Specifications

All of the advantages found in copper as a metal have been capitalized to the utmost in the manufacture of NIBCO® Fittings. Because of the accuracy of construction and design, copper plumbing is more efficient and less expensive.

NIBCO manufactures nine general types of fittings: Wrot Pressure; Cast Pressure; Wrot Drainage; Cast Drainage; Flanges; Flared Tube; Threaded Bronze; Insert Fittings for PEX; Barbed Insert Fittings for Polybutylene. Each has its particular place and use and each offers its own advantages when used for the proper service requirement.

Material & Construction — NIBCO Fittings are made from the highest quality raw materials — Cast Fittings are offered in traditional copper alloys C83600, and C84400 and high quality lead-free* dezincification-resistant (DZR) silicon bronze alloy C87850 cast or 69300 forged Performance Bronze™ per ASTM Specification B584. Wrot Copper Fittings are made from commercially pure copper mill products already meeting current lead-free* requirements per ASTM Specifications B75 Alloy C12200.

Lead Free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content ≤ 0.25%.

NIBCO Fittings are produced to meet the requirements of applicable standards.

The majority of NIBCO® brand wrot and cast fittings are manufactured in the U.S.A. and Mexico*. The manufacturing plants at Stuarts Draft, VA, Nacogdoches, TX and Reynosa, Mexico are registered to ISO 9001 quality standards.

Following is suggested phrasing to be incorporated in your specifications or bills of material for Copper Tube Fittings.

WROT SOLDER JOINT FITTINGS — "Solder Joint Fittings shall be produced to one of the following specifications:

1. "Material and workmanship shall be in accordance with ASME/ANSI B16.22; Wrought Copper and Copper Allo y Solder Joint Pressure Fittings."
2. "The dimensional, material and workmanship shall meet the requirements of MSS SP-104; Wrought Copper Solder Joint Pressure Fittings."
3. "The dimensional, material and workmanship of 5"–12" copper fittings shall meet the requirements of MSS SP-109 "Welded Fabricated Copper Solder Joint Pressure Fittings."
4. "Third party certified to NSF/ANSI61."
5. "Lead-free* fittings are third party certified to NSF/ANSI 61

CAST COPPER ALLOY SOLDER JOINT FITTINGS — "Cast Copper Alloy Solder Joint Fittings shall be in accordance with ASME B16.18."

WROT DRAINAGE FITTINGS — "Wrot Drainage Fittings shall be in accordance with ASME B16.29."

CAST COPPER ALLOY SOLDER JOINT DRAINAGE FITTINGS — "Cast Copper Alloy Solder Joint Drainage Fittings shall be in accordance with ASME B16.23."

CAST COPPER ALLOY FLARED TUBE FITTINGS — "Cast Copper Alloy Flared Tube Fittings shall be in accordance with ASME B16.26."

CAST COPPER ALLOY FLANGES AND FLANGED FITTINGS —

CLASS 150 — "Cast Copper Alloy Flanges and Flanged Fittings shall meet the requirements of MSS SP-106" and/or "the workmanship and dimensions of Federal Specifications WW-F-406 or ASME Std. B16.24."

"CLASS 125 — Material, workmanship and dimensions of flanges shall be in accordance with MSS SP-106."

CAST BRONZE THREADED FITTINGS — "Cast Bronze Threaded Fittings shall be in accordance with ASME B16.15."

POLYBUTYLENE COPPER INSERT TYPE VALVES AND FITTINGS — "Wrot Copper Insert Fittings shall be manufactured per MSS SP-103."

NIBCO® Copper Tube Fittings are all produced to above Standards. To simplify, write your specifications to read: "Copper Tube Fittings to be in accordance with specifications as outlined in NIBCO Copper Fittings Catalog."

WROT COPPER MEDICAL GAS SYSTEM COMPONENTS — "Wrot copper fittings that are to be installed in medical gas applications shall be prepared in accordance with NFPA 99, Health Care Facilities Gas and Vacuum Systems and the Compressed Gas Association, Pamphlet G4.1. Packaging shall be adequately protective and include labeling that identifies the preparer and states that the product has been cleaned and bagged for oxygen or med gas service."

For technical information and dimensions refer to the engineering section contained in this catalog.

