NOTE: MIL-STD-796 has been redesignated as a Standard Practice. The cover page has been changed for Administrative reasons. There are no other changes to this Document.

INCH-POUND

MIL-STD-796A (SH)
16 MARCH 1988
SUPERSEDING
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3 JANUARY 1966
(SEE 6.3)

DEPARTMENT OF DEFENSE
STANDARD PRACTICE

CHEMICAL CLEANING OF MAIN AND AUXILIARY BOILERS (HYDROCHLORIC ACID METHOD)

AMSC N/A FSC 4410

DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND

Washington, DC 20362-5101

Chemical Cleaning of Main and Auxiliary Boilers

1. This Military Standard is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

CONTENTS

CONTENTS - Continued

1. SCOPE

1.1 Scope. This standard covers the requirements governing the procedure for chemical cleaning of main boilers of ferrous alloy construction and auxiliary boilers of ferrous alloy or silicon-bronze alloy (Herculoy) construction. NAVSEA approval shall be obtained prior to acid cleaning any boiler.

1.2 Procedure. This procedure is intended for use under the direction of a chemist and is not intended for use by ships' force due to the hazardous nature of the chemicals employed. The procedure described herein shall not be used for cleaning superheaters or other sections of stainless steel construction nor shall it be used for cleaning desuperheaters or other sections of 16 percent chromium - 1 percent nickel construction.

2. REFERENCED DOCUMENTS

2.1 Government documents.

2.1.1 Specifications. Unless otherwise specified, the following specifications of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this standard to the extent specified herein.

SPECIFICATIONS

FEDERAL

O-H-765 - Hydrochloric Acid, Technical.
O-S-571 - Sodium Carbonate, Anhydrous, Technical.
O-S-604 - Sodium Metasilicate, Technical.
O-S-639 - Sodium Phosphate, Dibasic, Anhydrous, Technical.
O-S-642 - Sodium Phosphate, Tribasic, Anhydrous; Dodecahydrate; and Monohydrate; Technical.
BB-N-411 - Nitrogen, Technical.

MILITARY

MIL-S-13727 - Sodium Phosphate, Monobasic, Anhydrous, Technical.
MIL-D-16791 - Detergents, General Purpose (Liquid, Nonionic).
MIL-I-17433 - Inhibitor, Hydrochloric Acid Descaling and Pickling Solutions.
MIL-R-19180 - Regulators, Pressure, Compressed Gas.
DOD-P-23236 - Paint Coating Systems, Steel Ship Tank, Fuel and Salt Water Ballast. (Metric)
MIL-P-24138 - Passivator Compound, Navy Boiler.
MIL-P-24441 - Paint, Epoxy - Polyamide, General Specification for.
MIL-H-29210 - Hose Assembly, Rubber, Metal Lined, Wire Reinforced, 250 psig, Saturated and Superheated Steam Service.

2.1.2 Other Government publications. The following other Government publications form a part of this standard to the extent specified herein.

PUBLICATIONS

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

NAVSEA S9086-GY-STM-000/CH-221	- Naval Ships' Technical Manual, Boilers.
NAVSEA S9086-GX-STM-020/CH-220 V2	- Naval Ships' Technical Manual, Boiler Water/Feedwater Test and Treatment.
NAVSEA 0951-LP-037-5010	- High Pressure Water Jet Cleaning Equipment.

(Copies of specifications and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following document forms a part of this standard to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment. (DoD adopted)

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which 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 standard and the references cited herein, the text of this standard shall take precedence.

3. DEFINITIONS

Not applicable.

4. GENERAL REQUIREMENTS

4.1 General requirements.

4.1.1 Application. This procedure shall be applied for removal of mill scale from new boilers prior to final acceptance trials as well as for removal of waterside deposits which can form in boilers after extensive operation.

4.1.2 Utilities. The following utilities needed for chemical cleaning are normally available at dockside for use by shipyard personnel or private contractors fulfilling Naval contracts at Naval shipyards:

(a) Fresh water.
(b) Distilled, feed or tap water containing less than 50 parts per million (p/m) hardness as calcium carbonate.
(c) Steam at 100 pounds per square inch (lb/in^2).
(d) Compressed air at 90 to 100 lb/in^2.
(e) Electrical power.

