INCH-POUND
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PERFORMANCE SPECIFICATION

SCALE PREVENTION IN SEWAGE COLLECTION, HOLDING AND TRANSFER (CHT) AND VACUUM CHT (VCHT) PIPING SYSTEMS FOR USE ON NAVAL SURFACE SHIPS

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

1. SCOPE

1.1 Scope. This specification covers requirements for scale (see 6.4.4) prevention in sewage (see 6.4.7) collection, holding and transfer (CHT) and vacuum CHT (VCHT) piping systems for use on naval surface ships, including the use of scale prevention chemical/biological products and non-chemical/biological (physical treatment) processes and systems to prevent scale formation in shipboard sewage collection piping systems.

1.2 Classification. Scale prevention systems (see 6.4.6) are of the following classes and types (see 1.3 and 6.2).

1.2.1 Classes.

Class 1 - For use in freshwater (see 6.4.1)

Class 2 - For use in seawater (see 6.4.2)

Class 3 - For use in both freshwater and seawater

1.2.2 Types.

Type I - Manual Chemical/Biological Product Injection System (see 6.4.8)

Type II - Automatic Timed Chemical/Biological Product Injection System (see 6.4.9)

Type III - Automatic Flush-Triggered Chemical/Biological Product Injection System (see 6.4.10)

Type IV - Automatic Non-Chemical/Biological System (Physical Treatment) (see 6.4.11)

Comments, suggestions, or questions on this document should be addressed to: Commander, Naval Sea Systems Command, ATTN: SEA 05S, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to CommandStandards@navy.mil, with the subject line "Document Comment". Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.daps.dla.mil.

1.3 Part or identifying number (PIN). PINs to be used for a scale prevention system acquired to this specification are created as follows: (see 1.2.1 and 1.2.2 for PIN Code designations)

M	**32217**	**-**	**X**	**-**	**X**
Prefix for Military Specification	Specification Number		Class (see 1.2.1)		Type (see 1.2.2)

Example: M32217-1-II

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL STANDARDS

FED-STD-H28 - Screw-Thread Standards for Federal Services

COMMERCIAL ITEM DESCRIPTIONS

A-A-59423 - Vacuum Interface Valve for Shipboard Use

DEPARTMENT OF DEFENSE SPECIFICATIONS

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

MIL-PRF-6855 - Rubber, Synthetic, Sheets, Strips, Molded or Extruded Shapes, General Specification for

MIL-DTL-15024 - Plates, Tags, and Bands for Identification of Equipment, General Specification for

MIL-T-16420 - Tube, Copper-Nickel Alloy, Seamless and Welded (Copper Alloy Numbers 715 and 706)

MIL-A-18001 - Anodes, Sacrificial, Zinc Alloy

MIL-DTL-24779 - Anodes, Sacrificial, Aluminum Alloy

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-167-1	-	Mechanical Vibrations of Shipboard Equipment (Type I – Environmental and Type II – Internally Excited)
MIL-STD-461	-	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
MIL-STD-1310	-	Shipboard Bonding, Grounding, and Other Techniques for Electromagnetic Compatibility, Electromagnetic Pulse (EMP) Mitigation, and Safety
MIL-STD-1472	-	Human Engineering
MIL-STD-1474	-	Noise Limits

(Copies of these documents are available online at https://assist.daps.dla.mil/quicksearch/ or https://assist.daps.dla.mil.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

NAVAL SEA SYSTEMS COMMAND (NAVSEA) PUBLICATIONS

S6480-A4-CAT-010	-	U.S. Navy Surface Ship (Non-Submarine) Authorized Chemical Cleaning Products and Dispensing Systems Catalog
S9074-AR-GIB-010/278	-	Requirements for Fabrication Welding and Inspection, and Casting Inspection and Repair for Machinery, Piping, and Pressure Vessels
S9086-T8-STM-010/593	-	Pollution Control
T9640-AB-DDT-010/HAB	-	Shipboard Habitability Design Criteria Manual

(Copies of these documents are available from the Naval Logistics Library, 5450 Carlisle Pike, Mechanicsburg, PA 17055 or online at https://nll.ahf.nmci.navy.mil.)

OPNAV INSTRUCTIONS

OPNAVINST 5100.19	-	Navy Safety and Occupational Health (SOH) Program Manual for Forces Afloat

(Copies of this document are available from the Department of the Navy Issuances, SECNAV/OPNAV Directives Control Office (DNS-5), Washington Navy Yard, Bldg. 36, 720 Kennon Street, SE Rm. 203, Washington Navy Yard, DC 20374-5074 or online at http://doni.daps.dla.mil/default.aspx.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

AMERICAN PUBLIC HEALTH ASSOCIATION (APHA)

Standard Methods for the Examination of Water and Wastewater

(Copies of this document are available from American Public Health Association, 800 I Street, N.W. Washington, DC 20001-3710 or online at www.apha.org.)

ASME INTERNATIONAL

ASME B1.1 - Unified Inch Screw Threads, UN and UNR Thread Form

ASME B1.13M - Metric Screw Threads: M Profile

ASME B1.21M - Metric Screw Threads: MJ Profile

(Copies of these documents are available from ASME International, 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900 or online at www.asme.org.)

ASTM INTERNATIONAL

ASTM B61 - Standard Specification for Steam or Valve Bronze Castings

ASTM B75/75M - Standard Specification for Seamless Copper Tube

ASTM D471 - Standard Test Method for Rubber Property-Effect of Liquids

ASTM D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials

ASTM D2240 - Standard Test Method for Rubber Property – Durometer Hardness

ASTM D3601 - Standard Test Method for Foam in Aqueous Media (Bottle Test)

ASTM E1003 - Standard Test Method for Hydrostatic Leak Testing

ASTM F1412 - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems

ASTM G31 - Standard Practice for Laboratory Immersion Corrosion Testing of Metals

(Copies of these documents are available from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or online at www.astm.org.)

SAE INTERNATIONAL

SAE-AMS3260 - Ethylene Propylene-Diene (EPDM) Rubber, General Purpose, 45-55

SAE-AMS3631 - Polyvinyl Chloride (PVC) Plastic Extrusions High Temperature, Flexible

SAE-AMS7276 - Rings, Sealing, Fluorocarbon (FKM) Rubber High-Temperature-Fluid Resistant Low Compression Set 70 to 80

SAE-AS8791 - Hydraulic and Pneumatic Retainers (Back-Up Rings), Polytetrafluoroethylene (PTFE) Resin

(Copies of these documents are available from SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or online at www.sae.org.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. Scale prevention systems furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.1 and 6.3).

3.2 Chemical/biological products and physical processes qualification.

3.2.1 Toxicity. When evaluated in accordance with 4.3.1, the scale prevention chemical/biological products and physical treatment processes shall have no adverse effect on the health of personnel when used for their intended purpose and shall not cause any environmental problems during waste disposal (see 4.3.1 and 6.8).

3.2.2 Shipboard hazardous materials list (SHML). Scale prevention products provided under this specification are required to be listed in the Master Ships Hazardous Material List (Master SHML) in accordance with OPNAVINST 5100.19. The SMHL approval process includes, at a minimum, an assessment of aquatic toxicity, a Health Hazard Assessment (see 3.2.1), and a determination of whether less hazardous, but suitably performing, alternative products are available for use. The Master SHML approval process is intended to ensure the least hazardous materials are approved for shipboard use for each maintenance or operational application. Any questions regarding the information required to be listed on the Master SHML shall be addressed to Commanding Officer, Naval Supply Systems Command, ATTN: Code 077, P.O. Box 2050 Mechanicsburg, PA 17055-0787.

3.2.3 Chemical/biological product introduction.

3.2.3.1 Type I. Type I scale prevention system chemical/biological products shall be manually introduced into the shipboard sewage system via the water closet and urinal bowls not more than once a day. Product dispensing, mixing procedures, and usage periodicity shall be as specified by the manufacturer.

3.2.3.2 Type II. Type II scale prevention system design shall be fully automatic. During each timed cycle, the system shall deliver controlled quantities of chemical/biological product, and dilution water, as applicable, into the shipboard sewage piping system at the point where the upstream-most water closet or urinal drain intersects the collection piping. The volume of dilution water shall not exceed 0.5 and 3.0 gallons per cycle for Class 1 and Class 2 systems, respectively. Dispensing frequency (cycles/day) shall be as specified by the manufacturer.

