

NOTICE OF
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INCH- POUND

MIL-STD-777E(SH)

NOTICE 1

17 January 1990

MILITARY STANDARD

SCHEDULE OF PIPING, VALVES, FITTINGS, AND ASSOCIATED
PIPING COMPONENTS FOR NAVAL SURFACE SHIPS

TO ALL HOLDERS OF MIL-STD-777E(SH):

1. THE FOLLOWING PAGES OF MIL-STD-777E(SH) HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
5	17 January 1990	5	7 February 1986
5a	17 January 1990	NEW PAGE	
6	7 February 1986	6	REPRINTED WITHOUT CHANGE
G-3.1	17 January 1990	G-3.1	7 February 1986
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K-7.1	17 January 1990	K-7.1	7 February 1986
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2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS.

3. Holders of MIL-STD-777E(SH) will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. This issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the military standard is completely revised or canceled.

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4730

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4.13 Where required, straight threaded union connections fitted with O-rings are permitted. Otherwise pipe threaded connections (tapered or straight) between piping, machinery and valves and in piping system joints not permitted except as follows:

- (a) Connections to commercial equipment such as washing machines and drinking water coolers which are not essential to the ship under combat conditions and where failure would not create a hazard to personnel, the surrounding area or affect the operation of other vital equipment.
- (b) Pipe plugs, of a material compatible with the parent equipment material in sizes 3/4 inch and below used for applications where gauge pressures do not exceed 50 lb/in².
- (c) Instrumentation, controls, vents and filling and drain connections for applications where gauge pressures are 50 lb/in² and below where fluids handled are neither toxic or dangerous nor could cause atmospheric contamination and which would not cause, in the event of failure, a major breakdown of the equipment nor create a hazard to the surrounding area nor affect the operation of other vital equipment.
- (d) For equipment where taper pipe threads are specified in RR-C-901, MIL-V-2/15, MIL-V-17360, MIL-R-15835, MIL-R-15917, MIL-H-17902, MIL-H-21291, and MIL-H-24606.
- (e) In unpressurized connections.

4.14 Silver-brazed fittings. Silver-brazed joints are prohibited in fire hazardous areas for the following systems:

- I-1: JP-5
- H-1: Gasoline
- G-3, G-4, G-5, G-6, and G-7: Hydraulic oil
- J-2, J-3, J-4, and J-7: Air
- K-3, K-5, and K-7: Oxygen, nitrogen and propane
- S-1: AFFF (dry piping-only)

Fire hazardous areas are defined as those spaces where requirements for protecting flammable liquid hazards require fixed halon fire extinguishing systems. These spaces include:

- Main machinery rooms
- Auxiliary machinery rooms with fuel pumps or fossil-fueled equipment
- Fire rooms and engine rooms of fossil-fuel powered ships
- Propulsion engine enclosures
- Electric power generator engine enclosures
- Auxiliary fossil-fuel boiler rooms
- Aviation storerooms (flammable)
- Enclosed gasoline service stations
- Flammable gas cylinder storerooms
- Flammable liquid issue rooms
- Flammable liquid storerooms and cargo holds
- Fuel pump rooms (DFM, fuel oil, JP-5, LCAC, or MOGAS)

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Paint mixing and issue rooms
RAST machinery rooms
Ship service or emergency generator rooms
Storerooms for gasoline-powered bomb hoists
TACTAS handling rooms

Silver brazed fittings shall be of the pre-inserted ring type, except as follows:

- (a) In sizes 1/2 nominal pipe size (NPS) and below.
- (b) Fittings without preinserted brazing rings may be used in the refrigeration system (see category Q-1).
- (c) Expanded copper sleeves without preinserted brazing rings may be used in the inner wall of a double-walled gasoline piping system.
- (d) Water closet discharge fittings as shown on figures 6 and 7 of Drawing 810-1385706 may be used without preinserted rings.
- (e) Joints for voice tube and pneumatic tube systems.
- (f) Joints for bellmouth to pipe for tailpipes within tanks.

4.15 Threaded fasteners. In addition to the requirements contained in each category, the following also applies:

- (a) Piping system fasteners shall be of the UNC series with a class 2 or 3 fit.
- (b) Threaded fasteners shall be in accordance with MIL-S-1222 with dimensions in accordance with ANSI B18.2.1, washer faced or doubled chamfered.
- (c) Studs shall be in accordance with MIL-S-1222, type and style as applicable.
- (d) Nuts shall be in accordance with MIL-S-1222, with dimensions in accordance with ANSI B18.2.2, washer faced or double chamfered.

