

MIL-D-18641E(SHIPS)
AMENDMENT-10
15 October 1980
SUPERSEDING
AMENDMENT-9
26 May 1969

MILITARY SPECIFICATION

DISTILLATION UNITS, WATER: STEAM OR FLASHED VAPOR
OPERATED, OR FRESH WATER HEATED, LOW
PRESSURE, NAVAL SHIPBOARD

This amendment forms a part of Military Specification
MIL-D-18641E(SHIPS), dated 30 August 1960.

PAGES 1 and 2

- * 2.1, under "SPECIFICATIONS, FEDERAL": Delete reference to "WW-T-797",
and add:

"QQ-C-390 - Copper Alloy Castings (Including Cast Bar).
"QQ-C-465 - Copper-Aluminum Alloys (Aluminum Bronze) (Copper
Alloy Numbers 606, 614, 630, 632M, and 642);
Rod, Flat Products With Finished Edges (Flat
Wire, Strip, and Bar), Shapes and Forgings.
"QQ-N-281 - Nickel-Copper Alloy Bar, Plate, Rod, Sheet,
Strip, Wire, Forgings, and Structural and
Special Shaped Sections."

- * 2.1, under "SPECIFICATIONS, MILITARY": Delete reference to MIL-B-857,
MIL-D-963, MIL-A-15939, MIL-T-16420, MIL-D-1000/2, MIL-M-16576,
MIL-F-21467, MIL-B-23921, and add:

"DOD-D-1000 - Drawings, Engineering and Associated Lists.
"MIL-S-1222 - Studs, Bolts, Hex Cap Screws, and Nuts.
"MIL-Q-9858 - Quality Program Requirements.
"MIL-T-20157 - Tube and Pipe, Carbon Steel, Seamless.
"MIL-C-20159 - Copper-Nickel Alloy (70-30 and 90-10): Cast-
ings.
"MIL-N-24106 - Nickel-Copper Alloy Bars, Rods, and Forgings.
"MIL-T-24107 - Tube, Copper (Seamless) (Copper Numbers 102,
103, 108, 120, 122, and 142).
"MIL-B-24480 - Bronze, Nickel-Aluminum Castings, For Sea-
water Service."

- * 2.1, under "STANDARDS, MILITARY", add:

"DOD-STD-100 - Engineering Drawing Practices.
"MIL-STD-271 - Nondestructive Testing Requirements for
Metals.

MIL-D-18641E(SHIPS)
AMENDMENT-10

"MIL-STD-438 - Schedule of Piping Valves, Fittings and Associated Piping Components for Submarine Service.

"MIL-STD-777 - Schedule of Piping, Valves, Fittings and Associated Piping Components for Surface Ships."

- * 2.1: Delete all reference to "DRAWINGS", and substitute:

"DRAWING

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

B 214 - Root Connections for Attaching Piping."

- * 2.1: Add:

"PUBLICATION

MILITARY

NAVSEA 0900-001-7000 - Fabrication and Inspection of Brazed Piping System."

PAGE 3

- * 2.2, under "AMERICAN SOCIETY FOR TESTING AND MATERIALS": Delete all reference to A7, A53, and B143", and add:

"B 151-79 - Copper-Nickel-Zinc Alloy (Nickel-Silver) and Copper-Nickel Rod and Bar.

"B 584-79 - Copper Alloy Sand Castings for General Applications."

- 3.2.1: Add "Taper pipe threads shall not be used."

3.2.2: Add "Welded joints, except vent and drain nipple root connections, on the salt water side of heat exchangers subject to submarine submergence pressure shall be radiographable. Brazed connections may be used for vent and drain attachments to the salt water side of heat exchangers subject to submarine submergence pressure only for the case of gun metal and cast bronze water boxes; when used, they shall permit ultrasonic testing for bond, and shall be fabricated and inspected in accordance with NAVSEA 0900-001-7000, except that requirements for use of pre-inserted rings do not apply to the root connection."

- * Add as new paragraph 3.2.4:

"3.2.4 Recovered materials. Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and shall be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified."

MIL-D-18641E(SHIPS)
AMENDMENT-10

PAGE 4

3.4.1, second sentence: Delete and substitute: "For those distilling units for which provisions of feed treatment is made by 3.7.33 and 3.7.34, the approved treatment may be used during capacity tests."

PAGE 6

3.7.3, line 1: Delete "type I" and substitute "type III", and in line 6, delete "system" and substitute "steam".

