CATALOG C-ACR-1213

NIBCO®

AHEAD OF THE FLOW®

Air Conditioning and Refrigeration Products

Business-to-Business Solutions

Look to NIBCO for technology leadership.

The velocity with which e-business evolves demands that new products and services be continuously developed and introduced to keep our customers at the center of our business efforts. NIBCO provides an entire suite of business-to-business solutions that is changing the way we interact with customers.

NIBCOpartner.com[sm] is an exclusive set of secure web applications that allow quick access to customer-specific information and online order processing. This self-service approach gives you 24/7 access to your order status putting you in total control of your business.

Real time information includes:

- Online order entry
- Viewable invoices & reports
- Inventory availability
- Current price checks
- Order status
- Online library of price sheets, catalogs & submittals

Electronic Data Interchange (EDI) makes it possible to trade business documents at the speed of light. This technology cuts the cost of each transaction by eliminating the manual labor and paperwork involved in traditional order taking. This amounts to cost-savings, increased accuracy and better use of resources.

With EDI, you can trade:

- Purchase orders
- PO Acknowledgements
- Invoices
- Product activity data
- Advanced ship notices
- Remittance advice

Vendor Managed Inventory (VMI), a sophisticated service for automated inventory management, reduces your overhead by transferring inventory management, order entry and forecasting to NIBCO. This is an on-going, interactive partnership with NIBCO.

Through automation, VMI brings results:

- Improves customer service
- Optimum inventory efficiencies
- Better forecasting
- Cuts transaction costs
- Peace of mind
- Relief from day-to-day management

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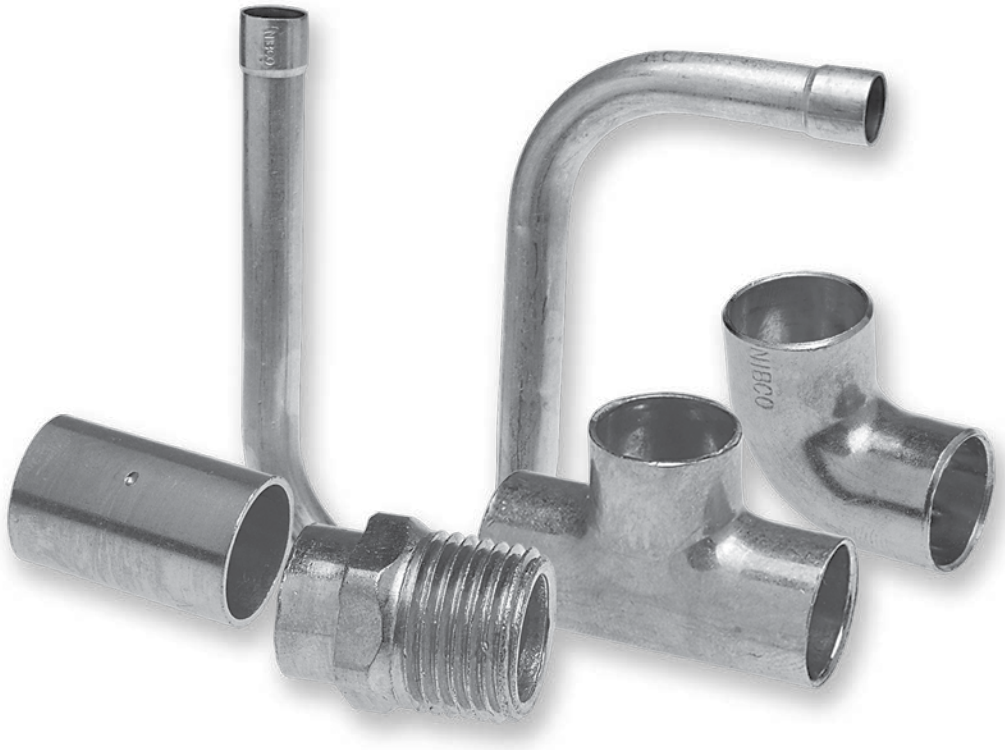
www.nibco.com

NIBCO® Copper Fittings



Wrot and Cast Pressure Fittings

600 Series – Wrot
700 Series – Cast

Engineering Data

Copper Fittings Demensional Data

Copper Tube Fittings

Installation Instructions

ISO 9001
BUREAU VERITAS
Certification

The manufacturing plants at Stuarts Draft, VA; Nacogdoches, TX; and Reynosa, Mexico manufacture products under a Quality Management System conforming to the current revision of ISO-9001 International Standards.

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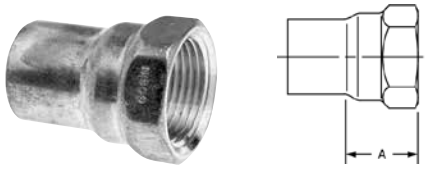
ACR COPPER FITTINGS

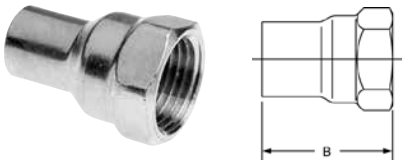
Adapters

9603
Adapter (C x F) - Wrot



O.D. SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. A INCHES
1/4 x 1/8	0.03	W-1207	13/32
1/4 x 1/4	0.03	W-1206	1/2
3/8 x 1/4	0.03	W-1215	5/8
3/8 x 3/8	0.04	W-1214	7/8
1/2 x 3/8	0.04	W-1225	11/16
1/2 x 1/4	0.03	W-1226	9/16
1/2 x 1/2	0.09	W-1224	29/32
1/2 x 3/4	0.1	W-1223	1
5/8 x 1/2	0.09	W-1231	27/32
5/8 x 1/4	0.06	W-1233	1/2
5/8 x 3/8	0.04	W-1232	17/32
5/8 x 3/4	0.14	W-1230	1
3/4 x 1/2	0.11	W-1239	3/4
3/4 x 3/4	0.13	W-1283	29/32
7/8 x 3/4	0.15	W-1246	29/32
7/8 x 1/2	0.1	W-1247	5/8
7/8 x 1	0.21	W-1245	1 1/8
1 1/8 x 1	0.24	W-1263	31/32
1 1/8 x 1/2	0.25	W-1265	5/8
1 1/8 x 3/4	0.19	W-1264	25/32
1 1/8 x 1 1/4	0.28	W-1261	1 7/32
1 3/8 x 1 1/4	0.33	W-1271	1 3/32
1 3/8 x 1	0.28	W-1272	29/32
1 3/8 x 1 1/2	0.40	W-1270	1 1/4
1 5/8 x 1 1/2	0.44	W-1279	1 1/8
1 5/8 x 1 1/4	0.42	W-1280	1 1/32
1 5/8 x 2	0.73	W-1278	1 1/32
2 1/8 x 2	0.63	W-1287	1 3/32
2 1/8 x 1 1/2	0.74	W-1288	1 11/32
2 5/8 x 2 1/2	1.15	W-1296	1 3/16
3 1/8 x 3	1.88	W-1297	1 5/16
4 1/8 x 4	3.14	—	1 7/8

9603-2
Fitting Adapter (Ftg x F) - Wrot

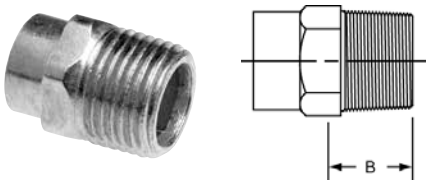


O.D. SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. B INCHES
3/8 x 1/4	0.03	-	1 3/32
1/2 x 3/8	0.06	W-1525	1 3/16
5/8 x 1/2	0.09	W-1531	1 7/16
5/8 x 3/8	0.05	W-1532	1 1/4
7/8 x 3/4	0.13	W-1546	1 11/16
1 1/8 x 1	0.27	W-1563	2 1/32
1 3/8 x 1 1/4	0.31	W-1571	2 1/8
1 5/8 x 1 1/2	0.43	W-1579	2 5/16
2 1/8 x 2	0.61	W-1587	2 17/32

ACR COPPER FITTINGS

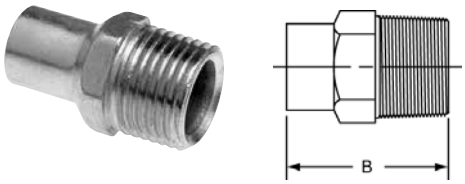
Adapters *cont.*

9604
Adapter (C x M) - Wrot



O.D. SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. B INCHES
1/4 x 1/4	0.03	W-1106	7/16
3/8 x 1/4	0.03	W-1115	23/32
3/8 x 1/2	0.07	W-1113	-
1/2 x 3/8	0.04	W-1125	15/32
1/2 x 1/4	0.06	W-1126	-
1/2 x 1/2	0.09	W-1124	1
1/2 x 3/4	0.15	W-1123	1 5/16
5/8 x 1/2	0.07	W-1131	5/8
5/8 x 1/4	0.05	W-1133	5/8
5/8 x 3/8	0.05	W-1132	19/32
5/8 x 3/4	0.14	W-1130	31/32
5/8 x 1	0.25	W-1129	1 1/2
3/4 x 1/2	0.08	W-1139	3/4
3/4 x 3/4	0.16	W-1138	1 1/8
7/8 x 3/4	0.14	W-1146	13/16
7/8 x 1/2	0.1	W-1147	27/32
7/8 x 1	0.26	W-1145	1 7/16
1 1/8 x 1	0.21	W-1163	31/32
1 1/8 x 1/2	0.18	W-1165	31/32
1 1/8 x 3/4	0.18	W-1164	29/32
1 1/8 x 1 1/4	0.38	W-1162	1 1/2
1 1/8 x 1 1/2	0.5	W-1161	1 7/32
1 3/8 x 1 1/4	0.35	W-1171	15/16
1 3/8 x 1	0.25	W-1172	1 5/32
1 3/8 x 1 1/2	0.51	W-1170	1 19/32
1 5/8 x 1 1/2	0.46	W-1179	31/32
1 5/8 x 1	0.44	W-1181	1 3/32
1 5/8 x 1 1/4	0.38	W-1180	1 3/16
1 5/8 x 2	0.76	W-1178	1 1/8
2 1/8 x 2	0.81	W-1187	1 3/32
2 1/8 x 1 1/2	0.58	W-1188	1 11/32
2 5/8 x 2 1/2	1.19	W-1196	1 27/32
3 1/8 x 3	1.39	W-1199	2 1/8
4 1/8 x 4	3.00	W-1150	-

9604-2
Fitting Adapter Ftg x M - Wrot



O.D. SIZE	WT./LBS.	MUELLER PART NUMBER	DIM. B INCHES
1/2 x 3/8	0.04	W-1425	1 1/4
5/8 x 1/2	0.09	W-1431	1 15/32
5/8 x 3/8	0.05	W-1432	1 11/32
7/8 x 3/4	0.17	W-1446	1 15/16
1 1/8 x 1	0.25	W-1463	2 1/4
1 5/8 x 1 1/2	0.58	W-1479	2 13/32

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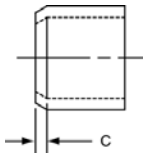
ACR COPPER FITTINGS

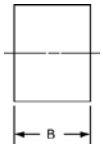
Bushings

9618
Flush Bushing Ftg x C - Wrot



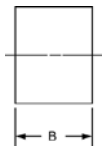
O.D. SIZE	WT./LBS.	MUELLER PART NUMBER	DIM. C INCHES
3/8 x 1/4	0.01	W-1706	3/32
1/2 x 3/8	0.01	W-1712	3/16
5/8 x 3/8	0.04	W-1717	9/32
5/8 x 1/2	0.02	W-1715	3/16
3/4 x 5/8	0.03	W-1720	3/32
7/8 x 1/2	0.11	W-1727	15/32
7/8 x 5/8	0.08	W-1726	11/32
7/8 x 3/4	0.04	W-1725	7/32
1 1/8 x 5/8	0.22	W-1739	15/32
1 1/8 x 7/8	0.12	W-1737	7/32
1 3/8 x 1 1/8	0.17	W-1743	5/32
1 5/8 x 1 3/8	0.22	W-1750	1/4
2 1/8 x 1 5/8	0.66	W-1758	5/16

9618-3
Flush Bushing Ftg x F - Wrot



O.D. SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. B INCHES
5/8 x 1/8	0.03	A-7812	9/16
5/8 x 1/4	0.02	A-7813	9/16
1 1/8 x 1/2	0.12	A-7815	31/32
1 5/8 x 1	0.24	A-7817	1 5/32

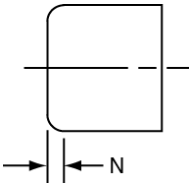
9718-3
Flush Bushing Ftg x F - Cast



O.D. SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. B INCHES
1 3/8 x 3/4	0.18	A-7816	1 1/32

Caps

9617
Cap C

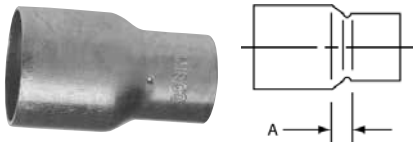


O.D. SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. N INCHES
1/4	0.01	W-7002	1/32
3/8	0.01	W-7004	1/16
1/2	0.01	W-7006	3/32
5/8	0.02	W-7007	1/8
3/4	0.03	W-7008	1/8
7/8	0.04	W-7009	3/16
1 1/8	0.07	W-7011	5/32
1 3/8	0.10	W-7012	3/32
1 5/8	0.16	W-7013	1/8
2 1/8	0.27	W-7014	5/32
2 5/8	0.47	W-7015	7/32
3 1/8	0.78	W-7016	7/32
4 1/8	1.66	W-7018	1/4

ACR COPPER FITTINGS

Couplings

9600
Reducing Coupling C x C - Wrot

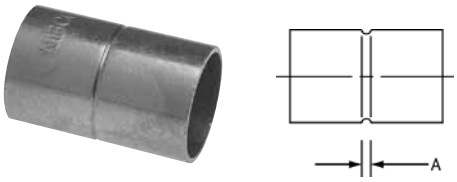


O.D. SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. A INCHES
1/4 x 3/16	0.01	W-1004	5/32
5/16 x 1/4	0.01	-	1/4
3/8 x 5/16	0.01	W-1010	3/16
3/8 x 1/4	0.01	W-1011	3/16
1/2 x 3/8	0.02	W-1019	3/16
1/2 x 5/16	0.01	-	1/4
1/2 x 1/4	0.01	W-1021	1/4
5/8 x 1/4	0.03	W-1027	11/32
5/8 x 3/8	0.02	W-1025	1/4
5/8 x 1/2	0.02	W-1023	3/16
3/4 x 3/8	0.03	W-1031	13/32
3/4 x 1/2	0.04	W-1030	11/32
3/4 x 5/8	0.05	W-1029	3/16
7/8 x 3/8	0.05	W-1038	11/32
7/8 x 1/2	0.06	W-1037	3/8
7/8 x 5/8	0.06	W-1036	5/16
7/8 x 3/4	0.07	W-1035	3/16
1 1/8 x 1/2	0.10	W-1052	13/32
1 1/8 x 5/8	0.10	W-1051	11/32
1 1/8 x 3/4	0.10	W-1050	3/8
1 1/8 x 7/8	0.11	W-1049	11/32
1 3/8 x 5/8	0.14	W-1060	7/16
1 3/8 x 3/4	0.18	-	19/32
1 3/8 x 7/8	0.18	W-1058	17/32
1 3/8 x 1 1/8	0.16	W-1056	5/16
1 5/8 x 5/8	0.19	W-1069	1/2
1 5/8 x 7/8	0.20	W-1067	3/8
1 5/8 x 1 1/8	0.22	W-1065	9/16
1 5/8 x 1 3/8	0.23	W-1064	5/16
2 1/8 x 5/8	0.38	W-1079	23/32
2 1/8 x 7/8	0.36	W-1077	17/32
2 1/8 x 1 1/8	0.37	W-1075	7/16
2 1/8 x 1 3/8	0.37	W-1074	11/16
2 1/8 x 1 5/8	0.40	W-1073	9/16
2 5/8 x 1 1/8	0.58	W-1086	29/32
2 5/8 x 1 3/8	0.57	W-1085	13/16
2 5/8 x 1 5/8	0.59	W-1084	11/16

Continues…

O.D. SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. A INCHES
2 5/8 x 2 1/8	0.59	W-1083	1/2
3 1/8 x 1 5/8	0.92	W-1095	1 1/32
3 1/8 x 2 1/8	1.06	W-1094	15/16
3 1/8 x 2 5/8	0.98	W-1093	1/2
3 5/8 x 3 1/8	1.52	W-10101	17/32
4 1/8 x 2 1/8	1.91	W-10111	1 1/4
4 1/8 x 2 5/8	1.78	W-10110	1
4 1/8 x 3 1/8	1.93	W-10109	27/32
4 1/8 x 3 5/8	2.12	W-10108	19/32

9600 - RS
Coupling with Rolled Tube Stop
C x C - Wrot



O.D. SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. A INCHES
1/8	0.01	-	1/16
3/16	0.01	W-1001	1/8
1/4	0.01	W-1003	1/8
5/16	0.01	-	1/8
3/8	0.01	W-1009	1/8
1/2	0.01	W-1017	3/32
5/8	0.03	W-1022	3/32
3/4	0.04	W-1028	3/32
7/8	0.06	W-1034	3/32
1	0.09	W-1040	3/32
1 1/8	0.11	W-1047	3/32
1 3/8	0.15	W-1055	1/8
1 5/8	0.22	W-1063	1/8
2 1/8	0.40	W-1072	1/8
2 5/8	0.66	W-1082	1/8
3 1/8	1.00	W-1092	1/8
3 5/8	1.45	W-10100	5/32
4 1/8	1.93	W-10107	7/32

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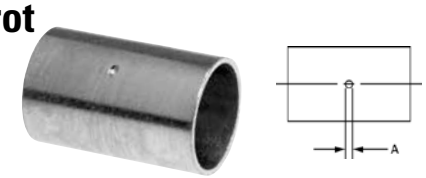
ACR COPPER FITTINGS

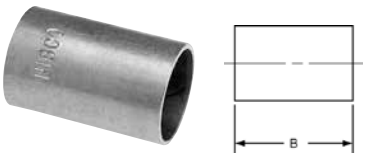
Couplings *cont.*

9600-DS
Coupling with Dimpled Tube Stop
C x C - Wrot



O.D. SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. A INCHES
3/16	0.01	-	3/32
1/4	0.01	W-10141	1/16
5/16	0.01	W-10142	3/32
3/8	0.01	W-10143	1/16
1/2	0.01	W-10144	3/32
5/8	0.03	W-10145	3/32
3/4	0.04	W-10157	3/32
7/8	0.06	W-10146	3/32
1	0.09	-	3/32
1 1/8	0.11	W-10147	3/32
1 3/8	0.15	W-10148	1/8
1 5/8	0.22	W-10149	1/8
2 1/8	0.40	W-10150	1/8
2 5/8	0.67	W-10151	1/8
3 1/8	1.00	W-10152	1/8
3 5/8	1.45	W-10153	5/32
4 1/8	1.93	W-10154	7/32

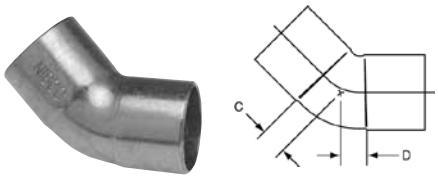
9601
Coupling without Stop
C x C - Wrot



O.D. SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. B INCHES
3/8	0.01	W-1901	11/16
1/2	0.01	W-1902	3/4
5/8	0.03	W-1903	1
3/4	0.04	W-1904	1 1/4
7/8	0.06	W-1905	1 1/2
1 1/8	0.11	W-1906	1 13/16
1 3/8	0.15	W-1907	1 15/16
1 5/8	0.22	W-1908	2 3/16
2 1/8	0.40	W-1909	2 11/16
2 5/8	0.66	W-1910	2 15/16
3 1/8	1.00	W-1911	3 5/16
3 5/8	1.40	-	3 13/16
4 1/8	1.84	W-1913	4 5/16

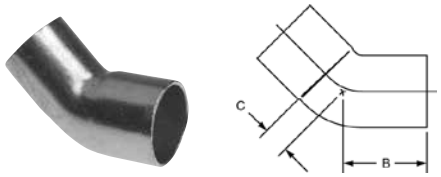
Elbows

9606
45 Degree Elbow C x C - Wrot



OD SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. C INCHES	DIM. D INCHES
1/4	0.01	W-3005	11/32	11/32
3/8	0.02	W-3012	9/32	9/32
1/2	0.03	W-3021	3/16	3/16
5/8	0.04	W-3026	9/32	9/32
3/4	0.09	W-3030	15/32	15/32
7/8	0.10	W-3034	11/32	11/32
1	0.20	-	11/16	11/16
1 1/8	0.15	W-3044	3/8	3/8
1 3/8	0.25	W-3050	17/32	17/32
1 5/8	0.35	W-3055	19/32	19/32
2 1/8	0.65	W-3059	25/32	25/32
2 5/8	1.07	W-3063	29/32	29/32
3 1/8	1.58	W-3067	1 1/8	1 1/8
4 1/8	3.35	W-3073	1 9/16	1 9/16

9606-2
45 Degree Fitting Elbow Ftg x C - Wrot

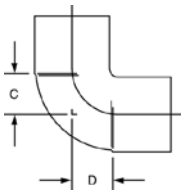


OD SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. B INCHES	DIM. C INCHES
3/8	0.02	W-3312	9/16	1/4
1/2	0.02	W-3321	21/32	3/16
5/8	0.04	W-3326	3/4	7/32
3/4	0.08	W-3330	1 1/8	13/32
7/8	0.10	W-3334	1 1/16	5/16
1 1/8	0.16	W-3344	1 9/32	15/32
1 3/8	0.25	W-3350	1 19/32	17/32
1 5/8	0.35	W-3355	1 25/32	19/32
2 1/8	0.65	W-3359	2 3/16	25/32
2 5/8	1.06	W-3363	2 3/16	29/32
3 1/8	1.55	W-3368	2 19/32	1 5/32

ACR COPPER FITTINGS

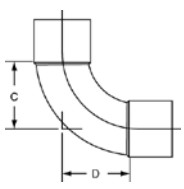
Elbows *cont.*

9607
90 Degree Elbow - Close Rough C x C - Wrot



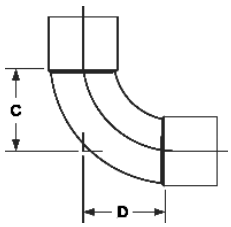
OD SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. C INCHES	DIM. D INCHES
1/4	0.01	W-2003	13/32	13/32
3/8	0.02	W-2009	3/8	3/8
1/2	0.03	W-2017	1/2	1/2
1/2 x 3/8	0.03	W-2019	-	-
5/8	0.04	W-1622	11/32	11/32
5/8 x 1/2	0.04	W-2023	7/16	21/32
7/8	0.10	W-1634	1/2	13/16
7/8 x 5/8	0.10	W-2036	9/16	25/32
7/8 x 3/4	0.11	W-2035	29/32	7/8
1	0.20	W-2040	29/32	29/32
1 1/8	0.18	W-2047	21/32	21/32
1 1/8 x 5/8	0.18	W-2051	-	-
1 1/8 x 7/8	0.20	W-2049	27/32	1 1/16
1 3/8	0.27	W-2084	15/16	15/16
1 3/8 x 1 1/8	0.23	W-2056	1 5/8	1 15/32
1 5/8	0.42	W-2085	1 1/32	1 1/32
1 5/8 x 1 3/8	0.35	W-2077	1 5/32	1 3/32
2 1/8	0.80	W-2086	1 13/32	1 13/32
2 1/8 x 1 5/8	0.58	W-2078	1 7/16	1 1/4
2 5/8	1.41	W-2087	1 5/8	1 5/8
3 1/8	2.07	W-2088	2	2
3 5/8	2.94	W-2089	2 7/16	2 7/16
4 1/8	4.23	W-2090	2 15/32	2 15/32

9607-I
90 Degree Elbow - Intermediate Radius C x C - Wrot



OD SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. C INCHES	DIM. D INCHES
5/8	0.05	W-2022	19/32	19/32
3/4	0.09	W-2028	7/8	7/8
7/8	0.14	W-2034	3/16	3/16
1 1/8	0.24	W-2047	1 1/16	1 1/16