4.1.3 Removal of preservative or oil. If visual inspection of boiler waterSides reveals the presence of preservative or oil, the boiler shall be boiled out prior to acid cleaning in accordance with NAVSEA S9086-GY-STM-000/CH-221. The boiling out solution shall be as specified in 5.3.1. The boiling out solution shall be heated by low pressure steam and maintained at 50 to 100 lb/in^2 for a minimum of 24 continuous hours. The vents shall be cracked to provide for intermittent steam injection into the solution. After dumping of the boiling out solution, the boiler watersides shall be thoroughly rinsed with feedwater meeting the requirements specified in NAVSEA S9086-GX-STM-020/CH-220 V2.

5. DETAILED REQUIREMENTS

5.1 Mobile cleaning equipment. The contractor or shipyard shall have the following trailer or truck mounted equipment:

(a) Two acid tanks with a minimum capacity of 3000 gallons total.
(b) Two acid pumps each with a minimum capacity of 100 gallons per minute against 50-foot head.
(c) One proportioning header or its equivalent for blending acid, water and steam.
(d) One steam heater assembly for heating solutions.
(e) Five hundred feet of 1.5 inch acid hose rated at 150 lb/in^2 for admitting solutions to the boiler.
(f) Assorted hoses for air, nitrogen or water supply and for venting hydrogen from the boiler.
(g) Flexible metallic steam hose meeting the requirements specified in MIL-H-29210.
(h) One chemical test kit for determining acid concentration of solutions.
(i) One explosimeter (Mines Safety Appliances, Model 3 or equivalent).
(j) One portable pyrometer (Alnor Pyrocon or equivalent) and assorted thermometers.
(k) Assorted nonsparking tools including hammers, wrenches, screwdrivers and tools to repair acid cleaning equipment.
(l) Safety clothing to be worn by operating crew and other safety provisions as required (see 5.6).

5.2 Preparation of boiler and equipment (see figure 1).

5.2.1 Ventilation. The boiler shall be ventilated in accordance with 5.6.2 before any personnel are allowed to enter.

5.2.2 Tube removal. A screen row tube, not recently installed, shall be removed from each boiler to be cleaned, preferably from an area about one-half to two-thirds of furnace depth. The tubes shall be replaced or the holes shall

oses to furnish under authorized representative that the dispensers he prop

be plugged. The tube shall be split and retained for record purposes to demonstrate the original condition of the boiler. A tube from a new boiler shall only be removed for the inspection of 5.5.1. To determine cleaning effectiveness, a tube from a new boiler may be removed prior to acid cleaning and securely hung in a vertical position in the steam drum.

5.2.3 Desuperheater cleaning. Desuperheaters shall be removed and, if cleaning is required, shall be cleaned mechanically. The desuperheaters shall not be pickled. The desuperheater inlet and outlet connections in the boiler shall be blanked using rubber gaskets to prevent acid leakage into these nipples. The inlet and outlet desuperheater nipples in the boiler shall be coated with either type I, class 1 epoxy coating conforming to DOD-P-23236 or type I or type II (as applicable) epoxy coating conforming to MIL-P-24441. The following coating procedure shall be used:

(a) The first coat shall be applied and allowed to dry for 6 hours if warm air (100 degrees Fahrenheit (°F)) is used or for 24 hours if dried at ambient temperature.
(b) A second coat (and a third coat conforming to MIL-P-24441 system) shall be applied and allowed to dry in a similar manner.

After the cleaning operation, the epoxy coatings shall be removed from the nipples by hand tool cleaning or mechanical tool cleaning.

5.2.4 Steam separators and girth plates. At least two steam separators and all girth plates shall be removed, left in the steam drum and positioned so as not to cover the tubes.

5.2.5 Superheater and economizer blanking. If cleaning of the superheater and economizer is not required, the superheater and economizer shall be filled with feedwater and shall be blanked off as shown on figure 1. The superheater inlet shall be blanked at the steam drum using the acid wash plug. The superheater outlet shall be blanked at the closest possible location to the superheater outlet header. A closed main stop valve is not considered satisfactory for proper isolation. A blank shall be installed at the economizer inlet to isolate the economizer from the feed system. A closed feed valve is not considered satisfactory for proper isolation. Blanks shall be placed on both sides of the check valve at the economizer outlet. Blanking both sides of the check valve prevents acid damage to the check valve. Superheaters and economizers that are not to be cleaned shall be kept filled with feedwater during the entire cleaning operation.