Add as 3.7.7.1.1.1:

"3.7.7.1.1.1 Shock resistance of distillation units shall be in accordance with the following levels, as specified (see 6.1).

- (a) Level A - The distillation unit, after sustaining mechanical shock, shall be capable of normal operation (see 3.3 and 3.4) and no parts thereof shall create a missile hazard to personnel or contiguous apparatus or otherwise constitute a personnel hazard (such as rupture of parts containing steam or hot water, with consequent danger of scalding personnel) at the time of the shock.
- (b) Level B - The requirements of level B shall be the same as level A except that the distillation unit need not be capable of normal operation after sustaining mechanical shock."

3.7.7.1.3.1: Delete and substitute:

"3.7.7.1.3.1 Bolts designed to be stressed in shear shall be installed in holes no greater than the following sizes:

<u>Nominal bolt diameter</u>	<u>Maximum diameter of hole</u>
Inches	Inches
3/4 and smaller	Nominal bolt diameter + 1/32
Larger than 3/4	Nominal bolt diameter + 1/16"

PAGE 7

3.7.8.1, lines 6 and 7: Delete "or A7 (open hearth, carbon content 0.35 percent maximum)".

3.7.10, first sentence: Delete "6 feet per second", and substitute "7.5 feet per second".

PAGE 8

3.7.18, line 12: Delete "41/64 inch diameter." and substitute "1/64 inch diameter larger than the nominal outside tube diameter."

MIL-D-18641E(SHIPS)
AMENDMENT-10

PAGE 9

* 3.7.25: Delete and substitute:

"3.7.25 Nuclear powered ships. Readily replaceable zinc anodes in accordance with MIL-A-19521 shall be installed in the salt water circuits of all heat exchangers of the distillation units except the evaporators. When use of pencil type anodes is necessary, support plugs shall be of the straight thread O-ring seal type in accordance with MIL-A-19521. In exception to the material requirements of MIL-A19521, plug materials shall conform to the following tabulations:

Submarine applications	
Material	Specification
Nickel-copper alloy Copper-nickel alloy, composition 70-30	QQ-N-281 MIL-C-15726

Surface ship applications	
Nickel-copper alloy Copper-nickel alloy Nickel-aluminum bronze	QQ-N-281 or ASTM B 164 MIL-C-15726 or Alloy 715 of ASTM B 151-79 Alloy 632M of QQ-C-465

Add as 3.7.25.1:

"3.7.25.1 Non-nuclear powered ships. Provisions for the future installation of replaceable zinc anodes in accordance with MIL-A-19521 shall be made in the salt water circuits of all heat exchangers of the distillation units except the evaporators. When provision for pencil type anodes is necessary, plugs shall be of the straight thread O-ring seal type in accordance with MIL-A-19521; plug materials shall conform to 3.7.25."

PAGE 10

3.7.29.1.1.3, first sentence: Delete and substitute: "For straight tube bundle exchangers, welding the inner tube sheets to the shell is a preferred construction vice 'blind' gasket construction (which would entail retubing in order to renew a gasket)."

Page 4 of 20

MIL-D-18641E(SHIPS)
AMENDMENT-10

PAGE 11

3.7.29.1.1.5, last two sentences including formula and note: Delete and substitute:

"In the design of heat exchangers, the forces exerted by the circulating water inlet and discharge piping on the respective water box nozzles shall be considered as resulting from a maximum bending stress in the piping equal to 11,000 pounds per square inch (lb/in²) and a direct axial force of 1000 pounds multiplied by the nominal pipe size. These two loading components shall be treated as a single overturning moment:

$$M = 10,000 d_m^2 t$$

Where:

M = overturning moment, inch-pounds.
d_m = mean diameter of attached piping, inches (see 6.1).
t = thickness of piping, inches (see 6.1)."

* 3.7.29.1.1.5.1: Delete and substitute:

"3.7.29.1.1.5.1 In the design of the heat exchanger salt water sides, full consideration shall be given to the cyclic nature of the pressure and external force loading. The design shall be based on 20,000 cycles to full design submergence. The design shall be justified by either submission of an analysis of the fatigue loading, or, for the case where water box design is not amenable to such analysis, by an experimental proof test (see 4.4.5). The analysis or the proof test results shall be submitted to the Naval Sea Systems Command (NAVSEA) for approval action. Release of the exchanger design for production shall be subject to approval of the analysis or proof test results."