3.2.3.3 Type III. Type III scale prevention system design shall be fully automatic once the flush is triggered. During each water closet or urinal flush, the system shall deliver controlled quantities of chemical/biological product into the flushing water to the sanitary fixture, into the fixture itself, or into the drain piping downstream of the fixture.

3.2.4 Chemical/biological product concentrations and dosage volumes, and physical treatment applications.

3.2.4.1 Type I and type II. Chemical/biological product concentrations and dosage volumes for Type I and Type II systems shall be sufficient enough to show that the total suspended solids (TSS) after exposure shall be at least 90 percent less than the TSS before exposure when tested in accordance with 4.3.3.

a. For Type I systems, the TSS of samples after addition of calcium carbonate and after addition of the product shall be at least 90 percent less than the TSS of the samples after addition of calcium carbonate, but before addition of the product.

b. For Type II systems, the TSS of samples after the addition of calcium carbonate and after addition of the product corresponding to Q_L shall be at least 90 percent less than the TSS of the samples after addition of calcium carbonate, but before addition of the product.

3.2.4.2 Type III. Chemical/biological product concentrations and dosage volumes for Type III systems shall be sufficient enough to show no visible precipitate at the product concentration tested, C_L. After addition of product, the TSS of samples at C_L after exposure shall not exceed the TSS before exposure by more than 20 percent when tested in accordance with 4.3.3. As an alternative, chemical/biological product concentrations and dosage volumes for Type III systems shall be sufficient enough to show no visible scaling on the metal specimens after exposure at the product concentration tested, C_L when tested in accordance with 4.3.4.

a. For Type III and Type IV systems, there shall be no visible precipitate at the product concentration/treatment method tested, C_L. The TSS of samples at C_L after exposure shall not exceed the TSS before exposure by more than 20 percent.

3.2.4.3 Type IV. Application of the physical treatment process for Type IV systems shall be sufficient enough to show no visible precipitate at the treatment method tested, C_L. After application of treatment, the TSS of samples at C_L after exposure shall not exceed the TSS before exposure by more than 20 percent when tested in accordance with 4.3.3. As an alternative, application of the physical treatment process for Type IV systems shall be sufficient enough to show no visible scaling on the metal specimens after exposure at the treatment method tested, C_L when tested in accordance with 4.3.4.

3.2.5 Chemical/biological product pH. The pH of the chemical/biological product (Type I, Type II, and Type III systems), when diluted with freshwater, shall be between 3.0 and 8.5 when tested in accordance with 4.3.5.

3.2.6 Local storage. A minimum of one week's supply of chemical/biological products (Type I, Type II, and Type III systems) shall be capable of fitting into a local storage volume with maximum dimensions of 36 inches wide by 12 inches deep by 24 inches high (S_{MAX} = 6 ft^3). Unless otherwise specified (see 6.2), storage requirements for this supply shall be based on chemical/biological product injection periodicity and 18 sanitary fixtures for Type I systems, on chemical/biological injection frequency for Type II systems, or on 50 personnel for Type III systems. Storage space required, S_R, shall be determined in accordance with 4.3.6.

3.2.7 Chemical/biological product foaming. Type I, Type II, and Type III chemical/biological products shall be tested for foaming in accordance with ASTM D3601. Residual foam height shall be less than 0.38 inch after the settling time period of 5 minutes as specified in the test method.

3.2.8 Sewage and flushing water systems deterioration. The chemical/biological products and physical treatment processes used to prevent scale formation shall not cause any significant detrimental effects to the sewage piping system, the flushing water supply system, or any other sanitary waste system components when used within the constraints established in this document and shall comply with the corrosion test requirements of 4.3.8.1 and maximum permissible corrosion rates shown in table I and the non-metallic material test requirements of 4.3.8.2 and the following non-metallic material test acceptance criteria:

a. There shall be no cracking of the surface of the non-metallic specimens detected when inspected under a 7-power magnifying glass.

b. The maximum permanent permissible volume change shall be ±3.5 percent when determined using ASTM D471, with the exception that the specimen shall be allowed to equilibrate at ambient conditions for 24 hours prior to measurement.

c. The maximum permissible change in hardness shall be ±5 points when determined using Durometer and/or Rockwell (ASTM D2240 or ASTM D785) tests before and after exposure.

TABLE I. Maximum permissible corrosion rates for scale prevention techniques.

	90-10 CuNi	Welded 90-10 CuNi	70-30 CuNi	Bronze	Copper	Aluminum	Zinc
Mils/yr	4	4	7	4	4	40	38

3.3 Scale prevention system qualification.

3.3.1 Materials. Materials selected for construction of scale prevention systems (Type II and III) are the responsibility of the contractor. The materials shall be suitable for scale prevention system service life and intended service, and of sufficient durability to meet all the performance requirements as specified herein.

3.3.1.1 Alternative materials. Consideration shall be given to the use of non-metallic (e.g., plastic or composite) scale prevention system components where the use of that material can benefit the operation and maintenance of the system. Proposed alternative materials may be substituted as approved by the purchasing activity.

3.3.1.2 Corrosion-resistant materials. Scale prevention systems shall be fabricated from compatible materials, inherently corrosion-resistant or treated to provide protection against the various forms of corrosion and deterioration that may be encountered in any of the applicable operation and storage environments to which the item may be exposed.

3.3.1.3 Dissimilar metals. When selecting material combinations, the scale prevention system supplier shall take into consideration the conditions under which the various materials interact with each other. Dissimilar metals shall not be used in intimate contact with each other unless protected against galvanic corrosion. For Class 2 and Class 3 systems, aluminum alloy components shall not be coupled to copper alloy components in any part of the design where they are both exposed to the process fluid.

3.3.1.4 Prohibited materials. Use of cadmium-plated parts, fasteners, and washers is prohibited. Use of mercury and asbestos is also prohibited.

3.3.2 Scale prevention system design. Scale prevention products, processes, and systems shall result in safe, readily disposable effluents (overboard and pier/treatment facility). The scale prevention products, processes, and systems shall be non-harmful to the shipboard environment and shall not cause any significant detrimental effects to the sewage piping system or any other sanitary waste system component (including gaskets, O-rings, valve seals, tank coatings, level sensors, sewage pumps, tank anodes, etc.) when used within the constraints established in this document. Chemical/biological products shall also be noncombustible.

3.3.3 Chemical/biological product storage. Type I, Type II, and Type III chemical/biological products shall be containerized or packaged to prevent direct contact when handling the products.

3.3.4 Refill periodicity. Refill of Type II and Type III chemical/biological product shall be no more than twice weekly when the scale prevention system is sized to accommodate from 1 to 50 personnel or more as specified in 6.2.

3.3.5 Chemical/biological product dispense rate. Type II and Type III scale prevention systems shall automatically dispense the chemical/biological product from a storage container at a pre-determined controlled rate(s). The product shall either be injected into the flushing water, into the fixture itself, or into the drain piping downstream of the fixture. Separate scale prevention systems or systems with multiple dilution ratios will be considered for water closets and urinals due to the large difference in flushing water usage between these sanitary fixtures. At a minimum, each system shall be capable of dispensing chemical/biological product at two different rates. The first rate shall correspond to the product concentration, C_L. The second rate shall be 25 percent of the first rate. For Type II systems, the second rate may be achieved by reducing the dispensing frequency by 75 percent.

3.3.6 Chemical/biological product integrity. Usage of solid chemical/biological products for Type II and Type III systems shall not result in chunks breaking off or formation of highly viscous matter that could cause blockages in sanitary waste drains.

3.3.7 Space and weight requirements. The design and construction of all Type II, Type III, and Type IV scale prevention systems shall comply with the following space and weight requirements: size not to exceed 30 inches wide by 48 inches high by 24 inches deep and weight not to exceed 100 pounds (without chemicals/biological products).

3.3.8 Self-containment. Type II, Type III, and Type IV scale prevention systems shall be self-contained.

3.3.9 Accessibility. Type II, Type III, and Type IV scale prevention systems shall be physically and visually accessible from the front for operation and for normal maintenance with tools, test equipment, and replacement parts.