* NIBCO, may, from time to time, source and/or supplement a wrot or cast fitting product from suppliers outside of the U.S.A. and/or Mexico.

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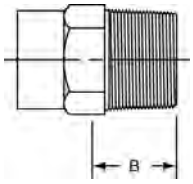
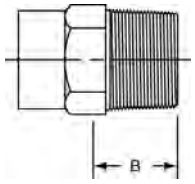
ADAPTERS *continued*

604
Adapter C x M – Wrot

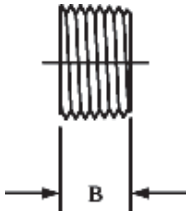
NOM. SIZE	APPROX. NET WT./LBS.	DIM. B INCHES
1/8 x 1/4	0.03	7/16
1/4	0.03	23/32
1/4 x 1/2	0.07	–
3/8	0.04	19/32
3/8 x 1/4	0.06	–
3/8 x 1/2	0.09	1
3/8 x 3/4	0.15	1 5/16
1/2	0.07	5/8
1/2 x 1/4	0.05	5/8
1/2 x 3/8	0.05	19/32
1/2 x 3/4	0.14	31/32
1/2 x 1	0.25	1 1/2
5/8 x 1/2	0.08	3/4
5/8 x 3/4	0.16	1 1/8
3/4	0.14	13/16
3/4 x 1/2	0.10	27/32
3/4 x 1	0.26	1 7/16
1	0.21	31/32
1 x 1/2	0.19	31/32
1 x 3/4	0.18	29/32
1 x 1 1/4	0.38	1 1/2
1 x 1 1/2	0.46	1 7/32
1 1/4	0.35	15/16
1 1/4 x 3/4	0.30	31/32
1 1/4 x 1	0.25	1 5/32
1 1/4 x 1 1/2	0.51	1 19/32
1 1/2	0.46	31/32
1 1/2 x 1	0.44	1 3/32
1 1/2 x 1 1/4	0.38	1 3/16
1 1/2 x 2	0.76	1 1/8
2	0.73	1 3/32
2 x 1 1/2	0.58	1 11/32
2 1/2	1.19	1 27/32
3	1.39	2 1/8
4	3.19	–

Consult price sheet for Made to Order items and for minimum order quantities.

704 ⚠
Adapter C x M – Cast

NOM. SIZE	APPROX. NET WT./LBS.	DIM. B INCHES
3/4 x 3/8	0.16	13/16
▲3/4 x 1 1/4	0.38	1 7/32
3/4 x 1 1/2	0.59	1 17/32
1 x 1 1/2	0.64	29/32
1 x 2	1.14	1 5/8
1 1/4 x 2	0.87	1 9/32
2 x 1 1/4	1.08	1 5/16
2 x 2 1/2	1.57	1 15/32
2 1/2	1.49	1 17/32
2 1/2 x 2	1.83	1 11/16
3	1.97	1 1/2
4	3.66	1 11/16
5	8.60	2 5/8

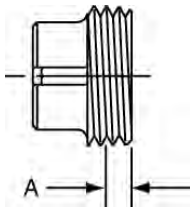
604-F
Flush Adapter C x M – Wrot

NOM. SIZE	APPROX. NET WT./LBS.	DIM. B INCHES
1/2	0.03	9/16
3/4	0.03	19/32

⚠ **WARNING:** This product can expose you to chemicals including lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

▲Also available in Lead-Free*. For additional details, see our Lead-Free* literature on www.nibco.com.

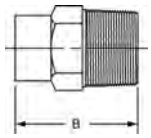
*Weighted average lead content ≤ 0.25%

704-H ⚠
Hose Adapter C x Hose – Cast

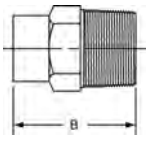
NOM. SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
1/2	0.09	3/16

NOTE: Fits 1/2," 5/8" and 3/4" Garden Hose.