* 3.7.29.1.1.6, first two sentences: Delete and substitute: "Bolts and studs subjected to submergence pressure shall be nickel-copper alloy in accordance with QQ-N-281, class A, hot finished; or nickel-copper alloy in accordance with MIL-N-24106, cold drawn, and stress relieved, or hot finished; or nickel-copper-aluminum alloy in accordance with QQ-N-286, class A, hot finished, annealed and age hardened or cold drawn, annealed and age hardened. Nuts for these bolts and studs shall be nickel-copper alloy in accordance with QQ-N-281, class A or B, hot finished condition; or nickel-copper alloy in accordance with MIL-N-24106, cold drawn and stress relieved, or hot finished; or nickel-copper alloy in accordance with ASTM B 164, hot finished."

* Add new paragraphs:

"3.7.29.2 Mercury shall not be incorporated in, or used for service (except fluorescent or mercury vapor lighting) in the production and testing of, distilling units without specific NAVSEA approval.

"3.7.29.3 Distilling units on nuclear propelled surface ships and submarines shall accommodate a one-button shutdown of the unit which will safely secure all steam, seawater feed and brine dilution, trip all solenoid operated dump valves, and secure all distilling plant pumps. The one-button shutdown system will be provided by the shipbuilder."

MIL-D-18641E(SHIPS)
AMENDMENT-10

"3.7.29.4 For distilling units on nuclear propelled surface ships, the heating steam circuit of the seawater heater shall be vented to atmosphere only. The vent piping shall contain an orifice sized for normal operation. A bypass with globe valve shall be provided around the orifice for use during startup."

3.7.31: Delete and substitute:

"3.7.31 Integral piping, valves, fittings, and similar items shall be in accordance with MIL-STD-777 or MIL-STD-438, as applicable."

* 3.7.32, lines 2 and 3: Delete "Specification MIL-A-15939" and substitute "Alloy 632M of QQ-C-465".

* 3.7.33, first sentence: Delete and substitute: "Connections shall be provided as required for introduction of scale prevention compound into the salt water feed stream for the following distillation units:

Type I

Type II

Type III

Type IV

Type VI

Type VII units meeting either of the following criteria:

(a) Rated capacity is 5000 GPD or greater.

(b) First effect design boiling temperature is 140°F or higher."

3.7.34: Delete and substitute:

"3.7.34 A proportioning pump and supply tank, in accordance with MIL-P-21397, shall be furnished for the distilling units specified in 3.7.33."

MIL-D-18641E(SHIPS)
AMENDMENT-10

PAGE 12

Table I: Delete and substitute:

"TABLE I. Material for class A distillation units.

Part	Material	Applicable document
Shell	Copper-nickel alloy, composition 70-30	MIL-C-15726
Tube sheets	Copper-nickel alloy, composition 70-30	MIL-C-15726
Tube support plates	Copper-nickel alloy, composition 70-30	MIL-C-15726
Steam chest (type I) or water boxes for hot fresh water (type VII)	Copper-nickel alloy, composition 70-30, or gun metal, or valve bronze, or steel plate, or nickel-aluminum bronze	MIL-C-15726 or MIL-C-20159 Alloy C90300 of ASTM B 584-79 Alloy C92200 of ASTM B 584-79 ASTM A 285 MIL-B-24480 MIL-C-15726
Baffles	Copper-nickel alloy, composition 70-30	MIL-C-15726
Vapor separators ^{1/}	Copper-nickel alloy, composition 70-30	MIL-C-15726
Bolts, nuts and stay rods exposed to salt water vapor or in joints involving salt water tightness ^{2/}	Nickel-copper alloy, or phosphor bronze, or copper-silicon alloy	ASTM B 164 Alloy C51000 or C52400 of ASTM B 139 ASTM B 98 MIL-S-1222
Other bolts and nuts	Nonferrous	
Piping, water	(see 3.7.31)	
Piping, steam inlet	(see 3.7.31)	
Piping, vapor	(see 3.7.31)	

^{1/} If manufacturer elects to furnish mesh type vapor separators, the mesh shall be galvanically compatible with adjacent materials.

^{2/} Form in accordance with MIL-S-1222."

3.8.1.2, lines 3 and 4: Delete "Specification MIL-A-15939" and substitute "Alloy 632M of QQ-C-465".

PAGE 13

3.8.10: Add "Access shall be provided for cleaning any strainer installed inside the shell."