3.3.10 Backflow prevention. Type II and Type III scale prevention systems shall have a backflow prevention feature to prevent cross-contamination of the flushing water supply system, as applicable.

3.3.11 Mounting. Scale prevention systems shall be bulkhead-, deck-, or overhead-mounted. Sufficient means (mounting holes, slots, etc.) shall be provided for attaching the scale prevention system to the bulkhead, deck, or overhead. Scale prevention system mounting plates, brackets, or other mounting hardware shall be corrosion-resistant stainless steel (CRES).

3.3.12 Installation. Electronic scale prevention systems shall meet the installation requirements of S6480-A4-CAT-010.

3.3.13 Enclosures.

3.3.13.1 Tamper resistance. Type II, Type III, and Type IV scale prevention systems shall have a lock and key or similar tamper resistant mechanism. If the system is not originally designed with this feature, a system enclosure shall be provided.

3.3.13.2 Ruggedization. Type II, Type III, and Type IV scale prevention system enclosures shall be sufficiently rigid to minimize damage that could result during handling, shipment, and installation onboard the ship.

3.3.14 Chemical/biological product holding reservoir. A chemical/biological product holding reservoir shall be provided for Type II and Type III scale prevention systems within the enclosure and shall be capable of being refilled without removal from the enclosure. A means to visually monitor the chemical/biological product level in the reservoir shall be provided.

3.3.15 Chemical/biological product shelf-life. Chemical/biological products shall have a minimum shelf-life as specified in 6.5.

3.3.16 Bulk storage. For bulk storage, containers for chemical/biological products shall be capable of being stacked a minimum of four high.

3.3.17 Threaded fasteners and fittings.

3.3.17.1 Threaded parts. Threaded parts such as bolts, studs, and nuts shall be in accordance with FED-STD-H28.

3.3.17.2 Screw threads. Unified inch screw threads shall be in accordance with ASME B1.1. Metric screw threads shall be in accordance with ASME B1.13 and ASME B1.21M.

3.3.18 Painting and coating. Except for stainless steel, external surfaces shall be thoroughly cleaned and painted. The topcoat shall be durable and resistant to degradation by the scale prevention chemicals or biological treatments and the common shipboard cleaners listed in S6480-A4-CAT-010.

3.3.19 Identification plates. Identification plates shall be furnished on each scale prevention unit. Identification plates shall not be painted or oversprayed.

3.3.19.1 Material. Identification plates shall be made of a durable, weather- and corrosion-resistant material that will last throughout the service life of the unit. Adhesive-backed identification plates, Type G, in accordance with MIL-DTL-15024, are preferred.

3.3.19.2 Attachment. Identification plates shall be securely attached to each scale prevention system in a place where the data will be visible and legible but not interfere with system operation and maintenance.

3.3.19.3 Information. Identification plates shall contain, at a minimum, the following information:

a. Manufacturer's name.

b. Manufacturer's model number.

c. Manufacturer's part number.

d. Manufacturer's serial number.

e. Service application.

f. Contract number.

g. National stock number (NSN) if available.

3.3.20 Safety placards. The manufacturer shall provide necessary safety information in the form of safety placards in accordance with S9086-T8-STM-010/593.

3.3.21 Performance and environmental conditions.

3.3.21.1 Sea state conditions. Type II and Type III scale prevention systems shall not leak chemical/biological product when subjected to a list angle of 18 degrees when tested in accordance with 4.4.8.

3.3.21.2 Operation. The operating characteristics of Type II, Type III, and Type IV scale prevention systems shall be fully automatic with no action other than the refilling of chemical/biological product (Type II and Type III) required from ship's force. If the same Type II or Type III system is offered for both water closets and urinals, a means shall be provided to change or adjust the dosage as applicable (see 3.3.5). Type II, Type III, and Type IV scale prevention systems shall undergo an endurance test in accordance with 4.4.3 with the following acceptance criteria:

a. System performance and operation after 60 days of operation shall be within all specification requirements.

b. System shall deliver the required chemical/biological product dosages without deviating by more than ±5 percent of those specified for Type II or Type III system being tested.

c. The pH of the fluid draining from the test fixture shall be between 3.0 and 8.5 at least 98 percent of the time throughout the entire endurance test.

d. Type II systems requiring dilution water shall deliver the required water volumes without deviating by more than ±5 percent of those specified in 3.2.3.2.

e. Type II systems cycle frequency shall be maintained without deviating by more than ±5 percent of those specified by the manufacturer.

f. There shall be no accumulation of solid matter (solid chunks) with any dimension greater than ¼ inch and there shall be no adherence of foreign material (e.g., highly viscous matter) on the test fixture's drain holes or on the basket strainer's perforations.

3.3.21.3 Hydrostatic pressure. Type II, Type III, and Type IV scale prevention system components that interface with ship water piping shall be capable of withstanding a pressure of at least 1.5 times the maximum allowable design pressure for that ship system when tested in accordance with 4.4.2. No leakage shall be permitted at the pressure boundary material or joints.

3.3.21.4 Reliability. Mean-time-between-failure (MTBF) shall be not less than 1000 hours when the units are tested in accordance with 4.4.4.

3.3.21.5 Maintainability. The scale prevention systems shall have maintenance ratios (see 6.4.3) of not greater than 0.06 when the units are tested in accordance with 4.4.5. Chemical/biological product replenishment times shall be included when determining the maintenance ratio for Type II and Type III systems. Man-hours for repair of replaced components and scheduled before-and-after-operation checks are excluded.

3.3.21.6 Human factors. Human Systems Integration (HSI) shall be a major part of the scale prevention system design. It shall encompass human engineering in the equipment design to minimize the possibility of failure through improved operation and maintenance and to preclude personnel safety hazards. General human engineering criteria established in MIL-STD-1472 shall be used during equipment design.

3.3.21.7 Safety. Electrical equipment shall be effectively guarded and grounded in accordance with MIL-STD-1310 to prevent electrical hazards.

3.3.21.8 Temperature. Scale prevention systems shall perform as specified herein in ambient temperatures from 32 to 120 °F. Systems shall not be damaged by storage in ambient temperatures from -65 to 160 °F.

3.3.21.9 Shock. Scale prevention system appurtenances and controls shall be capable of passing a Grade B shock test in accordance with MIL-S-901. Scale prevention systems shall withstand shock tests without creating a hazard to personnel or to other equipment. In addition, chemical/biological product shall not be released as a result of exposure of the tested system. Detailed acceptance criteria shall be in accordance with MIL-S-901.

3.3.21.10 Vibration. Scale prevention systems shall operate within the vibration limits set in MIL-STD-167-1 over the expected service life of the unit. The units shall not be damaged or caused to malfunction either by the environmental vibrations specified in MIL-STD-167-1, or by internally excited vibrations when applicable.

3.3.21.11 Noise. The design, construction, and workmanship of the equipment shall be such that noise levels under all conditions of operation shall meet the Category B airborne noise requirements of T9640-AB-DDT-010/HAB.

3.3.21.12 Electromagnetic interference (EMI). The scale prevention system shall meet and demonstrate compliance with the requirements of MIL-STD-461 for surface ship, below deck, metallic hull installations.

3.3.22 Service life. Type II, Type III, and Type IV scale prevention systems shall be designed to have a service life of at least 10 years. There shall be no limit on the number of cycles during the life of the scale prevention units. Parts subject to unavoidable wear and deterioration shall have a service life of not less than 3 years.

4. VERIFICATION

4.1 Qualification inspection. Qualification inspection shall be performed on each scale prevention chemical/biological product and process as specified in 4.3 and on each scale prevention system as specified in 4.4. This inspection shall include the examination and tests listed in table II. Qualification test sequencing is provided on figure 1.

TABLE II. Qualification inspection.