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- (e) Nuts located within tanks, in the bilge region or inaccessible for examination or routine replacement in service shall be of the self-locking type as specified in section 075 of the ship's specifications.
- (f) Hull integrity piping connections are defined as all flanged joints from the hull up to and including the inboard flange of the hull valve. Included in this category are the bonnet joints of the hull valves and both line flanges and the bonnet joint of the first valve (such as blow-out valve) in branch lines connected to piping between the hull and the hull valve. Connections shall be as follows:
 - (1) Bolted hull integrity piping connections shall be fitted with nickel-copper-aluminum alloy fasteners in accordance with MS18116 except that lot identification is not required and with self-locking nuts, as specified in (e). Nuts may be nickel-copper alloy QQ-N-281 class A or B or nickel-copper-aluminum alloy in accordance with QQ-N-286.
 - (2) For services involving integrity of the hull against the sea, as defined in (f) above, energy absorption shall be provided by making the mounting fasteners essentially constant throughout their length. This may be achieved by threading over the entire length, reducing the non-threaded shank diameter to a dimension that falls between the pitch diameter and the root diameter (usually for cut threads), or maintaining the unthreaded shank diameter the same dimension as the unthreaded blank (usually for rolled threads). For resistance to shear forces, mating surfaces of the fasteners holes shall be beveled.
- (g) Nickel-copper alloy bolting in accordance with class A or B of QQ-N-281 shall be used in the following application:
 - (1) Where subject to sea water spray or submergence.
 - (2) Where not readily accessible for examination or maintenance in service due to their location and carbon steel, alloy steel, or bronze bolting is specified for the rest of the system. Some examples are: bilges, below floor plates, tanks, voids and other hidden areas. Where nickel-copper bolting does not meet the strength requirements of the joint, nickel-copper-aluminum alloy QQ-N-286 shall be used.
- (h) Threaded fasteners in non-ferrous joints where ferrous bolting is specified and located in high condensation areas, such as machinery spaces, scullery, galley, laundry and sanitary spaces shall be either nickel-copper in accordance with QQ-N-281 or silicon-bronze in accordance with QQ-C-591.
- (i) Wherever non-ferrous flanges mate up to ferrous flanges bolting material shall be either nickel-copper in accordance with QQ-N-281 or silicon-bronze in accordance with QQ-C-591.
- (j) Carbon and alloy steel fasteners shall be given protective coating as follows:

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Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
G-3	Hydraulic oil - other than steam catapult	3000	180	Silver-braze restriction See paragraph 4.14 See note G-3-1

Item	Types	Material	Applicable documents	Remarks	
Pipe	Seamless	70-30 Copper-nickel alloy	MIL-T-16420		
		Copper	MIL-T-24107		
		Carbon steel	MIL-T-20157, type E or ASTM A 106, grade B		
		Corrosion-resisting steel, TP 304L or TP 316L	MIL-P-24691/3, ASTM 312		
Valves	Globe, angle	Aluminum-bronze	MIL-V-24109		
		Carbon steel	Drawing 803-5184193		
	Gate		MIL-V-22052		See note G-3-4
			MIL-V-18110		
	Check-lift or in-line	Aluminum-bronze	Commercial		
	Ball	Corrosion-resisting steel	MIL-V-24630/1A		
	Corrosion-resisting steel	MIL-V-22687 with end connections: Drawing 810-1385883			
Fittings	Relief	Carbon steel, corrosion-resisting steel	Drawing 803-1385884	See note G-3-4	
	Control	As approved	Commercial	See note G-3-4	
	Sampling and bleed	Aluminum-bronze	MIL-V-81940 and		
		Corrosion-resisting steel	MIL-V-81940/1		
	Silver-brazing	Nickel-aluminum-bronze	Drawing 810-1385963		
		Bronze	Drawing 803-1385941		
	Unions, silver-brazing	Nickel-aluminum-bronze	Drawing 803-1385943		
	Union welding	Carbon steel, ASTM A 105	NAEL Drawing A404734	See note G-3-2	
		Carbon steel, ASTM A 105, ASTM A 181, class 70, ASTM A 106, grade B or corrosion-resisting steel	ANSI B16.9		
	Butt welding	Carbon steel, ASTM A 105, ASTM A 181, class 70, ASTM A 106, grade B or corrosion-resisting steel			See note G-3-5

Supersedes page G-3.1 of 7 February 1986.

Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
G-3, cont'd	Hydraulic oil - other than steam catapult	3000	180	Silver-braze restriction See paragraph 4.14 See note G-3-1

Item	Types	Material	Applicable documents	Remarks
	Socket welding	Carbon steel, ASTM A 105, ASTM A 181, class 70, Corrosion-resisting steel ASTM A 182, 304L or 316L Copper-nickel alloy, MIL-C-15726	ANSI B16.11	See note G-3-5
Flanges	Butt welding	Carbon steel, ASTM A 105 or ASTM A 181, class 70 Corrosion-resisting steel, ASTM A 182, 304L or 316L Copper-nickel alloy, MIL-C-15726	ANSI B16.5	See note G-3-3
	Socket welding			See note G-3-5
	Silver-brazing	Bronze	MIL-F-20042	
Gaskets	O-ring	Fluorocarbon	MIL-R-83248, type I, class 1	
	Spiral wound	Metallic	MIL-G-21032	
Flange bolting	Bolt studs	Carbon steel	MIL-S-1222, grade 8	
	Nuts			

NOTES:

- G-3-1 Hydraulic piping and fittings which are located on weather decks or other locations where they are, or may be exposed to the weather shall be corrosion-resisting steel.
- G-3-2 Where unions to NAEL Drawing A404734 are used, the material for union nut shall be of nickel-copper alloy in accordance with QQ-N-281.
- G-3-3 ANSI flanges may be modified to use O-ring gaskets.
- G-3-4 The use of commercial items shall be subject to NAVSEA approval.
- G-3-5 The forged copper-nickel alloy, soft condition, shall conform to the chemical composition of MIL-C-15726.

Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
G-4	Hydraulic oil - other than steam catapult	1500	180	Silver-braze restriction See paragraph 4.14 See note G-4-1

Item	Types	Material	Applicable documents	Remarks	
Pipe	Seamless	70-30 Copper-nickel alloy	MIL-T-16420		
		Copper	MIL-T-24107		
		Carbon steel	MIL-T-20157, type E or ASTM A 106, grade B		
		Corrosion-resisting steel, TP 304L or TP 316L	MIL-P-24691/3, ASTM A 312		
Valves	Gate	Carbon steel	MIL-V-18110		
	Globe, angle	Carbon steel	Drawing 803-5184193		
		Aluminum-bronze	MIL-V-22052		
	Check	Aluminum-bronze Bronze	MIL-V-24109	Commercial	See note G-4-4
		Corrosion-resisting steel	MIL-V-24630/1		
	Relief	Carbon steel or corrosion-resisting steel	Commercial	Commercial	See note G-4-4
	Ball	Corrosion-resisting steel Bronze	MIL-V-22687 with end connections: Drawing 810-1385883 Drawing 803-1385884		
Sampling and bleed	Aluminum-bronze Corrosion-resisting steel	MIL-V-81940 and MIL-V-81940/1			
Fittings	Silver-brazing	Bronze	Drawing 803-1385942		
		Copper-nickel (70-30) MIL-C-15726	Drawing 803-1385945		
		Nickel-aluminum-bronze	Drawing 810-1385963		
	Butt welding	Carbon steel, ASTM A 105, ASTM A 181, class 70 ASTM A 106, grade B Corrosion-resisting steel ASTM A 182, 304L or 316L Copper-nickel alloy, MIL-C-15726	ANSI B16.9		

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Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
G-4, cont'd	Hydraulic oil - other than steam catapult	1500	180	Silver-braze restriction See paragraph 4.14 See note G-4-1