604-2
Fitting Adapter Ftg x M – Wrot

NOM. SIZE	APPROX. NET WT./LBS.	DIM. B INCHES
1/4	0.03	1 1/8
3/8	0.04	1 1/4
1/2	0.09	1 15/32
1/2 x 3/8	0.05	1 11/32
1/2 x 3/4	0.16	1 13/16
3/4	0.17	1 15/16
3/4 x 1/2	0.12	1 21/32
1	0.25	2 1/4
1 1/4	0.36	2 3/16
1 1/2	0.58	2 13/32
2	0.83	2 3/4
2 1/2	0.58	3 3/16
3	1.81	3 9/16

704-2 ⚠
Fitting Adapter Ftg x M – Cast

NOM. SIZE	APPROX. NET WT./LBS.	DIM. B INCHES
3/4 x 1	0.27	1 31/32
1 x 3/4	0.20	1 15/16
1 1/2	0.54	2 13/32
2	0.89	2 3/4

Visit our website for the most current information.

Copper Tube Fittings

TYPES OF JOINTS

Flared Joint — The principle of the flared joint was first developed for copper tube plumbing in 1928 by NIBCO. The flared type joint is wholly a mechanical means of joining copper tubes. The tube nut is placed over the end of the copper tube to be joined; the tube end then is flared out at an approximate 45 degree angle by a flaring tool. The flared end is then drawn up by the tube nut so the inside surface is tightly secured against the ball seat of the fitting. This joint can be readily dismantled at any time and is, in effect, a type of union connection. Its use is generally restricted to soft (annealed) copper tubes since hard drawn tubes would be subject to splitting when flared (if the ends were not previously annealed). The flared ends of NIBCO® Flared Fittings are produced to the requirements of ASME B16.26, "Cast Copper Alloy Fittings for Flared Copper Tube."

Solder Joint — NIBCO pioneered the development of the solder joint and its application to the field of copper tube piping. Today the solder joint is widely adopted, as evidenced by the majority of cities and states that have written codes to include copper tube and solder joints as desirable for general plumbing, water lines, vent, stack, waste and drain lines, as well as other uses in industry. Testing has shown that often the solder joint has greater strength than the tubes being joined, depending upon the soldering alloy selected. While the method of preparing a solder joint is an exacting art to insure a full strength joint, it can be readily mastered by skilled tradesmen. It is for this reason — to insure the public of the protection afforded by properly prepared joints — that NIBCO® products are marketed through the reputable sources of supply to the piping trades. Important procedures for preparing a solder joint are graphically illustrated in this catalog on page 46.

Brazed Joint — This type of joint has long been used wherever and whenever critical situations have been encountered in copper piping. The joint itself is completed much in the same manner as the solder joint; however, considerably more heat and several refinements of technique require separate procedures that are described further in this catalog on pages 47-48.

Threaded Ends — To adapt copper tube to equipment having National Standard Pipe Taper (NPT) threads or to add copper tube to existing iron pipe installations or other threaded connections, NIBCO provides fittings having both external and internal NPT threads. These threaded ends are produced to the requirements of ASME B1.20.1, "Pipe Threads, General Purpose (Inch)."

Flanges — To adapt copper tube to equipment having flanged connections, or to add copper tube to flanged pipe installations or other purposes, NIBCO provides flanges. The flanges are produced in two standard types widely used in this field where copper tube can serve — Class 150, comply with ASME B16.24, "Cast Copper Alloy Pipe Flanges and Flanged Fittings Class 150, 300, 400, 600, 900, 1500 and 2500"; and Class 125, which conform to MSS SP-106, "Cast Copper Alloy Flanges and Flanged Fittings Class 125, 150 and 300."

Barbed Insert Fittings for Polybutylene (PB) — NIBCO offers a complete line of copper barbed insert fittings for joining PB tube. The insert fittings are produced to the requirements of ASTM F1380. Along with the insert fittings are copper crimp rings, which, when properly installed, provide a leak-tight mechanical joint. Transition fittings are available for adapting to new or existing threaded or solder joint ends.

Fitting Terms and Abbreviations

C	Female solder cup
Ftg	Male solder end
F	Female NPT thread
M	Male NPT thread
Hose	Standard hose thread
Hub	Female end for soil pipe
Spigot	Male end for soil pipe
No Hub	Used with mechanical coupling
O.D. Tube	Actual tube outside diameter
S	Straight thread
SJ	Slip joint
FL	Flared

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WHAT MAKES A PLUMBING SYSTEM FAIL?