9607-LT
90 Degree Elbow - Long Radius C x C - Wrot



OD SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. C INCHES	DIM. D INCHES
3/16	0.01	W-2701	13/32	13/32
1/4	0.01	W-2715	13/32	13/32
5/16	0.02	W-2710	9/16	9/16
3/8	0.02	W-2716	17/32	17/32
3/8 x 1/4	0.01	W-2711	19/32	1/2
1/2	0.04	W-2717	23/32	23/32
5/8	0.08	W-2722	7/8	7/8
5/8 x 1/2	0.06	W-2723	13/16	13/16
5/8 x 3/8	0.03	W-2725	25/32	21/32
3/4	0.11	W-2728	1 3/32	1 3/32
3/4 x 5/8	0.09	W-2729	1 1/16	1 1/16
7/8	0.16	W-2734	1 1/8	1 1/8
7/8 x 3/4	0.13	W-2735	1 1/4	1 3/32
7/8 x 5/8	0.10	W-2736	1 1/8	1 1/16
1	0.28	-	1 19/32	1 19/32
1 1/8	0.28	W-2747	1 7/16	1 7/16
1 1/8 x 7/8	0.20	W-2749	1 1/4	1 1/8
1 1/8 x 3/4	0.15	-	1 13/32	1 3/32
1 3/8	0.42	W-2055	1 7/8	1 7/8
1 3/8 x 1 1/8	0.33	W-2756	1 25/32	1 1/2
1 5/8	0.66	W-2063	2 1/4	2 1/4
2 1/8	1.23	W-2072	2 15/16	2 15/16
2 5/8	2.15	W-2082	3 11/16	3 11/16
2 5/8 x 2 1/8	1.53	-		
3 1/8	2.93	W-2092	4 1/32	4 1/32
3 5/8	5.63	-		
4 1/8	5.96	W-2095	5 1/4	5 1/4

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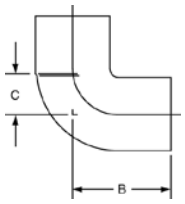
ACR COPPER FITTINGS

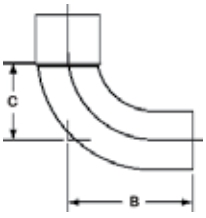
Elbows *cont.*

9607-2
90 Degree Fitting Elbow - Close Rough Ftg x C - Wrot

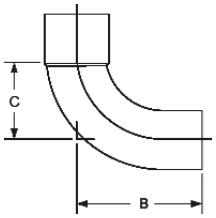
OD SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. B INCHES	DIM. C INCHES
1/4	0.01	-		
3/8	0.02	W-2312	3/4	3/8
1/2	0.03	W-2321	15/16	1/2
5/8	0.04	W-1652	31/32	3/8
7/8	0.11	W-1654	1 11/32	17/32
1 1/8	0.20	W-2344	1 3/4	27/32
1 3/8	0.28	W-2384	2 1/8	1 1/32
1 5/8	0.43	W-2385	2 13/32	1 7/32
2 1/8	0.82	W-2386	2 27/32	1 1/2
2 5/8	1.39	W-2387	3 15/32	1 29/32
3 1/8	2.10	W-2388	3 13/16	2 3/32
4 1/8	4.00	W-2390	4 3/4	2 25/32

9607-2-I
90 Degree Fitting Elbow - Intermediate Radius Ftg x C - Wrot

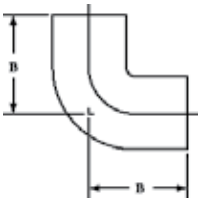
OD SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. B INCHES	DIM. C INCHES
5/8	0.05	W-2326	1 5/32	19/32
3/4	0.09	W-2330	1 9/16	7/8
7/8	0.14	W-2334	1 5/8	13/16
1 1/8	0.24	W-2344	2 1/32	1 1/16

9607-2-LT
90 Degree Fitting Elbow - Long Radius Ftg x C - Wrot

OD SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. B INCHES	DIM. C INCHES
1/4	0.01	-	13/16	1/2
3/8	0.02	W-2809	1 1/8	3/4
1/2	0.05	W-2817	1 1/8	7/8
5/8	0.08	W-2822	1 9/16	1 3/32
5/8 x 1/2	0.06	-	1 3/16	3/4
3/4	0.11	W-2828	1 25/32	1 3/32
7/8	0.16	W-2834	1 15/16	1 1/8
1 1/8	0.32	W-2847	2 1/2	1 21/32
1 3/8	0.47	W-2350	2 31/32	1 7/8
1 5/8	0.66	W-2355	3 13/32	2 1/4
2 1/8	1.27	W-2359	4 11/32	2 15/16
2 5/8	2.16	W-2363	5 7/32	3 11/16
3 1/8	3.10	W-2368	5 3/4	4 1/32

9607-2-2
90 Degree Fitting Elbow - Close Rough Ftg x Ftg - Wrot

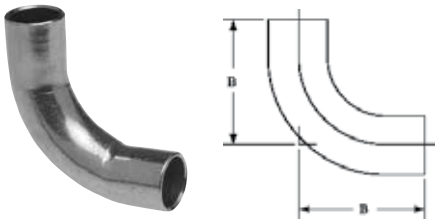



OD SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. B INCHES
5/8	0.09	W-2626	1 1/16
7/8	0.09	W-2634	1 15/32
1 1/8	0.31	W-2644	1 23/32
1 3/8	0.31	W-2684	2 1/8
1 5/8	0.46	W-2685	2 11/32
2 1/8	0.82	W-2686	2 27/32
3 1/8	2.12	W-2688	3 7/8

ACR COPPER FITTINGS

Elbows *cont.*

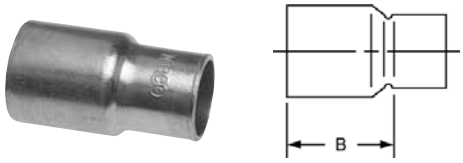
9607-2-2-LT
90 Degree Fitting Elbow - Close Rough Ftg x Ftg - Wrot



OD SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. B INCHES
3/8	0.02	-	27/32
1/2	0.04	-	1 1/8
5/8	0.08	-	1 19/32
3/4	0.11	-	1 25/32
7/8	0.16	-	1 15/16
1 1/8	0.31	-	2 1/2
1 3/8	0.43	W-2650	2 29/32
1 5/8	0.65	W-2655	3 7/16
2 1/8	1.25	W-2659	4 11/32

Fitting Reducers

9600-2
Fitting Reducer Ftg x C - Wrot



OD SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. B INCHES
3/8 x 1/4	0.01	W-1306	17/32
1/2 x 1/4	0.01	W-1314	23/32
1/2 x 3/8	0.01	W-1312	27/32
5/8 x 3/8	0.02	W-1317	27/32
5/8 x 1/2	0.03	W-1315	11/16
3/4 x 3/8	0.03	W-1322	1 1/32
3/4 x 1/2	0.04	W-1321	31/32
3/4 x 5/8	0.05	W-1320	7/8
7/8 x 3/8	0.05	W-1328	1 3/32
7/8 x 1/2	0.05	W-1327	1 1/8
7/8 x 5/8	0.06	W-1326	1 1/8
7/8 x 3/4	0.06	W-1325	15/16
1 1/8 x 1/2	0.08	W-1340	1 9/32
1 1/8 x 5/8	0.09	W-1339	1 1/4
1 1/8 x 3/4	0.09	W-1338	1 3/8
1 1/8 x 7/8	0.10	W-1337	1 7/32
1 3/8 x 5/8	0.13	W-1347	1 3/8
1 3/8 x 7/8	0.16	W-1345	1 1/2
1 3/8 x 1 1/8	0.15	W-1343	1 5/16
1 5/8 x 5/8	0.16	W-1355	1 19/32
1 5/8 x 7/8	0.20	W-1353	1 17/32
1 5/8 x 1 1/8	0.21	W-1351	1 5/8
1 5/8 x 1 3/8	0.23	W-1350	1 13/32
2 1/8 x 5/8	0.34	W-1364	1 15/16
2 1/8 x 7/8	0.34	W-1362	1 27/32
2 1/8 x 1 1/8	0.35	W-1360	1 27/32
2 1/8 x 1 3/8	0.34	W-1359	2 3/32
2 1/8 x 1 5/8	0.39	W-1358	1 31/32
2 5/8 x 1 1/8	0.51	W-1370	2 9/32
2 5/8 x 1 3/8	0.60	W-1369	2 9/32
2 5/8 x 1 5/8	0.59	W-1368	2 3/8
2 5/8 x 2 1/8	0.65	W-1367	1 31/32
3 1/8 x 1 3/8	0.88	W-1379	3 1/4
3 1/8 x 1 5/8	0.81	W-1378	2 19/32
3 1/8 x 2 1/8	0.99	W-1377	2 9/16
3 1/8 x 2 5/8	1.03	W-1376	2 1/4
3 5/8 x 3 1/8	1.48	W-1381	2 11/32
4 1/8 x 2 1/8	1.66	W-1389	3 13/32
4 1/8 x 2 5/8	1.82	W-1388	3 1/32
4 1/8 x 3 1/8	2.00	W-1387	3 1/32
4 1/8 x 3 5/8	2.09	W-1386	3 1/32

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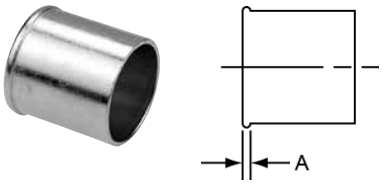
ACR COPPER FITTINGS

Plugs

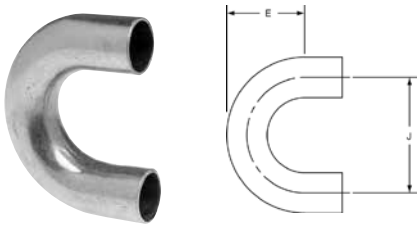
9616
Fitted Plug Ftg - Wrot



OD SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. A INCHES
1/2	0.012	A-1392	1/16
5/8	0.02	A-1504	3/32
7/8	0.04	A-1529	5/32

Return Bends

9638
Return Bend C x C - Wrot



OD SIZE	APPROX. NET WT./ LBS.	MUELLER PART NUMBER	DIM. E INCHES	DIM. J INCHES
1/4	0.02	-	21/32	1
3/8	0.04	W-6020	31/32	1 1/4
1/2	0.08	W-6032	1 3/32	1 1/2
5/8	0.13	W-6051	1 1/2	2
7/8	0.26	W-6092	1 19/32	2 1/2
1 1/8	0.44	W-60110	2 3/32	3
1 3/8	0.70	-	2 13/16	4
1 5/8	1.04	W-60131	3 5/32	4 1/2
2 1/8	1.92	W-60140	3 29/32	5 1/2

Straps and Hangers

9623
Copper Hanger Strap

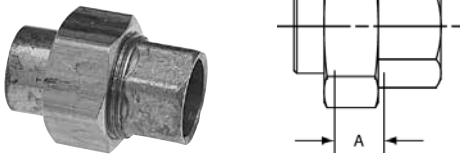
SIZE	APPROX. NET WT./LBS
3/4" Wide x 25 Ft. Roll	1.93

9624
Tube Strap

OD SIZE	MUELLER PART NUMBER	APPROX. NET WT./LBS.
1/4	A-1203	0.01
3/8	A-1278	0.01
1/2	A-1366	0.01
5/8	A-2529	0.02
3/4	A-1467	0.02
7/8	A-2574	0.02
1 1/8	A-2614	0.02
1 3/8	A-2650	0.03
1 5/8	A-2675	0.03
2 1/8	A-2708	0.04

Unions

9633-W
Union C x C - Wrot



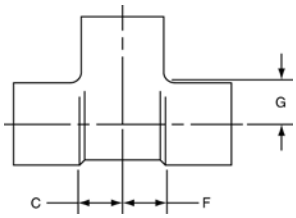
OD SIZE	APPROX. NET WT./LBS.	MUELLER PART NUMBER	DIM. A INCHES
3/8	0.13	W-8001	1/2
1/2	0.12	W-8002	7/16
5/8	0.12	W-8003	7/16
7/8	0.28	W-8004	7/16
1 1/8	0.44	W-8005	1/2

ACR COPPER FITTINGS

Tees

9611

Tee C x C x C - Wrot



OD SIZE	APPROX. NET WT./ LBS.	MUELLER PART NUMBER	DIMENSIONS INCHES C	F	G
3/16	0.01	W-40302	7/32	7/32	7/32
1/4	0.02	W-40306	15/16	15/16	1/4
1/4 x 1/4 x 3/8	0.02	W-40368	13/32	13/32	9/32
1/4 x 1/4 x 3/16	0.01	W-40308	5/16	5/16	5/16
1/4 x 3/16 x 1/4	0.01	-	5/16	11/32	1/4
5/16	0.02	W-40313	3/8	3/8	5/16
5/16 x 1/4 x 1/4	0.02	-	3/8	13/32	11/32
5/16 x 1/4 x 5/16	0.02	-	3/8	13/32	5/16
5/16 x 5/16 x 1/4	0.03	-	3/8	3/8	5/16
5/16 x 5/16 x 3/8	0.02	W-40334	3/8	3/8	9/32
3/8	0.02	W-4000	5/16	5/16	1/4
3/8 x 1/4 x 1/4	0.02	W-40332	5/16	13/32	11/32
3/8 x 1/4 x 3/8	0.02	W-40330	5/16	13/32	9/32
3/8 x 5/16 x 3/8	0.02	-	5/16	3/8	9/32
3/8 x 3/8 x 1/4	0.03	W-40324	5/16	5/16	5/16
3/8 x 3/8 x 1/2	0.04	W-4005	17/32	17/32	11/32
3/8 x 3/8 x 5/8	0.07	W-4016	19/32	19/32	3/8
3/8 x 3/8 x 3/16	0.02	W-40325	5/16	5/16	7/16
3/8 x 3/8 x 5/16	0.02	-	5/16	5/16	5/16
1/2	0.04	W-4001	11/32	11/32	11/32
1/2 x 1/4 x 1/4	0.04	W-40366	11/32	19/32	19/32
1/2 x 1/4 x 1/2	0.04	W-40363	11/32	19/32	11/32
1/2 x 3/8 x 1/4	0.04	W-40358	11/32	17/32	9/16
1/2 x 3/8 x 3/8	0.04	W-4004	11/32	17/32	15/32
1/2 x 3/8 x 1/2	0.04	W-4003	11/32	17/32	11/32
1/2 x 1/2 x 1/4	0.04	W-40350	11/32	11/32	9/16
1/2 x 1/2 x 5/16	0.04	-	11/32	11/32	15/32
1/2 x 1/2 x 3/8	0.04	W-4002	11/32	11/32	15/32
1/2 x 1/2 x 5/8	0.07	W-4015	17/32	17/32	3/8
5/8	0.06	W-4006	11/32	11/32	11/32
5/8 x 3/8 x 1/2	0.06	W-40367	5/16	5/8	13/32
5/8 x 1/2 x 3/8	0.06	W-4011	5/16	17/32	9/16
5/8 x 1/2 x 1/2	0.06	W-4010	5/16	17/32	1/2
5/8 x 1/2 x 5/8	0.07	W-4009	7/16	17/32	3/8
5/8 x 5/8 x 1/4	0.06	W-4014	1/4	1/4	11/16
5/8 x 5/8 x 3/8	0.06	W-4008	5/16	5/16	9/16
5/8 x 5/8 x 1/2	0.07	W-4007	5/16	5/16	13/32
5/8 x 5/8 x 3/4	0.11	W-4029	5/8	5/8	7/16
5/8 x 5/8 x 7/8	0.12	W-4047	17/32	17/32	11/32
5/8 x 5/8 x 1 1/8	0.29	W-4067	1	1	21/32

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OD SIZE	APPROX. NET WT./ LBS.	MUELLER PART NUMBER	DIMENSIONS INCHES C	F	G
3/4	0.12	W-4017	7/16	7/16	7/16
3/4 x 1/2 x 1/2	0.11	W-4027	7/16	3/4	5/8
3/4 x 1/2 x 3/4	0.10	W-4025	7/16	3/4	7/16
3/4 x 5/8 x 5/8	0.11	W-4022	7/16	19/32	13/32
3/4 x 5/8 x 3/4	0.10	W-4021	7/16	5/8	7/16
3/4 x 3/4 x 3/8	0.11	W-4020	7/16	7/16	3/4
3/4 x 3/4 x 1/2	0.09	W-4019	7/16	7/16	5/8
3/4 x 3/4 x 5/8	0.11	W-4018	7/16	7/16	13/32
3/4 x 3/4 x 7/8	0.15	W-4046	23/32	23/32	1/2
7/8	0.16	W-4031	7/16	7/16	7/16
7/8 x 1/2 x 1/2	0.12	W-40232	7/16	23/32	21/32
7/8 x 1/2 x 5/8	0.12	W-40231	7/16	23/32	17/32
7/8 x 1/2 x 7/8	0.15	W-40230	17/32	27/32	1/2
7/8 x 5/8 x 1/2	0.12	W-4044	7/16	21/32	21/32
7/8 x 5/8 x 5/8	0.12	W-4043	13/32	19/32	1/2
7/8 x 5/8 x 7/8	0.16	W-4041	1/2	5/8	15/32
7/8 x 3/4 x 3/4	0.15	W-4037	1/2	3/4	11/16
7/8 x 3/4 x 7/8	0.15	W-4036	17/32	11/16	1/2
7/8 x 7/8 x 1/4	0.12	-	7/16	7/16	13/16
7/8 x 7/8 x 3/8	0.12	W-4035	13/32	13/32	25/32
7/8 x 7/8 x 1/2	0.12	W-4034	13/32	13/32	21/32
7/8 x 7/8 x 5/8	0.12	W-4033	3/8	3/8	15/32
7/8 x 7/8 x 3/4	0.16	W-4032	17/32	17/32	11/16
7/8 x 7/8 x 1 1/8	0.22	W-4065	23/32	23/32	1/2
1	0.30	-	23/32	23/32	23/32
1 1/8	0.31	W-4048	11/16	11/16	21/32
1 1/8 x 5/8 x 5/8	0.22	W-4063	1/2	25/32	11/16
1 1/8 x 5/8 x 7/8	0.24	W-4062	9/16	7/8	11/16
1 1/8 x 5/8 x 1 1/8	0.30	W-4061	11/16	1 1/32	21/32
1 1/8 x 7/8 x 5/8	0.22	W-4058	15/32	11/16	11/16
1 1/8 x 7/8 x 7/8	0.24	W-4056	9/16	25/32	23/32
1 1/8 x 7/8 x 1 1/8	0.31	W-4055	11/16	31/32	21/32
1 1/8 x 1 1/8 x 3/8	0.22	-	1/2	1/2	1 3/16
1 1/8 x 1 1/8 x 1/2	0.22	W-4052	1/2	1/2	29/32
1 1/8 x 1 1/8 x 5/8	0.23	W-4051	1/2	1/2	11/16
1 1/8 x 1 1/8 x 3/4	0.24	W-4050	19/32	19/32	29/32
1 1/8 x 1 1/8 x 7/8	0.25	W-4049	19/32	19/32	23/32
1 1/8 x 1 1/8 x 1 3/8	0.42	W-4082	1 5/32	1 5/32	7/8
1 1/8 x 1 1/8 x 1 5/8	0.59	W-40101	1 11/32	1 11/32	31/32
1 3/8	0.43	W-4068	13/16	13/16	13/16
1 3/8 x 5/8 x 1 3/8	0.42	W-4083	13/16	1 7/32	13/16
1 3/8 x 7/8 x 5/8	0.31	W-4081	15/32	3/4	25/32
1 3/8 x 7/8 x 7/8	0.36	W-4080	21/32	15/16	3/4
1 3/8 x 7/8 x 1 1/8	0.45	W-4079	25/32	1 1/16	29/32
1 3/8 x 7/8 x 1 3/8	0.41	W-4078	13/16	1 1/8	13/16
1 3/8 x 1 1/8 x 5/8	0.31	W-4076	15/32	19/32	13/16
1 3/8 x 1 1/8 x 7/8	0.37	W-4075	21/32	13/16	25/32
1 3/8 x 1 1/8 x 1 1/8	0.47	W-4074	25/32	31/32	29/32
1 3/8 x 1 1/8 x 1 3/8	0.41	W-4073	13/16	1 1/32	13/16
1 3/8 x 1 3/8 x 1/2	0.30	W-4072	15/32	15/32	29/32
1 3/8 x 1 3/8 x 5/8	0.31	W-4071	15/32	15/32	25/32
1 3/8 x 1 3/8 x 7/8	0.39	W-4070	21/32	21/32	3/4
1 3/8 x 1 3/8 x 1 1/8	0.45	W-4069	25/32	25/32	27/32
1 3/8 x 1 3/8 x 1 5/8	0.57	W-40100	1 3/16	1 3/16	29/32

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TECH SERVICES PH: 1.888.446.4226 • FAX: 1.888.336.4226 • INTERNATIONAL OFFICE PH: +1.574.295.3327 • FAX: +1.574.295.3455
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ACR COPPER FITTINGS