Inspection	Requirement paragraphs	Inspection paragraphs	Qualification systems type	Minimum no. of units 1/ to be inspected
Scale prevention chemical/biological products and physical processes				
Toxicity (Health Hazard Assessment (HHA))	3.2.1	4.3.1	I, II, III, IV	NA
Shipboard Hazardous Materials List (SHML)	3.2.2	4.3.2	I, II, III	NA
Suspended solids 2/	3.2.4	4.3.3	I, II, III, IV	2
Adherence 2/	3.2.4	4.3.4	III, IV	2
pH	3.2.5	4.3.5	I, II, III	2
Usage rate and storage analysis	3.2.6	4.3.6	I, II, III	NA
Foam	3.2.7	4.3.7	I, II, III	2
Corrosion	3.2.8	4.3.8.1	I, II, III	2
Effects on non-metallic materials	3.2.8	4.3.8.2	I, II, III	2
Scale prevention systems				
Examination/visual inspection	3.3.1 thru 3.3.20	4.4.1	I, II, III, IV	2
Hydrostatic pressure	3.3.21.3	4.4.2	II, III, IV	2
Endurance	3.3.21.2	4.4.3	II, III, IV	2
Reliability	3.3.21.4	4.4.4	II, III, IV	2
Maintainability	3.3.21.5	4.4.5	II, III, IV	2
Noise	3.3.21.11	4.4.6	II, III, IV	1
Vibration	3.3.21.10	4.4.7	II, III, IV	1
Inclined operation	3.3.21.1	4.4.8	II, III	2
Shock	3.3.21.9	4.4.9	II, III, IV	1
EMI	3.3.21.12	4.4.10	II, III, IV	1

NOTES:

1/ Unit applies to a scale prevention chemical/biological product or an entire system as applicable.

2/ Chemical/biological products to be qualified per suspended solids or adherence testing, not both.

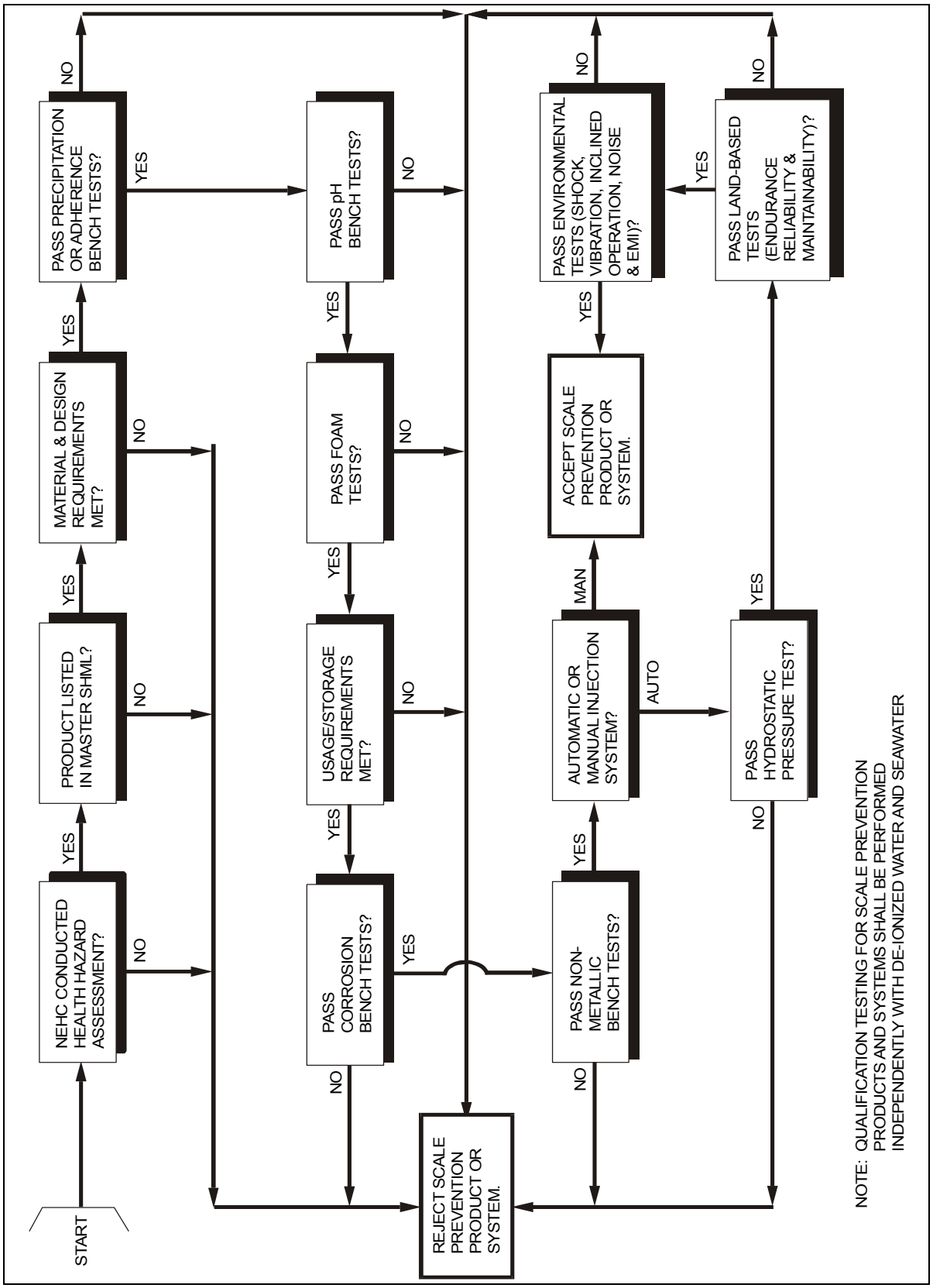

FIGURE 1. Sequence of scale prevention products and systems qualification.

4.2 Testing.

4.2.1 Test conditions. Where applicable, tests shall be shall be conducted at temperatures between 65 °F and 75 °F and at atmospheric pressure. The salinity of the seawater, when used, shall be between 3.2 and 3.8 weight-percent. Water supply pressure to test scale prevention systems (where applicable) shall be 30 to 70 pound-force per square inch gauge (psig).

4.2.2 Independent test laboratories. Where applicable, requirements for independent test laboratories shall be as specified (see 6.7).

4.3 Scale prevention chemical/biological products and physical processes qualification.

4.3.1 Toxicity. The Navy and Marine Corps Public Health Center (NMCPHC) will evaluate the scale prevention chemical/biological products and physical treatment processes using the administrative Health Hazard Assessment (HHA). Sufficient data to permit an HHA of the product shall be provided by the manufacturer/distributor to the NMCPHC. To obtain current technical information requirements specified by the NMCPHC, see 6.8.

4.3.2 Shipboard hazardous materials list (SHML). All scale prevention chemical/biological products shall be submitted to Naval Supply Systems Command (NAVSUP) to be listed on the Master SHML.

4.3.3 Suspended solids tests. Suspended solids tests shall be performed by an independent laboratory (see 4.2.2). Acceptance criteria for the suspended solids tests shall be in accordance with 3.2.4.

4.3.3.1 Freshwater tests.

4.3.3.1.1 Type I systems. For Type I systems, 100 mg of finely ground, reagent-grade calcium carbonate shall be added to 1 gallon of de-ionized or distilled water and thoroughly mixed for 20 seconds. Immediately after mixing, a sample of this solution shall be analyzed for total suspended solids (TSS) in accordance with Method 2540D of APHA Standard Methods for the Examination of Water and Wastewater. The manufacturer-recommended dosage quantity of chemical/biological product that would be introduced into a single sanitary fixture shall then be added to the solution and thoroughly mixed for 20 seconds. Immediately after mixing, a sample of the test solution shall again be analyzed for TSS.

4.3.3.1.2 Type II systems. For Type II systems, several solutions shall be prepared. For each solution, 100 mg of finely ground, reagent-grade calcium carbonate shall be added to 1 gallon of de-ionized or distilled water and thoroughly mixed for 20 seconds. Immediately after mixing, a sample of each solution shall be analyzed for total suspended solids (TSS) in accordance with Method 2540D of APHA Standard Methods for the Examination of Water and Wastewater. Varying quantities of the scale preventing product shall be added to the solutions and thoroughly mixed for 20 seconds. Immediately after mixing, a sample of each test solution shall again be analyzed for TSS. The minimum quantity of scale prevention product added that resulted in a reduction in TSS of at least 90 percent shall be designated as Q_L. This value represents the quantity of chemical/biological product to be dispensed during each timed cycle.