5.2.5.1 Superheater and economizer cleaning. Superheaters shall not be chemically cleaned without prior approval of NAVSEA (see NAVSEA S9086-GY-STM-000/CH-221). If the economizer requires cleaning, it shall be cleaned while blanked from the boiler as in 5.2.5. The blanked economizer can be cleaned simultaneously with the boiler (see figure 1).

5.2.6 Valves, gauges, manholes, handholes and gaskets. Safety valves, gauges and other valves which will not be used during acid circulation shall be removed and blanks installed. Manhole and handhole plates shall be removed and cleaned by grinding or with wire brush where necessary to remove deposits.

Gaskets shall be replaced where necessary as determined by a 100 percent design pressure hydrostatic test. If available, neoprene gaskets may be installed for use during the cleaning.

5.2.7 Steam drum connections. A tee shall be attached to the air cock with valves on each side. The hydrogen vent hose shall be attached to one of the valves and shall lead to the weather deck or pier. The hose shall not be crimped or obstructed in any way to prevent escape of the evolving hydrogen gas. A length of copper tubing or hose (that can withstand a pressure of 100 lb/in^2) shall be connected from the nitrogen supply to the valve on the other side of the tee. A 1.5-inch valve shall be attached to the safety valve flange on top of the boiler. The 1.5-inch acid resistant discharge hose shall be connected to the nipple on this valve and the line shall be led back to the acid tanks to permit recirculation of the acid solutions (see 5.6.2.1). Valves, fittings and pipes shall be made of black iron (ungalvanized mild steel).

5.2.8 Temporary valve manifold. Bottom blow valves and piping shall be disconnected from the boiler and a temporary valve manifold shall be installed as shown on figure 1. The manifold shall have a separate valve for each line filling the water drum and each header. At one end of the manifold, a tee shall be installed with 1.5-inch valves attached to each side to permit alternate introduction of steam or acid into the boiler. Valves, fittings and pipes shall be made of black iron (ungalvanized mild steel).

5.2.9 Hydrostatic test. After the temporary piping hookup is completed, a hydrostatic test shall be applied to the boiler and temporary bottom blow manifold. The hydrostatic test shall be in accordance with NAVSEA S9086-GY-STM-000/CH-221. Test pressure shall be 150 lb/in^2 for main propulsion boilers and shall not exceed 100 percent of maximum allowable working pressure for all other boilers. The fresh water used in the hydrostatic test shall not be treated with sodium nitrite.

5.2.10 Boiler preheating. The boiler shall be filled with fresh water and preheated to 175 to 185°F using 100 lb/in^2 steam. The boiler shall not be preheated with live steam. Lighting off the boiler shall not be permitted.

5.2.11 Boiler draining. The boiler shall be drained immediately before introduction of the dilute acid. Early dumping shall result in excessive cooling of the boiler metal. The preheated water may be displaced by compressed air.

5.3 Chemicals required.

5.3.1 Boiling out solution. The boiling out solution, if required (see 4.1.3), shall be prepared with distilled, feed or fresh water containing less than 50 p/m hardness as calcium carbonate and shall contain the following:

(a) Trisodium phosphate in accordance with O-S-642 shall be used. Two hundred and fifty pounds of trisodium phosphate, dodecahydrate or 110 pounds of trisodium phosphate, anhydrous, per 1000 gallons of water shall be used.
(b) Sodium metasilicate in accordance with O-S-604, type II anhydrous. One hundred and ten pounds of sodium metasilicate, anhydrous, per 1000 gallons of water shall be used.

(c) Nonionic detergent (wetting agent) in accordance with MIL-D-16791 shall be used. Five quarts of nonionic detergent shall be added for every 1000 gallons of trisodium phosphate solution.