MIL-D-18641E (SHIPS)
AMENDMENT-10

3.8.11: Delete and substitute:

"3.8.11 Adjustable weir type level controls shall be provided for maintaining a constant level of brine in each effect."

- * 3.9.1.2, lines 3 and 4: Delete "Specification MIL-A-15939" and substitute "Alloy 632M of QQ-C-465".

PAGE 14

- * Table II: Delete and substitute:

"TABLE II. Materials for class A distilling units.

Part	Materials	Applicable documents
Shell	Copper-nickel alloy, composition 70-30	MIL-C-15726
Tube sheets	Copper-nickel alloy, composition 70-30	MIL-C-15726
Tube support plates	Copper-nickel alloy, composition 70-30	MIL-C-15726
Baffles	Copper-nickel alloy, composition 70-30	MIL-C-15726
Vapor separators ^{1/}	Copper-nickel alloy, composition 70-30	MIL-C-15726
Bolts exposed to salt water, vapor, or condensate or for joints involving salt water tightness ^{2/3/}	Nickel-copper alloy, class A, or phosphor bronze,	ASTM B 164 Alloy C51000 or C52400 of ASTM B 139
Stay rods exposed to salt water ^{2/}	or copper-silicon alloy Nickel-copper alloy, class A, or phosphor bronze,	ASTM B 98 ASTM B 164 Alloy C51000 or C52400 of ASTM B 139
Nuts for bolts and stay rods specified above ^{2/3/}	or copper-silicon alloy Nickel-copper alloy, class B, or phosphor bronze,	ASTM B 98 ASTM B 164 Alloy C51000 or C52400 of ASTM B 139
Other bolts and nuts	or copper-silicon alloy Nonferrous	ASTM B 98 MIL-S-1222
Piping, water	(see 3.7.3.1)	
Piping, vapor	(see 3.7.3.1)	
Water boxes	Gun metal,	Alloy C90300 of ASTM B 584-79
	or valve bronze,	Alloy C92200 of ASTM B 584-79
	or copper-nickel alloy, composition 70-30,	MIL-C-15726
	or nickel-aluminum bronze	MIL-B-24480

See footnotes at top of next page.

MIL-D-18641E(SHIPS)
AMENDMENT-10

- 1/ If manufacturer elects to furnish mesh type vapor separators, the mesh shall be galvanically compatible with adjacent materials.
- 2/ Form in accordance with MIL-S-1222.
- 3/ Materials for bolts, studs, and nuts in joints subjected to submergence pressure (submarine service) shall be in accordance with 3.7.29.1.1.6."

PAGE 15

* Table III: Delete and substitute:

"TABLE III. Materials for class A distilling units.

Part	Material	Applicable document
Shell	Nickel-copper alloy	ASTM B 127
Corrugated baskets	Nickel-copper alloy	ASTM B 127
Vapor separators	Copper-nickel alloy, composition 70-30 or nickel-copper alloy	MIL-C-15726 ASTM B 127
Bolts exposed to salt water, vapor, or condensate or for joint involving salt water tightness ^{1/}	Nickel-copper alloy, class A, or phosphor bronze,	ASTM B 164 Alloy C51000 or C52400 of ASTM B 139
Stay rods exposed to salt water	or copper-silicon alloy	ASTM B 98
Nuts for bolts and stay rods specified above ^{1/}	Nickel-copper alloy, class A	ASTM B 164
Other bolts and nuts	Copper-silicon alloy, or phosphor bronze	ASTM B 98 Alloy C51000 or C52400 of ASTM B 139
Piping, water	Nonferrous (see 3.7.31)	MIL-S-1222
Piping, steam inlet	(see 3.7.31)	
Piping, vapor	(see 3.7.31)	

1/ Form in accordance with MIL-S-1222."

* 3.10.1.2, line 3: Delete "Specification MIL-A-15939" and substitute "Alloy 632M of QQ-C-465".

Add as 3.10.2.1 and 3.10.2.2:

"3.10.2.1 The dimensions of the corrugated baskets of distilling units to be installed in submarines shall be such that the baskets can be removed via a standard hatch, or in case there is no hatch in the compartment in which the distilling unit is to be installed, such that the basket can be moved through bulkhead openings into a compartment provided with a hatch. Hatch and bulkhead opening dimensions will be as specified (see 6.1).

MIL-D-18641E(SHIPS)
AMENDMENT-10

"3.10.2.2 The dimensions of the corrugated baskets of distilling units to be installed in surface vessels shall be such that they can be removed from the engine room via hatch or access openings provided (see 6.1)."