4.3.3.1.3 Type III and type IV systems. For Type III and Type IV systems, synthetic or natural urine samples shall be diluted with an equal volume of de-ionized or distilled water for the test solutions. Synthetic urine samples shall contain a minimum calcium carbonate concentration of 2,000 milligrams per liter (mg/l). This minimum concentration may be achieved by adding a suitable amount of finely ground, reagent-grade calcium carbonate to the urine samples. The pH of the solutions shall be adjusted to 8.0 using hydrochloric acid or sodium hydroxide. The TSS of the solution before the addition of the scale preventing product or application of the physical treatment process shall be determined. Varying quantities of the chemical/biological product or treatment dose shall then be added/applied to the diluted urine for the test samples and the mixture shall be allowed to set for a minimum of 20 hours at a minimum of 70 °F. The exposed test samples shall be examined for visible precipitate. Samples shall then be analyzed for TSS. A regression curve of TSS versus chemical/biological product concentration or treatment dose shall be constructed. A sample regression curve is shown on figure 2.

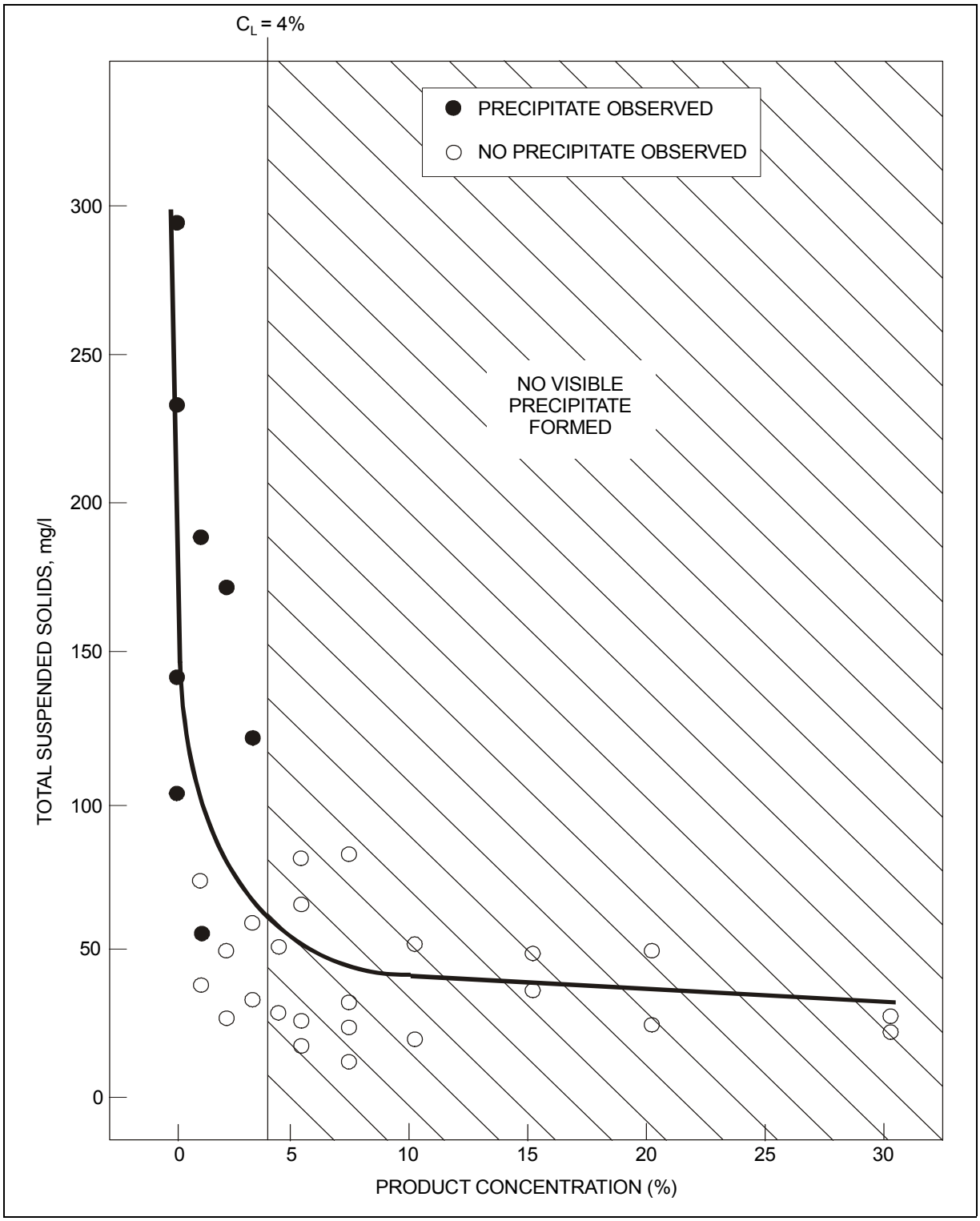

FIGURE 2. Sample static scale precipitation test curve.

4.3.3.2 Seawater tests. Following successful evaluation using freshwater, an identical evaluation with synthetic or natural seawater shall be performed on each type system in accordance with 4.3.3.1. The salinity of the seawater shall be between 3.2 and 3.8 weight-percent.

4.3.4 Adherence tests. Adherence tests shall be performed by an independent laboratory (see 4.2.2).

4.3.4.1 Freshwater tests. For Type III and Type IV systems, synthetic or natural urine samples shall be diluted with an equal volume of de-ionized or distilled water. Synthetic urine samples shall contain a minimum calcium carbonate concentration of 2,000 mg/l. This minimum concentration may be achieved by adding a suitable amount of finely ground, reagent-grade calcium carbonate to the urine samples. The pH of the samples shall be adjusted to 8.0 using hydrochloric acid or sodium hydroxide. Test temperature shall be at a minimum of 70 °F. The diluted urine samples shall then be exposed to varying quantities of the chemical/biological product or to the physical treatment process. A minimum of one diluted urine sample shall remain untreated and serve as a control. Metal and non-metal specimens identified in 4.3.8.1 and 4.3.8.2 shall be submerged in the treated and untreated solutions for 10 seconds then removed and allowed to dry for 10 minutes. This process shall be repeated for a minimum of 20 hours. A longer time may be required and shall be dictated by a minimum of 10 mils of scale deposits on the control specimens. After exposure, the test specimens shall be rinsed with freshwater for 30 seconds at a supply pressure less than 50 psig, allowed to dry, and inspected for any scale formation at 200X and 500X magnification using a reflected light optical microscope.

4.3.4.2 Seawater tests. Following successful evaluation using freshwater, an identical evaluation with synthetic or natural seawater shall be performed on Type III and Type IV systems in accordance with 4.3.4.1. The salinity of the seawater shall be between 3.2 and 3.8 weight-percent.

4.3.5 pH tests. pH tests shall be conducted by an independent laboratory (see 4.2.2). The pH of the diluted test samples shall meet the requirements of 3.2.5.

4.3.5.1 Freshwater tests. Tap water shall be used for freshwater in the following tests.

4.3.5.1.1 Type I systems. For Type I systems, the manufacturer-recommended dosage quantity of product that would be introduced into a single sanitary fixture shall be diluted with 1 gallon of freshwater for the test sample. A portion of the test sample shall be diluted with freshwater tenfold and the pH measured.

4.3.5.1.2 Type II systems. For Type II systems, the quantity of chemical/biological product that would be introduced into the shipboard sewage piping system during a timed cycle, Q_L, shall be diluted with 1 gallon of freshwater for the test sample. A portion of the test sample shall be diluted with freshwater tenfold and the pH measured.

4.3.5.1.3 Type III systems. For Type III systems, a solution of the product diluted with freshwater to the concentration that effectively prevented the formation or adhesion of scale deposits during tests of 4.3.3 and 4.3.4 shall be used for the test sample. A portion of the test sample shall be diluted with freshwater tenfold and the pH measured.

4.3.5.2 Seawater tests. Following successful evaluation using freshwater, an identical evaluation with synthetic or natural seawater shall be performed on Type I, Type II, and Type III systems in accordance with 4.3.5.1. The salinity of the seawater shall be between 3.2 and 3.8 weight-percent.

4.3.6 Usage rate and storage analysis. Chemical/biological product concentrations that effectively prevent precipitation or adhesion during laboratory testing shall be identified for both the freshwater and seawater tests. Usage rate for each chemical/biological product shall then be determined and resultant storage space requirements shall be estimated. Chemical/biological product storage space required, S_R, shall be less than the specified maximum permissible storage space, S_{MAX}, specified in 3.2.6.