Item	Types	Material	Applicable documents	Remarks
	Socket welding	Carbon steel, ASTM A 105, ASTM A 181, class 70 Corrosion-resisting steel ASTM A 182, 304L or 316L Copper-nickel alloy, MIL-C-15726	ANSI B16.11	
	Unions, silver-brazing	Bronze	Drawing 803-1385946	
		Nickel-aluminum-bronze	Drawing 803-1385943	
	Union welding	Carbon steel, ASTM A 105	NAEL Drawing A404734	See note G-4-2
Flanges	Butt welding	Carbon steel, ASTM A 105 or ASTM A 181, class 70 Corrosion-resisting steel, ASTM A 182, 304L or 316L Copper-nickel alloy, MIL-C-15726	ANSI B16.5	See note G-4-3
	Socket welding			
Gaskets	O-ring	Fluorocarbon	MIL-R-83248, type I, class 1	
	Spiral wound	Metallic	MIL-G-21032	
Flange bolting	Bolts or bolt-stud	Carbon steel	MIL-S-1222, grade 8	
	Nuts			

NOTES:

- G-4-1 Hydraulic piping and fittings which are located on weather decks or other locations where they are, or may be exposed to the weather shall be corrosion-resisting steel.
- G-4-2 Where unions to NAEL Drawing A404734 are used, the material for union nut shall be of nickel-copper alloy in accordance with QQ-N-281.
- G-4-3 ANSI flanges may be modified to use O-ring gaskets.
- G-4-4 The use of commercial items shall be subject to NAVSEA approval.

Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
G-6	Hydraulic oil - other than steam catapult	300	180	Silver-braze restriction See paragraph 4.14 See note G-6-1

Item	Types	Material	Applicable documents	Remarks
Pipe	Seamless	Copper-nickel alloy	MIL-T-16420	
		Copper	MIL-T-24107	
		Carbon steel	MIL-T-20157, ASTM A 106, grade B	
		Corrosion-resisting steel, TP 304L or 316L	MIL-P-24691/3, ASTM A 312	
Valves	Gate	Bronze	MIL-V-1189 Drawing 803-1385714	See note G-6-4
		Carbon steel	MIL-V-18110	
	Globe, angle	Bronze	Drawing 803-4384536	
		Carbon steel	Drawing 803-2177525 MIL-V-22052	
	Swing check	Bronze	Drawing 803-1385721	
	Relief	Bronze or steel	Commercial	
	Sampling and bleed	Aluminum-bronze Corrosion-resisting steel	MIL-V-81940 and MIL-V-81940/1	
	Ball, 1/4 inch - 2-1/2 inches	Corrosion-resisting steel	Drawing 803-5001003	
Fittings	Silver-brazing	Bronze	MIL-F-1183	
	Butt welding	Carbon steel, ASTM A 105, ASTM A 181, class 70 ASTM A 106, grade B or corrosion-resisting steel, ASTM A 182, 304L or 316L Copper-nickel alloy, MIL-C-15726	MIL-F-20236 ANSI B16.9	
		Socket welding		ANSI B16.11
Take-down joints	Union, silver-brazing	Bronze	MIL-F-1183	
	Flanged, silver-brazing		MIL-F-20042	

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Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
G-6, cont'd	Hydraulic oil - other than steam catapult	300	180	Silver-braze restriction See paragraph 4.14 See note G-6-1

Item	Types	Material	Applicable documents	Remarks
Gaskets	Flanged	Carbon steel, ASTM A 105, ASTM A 181, class 70 or corrosion-resisting steel, ASTM A 182, 304L or 316L Copper-nickel alloy, MIL-C-15726	ANSI B16.5	See note G-6-2
	Unions, welding	Carbon steel, ASTM A 105	NAEL Drawing A404734	See note G-6-3
Flange bolting	O-ring	Fluorocarbon	MIL-R-83248, type I, class 1	
	Spiral wound	Metallic	MIL-G-21032	
Flange bolting	Bolts or bolt-studs	Carbon steel	MIL-S-1222, grade 5	
	Nuts			

NOTES:

- G-6-1 Hydraulic piping and fittings which are located on weather decks or other locations where they are, or may be, exposed to the weather, shall be corrosion-resisting steel.
- G-6-2 ANSI flanges may be modified to use O-ring gaskets.
- G-6-3 Where unions to NAEL Drawing A404734 are used, the material for union nuts shall be of nickel-copper alloy in accordance with QQ-N-281.
- G-6-4 The use of commercial items shall be subject to NAVSEA approval.

Supersedes page G-6.2 of 7 February 1986.

Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
G-7	Hydraulic oil - other than steam catapult	150	150	Silver-braze restriction See paragraph 4.14 See note G-7-1

Item	Types	Material	Applicable documents	Remarks	
Pipe	Seamless	Copper-nickel alloy	MIL-T-16420		
		Copper	MIL-T-24107		
		Carbon steel	MIL-T-20157		
		ASTM A 106, grade A			
	Seamless or welded	70-30 copper-nickel alloy	MIL-T-16420		
	Seamless	Corrosion-resisting steel, TP 304L or TP 316L	MIL-P-24691/3 MIL-P-1144 ASTM A 312		
Valves	Gate	Bronze	Drawing 803-2177917		
		Carbon steel	Drawing 803-1385714		
	Globe, angle	Bronze	MIL-V-18110		
		Carbon steel	Drawing 803-1385623		
	Globe, angle	Bronze	Drawing 803-4384536		
		Carbon steel	Drawing 803-2177525		
	Swing check	Bronze	MIL-V-22052		
		Relief	Bronze or steel		Drawing 803-1385721
	Sampling and bleed	Aluminum-bronze Corrosion-resisting steel	Commercial		See note G-7-5
	Ball, 1/4 inch - 2-1/2 inches	Carbon steel	MIL-V-81940 and MIL-V-81940/1		
Butterfly	Carbon steel	Drawing 803-5001003			
Fittings	Silver-brazing	Corrosion-resisting steel, Bronze	MIL-V-24624		
	Socket welding	Bronze	MIL-F-1183		
		Carbon steel, ASTM A 105, ASTM A 181, class 70, ASTM A 106, grade B or corrosion-resisting steel, ASTM A 182, 304L or 316L	ANSI B16.11		
Butt welding	Copper-nickel alloy, MIL-C-15726	MIL-F-20236, ANSI B16.9			

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G-7.1

Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
G-7, cont'd	Hydraulic oil - other than steam catapult	150	150	Silver-braze restriction See paragraph 4.14 See note G-7-1

Item	Types	Material	Applicable documents	Remarks
Take-down joints	Union, silver-brazing	Bronze	MIL-F-1183	
	Unions, welding	Carbon steel, ASTM A 105	NAEL Drawing A404734	See note G-7-3
	Flanged, silver-brazing	Bronze	MIL-F-20042	See note G-7-2
	Flanged	Carbon steel, ASTM A 181, class 70, ASTM A 105, corrosion-resisting steel, ASTM A 182, 304L or 316L Copper-nickel alloy, MIL-C-15726	ANSI B16.5, flat face	See note G-7-4
Gaskets	O-ring	Fluorocarbon	MIL-R-83248, type I, class 1	
	Flat	Asbestos	HH-P-46	
Flange bolting	Bolts, studs and nuts	Carbon steel	MIL-S-1222, grade 5	

NOTES:

- G-7-1 Hydraulic piping and fittings which are located on weather decks or other locations where they are, or may be, exposed to the weather shall be corrosion-resisting steel.
- G-7-2 Where bronze 150 lb/in² line flanges bolt up to 250 lb/in² valve flanges in sizes 2 to 4 inches, the diameter of the bolt holes in the line flanges shall be increased to match the 250 lb/in² flange bolting.
- G-7-3 Where unions to NAEL Drawing A404734 are used, the material for union nuts shall be of nickel-copper alloy in accordance with QQ-N-281.
- G-7-4 ANSI flanges may be modified to use O-ring gaskets.
- G-7-5 The use of commercial items shall be subject to NAVSEA approval.

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Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
H-1	Gasoline	150	150	Silver-braze restriction See paragraph 4.14

Item	Types	Material	Applicable documents	Remarks
Pipe	Seamless or welded	Copper-nickel alloy 90-10	MIL-T-16420, class 200	See note H-1-1
	Seamless	Copper	MIL-T-24107	
Valves	Gate	Bronze	Drawing 803-2177917	
	Globe, angle and cross	90-10 Copper-nickel alloy	Drawing 803-1385714	
			Drawing 803-4384536	
	Swing check	Commercial		See note H-1-2
Fittings	Butterfly	Commercial	MIL-V-17547	See note H-1-2
	Relief	Commercial		Type III
	Regulating	Commercial	MIL-V-24624	
	Socket welding	Commercial	MIL-V-24332	See note H-1-2
	Butt welding	Copper-nickel alloy	Drawing 803-1385880	
	Silver-brazing	Bronze	Commercial	See note H-1-2
Take-down joints	Flanged (silver-brazing)	Bronze	MIL-F-24227, MIL-F-1183	
	Flanges (butt weld)	Copper-nickel alloy	MIL-F-20042, MIL-F-24227	Special flange for butterfly valves
			Drawing 810-1385892	
Gaskets	Flanges (socket weld)		Drawing 810-1385992	
	Unions (silver-brazing)		Drawing 810-4715319	
	Unions (welded)		MIL-F-1183, MIL-F-24227	
	Flat	90-10 Copper-nickel alloy	Commercial	See note H-1-2
Flange bolting	Bolts, studs and nuts	Buna-N and cork	MIL-C-6183, class 1, grade C-firm	
		Silicon bronze	MIL-S-1222, grade 655, 661	