PAGE 16

* Table IV: Delete and substitute:

"TABLE IV. Materials for class A distillation units.

Part	Material	Applicable document
Shell	Steel plate, or steel tubing, or copper tubing	ASTM A 285 MIL-T-20157 MIL-T-24107
Tube support plates and baffle plates	Steel plate	ASTM A 285
Water boxes	Copper-nickel alloy, composition 70-30, or valve bronze, or gun metal, or nickel-aluminum bronze (see 3.7.31)	MIL-C-15726 or MIL-C-20159 Alloy C92200 of ASTM B 584-79 Alloy C90300 of ASTM B 584-79 MIL-B-24480
Steam piping	Nickel-copper alloy, class A, or phosphor bronze, or copper-silicon alloy	ASTM B 164 Alloy C51000 or C52400 of ASTM B 139 ASTM B 98 ASTM B 36
Bolts in contact with salt water or for joints involving salt water tightness ^{1/}	Brass	
Tie rods and spacers in contact with fresh water	Nickel-copper alloy, or phosphor bronze, or copper-silicon alloy	ASTM B 164 Alloy C51000 or C52400 of ASTM B 139 ASTM B 98
Nuts for bolts and tie rods specified above ^{1/}	Copper-nickel alloy, composition 70-30	MIL-C-15726
Tube sheets	Nonferrous	MIL-S-1222
Other bolts and nuts		

^{1/} Form in accordance with MIL-S-1222."

PAGE 17

* 3.11.1.2 (continued), line 4: Delete "Specification MIL-A-15939" and substitute "Alloy 632M of QQ-C-465".

MIL-D-18641E(SHIPS)
AMENDMENT-10

Table V: Delete and substitute:

"TABLE V. Materials for class A distillation units.

Part	Material	Applicable document
Shell, if separate	Copper-nickel alloy, composition 70-30	MIL-C-15726
Tube sheets	Copper-nickel alloy, composition 70-30	MIL-C-15726
Tube support plates and baffle plates	Copper-nickel alloy, composition 70-30	MIL-C-15726
Water boxes	Copper-nickel alloy, composition 70-30, or nickel-aluminum bronze	MIL-C-15726 or MIL-C-20159 MIL-B-24480
Flash chamber	Copper tubing, or copper-nickel alloy, composition 70-30	MIL-T-24107 MIL-C-15726
Bolts, nuts, tie rods and spacers in contact with water or vapor or in joints involving salt water tight- ness ^{1/3/}	Nickel-copper alloy, or phosphor bronze, or copper-silicon alloy or admiralty metal ^{2/}	ASTM B 164 Alloy C51000 or C52400 of ASTM B 139 ASTM B 98 ASTM B 111
Other bolts and nuts	Nonferrous	MIL-S-1222

^{1/} Form in accordance with MIL-S-1222.

^{2/} Spacers only.

^{3/} Materials for bolts, studs, and nuts in joints subjected to submergence pressure (submarine service) shall be in accordance with 3.7.29.1.1.6."

MIL-D-18641E(SHIPS)
AMENDMENT-10

PAGE 18

* Table VI: Delete and substitute:

"TABLE VI. Materials for class C.

Part	Material	Applicable document
Shell, if separate	Bronze, aluminum, wrought	Alloy 632M of QQ-C-465
Tube support plates and baffle plates	Bronze, aluminum, wrought	Alloy 632M of QQ-C-465
Water boxes	Bronze, aluminum, wrought, or valve bronze, or gun metal, or nickel-aluminum bronze	Alloy 632M of QQ-C-465 Alloy C92200 of ASTM B 584-79 Alloy C90300 of ASTM B 584-79
Flash chamber	Copper tubing, or bronze, aluminum, wrought	MIL-B-24480 MIL-T-24107 Alloy 632M of QQ-C-465
Bolts, nuts, tie rods and spacers in con- tact with water or vapor or in joints involving salt water tightness ^{1/}	Bronze, aluminum, wrought, or phosphor bronze, or copper-silicon alloy, or admiralty metal ^{2/} , or commercial brass ^{3/}	Alloy 632M of QQ-C-465 Alloy C51000 or C52400 of ASTM B 139 ASTM B 98 ASTM B 111
Other bolts and nuts	Nonferrous	MIL-S-1222
Tube sheets	Bronze, aluminum, wrought	Alloy 632M of QQ-C-465

^{1/} Form in accordance with MIL-S-1222.