Failure in a copper plumbing system is rare, but may occur due to a variety of reasons. The most common causes of failure are:

1. Excessive fluid velocity causes erosion-corrosion or impingement (to strike or hit against) attack in the tube and/or fitting. For this reason, the copper plumbing industry has establish design velocity limits for copper plumbing systems to the following:

Hot Water > 140°F (60°C)	2 to 3 feet per second (0.6 to 0.9 meters per second)
Hot Water 140°F (60°C)	4 to 5 feet per second (1.2 to 1.5 meters per second)
Cold Water	5 to 8 feet per second (1.5 to 2.4 meters per second)

2. Localized high velocities and/or turbulence. The presence of a dent, tube ends which are not reamed or deburred before soldering, and sudden changes in direction can all cause localized high velocity conditions.
3. Flux Corrosion is typified by pin hole leaks, generally in the bottom of a horizontal line. Fluxes are mildly corrosive liquid or petroleum-based pastes containing chlorides of zinc and ammonia. Unless the flux is flushed from the system, it will lay in the bottom of the tube and remain active. ASTM B 813, "Liquid and Paste Fluxes for Soldering Applications of Copper and Copper-Alloy Tube," limits the corrosivity of soldering fluxes and ensures that these fluxes are flushable in cold water, which facilitates easy removal of flux residue following installation.
4. Galvanic Corrosion may be defined as the destruction of a material by electrochemical interaction between the environment and the material. Generally, it is slow but persistent in character and requires the presence of dissimilar metals. Galvanic corrosion requires the flow of an electric current between certain areas of dissimilar metal surfaces. To complete the electric circuit, there must be two electrodes, an anode and a cathode, and they must be connected by an electrolyte media (water) through which the current can pass. The amount of metal which dissolves at the anode is proportional to the number of electrons flowing, which in turn is dependent upon the potential and resistance of the two metals. The use of dissimilar metals in a plumbing system may or may not create a problem. For instance, copper and steel are perhaps the most common dissimilar metals found together in a plumbing system. In closed systems, such as a chilled or heating water piping, the use of dissimilar metals may not create a serious problem; this is because there is virtually no oxygen in the water and corrosion relations tend to be stifled. Where dissimilar metals must be used, some codes require that they should be separated by dielectric union or a similar type of fitting. The effectiveness depends upon; distance between the metals on the electromotive-force series (EMF) chart, ratio of cathode to anode area, degree of aeration, amount of agitation, temperature, presence of dissolved salts, and other factors.

ABBREVIATED EMF SERIES
(Electromotive-Force Series; Common Piping Materials in Sea Water)

CATHODE (+) Passive
- GOLD – Fixtures, Faucets, Plating
- PLATINUM
- SILVER – Brazing alloys, Silver-bearing solders
- TITANIUM – Condenser tubes
- MONEL (67% Ni - 33% Cu) – Specialty piping & equipment
- CUPRO-NICKEL – Condensers, Marine, Nuclear
- COPPER – Pressure, DWV, Gases, Air, Refrigeration, etc.
- BRASS (85/15 - Red) – Cast fittings, Valves
- BRASS (70/30 - Yellow) – Gas-cocks, Fittings, Connectors
- LEAD – Solder, Pipe, Sheet, Coating, Lining
- TIN – Solders, Coating, Lining
- CAST IRON – Pressure, DWV
- WROUGHT IRON – Pressure
- MILD STEEL – Fire Protection
- ALUMINUM – Refrigeration, Irrigation, some Solar
- GALVANIZED STEEL – Pressure, DWV
- ZINC – Coatings, Linings, some Fittings
- MAGNESIUM – Water Heater Anodes, Cathodic protection for pipelines