NOTES:

- H-1-1 Within gasoline tanks and for salt water compensating system.
H-1-2 The use of commercial items shall be subject to NAVSEA approval.

Supersedes page H-1.1 of 7 February 1986.

Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
H-2	Cleaning fluid and contaminated aviation lubricating system	100	150	

Item	Types	Material	Applicable documents	Remarks
Pipe	Seamless	Copper	MIL-T-24107	
	Seamless or welded	Copper-nickel, 90-10	MIL-T-16420	See note H-2-1
Valves	Gate	Bronze	Drawing 803-2177917	
			Drawing 803-1385714	
	Globe, angle and cross		Drawing 803-1385541	
			Drawing 803-4384536	
	Butterfly		MIL-V-24624	Type III
	Swing check		MIL-V-17547	
			Drawing 803-1385721	
	Relief		MIL-V-24332	
	Regulating		MIL-V-15358	
	Ball, 1/4 inch - 2-1/2 inches		Drawing 803-5001003	
Ball, 3 inches - 6 inches	Drawing 803-5001004			
Fittings	Welding	Copper-nickel alloy	Drawing 803-1385880 or ANSI B16.11	
	Silver-brazing	Bronze	MIL-F-1183 MIL-F-24227	
Take-down joints	Flanged	Bronze	MIL-F-20042 MIL-F-24227	
			Drawing 810-1385892	Special flange for butterfly valves
	Union		MIL-F-1183 MIL-F-24227	
Gaskets	Flat	Buna-N and cork	MIL-C-6183, class 1, grade C-firm	
Flange bolting	Bolts, studs and nuts	Silicon bronze	MIL-S-1222, grade 655, 661	

NOTE:

H-2-1 Within gasoline tanks and for salt water compensating system.

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Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
I-1	JP-5	200	100	Silver-braze restriction See paragraph 4.14 See notes I-1-1 and I-1-2

Item	Types	Material	Applicable documents	Remarks
Pipe	Seamless or welded	90-10 copper-nickel alloy	MIL-T-16420, class 200	
Valves	Gate	Bronze	Drawing 803-2177917	100 lb/in ² maximum
			Drawing 803-1385714	
	Drawing 803-1385541			
	Drawing 803-1385623			
	Drawing 803-4384536			
	Globe, angle and cross	90-10 copper-nickel alloy	Commercial	See note I-1-3
		Bronze	MIL-V-24624	Type III
	MIL-V-24332			
	Drawing 803-1385637			
Drawing 803-5001003				
Drawing 803-5001004				
Butterfly				
Relief				
Swing check				
Ball, 1/4 inch - 2-1/2 inches				
Ball, 3 inches - 6 inches				
Fittings	Silver-brazing	Bronze	MIL-F-1183 MIL-F-24227	
	Butt welding	90-10 copper-nickel	Commercial	See note I-1-3
	Socket welding		Drawing 803-1385880	
Take-down joints	Flanges (silver-brazing)	Bronze	MIL-F-20042 MIL-F-24227	Special flange for butterfly valves
			Drawing 810-1385892	
	Flanges (butt weld)	Copper-nickel	Drawing 810-1385992	
	Flanges (socket weld)	Copper-nickel	Drawing 810-4715319	
	Unions (silver-brazing)	Bronze	MIL-F-1183 MIL-F-24227	
	Unions (welded)	90-10 copper-nickel alloy	Commercial	See note I-1-3

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Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
I-1, cont'd	JP-5	200	100 •	Silver-braze restriction See paragraph 4.14 See notes I-1-1 and I-1-2

Item	Types	Material	Applicable documents	Remarks
Gaskets	Sheet	Buna-N and cork	MIL-C-6183, class 1, grade C-firm	
Flange bolting	Bolts, studs and nuts	Silicon bronze	MIL-S-1222, grade 655, 661	

NOTES:

- I-1-1 See category U-1 for those sections of tank stripping which discharge overboard.
 I-1-2 This category includes cargo JP-5 systems. The cargo JP-5 piping within convertible cargo tanks (those intended for selective stowage of JP-5 fuel) shall be in accordance with this category.
 I-1-3 The use of commercial items shall be subject to NAVSEA approval.