Tees *cont.*

OD SIZE	APPROX. NET WT./ LBS.	MUELLER PART NUMBER	DIMENSIONS INCHES C	F	G
1 3/8 x 1 3/8 x 2 1/8	1.04	W-40122	1 15/16	1 15/16	1 1/4
1 5/8	0.62	W-4084	15/16	15/16	15/16
1 5/8 x 5/8 x 1 5/8	0.60	W-40244	1 1/32	1 13/32	31/32
1 5/8 x 7/8 x 5/8	0.39	W-40243	1/2	29/32	1 1/32
1 5/8 x 7/8 x 7/8	0.47	W-40238	19/32	1 3/32	29/32
1 5/8 x 7/8 x 1 1/8	0.54	W-40240	25/32	1 1/4	1 1/32
1 5/8 x 7/8 x 1 3/8	0.60	W-40239	29/32	1 11/32	1 1/16
1 5/8 x 7/8 x 1 5/8	0.59	W-4099	15/16	1 3/8	15/16
1 5/8 x 1 1/8 x 5/8	0.39	W-40237	1/2	25/32	1 1/32
1 5/8 x 1 1/8 x 7/8	0.46	W-4098	11/16	31/32	15/16
1 5/8 x 1 1/8 x 1 1/8	0.54	W-4097	3/4	1 1/16	31/32
1 5/8 x 1 1/8 x 1 3/8	0.60	W-4096	29/32	1 1/8	1 1/16
1 5/8 x 1 1/8 x 1 5/8	0.60	W-4095	1 1/32	1 11/32	29/32
1 5/8 x 1 3/8 x 5/8	0.41	W-4094	1/2	25/32	1 1/32
1 5/8 x 1 3/8 x 7/8	0.46	W-4093	19/32	29/32	15/16
1 5/8 x 1 3/8 x 1 1/8	0.54	W-4092	25/32	1	1 1/32
1 5/8 x 1 3/8 x 1 3/8	0.59	W-4091	31/32	1 3/32	31/32
1 5/8 x 1 3/8 x 1 5/8	0.60	W-4090	1 1/32	1 3/16	29/32
1 5/8 x 1 5/8 x 5/8	0.40	W-4088	1/2	1/2	1
1 5/8 x 1 5/8 x 7/8	0.48	W-4087	19/32	19/32	15/16
1 5/8 x 1 5/8 x 1 1/8	0.55	W-4086	3/4	3/4	15/16
1 5/8 x 1 5/8 x 1 3/8	0.61	W-4085	29/32	29/32	1
1 5/8 x 1 5/8 x 2 1/8	1.05	W-40121	1 11/16	1 11/16	1 1/4
2 1/8	1.11	W-40102	1 9/32	1 9/32	1 1/32
2 1/8 x 5/8 x 2 1/8	1.09	W-40249	1 9/32	2 3/8	1 1/4
2 1/8 x 7/8 x 2 1/8	1.07	W-40248	1 9/32	2 3/16	1 1/4
2 1/8 x 1 1/8 x 1 1/8	0.91	W-40247	27/32	1 19/32	1 11/32
2 1/8 x 1 1/8 x 2 1/8	1.06	W-40245	1 1/8	1 25/32	1 1/4
2 1/8 x 1 3/8 x 7/8	1.04	-	1 1/4	1 31/32	2 3/32
2 1/8 x 1 3/8 x 1 1/8	0.90	W-40118	27/32	1 9/32	1 23/64
2 1/8 x 1 3/8 x 1 3/8	1.06	W-40117	1 7/32	2	1 15/16
2 1/8 x 1 3/8 x 1 5/8	1.04	W-40116	1 3/32	1 7/32	1 3/8
2 1/8 x 1 3/8 x 2 1/8	1.08	W-40115	1 9/32	1 31/32	1 1/32
2 1/8 x 1 5/8 x 5/8	0.79	W-40114	11/16	29/32	1 5/16
2 1/8 x 1 5/8 x 7/8	1.04	W-40113	1 1/4	1 23/32	23/32
2 1/8 x 1 5/8 x 1 1/8	0.91	W-40112	29/32	1 1/8	1 7/32
2 1/8 x 1 5/8 x 1 3/8	1.07	W-40111	1 15/16	1 25/32	1 7/8
2 1/8 x 1 5/8 x 1 5/8	1.06	W-40110	1 3/32	1 15/32	1 11/32
2 1/8 x 1 5/8 x 2 1/8	1.07	W-40109	1 9/32	1 25/32	1 1/32
2 1/8 x 2 1/8 x 5/8	0.77	W-40107	19/32	19/32	1 5/16
2 1/8 x 2 1/8 x 7/8	0.66	W-40106	7/16	7/16	1 1/4
2 1/8 x 2 1/8 x 1 1/8	0.91	W-40105	27/32	27/32	1 1/4
2 1/8 x 2 1/8 x 1 3/8	1.09	W-40104	1 9/32	1 9/32	1 27/32
2 1/8 x 2 1/8 x 1 5/8	1.07	W-40103	1 1/4	1 1/4	1 23/32
2 1/8 x 2 1/8 x 2 5/8	2.11	W-40144	2 3/16	2 3/16	1 7/8
2 5/8	2.08	W-40123	1 9/16	1 9/16	1 7/8
2 5/8 x 7/8 x 2 5/8	2.16	W-40222	1 9/16	2 15/16	1 7/8
2 5/8 x 1 1/8 x 2 5/8	2.22	W-40221	1 9/16	2 9/16	1 7/8
2 5/8 x 1 3/8 x 2 1/8	2.26	-	1 9/16	2 5/8	2 3/16
2 5/8 x 1 3/8 x 2 5/8	2.20	W-40220	1 9/16	2 5/8	1 7/8
2 5/8 x 1 5/8 x 2 5/8	2.20	W-40137	1 9/16	2 17/32	1 7/8
2 5/8 x 2 1/8 x 7/8	1.34	W-40135	25/32	1 3/16	1 27/32
2 5/8 x 2 1/8 x 1 1/8	1.34	W-40134	25/32	1 5/32	1 11/16
2 5/8 x 2 1/8 x 1 3/8	1.62	W-40133	1 3/32	1 13/32	1 27/32
2 5/8 x 2 1/8 x 1 5/8	1.61	W-40132	1 3/32	2 13/32	1 21/32
2 5/8 x 2 1/8 x 2 1/8	1.72	W-40131	1 7/16	1 11/16	1 9/16
2 5/8 x 2 1/8 x 2 5/8	2.20	W-40130	1 9/16	2 3/16	1 7/8
2 5/8 x 2 5/8 x 5/8	1.30	W-40129	25/32	25/32	2 1/8
2 5/8 x 2 5/8 x 7/8	1.28	W-40128	25/32	25/32	1 13/16
2 5/8 x 2 5/8 x 1 1/8	1.26	W-40127	25/32	25/32	1 11/16
2 5/8 x 2 5/8 x 1 3/8	1.58	W-40126	1 3/32	1 3/32	1 27/32
2 5/8 x 2 5/8 x 1 5/8	1.58	W-40125	1 3/32	1 3/32	1 21/32
2 5/8 x 2 5/8 x 2 1/8	1.70	W-40124	1 13/32	1 13/32	1 19/32
3 1/8	3.12	W-40152	1 7/8	1 7/8	2 1/32
3 1/8 x 7/8 x 3 1/8	3.28	W-40179	1 13/16	3 1/4	2 3/16
3 1/8 x 1 1/8 x 3 1/8	3.34	W-40178	1 13/16	3 1/4	2 3/16
3 1/8 x 1 3/8 x 3 1/8	3.28	W-40181	1 13/16	2 7/8	2 3/16
3 1/8 x 1 5/8 x 3 1/8	3.31	W-40174	1 13/16	2 29/32	2 3/16
3 1/8 x 2 1/8 x 2 1/8	2.34	W-40164	1 15/32	1 31/32	1 31/32
3 1/8 x 2 1/8 x 2 5/8	3.18	W-40165	1 13/16	2 25/32	2 1/2
3 1/8 x 2 1/8 x 3 1/8	3.31	W-40167	1 13/16	2 21/32	2 3/16
3 1/8 x 2 5/8 x 1 1/8	3.08	W-40154	1 13/16	2 15/32	3 1/4
3 1/8 x 2 5/8 x 1 3/8	3.07	W-40155	1 13/16	2 15/32	2 29/32
3 1/8 x 2 5/8 x 2 1/8	2.34	W-40157	1 15/32	1 27/32	1 31/32
3 1/8 x 2 5/8 x 2 5/8	3.21	W-40158	1 13/16	2 15/32	2 1/2
3 1/8 x 2 5/8 x 3 1/8	3.35	W-40159	1 13/16	2 15/32	3 3/16
3 1/8 x 3 1/8 x 5/8	1.94	W-40145	27/32	27/32	2 3/8
3 1/8 x 3 1/8 x 7/8	1.94	W-40146	27/32	27/32	2 3/16
3 1/8 x 3 1/8 x 1 1/8	1.88	W-40147	27/32	27/32	15/16
3 1/8 x 3 1/8 x 1 3/8	2.44	W-40148	1 15/32	1 15/32	2 7/16
3 1/8 x 3 1/8 x 1 5/8	2.40	W-40149	1 15/32	1 15/32	2 9/32
3 1/8 x 3 1/8 x 2 1/8	2.32	W-40150	1 15/32	1 15/32	1 31/32
3 1/8 x 3 1/8 x 2 5/8	3.34	W-40151	1 13/16	1 13/16	2 1/2
3 5/8	6.57	W-40190	2 17/32	2 17/32	2 17/32
4 1/8	7.89	W-40200	2 13/32	2 13/32	2 17/32
4 1/8 x 1 1/8 x 4 1/8	7.58	W-40213	2 3/8	4 1/4	2 23/32
4 1/8 x 2 1/8 x 2 1/8	7.62	-	2 3/8	4	3 15/16
4 1/8 x 2 1/8 x 4 1/8	7.86	W-40216	2 3/8	4	2 23/32
4 1/8 x 2 5/8 x 2 5/8	7.52	-	2 3/8	3 25/32	3 29/32
4 1/8 x 2 5/8 x 4 1/8	7.84	W-40212	2 3/8	3 25/32	2 23/32
4 1/8 x 3 1/8 x 2 1/8	7.50	W-40204	2 3/8	3 9/16	3 15/16
4 1/8 x 3 1/8 x 2 5/8	7.42	W-40205	2 3/8	3 9/16	3 29/32
4 1/8 x 3 1/8 x 3 1/8	7.43	W-40206	2 3/8	3 9/16	3 1/2
4 1/8 x 3 1/8 x 4 1/8	7.76	W-40208	2 3/8	3 23/32	2 23/32
4 1/8 x 4 1/8 x 5/8	4.42	W-40191	1 3/32	1 3/32	2 7/8
4 1/8 x 4 1/8 x 7/8	4.17	W-40192	1 3/32	1 3/32	2 29/32
4 1/8 x 4 1/8 x 1 1/8	4.45	W-40193	31/32	31/32	2 9/16
4 1/8 x 4 1/8 x 1 3/8	4.60	W-40194	1 11/32	1 11/32	2 7/8
4 1/8 x 4 1/8 x 1 5/8	4.50	W-40195	1 9/32	1 9/32	2 3/4
4 1/8 x 4 1/8 x 2 1/8	4.98	W-40196	1 11/32	1 11/32	2 7/16
4 1/8 x 4 1/8 x 2 5/8	7.78	W-40197	2 3/8	2 3/8	3 29/32
4 1/8 x 4 1/8 x 3 1/8	7.77	W-40198	2 3/8	2 3/8	3 1/2

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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. 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 brass alloy C87850 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% per the Safe Drinking Water Act (Sec. 1417) amended 1-4-2011 and other equivalent state regulations.

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; Wrot Copper and Copper Alloy Solder Joint Pressure Fittings."
2. "The dimensional, material and workmanship shall meet the requirements of MSS SP-104; Wrot 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/ANSI 61."
5. "*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% per the Safe Drinking Water Act (Sec. 1417) amended 1-4-2011 and other equivalent state regulations."

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 ANSI/ASME B16.15."

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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TECH SERVICES PH: 1.888.446.4226 • FAX: 1.888.336.4226 • INTERNATIONAL OFFICE PH: +1.574.295.3327 • FAX: +1.574.295.3455
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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 26.

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 27-28.

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."

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

Copper Tube Fittings continued

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.

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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."

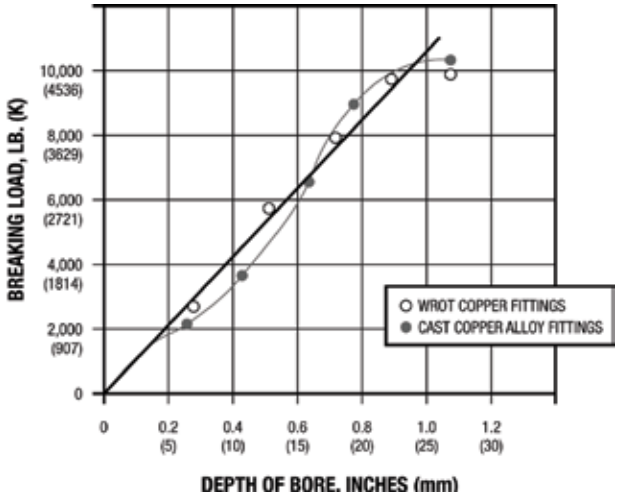
2. **Depth of Solder Penetration** drastically affects the breaking load of the joint. When there is too great a soldering clearance, there is no capillary flow to assure complete solder penetration. As shown in the chart below, the holding power of the 3/4-inch joint is directly proportional to the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

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Copper Tube Fittings continued

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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Copper Tube Fittings continued

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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Copper Fittings Dimensional Data

The mechanics of making both the solder joint and the brazing joint are comparatively similar. Complete instructions on proper techniques of both of these joining methods are outlined in this catalog on pages 26-28.

CAUTION: A very important consideration in Copper Piping is the selection of the proper bonding medium. As a general rule, the working temperature of the installation is a more important consideration than the working pressures. If the working temperature is not over 250°F (121°C), either 50-50%* or 95-5% solder can be used successfully. However, if the temperature exceeds 250°F (121°C), a low temperature brazing alloy should be used, with a melting temperature somewhat in excess of 1000°F (538°C). FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN INSTALLATION ERRORS.

CAUTION: According to BMS report No. 58, joints made with tin or tin-alloy solders should not be subject continuously to temperatures above 250°F (121°C). A number of brazing alloys are available and a careful study should be made in every case to determine the proper alloy for the particular application. **FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN INSTALLATION ERRORS.**

*The Safe Drinking Water Act Amendment of 1986 prohibits the use in potable water systems of any solder having a lead content in excess of 0.2%.

DIMENSIONAL DATA – SOLDER JOINT FITTING ENDS

Nominal Water Tube Size (In Inches)	Solder Joint Fittings – Tolerances: Male End (Fitting Connector) Diameter Min. Inch	(mm)	Male End (Fitting Connector) Diameter Max. Inch	(mm)	Female End (Solder Cup) Diameter Min. Inch	(mm)	Female End (Solder Cup) Diameter Max. Inch	(mm)	Solder Joint Fittings Copper Alloy – Pressure [1, 2] Fitting End Length Min. Inch	(mm)	Solder Cup Length Min. Inch	(mm)	Solder Joint Fittings Copper Alloy – Drainage [3, 4] Fitting End Length Min. Inch	(mm)	Solder Cup Length Min. Inch	(mm)
1/8	0.248	(6.30)	0.251	(6.38)	0.252	(6.40)	0.256	(6.50)	0.31	(7.9)	0.25	(6.4)	N/A	N/A	N/A	N/A
1/4	0.373	(9.47)	0.376	(9.55)	0.377	(9.58)	0.381	(9.68)	0.38	(9.7)	0.31	(7.9)	N/A	N/A	N/A	N/A
3/8	0.497	(12.62)	0.501	(12.73)	0.502	(12.75)	0.506	(12.85)	0.44	(11.2)	0.38	(9.7)	N/A	N/A	N/A	N/A
1/2	0.622	(15.80)	0.626	(15.90)	0.627	(15.93)	0.631	(16.03)	0.56	(14.2)	0.50	(12.7)	N/A	N/A	N/A	N/A
5/8	0.747	(18.97)	0.751	(19.08)	0.752	(19.10)	0.756	(19.20)	0.69	(17.5)	0.62	(15.7)	N/A	N/A	N/A	N/A
3/4	0.872	(22.15)	0.876	(22.25)	0.877	(22.28)	0.881	(22.38)	0.81	(20.6)	0.75	(19.1)	N/A	N/A	N/A	N/A
1	1.122	(28.50)	1.127	(28.63)	1.128	(28.65)	1.132	(28.75)	0.97	(24.6)	0.91	(23.1)	N/A	N/A	N/A	N/A
1 1/4	1.372	(34.85)	1.377	(34.98)	1.378	(35.00)	1.382	(35.10)	1.03	(26.2)	0.97	(24.6)	0.56	(14.2)	0.50	(12.7)
1 1/2	1.621	(41.17)	1.627	(41.33)	1.628	(41.35)	1.633	(41.48)	1.16	(29.5)	1.09	(27.7)	0.62	(15.7)	0.56	(14.2)
2	2.121	(53.87)	2.127	(54.03)	2.128	(54.05)	2.133	(54.18)	1.41	(35.8)	1.34	(34.0)	0.69	(17.5)	0.62	(15.7)
2 1/2	2.621	(66.57)	2.627	(66.73)	2.628	(66.75)	2.633	(66.88)	1.53	(38.9)	1.47	(37.3)	N/A	N/A	N/A	N/A
3	3.121	(79.27)	3.127	(79.43)	3.128	(79.45)	3.133	(79.58)	1.72	(43.7)	1.66	(42.2)	0.81	(20.6)	0.75	(19.1)
3 1/2	3.621	(91.97)	3.627	(92.13)	3.628	(92.15)	3.633	(92.28)	1.97	(50.0)	1.91	(48.5)	N/A	N/A	N/A	N/A
4	4.121	(104.67)	4.127	(104.83)	4.128	(104.85)	4.133	(104.98)	2.22	(56.4)	2.16	(54.9)	1.06	(26.9)	1.00	(25.4)
5	5.121	(130.07)	5.127	(130.23)	5.128	(130.25)	5.133	(130.38)	2.72	(69.1)	2.66	(67.6)	1.31	(33.3)	1.25	(31.8)
6	6.121	(155.47)	6.127	(155.63)	6.128	(155.65)	3.133	(79.58)	3.22	(81.8)	3.09	(78.5)	1.62	(41.1)	1.50	(38.1)
8	8.119	(206.22)	8.127	(206.43)	8.128	(206.45)	8.133	(206.58)	4.09	(103.9)	3.97	(100.8)	2.12	(53.8)	2.00	(50.8)
10	10.119	(257.02)	10.127	(257.23)	10.128	(257.25)	10.133	(257.38)	4.12	(104.6)	4.00	(101.6)	N/A	N/A	N/A	N/A
12	12.119	(307.82)	12.127	(308.03)	12.128	(308.05)	12.133	(308.18)	4.62	(117.3)	4.50	(114.3)	N/A	N/A	N/A	N/A

1 As shown Standard ASME B16.18
2 As shown Standard ASME B16.22
3 As shown Standard ASME B16.23
4 As shown Standard ASME B16.29

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DIMENSIONAL DATA – BRAZING FITTING ENDS

Nominal Water Tube Size (In Inches)	Male End (Fitting Connector) Diameter				Female End (Brazing Cup) Diameter				Fitting End Length Min.		Solder Cup Length Min.	
	Min.		Max.		Min.		Max.					
	Inch	(mm)	Inch	(mm)	Inch	(mm)	Inch	(mm)	Inch	(mm)	Inch	(mm)
1/4	0.373	(9.47)	0.376	(9.55)	0.377	(9.58)	0.381	(9.68)	0.23	(5.8)	0.17	(4.3)
3/8	0.497	(12.62)	0.501	(12.73)	0.502	(12.75)	0.506	(12.85)	0.26	(6.6)	0.20	(5.1)
1/2	0.622	(15.80)	0.626	(15.90)	0.627	(15.93)	0.631	(16.03)	0.28	(7.1)	0.22	(5.6)
5/8	0.747	(18.97)	0.751	(19.08)	0.752	(19.10)	0.756	(19.20)	N/A	N/A	N/A	N/A
3/4	0.872	(22.15)	0.876	(22.25)	0.877	(22.28)	0.881	(22.38)	0.31	(7.9)	0.25	(6.4)
1	1.122	(28.50)	1.127	(28.63)	1.128	(28.65)	1.132	(28.75)	0.34	(8.6)	0.28	(7.1)
1 1/4	1.372	(34.85)	1.377	(34.98)	1.378	(35.00)	1.382	(35.10)	0.37	(9.4)	0.31	(7.9)
1 1/2	1.621	(41.17)	1.627	(41.33)	1.628	(41.35)	1.633	(41.48)	0.40	(10.2)	0.34	(8.6)
2	2.121	(53.87)	2.127	(54.03)	2.128	(54.05)	2.133	(54.18)	0.47	(11.9)	0.40	(10.2)
2 1/2	2.621	(66.57)	2.627	(66.73)	2.628	(66.75)	2.633	(66.88)	0.53	(13.5)	0.47	(11.9)
3	3.121	(79.27)	3.127	(79.43)	3.128	(79.45)	3.133	(79.58)	0.59	(15.0)	0.53	(13.5)
3 1/2	3.621	(91.97)	3.627	(92.13)	3.628	(92.15)	3.633	(92.28)	0.65	(16.5)	0.59	(15.0)
4	4.121	(104.67)	4.127	(104.83)	4.128	(104.85)	4.133	(104.98)	0.72	(18.3)	0.64	(16.3)
5	5.121	(130.07)	5.127	(130.23)	5.128	(130.25)	5.133	(130.38)	0.81	(20.6)	0.73	(18.5)
6	6.121	(155.47)	6.127	(155.63)	6.128	(155.65)	3.133	(79.58)	0.94	(23.9)	0.83	(21.1)
8	8.119	(206.22)	8.127	(206.43)	8.128	(206.45)	8.133	(206.58)	1.28	(32.5)	1.17	(29.7)
10	10.119	(257.02)	10.127	(257.23)	10.128	(257.25)	10.133	(257.38)	N/A	N/A	N/A	N/A
12	12.119	(307.82)	12.127	(308.03)	12.128	(308.05)	12.133	(308.18)	N/A	N/A	N/A	N/A

[1] In accordance with MS SP-73

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www.nibco.com

EXPANSION AND CONTRACTION

In the majority of low-pressure heating systems employing copper tube and installed in small houses or private dwellings, provision for expansion and contraction is relatively simple. Mains, risers, and branches to radiators should be free or floating at one end of the line. Holes should be large enough to permit free movement of the tube, and care should be exercised so that pipe hangers and supports permit unrestricted movement and do not anchor the tube. Wrot copper tube hangers that are both practicable and neat in appearance are available.

Unusually long runs of copper tubing should be provided with an expansion bend or loop. By bending soft temper copper tube, a simple form of expansion loop can be made. With the addition of combination flared-tube to solder joint fittings, as illustrated in Figure 1, these types of loops can be used when space or other limitations exist. The correct proportions of such expansion loop to meet various conditions are shown in the accompanying table.

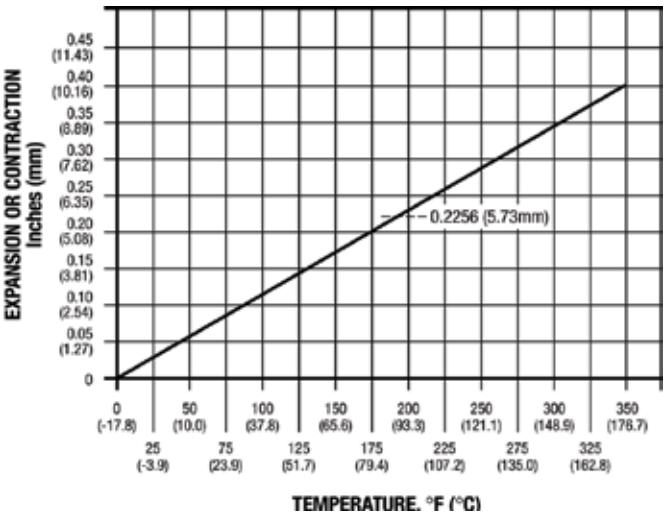
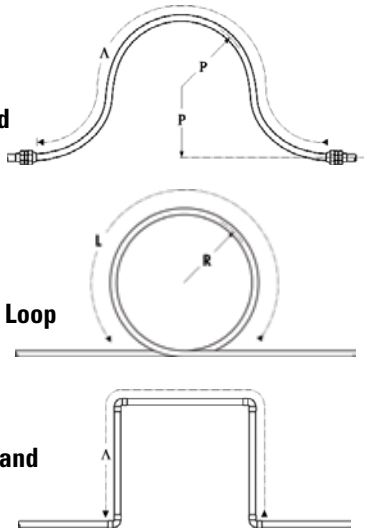


FIGURE 1



The above chart is calculated using 10ft (3.05m) of copper tubing as the reference point. You may use it as follows: 100ft (30.5m) of copper tube, with a 200°F (93.3°C) temperature change. Reference point .2256 inches for 10ft, (5.73mm for 3.05m), multipy by 10 for 100ft (30.5m), resulting in an answer of 2.256 inches (57.3mm) of expansion or contraction.

NOTE: Calculations for expansion and contraction should be based on the average coefficient of expansion of copper which is 0.0000094 per °F (0.00001692 per °C) between 77°F and 212°F (25°C and 100°C). For example, the expansion for each 10ft (3.05m) of any size of tube heated from room temperature of 70°F (21.1°C) to 170°F (76.7°C), that is, 100°F (55.6°C) rise, is:

Rise						Coefficient		
100°F (55.6°C)	x	10ft (3.05m)	x	12 inches (1000mm)	x	0.000094 (0.00001692)	=	0.1128 in. (2.87mm)

RADII OF COILED EXPANSION LOOPS AND DEVELOPED LENGTHS OF EXPANSION OFFSETS

Nominal Tube Size	Expected Expansion																			
	1/2		1		1 1/2		2		2 1/2		3		3 1/2		4					
	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L				
	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)	Inch (mm)					
1/4	6 (152.4)	38 (965.2)	9 (228.6)	54 (1371.6)	11 (279.4)	66 (1676.4)	12 (304.8)	77 (1955.8)	14 (355.6)	86 (2184.4)	15 (381.0)	94 (2387.6)	16 (406.4)	102 (2590.8)	17 (431.8)	109 (2768.6)				
3/8	7 (177.8)	44 (1117.6)	10 (254.0)	63 (1600.2)	12 (304.8)	77 (1955.8)	14 (355.6)	89 (2260.6)	16 (406.4)	99 (2514.6)	17 (431.8)	109 (2768.6)	19 (482.6)	117 (2971.8)	20 (508.0)	126 (3200.4)				
1/2	8 (203.2)	50 (1270.0)	11 (279.4)	70 (1778.0)	14 (355.6)	89 (2260.6)	16 (406.4)	99 (2514.6)	18 (457.2)	111 (2819.4)	19 (482.6)	122 (3098.8)	21 (533.4)	131 (3327.4)	22 (558.8)	140 (3556.0)				
3/4	9 (228.6)	59 (1498.6)	13 (330.2)	83 (2108.2)	16 (406.4)	101 (2565.4)	19 (482.6)	117 (2971.8)	21 (533.4)	131 (3327.4)	23 (584.2)	143 (3632.2)	25 (635.0)	155 (3937.0)	26 (660.4)	166 (4216.4)				
1	11 (279.4)	67 (1701.8)	15 (381.0)	94 (2387.6)	18 (457.2)	115 (2921.0)	21 (533.4)	133 (3378.2)	24 (609.6)	149 (3784.6)	26 (660.4)	163 (4140.2)	28 (711.2)	176 (4470.4)	30 (762.0)	188 (4775.2)				
1 1/2	13 (330.2)	80 (2032.0)	18 (457.2)	113 (2870.2)	22 (558.8)	138 (3505.2)	25 (635.0)	160 (4064.0)	29 (736.6)	179 (4546.6)	31 (787.4)	196 (4978.4)	34 (863.6)	212 (5384.8)	36 (914.4)	226 (5740.4)				
2	15 (381.0)	91 (2311.4)	21 (533.4)	129 (3276.6)	25 (635.0)	158 (4013.2)	29 (736.6)	183 (4648.2)	33 (838.2)	205 (5207.0)	36 (914.4)	224 (5689.6)	39 (990.6)	242 (6146.8)	41 (1041.4)	259 (6578.6)				
2 1/2	16 (406.4)	102 (2590.8)	23 (584.2)	144 (3657.6)	28 (711.2)	176 (4470.4)	32 (812.8)	203 (5156.2)	36 (914.4)	227 (5765.8)	40 (1016.0)	249 (6324.6)	43 (1092.2)	269 (6832.6)	46 (1168.4)	288 (7315.2)				
3	18 (457.2)	111 (2819.4)	25 (635.0)	157 (3987.8)	30 (762.0)	191 (4851.4)	35 (889.0)	222 (5638.8)	40 (1016.0)	248 (6299.2)	43 (1092.2)	272 (6908.8)	47 (1193.8)	293 (7442.2)	50 (1270.0)	314 (7975.6)				
3 1/2	19 (482.6)	120 (3048.0)	27 (685.8)	169 (4292.6)	33 (838.2)	206 (5232.4)	38 (965.2)	239 (6070.6)	43 (1092.2)	267 (6781.8)	47 (1193.8)	293 (7442.2)	50 (1270.0)	316 (8026.4)	54 (1371.6)	338 (8585.2)				
4	20 (508.0)	128 (3251.2)	29 (736.6)	180 (4572.0)	35 (889.0)	220 (5588.0)	41 (1041.4)	255 (6477.0)	45 (1143.0)	285 (7239.0)	50 (1270.0)	312 (7924.8)	54 (1371.6)	337 (8559.8)	57 (1447.8)	361 (9169.4)				
5	23 (584.2)	142 (3606.8)	32 (812.8)	201 (5105.4)	39 (990.6)	245 (6223.0)	45 (1143.0)	284 (7213.6)	51 (1295.4)	318 (8077.2)	55 (1397.0)	348 (8839.2)	60 (1524.0)	376 (9550.4)	64 (1625.6)	402(10210.8)				

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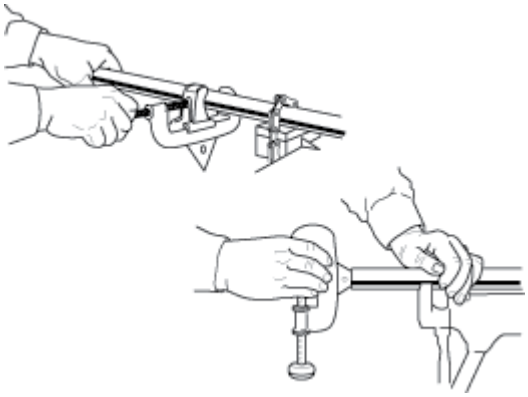
The Fine Art of Soldering

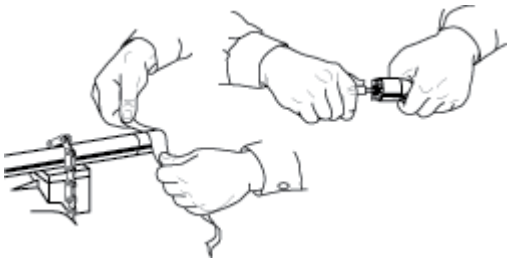
When adjoining surfaces of copper and copper alloys meet under proper conditions of cleanliness and temperature, solder will make a perfect adhesion. The strength of joint is equal to or even greater than the strength of tube alone. Surface tension seals the joint. Capillary attraction draws solder into, around, and all about the joint. It's easy to learn to make a perfect solder joint when you use NIBCO® Fittings.