ANODE (-) Active; Sacrificial Material

5. Dezincification is a type of corrosion in which brass dissolves as an alloy and the copper constituent redeposits from solution onto the surface of the brass as a metal, but in the porous form. The zinc constituent may be carried away from the brass as a soluble salt, or may be deposited in place as an insoluble compound. Dezincification is normally associated with brass valves where the zinc content exceeds 15%. Generally, areas of high stress, such as valve stems and gate valve bodies, are primary targets of attack.
6. On rare occasion problems of corrosion by aggressive water, possibly aggravated by poor design or workmanship, do exist. Aggressive, hard well waters that cause pitting can be identified by chemical analysis and treated to bring their composition within acceptable limits. Typically these hard waters are found to have high total dissolved solids (t.d.s.) including sulfates and chlorides, a pH in the range of 7.2 to 7.8, a high content of carbon dioxide (CO_2) gas (over 10 parts per million, ppm), and the presence of dissolved oxygen (D.O.) gas. Soft acidic waters can cause the annoying problem of green staining of fixtures or "green water". Raising the pH of such waters to a value of about 7.2 or more usually solves the problem, but a qualified water treatment specialist should be consulted.
7. Aggressive soil conditions can be a cause for external corrosion of copper piping systems. Non-uniform soil characteristics, such as different soil aeration, resistivity, or moisture properties, between adjacent sections of tube can create galvanic corrosion cells. Soils contaminated with high concentrations of road salts or fertilizers containing ammonia, chlorides, and nitrogen are known to combine with water to form acids. Any metal pipe laid in ash or cinders is subject to attack by the acid generated when sulfur compounds combine with water to form sulfuric acid.

U.S. customary units in this document are the standard; the metric units are provided for reference only. The values stated in each system are not exact equivalents.

Copper Tube Fittings continued

SOLDER JOINT SPECIFICATION

1. **Soldering Clearance** (between the outside of the tube and the inside diameter of the solder cup) **and the Depth of the Solder Cup** (into which the tube is inserted).

Chart 1 – Soldering Clearance and Solder Cup Depth

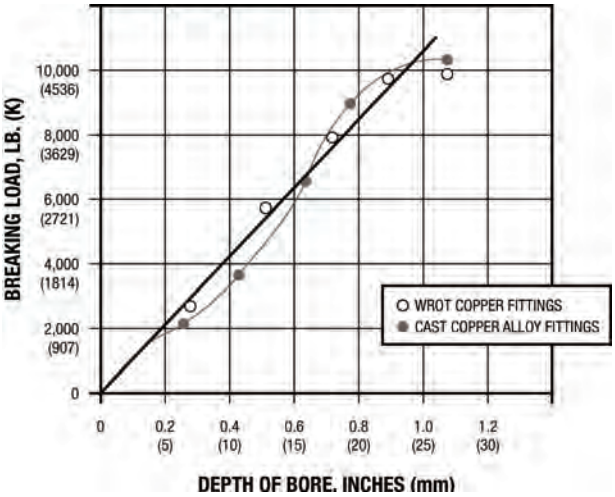
Nominal Size of Fitting (Inches)	Maximum I.D. of Fitting Inch	(mm)	Minimum O.D. of Tube Inch	(mm)	Maximum Clearance for Soldering Inch	(mm)	Depth of Solder Cup Inch	(mm)
1/4	0.381	(9.66)	0.374	(9.50)	0.007	(0.18)	0.31	(7.9)
3/8	0.506	(12.85)	0.499	(12.67)	0.007	(0.18)	0.38	(9.7)
1/2	0.631	(16.03)	0.622	(15.80)	0.009	(0.23)	0.50	(12.7)
5/8	0.756	(19.20)	0.749	(19.02)	0.007	(0.18)	0.62	(15.7)
3/4	0.881	(22.38)	0.872	(22.20)	0.009	(0.23)	0.75	(19.1)
1	1.132	(28.75)	1.123	(28.54)	0.009	(0.23)	0.91	(23.1)
1 1/4	1.382	(35.10)	1.373	(34.88)	0.009	(0.23)	0.97	(24.6)
1 1/2	1.633	(41.48)	1.623	(41.22)	0.010	(0.25)	1.09	(27.7)
2 (34.0)	2.133	(54.18)	2.123	(53.92)	0.010	(0.25)	1.34	
2 1/2 (37.3)	2.633	(66.88)	2.623	(66.62)	0.010	(0.25)	1.47	
3 (42.2)	3.133	(79.58)	3.123	(79.32)	0.010	(0.25)	1.66	
3 1/2	3.633	(92.28)	3.623	(92.02)	0.010	(0.25)	1.91	(48.5)
4	4.133	(104.98)	4.123	(104.72)	0.010	(0.25)	2.16	(54.9)
5 (67.6)	5.133	(130.38)	5.123	(130.12)	0.010	(0.25)	2.66	
6	6.133	(155.78)	6.123	(155.52)	0.010	(0.25)	3.09	(78.5)

The National Bureau of Standards Report BMS58, "Strength of Soft-Soldered Joints in Copper Tubing," reporting on tests conducted with 3/4-inch tubing and fitting, says "When the clearance is greater than 0.010 inch (0.25 mm), there is difficulty in filling the joint properly."