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Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
K-3	Gaseous oxygen	100	Ambient	Silver-braze restriction See paragraph 4.14 See notes K-3-1 and K-3-2

Item	Types	Material	Applicable documents	Remarks
Pipe	Seamless	Copper	MIL-T-24107	0.065 inch minimum wall thickness
		Copper-Nickel Alloy	MIL-T-16420	
Valves	Globe Gate Swing check	Bronze	Drawings 803-4384536, 803-1385714, 803-1385721	Soft seated globe valves See note K-3-4
	Pressure-reducing	Bronze	MIL-V-24336	Union ends
	Diaphragm, packless	Bronze, ASTM B 61	Commercial	See note K-3-5, teflon or nylon disc washer
	Relief	Bronze, ASTM B 61	MIL-V-22549	See note K-3-3
Fittings	Silver-brazing	Bronze	MIL-F-1183	
	Unions, silver-brazing		Drawing 810-1385859	With O-ring material to MIL-R-83248, type I, class 1
	Unions, weld	Copper-nickel alloy, MIL-C-15726	Commercial	See note K-3-5

NOTES:

- K-3-1 Components shall be cleaned in accordance with the requirements of MIL-STD-1330.
- K-3-2 Lubricants shall be of an approved type as listed in MIL-HDBK-267. (Private shipbuilding activities may obtain information covered in the handbook from the cognizant Supervisor of Shipbuilding.)
- K-3-3 Relief valves shall conform with the basic requirements of MIL-V-22549. Seat or disc material shall be suitable for oxygen service.
- K-3-4 Valve packing shall be in accordance with MIL-P-24396, type C.
- K-3-5 The use of commercial items shall be subject to NAVSEA approval.

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K-3.1

Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
K-4	Liquid oxygen and nitrogen	6000		See notes K-4-1 and K-4-2

Item	Types	Material	Applicable documents	Remarks
Pipe	Seamless	Corrosion-resisting steel	MIL-P-1144, 316L ASTM A 312, 316L	
Valves	Globe		MIL-V-24109	
Fittings	Socket welding	Corrosion-resisting steel, ASTM A 182, 316L	ANSI B16.11	
	Butt welding, seamless	Corrosion-resisting steel, MIL-P-1144, 316L ASTM A 182, 316L	ANSI B16.9	

NOTES:

- K-4-1 Lubricants shall be of an approved type as listed in MIL-HDBK-267. (Private shipbuilding activities may obtain information covered in the handbook from the cognizant Supervisor of Shipbuilding.)
- K-4-2 Components shall be cleaned in accordance with the requirements of MIL-STD-1330.

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Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
K-5	Liquid oxygen and nitrogen	250		Silver-braze restriction See paragraph 4.14 See notes K-5-1 and K-5-2

Item	Types	Material	Applicable documents	Remarks
Pipe	Seamless	Copper-nickel alloy	MIL-T-16420	0.065 inch minimum wall thickness
		Copper	MIL-T-24107	
		Corrosion-resisting steel, Grade TP 304 or TP 316	MIL-P-24691/3	
Valves	Globe, gate, and swing check	Bronze	Drawings 803-4384536, 803-1385714, 803-1385721	See note K-5-3
	Relief	Corrosion-resisting steel	Commercial	See note K-5-4
Fittings	Silver-brazing	Bronze	MIL-F-1183	With suitable O-ring gasket material
	Unions, silver-brazing		Drawing 810-1385859	
	Unions, weld	Copper-nickel alloy, MIL-C-15726	Commercial	See note K-5-4
	Socket welding	Corrosion-resisting steel, ASTM A 182, 304 or 316	ANSI B16.11	

NOTES:

- K-5-1 Components shall be cleaned in accordance with the requirements of MIL-STD-1330.
- K-5-2 Lubricants shall be of an approved type as listed in MIL-HDBK-267. (Private shipbuilding activities may obtain information covered in the handbook from the cognizant Supervisor of Shipbuilding.)
- K-5-3 Valve packing shall be in accordance with MIL-P-24396, type C.
- K-5-4 The use of commercial items shall be subject to NAVSEA approval.