^{2/} Spacers only.

^{3/} Tie rods and tie rod nuts only."

MIL-D-18641E(SHIPS)
AMENDMENT-10

PAGE 19

Table VII: Delete and substitute:

"TABLE VII: Materials for class A.

Part	Material	Applicable document
Shell	Copper-nickel alloy, composition 70-30, or seamless copper tubing, or gun metal, or valve bronze	MIL-C-15726 MIL-T-24107 Alloy C90300 of ASTM B 584-79 Alloy C92200 of ASTM B 584-79 MIL-C-15726
Baffles	Copper-nickel alloy, composition 70-30	
Tube sheets	Copper-nickel alloy, composition 70-30	MIL-C-15726 or MIL-C-20159
Water boxes	Copper-nickel alloy, composition 70-30, or nickel-aluminum bronze	MIL-C-15726 or MIL-C-20159 MIL-B-24480
Bolts, nuts, tie rods and spacer in contact with water or in joints involving salt water tightness ^{1/2/}	Nickel-copper alloy, or phosphor bronze, or copper-silicon alloy	ASTM B 164 Alloy C51000 or Alloy C52400 of ASTM B 139 ASTM B 98
Other bolts and nuts	Nonferrous	MIL-S-1222

^{1/} Form in accordance with MIL-S-1222.

^{2/} Materials for bolts, studs, and nuts in joints subjected to submergence pressure (submarine service) shall be in accordance with 3.7.29.1.1.6."

MIL-D-18641E (SHIPS)
AMENDMENT-10

PAGE 20

* Table VIII: Delete and substitute:

"TABLE VIII. Material for class C.

Part	Material	Applicable document
Shell	Bronze, aluminum, wrought, or seamless copper tubing, or gun metal, or valve bronze	Alloy 632M of QQ-C-465 MIL-T-24107 Alloy C90300 of ASTM B 584-79 Alloy C92200 of ASTM B 584-79
Baffles	Bronze, aluminum, wrought, or Naval brass	Alloy 632M of QQ-C-465 ASTM B 171
Tube sheets	Bronze, aluminum, wrought	Alloy 632M of QQ-C-465
Water boxes	Bronze, aluminum, wrought, or gun metal, or valve bronze, or nickel-aluminum bronze	Alloy 632M of QQ-C-465 Alloy C90300 of ASTM B 584-79 Alloy C92200 of ASTM B 584-79 MIL-B-24480
Bolts, nuts, tie rods, and spacers in con- tact with water or in joints involving salt water tightness ^{1/}	Bronze, aluminum, wrought, or phosphor bronze, or copper-silicon alloy	Alloy 632M of QQ-C-465 Alloy C51000 or C52400 of ASTM B 139 ASTM B 98
Other bolts and nuts	Nonferrous	MIL-S-1222

^{1/} Form in accordance with MIL-S-1222."

MIL-D-18641E(SHIPS)
AMENDMENT-10

Table IX: Delete and substitute:

"TABLE IX. Materials for class A.

Part	Material	Applicable document
Water boxes	Copper-nickel alloy, composition 70-30, or gun metal, or valve bronze, or nickel-aluminum bronze	MIL-C-15726 or MIL-C-20159 Alloy C90300 of ASTM B 584-79 Alloy C92200 of ASTM B 584-79 MIL-B-24480
Tube sheets	Copper-nickel alloy, composition 70-30	MIL-C-15726
Tube support plates	Copper-nickel alloy, composition 70-30	MIL-C-15726
Shell	Copper-nickel alloy, composition 70-30	MIL-C-15726
Bolts, nuts, or tie rods exposed to water or vapor ^{1/} or in joints	Nickel-copper alloy, class A, or phosphor bronze,	ASTM B 164 Alloy C51000 or C52400 of
involving salt water tightness ^{1/2/} Other bolts and nuts	or copper-silicon alloy Nonferrous	ASTM B 139 ASTM B 98 MIL-S-1222

^{1/} Form in accordance with MIL-S-1222.

^{2/} Materials for bolts, studs, and nuts in joints subjected to submergence pressure (submarine service) shall be in accordance with 3.7.29.1.1.6."

PAGE 21

Table X: Delete and substitute:

"TABLE X. Materials for class C.