WITH 95-5 SOLDER AND INTERMEDIATELY CORROSIVE FLUX

1. Cut tube end square, ream, burr and size.



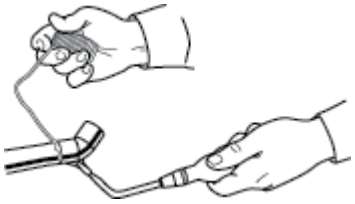
2. Use sand cloth or steel wire brush to clean tube and cup to a bright metal finish.



3. Apply solder flux to outside of tube and inside of cup of fitting carefully so that surfaces to be joined are completely covered. **Use flux sparingly.**

4. Apply flame to the fitting to heat tube and solder cup of fitting until solder melts when placed at joint of tube and fitting.

5. Remove flame and feed solder into the joint at one or two points until a ring of solder appears at the end of the fitting. The correct amount of solder is approximately equal to $1\frac{1}{2}$ the diameter of the fitting… $\frac{3}{4}$" (20mm) solder for $\frac{1}{2}$" fitting, etc.



6. Remove excess solder with a small brush or wiping cloth while the solder is plastic.

NOTE: The installer is responsible for proper soldering and installation and must follow industry best practices when soldering components.

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The Fine Art of Brazing

Best results will be obtained by a skilled operator employing the step-by-step brazing technique that follows:

1. The tube should be cut to desired length with a square cut, preferably in a square-end sawing vise. The cutting wheel of the type specifically designed for cutting copper tube will also do a satisfactory job. The tube should be the exact length needed, so that the tube will enter the cup of the fitting all the way to the shoulder of the cup. Remove all slivers and burrs left from cutting the tube, by reaming and filing, both inside and outside.

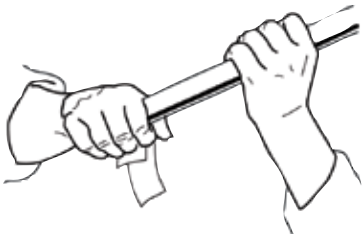
2. To make a proper brazing joint, the clearance between the solder cup and the tube should be approximately 0.001" to 0.010" (0.0254mm to 0.254mm). Maintaining a good fit on parts to be brazed insures:

   Ease of Application — Excessively wide tolerances tend to break capillary force; and, as a result the alloy will either fail to flow throughout the joint or may flush out of the joint.

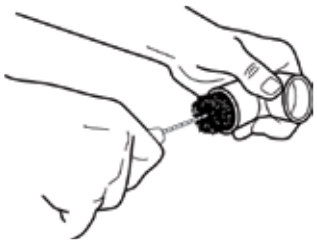
   Corrosion Resistance — There is also a direct relation between the corrosion resistance of a joint and the clearance between members.

   Economy — If brazing alloys are to be used economically, they, of necessity, must be applied in the joint proper and in minimum quantities, using merely enough alloy to fill the area between the members.

3. The surfaces to be joined must be clean and free from oil, grease and heavy oxides. The end of the tube need be cleaned only for a distance slightly more than it is to enter the cup. Special wire brushes designed to clean tube ends may be used, but they should be carefully used so that an excessive amount of metal will not be removed from the tube. Fine sand cloth or emery cloth may also be used with the same precautions. The cleaning should not be done with steel wool, because of the likelihood of leaving small slivers of the steel or oil in the joint.



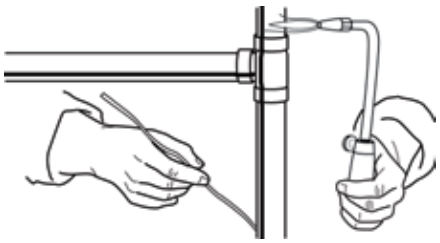
4. The cup of the fitting should be cleaned by methods similar to those used for the tube end, and care should be observed in removing residues of the cleaning medium. Attempting to braze a contaminated or an improperly cleaned surface will result in an unsatisfactory joint. Brazing alloys will not flow over or bond to oxides; and oily or greasy surfaces tend to repel fluxes, leaving bare spots which will oxidize, resulting in voids and inclusions.



5. Flux should be applied to the tube and solder cup sparingly and in a fairly thin consistency. Avoid flux on areas not cleaned. Particularly avoid getting excess flux into the inside of the tube itself. Flux has three principal functions to perform:

   A. It prevents the oxidation of the metal surfaces during the heating operation by excluding oxygen.
   B. It absorbs and dissolves residual oxides that are on the surface and those oxides which may form during the heating operation.
   C. It assists in the flow of the alloy by presenting a clean nascent surface for the melted alloy to flow over. In addition, it is an excellent temperature indicator, especially if an indicating flux is used.

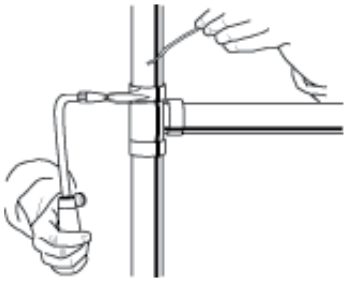
6. Immediately after fluxing, the parts to be brazed should be assembled. If fluxed parts are allowed to stand, the water in the flux will evaporate, and dried flux is liable to flake off, exposing the metal surfaces to oxidation from the heat. Assemble the joint by inserting the tube into the cup, hard against the stop. The assembly should be firmly supported so that it will remain in alignment during the brazing operation.



NOTE: The installer is responsible for proper brazing and installation and must follow industry best practices when brazing components.

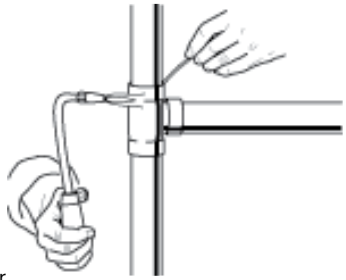
7. Brazing is started by applying heat to the parts to be joined. The preferred method is by the oxyacetylene flame. Propane and other gases are sometimes used on smaller sizes. A slightly reducing flame should be used, with a slight feather on the inner blue cone; the outer portion of the flame, pale green. Heat the tube first, beginning at about one inch from the edge of the fitting. Sweep the flames around the tube in short strokes up and down at right angles to the run of the tube. It is very important that the flame be in continuous motion and should not be allowed to remain on any one point to avoid burning through the tube. Generally, the flux may be used as a guide as to how long to heat the tube, continuing heating after the flux starts to bubble or work, and until the flux becomes quiet and transparent, like clear water. The flux will pass through four stages:
   A. At 212°F (100°C) the water boils off.
   B. At 600°F (315.6°C) the flux becomes white and slightly puffy and starts to work.
   C. At 800°F (426.7°C) it lays against the surface and has a milky appearance.
   D. At 1100°F (593.3°C) it is completely clear and active and has the appearance of water.

8. Now switch the flame to the fitting at the base of the cup. Heat uniformly, sweeping the flame from the fitting to the tube until the flux on the fitting becomes quiet. Avoid excessive heating of cast fittings.

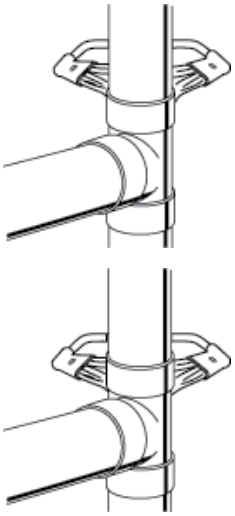


9. When the flux appears liquid and transparent on both the tube and the fitting, start sweeping the flame back and forth along the axis of the joint to maintain heat on the parts to be joined, especially toward the base of the cup of the fitting. The flame must be kept moving to avoid burning the tube or the fitting.

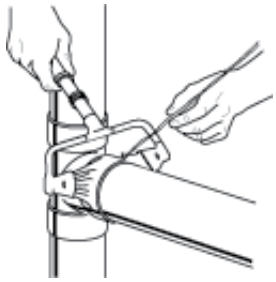
10. Apply the brazing wire or rod at a point where the tube enters the socket of the fitting. The temperature of the joint should be hot enough to melt the brazing alloy. Keep the flame away from the rod or wire as it is fed into the joint. Keep both the fitting and the tube heated by moving the flame back and forth from one to the other as the alloy is drawn into the joint. When the proper temperature is reached, the alloy will flow readily into the space between the tube outer wall and the fitting socket, drawn in by the natural force of capillary attraction. When the joint is filled, a continuous fillet of brazing alloy will be visible completely around the joint. Stop feeding as soon as the joint is filled.



NOTE: For tubing one inch and larger, it is difficult to bring the whole joint up to heat at one time. It frequently will be found desirable to use a double-tip torch to maintain the proper temperature over the larger area. A mild pre-heating of the whole fitting is recommended. The heating then can proceed as in steps 7, 8, 9, and 10. If difficulty is encountered in getting the whole joint up to heat at one time, then when the joint is nearly up to the desired temperature the alloy is concentrated in a limited area. At the brazing temperature the alloy is fed into the joint and the torch is then moved to an adjacent area and the operation carried on progressively all around the joint.



HORIZONTAL JOINTS — When making horizontal joints, it is preferable to start applying the brazing alloy at the 5 o'clock position, then move around to the 7 o'clock position and then move up the sides to the top of the joint, making sure that the operations overlap.



VERTICAL JOINTS — On vertical joints, it is immaterial where the start is made. If the opening of the cup is pointed down, care should be taken to avoid overheating the tube, as this may cause the alloy to run down the tube. If this condition is encountered, take the heat away and allow the alloy to set. Then reheat the solder cup of the fitting to draw up the alloy.

After the brazing alloy has set, remove residual flux from the joint area as it is corrosive and presents an unclean appearance and condition. Hot water or steam and a soft cloth should be used. Wrot fittings may be chilled; however it is advisable to allow cast fittings to cool naturally to some extent before applying a swab. All flux must be removed before inspection and pressure testing.

TROUBLE SPOTS

If the alloy fails to flow or has a tendency to ball up, it indicates oxidation on the metal surfaces, or insufficient heat on the parts to be joined. If work starts to oxidize during heating, it indicates too little flux, or a flux of too thin consistency. If the brazing alloy refuses to enter the joint and tends to flow over the outside of either member of the joint, it indicates this member is overheated, or the other is underheated, or both. In both cases, operations should be stopped and the joints disassembled, recleaned and fluxed.

NOTE: The installer is responsible for proper brazing and installation and must follow industry best practices when brazing components.

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Frequently Asked Questions

Q: What is the pressure rating of a given fitting?

A: Fittings are rated per Table 1 of ASME B16.22. The system rated pressure shall be the lowest of the fitting, tube or joint.

Q: When copper fails in a system, what is the problem?

A: MOST COMMON:

1. Velocity – fluid is moving too fast. Recommendation: 2-3 fps (0.0508-0.0762 m/s) hot water 140°F, 5-8 fps (0.127-0.2032 m/s) cold water.
2. Turbulence – burrs left on the cut tubing causes a tumbling effect causing localized erosion and eventual failure.
3. Aggressive Waters – tend to cause pitting or green staining of fixtures. Aggressive, hard well waters that cause pitting typically are found to have total dissolved solids including suflates and chlorides, a pH in the range of 7.2 to 7.8, a high content of carbon dioxide gas and the pressence of dissolved oxygen gas. Soft acidic waters that cause green staining typically tend to be more corrosive. Low alkalinity, low mineralization, pH levels lower than 8 should be avoided.

LESS COMMON:

1. Flux Corrosion – using too much flux when making joints can potentially leave residue and cause isolated corrosion. Flux should be used sparingly and system adequately flushed.
2. Electrolysis – stray (D.C.) current; inadequate grounding for the piping.
3. Sand or other solid particulates – erosion/corrosion problems can occur. Lower velocities must be maintained if solids are present in flow media.
4. Galvanic Corrosion – destruction of a material by electrochemical interaction between the environment and the material.

Q: Copper tubing wall thickness is designated “K,” “L” or “M.” What are the copper fittings applicable to?

A: Copper fittings wall thickness is determined by standards (ASME B16.22 and MSS SP-104). These standards address minimum wall thickness (per size) for the full range of copper fittings and are not intended to match tubing wall thicknesses.

Q: Can dissimilar metals (i.e., copper and iron) be joined together without use of dielectric insulators to prevent corrosion?

A: In most situations dissimilar metals (copper/iron/steel) can be joined successfully without using dielectric insulators. Factors to consider:

1. The composition of the two metals.
2. The rate of liquid flow past the two metals.
3. Chemicals in the water which could enhance or destroy protective films.
4. The relative areas of the two metals - unless the surface area of the less noble (steel) material is less that 5% of the more noble (copper) material, the need for a dielectric separator is not needed. (Failures due to galvanic corrosion are very unusual and only occur under very strict conditions.)
5. Local code requirements.

Q: What should the installer of copper unions know and do in order to assure a proper leak-free installation?

A. The following should be done:

1. Make sure the ground-joint(mating area of union's tail and thread pieces) are free of nicks and scratches.
2. Spray the ground-joint area with a food grade silicone spray or apply bees wax to enhance seating.
3. Make sure alignment of line does not put lateral stress on the ground-joint seal.
4. Make sure that excess solder (droplets) do not reach the ground-joint area.

NIBCO® Copper Fittings Warranty

NIBCO INC. 50 YEAR LIMITED WARRANTY
Applicable to NIBCO INC. Copper Fittings

NIBCO INC. warrants each NIBCO® copper fitting to be free from defects in material and workmanship under normal use and service for a period of fifty (50) years from the date of original installation.

In the event any defect in material or workmanship occurs which the owner believes is covered by this warranty, the owner should immediately contact NIBCO Technical Services, either in writing or by telephone at 1.888.446.4226 or 1.574.295.3000. The owner will be instructed to return said product, at the owner's expense, to NIBCO INC., or to an authorized representative for inspection. In the event said inspection discloses to the satisfaction of NIBCO INC. that said fitting is defective in material or workmanship, it will be replaced at the expense of NIBCO INC. Replacements shall be shipped free of charge to the owner. This warranty is limited to the cost of repairing or replacing the product, including reasonable and customary installation.

TO THE EXTENT PERMITTED BY APPLICABLE LAW, THIS WARRANTY SPECIFICALLY EXCLUDES INCIDENTAL AND CONSEQUENTIAL DAMAGES OF EVERY TYPE AND DESCRIPTION RESULTING FROM ANY CLAIMED DEFECT IN MATERIAL OR WORKMANSHIP, INCLUDING BUT NOT LIMITED TO, PERSONAL INJURIES AND PROPERTY DAMAGES.

Some states do not allow the exclusion or limitations of incidental or consequential damages, so these limitations may not apply to you.

TO THE EXTENT PERMITTED BY APPLICABLE LAW, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE SPECIFICALLY EXLCLUDED.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and country to country.

How to Order

State quantity, figure number and size for each valve or fitting you wish to order. See individual catalog pages for specific or special product designations.

HOW MANY TO ORDER
NIBCO® valves and fittings are decimal packed for your convenience in handling, shipping and stock-keeping. Number in master carton varies with item.

POLICY ON RETURNS TO FACTORY
No NIBCO valves and fittings are to be returned without prior written agreement. Transportation must be prepaid. A 20% charge will be made to cover cost of rehandling and reinspection.

TECHNICAL ASSISTANCE
Engineers, contractors, wholesalers or manufacturers may obtain special or technical assistance from any factory representative of NIBCO. Write, fax or phone.

NIBCO INC.
World Headquarters
1516 Middlebury Street
Elkhart, IN 46516-4740
USA

PH: 1.574.295.3000 or 1.888.446.4226
FAX: 1.574.295.3307 or 1.888.336.4226

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ISO 9001 BUREAU VERITAS Certification

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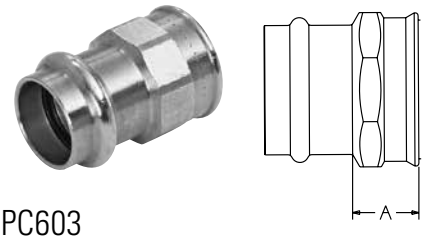
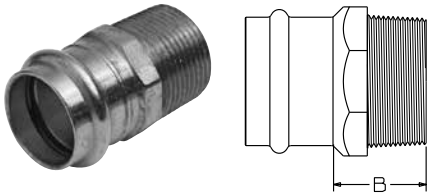
ADAPTERS



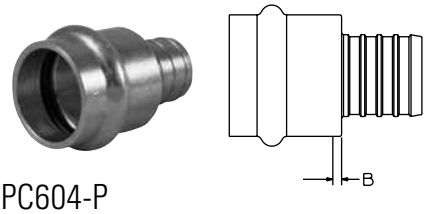
PC603
Adapter P x F – Wrot

NOM. SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
1/2	.097	13/16
1/2 x 3/8	.081	21/32
1/2 x 3/4	.151	31/32
3/4	.162	27/32
3/4 x 1/2	.153	25/32
1	.237	15/16
1 x 1/2	.129	3/4
1 x 3/4	.217	13/16
1 x 1 1/4	.436	2 1/4
1 1/4	.372	1 1/16
1 1/4 x 1	.302	1 1/16
1 1/4 x 1 1/2	.602	2 11/32
1 1/2	.518	1 1/16
1 1/2 x 1 1/4	.648	1
2	.714	1
2 1/2	1.222	1 13/32
3	1.884	1 23/32
4	3.238	1 7/8



PC604
Adapter P x M – Wrot

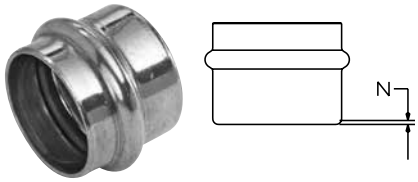
NOM. SIZE	APPROX. NET WT./LBS.	DIM. B INCHES
1/2	.106	7/8
1/2 x 3/8	.105	27/32
1/2 x 3/4	.248	1 1/4
3/4	.195	1 1/16
3/4 x 1/2	.189	31/32
1	.268	1 3/32
1 x 3/4	.253	1 1/32
1 x 1 1/4	.662	1 17/32
1 1/4	.467	1 13/32
1 1/4 x 1	.408	1 3/16
1 1/4 x 1 1/2	.630	1 1/2
1 1/2	.696	1 1/2
1 1/2 x 1 1/4	.670	1 3/8
2	.927	1 7/16
2 1/2	1.322	1 27/32
3	2.104	2 1/8
4	3.298	2 9/32



PC604-P
Adapter PEX x P – Wrot

NOM. SIZE	APPROX. NET WT./LBS.	DIM. B INCHES
1/2 x 1/2	.055	1/8
1/2 x 3/4	.108	13/64
3/4 x 1/2	.150	5/64
3/4 x 3/4	.108	5/32
1 x 1	.148	11/64

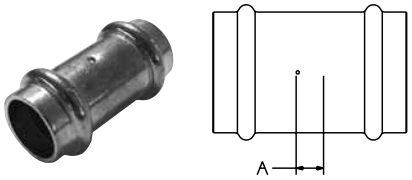
CAPS



PC617
Cap P – Wrot

NOM. SIZE	APPROX. NET WT./LBS.	DIM. N INCHES
1/2	.046	5/32
3/4	.091	5/32
1	.125	1/8
1 1/4	.171	1/8
1 1/2	.314	3/16
2	.493	3/16
2 1/2	.476	7/32
3	.713	7/32
4	1.491	1/4

COUPLINGS

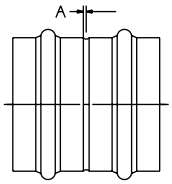


PC600-DS
Coupling P x P – Wrot

NOM. SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
1/2	.080	3/16
3/4	.153	5/32
1	.190	5/32
1 1/4	.250	5/32
1 1/2	.511	3/16
2	.741	3/16
2 1/2	.669	1/8
3	.979	1/8
4	1.969	7/32

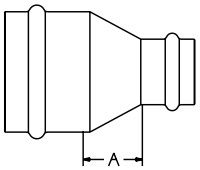
NOTE: Some items not certified by NSF to NSF/ANSI 61. See manufacturer's listing for approved sizes and applications, or contact NIBCO Technical Services for a complete listing of current certifications.

COUPLINGS (Cont.)

PC600-RS
Coupling P x P – Wrot

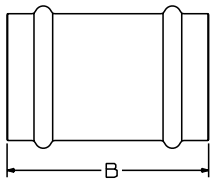
NOM. SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
2 1/2	.688	1/16
3	.979	1/16
4	1.969	1/8

PC600-R
Reducing Coupling P x P – Wrot

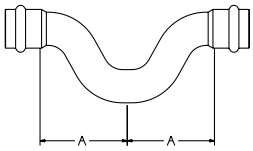
NOM. SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
3/4 x 1/2	.116	11/32
1 x 1/2	.159	11/32
1 x 3/4	.184	7/16
1 1/4 x 3/4	.245	5/16
1 1/4 x 1	.231	1/2
1 1/2 x 3/4	.382	1/2
1 1/2 x 1	.370	13/32
1 1/2 x 1 1/4	.399	1/14
2 x 3/4	.516	27/32
2 x 1	.552	11/16
2 x 1 1/4	.570	11/16
2 x 1 1/2	.662	7/16
2 1/2 x 1	.594	29/32
2 1/2 x 1 1/4	.587	13/16
2 1/2 x 1 1/2	.697	11/16
2 1/2 x 2	.735	9/16
3 x 1 1/2	.938	1 1/32
3 x 2	1.002	31/32
3 x 2 1/2	.951	1/2
4 x 2	1.935	1 1/4
4 x 2 1/2	1.807	1
4 x 3	1.960	27/32

COUPLINGS (Cont.)