4.3.6.1 Type I systems. Usage rate for each chemical/biological product shall be determined based on the quantity of sanitary fixtures in a given sanitary space and local storage requirements (see 3.2.6) for manual injection systems shall be estimated as follows:

$U_R = W \times P$

$S_R = (U_R \times N_F \times T_{MIN} \times F_B) / D$

Where: U_R = Chemical/biological product usage rate (lbs/sanitary fixture/day).

P = Injection periodicity. Assumes chemical/biological product will be injected into each sanitary fixture within the selected sanitary space at a scheduled time (days). Periodicity shall be provided by the manufacturer but shall not exceed once per day.

W = Weight of chemical/biological product introduced into sanitary fixture (lbs/fixture).

S_R = Storage space required (ft^3).

N_F = Maximum number of sanitary fixtures. Unless otherwise specified (see 6.2), an N_F value of 18 shall be used.

T_{MIN} = Minimum storage time required. Unless otherwise specified (see 6.2), a T_{MIN} value of 7 days shall be used.

D = Chemical/biological product density as stored (lbs/ft^3).

F_B = Buffer factor (greater than 1.0) to allow for voids between packages, within containers, etc. Unless the chemical/biological product manufacturer provides specific packaging data, an F_B value of 2 shall be used.

4.3.6.2 Type II systems. Usage rate for each chemical/biological product shall be determined based on the quantity and frequency of chemical/biological product injections, and local storage requirements (see 3.2.6) for automatic injection systems shall be estimated as follows:

$U_R = Q_L \times F$

$S_R = (U_R \times T_{MIN} \times F_B)/D$

Where: U_R = Chemical/biological product usage rate (lbs/day).

F = Injection frequency. Frequency shall be provided by the manufacturer (cycles/day).

Q_L = Weight of chemical/biological product introduced into the sewage drain each timed cycle (lbs/cycle).

S_R = Storage space required (ft^3).

T_{MIN} = Minimum storage time required. Unless otherwise specified (see 6.2), a T_{MIN} value of 7 days shall be used.

D = Chemical/biological product density as stored (lbs/ft^3).

F_B = Buffer factor (greater than 1.0) to allow for voids between packages, within containers, etc. Unless the chemical/biological product manufacturer provides specific packaging data, an F_B value of 2 shall be used.

4.3.6.3 Type III systems. Usage rate per capita day for each chemical/biological product shall then be determined and resultant local storage space requirements (see 3.2.6) for automatic injection systems shall be estimated as follows:

$U_R = C_L \times R$

$S_R = (U_R \times N_{MAX} \times T_{MAX} \times F)/D$

Where: U_R = Chemical/biological product usage rate (lbs/man-day).

R = Sewage generation rate (30 gallons/man-day for seawater flush and 3 gallons/man-day for freshwater flush).

C_L = Chemical/biological product concentration (lbs/gal).

S_R = Storage space required (ft^3).

N_{MAX} = Maximum number of shipboard personnel. Unless otherwise specified (see 6.2), an N_{MAX} value of 50 shall be used.

T_{MIN} = Minimum storage time required. Unless otherwise specified (see 6.2), a T_{MIN} value of 7 days shall be used.

D = Chemical/biological product density as stored (lbs/ft^3).

F_B = Buffer factor (greater than 1.0) to allow for voids between packages, within containers, etc. Unless the chemical/biological product manufacturer provides specific packaging data, an F_B value of 2 shall be used.

4.3.7 Foam tests. Foam tests shall be conducted and reported in accordance with ASTM D3601. These tests shall be performed by an independent laboratory (see 4.2.2) using tap water. The residual foam height after the 5-minute settling time shall meet the requirements of 3.2.7.

4.3.7.1 Type I systems. For Type I systems, the manufacturer-recommended dosage quantity of product that would be introduced into a single sanitary fixture shall be diluted with 1 gallon of water from which the test sample shall be withdrawn.

4.3.7.2 Type II systems. For Type II systems, a test sample shall be taken from a solution of the product diluted with water to the concentration that effectively removed scale deposits (see 4.3.3.1.2).

4.3.7.3 Type III systems. For Type III systems, a test sample shall be taken from a solution of the product diluted with water to the concentration that effectively prevented the formation or adhesion of scale deposits (see 4.3.3.1.3 and 4.3.3.1).

4.3.8 Materials tests.

4.3.8.1 Corrosion tests (metals). The corrosion tests shall be performed by an independent laboratory (see 4.2.2) in accordance with ASTM G31 using freshwater or seawater indicated below, as applicable. The specified metals shall be exposed to the test solutions for at least 72 hours. Corrosion data shall be obtained and reported for every 24 hours of exposure and shall indicate the corrosion rates of the metals listed in table III.

TABLE III. Metals to be exposed to corrosion tests.

Metal	UNS no.	Reference
90-10 copper-nickel (CuNi)	C70600	MIL-T-16420
70-30 copper-nickel (CuNi)	C71500	MIL-T-16420
90-10 CuNi welded with 70-30 CuNi	C70600	S9074-AR-GIB-010/278
Navy M Bronze	C92200	ASTM B61
Copper	C10100 and C12200	ASTM B75/75M
Aluminum	NA	MIL-DTL-24779
Zinc	NA	MIL-A-18001

4.3.8.1.1 Freshwater tests.

4.3.8.1.1.1 Type I systems. For Type I systems, the manufacturer-recommended dosage quantity of product that would be introduced into a single sanitary fixture shall be diluted with 1 gallon of freshwater for the test solution. This test solution shall be used for the copper-nickel (CuNi), bronze, and copper specimens. A portion of the test solution shall be diluted with water tenfold and used for the aluminum and zinc specimens.

4.3.8.1.1.2 Type II systems. For Type II systems, the quantity of product that would be introduced into the sewage drain for a timed cycle, Q_L, determined during the tests of 4.3.3 shall be diluted with 1 gallon of freshwater for the test solution. This test solution shall be used for the copper-nickel (CuNi), bronze, and copper specimens. A portion of the test solution shall be diluted with water tenfold and used for the aluminum and zinc specimens.

4.3.8.1.1.3 Type III systems. For Type III systems, a solution of the chemical/biological product diluted with water to the concentration that effectively prevented the formation or adhesion of scale deposits during the tests of 4.3.3 or 4.3.4 shall be used for the test solution. This test solution shall be used for the copper-nickel (CuNi), bronze, and copper specimens. A portion of the test solution shall be diluted with water tenfold and used for the aluminum and zinc specimens.

4.3.8.1.2 Seawater tests. An identical evaluation with synthetic or natural seawater shall be performed on Type I, Type II, and Type III systems. The salinity of the seawater shall be between 3.2 and 3.8 weight-percent.

4.3.8.2 Effects on non-metallic materials tests. The effects on non-metallic materials tests shall be performed by an independent laboratory (see 4.2.2) in accordance with ASTM D471, with the exception that the specimen shall be allowed to equilibrate at ambient conditions for 24 hours prior to volume change measurement. The specified materials listed in table IV shall be exposed for at least 70 hours to the chemical/biological product diluted with distilled or de-ionized water indicated below.

TABLE IV. Non-metals to be exposed to material tests.

Material	Reference
Neoprene	MIL-PRF-6855 Class 2
Buna-N	MIL-PRF-6855 Class 1
Teflon PTFE	SAE-AS8791
Viton	SAE-AMS7276
PVC	SAE-AMS3631
EPDM	SAE-AMS3260
Polyolefin	ASTM F1412

4.3.8.2.1 Type I systems. For Type I systems, the manufacturer-recommended dosage quantity of product that would be introduced into a single sanitary fixture shall be diluted with 1 gallon of distilled or de-ionized water for the test solution.

4.3.8.2.2 Type II systems. For Type II systems, the quantity of product that would be introduced into the sewage drain for a timed cycle, Q_L, determined during the tests of 4.3.3 shall be diluted with 1 gallon of distilled or de-ionized water for the test solution.

4.3.8.2.3 Type III systems. For Type III systems, a solution of the chemical/biological product diluted with distilled or de-ionized water to the concentration that effectively prevented the formation or adhesion of scale deposits during the tests of 4.3.3 or 4.3.4 shall be used for the test solution.