Part	Material	Applicable document
Water boxes	Bronze, aluminum, wrought, or gun metal, or valve bronze, or nickel-aluminum bronze	Alloy 632M of QQ-C-465 Alloy C90300 of ASTM B 584-79 Alloy C92200 of ASTM B 584-79 MIL-B-24480
Tube sheets	Bronze, aluminum, wrought	Alloy 632M of QQ-C-465
Tube support plates	Bronze, aluminum, wrought, or Naval brass	Alloy 632M of QQ-C-465 ASTM B 171

MIL-D-18641E(SHIPS)
AMENDMENT-10

TABLE X, Materials for class C, - Continued

Part	Material	Applicable document
Shell	Bronze, aluminum, wrought	Alloy 632M of QQ-C-465
Bolts, nuts or tie rods exposed to water or vapor or in joints involving salt water tightness ^{1/}	Bronze, aluminum, wrought, or phosphor bronze, or copper-silicon alloy	Alloy 632M of QQ-C-465 Alloy C51000 or C52400 of ASTM B 139 ASTM B 98
Other bolts and nuts	Nonferrous	MIL-S-1222

^{1/} Form in accordance with MIL-S-1222."

* Table XI: Delete and substitute:

*TABLE XI. Material for regulator.

Part	Material	Applicable document
Bodies and covers	Gun metal, or valve bronze	Alloy C90300 of ASTM B 584-79 Alloy C92200 of ASTM B 584-79
Valve	Nickel-copper alloy, wrought, or nickel-copper alloy, cast	ASTM B 164 QQ-N-288
Float (for condensate)	Copper	ASTM B 152
Float (for salt water)	Nickel-copper alloy	ASTM B 127

3.15.4, last sentence: Delete.

PAGE 24

3.20.2, lines 3 and 4: Delete "any special" and substitute "a special".

3.21: Delete and substitute:

"3.21 Manuals. Manuals shall be in accordance with MIL-M-15071. Manuals for distilling units for submarines shall include instructions as to maximum torque which shall be placed on the bolting subjected to submergence pressure and the pattern of tightening the bolting."

* 3.22.2 and 3.22.2.1: Delete and substitute:

"3.22.2 Drawings shall be furnished in accordance with the requirements of DOD-D-1000 and DOD-STD-100."

MIL-D-18641E(SHIPS)
AMENDMENT-10

"3.22.2.1 Types of drawing. The following types of drawings are required:"

PAGE 25

3.22.2.3.2: Delete and substitute:

"3.22.2.3.2 The drawing shall indicate that for nuclear powered ships, the zinc anodes provided in the heat exchanger components shall comply with the requirements of MIL-A-19521, as modified herein (see 3.7.25). For non-nuclear powered ships, the drawing shall indicate that the provisions for future zinc anode installation in the heat exchanger components comply with the requirements of MIL-A-19521 as modified herein (see 3.7.25.1)."

* 3.22.2.8: Delete "MIL-D-963" and substitute "DOD-D-1000 and DOD-STD-100".

3.22.2.8(b): Delete and substitute:

"(b) Complete heat balance diagrams showing capability of the unit to produce rated capacity over the required operating range; diagrams for seawater temperatures of 28°, 60° and 85°F are required."

3.22.2.8(c), line 3, delete: "list of reference drawings".

Add as 3.22.2.8(d):

"(d) A 'Drawing List' tabulation with columns for drawing title, manufacturer's drawing number, and revision symbol. This list shall include all equipment drawings which comprise the design. The revision symbol column shall be kept up to date to the time of manufacture so that it will finally indicate for each drawing the revision applicable to the equipment as built."

* Add as 3.24:

"3.24 Interchangeability. In no case shall parts be physically ~~interchangeable or reversible~~ unless such parts are also interchangeable or reversible with regard to function, performance and strength."

* 4.1: Delete and substitute:

"4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements."

MIL-D-18641E(SHIPS)
AMENDMENT-10

Add as 4.1.1:

"4.1.1 Quality program requirements. The contractor shall provide and maintain a quality program acceptable to the Government for the supplies covered by this specification. The system of quality control shall be in accordance with MIL-Q-9858 except that the requirements covering 'Costs related to quality' do not apply."

* 4.2, lines 2 and 3: Delete "Bureau of Ships", and substitute "Naval Sea Systems Command". Delete reference to footnote 1/.

* 4.2.1, lines 3 and 4: Delete "Bureau of Ships", and substitute "Naval Sea Systems Command".

* Delete footnote 1/ at bottom of page.