PC601 (No Stop)
Repair Coupling P x P – Wrot

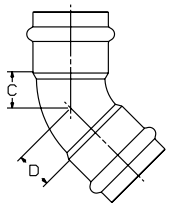
NOM. SIZE	APPROX. NET WT./LBS.	DIM. B INCHES
1/2	.080	1 3/4
3/4	.151	2 1/4
1	.190	2 1/4
1 1/4	.250	2 15/32
1 1/2	.511	3 11/32
2	.741	3 5/8
2 1/2	669	2 15/16
3	.979	3 5/16
4	1.878	4 5/16

PC636
Crossover Coupling P x P – Wrot

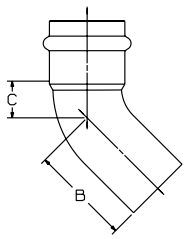
NOM. SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
1/2	0.402	1 29/32
3/4	.402	2 1/4

ELBOWS

PC606
45° Elbow P x P – Wrot

NOM. SIZE	APPROX. NET WT./LBS.	DIM. C INCHES	DIM. D INCHES
1/2	.092	25/64	25/64
3/4	.204	31/64	31/64
1	.251	5/8	5/8
1 1/4	.378	25/32	25/32
1 1/2	.666	7/8	7/8
2	1.096	1 11/64	1 11/64
2 1/2	1.041	29/32	29/32
3	1.536	1 1/8	1 1/8
4	3.375	1 11/16	1 11/16

PC606-2
45° Elbow Ftg x P – Wrot

NOM. SIZE	APPROX. NET WT/LBS.	DIM. B INCHES	DIM. C INCHES
1/2	.086	1 11/32	11/32
3/4	.174	1 15/32	9/16
1	.248	1 19/32	9/16
1 1/4	.368	1 27/32	11/16
1 1/2	.673	2 3/8	7/8
2	1.098	2 5/8	1 3/32
2 1/2	1.050	2 3/16	29/32
3	1.526	2 19/32	1 5/32
4	3.284	3 3/32	1 1/2

NOTE: Some items not certified by NSF to NSF/ANSI 61. See manufacturer's listing for approved sizes and applications, or contact NIBCO Technical Services for a complete listing of current certifications.

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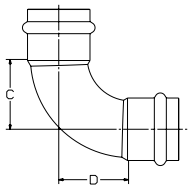
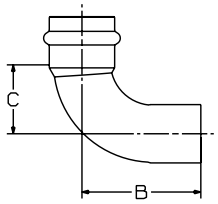
ELBOWS *(Cont.)*

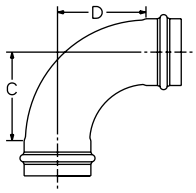
PC607
90° Elbow P x P – Wrot

NOM. SIZE	APPROX. NET WT./LBS.	DIM. C INCHES	DIM. D INCHES
1/2	.135	1 3/32	1 3/32
3/4	.223	1 5/64	1 5/64
3/4 x 1/2	.190	1 3/16	1 1/16
1	.323	1 7/16	1 7/16
1 1/4	.554	1 11/16	1 11/16
1 1/2	.863	2 13/64	2 13/64
2	1.562	2 15/16	2 15/16
2 1/2	1.224	1 27/32	1 27/32
3	1.998	2 3/32	2 3/32
4	4.060	2 25/32	2 25/32

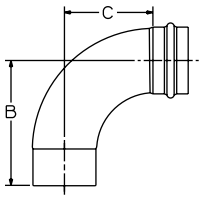
PC607-2
90° Elbow Ftg x P – Wrot

NOM. SIZE	APPROX. NET WT/LBS.	DIM. B INCHES	DIM. C INCHES
1/2	.125	1 23/32	25/32
3/4	.212	2 13/64	1 3/64
1	.319	2 1/2	1 13/32
1 1/4	.490	2 31/32	1 7/8
1 1/2	.871	3 21/32	2 1/4
2	1.622	4 15/32	2 15/16
2 1/2	1.356	3 15/32	1 29/32
3	2.065	3 13/16	2 3/32
4	3.920	4 3/4	2 25/32

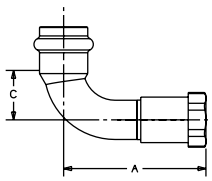
PC607-LT
90° Long Radius Elbow
P x P – Wrot

NOM. SIZE	APPROX. NET WT/LBS.	DIM. C INCHES	DIM. D INCHES
2 1/2	2.066	3 11/16	3 11/16
3	3.037	4 1/32	4 1/32
4	5.696	5 1/4	5 1/4

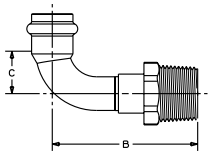
PC607-2-LT
90° Long Radius Elbow
Ftg x P - Wrot

NOM. SIZE	APPROX. NET WT/LBS.	DIM. B INCHES	DIM. C INCHES
2 1/2	2.114	5 7/32	3 11/16
3	3.037	5 3/4	4 1/32

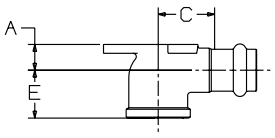
PC607-3
90° Elbow P x F - Wrot

NOM. SIZE	APPROX. NET WT/LBS.	DIM. A INCHES	DIM. C INCHES
1/2	.213	2 13/16	1 3/32
1/2 x 3/8	.148	2 1/4	25/32
1/2 x 3/4	.243	2 13/16	1 3/64
3/4	.361	3 21/64	1 3/64
3/4 x 1/2	.316	2 13/16	1 3/64
1	.513	3 15/32	1 13/32
1 1/4	.877	4 3/16	1 27/32
1 1/2	1.276	5 5/64	2 7/32
2	2.033	5 21/32	2 15/16

PC607-4
90° Elbow P x M - Wrot

NOM. SIZE	APPROX. NET WT/LBS.	DIM. B INCHES	DIM. C INCHES
1/2	.197	2 5/64	23/32
1/2 x 3/4	.245	2 11/16	25/32
3/4	.373	3 1/64	1 3/64
3/4 x 1/2	.340	3 3/64	1 3/64
1	.543	3 25/64	1 27/64
1 1/4	.906	4 1/32	1 27/32
1 1/2	1.433	4 31/32	2 9/32
2	2.080	6 21/32	2 59/64

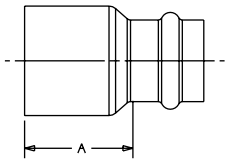
PC707-3-5
90° Drop Elbow P x F – Cast
*Lead Free

NOM. SIZE	APPROX. NET WT. LBS.	DIMENSIONS INCHES A	C	E
1/2	.172	17/32	7/8	27/32
3/4	.316	11/16	1 1/4	31/32

*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% per the Safe Drinking Water Act (Sec. 1417) amended 1-4-2011 and other equivalent state regulations.

NOTE: Some items not certified by NSF to NSF/ANSI 61. See manufacturer's listing for approved sizes and applications, or contact NIBCO Technical Services for a complete listing of current certifications.

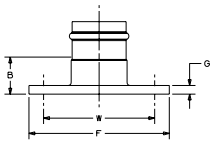
FITTING REDUCERS



PC600-2
Fitting Reducer Ftg x P – Wrot

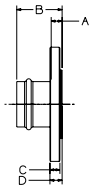
NOM. SIZE	APPROX. NET WT/LBS.	DIM. A INCHES
3/4 x 1/2	.108	1 3/8
1 x 1/2	.133	1 15/32
1 x 3/4	.167	1 1/32
1 1/4 x 3/4	.211	5/16
1 1/4 x 1	.191	1 15/32
1 1/2 x 1/2	.242	37/64
1 1/2 x 3/4	.298	15/32
1 1/2 x 1	.294	1 13/16
1 1/2 x 1 1/4	.311	1 3/4
2 x 1/2	.443	2 1/4
2 x 3/4	.470	3/4
2 x 1	.433	2 7/32
2 X 1 1/4	.459	1 15/16
2 x 1 1/2	.543	1 7/8
2 1/2 x 1	.507	2 11/32
2 1/2 x 1 1/4	.658	2 9/32
2 1/2 x 1 1/2	.806	2 13/32
2 1/2 x 2	.810	1 31/32
3 x 1 1/4	.882	3 9/32
3 x 1 1/2	.812	2 5/8
3 x 2	1.041	2 9/16
3 x 2 1/2	.820	2 1/4
4 x 2	1.670	3 13/32
4 x 2 1/2	1.837	3 1/32
4 x 3	2.013	3 1/32

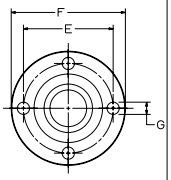
FLANGES



PC741
Companion Flange
P x Flange - Cast Bronze Flange/
Wrot Outlet

NOM. SIZE	APPROX. NET WT. LBS.	DIMENSIONS INCHES B	F	G	W
1	1.419	1 5/32	4 1/4	1/4	3 1/8
1 1/4	1.632	1 5/16	4 5/8	1/4	3 1/2
1 1/2	2.186	1 7/16	5	5/16	3 7/8
2	3.352	1 11/16	6	3/8	4 3/4





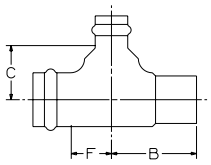
PC641
Companion Flange
P x Flange - Wrot

NOM. SIZE	APPROX. NET WT. LBS.	DIMENSIONS INCHES A	B	C
2 1/2	6.177	19/32	2 25/32	5/8
3	7.554	3/4	2 15/16	21/32
4	11.211	29/32	3 3/8	27/32

NOM. SIZE	DIMENSIONS INCHES D	E	F	G
2 1/2	3/4	5 1/2	7	3/4
3	13/16	6	7 1/2	3/4
4	1	7 1/2	9	3/4

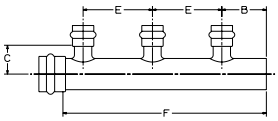
NOTE: 4" requires (8) "G" holes equally spaced.
NOTE: Mates with ANSI Class 125/150 flanges.

MANIFOLDS



PC695
1-Outlet Manifold
P x Ftg x P - Wrot

NOM. SIZE	APPROX. NET WT. LBS.	DIMENSIONS INCHES B	C	F
1 x 1 x 1/2	.504	1 15/16	1 1/8	15/16



PC696
3-Outlet Manifold
P x Ftg x P - Wrot

NOM. SIZE	APPROX. NET WT. LBS.	DIMENSIONS INCHES B	C	E	F
1 x 1 x 1/2	.882	1 21/32	3/4	1 31/32	6 3/8

*See online catalog at www.nibco.com

NOTE: Some items not certified by NSF to NSF/ANSI 61. See manufacturer's listing for approved sizes and applications, or contact NIBCO Technical Services for a complete listing of current certifications.

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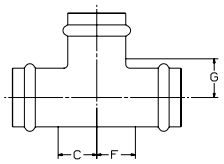
TEES



PC611
Tee P x P x P – Wrot

NOM. SIZE	APPROX. NET WT. LBS.	DIMENSIONS INCHES C	F	G
1/2	.182	11/16	11/16	15/32
1/2 x 1/2 x 3/4	.261	13/16	13/16	5/8
1/2 x 1/2 x 1	.491	17/32	17/32	63/64
3/4	.340	23/32	23/32	5/8
3/4 x 1/2 x 1/2	.329	23/32	13/16	11/16
3/4 x 1/2 x 3/4	.333	23/32	13/16	5/8
3/4 x 3/4 x 1/2	.339	23/32	23/32	11/16
3/4 x 3/4 x 1	.461	13/32	13/32	29/32
1	.486	7/8	7/8	29/32
1 x 1/2 x 1	.513	15/16	13/16	29/32
1 x 3/4 x 1/2	.368	7/8	13/32	13/16
1 x 3/4 x 3/4	.465	7/8	13/32	11/16
1 x 3/4 x 1	.521	7/8	11/8	29/32
1 x 1 x 1/2	.457	7/8	7/8	17/32
1 x 1 x 3/4	.480	27/32	27/32	11/16
1 x 1 x 1 1/4	.723	17/32	17/32	29/32
1 1/4	.714	1	1	29/32
1 1/4 x 1 x 3/4	.753	1	17/32	13/8
1 1/4 x 1 x 1	.725	1	19/64	117/64
1 1/4 x 1 1/4 x 1/2	.747	1	1	17/16
1 1/4 x 1 1/4 x 3/4	.767	1	1	13/8
1 1/4 x 1 1/4 x 1	.690	1	1	1 1/4
1 1/2	1.179	15/16	15/16	13/32
1 1/2 x 1/2 x 1 1/2	1.227	31/32	17/8	1
1 1/2 x 3/4 x 3/4	1.101	61/64	155/64	113/16
1 1/2 x 1 x 3/4	1.101	61/64	111/16	113/16
1 1/2 x 1 x 1	1.105	1	147/64	141/64
1 1/2 x 1 x 1 1/2	1.146	31/32	15/8	1
1 1/2 x 1 1/4 x 1	1.105	61/64	141/64	15/8
1 1/2 x 1 1/4 x 1 1/4	1.160	31/32	17/16	115/32
1 1/2 x 1 1/2 x 1/2	1.209	15/16	15/16	131/32
1 1/2 x 1 1/2 x 3/4	1.070	15/16	15/16	113/16
1 1/2 x 1 1/2 x 1	1.074	15/16	15/16	1 19/32
1 1/2 x 1 1/2 x 1 1/4	1.166	61/64	61/64	111/16
2	1.771	113/32	113/32	113/32
2 x 1/2 x 2	1.663	113/32	23/8	113/32
2 x 1 x 1	1.764	123/64	21/4	27/32
2 x 1 x 2	1.564	113/32	27/32	127/32
2 x 1 1/4 x 1 1/4	1.471	113/32	127/32	17/8
2 x 1 1/2 x 3/4	1.542	113/32	111/16	27/32
2 x 1 1/2 x 1	1.546	113/32	123/32	23/32
2 x 1 1/2 x 1 1/4	1.543	113/32	111/16	21/16
2 x 1 1/2 x 1 1/2	1.670	113/32	123/32	123/32
2 x 2 x 1/2	1.576	113/32	113/32	25/16
2 x 2 x 3/4	1.573	113/32	113/32	29/32
2 x 2 x 1	1.633	113/32	113/32	27/32
2 x 2 x 1 1/4	1.576	113/32	113/32	131/32
2 x 2 x 1 1/2	1.770	11/8	11/8	17/16
2 1/2	2.082	15/8	15/8	15/8
2 1/2 x 3/4 x 2 1/2	2.296	19/16	23/16	17/8
2 1/2 x 1 x 2 1/2	2.297	19/16	219/32	17/8
2 1/2 x 1 1/4 x 2 1/2	2.202	19/16	219/32	17/8
2 1/2 x 1 1/2 x 2 1/2	2.223	19/16	21/4	17/8
2 1/2 x 2 x 3/4	2.233	19/16	21/4	229/32
2 1/2 x 2 x 1	2.090	19/16	21/4	219/32
2 1/2 x 2 x 1 1/4	2.151	19/16	21/4	29/16
2 1/2 x 2 x 1 1/2	2.155	19/16	21/4	25/8
2 1/2 x 2 x 2	2.694	19/16	21/4	21/4
2 1/2 x 2 x 2 1/2	2.282	19/16	21/32	17/8
2 1/2 x 2 1/2 x 1/2	2.296	19/16	19/16	31/16
2 1/2 x 2 1/2 x 3/4	2.029	19/16	19/16	31/16
2 1/2 x 2 1/2 x 1	2.089	19/16	19/16	29/16
2 1/2 x 2 1/2 x 1 1/4	2.066	19/16	19/16	25/8
2 1/2 x 2 1/2 x 1 1/2	2.078	19/16	19/16	25/8
2 1/2 x 2 1/2 x 2	2.531	19/16	19/16	27/32
3	3.122	17/8	17/8	21/32
3 x 3/4 x 3	3.136	113/16	31/4	23/16
3 x 1 x 3	3.146	113/16	39/32	23/16
3 x 1 1/4 x 3	3.070	113/16	27/8	23/16
3 x 1 1/2 x 3	3.110	113/16	215/16	23/16
3 x 2 x 2	3.158	113/16	213/16	225/32
3 x 2 x 2 1/2	3.089	113/16	213/16	21/2
3 x 2 x 3	3.164	113/16	211/16	23/16
3 x 2 1/2 x 2	3.153	113/16	215/32	225/32
3 x 2 1/2 x 2 1/2	3.010	113/16	215/32	21/2
3 x 2 1/2 x 3	3.194	113/16	215/32	23/16
3 x 3 x 1/2	2.891	113/16	113/16	33/8
3 x 3 x 3/4	2.462	113/16	113/16	313/32
3 x 3 x 1	2.978	113/16	113/16	31/4
3 x 3 x 1 1/4	2.963	113/16	113/16	215/16
3 x 3 x 1 1/2	3.006	113/16	113/16	3
3 x 3 x 2	3.113	113/16	113/16	215/32
3 x 3 x 2 1/2	3.034	129/32	129/32	23/8
4	7.169	213/32	213/32	217/32
4 x 2 x 4	7.332	23/8	41/32	223/32
4 x 2 1/2 x 4	6.984	23/8	325/32	223/32
4 x 3 x 2	7.160	23/8	39/16	33/4
4 x 3 x 2 1/2	6.990	23/8	39/16	329/32
4 x 3 x 3	7.085	23/8	39/16	31/2
4 x 3 x 4	6.993	23/8	323/32	223/32
4 x 4 x 1/2	6.770	23/8	23/8	415/32
4 x 4 x 3/4	6.756	23/8	23/8	41/8
4 x 4 x 1	6.929	23/8	23/8	45/32
4 x 4 x 1 1/4	6.902	23/8	23/8	41/32
4 x 4 x 1 1/2	7.099	23/8	23/8	33/4
4 x 4 x 2	7.072	23/8	23/8	315/16
4 x 4 x 2 1/2	6.925	23/8	23/8	329/32
4 x 4 x 3	7.083	23/8	23/8	31/2

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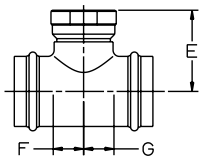
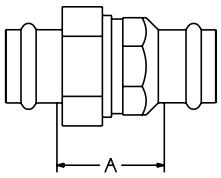
TEES *(Cont.)*



PC612
Tee P x P x F – Wrot

NOM. SIZE	APPROX. NET WT. LBS.	DIMENSIONS INCHES E	F	G
1/2	.266	1 31/32	11/16	11/16
3/4 x 3/4 x 1/2	.423	2 5/8	23/32	23/32
1 x 1 x 1/2	.541	2 11/16	7/8	7/8
1 x 1 x 3/4	.673	2 27/32	27/32	27/32
1 1/4 x 1 1/4 x 1/2	.832	2 7/8	1	1
1 1/4 x 1 1/4 x 3/4	.922	3 1/16	1	1
1 1/2 x 1 1/2 x 1/2	1.141	3 19/64	15/16	15/16
1 1/2 x 1 1/2 x 3/4	1.291	3 3/8	31/32	31/32
2 x 2 x 1/2	1.699	3 13/16	1 13/32	1 13/32
2 x 2 x 3/4	1.693	3 31/32	1 13/32	1 13/32
2 1/2 x 2 1/2 x 3/4	1.049	2 15/32	11/16	11/16
2 1/2 x 2 1/2 x 2	1.925	3 7/32	1 9/32	1 9/32
3 x 3 x 3/4	1.435	2 3/4	11/16	11/16
3 x 3 x 2	2.097	3 15/32	1 9/32	1 9/32
4 x 4 x 3/4	2.786	3 1/4	11/16	11/16
4 x 4 x 2	3.675	4	1 9/32	1 9/32

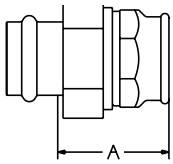
UNIONS



PC633
Union P x P – Wrot

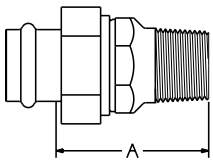
NOM. SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
1/2	.383	1 5/16
3/4	.590	1 9/32
1	.850	1 11/32
1 1/4	1.126	1 37/64
1 1/2	1.723	1 5/8
2	2.627	1 27/32

UNIONS *(Cont.)*



PC633-3
Union P x F – Wrot

NOM. SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
1/2	.374	1 7/16
3/4	.559	1 17/32
1	.918	1 39/64
1 1/4	1.608	1 15/16
1 1/2	1.187	1 29/32
2	2.445	2 11/64



PC633-4
Union P x M – Wrot

NOM. SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
1/2	.397	1 13/16
3/4	.574	1 29/32
1	.904	2 5/32
1 1/4	1.287	2 25/64
1 1/2	1.769	2 11/32
2	2.789	2 49/64

ACCESSORIES

EPDM Seal **(leak detection)**

SIZE	PART No.	
1/2	T048352	Leak Detect
3/4	T048354	Leak Detect
1	T048356	Leak Detect
1 1/4	T048358	Leak Detect
1 1/2	T048360	Leak Detect
2	T048362	Leak Detect

EPDM Seal (prior design)

SIZE	PART No.
1/2	T048052
3/4	T048054
1	T048056
1 1/4	T048058
1 1/2	T048060
2	T048062

EPDM Seal (large diameter)

SIZE	PART No.
2 1/2	T048064
3	T048066
4	T048070

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NIBCO® Press System® Bronze Ball Valves

Two-Piece Body • Full Port • Bronze Trim • Blowout-Proof Stem

Dezincification Resistant

250 PSI/17.2 Bar Non-Shock Cold Working Pressure
250°F Maximum Operating Temperature

CONFORMS TO MSS SP-110

MATERIAL LIST

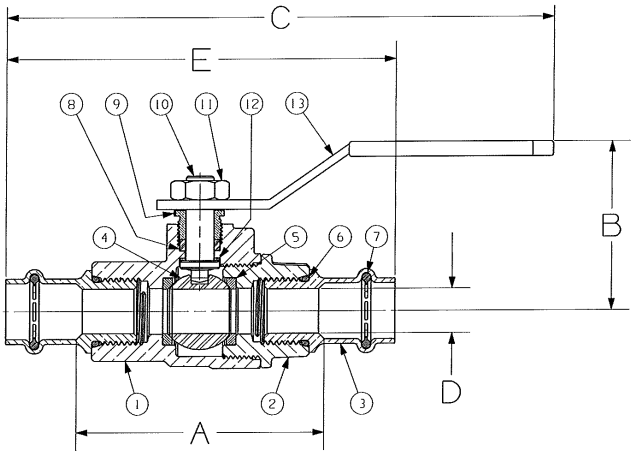
	PART	SPECIFICATION
1.	Body	Bronze ASTM B584 Alloy C84400
2.	Body End	Bronze ASTM B584 Alloy C84400
3.	Press End Adapter (2)	Wrot Copper ASTM B75 Alloy C12200
4.	Ball	Brass ASTM B16 Alloy C36000 or ASTM B283 Alloy C37700 (Chrome/Nickel Plated)
5.	Seat Ring (2)	Reinforced PTFE
6.	Boss seal o-ring (2)	EPDM
7.	O-Ring (2)	EPDM
8.	Packing	PTFE
9.	Pack Gland	Brass ASTM B16 Alloy C36000
10.	Stem	Silicon Bronze ASTM B371 Alloy C69430 or ASTM B371 Alloy C69430
11.	Handle Nut	Zinc Plated Steel
12.	Thrust Washer	Reinforced PTFE
13.	Handle Assembly	Zinc Plated Steel with Plastisol Coating

PC585-70
Press x Press
Female End

DIMENSIONS—WEIGHTS

SIZE		Dimensions A		B		C		D		E		Weight	
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.
1/2"	13	2.76	70	1.90	48	6.00	152	.50	13	4.15	105	.80	.36
3/4"	19	3.28	83	2.28	58	7.29	185	.75	19	5.05	128	1.56	.71
1"	25	3.59	91	2.41	61	7.34	186	1.00	25	5.36	136	2.13	1.00
1¼"	32	4.62	117	3.05	77	10.04	255	1.25	32	6.64	169	3.73	1.69
1½"	38	5.23	133	3.30	84	10.72	272	1.50	38	8.00	203	5.53	2.51
2"	50	5.63	143	3.51	89	11.05	281	2.00	50	8.65	220	7.95	3.61

NIBCO® Press System® ball valves are designed to meet MSS SP-110 with the exception of the end connection. Ball valves are down-rated from 600 PSI CWP to 250 PSI CWP to match the Press System. Male and female press-to-connect ends are new technology not yet covered in the current edition of this specification.