4.4 Scale prevention systems qualification.

4.4.1 Examination. Each scale prevention system design shall be physically examined for compliance with the requirements specified in 3.3.1 through 3.3.20. Any redesign or modification to comply with specified requirements shall receive particular attention for adequacy and suitability. This element of inspection shall encompass all examinations of performance, safety, human engineering, and dimensional requirements. Non-compliance with any specified requirement or the presence of one or more defects lessening overall effectiveness shall constitute cause for rejection.

4.4.2 Hydrostatic pressure test. All pressure boundary parts shall be tested hydrostatically to 150 psig in accordance with ASTM E1003. The hydrostatic test pressure shall be maintained for at least 30 minutes or longer as necessary for examination of entire scale prevention system less enclosure and chemical/biological product storage container as applicable. The leakage through the pressure boundary material or joints shall meet the requirements in 3.3.21.3.

4.4.3 Endurance tests. The endurance tests shall be conducted for a minimum of 60 consecutive days. During these tests, the scale prevention system shall be monitored to record the conditions of operation and the general performance observed. Data shall be collected and the system inspected at least twice per day of operation. For each periodic inspection, the following shall be observed.

a. The smoothness of operation (normal-abnormal).
b. Any other abnormal findings.
c. All adjustments made.
d. Changes made in the conditions or method of operation.
e. Chemical/biological product usage and refill frequency.
f. Number of operating cycles.
g. pH of the fluid draining from the test fixture.

4.4.3.1 Test apparatus. A water supply system with isolation valves and pressure gauge (see figure 3) shall be assembled that is capable of automatically cycling for a minimum of 400 times per day to provide water to a sanitary fixture. A suitable test fixture developed by the vender may be used in lieu of an actual sanitary fixture. For half of the endurance test (30 days), 1 pint of freshwater or 0.8 gallon of seawater shall be provided per cycle. For the remaining 30 days, 3 pints of freshwater or 3.5 gallons of seawater shall be provided per cycle. Water supply pressure shall be 30 to 70 psig. Flow regulators to achieve the required water flows and a totalizing flow meter shall be installed. Cycling time shall be 7 seconds ON (water supply open) and 30 seconds OFF (water supply closed). Cycling shall be controlled by a timer and a solenoid valve. A cycle counter shall also be provided. For Type II, Type III, and Type IV systems, the water supply system shall discharge into a sanitary fixture. An additional independent water supply with a totalizing flow meter, an elapsed time meter, and a cycle counter (not shown on figure 3) shall be provided to Type II systems when they require dilution water for operation. The sanitary fixture's drain plumbing shall include a basket-type strainer with ⅛-inch perforations and removable lid. A pH sensor shall be installed at the low point of the trap. For all scale prevention systems, except Class 1 systems that inject chemical/biological product into the sewage drain piping, the drain piping may be routed directly to an existing wastewater gravity drain. For Class 1 systems, the drain piping shall have a minimum volume of 1 cubic foot (vacuum reserve) and shall be maintained at a partial vacuum of 12 to 14 inHg. A vacuum interface valve, in accordance with A-A-59423, shall be installed immediately downstream of the basket-type strainer (see figure 3). The vacuum drain shall be connected to a vacuum generator capable of evacuating water from the piping at a minimum of 0.5 gallon per minute at 12 to 14 inHg.

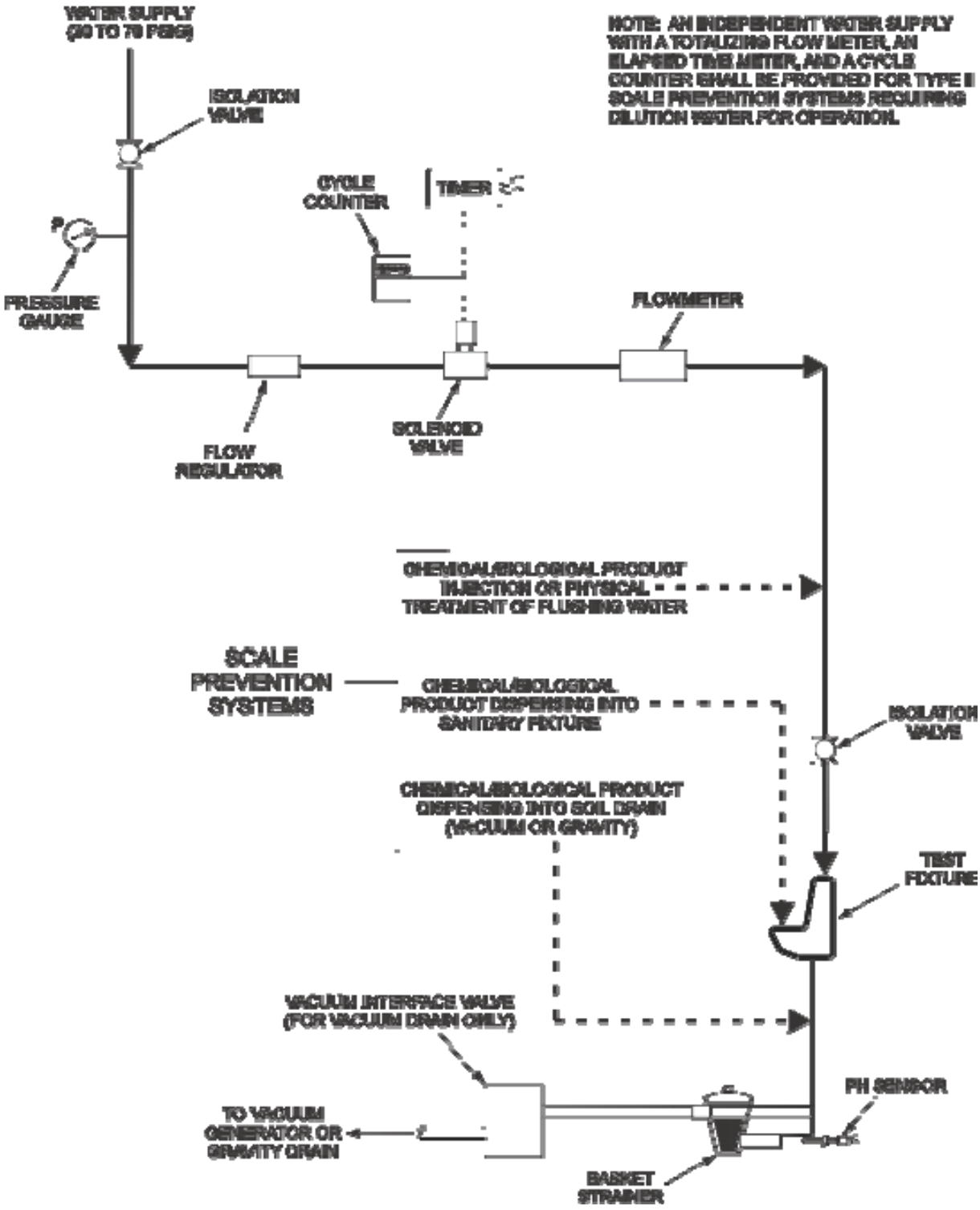

FIGURE 3. Endurance test apparatus set-up.

4.4.3.2 Type II systems. Type II systems shall automatically inject chemical/biological product into the sanitary fixture's drain piping upstream of the pH sensor. Chemical/biological product injection quantity, Q_L, and dilution water volumes (as applicable) specified in 3.2.3.2 shall be injected each timed cycle. Injection frequency shall be provided by the manufacturer.

4.4.3.3 Type III systems. Type III systems shall automatically inject chemical/biological product into the flushing water to a sanitary fixture, into the fixture itself, or into the drain piping upstream of the pH sensor. Injection rate shall be set to correspond to the dispensing rates established in 3.3.5.

4.4.3.4 Type IV systems. Type IV systems shall automatically treat (by physical means) the flushing water to the sanitary fixture.

4.4.4 Reliability test. The reliability test shall be conducted concurrently with the endurance test during which time all failures will be monitored. The test shall continue for a sufficient length of time to reach an "accept" or "reject" decision. Total test hours shall be at least two times and not greater than five times the specified MTBF. The specified MTBF (see 3.3.21.4) shall be met. A failure is defined as any malfunction that:

a. Cannot be corrected within 30 minutes by adjustment, repair, or replacement using only standard maintenance tools and repair parts furnished with the equipment.

b. May cause failure to commence system operation, cessation of operation, or degradation of performance below specified level.

c. May damage the scale prevention system by continued operation.

d. May cause a safety hazard to personnel.