2. **Depth of Solder Penetration** drastically affects the breaking load of the joint. When there is too great a soldering clearance, there is no capillary flow to assure complete solder penetration. As shown in the chart below, the holding power of the 3/4-inch joint is directly proportional to the depth of solder penetration.

   For example: If you get only one-third penetration, you get approximately one-third the strength needed to assure complete satisfaction.

Chart 2 – Type K 3/4" Tubing



Solder penetration of one-third the cup depth — breaking load, approximately 2,100 lb. (955 kg)

Solder penetration of the entire cup depth — breaking load approximately 7,000 lb. (3175 kg)

HOW TO BE SURE OF PROPER TOLERANCES

It is apparent that all of the scientific apparatus used to test tube and fittings, according to the dimensions indicated in Chart 1, would be impractical to use on the job. It is therefore essential that you install tube and fittings manufactured by companies known to be dedicated to the highest quality control standards. Should you encounter a condition where there is difficulty in filling the joint properly, NIBCO will analyze the trouble without charge. Just send six inches of the tube, along with the fitting and our technicians will provide you with an authoritative report.

Visit our website for the most current information.

U.S. customary units in this document are the standard; the metric units are provided for reference only. The values stated in each system are not exact equivalents.

BRAZING INFORMATION

Copper Water Tube Size (In Inches)	Brazing[A] Filler Required Inches	(mm)	Torch Tip Drill Size No.	For Estimating Purposes: Acetylene Consumption C.F.H.	(C.M.H.)	Oxygen Pressure (Approx.) PSI	(kPa)	Acetylene Pressure (Approx.) PSI	(kPa)
1/4	0.25[B]	(6.4)	54	15.9	(0.5)	4	(27)	4	(27)
3/8	0.38[B]	(9.7)	54	15.9	(0.5)	4	(27)	4	(27)
1/2	0.50	(12.7)	51	24.8	(0.7)	5	(34)	5	(34)
5/8	0.62	(15.7)	51	24.8	(0.7)	5	(34)	5	(34)
3/4	1.00	(25.0)	51	24.8	(0.7)	5	(34)	5	(34)
1	1.60	(41.0)	48	31.6	(0.9)	6	(41)	6	(41)
1 1/4	2.00	(51.0)	48	31.6	(0.9)	6	(41)	6	(41)
1 1/2	2.60	(66.0)	44	38.7	(1.1)	7	(48)	7	(48)
2	4.40	(112.0)	40	60.0	(1.7)	7	(48)	7	(48)
2 1/2	5.90	(150.0)	40	60.0	(1.7)	7	(48)	7	(48)
3	7.90	(200.0)	35	70.0	(2.0)	7 1/2	(52)	7 1/2	(52)
3 1/2	10.50	(207.0)	35	70.0	(2.0)	7 1/2	(52)	7 1/2	(52)
4	13.50	(343.0)	30	88.5	(2.5)	9	(62)	9	(62)
5	20.50	(521.0)	30	88.5	(2.5)	9	(62)	9	(62)
6	28.50	(724.0)	30	88.5	(2.5)	9	(62)	9	(62)

[A] Approximate consumption when brazing one cup of the fitting. Actual consumption depends on workmanship.
For filler sizes shown, one pound of filler alloy provides 1,068 inches (27.13 mm) of 1/16-inch wire or 475 inches (12,065 mm) of 3/32-inch wire.

[B] 1/16-inch (1.59 mm) diameter wire; all other is 3/32-inch (2.38 mm) diameter.

SOLDER AND FLUX REQUIREMENTS

Nom. Size Joint (In Inches)	Solder Required, LB (kg) General Use	Drainage Use	
1/4	0.097	–	
3/8	0.159	–	
1/2	0.261	–	
5/8	0.389	–	
3/4	0.548	–	
1	0.856	–	
1 1/4	1.115	1.2	(0.5)
1 1/2	1.480	1.4	(0.6)
2	2.380	1.5	(0.7)
2 1/2	3.225	–	
3	4.335	2.8	(1.3)
3 1/2	5.786	–	
4	7.446	4.2	(1.9)
5	11.392	–	
6	15.815	–	
8	26.955	–	

Solder requirements in this table are based on estimate of weight of solder used to prepare 100 solder joints of sizes shown.