PC585-70
P x P

NIBCO® Press System® Brass Ball Valves

Two-Piece Body • Full Port • Brass Trim • Blowout-Proof Stem • PTFE Seats

200 PSI/41.4 Bar Non-Shock Cold Working Pressure
250°F Maximum Operating Temperature

CONFORMS TO MSS SP-110

MATERIAL LIST

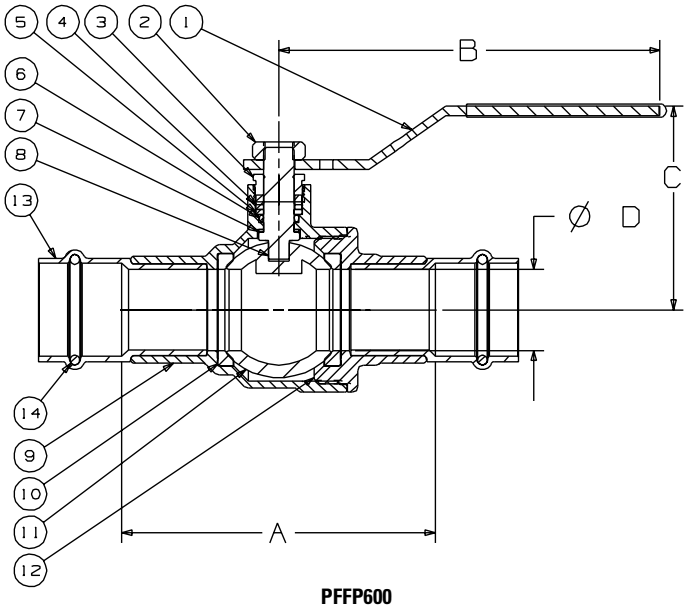
PART		SPECIFICATION
1. Handle		Plated Steel with Plastisol Cover
2. Handle Nut		Plated Steel
3. Pack Gland		Brass ASTM B16 Alloy C36000
4. Packing, Stem		Virgin PTFE
5. Flat Washer		430 Stainless
6. O-Ring (Stem Seal)		Fluorocarbon (FKM)
7. Thrust Washer		Reinforced PTFE
8. Stem	½" - 1"	Brass ASTM B16 Alloy C36000
	1¼" - 2"	Silicon Bronze ASTM B371 Alloy 69400 or 69430
9. Body		Forged Brass ASTM B283 Alloy C37700
10. Seat Ring (2)		Virgin PTFE
11. Ball	½" - ¾"	Brass ASTM B16 Alloy C36000 (Chrome/Nickel Plated)
	1" - 2"	Forged Brass ASTM B124 Alloy C37700 (Chrome/Nickel Plated)
12. Body End Piece		Forged Brass ASTM B283 Alloy C37700
13. Female Adapter (2)		Bronze ASTM B61 Alloy C92200
14. O-Ring (2)		EPDM

PFFP600
Press x Press
Female End

DIMENSIONS—WEIGHTS

Size		Dimensions A		B		C		D		Weight	
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.
½	15	2.37	60	3.90	99	1.95	50	0.50	13	.54	1.19
¾	20	3.18	81	4.66	118	2.30	58	0.75	19	1.16	2.55
1	25	3.84	98	4.66	118	2.50	64	1.00	25	1.61	3.54
1 ¼	32	4.34	110	6.69	170	3.05	78	1.25	32	2.63	5.79
1 ½	40	4.88	124	6.69	170	3.23	82	1.50	38	3.69	8.12
2	50	6.04	153	6.69	170	3.55	90	2.00	51	5.76	12.68

NIBCO® Press System® ball valves are designed to meet MSS SP-110 with the exception of the end connection. Ball valves are down-rated from 600 PSI CWP to 200 PSI CWP to match the Press System. Male and female press-to-connect ends are new technology not yet covered in the current edition of this specification.



PFFP600
P x P

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NIBCO® Press System® Ball Valve Handle Options

A wide variety of handles are available to fulfill safety and operation requirements in various processing and manufacturing industries. The lever handle with plastic cover is standard. Other handle options are shown. Stainless steel lever handles are available, as an option, also with plastic covers. If an optional handle is desired, please indicate which one when ordering. Many of these options are field assembly only.

 **CS Standard Lever Handle**	 **CS Extended Lever Handle with Memory Stop**	 **NIB-SEAL® Handle**
 **CS Locking Lever Handle**	 **CS Round Handle**	 **Vertical Chain Lever**
 **SS Standard Lever Handle**	 **CS Extended Round Handle**	 **Horizontal Chain Lever**
 **SS Locking Lever Handle**	 **CS Wing Handle**	 **Memory Stop Kit**
 **CS Extended Lever Handle**		

NIBCO® Press System® Bronze Ball Valves
NIB-SEAL® Technical Data

NIBCO® bronze ball valves installed with NIB-SEAL® insulated handles are the only approach that keeps your insulated piping system completely intact.

The revolutionary NIB-SEAL bronze ball valve stops condensate cold. Its unique thermal barrier design keeps moisture from infiltrating your insulated system while preventing thermal energy loss through exposed metal handles.

Designed for new installations or retrofitting existing systems, NIB-SEAL bronze ball valves offer a wide range of advantages for typical commercial HVAC systems as well as industrial applications where insulated piping is desirable.

- Protective sleeve provides a stationary surface to affix the insulation, allowing operation and maintenance of the valve without destroying the integrity of the insulated system.
- High-strength cylindrical handle design features easy access to standard adjustable memory stop for system balancing. The valve packing is also readily accessible for routine maintenance.
- Cap and insulating plug provide a vapor seal to prevent exchange of air to maximize the efficiency of your insulated piping system.
- Position indicators allow at-a-glance determination of whether valve is in open or closed position.
- Pre-formed hole allows for convenient tagging.

Temperature range: 15° F to 250° F

US PATENT 5,236,006

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NIBCO® Press System® Tools

PC-280
1/2" through 4"

MATERIAL LIST

MODEL NO.	DESCRIPTION	LBS.
PC-280	Pressing Tool with 2 - 18V, 3.0 Ah Lithium-ion batteries, 110V battery charger & case	25.40
PC-10S	1/2" Standard Pressing Jaw (for PC-100 or PC-280)	4.14
PC-11S	3/4" Standard Pressing Jaw (for PC-100 or PC-280)	4.18
PC-12S	1" Standard Pressing Jaw (for PC-100 or PC-280)	4.52
PC-13S	1 1/4" Standard Pressing Jaw (for PC-100 or PC-280)	4.30
PC-14S	1 1/2" Standard Pressing Jaw (for PC-100 or PC-280)	9.61
PC-15S	2" Standard Pressing Jaw (for PC-100 or PC-280)	9.26
PC-16S	1/2"-1 1/4" (4 jaws) Standard Press Jaw Kit w/Case (for PC-100 or PC-280)	25.25
PC-17S	1 1/2"-2" (2 jaws) Standard Press Jaw Kit w/Case (for PC-100 or PC-280)	23.76
PC-2	2 1/2" Pressing Chain w/Case (for PC-100 or PC-280)	18.58
PC-3	3" Pressing Chain w/Case (for PC-100 or PC-280)	19.40
PC-4	4" Pressing Chain w/Case (for PC-100 or PC-280)	23.81
PC-234	2 1/2", 3" & 4" Pressing Chain Kit (for PC-100 or PC-280)	44.42
PC-5	PC-5 Pressing Chain Adapter Jaw (note: must be used with 2 1/2", 3" & 4" chains)	7.01
PC-7L	18V, 3.0Ah Lithium-ion Battery (for PC-280 or PC-20M)	1.30
PC-8L	110V Battery Charger (for PC-4ML or PC-7L)	2.20
PC-9L	AC Adapter (for PC-280 or PC-20M)	1.70
PC-280C	Plastic Replacement Case for PC-280 Tool	7.50
PC-2C	Metal Replacement Case for PC-2 or PC-3 Chain	8.10
PC-4C	Metal Replacement Case for PC-4 Chain	8.10
PC-234C	Plastic Replacement Case for PC-234 Chain Kit	7.72
PC-16SC	Metal Replacement Case for PC-16S (1/2" - 1 1/4" Jaws)	8.10
PC-17SC	Metal Replacement Case for PC-17S (1 1/2" - 2" Jaws)	4.40
PC-51	1/2" - 2" Deburring Tool	0.92

PC-10S thru PC-15S
Standard Pressing Jaw

PC-280
Pressing Tool

PC-2 thru PC-4
Pressing Chain

PC-5
Pressing Chain Adapter Jaw

PC-7L
18V, 3.0 Ah
Lithium-ion Battery

PC-8L
110V Battery Charger

PC-51
1/2" - 2" Deburring Tool

PC-9L
AC Adapter

NIBCO® Press System® Tools

PC-20M
1/2" through 1"

MATERIAL LIST

MODEL NO.	DESCRIPTION	LBS.
PC-20M	Mini Pressing Tool, 2 - 18V, 1.3 Ah Lithium-ion batteries, 110V charger & case (NO jaws)	11.00
PC-200M	Mini Pressing Tool, 3 Jaws, 2 - 18V, 1.3 Ah Lithium-ion batteries, 110V charger & case	18.00
PC-1M	1/2" Jaw (for Mini Pressing Tool - PC-10M or PC-20M)	2.09
PC-2M	3/4" Jaw (for Mini Pressing Tool - PC-10M or PC-20M)	2.05
PC-3M	1" Jaw (for Mini Pressing Tool - PC-10M or PC-20M)	2.07
PC-4ML	18V, 1.3Ah Lithium-ion Battery (for PC-20M)	0.80
PC-7L	18V, 3.0Ah Lithium-ion Battery (for PC-280 or PC-20M)	1.30
PC-8L	110V Battery Charger (for PC-4ML and PC-7L)	2.20
PC-9L	AC Adapter (for PC-280 or PC-20M)	1.70
PC-20MC	Plastic Replacement Case for PC-10M & PC-20M)	4.00
PC-50	1/2" - 1" Deburring Tool	0.42

PC-20M
Mini Pressing Tool

PC-200M
Mini Pressing Tool with
1/2", 3/4" and 1" Jaws

PC-1M, 2M, 3M
Mini Pressing Jaw

PC-4ML
18V, 1.3 Ah
Lithium-ion Battery

PC-8L
110V Battery Charger

PC-50
1/2" - 1" Deburring Tool

PC-7L
18V, 3.0 Ah
Lithium-ion Battery

PC-9L
AC Adapter

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NIBCO® Press System® Tools

PC-280 & PC-20M FEATURES

TOOLS

Light weight
PC-20M Mini: 3.7 lbs. (without jaw)
PC-280: 9.4 lbs. (without jaw)

Easy to handle / simple design
Jaws rotate 350°
No calibration necessary
No complicated switches or controls
Mini: Ergonomic compact design is easy to use in tight spaces

Interruptible crimp cycle
Safety feature prevents injuries
Can begin crimp, stop to align and level fitting / tube, and complete crimp

Battery
Can be changed during crimp cycle
Lithium-ion has short charging cycle and larger capacity
- PC-4ML: 15 minute recharge time
- PC-7L: 22 minute recharge time

AC Power Adapter
Converts the tool to electric power
Allows continuous use

Service light
Illuminates at 10,000 cycles
Tool will not stop operating when light illuminates
- RED indicates battery charge status, service intervals, tool functions & faults
- WHITE illuminates the work area

Hydraulic Pressure Check (HPC)
An audible warning signal sounds if adequate working pressure is not achieved

PRESSING CHAINS (2 1/2" to 4" ONLY)

Uniform crimp
Maintains proper pipe alignment

Easy to install and remove
Once secured to fitting, chain cannot fall off prior to crimp
Chain easily removed post crimp

Crimp Identification
Easy to identify crimp has been made from a distance

PC-100 and PC-10M Accessories

MATERIAL LIST

MODEL NO.	DESCRIPTION	LBS.
PC-6	12V, NiMH Battery - 2.6Ah for PC-100	1.51
PC-7	12V, NiMH Battery - 3.0Ah for PC-100	1.57
PC-8	120V Standard Battery Charger for PC-6 or PC-7	1.10
PC-9	AC Adapter for PC-100 Press Tool	1.32
PC-4M	1.3 Ah NiCd 9.6V Battery for Mini Pressing Tool	0.85
PC-5M	120V Charger for Mini Pressing Tool	1.13
PC-100C	Metal Case for PC-100 Tool	14.30

PC-4M
9.6V, 1.3 Ah
NiMH Battery

PC-7
12V, 3.0 Ah
NiMH Battery

PC-8
120V Battery Charger

PC-9
AC Adapter

NIBCO® Press System®
Approved Tool and Jaw Compatibility Matrix

Pressing tool, jaw and chain sets are an integral part of ensuring a reliable, permanent connection between NIBCO® Press System® fittings, valves and copper piping. ***Only use pressing tools, jaws and chain sets that have been tested and approved for use with NIBCO Press System fittings and valves.***

The following table details compatibility of **approved** pressing tools, chains and jaws with the NIBCO Press System fittings and valves:

		1/2" - 1" NIBCO® PressSystem® Mini Pressing Jaws (PC-1M, PC-2M, PC-3M)	1/2" - 1" RIDGID® ProPress® Compact Pressing Jaws	1/2" - 1-1/4" RIDGID® ProPress® C1 Compact Kit (C1 Actuator & Press Rings)	Rothenberger Compact Pressing Jaws	Stanley® VIRAX® Press Inserts	1/2" - 1" Milwaukee® M12™ Pressing Jaws	1/2" - 2" NIBCO® PressSystem® Standard Pressing Jaws (PC-10S, PC-11S, PC-12S, PC-13S,PC-14S, PC-15S)	1/2" - 2" RIDGID® ProPress® Standard Pressing Jaws	1/2" - 1-1/4" RIDGID® ProPress® V1 Kit (V1 Actuator & Press Rings)	1/2" - 2" Rothenberger Standard Pressing Jaws	1/2" 2" REMS Standard Pressing Jaws	Stanley® VIRAX® Pressing Jaws	1/2" - 2" Milwaukee® M18™ Pressing Jaws	2 1/2" - 4" NIBCO® Pressing Chains (PC-2, PC-3, PC-4)
	SIZE	**1/2" - 1"**						**1/2" - 2"**							**2½" - 4"**
PRESSING TOOLS	NIBCO® PC-280	—	—	—	—	—	—	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	—	**YES**
	NIBCO® PC-100	—	—	—	—	—	—	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	—	**YES**
	RIDGID® 320-E	—	—	—	—	—	—	**YES**	**YES**	**YES**	—	—	—	—	—
	RIDGID® RP 330-B	—	—	—	—	—	—	**YES**	**YES**	**YES**	—	—	—	—	—
	RIDGID® CT400	—	—	—	—	—	—	**YES**	**YES**	**YES**	—	—	—	—	—
	RIDGID® RP 330-C	—	—	—	—	—	—	**YES**	**YES**	**YES**	—	—	—	—	—
	Rothenberger ROMAX® Pressliner	—	—	—	—	—	—	—	—	—	**YES**	—	—	—	—
	Rothenberger ROMAX® AC ECO	—	—	—	—	—	—	—	—	—	**YES**	—	—	—	—
	REMS Akku-Press	—	—	—	—	—	—	—	—	—	—	**YES**	—	—	—
	REMS Power-Press	—	—	—	—	—	—	—	—	—	—	**YES**	—	—	—
	Stanley® VIRAX® P20+	—	—	—	—	—	—	—	—	—	—	—	**YES**	—	—
	NIBCO® PC-20M Mini	**YES**	—	—	**YES**	—	—	—	—	—	—	—	—	—	—
	NIBCO® PC-10M Mini	**YES**	—	—	**YES**	—	—	—	—	—	—	—	—	—	—
	RIDGID® 100-B Compact	—	**YES**	**YES**	—	—	—	—	—	—	—	—	—	—	—
	RIDGID® RP 210-B Compact	—	**YES**	**YES**	—	—	—	—	—	—	—	—	—	—	—
	Rothenberger Compact	**YES**	—	—	**YES**	—	—	—	—	—	—	—	—	—	—
	Stanley® VIRAX® M20+ Compact	—	—	—	—	**YES**	—	—	—	—	—	—	—	—	—
	Milwaukee® M12™ Force Logic™	—	—	—	—	—	**YES**	—	—	—	—	—	—	—	—
	Milwaukee® M18™ Force Logic™	—	—	—	—	—	—	—	—	—	—	—	—	**YES**	—

For the latest listing of approved Pressing tool, jaw and chain combinations, visit nibco.com.
NIBCO recommends minor tool service performed once per year and major service every three years.
For technical or service assistance, contact NIBCO Technical Services 1-888-446-4226.

CAUTION:
NIBCO® Press Fittings and Valves (2½", 3", 4" ends) to be installed ***ONLY*** with NIBCO® Pressing Tools & Chains.

RIDGID® is a registered trademark of RIDGID Inc.
ProPress® is a registered trademark of Viega NA.
ROMAX® is a registered trademark of ROTHENBERGER USA LLC

VIRAX® is a registered trademark of The Stanley Works.
Force Logic™ is a trademark of Milwaukee® Tool

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NIBCO® Press System® — Engineering Data
Copper and Copper Alloy Fittings

Standards

O-Ring seal joints are not new to the piping industry, but joining techniques like the NIBCO Press System are providing new alternatives for copper piping assembly. NIBCO has relied on its century of experience in copper and brass piping products to design the best performing and most dependable line of fittings possible.

Applications

The NIBCO Press System fittings are designed to join with ASTM B 88 seamless copper water tube in residential and commercial potable, hot, chilled and process water applications for plumbing and HVAC systems. Copper and copper alloy materials and EPDM elastomeric seals have a long history of compatibility with common chemicals used in these systems. A chemical resistance chart should always be referenced when other fluids are to be introduced.

NOTE: FLUIDS CONTAINING HYDROCARBON-BASED OILS ARE <u>NOT</u> COMPATIBLE WITH THE EPDM SEAL.

Pressure/Temperature Limitations

-20°F to 250°F up to 200 PSIG, non-shock working pressure.

Materials:

- Wrot Copper
  - ASTM B 75 Alloy C12200
- Cast Copper Alloy
  - ASTM B584-12a Alloy C87600
- Elastomeric Seals
  - EPDM O-Rings compliant with BS EN 681-1 and ASME B16.51

Flow area consistent with ASME B16.22

NIBCO® Press Fittings meet all performance requirements of ASME B16.51-2011

CAUTION: Freezing Weather Precaution — Subsequent to testing a piping system, valve should be in an open position to allow complete drainage. Failure to follow this warning may result in property or product damage.

Performance

The following performance tests were conducted per ASME B16.51. The fitting dimensions, materials of construction and performance tests were witnessed and verified by internationally recognized NSF. A letter of verification is available upon request:

1. Dimensional Verification
   a. Inside diameter of press cup and waterway
   b. Outside diameter of press cup and waterway
   c. Wall thickness
   d. Threaded ends conformance to ASME B1.20.1
2. Hydrostatic Minimum Burst Strength Pressure
   a. Fitting samples hydrostatically tested to a minimum of 600 PSI (three times the rated internal working pressure) at 73°F.
3. Unrestrained Hydrostatic Pressure Test at 68°F (20°C) and 200°F (93°C)
   a. Fitting assemblies were filled with water and pressurized to 600 PSIG at 68° or 200°F for 48 hours.
4. Static Torque
   a. Fittings were filled with water, had a minimum torque applied and released. Each fitting was then pressurized to 400 PSIG for 48 hours.
5. Bending Test
   a. A sample fitting was installed between two equal lengths of hard-drawn copper tubing supported six (6) feet apart. A concentrated load was applied to the center of the fitting. The assembly was subjected to 600 PSIG water pressure for one (1) hour at 68°F (20°C).
6. Vacuum Pressure Test
   a. Fittings were subjected to a vacuum pressure of 24.5 inches of mercury for one (1) hour at 68°F (20°C).
7. Cyclic Pressure Test
   a. Fittings were subjected to a hydraulic shock pressure of 400 PSIG for 10,000 cycles.
8. Vibration Test
   a. Fitting assemblies were subjected to a hydrostatic cyclic vibration test at 400 PSIG for 1,000,000 cycles. After cycling, the assemblies were pressurized to 600 PSIG for 30 minutes.
9. Thermocycling Test
   a. Test assemblies were constructed using type L copper tube and press connect fittings. The test assemblies were subjected to flowing water at 145 psi cycled between 68°F (5°C) and 200°F (93°C) for a period of 15 minutes at each temperature for nominal size 2" and smaller and 30 minutes for nominal size 2 1/2" and larger. Cycling continued for 5,000 cycles for sizes 2" and smaller and 2,500 cycles for 2 1/2" and larger size fittings.
10. Dynamic Torque at 68°F (20°C) and 200°F (93°C)
    a. Fittings were assembled between two lengths of hard-drawn copper tubing. With one tube fixed, the other tube twisted ±5° for 10,000 cycles at 68°F (20°C) or 200°F (93°C). Each assembly was then subjected to 400 PSIG water pressure at 68°F (20°C) or 200°F (93°C) for 1 hour.

Tests were performed with K and M hard drawn tubing. The thermocycle test used L hard drawn tube.

NIBCO® Press System® — Sample Specification

FITTINGS

2" and Smaller:

Fittings shall comply with NSF 61, CSA, UPC and be approved by the local jurisdiction. The NIBCO Press System may be used at the contractor's option for the following building services piping - 20°F to +250°F up to 200 PSI:

- **Hot and Cold Domestic Water**
- **Potable Water**
- **Condenser and Chilled Water Service**
- **Hot Water Heating Service**

Wrot copper press fittings shall be made from commercially pure copper mill products per ASTM B 75 Alloy C12200. Cast copper alloy press fittings shall be made from materials with a minimum of 78% copper and a maximum of 15% zinc. The press fittings connections shall be compatible with seamless K, L or M copper tube made to ASTM B 88. Fittings shall have a maximum non-shock working pressure of 200 PSI between the temperatures of -20°F and +250°F. Elastomeric seals shall be made of EPDM material, and the fittings shall be manufactured with an inboard bead design. All fittings shall be installed in accordance with the manufacturer's installation instructions and according to local plumbing and mechanical codes. The press-to-connect joint shall be made with pressing tools and jaw sets recommended and authorized by NIBCO.

2½" through 4":

Fittings shall comply with NSF 61, CSA, UPC and be approved by the local jurisdiction. The NIBCO Press System may be used at the contractor's option for the following building services piping - 20°F to +250°F up to 200 PSI:

- **Hot and Cold Domestic Water**
- **Potable Water**
- **Condenser and Chilled Water Service**
- **Hot Water Heating Service**

Wrot copper press fittings shall be made from commercially pure copper mill products per ASTM B 75 Alloy C12200. Cast copper alloy press fittings shall be made from materials with a minimum of 78% copper and a maximum of 15% zinc. The press fittings connections shall be compatible with seamless K, L or M copper tube made to ASTM B 88. Fittings shall have a maximum non-shock working pressure of 200 PSI between the temperatures of -20°F and +250°F. Elastomeric seals shall be made of EPDM material, and the fittings shall be manufactured with an inboard bead design. All fittings shall be installed in accordance with the manufacturer's installation instructions and according to local plumbing and mechanical codes. The press-to-connect joint shall be made with pressing tools and jaw sets recommended and authorized by NIBCO.

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NIBCO® Press System® — Sample Specification

VALVES

2" and Smaller Ball Valves: (On/Off, Isolation or Throttling)

Ball valves with male or female press-to-connect ends shall be rated at 200 PSI CWP to +250°F maximum. Valves shall be manufactured in accordance with MSS SP-110 and constructed of dezincification resistant cast bronze bodies. No brass containing more than 15% zinc shall be approved. Valve shall have reinforced PTFE seats, blow-out proof stem, full-port ball, chrome/nickel plated ball or 316 SS ball for aggressive water conditions. Where piping is to be insulated, ball valves shall be equipped with 2" extended handles of non-thermal conductive material. Handle to have extended sleeve incorporating an insulation plug to provide a vapor barrier and allow valve operation without disturbing the insulation, and a memory stop, which can be set after installation.

Acceptable Valves: (non-insulated lines):

NIBCO® PC585-70, PF585-70 or PS585-70
(Chrome/nickel plated ball)
NIBCO® PC585-70-66, PF585-70-66, PS585-70-66 or PCM585-60
(316 SS ball)

Acceptable Valves: (insulated lines):

NIBCO® PC585-70-NS, PF585-70-NS or PS585-70-NS
(Chrome/nickel plated ball)
NIBCO® PC585-70-66-NS, PF585-70-66-NS or PCM585-60-NS
(316 SS ball)

(Note to Specifier: Include press gate valves in addition/in lieu of press ball valves for ON/OFF and isolation services if requested or required.)

2" and Smaller Gate Valves: (On/Off and Isolation)

Gate valves with male or female press-to-connect ends shall be rated to 200 PSI CWP at +250°F maximum. Valves shall be manufactured in accordance with MSS SP-80. Valve body, bonnet and wedge to be manufactured of dezincification resistant cast bronze (ASTM B 62). Stems shall be of silicon bronze (ASTM B 371) or low zinc alloy (ASTM B 99). Non-asbestos packing and malleable or ductile iron hand-wheel shall be standard.

Acceptable Valves:

NIBCO® PF111 or PS111 - Rising Stem Gate Valve
NIBCO® PF113 or PS113 - Non-Rising Stem Gate Valve

2" and Smaller Globe and Angle Valves: (Throttling Service)

Globe and angle valves with male or female press-to-connect ends shall be rated to 200 PSI CWP at +250°F maximum. Valves shall be manufactured in accordance with MSS SP-80. Valve body, bonnet and wedge to be manufactured of dezincification resistant cast bronze (ASTM B 62). Stems shall be of silicon bronze (ASTM B 371) or low zinc alloy (ASTM B 99). Non-asbestos packing and malleable or ductile iron hand-wheel shall be standard.