5.3.2 Descalant solution. The descalant formulation shall be an aqueous solution of the following:

(a) One hundred and forty-three gallons of 20 degrees Baume (20° Be) hydrochloric acid in accordance with O-H-765, and sufficient fresh water shall be used to obtain 1000 gallons of the diluted acid solution. This results in a solution containing 5 ± 1 percent by weight hydrogen chloride.
(b) Corrosion inhibitor in accordance with MIL-I-17433 shall be used. Concentration shall be as specified by the manufacturer.
(c) Eighty-five pounds of 1,3 diethylthiourea shall be used for every 1000 gallons of diluted acid solution. This results in a solution containing 1 percent of 1,3 diethylthiourea by weight.
(d) One hundred and twenty pounds of ammonium bifluoride shall be used for every 1000 gallons of the diluted acid solution. This results in a solution containing 1.4 percent of ammonium bifluoride by weight. Ammonium bifluoride is not needed when cleaning new boilers.
(e) One gallon of nonionic detergent (wetting agent) in accordance with MIL-D-16791 shall be used for every 1000 gallons of diluted acid solution. This results in a solution containing 0.1 percent of nonionic detergent by weight (or volume).

5.3.3 Mild acid solution. The mild acid rinse shall be an aqueous solution of the following:

(a) Two gallons of 20° Be hydrochloric acid, in accordance with O-H-765, and sufficient fresh water shall be used to obtain 1000 gallons of mild acid solution. This results in a solution containing 0.2 percent of hydrochloric acid by volume.
(b) Corrosion inhibitor in accordance with MIL-I-17433 shall be used. One fiftieth of the quantity required to inhibit the nominal 5 percent acid solution shall be used.

5.3.4 Passivating solution. The passivating solution shall be prepared with distilled, feed or fresh water containing less than 50 p/m hardness as calcium carbonate and shall contain the following:

(a) Sodium nitrite - 0.5 percent by weight.
(b) Disodium phosphate in accordance with O-S-639 - 0.25 percent by weight.
(c) Monosodium phosphate in accordance with MIL-S-13727 - 0.25 percent by weight.

Alternatively, 80 pounds of passivator compound conforming to MIL-P-24138 shall be used for each 1000 gallons of passivating solution. Passivator compound contains the three chemicals listed above in the correct proportion.

5.3.5 Nitrogen. Nitrogen (oil free) for displacing solutions from the boiler shall conform to type I, grade C, class 1 of BB-N-411. Nitrogen cylinders shall be fitted with regulators in accordance with type II, class B2-W of MIL-R-19180.

5.4 Specific cleaning procedure. (See 5.6 for safety precautions and 5.7 for disposal solutions.)

5.4.1 Descalant preparation and injection. The descalant formulation may be completely blended in an acid mixing tank or by means of a proportioning header. The solution shall not be blended prior to arrival on the job site. The 1,3 diethylthiourea, wetting agent and ammonium bifluoride shall be predissolved in a separate tank before blending with the inhibited acid. The acid descalant shall be properly inhibited before being injected into the boiler. This shall be verified by placing a mild steel coupon into a beaker containing the heated (160 to 170°F) inhibited acid descalant. No reaction shall be noticeable, as indicated by the absence of hydrogen gas bubbles around the coupon after exposure for about 1 minute. (If the reaction does not subside, the acid is improperly inhibited and shall not be injected into the boiler.) The boiler shall be filled with the diluted acid. The acid concentration of the descalant mixture entering the boiler shall strictly conform to the requirement of 5 $\pm$ 1 percent by weight. The temperature of the descalant entering the boiler shall be 160 to 170°F. The on-site chemist shall carefully direct and maintain a log of this phase of the operation as to proper inhibition, acid concentration and temperature.

5.4.1.1 Descalant temperature. The temperature of the descalant in the boiler shall be maintained at 160 to 170°F. The temperature shall be checked periodically at both drums using a portable pyrometer. The temperature shall not exceed 170°F at either drum.

5.4.1.2 Descalant soaking and recirculation. The descalant shall be allowed to soak for 8 hours. The descalant shall be recirculated at a rate of about 50 gallons per minute for approximately 15 minutes during each hour. The recirculation shall be alternated between the water drum and headers by opening and closing the appropriate valves on the temporary valved manifold. This provides for more uniform solvent strength and temperature throughout the boiler. The vent and nitrogen lines shall be secured during descalant recirculation. Before opening the vent line during static conditions, opening of the valve shall be delayed 5 to 10 minutes to allow for pressure equalization. When descaling economizers, the hourly recirculation shall be for 5 minutes. Steam shall not be injected directly into the economizer to maintain the temperature as pressure build-up would occur.

5.4.1.3 Descalant testing. The on-site chemist shall sample and test the descalant for acid concentration at least once each hour. The results shall be logged. Temperature readings shall be taken and logged at least every 30 minutes.