Add as 4.2.1.2:

"4.2.1.2 The unit shall be tested for resistance to level A mechanical shock (see 3.7.7.1)."

4.2.2: Delete and substitute:

"4.2.2 Qualification of type I, II, or III units will be considered as qualifying type IV or VII units. Qualification of type VII units will be considered as qualifying type I units."

Footnote 1/, line 1: Delete "conditions".

PAGE 26

Add as 4.4.4, 4.4.5, and 4.4.5.1:

"4.4.4 During or after fabrication of the corrugated baskets for types III or VI units, the welds joining the basket flanges to the corrugated heating surface, the crimped over ends of the fingers, and the longitudinal welds of the fingers shall be 100 percent radiographed in accordance with MIL-STD-271 to prove them free from the following unacceptable defects:

- (a) Cracks of any length.
- (b) Incomplete penetration of any degree.
- (c) Lack of fusion.
- (d) Any porosity.
- (e) Any inclusion which may lead to a high stress area under alternating cycles.
- (f) Any undercutting of the welds.

"4.4.5 Experimental proof test. For each heat exchanger salt water side which will be subjected to submarine submergence pressure and which is not amenable to a fatigue loading analysis, the experimental proof test (see 3.7.29.1.1.5.1) shall stress coat (or its equivalent), or photostress (molded birefringent coatings) techniques as deemed suitable, in order

MIL-D-18641E(SHIPS)
AMENDMENT-10

to determine the location of maximum strain. Quantitative measurement of the magnitude of maximum principal strain in the water box shall be obtained from strain gages of 1/8 inch gage length or smaller. Water box loading shall be comprised of a combination of design submergence pressure in conjunction with piping reaction loading applied to the nozzles. The nozzle loads shall be applied in the form of a pure moment, the magnitude of which shall be calculated as specified in 3.7.29.1.1.5. A suitable loading jig incorporating mechanical or hydraulic jacks shall be provided to induce pure moment on the nozzle flanges. The following combinations of loads shall be applied:

- (a) Internal pressure and moment applied to one flange.
- (b) Internal pressure and equal moments applied to both flanges.

"4.4.5.1 Since the angular orientations of the applied moments to give the maximum stress for each load combination are unknown, and the location of maximum stress is also unknown, the angular orientations of the applied moments for load combinations (a) and (b) shall correspond to increments of 45 degrees around the nozzles from 0 to 360 degrees in the first run, and a minimum of 9 degree increments shall be used in the 45 degrees maximum stress sector in the second run. The location, magnitude and direction of the maximum principal strain (stress) can be determined by brittle coating or photostress, but must be checked with electric resistance strain gauges. If the maximum value of principal strain (stress) thus determined in any location of the water box (by either load combination (a) or (b)) does not exceed the allowable strain (stress) range for a 25,000 cycle life as determined by the Modified Goodman Diagram and Fatigue Curve for the particular material involved, the water box design is acceptable. The contractor shall submit to NAVSEA an outline of the test procedures involved. The set-up for test, procedures, and taking of data shall be monitored. Results shall be submitted to NAVSEA (see 3.7.29.1.1.5.1)."

PAGE 27

* 5.5, line 3: Delete "MIL-D-963", and substitute "DOD-D-1000 and DOD-STD-100."

6.1, items (s) and (u): Delete.

PAGE 28.

6.1 (continued), add as "(aa)" and "(bb)":

- "(aa) Level of resistance to mechanical shock (level A should be specified if operation of the distillation unit is necessary to allow the ship to complete its immediate operation and to allow it to return to port) (see 3.7.7.1.1.1).
- "(bb) Dimensions of hatch, bulkhead opening, or other access openings available for removal of corrugated basket of types III or VI distilling units from the compartment in which the unit will be installed (see 3.10.2.1 and 3.10.2.2)."

MIL-D-18641E(SHIPS)
AMENDMENT-10

6.2 and 6.3: Delete and substitute:

"6.2 With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List QPL 18641 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. The activity responsible for the Qualified Products List is Naval Sea Systems Command, SEA 3112, Department of the Navy, Washington, DC 20362, and information pertaining to qualification of products may be obtained from that activity. Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification SD-6" (see 6.3).

"6.3 Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120."

Delete "Notice" paragraph.

NOTE: The margins of this amendment are marked with an asterisk (*) to indicate where changes (additions, modifications, corrections, deletions) from the previous amendment were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous amendment.

Preparing activity:
Navy - SH
(Project 4620-N031)