Acceptable Valves:

NIBCO® PF211-Y or PS211-Y - Globe Valve
NIBCO® PF311-Y or PS311-Y - Angle Valve

2" and Smaller Check Valves: (Back Flow Prevention)

Check valves (Y pattern, swing type or in-line) with male or female press-to-connect ends shall be rated at 200 PSI CWP to +250°F maximum. Valves shall be manufactured in accordance with MSS SP-80. Body and cap to be manufactured of dezincification resistant cast bronze (ASTM B 62 or ASTM B 584 Alloy C84400). Valves to have PTFE seat disc.

Acceptable Valves:

NIBCO® PF413-Y or PS413-Y - Y Pattern, Swing Type Check Valve
NIBCO® PF480-Y or PS480-Y - In-line spring loaded Silent Check Valve

Drain Valves

At all low points in water piping to be drained or vented, provide 1/2" or 3/4" ball valves with male or female press-to-connect ends by hose-end drain valves. Valves shall be rated by 200 PSI CWP to +250°F maximum. Valves shall be manufactured in accordance with MSS SP-110. Valves to be constructed of dezincification resistant cast bronze bodies. Valve shall have reinforced PTFE seats, blow-out proof stem, and be full port. All valves shall be provided with 3/4" hose connection with cap and chain.

Acceptable Valves:

NIBCO® PS585-70-HC or PF585-70-HC

2 1/2" thru 4" Butterfly Valves: (On/Off, Isolation or Throttling)

Butterfly valves with female press-to-connect ends shall be rated at 200 PSI CWP to +250°F maximum. Valves shall be manufactured in accordance with MSS SP-67 and constructed of a ductile-iron body, for bubble-tight shutoff, extended-neck for insulation, disc and lining suitable for potable water, valves shall be suitable for bi-directional dead end service at full rated pressure, one-piece Type 416 stainless-steel stem, copper bushing, fasteners and pins shall not be used to attach stem to disc, no pins or fasteners in waterway, aluminum-bronze disc, and molded-in EPDM seat (liner).

Acceptable Valves:

NIBCO® PFD2000 Series

NIBCO® Press System® — Installation Instructions

NIBCO Press System

The NIBCO Press System, when used with tested and authorized pressing tools and jaws, is designed to mechanically crimp fittings and valves onto copper tubing to create a watertight, permanent seal. When the switch on the pressing tool is depressed, an internal motor powers a hydraulic pump which forces fluid into the cylinder of the tool, forcing the ram forward and applying thousands of pounds of crimping force onto the specially designed fittings and valves.

System Components

Fittings and Valves

NIBCO® Press System® copper or bronze fittings and valves

Tubing

ASTM B 88 seamless Hard Drawn Copper Water Tube: Types K, L and M.

Pressing Tools, Chains and Jaws

The pressing tool, chain and jaw are important parts of ensuring a reliable, permanent connection between NIBCO Press System fittings and valves and the copper water tube.

CAUTION — Use only pressing tools and jaw sets that have been tested and authorized for use with NIBCO Press System fittings and valves [1]. Use of unauthorized pressing tools and/or jaws may result in an improper seal that could cause extensive property damage.

(1) See approved tool and jaw compatibility matrix on page 46.

Pressing Tool Safety

- Only use authorized pressing tools and jaws with NIBCO Press System fittings and valves. Other uses or modification of the jaws for other applications may damage the press tool, damage the jaws and/or cause personal injury.
- Keep fingers and hands away from jaws during pressing cycle. Your fingers or hands can be crushed, fractured or amputated if they become caught between the jaw tips or between the jaw and any other object.
- Always wear safety glasses while using pressing tools and jaws.
- Never attempt to repair a damaged jaw set. A jaw that has been welded, ground, drilled or modified in any manner can shatter during crimping resulting in serious injury. Discard the entire damaged jaw set. Replace with a new jaw set.

NOTE: Consult manufacturer's pressing tool and jaw set operators manual to determine replaceable jaw set components.

WARNING: Please read these installation instructions and the manufacturer's pressing tool and jaw operators manual(s) carefully prior to installation of the NIBCO Press System. Failure to understand and follow the contents of this manual may result in extensive property damage, severe personal injury or death.

Please contact NIBCO Technical Services at 888.446.4226 if you have installation questions.

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NIBCO® Press System® — Installation Instructions

Installation Instructions for 1/2" - 2" Press Fittings and Valves

WARNING: To prevent serious injury, inspect the pressing tool, battery charger (if applicable) and jaw sets according to the procedure outlined in the pressing tool instruction manual prior to beginning installation.

Failure to clean jaws can result in an improper connection that can lead to extensive property damage.

Work Area Set-Up

To prevent serious injury, proper set-up of the pressing tool and work area is required. The following procedure should be followed:

1. Check work area for:
   - Adequate lighting
   - Flammable liquids, vapors or dust that may ignite
2. Follow the tool set-up procedures specified in the manufacturer's pressing tool instruction manual.

Preparing the Copper Tube

1. Select clean, undamaged copper tube and cut to desired length. Cut tube end square using a tube cutter or fine-toothed saw *(Figure 1).*

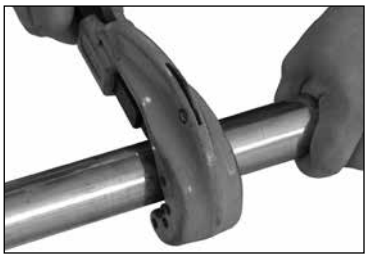

Figure 1 — Cut tube to desired length using a tube cutter

2. Deburr the tube inside and outside diameter using a half-round file or a deburring tool.
3. Clean the tube end of all dirt, oil and grease. (Emery cloth or sandpaper to clean the tube or remove oxidation is not required.)

Inserting the Tube into the Fitting or Valve

1. Check the fitting to make sure the EPDM seal is in place, clean and free of dirt and debris *(Figure 2).*

Figure 2 — Check for EPDM Seal

WARNING: Never lubricate the EPDM seal in the NIBCO Press System fitting or valve with anything other than water. Oil-based lubricant, dirt or debris may damage the seal. An improper seal can lead to extensive property damage.

2. Insert the tube into the fitting or valve using a twisting motion. Make sure that the tube is fully inserted into the fitting stop or shoulder.
3. Mark the tube with a permanent marker to indicate the proper tube insertion depth *(Figure 3).*

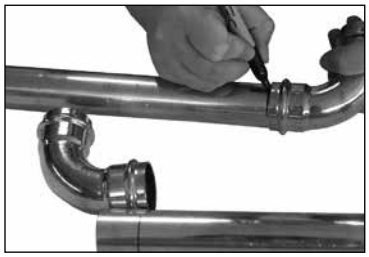

Figure 3 — Inserting the tube to proper depth

4. Refer to the minimum insertion depth table for correct depths

Tube Size	Insertion Depth (min.)	
Inches	Inches	mm
1/2	11/16	18
3/4	7/8	22
1	7/8	22
1¼	1	25
1½	1⅜	35
2	1½	38

CAUTION: Tubing that is difficult to insert may have burrs or could be out-of-round. Burrs must be removed and tubing end should be undamaged. Make sure tube is inserted to the proper depth. Failure to do so may result in an improper seal.

Attaching Pressing Jaws

1. Make sure the battery is removed or the cord is unplugged on the pressing tool prior to attaching or changing the crimp jaws.
2. Push and twist to open the jaw set mounting pin. *(Figure 4).*

Figure 4 — Pushing and twisting to open the jaw set mounting pin

3. If press tool contains a jaw set, slide it out of the crimping tool.

NIBCO® Press System® — Installation Instructions

4. Select the jaw set that corresponds to the size of the joint to be crimped and insert the jaw set into the pressing tool *(Figure 5)*.

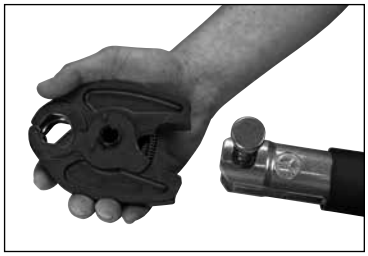

Figure 5 — Inserting the NIBCO® Press System® jaw

5. Push the jaw set mounting pin until it clicks into position.

   NOTE: The tool will not work unless the pin is fully engaged.

Crimping a NIBCO® Press System® Fitting or Valve

1. Make sure the tubing is inserted to the proper depth in the fitting, and that tube and fitting are aligned properly. *(Figure 6)*.

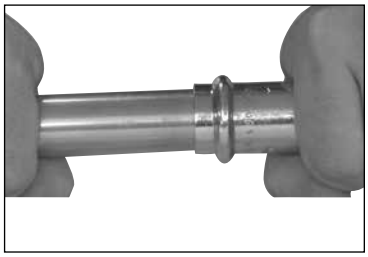

Figure 6 — Inserting the tube to proper depth

2. Squeeze jaw arms to open the jaw set.

3. Place the open jaws around the fitting and ensure that the contour of the jaw is properly aligned with the contour of the fitting *(Figure 7)*.

Figure 7 — Open the jaw set and place around the fitting

4. Make sure the tool is square to the tubing and depress the switch *(Figure 8)*. Once the crimp cycle begins and the rollers contact the jaw arms, the tool will complete the crimp cycle, as long as the trigger is depressed.

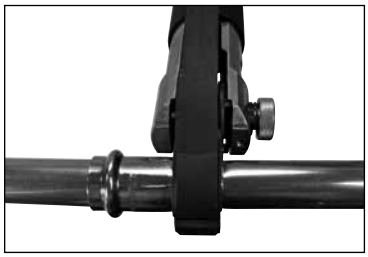

Figure 8 — Jaw set should be square to tubing

5. Once the crimp is complete, press the jaw arms to open the jaw and remove from the fitting.

   If the tool malfunctions, please refer to the tool instruction manual for troubleshooting suggestions.

CAUTION Avoid sharp edges that may have formed on the fitting during the crimping operation.

Inspecting the Crimp

1. Inspect the crimped fitting to ensure proper crimp.

NOTE: The use of the NIBCO Press System jaw will produce a unique witness mark "N" on the crimped fitting.

2. Inspect the crimped fitting checking the connection for the following problems:

   - Misaligned tube
   - Not fully inserted tube, double check depth marks
   - Incorrect jaw alignment with the fitting contour

   If one or more of these problems are found, a new section of tubing and a new fitting will need to be prepared, installed and crimped.

3. Test the NIBCO® Press System® in accordance with normal practice and to local jurisdiction piping code. See additional testing instructions for fittings and valves with leak detection on page 54.

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NIBCO® Press System® — Installation Instructions

Installation Instructions for 2 1/2" - 4" Press Fittings and Valves

WARNING: To prevent serious injury, the pressing tool, battery charger (if applicable) and pressing chains should be inspected according to the procedure outlined in the pressing tool instruction manual prior to beginning installation.

Failure to clean pressing chains can result in an improper connection that can lead to extensive property damage.

Work Area Set-Up

To prevent serious injury, proper set-up of the pressing tool and work area is required. The following procedure should be followed:

1. Check work area for:
   - Adequate lighting
   - Flammable liquids, vapors or dust that may ignite
2. Follow the tool set-up procedures specified in the pressing tool instruction manual.

Preparing the Copper Tube

1. Select clean, undamaged copper tube and cut to the desired length. Cut tube end square using a tube cutter or fine-toothed saw *(Figure 1).*

Figure 1: Cut tube to desired length using s tube cutter

2. Deburr the tube inside diameter using a half-round file or deburring tool. Remove any copper shavings or filings *(Figures 2 & 3).*

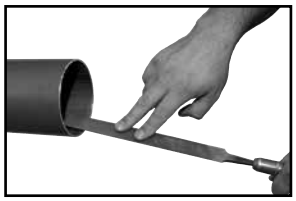

Figure 2: Deburr inside diameter using a half-round file

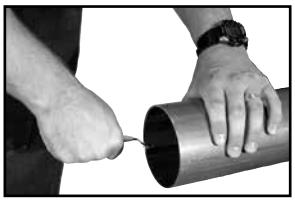

Figure 3: Deburr inside diameter deburring tool

3. Deburr the tube outside diameter using a half-round file to prevent damage to the EPDM seal *(Figure 4).*

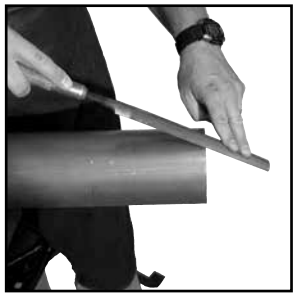

Figure 4: Deburr outside diameter using a half-round file

4. Clean the tube end of all contamination, oils and shavings. A smooth transition chamfer is recommended to ease tube insertion past the seal. (Emery cloth or sandpaper to clean the tube or remove oxidation is not required.)

Inserting the Tube into the Fitting or Valve

1. Check the fitting to make sure that the seal is in place and is free of oil or grease. Only original NIBCO® EPDM seals are to be used when making a press connection with NIBCO® Press System® fittings and valves. If it is necessary to lubricate the seals, use water only. **DO NOT** use any petroleum-based lubricants *(Figure 5).*

Figure 5: Check for EPDM seal

WARNING: Never lubricate the EPDM seal in a NIBCO® Press System® fitting or valve with anything other than water. Oil-based lubricants, dirt or debris may damage the seal. An improper seal can lead to extensive property damage.

2. Mark the proper insertion depth on the tube with a permanent marker prior to insertion, based on insertion depth chart. Refer to minimum insertion depth table for correct depths.

NIBCO Press System Insertion Depth Chart			
Tube Size	2½"	3"	4"
Insertion Depth (min.)	1½"	1⅝"	2⅛"

WARNING: If tube is not inserted to the proper depth, an inadequate seal may result.

3. Insert the tube into the fitting or valve using a twisting motion. Make sure that the tube is fullly inserted into the fitting or valve. If tube is not inserted to the proper depth, an inadequate seal may result.

CAUTION: Tubing that is difficult to insert may have burrs or could be out-of-round. Burrs must be removed and tubing end should be undamaged. Make sure tube is inserted to the proper depth. Failure to do so may result in an improper seal.

NIBCO® Press System® — Installation Instructions

Crimping a NIBCO® Press System® Fitting or Valve

CAUTION:
NIBCO Press Fittings and Valves (2½", 3", 4" ends) to be installed ***ONLY*** with:
- NIBCO® PC-100 Pressing Tool
- NIBCO® PC-5 Adapter Jaw
- NIBCO® Pressing Chain - 2½" (PC-2), 3" (PC-3), 4" (PC-4)

1. Make sure that the battery is removed or that the cord is unplugged on the pressing tool prior to attaching or changing the adapter jaw.

2. Select the correct size pressing chain. Pull the pin on the chain which allows the segments to open. Position the chain on the raised bead and wrap the chain around the fitting with the "pipe side" designation facing the tube. When the chain is fully wrapped around the fitting, reinsert the pin to secure the chain on the assembled joint. Visually inspect the mark made for insertion depth, to ensure the tube remained in position *(Figure 6)*.

Figure 6: Placement of the pressing chain onto fitting or valve

3. Release the pin (push and twist) on the jaw holder of the pressing tool, and install the adapter jaw on the tool. Return the pin to its original position, securing the jaw. The red sleeve on the tool must be in the back position to allow for crimping sizes 2½", 3" and 4". (The red sleeve in the forward position allows for use with ½" - 2" standard pressing jaws.) Rollers on the pressing tool must be in the forward position to allow the red sleeve to move forward *(Figure 7)*.

Figure 7: Placement of adapter jaw into the tool

4. Squeeze adapter jaw arms to open the jaw. Rollers must be fully retracted to open the adapter jaw. Place the open adapter jaw into the grooves in the pressing chain and let go of the jaw arms (Figure 8).

Figure 8: Placement of adapter jaw into pressing chain

5. Make sure the tubing is inserted to the proper depth in the fitting or valve, and that the tube and fitting or valve are aligned properly.

6. With the pressing tool perpendicular to the tube, begin the pressing cycle by pulling the trigger of the pressing tool.

7. Allow the pressing cycle to complete. Remove the pressing tool and adapter jaw from the pressing chain. Remove the pressing chain from the fitting.

If the tool malfunctions, please refer to the tool instruction manual for troubleshooting suggestions.

CAUTION: Avoid sharp edges that may have formed on the fitting during the crimping operation.

Inspecting the Crimp

1. Inspect the crimped fitting or valve to ensure proper crimp. The final crimp should appear pressed uniformly around the fitting or valve *(Figure 9)*.

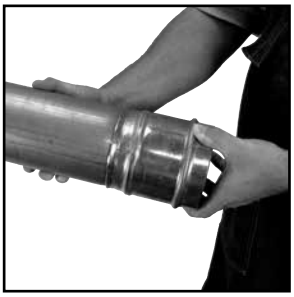

Figure 9: Inspection of final crimp

NOTE: The use of the NIBCO® Press System® chain will produce a unique witness mark "N".

2. Inspect the crimped fitting checking the connection for the following problems:
   - Misaligned tube
   - Not fully inserted tube, double check depth marks
   - Incorrect chain alignment with the fitting contour

   If one or more of these problems are found, a new section of tubing and a new fitting will need to be prepared, installed, and crimped.

3. Test the NIBCO Press System in accordance with normal practice and to local jurisdiction piping code.

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NIBCO® Press System® — Testing Instructions for Fittings & Valves with Leak Detection

PRESSURE TESTING:

NIBCO recommends the following leak testing procedures when installing NIBCO Press System with the leak detection feature. These test procedures allow the installer to find un-pressed connections while the system is being tested under pressure.The uniquely designed EPDM o-ring allows fluids or gases to flow past the seal and leak when the fitting has not yet been pressed. When the fitting has been pressed, the o-ring will create a water tight seal around the tube.

AIR LEAK TESTING

1. Pressurize system up to 15 psi maximum using dry, oil free compressed air, carbon dioxide, or nitrogen.
2. Allow system pressure to stabilize for a minimum of 2 hours.
3. If system pressure has dropped, add more air to bring entire system up to 15 psi maximum. If system pressure increases above 15 psi, bleed off excess pressure to ensure system is at a maximum pressure of 15 psi.
4. If the system pressure continues to drop, inspect all joints for un-pressed fittings. The NIBCO Press System fittings with the leak detection feature are designed to leak in an un-pressed condition.
5. Check all press joints for air leaks using a commercially available leak test solution or a soap and water mixture.
6. Once the system has been confirmed to be leak free, pressure can be increased to the recommended working pressure to verify system integrity.

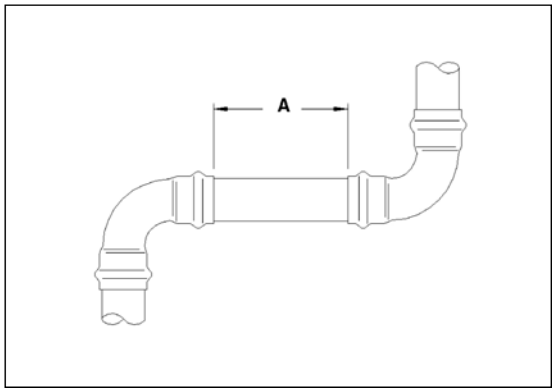
WATER LEAK TESTING

1. Pressurize system up to 50 psi maximum using potable water.
2. Allow system pressure to stabilize for a minimum of 2 hours.
3. If system pressure has dropped, add more water to bring entire system up to 50 psi maximum. If system pressure increases above 50 psi, bleed off excess pressure to ensure system is at a maximum pressure of 50 psi.
4. If the system pressure continues to drop, inspect all joints for un-pressed fittings. The NIBCO Press System fittings with the leak detection feature are designed to leak in an un-pressed condition.
5. Check all press joints for leaking water.
6. Once the system has been confirmed to be leak free, water pressure can be increased to the recommended working pressure to verify system integrity

NIBCO® Press System® — Installation Instructions

Minimum Distance Between Joints

To prevent distortion of the tubing, certain fitting sizes require a minimum distance between crimp joints (refer to *Chart 1* below). Failure to provide this minimum distance may result in an improper seal.



Tube Dia.	A (min.)	
	Inches	mm
½"*	0	0
¾"*	0	0
1"*	0	0
1¼"*	0	0
1½"*	0	0
2"*	0	0
2½"	⅜"	10
3"	⅜"	10
4"	⅜"	10

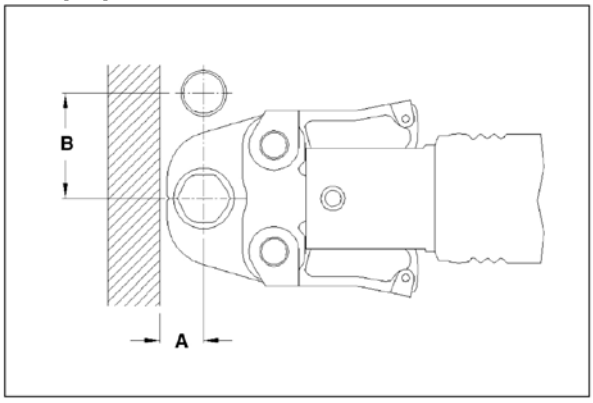
***No minimum distance required.**

Spacing

1. Sufficient clearance must be left around each joint to allow room for the pressing tool and jaw to be attached without interference.

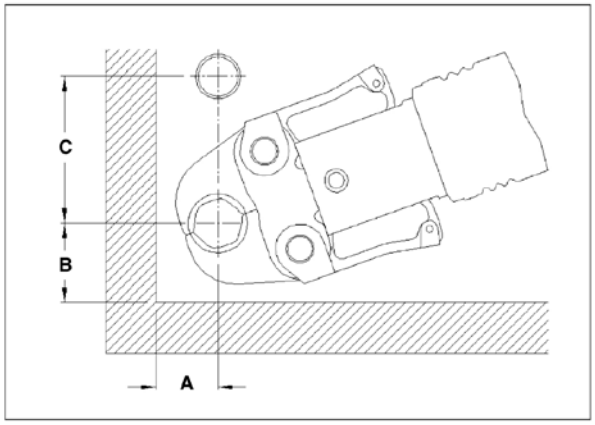
Clearance Requirements — Standard Jaw Sets

Tool perpendicular to wall



Tube Dia.	A (min.)		B (min.)	
	Inches	mm	Inches	mm
1/2	15/16	24	1 5/8	41
3/4	7/8	22	2 1/8	54
1	1 1/4	31	2 1/2	64
1 1/4	1 1/8	29	2 7/8	73
1 1/2	2	51	4 3/8	111
2	2	51	4 3/8	111

Tool angled to wall



Tube Dia.	A (min.)		B (min.)		C (min.)	
	Inches	mm	Inches	mm	Inches	mm
1/2	1 1/8	28	1 3/8	35	2 1/2	64
3/4	1	26	1 1/2	38	2 1/2	64
1	1 5/16	34	1 3/4	45	3	76
1 1/4	1 1/4	32	2 1/4	57	3 1/8	80
1 1/2	2 1/8	54	3 1/8	80	5	127
2	2 1/8	54	3 1/8	80	5	127
2 1/2	3 5/8	92	6	152	3 1/2	89
3	3 7/8	98	6 1/2	165	4	102
4	4 7/8	124	7 5/8	194	4 1/4	108

NOTE: Clearance dimensions for 2½", 3" & 4" are for wrapping pressing chains around fittings.

System Support

CAUTION — In any installation, the system should be suported to ensure the minimum stress is imposed on the tube and joints. The NIBCO Press System should be supported in accordance with normal practice and to local jurisdiction piping code.

Annealing of Copper Tube

A NIBCO Press System installation should not be conducted within 12" of a **brazed** joint. The high temperature required for capillary joinery may cause the copper tube to become annealed and render it too soft for proper crimping. However, a NIBCO Press System product may be crimped adjacent to a **soldered** joint, as normal temperatures created by silver soldering are not hot enough to cause the copper tube to become annealed.

CAUTION — Brazing or soldering should not be conducted within 12" of an existing NIBCO Press System connection as this may damage the EPDM seal. If there is any concern about heat damage to the o-ring, a cold, wet cloth should be wrapped around the crimped connection

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NIBCO® Press System® — Frequently Asked Questions

What is the NIBCO product offering?

The NIBCO Press System features a full range of copper and copper alloy fittings, commercial valves, accessories and pressing tools, jaws and chains for use with K, L and M copper water tube.

What is the system temperature rating?

The NIBCO Press System is rated at 200 PSIG over a temperature range of -20°F to 250°F.

What are the approved system applications?

Approved applications include residential and commercial potable, hot, chilled and process water for plumbing and HVAC systems. The NIBCO Press System is designed for use with water glycol mixtures of ethylene or propylene glycol up to 50% at 200°F.

What was the testing protocol for the NIBCO Press System fittings and valves?

NIBCO Press System fittings and valves were subjected to a wide range of performance tests including dimensional verification, thread end specification, hydrostatic burst strength, unrestrained pressure, static torque, bending, vacuum pressure, cyclic pressure, vibration, thermo-cycling and dynamic torque. The testing protocol included testing to a 3X safety factor above the 200 PSIG system rating.