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Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
K-6	Mixed gas	4500	150	See notes K-6-1, K-6-2, and K-6-4

Item	Types	Material	Applicable documents	Remarks
Pipe	Seamless	Corrosion-resisting steel	MIL-P-1144, or ASTM A 312, 304L or 316L	
Valves	Globe and angle	Corrosion-resisting steel	MIL-V-24109	Union ends to Drawing 803-1385884 See note K-6-3
	Relief		MIL-V-22549	
	Pressure-reducing		MIL-V-24336	
Fittings	Socket welding	Corrosion-resisting steel, ASTM A 182, 304L or 316L	ANSI B16.11	
	Butt welding		ANSI B16.9	
Take-down joints	Unions	Corrosion-resisting steel, QQ-S-763, 304L or 316L or ASTM A 182, 304L or 316L	Drawing 803-1385884	

NOTES:

- K-6-1 Oxygen system components shall be cleaned in accordance with the requirements of MIL-STD-1330.
- K-6-2 Lubricants shall be of an approved type as listed in MIL-HDBK-267. (Private shipbuilding activities may obtain information covered in the handbook from the cognizant Supervisor of Shipbuilding.)
- K-6-3 Valves intended for use where system operating gauge pressure exceeds 3000 lb/in² shall be modified for the applicable pressure and approved by NAVSEA.
- K-6-4 For systems with oxygen content greater than 40 percent by volume, see category K-1 or K-2.

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Category and group	Services	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
K-7	Propane	200		Silver-braze restriction See paragraph 4.14

Item	Types	Material	Applicable documents	Remarks
Pipe	Seamless or welded	Copper-nickel (90-10)	MIL-T-16420	
Valves	Globe, angle, stop and stop check	Bronze	Drawing 803-4384536 Commercial	See note K-7-1
Fittings	Silver-brazing Unions, silver-brazing	Bronze	MIL-F-1183	
	Unions, weld	Copper-nickel alloy, MIL-C-15726	Commercial	See note K-7-1

NOTES:

K-7-1 The use of commercial items shall be subject to NAVSEA approval.

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Remarks
See note L-1-2

Remarks
See note L-1-1

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Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
250		Silver-braze restriction See paragraph 4.14

Material	Applicable documents	Remarks
Bronze	MIL-F-1183	With ethylene propylene terpolymer O-rings See note S-1-1
Copper-nickel alloy, MIL-C-15726	Commercial	
Ethylene propylene terpolymer (EPT)	MIL-G-22050	
Silicon bronze	MIL-S-1222, grade 655, 661	

Commercial items shall be subject to NAVSEA approval.

ethylene
inhibited
1 or C-2.

Category and group	Service	Maximum system pressure lb/in ²	Maximum system temperature °F	Remarks
T-1	Fixed CO ₂ fire fighting inerting system	1900		See note T-1-1

Item	Types	Material	Applicable documents	Remarks
Pipe	Seamless	Copper	MIL-T-24107	
		Carbon steel	MIL-T-20157, type E	
Valves	Globe and angle	Bronze or carbon steel	Drawing 803-4384536	400 lb/in ² maximum
	Ball		MIL-V-22687	
	Pressure-reducing		MIL-V-2961	
	Relief		MIL-V-22549	
	Cylinder	Bronze	MIL-V-2/15	
Fittings	Silver-brazing	Bronze	Drawing 5000-S4823-1385766, Drawing 803-1385942	
			Drawing 810-1385863, Drawing 803-1385945	
	Drawing 810-1385859 Drawing 803-1385946			
	Unions, silver-brazing			
	Socket welding	Carbon steel, ASTM A 105 or ASTM A 181, class 70	ANSI B16.11	
Butt welding	Carbon steel, ASTM A 105, ASTM A 181, class 70 or ASTM A 106, grade B	ANSI B16.9		
Gaskets	O-ring			
Cylinders	Non-shatterable	Steel	RR-C-901	

NOTE:

T-1-1 For CO₂ fire fighting systems see MIL-E-2185, or MIL-E-2186 for specifications and applicable material and pressure requirements.

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