5.4.1.4 Records. A record of the entire operation shall be kept.

5.4.1.5 Descalant draining. Descalant draining shall be as follows: The descalant shall be drained from the boiler by nitrogen displacement using 40 to 50 lb/in^2 pressure. After nitrogen is initially noted in the return, drain the water drum and each header separately by opening and closing the appropriate valves. Maintain nitrogen pressure while draining. Repeat the sequence several times as necessary to ensure complete removal of the descalant from the boiler. If leaks develop when the system is under nitrogen pressure, the pressure source and vent system shall be secured immediately to reduce pressure to atmospheric. An alternate method of removing the acid shall be used, such as pumping.

5.4.2 Water rinse. The boiler shall be filled with fresh water at 150 to 160°F and allowed to soak for 15 minutes. The boiler shall be drained by nitrogen displacement at 40 to 50 lb/in^2. Drain each boiler circuit separately to ensure complete removal of the water rinse (see 5.4.1.5). The economizer shall also be rinsed if it was cleaned.

5.4.3 Mild acid rinse. The mild acid rinse solution shall be prepared by blending 20° Be hydrochloric acid with fresh water either in a mixing tank or through a proportioning header. The mild acid rinse entering the boiler shall be at 150 to 160°F. The boiler shall be filled with the mild acid rinse and held at 150 to 160°F for 30 minutes. The mild acid rinse shall be displaced from the boiler with nitrogen gas at 40 to 50 lb/in^2. Drain each boiler circuit separately to ensure complete removal of the mild acid rinse (see 5.4.1.5). After draining is complete, the pump discharge line valve shall be secured and the nitrogen supply shall be immediately shut off. This shall maintain nitrogen gas pressure on the boiler and shall prevent air inleakage. Air may cause corrosion of the cleaned boiler surfaces. The economizer shall also be given a mild acid rinse if it was cleaned.

5.4.4 Passivating solution preparation. The passivating solution shall be prepared by adding the chemicals in the proportions specified in 5.3.4 to the weight of water required to completely fill the boiler. The chemicals may be completely blended in a mixing tank or a concentrated solution may be prepared for further dilution through a proportioning header. Distilled, feed or fresh water containing less than 50 p/m hardness as calcium carbonate shall be used in preparing this solution; otherwise undesirable phosphates may precipitate on the cleaned boiler surfaces.

5.4.4.1 Passivating solution injection and draining. The passivating solution shall be introduced into the boiler and economizer, if it was cleaned, at 150 to 160°F, circulated for 10 minutes and held for an additional 30 minutes at 150 to 160°F. The passivating solution shall be displaced by nitrogen or air.

5.4.5 Opening and ventilating. The boiler shall be opened immediately after dumping, ventilated in accordance with 5.6.2 and inspected in accordance with 5.5.1. An explosimeter shall be used around the boiler and in the steam drum to ascertain the absence of explosive gas before proceeding with the inspection. Oxygen sufficiency shall be checked before entering the boiler.

5.5 Procedure following chemical cleaning.

5.5.1 Inspection. The boiler shall be ventilated in accordance with 5.6.2 before any personnel are allowed to enter. To determine the effectiveness of the cleaning operation, a screen tube shall be removed, preferably adjacent to the tube removed prior to acid cleaning. The tube shall be split and then thoroughly wire brushed to remove loose deposits. A tube from new boilers, if not removed prior to acid cleaning as specified in 5.2.2, shall be removed and inspected.

5.5.1.1 Crimping. A split tube section (from an area that was located in a bend near the water drum) shall be crimped in a vise. If hard crimpable deposits are found on the tube, the boiler shall be recleaned following the procedure specified herein. A few small particles or fine granules do not constitute hard, crimpable deposits.

5.5.2 Water jetting. Following the successful acid cleaning operation, all boiler waterside surfaces shall be cleaned using a high pressure water jet in accordance with NAVSEA S9086-GY-STM-000/CH-221 and NAVSEA 0951-LP-037-5010. Water jetting may be delayed if work is to be performed on the boiler. After water jet cleaning is completed, the boiler shall be dried out, preferably by using hot air.

5.5.3 Reinstallation. Temporary connections shall be removed and fittings reinstalled. Manhole and handhole gaskets and any valve gaskets or packing that have been in contact with acid shall be renewed. Blanks shall be removed and all boiler parts which were removed prior to acid cleaning shall be reinstalled.

