.3)
(4) When the precoat tank mixture is to be agitated by nozzles (see 3.10.3)
(5) Agitator motors (precoat tank and slurry feed tank) required, if different (see 3.10.3 and 3.10.5)
(6) If the slurry feed pump control is to be manual or automatic; if automatic control is specified, the method of control and the flow variation or pump speed range as required (see 3.10.7)
(7) Type of filter material to be used (see 3.10.9 and 6.6)
(8) When flow controls and bypass piping are required (see 3.10.10)
(9) When a means for cleaning without disassembly is to be provided; if the control of the cleaning cycle is to be manual or automatic; and the method of disengaging the filter cake (see 3.10.11)
(10) Maximum cleaning time when a single filter tank is used (see 3.10.11.2)
(11) When a mobile cart is to be provided (see 3.10.13)

m. These items apply only to type II components:

(1) Type of filter bed cleaning required (see 3.11.3)
(2) When automatic operation controls are required (see 3.11.4)
(3) If the chemical pump control is to be manual or automatic; if automatic control is specified, the method of control and the flow variation or pump speed range as required (see 3.11.5)

n. These items apply only to type III components:

(1) If control of the filtration operation is to be manual or automatic (see 3.12.4)

o. When feedwater pump is required; and the rated capacity and discharge head of feedwater pump required (see 3.13)
p. When a turbidity indicator is not required; when the turbidity indicator is to be battery-operated, and without an alarm (see 3.14)
q. When strainers are required and where required (see 3.19)
r. If the control panel is to be mounted on the wall or on the equipment (see 3.21)
s. Electric motors required, if different (see 3.22)
t. Motor starters required, if different (see 3.23)
u. If skid base mounting is to be provided (see 3.26)

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v. If lifting attachments and tiedown devices are to be required (see 3.27)
w. If treatment for fungus resistance is to be required (see 3.28)
x. Means for lubrication required, if different (see 3.29)
y. Treatment and painting required, if different (see 3.30)
z. If on-site testing is to be required and if it is to be performed by the filter manufacturer or the installing contractor. Detailed requirements and schedule for the test program (see 4.2.3)
aa. Level of preservation and packaging, and level of packing required (see 5.1 and 5.2)

6.3 Data requirements. When this specification is used in an acquisition and data are required to be delivered, the data requirements should be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (DD Form 1423) incorporated into the contract. When the provisions of DoD FAR Supplement, Part 27, Sub-Part 27.475-1 are invoked and the DD Form 1423 is not used, the data should be delivered by the contractor in accordance with the contract or purchase order requirements.

6.4 First article. When a first article inspection is required, the item will be tested and should be a first production item or it may be a standard production item from the contractor's current inventory as specified in 4.2.1. The first article should consist of one complete filter assembly. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examination, test, and approval of the first article.

6.5 Part or Identifying Numbers (PINs). The specification number, type, group, and size are combined to form PINs for filters covered by this document (see 1.2). The PIN for the filter is established as follows:

```
                                  WWF2849 - X - XX
Specification part number -----------*      *   *
Type code (see 6.5.1) ----------------------*   *
Group and size code (see 6.5.2) ----------------*
```

6.5.1 Type code. The type of the filter (see 1.2) is identified by a single digit number (see table II).

TABLE II. Code number to type.

Type	Code
Type I - Precoat type	1
Type II - Chemical type	2
Type III - Disk-cartridge type	3

6.5.2 Group and style code. The group and style code of the filter (see 1.2) is identified by a two-digit code (see table III).

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TABLE III. Code to group and style.

Group and style	Code
Group 1, Style A	1A
Group 1, Style B	1B
Group 2, Style C	2C
Group 2, Style D	2D
No Group, No Style (Types II and III)	00

6.6 Application. Oil in the boiler feedwater from the condensate of steam engines, turbines, pumps, and other power units causes foaming with subsequent carryover of solids. The solids foul the zeolite resins in softeners or demineralizers of the boiler plant system. The use of filters lengthens the operational time of the softeners or demineralizers, increases zeolite resin life, and minimizes the damaging effects of "crud-storms" at startup or from condenser leaks. The filters will reduce the chemical and water requirements because of less frequent regenerations and preserves the ion-exchange capability by removing substances which foul or destroy ion-exchange resins. The filters are located upstream of the boiler and any softeners or demineralizers. When oil in the condensate exceeds 10 mg/L, auxiliary equipment may be used to reduce the oil content to 10 mg/L before the feedwater is delivered to the filter. The suspended solids of the feedwater should not exceed the values specified in the American Boiler Manufacturers Association Industry Standards and Engineering Information Manual for the specified operating pressures. If the suspended solids exceed these values, a prefilter of a pressure type using metal screens should be used to reduce them to acceptable levels. The filter may be used for feedwater with oil content to 30 mg/L and greater solids concentration for short periods, but will then require more frequent filter medium renewal and cleaning. Generally, two filter tanks are used in parallel, size based on calculations in which one-half the maximum boiler feedwater flow is taken through each filter. The entire flow is taken through one filter with dependence on the normal condensate storage to make up the difference during the cleaning cycle of the other. It is possible to use a single filter tank when the condensate system provides sufficient condensate storage capability or is otherwise arranged to allow the filter to be taken off the line for the cleaning cycle and for maintenance. Type I, style B and D filters are less subject to dislodging of portions of the filter cake when operating with condensate flow that is subject to surges or that is intermittent. Type I, style A and C filters are more easily cleaned by manual methods. Type III filters are for use with boiler plant systems requiring a minimum of relatively clean makeup water where it is desired to reduce the suspended solids with the least equipment and reasonable maintenance and operating costs.

6.7 Filter materials. Manufacturers of filter media can provide assistance in determining what blend of precoat and filter-aid best fit the needs of a particular situation. Before making a selection of the filter material, a pilot run or runs should be made with various blends of media and screens to determine the best arrangement to a particular application. Manufacturers make such test filter units available, but may charge for this service.

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6.8 Feedwater analysis. The procuring agency should furnish data to the supplier of the filter unit concerning the raw feedwater. The analysis of the raw feedwater should include information on the following substances:

Calcium	Hydroxide	Total alkalinity, calcium carbonate (CaCO3)
Magnesium	Sulphate	
Sodium	Chloride	Carbon dioxide (free)
Silica (total)	Phosphate	Hardness, CaCO3
Silica (colloidal)	Volatile matter	Free acid
Iron oxide and alumina	Organic matter	pH
Bicarbonate	Total dissolved solids	Color
Carbonate	Suspended solids	Turbidity

The data presented should indicate the minimum, maximum, or composite values of the substances found in mg/L. Turbidity should be expressed in NTU in accordance with ASTM D1889. Sampling and analysis performed should comply with applicable ASTM procedures. ASTM D3370 should be used as a guide for sampling.

6.9 Cross-reference of classification. There have been no classification changes made from previous revision.

6.10 Supersession data. This specification replaces military specification MIL-F-17559D(YD) dated 2 January 1990.

6.11 Subject term (key word) listing.

Boiler plant
Chemical plant
Disk-cartridge
Horizontal plate
Horizontal tray
Pre-coat
Slurry
Vertical leaf

MILITARY INTEREST:

Military Coordinating Activity

Navy - YD1

Review Activity

DLA - CS

CIVIL AGENCY COORDINATING ACTIVITY:

GSA - FSS

PREPARING ACTIVITY:

Navy - YD1

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