Two (2) ounces (0.06 kg) of solder flux will be required for each pound (0.45 kg) of solder.

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Copper Tube Fittings continued

RATED INTERNAL WORKING PRESSURES OF JOINTS MADE WITH COPPER WATER TUBE AND SOLDER TYPE FITTINGS, PSI (BAR)

Joining Material	Working Temperature °F	°C	Maximum Gauge Working Pressure for Standard Water Tube Sizes [Note (1)] 1/8" though 1" PSI	BAR	1 1/4" through 2" PSI	BAR	2 1/2" through 4" PSI	BAR	5" through 8" PSI	BAR	10" to 12" PSI	BAR	Saturated Steam LB (kg) All Sizes
Alloy Sn50 50-50 Tin-Lead solder [Notes (2), (3)]	100	38	200	(14)	175	(12)	150	(10)	135	(9)	100	(6)	15
	150	66	150	(10)	125	(9)	100	(7)	90	(6)	70	(5)	
	200	93	100	(7)	90	(6)	75	(5)	70	(5)	50	(3)	
	250	121	85	(6)	75	(5)	50	(3)	45	(3)	40	(3)	
Alloy Sb5 95-5 Tin-Antimony solder [Note (4)]	100	38	1090[9]	(75)	850[8]	(59)	705[9]	(49)	660[8]	(46)	340	(23)	15
	150	66	625[10]	(43)	485[10]	(34)	405[10]	(28)	375[10]	(26)	280	(19)	
	200	93	505[11]	(35)	395[10]	(27)	325[10]	(32)	305[10]	(21)	230	(16)	
	250	121	270	(19)	210	(15)	175	(12)	165	(11)	120	(8)	
Alloy E	100	38	710[10]	(49)	555[10]	(38)	460[10]	(32)	430[10]	(30)	320	(22)	15
	150	66	475[11]	(33)	370[10]	(26)	305[10]	(21)	285[11]	(20)	215	(15)	
	200	93	375	(26)	290	(20)	240[11]	(17)	225[11]	(16)	170	(12)	
	250	121	320	(22)	250	(17)	205	(14)	195	(13)	145	(9)	
Alloy HB [Note (6)]	100	38	1035[9]	(71)	805[8]	(56)	670[8]	(46)	625[9]	(43)	340	(23)	15
	150	66	710[10]	(49)	555[10]	(38)	460[10]	(32)	430[10]	(30)	320	(22)	
	200	93	440[11]	(30)	345[11]	(24)	285[11]	(20)	265[11]	(18)	200	(14)	
	250	121	430[11]	(30)	335[11]	(23)	275[11]	(19)	260[11]	(18)	195	(13)	
Joining materials at or above 593°C [Note (7)]	Pressure-temperature ratings consistent with the materials and procedures employed.												

GENERAL NOTE:

For extremely low working temperatures in the 0°F to 200°F range, it is recommended that a joint material melting at or above 1000°F be employed [see Note (5)].

NOTES:
(1) Standard water tube sizes per ASTM B 88
(2) ASTM B 32 Alloy Grade Sn50
(3) The Safe Drinking Water Act Amendment of 1986 prohibits the use of any solder having a lead content in excess of 0.2% in potable water systems.
(4) ASTM B 32 Alloy Grade Sb5
(5) ASTM B 32 Alloy Grade E
(6) ASTM B 32 Alloy Grade HB
(7) These joining materials are defined as *brazing alloys* by the American Welding Society.
(8) The solder joint exceeds the strength of Types K, L & M tube in drawn and annealed tempers.
(9) The solder joint exceeds the strength of Types L & M tube in drawn temper and Type K tube in annealed temper.
(10) The solder joint exceeds the strength of Type M tube in drawn temper and Types L & K in annealed temper.
(11) The solder joint exceeds the strength of Type L tube in annealed temper.