5.5.4 Hydrostatic test. After reinstallation of all boiler parts, a hydrostatic test shall be applied to the boiler and bottom blow system in accordance with NAVSEA S9086-GY-STM-000/CH-221. After the hydrostatic test is performed, the water used for the hydrostatic test shall be drained from the boiler.

5.5.5 Boiler fill and light off. Prior to light-off, the boiler shall be filled with feedwater and chemically treated in accordance with NAVSEA S9086-GX-STM-020/CH-220 V2. When the boiler is first lit off after cleaning, it shall be brought up to operating temperature slowly.

5.5.6 Blowdown. After the boiler is lit off, it shall be blown down frequently until the boiler water is clear.

5.6 Safety precautions.

5.6.1 Safety coordination. The contractor or shipyard representative shall ensure that the cleaning work is coordinated through the safety superintendent to provide personnel protection from acid and other chemical hazards.

5.6.2 Ventilation. The oxygen content in the boiler shall be measured by a calibrated instrument and shall be between 20 and 22 percent by volume before any personnel are allowed to enter the boiler. All nitrogen and steam

lines shall be blanked off or disconnected before any personnel are allowed to enter the boiler. One person equipped with supplied-air respirators shall be in constant communication with personnel in the boiler should a rescue become necessary.

5.6.2.1 Hydrogen venting. During acid cleaning there is a possibility of liberating explosive concentrations of hydrogen. For this reason, the vent from the steam drum shall be piped to the atmosphere at a safe distance. "No smoking", "no burning" and "no welding" signs shall be posted in the fireroom, at the mixing tank and near the vent discharge. Nonsparking tools and safety explosion-proof lights shall be used if it becomes necessary to work on the boiler prior to the passivating step.

5.6.2.2 Nitrogen venting. Nitrogen gas must be vented outside the ship when it is displaced by the solutions.

5.6.2.3 Hydrogen chloride venting. Adequate ventilation is required in the fireroom to control hydrogen chloride vapors below the permissible exposure level of 5 p/m.

5.6.3 Acid spillage. Acid spillage shall be neutralized with sodium carbonate conforming to O-S-571. The area shall then be washed down with water. Supplies of sodium carbonate shall be on hand in the fireroom and with the acid cleaning equipment.

5.6.4 Personal protective equipment. Personnel working with and around acid cleaning operations shall wear coveralls, aprons, acid impervious gloves, boots, chemical goggles or full face shields. Personnel must be trained to wear half-mask respirators with dust and acid mist cartridges.

5.6.5 Safety shower and eyewash. Portable combination safety showers and eyewash stations in accordance with ANSI Z358.1 shall be available in the fireroom and at the acid cleaning equipment.

5.6.6 Boiler light off. The boiler shall not be lit off for preheating purposes nor at any time during the cleaning operation.

5.6.7 Equipment location. Chemical cleaning equipment shall not be located in the fireroom.

5.6.8 Ship's pumps. Ship's pumps shall not be used for acid recirculation or filling the boiler.

5.6.9 Acid dilution. Concentrated acid shall not be added to the boiler for eventual dilution with water in the boiler.

5.6.10 Acid circulation. The 5 percent acid solution shall be circulated only intermittently (15 minutes each hour as specified in 5.4.1.2), rather than continuously, to prevent excessive boiler metal corrosion.

5.6.11 Superheater leakage. The water-filled superheater shall be monitored for possible acid inleakage. If this occurs, the superheater shall be thoroughly rinsed with distilled water to remove all traces of acid.

5.6.12 Passivator and acid. The passivator solution shall not be allowed to contact acids.

5.7 Disposal regulations. The spent solutions specified in 4.1.3, 5.4.1.5, 5.4.2, 5.4.3, 5.4.4.1 and 5.5.4 shall be disposed of in accordance with local, state and federal regulations. Each of these solutions except the passivator (see 5.5.4) shall be neutralized after being drained from the boiler. Spent solutions shall not be reused.