4.4.5 Maintainability test. The maintainability test shall be conducted concurrently with the endurance and reliability tests during which time all maintenance and operations will be monitored. Man-hours expended while performing each maintenance action shall be recorded. The maintenance ratio shall be computed. Man-hours for repair of replaced components and scheduled before-and-after-operation checks are excluded. The maintenance ratio shall meet the requirements of 3.3.21.5.

4.4.6 Noise tests. Airborne noise tests shall be conducted and reported in accordance with MIL-STD-1474. The system shall meet the noise level limits specified in 3.3.21.11.

4.4.7 Vibration test. The scale prevention system shall undergo a vibration test in accordance with MIL-STD-167-1, Type I. The scale prevention system shall be operated at the conclusion of the vibration test to determine that it is fully functional. Less than full operational capability shall constitute failure.

4.4.8 Inclined leak test. Type II and Type III scale prevention systems shall be leak tested for not less than 30 minutes inclined at an angle from the normal equal to 18 degrees. The system shall meet the leakage requirements of 3.3.21.1.

4.4.9 Shock test. The scale prevention systems shall undergo a shock test in accordance with MIL-S-901, Grade B, Class I, Type A. After the shock test, the scale prevention system shall be disassembled to the extent necessary for inspection. During disassembly, the critical components and assemblies with shock damage and distortion shall be identified. The condition of each component and assembly shall be determined and recorded. The system shall meet the shock test acceptance criteria of 3.3.21.9.

4.4.10 Electromagnetic interference (EMI) tests. Conducted and radiated emissions and susceptibility tests shall be conducted in accordance with MIL-STD-461. The system shall meet the EMI acceptance criteria of 3.3.21.10.

5. PACKAGING

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

6. NOTES

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

6.1 Intended use. All scale prevention systems are intended for preventing the buildup of scale deposits in shipboard sewage drain piping.

6.2 Acquisition requirements. Acquisition documents should specify the following:

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

b. Classification (see 1.2).

(1) Class (see 1.2).

(2) Type (see 1.2).

c. When the scale prevention system should be sized to accommodate more than 50 personnel (see 3.3.4).

d. When storage requirements for one week's supply of chemical/biological products are based on other than 50 personnel for Type II systems (see 3.3.5).

e. Packaging requirements (see 5.1).

f. Chemical/biological product shelf-life requirements (see 6.5).

g. Data requirements (see 6.6).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No. 32217 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Commander, Naval Sea Systems Command, ATTN: SEA 05S, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to CommandStandards@navy.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at https://assist.daps.dla.mil/online.

6.4 Definitions.

6.4.1 Class 1 scale prevention system. A scale prevention system that treats freshwater flush sewage drains to prevent the accumulation of scale deposits in the drain piping.

6.4.2 Class 2 scale prevention system. A scale prevention system that treats seawater flush sewage drains to prevent the accumulation of scale deposits in the drain piping.

6.4.3 Maintenance ratio. Maintenance ratio is the ratio of the total active maintenance man-hours required (scheduled and unscheduled) to the total operating time.

6.4.4 Scale. A dense, hard material that builds up in both freshwater and seawater-serviced shipboard sewage drains that is composed predominantly of calcium and magnesium-based salts with traces of organic matter.

6.4.5 Scale prevention chemical/biological product. A chemical or active biological agent that is introduced into the shipboard sewage drain system to remove any accumulated scale deposits or to prevent the formation of scale deposits or the adherence of the deposits to the sewage drain pipe walls.

6.4.6 Scale prevention system. A physical, chemical, or biological system that prevents the accumulation of scale in shipboard sewage drains.

6.4.7 Sewage. Wastes of human origin from water closets, urinals, and medical spaces which are transported by the ship sewage drainage system.

6.4.8 Type I scale prevention system. A scale prevention system that requires manual mixing and dispensing of chemical/biological product in accordance with manufacturers' instructions into the shipboard sewage system via the water closet and urinal bowls to remove any accumulated scale deposits on a scheduled basis.

6.4.9 Type II scale prevention system. A scale prevention system that automatically dispenses controlled doses of chemical/biological product directly into the shipboard sewage drain system on a timed basis to remove any accumulated scale deposits. Type II systems inject product, and dilution water as applicable, into the drain piping at the point where the upstream-most water closet or urinal drain intersects the piping.

6.4.10 Type III scale prevention system. A scale prevention system that automatically dispenses controlled doses of chemical/biological product into the shipboard sewage drain system to prevent the formation of scale deposits or the adherence of the deposits to the sewage drain pipe walls. Type III systems inject product into the flushing water to the sanitary fixture, into the fixture itself, or into the drain piping downstream of the fixture.

6.4.11 Type IV scale prevention system. A non-chemical/biological scale prevention system that automatically treats the flushing water to the sanitary fixtures using physical processes to prevent the formation of scale deposits or the adherence of the deposits to the sewage drain pipe walls.

6.5 Shelf-life guidance. This specification covers items where the assignment of a Federal shelf-life code is a consideration. Specific shelf-life requirements should be specified in the contract or purchase order, and should include, as a minimum, shelf-life code, shelf-life package markings in accordance with MIL-STD-129 or FED-STD-123, preparation of a materiel quality storage standard for Type II (extendible) shelf-life items, and a minimum of 85 percent shelf-life remaining at time of receipt by the Government. These and other requirements, if necessary, are in DoD 4140.27-M, *Shelf-life Management Manual*. The shelf-life codes are in the Federal Logistics Information System Total Item Record. Additive information for shelf-life management may be obtained from DoD 4140.27-M, or the designated shelf-life Points of Contact (POC). The POC should be contacted in the following order: (1) the Inventory Control Points that manage the item and, and (2) the DoD Service and Agency Administrators for the DoD Shelf-Life Program. Appropriate POCs for the DoD Shelf-Life Program can be contacted through the DoD Shelf-Life Management website: https://www.shelflife.hq.dla.mil/.

6.6 Data requirements. The contracting officer should include requirements for such data as Material Safety Data Sheets (MSDS), drawings, technical publications, chemical/biological product usage or other instructional materials, illustrated parts lists, and contractors' maintenance and operation manuals to be furnished with each scale prevention system (see 6.2).

6.7 Independent test laboratories. Where applicable, tests are to be conducted by independent laboratories certified by the American Association for Laboratory Accreditation (A2LA). A list of A2LA accredited laboratories is available online at www.a2la.org/Applications/ApplyTestLab.cfm or from the American Association for Laboratory Accreditation, 5301 Buckeystown Pike, Suite 350, Frederick, MD 21704. In addition, water tests are to be conducted by independent laboratories certified by the U.S. Environmental Protection Agency (EPA) for analyzing drinking water. A list of EPA certified laboratories is available online at www.epa.gov/safewater/labcert/index.html or from the U.S. Environmental Protection Agency, Ariel Rios Building, 1200 Pennsylvania Avenue, N.W., Washington, DC 20460.

6.8 Toxicity evaluation. The Navy and Marine Corps Public Health Center (NMCPHC) requires sufficient information to permit an HHA of the product. Any questions concerning toxicity and requests for HHA should be addressed to the Commanding Officer, Navy and Marine Corps Public Health Center (NMCPHC), ATTN: Industrial Hygiene Department, Acquisition Technical Support Division, 620 John Paul Jones Circle, Suite 1100, Portsmouth, VA 23708-2103. Upon receipt of the HHA, a copy should be provided to the Naval Sea Systems Command, ATTN: SEA 05S, 1333 Isaac Hull Ave., SE, Stop 5160, Washington Navy Yard, DC 20376-5160 or emailed to commandstandards@navy.mil.

6.9 Subject term (key word) listing.

Chemical/biological product injection

Corrosion

Non-chemical/biological physical treatment

Scale prevention chemical/biological product

Scale prevention physical process

Scale prevention system

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

Custodians:
Army – AT
Navy – SH
Air Force – 99

Review Activities:
Navy – YD
Air Force – 84
DLA – IS

Preparing Activity:
Navy – SH
(Project 4630-2011-001)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.daps.dla.mil.