RATED INTERNAL WORKING PRESSURES OF JOINTS MADE WITH FLARED FITTINGS AND COPPER WATER TUBE

Nominal Size Joint (In Inches)	Temperature, °F (°C)[A]	Pressure, PSI (BAR)[A]
3/8, 1/2, 3/4, 1, 1 1/4, 1 1/2, 2	100 (38)	175 (12)

[A] ASME B16.26

RATED INTERNAL WORKING PRESSURES OF POLYBUTYLENE TUBE AND COPPER BARBED INSERT FITTINGS

Nominal Size Joint (In Inches)	Temperature, °F (°C)	Pressure, PSI (BAR)
3/8, 1/2, 3/4, 1	73 (23)	200 (14)
	140 (60)	160 (11)
	180 (82)	100 (7)
	200 (93)	80 (5)

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RATED INTERNAL WORKING PRESSURE[1] FOR COPPER FITTINGS, PSI (BAR)

Nominal Water Tube Size (In Inches)	Water Temperature Range						
	-20° to 100°F (-29° to 38°C)	150°F (66°C)	200°F (95°C)	250°F (120°C)	300°F (149°C)	350°F (177°C)	400°F (204°C)
1/4	912 (62)	775 (53)	729 (50)	729 (50)	714 (49)	608 (42)	456 (31)
3/8	779 (54)	662 (46)	623 (43)	623 (43)	610 (42)	519 (36)	389 (27)
1/2	722 (50)	613 (42)	577 (40)	577 (40)	565 (39)	481 (33)	361 (25)
5/8	631 (43)	537 (37)	505 (35)	505 (35)	495 (34)	421 (29)	316 (21)
3/4	582 (40)	495 (34)	466 (32)	466 (32)	456 (31)	388 (27)	291 (20)
1	494 (34)	420 (29)	395 (27)	395 (27)	387 (26)	330 (23)	247 (17)
1 1/4	439 (30)	373 (26)	351 (24)	351 (24)	344 (23)	293 (20)	219 (15)
1 1/2	408 (28)	347 (24)	327 (23)	327 (23)	320 (22)	272 (19)	204 (14)
2	364 (25)	309 (21)	291 (20)	291 (20)	285 (20)	242 (17)	182 (13)
2 1/2	336 (23)	285 (20)	269 (19)	269 (19)	263 (18)	224 (15)	168 (12)
3	317 (22)	270 (19)	254 (17)	254 (17)	248 (17)	211 (15)	159 (11)
3 1/2	304 (21)	258 (18)	243 (17)	243 (17)	238 (16)	202 (14)	152 (10)
4	293 (20)	249 (17)	235 (16)	235 (16)	230 (16)	196 (13)	147 (10)
5	269 (19)	229 (16)	215 (15)	215 (15)	211 (15)	179 (12)	135 (9)
6	251 (17)	213 (15)	201 (14)	201 (14)	196 (14)	167 (12)	125 (8)
8	270 (19)	230 (16)	216 (15)	216 (15)	212 (15)	180 (12)	135 (9)

[1] The fitting pressure rating applies to the largest opening of the fitting.

RATED INTERNAL WORKING PRESSURES OF CAST COPPER ALLOY FLANGES AND FLANGED FITTINGS

Nominal Size Joint (In Inches)	Temperature °F (°C) [A]	Pressure (PSI)		
		Class 125 [A, B]	Class 150 [B]	Class 150 [A, C]
1/2, 3/4, 1, 1 1/4, 1 1/2, 2, 2 1/2, 3, 4, 5, 6, 8 (also 10" for Class 125)	0 – 150 (0 – 66)	105 (7)	210 (14)	225 (15)
	175 (79)	100 (7)	205 (14)	220 (15)
	200 (93)	95 (7)	195 (13)	210 (15)
	225 (107)	90 (6)	190 (13)	205 (14)
	250 (121)	90 (6)	180 (12)	195 (13)
	275 (135)	85 (6)	175 (12)	190 (13)
	300 (149)	85 (6)	170 (12)	180 (12)
	350 (177)	75 (5)	150 (10)	165 (11)
	406 (208)	70 (5)	140 (9)	150 (10)

[A] MSS SP-106

[B] ASTM B584, UNS C83800 and UNS C84400

[C] ASTM B62, UNS C83600 and ASTM B584, UNS C83600

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