6. NOTES

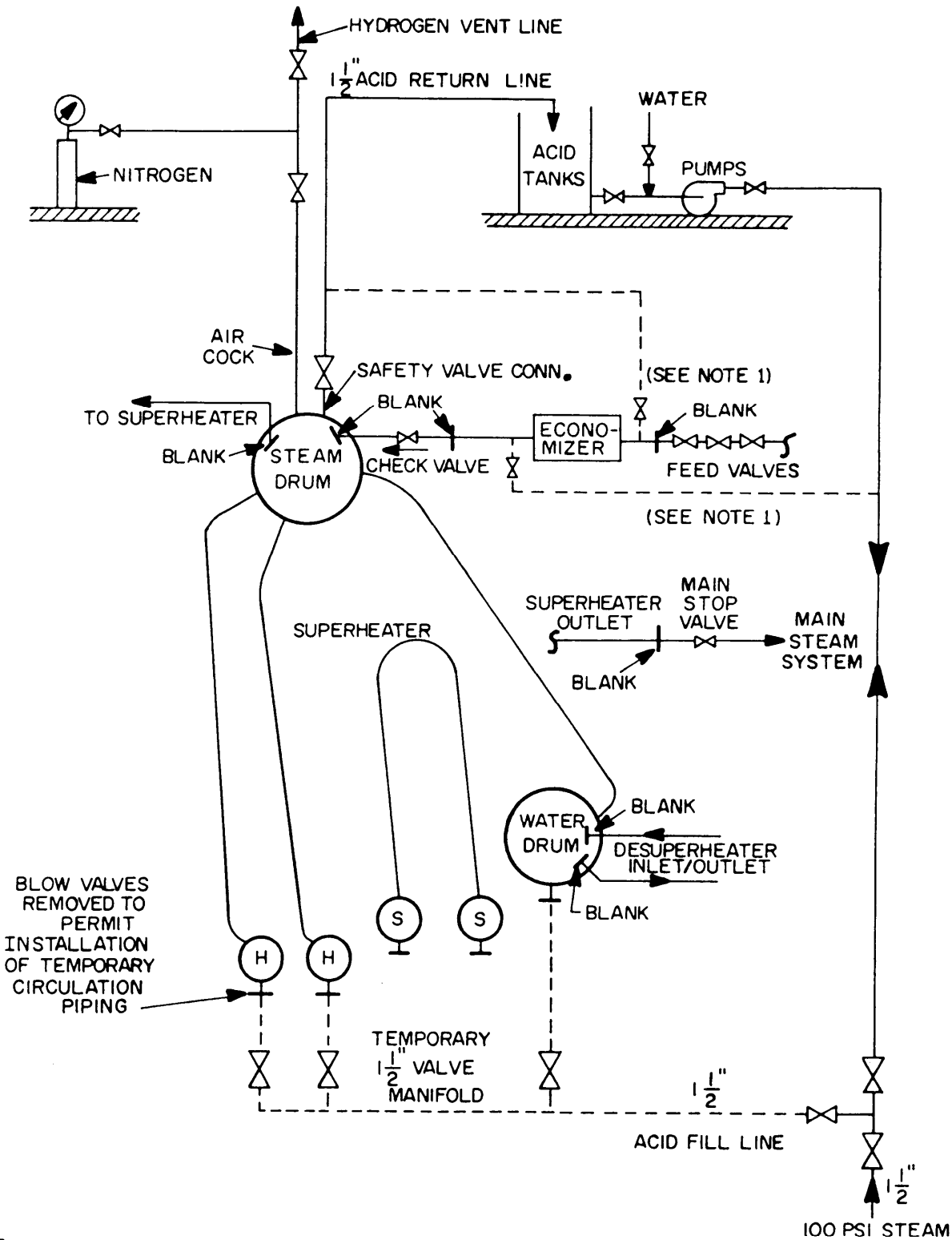
6.1 Intended use. The chemical cleaning procedures covered by this standard are intended for use by Navy approved private contractors or Naval shipyards.

6.2 Subject term (key word) listing.

Economizer
Nionic detergent
Passivating solution
Superheater

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

Preparing activity:
Navy - SH
(Project 4410-N066)



NOTE:
1. Arrangement for simultaneous economizer-boiler cleaning, if required.

SH 132317664

FIGURE 1. Piping diagram.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-STD-796A(SH)	CHEMICAL CLEANING OF MAIN AND AUXILIARY BOILERS (HYDROCHLORIC ACID METHOD)

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*:

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426 PREVIOUS EDITION IS OBSOLETE.