NIBCO testing was witnessed and validated by the internationally recognized NSF.

Can other available pressing tools and jaws be used on the NIBCO Press System?

See page 52 for a complete listing of approved tools and jaws.

Can a NIBCO Press System connection be re-crimped?

If for any reason the press cycle is interrupted, it is possible to re-crimp a NIBCO Press System connection. However, when re-crimping the connection, the jaws must be properly aligned so that the crimp is performed in the same location as the original.

How long will the EPDM seal last?

Accelerated life tests show that the EPDM seals used with the NIBCO Press System fittings and valves have a life expectancy of 50 years.

Are NIBCO Press System fittings available with solder or threaded by Press System connection?

NIBCO offers many Press System fitting combinations by soldered or threaded connection. Please note, always solder the standard wrot connection first when possible. Prior to soldering, remove the press end EPDM o-ring, solder, allow the fitting to cool, insert the EPDM o-ring, and then Press the connection.

Can a fitting be soldered close to a Press System connection?

NIBCO recommends soldering at least 12 inches away from the Press System connection. If this length is not possible, either solder the joint prior to connecting the press fitting or wrap the connection with a cold wet cloth.

Is the NIBCO Press System approved for underground use?

In accordance with local plumbing codes, the NIBCO Press System can be installed underground.

Is the NIBCO Press System compatible with standard disinfectant cleaning agents commonly utilized in a new water system?

Yes, the NIBCO Press System is typically compatible. For specific cleaning agent compatibility, contact NIBCO Technical Services at the below noted number.

NIBCO® Press System® Fittings Limited Warranty

NIBCO INC. warrants:

- NIBCO Press System fittings to be free from defects in materials and workmanship under normal use and service, for a period of 50 years from the Warranty Commencement Date. The Warranty Commencement Date for NIBCO Press System fittings shall be the date upon which the fitting is installed.

NIBCO does NOT warrant against failure of NIBCO Press System fittings (referred to hereafter as "product") for:

1. any product, parts or systems which are not manufactured or sold by NIBCO INC.;
2. any product which is used for any purposes other than a purpose authorized by NIBCO INC.;
3. any product not installed in accordance with either the recommended installation guidelines provided by NIBCO INC. and/or applicable plumbing codes;
4. damage to the product caused by, contributed in whole or in part by, or resulting from, any of the following:
    a. abuse, misuse, mishandling, tampering, neglect or accidental damage, such as, without limitation, vandalism
    b. natural disasters, such as, without limitation, flooding, windstorm and lightning
    c. attachments or modifications to the product that are not authorized by NIBCO INC.
    d. external causes, where external, physical or chemical qualities produce damage to the product, such as, without limitation, variation in water quality, aggressive water or an unsuitable or hostile environment, or
    e. any other cause beyond the control of NIBCO INC.

NIBCO shall NOT be liable under any circumstances for any other direct or indirect, incidental or consequential damages of any kind, including but not limited to loss of business, lost profits, mold intrusion, water damage, etc. The liability of NIBCO under this warranty is solely limited to the repair or replacement, including installation expenses, of any product that has been determined by NIBCO INC., or an authorized representative or agent thereof, to contain a defect in material or workmanship.

This warranty is the only warranty for the product provided by NIBCO INC., and is and shall be in lieu of any and all other warranties, expressed or implied, including but not limited to an implied warranty of merchantability, and for all other obligations or liabilities on the part of the Manufacturer. No employee of NIBCO INC., or any other distributor, agent or other person or business, is authorized to make any other warranty on behalf of NIBCO INC.

In the event any defect occurs which is believed to be covered by this warranty, NIBCO Technical Services should be immediately contacted either in writing or by telephone at 888.446.4226. NIBCO Technical Services will make further arrangements for the product's return to NIBCO INC. for review and evaluation. In the event that a returned product is determined by NIBCO INC. to be defective, NIBCO INC. will remediate the failure by repairing or replacing the product within a reasonable time, without charge to the owner of the product.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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NIBCO® Press System® Valves

5 year 125% warranty

NIBCO INC. 125% LIMITED WARRANTY
Applicable to NIBCO INC. Pressure Rated Metal Valves

NIBCO INC. warrants each NIBCO® pressure rated metal valve to be free from defects in materials and workmanship under normal use and service for a period of five (5) years from date put into service.

In the event any defect occurs which the owner believes is covered by this warranty, the owner should immediately contact NIBCO Technical Services, either in writing or by telephone at (888) 446-4226 or (574) 295-3000. The owner will be instructed to return said product, at the owner's expense, to NIBCO INC., or an authorized representative for inspection. In the event said inspection discloses to the satisfaction of NIBCO INC. that said valve is defective, it will be replaced at the expense of NIBCO INC. Replacements shall be shipped free of charge to the owner. In the event of the replacement of any valve, NIBCO INC. shall further pay the owner the greater of Twenty-Five (25%) Percent of the price of the valve according to the NIBCO INC. published suggested list price schedule in effect at the time of purchase, or Ten ($10.00) Dollars, to apply on the cost of the installation of said replacement valve.

TO THE EXTENT PERMITTED BY LAW, THIS WARRANTY SPECIFICALLY EXCLUDES INCIDENTAL AND CONSEQUENTIAL DAMAGES OF EVERY TYPE AND DESCRIPTION RESULTING FROM ANY CLAIMED DEFECT IN MATERIAL OR WORKMANSHIP, INCLUDING BUT NOT LIMITED TO, PERSONAL INJURIES AND PROPERTY DAMAGES. Some states or countries do not allow the exclusion or limitation of incidental or consequential damages so these limitations may not apply to you. TO THE EXTENT PERMITTED BY LAW, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED IN DURATION.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and country to country.

how to order

State quantity, figure number and size for each valve you wish to order. See individual valve catalog pages for specific or special product designations.

HOW MANY TO ORDER
NIBCO valves are decimal packed for your convenience in handling, shipping and stock-keeping. Number in master carton varies with item.

POLICY ON RETURNS TO FACTORY
NO NIBCO® valves are to be returned without prior written agreement. Transportation must be prepaid. A 20% charge will be made to cover cost of rehandling and reinspection.

TECHNICAL ASSISTANCE
Engineers, contractors, wholesalers or manufacturers may obtain special or technical assistance from any factory representative of NIBCO. Write, fax or phone.

NIBCO INC.
World Headquarters
1516 Middlebury Street
Elkhart, IN 46516-4740
USA

Phone: 1.574.295.3000
Fax: 1.574.295.3307
Technical Service Phone: 1.888.446.4226
Fax: 1.888.336.4226

NIBCO® Plastic Fittings

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Plastic Fittings
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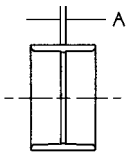
Visit our website for the most current information.

ACR PLASTIC FITTINGS

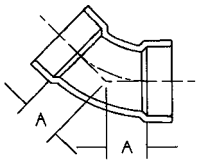
PVC Vent Fittings

4801
Coupling Hub x Hub



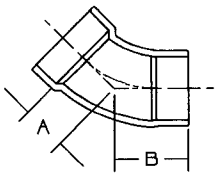
NOM SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
2	0.119	1/8
3	0.466	3/16

4806
45 Degree Elbow Hub x Hub



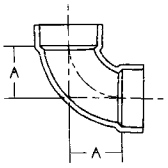
NOM SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
2	0.281	1 1/2
3	0.842	1 3/4

4806-2
45 Degree Street Elbow Spg x Hub



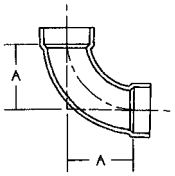
NOM SIZE	APPROX. NET WT./LBS.	DIM. A INCHES	DIM. B INCHES
2	0.277	1 7/16	2 1/4
3	0.818	1 3/4	3 1/4

4807
90 Degree Elbow Hub x Hub



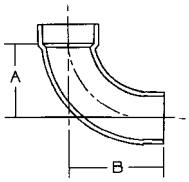
NOM SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
2	0.331	2 5/16
3	1.008	3

4807-LT
90 Degree Long Turn Elbow Hub x Hub



NOM SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
2	0.409	3 7/32
3	1.268	4 1/16

4807-2-LT
90 Degree Long Turn Street Elbow Spg x Hub



NOM SIZE	APPROX. NET WT./LBS.	DIM. A INCHES	DIM. B INCHES
2	0.277	1 7/16	2 1/4
3	0.818	1 3/4	3 1/4

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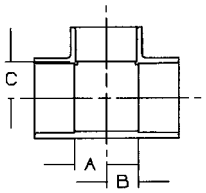
ACR PLASTIC FITTINGS

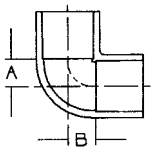
PVC Schedule 40 Pressure Fittings

4611
Tee Slip x Slip x Slip



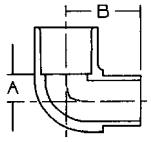
UNIV FIG. NO	NOM SIZE	APPROX. NET WT./ LBS.	DIM. A INCHES	DIM. B INCHES	DIM. C INCHES
401-005	1/2	0.065	1/2	1/2	1/2
401-007	3/4	0.099	9/16	9/16	9/16
401-010	1	0.155	11/16	11/16	11/16
401-012	1 1/4	0.241	7/8	7/8	7/8
401-015	1 1/2	0.353	1	1	1
401-020	2	0.448	1 1/4	1 1/4	1 1/4
401-025	2 1/2	0.913	1 1/2	1 1/2	1 1/2
401-030	3	1.588	1 13/16	1 13/16	1 13/16
401-040	4	2.630	2 5/16	2 5/16	2 5/16

4607
90 Degree Elbow Slip x Slip



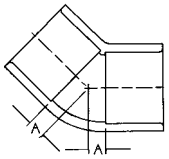
UNIV FIG. NO	NOM SIZE	APPROX. NET WT./ LBS.	DIM. A INCHES	DIM. B INCHES
406-005	1/2	0.047	1/2	1/3
406-007	3/4	0.073	9/16	9/17
406-010	1	0.117	11/16	11/17
406-012	1 1/4	0.188	7/8	7/9
406-015	1 1/2	0.240	1	2
406-020	2	0.375	1 1/4	2 1/4
406-025	2 1/2	0.869	1 1/2	2 1/2
406-030	3	1.189	1 13/16	2 13/16
406-040	4	2.100	2 5/16	3 5/16

4607-2
90 Degree Street Elbow Spg x Slip



UNIV FIG. NO	NOM SIZE	APPROX. NET WT./ LBS.	DIM. A INCHES	DIM. B INCHES
409-005	1/2	0.060	1/2	1 7/16
409-007	3/4	0.071	9/16	1 9/16
409-010	1	0.118	11/16	2
409-012	1 1/4	0.200	7/8	2 1/16
409-015	1 1/2	0.240	1	2 19/32
409-020	2	0.363	1 1/4	2 7/8

4606
45 Degree Elbow Slip x Slip

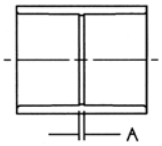


UNIV FIG. NO	NOM SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
417-005	1/2	0.037	1/4
417-007	3/4	0.065	5/16
417-010	1	0.098	11/32
417-012	1 1/4	0.148	3/8
417-015	1 1/2	0.191	7/16
417-020	2	0.281	5/8

ACR PLASTIC FITTINGS

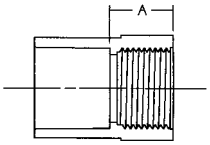
PVC Schedule 40 Pressure Fittings *cont.*

4601
Coupling Slip x Slip



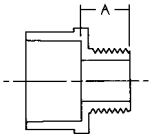
UNIV FIG. NO	NOM SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
429-005	1/2	0.032	3/32
429-007	3/4	0.049	3/32
429-010	1	0.080	3/32
429-012	1 1/4	0.121	3/32
429-015	1 1/2	0.149	3/32
429-020	2	0.200	3/32
429-025	2 1/2	0.648	3/16
429-030	3	0.570	3/16
429-040	4	0.919	3/16

4603
Female Adapter Slip x FIPT



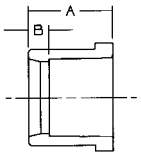
UNIV FIG. NO	NOM SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
435-005	1/2	0.038	13/16
435-007	3/4	0.051	13/16
435-010	1	0.082	3/32
435-012	1 1/4	0.108	1
435-015	1 1/2	0.132	1
435-020	2	0.180	1

4604
Male Adpter MIPT x Slip



UNIV FIG. NO	NOM SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
436-005	1/2	0.027	7/8
436-007	3/4	0.043	11/16
436-010	1	0.072	7/8
436-012	1 1/4	0.102	7/8
436-015	1 1/2	0.126	29/32
436-020	2	0.175	31/32

4618
Bushing Spg x Slip



UNIV FIG. NO	NOM SIZE	APPROX. NET WT./ LBS.	DIM. A INCHES	DIM. B INCHES
437-073	1/2 x 3/8	0.010	15/16	1/4
437-101	3/4 x 1/2	0.019	1 7/32	5/16
437-130	1 x 1/2	0.046	1 9/32	1/2
437-131	1 x 3/4	0.034	1 9/32	9/32
437-166	1 1/4 x 1/2	0.085	1 7/8	11/16
437-167	1 1/4 x 3/4	0.084	1 1/2	3/4
437-168	1 1/4 x 1	0.061	1 15/16	13/32
437-209	1 1/2 x 1/2	0.140	1 17/32	5/8
437-210	1 1/2 x 3/4	0.114	1 1/2	17/32
437-211	1 1/2 x 1	0.111	1 1/2	7/16
437-212	1 1/2 x 1 1/4	0.057	1 1/2	1/4
437-247	2 x 1/2	0.146	1 11/16	25/32
437-248	2 x 3/4	0.200	1 9/16	13/16
437-249	2 x 1	0.158	1 9/16	1/2
437-250	2 x 1 1/4	0.170	1 9/16	5/16
437-251	2 x 1 1/2	0.131	1 9/16	1/4
437-287	2 1/2 x 1/2	0.320	1 15/16	1 3/32
437-288	2 1/2 x 3/4	0.320	1 15/16	31/32
437-289	2 1/2 x 1	0.330	1 15/16	27/32
437-290	2 1/2 x 1 1/4	0.280	1 15/16	23/32
437-291	2 1/2 x 1 1/2	0.330	1 15/16	19/32
437-292	2 1/2 x 2	0.201	1 31/32	19/32

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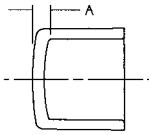
ACR PLASTIC FITTINGS

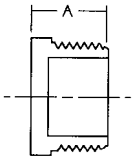
PVC Schedule 40 Pressure Fittings *cont.*

4617
Cap Slip



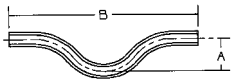
UNIV FIG. NO	NOM SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
447-007	3/4	0.034	7/32
447-010	1	0.055	1/4

4616-4
Plug MIPT



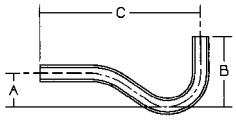
UNIV FIG. NO	NOM SIZE	APPROX. NET WT./LBS.	DIM. A INCHES
450-007	3/4	0.030	1 3/32
450-010	1	0.070	1 1/4
450-012	1 1/4	0.108	1 1/8

Running Trap (Spg x Spg)



UNIV FIG. NO	NOM SIZE	APPROX. NET WT./ LBS.	DIM. A INCHES	DIM. B INCHES
488-007	3/4	0.225	1 7/8	11 1/8

P-Trap (Spg x Spg)



UNIV FIG. NO	NOM SIZE	APPROX. NET WT./ LBS.	DIM. A INCHES	DIM. B INCHES	DIM. C INCHES
489-005	1/2	.163	1 3/4	3 5/8	8 15/16
489-007	3/4	.200			

Key to NIBCO Figure Numbers

DWV Fittings 1 2 3 4 - 5

1 2 TYPE OF MATERIALS

48 = PVC
58 = ABS

3 4 TYPE OF FITTING & DESCRIPTION

01 = Coupling
03 = Female Adapter
04 = Male Adapter
05 = Soil Pipe Adapter
06 = 45° Ell
07 = 90° Ell
08 = 22 1/2° Ell
10 = Wye
11 = Tee
12 = Long Turn TY
14 = Test Tee
16 = Cleanout
17 = Cap
18 = Plug
19 = Blind Flange
26 = Plug (Spg)
27 = Cap (FIPT)
28 = Cross
29 = Nipple
30 = True Y
34 = Double Y
35 = Double Tee
36 = Double Long Turn TY
37 = Double Ell
48 = Offset Closet Flange
51 = Closet Flange
53 = Closet Flange-Flush
55 = Closet Flange w/Knockout Test Plug
60 = 60° Ell
61 = 90° Ell w/Heel Inlet
63-73 = Various Stack Fittings
76 = Return Bend w/CO Hub x SJ
77 = Return Bend Hub x SJ
78 = Return Bend w/CO Hub x Hub
79 = Return Bend Hub x Hub
80 = P-Trap w/CO Hub x SJ
81 = P-Trap Hub x SJ
84 = P-Trap w/CO Hub x SJ
85 = P-Trap Hub x Hub
91 = Drum Trap
92 = P-Trap w/Union Hub x SJ
95 = P-Trap w/Union Hub x Hub

5 TYPE OF CONNECTIONS

Numerical Suffix
2 = Fitting Connection
3 = Female Connection
4 = Male Connection
7 = Slip Joint Connection
9 = Side Inlet
13 = Female Connection Indicating Hub x FIPT x Hub
14 = Female Connection Indicating Hub x Hub x FIPT
16 = Female Connection Indicating Hub x CO x Hub
17 = Female Connection Indicating FIPT x Hub x Hub
18 = Female Connection Indicating FIPT x FIPT x Hub
19 = Baffle Tee Hub x Hub x Hub

Letter Suffix
A = Adjustable Closet Flange
B = Double Fixture Tee
BAF = Baffle
CL = Water Closet Ell
CLAY = Clay
CO = Cleanout
DC = Dust Cap
DP = Dust Plug
EH = Extra Heavy
EL = Extra Long
F = Flush
FX = Fixture Tee
KO = Knockout
L = Lead & Left
LH = Low Heel
LR = Long Radius
LT = Long Turn
N = No Hub
NS = No Stop
P = Fits Pipe I.D.
R = Right
RP = Repair
S = Stack Upturn
SD = Sewer Drain ASTM-D2852
SE = Special
TE = Trap El
TPA = Tray Plug Adapter
TY = TY-Seal
V = Vent
XL = Extra Long

Schedule 40 - PVC Plastic Fittings

UNIV. PART NO.	DESCRIPTION	END CONNECTIONS
401	Tee	Slip x Slip x Slip
402	Tee	Slip x Slip x FIPT
405	Tee	FIPT x FIPT x FIPT
406	90° Ell	Slip x Slip
407	90° Ell	Slip x FIPT
408	90° Ell	FIPT x FIPT
409	90° Street Ell	Spg x Slip
410	90° Ell	MIPT x Slip
411	90° Street Ell	Spg x FIPT
412	90° Street Ell	MIPT x FIPT
414	90° Side Outlet Ell	Slip x Slip x FIPT
417	45° Ell	Slip x Slip
420	Cross	All Slip
429	Coupling	Slip x Slip
430	Coupling	FIPT x FIPT
434	Riser Extender	MIPT x FIPT
435	Female Adapter	Slip x FIPT
436	Male Adapter	MIPT x Slip
437	Bushing	Slip x Slip
438	Bushing	Spg x Slip
439	Thread Bushing	MIPT x FIPT
447	Cap	Slip
448	Thread Cap	FIPT
449	Plug	Spg
450	Thread Plug	MIPT
475	Wye	All Slip
488	Running Trap	Spg x Spg
489	P-Trap	Spg x Spg

SIZE KEY STRAIGHT SIZES		SIZE KEY REDUCING SIZES		SIZE KEY REDUCING SIZES	
1/4	002	1/2 x 1/2 x 1/4	072	2 x 1 1/2 x 3/4	238
3/8	003	1/2 x 1/2 x 3/4	074	2 x 1 1/2 x 1	239
1/2	005	3/4 x 1/2 x 1/2	094	2 x 1/2 x 1 1/2	241
3/4	007	3/4 x 1/2 x 3/4	095	2 x 2 x 1/2	247
1	010	3/4 x 3/4 x 1/2	101	2 x 2 x 3/4	248
1 1/4	012	3/4 x 3/4 x 1	102	2 x 2 x 1	249
1 1/2	015	1 x 1/2 x 1	122	2 x 2 x 1 1/4	250
2	020	1 x 3/4 x 1/2	124	2 x 2 x 1 1/2	251
2 1/2	025	1 x 3/4 x 3/4	125	2 1/2 x 2 1/2 x 1/2	287
3	030	1 x 3/4 x 1	126	2 1/2 x 2 1/2 x 3/4	288
4	040	1 x 1 x 1/2	130	2 1/2 x 2 1/2 x 1	289
5	050	1 x 1 x 3/4	131	2 1/2 x 2 1/2 x 1 1/4	290
6		1 x 1 x 1 1/4	132	2 1/2 x 2 1/2 x 1 1/2	291
060		1 x 1 x 1 1/2	133	2 1/2 x 2 1/2 x 2	292
8	080	1 1/4 x 1 x 1/2	156	3 x 3 x 1/2	333
10	100	1 1/4 x 1 x 3/4	157	3 x 3 x 3/4	334
12	120	1 1/4 x 1 x 1	158	3 x 3 x 1	335
		1 1/4 x 1 1/4 x 1/2	166	3 x 3 x 1 1/4	336
		1 1/4 x 1 1/4 x 3/4	167	3 x 3 x 1 1/2	337
		1 1/4 x 1 1/4 x 1	168	3 x 3 x 2	338
		1 1/2 x 1 1/4 x 1/2	199	3 x 3 x 4	342
		1 1/2 x 1 1/4 x 3/4	201	4 x 4 x 3/4	416
		1 1/2 x 1 1/4 x 1	202	4 x 4 x 1	417
		1 1/2 x 1 1/2 x 1/2	209	4 x 4 x 1 1/4	418
		1 1/2 x 1 1/2 x 3/4	210	4 x 4 x 1 1/2	419
		1 1/2 x 1 1/2 x 1	211	4 x 4 x 2	420
		1 1/2 x 1 1/2 x 1 1/4	212	4 x 4 x 3	422
		1 1/2 x 1 1/2 x 2	213		

Fitting Terms and Abbreviations

FIPT = Female NPT Thread
Spg = Male End (Spigot)
MIPT = Male NPT Thread
NPSM = Straight Thread for Mechanical Joint
SJ = Slip Joint
Hub = Plastic Socket

Schedule 40 Only
FIPT = Female NPT Thread
MIPT = Male NPT Thread
Slip = Female Socket
Spg = Male End (Spigot)

Ball Valve
S = Socket
T = Threaded

Schedule 80 Only
FIPT = Female NPT Thread
CL = Close
MIPT = Male NPT Thread
Slip = Female Socket
SH = Short
Spg = Male End (Spigot)

CPVC-CTS Only
C = Copper Solder Joint (Transition)
Compression = Transition Fitting
FIPT = Female NPT Thread
MIPT = Male NPT Thread
Slip = Female Socket
Spg = Male End (Spigot)
IPS = Iron Pipe Size
CTS = Copper Tube Size

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Material Selection

Thermoplastic and Elastomers

ABS

(Acrylonitrile-butadiene-styrene) Class 3-2-2-2-2, conforming to ASTM D 3965, is a time proven material. The smooth inner surface and superior resistance to deposit formation makes ABS drain, waste and vent material ideal for residential and commercial sanitary systems. The residential DWV system can be exposed in service to a wide temperature span. ABS-DWV has proven satisfactory for use from -40°F to 180°F. These temperature variations can occur due to ambient temperature fluctuations or the discharge of hot liquids into the system. ABS-DWV is very resistant to a wide variety of materials ranging from sewage to commercial household chemical formulations. ABS-DWV is joined by solvent cementing or threading and can easily be connected to steel, copper, or cast iron through the use of transition fittings.

PVC

(Polyvinyl Chloride) conforming to ASTM D 1784 Class 12454, formerly designated Type 1, Grade 1. PVC is the most frequently specified of all thermoplastic materials. It has been used successfully for over 30 years in such areas as chemical processing, industrial plating, chilled water distribution, deionized water lines, chemical drainage, and irrigation systems. PVC is characterized by high physical properties and resistance to corrosion and chemical attack by acids, alkalies, salt solutions and many other chemicals. It is attacked, however, by polar solvents such as ketones, some chlorinated hydrocarbons, and aromatics. The maximum service temperature of PVC is 140°F. With a design stress of 2,000 psi, PVC has the highest long-term hydrostatic strength at 73°F of any of the major thermoplastics being used for piping systems. PVC is joined by solvent cementing, threading, or flanging.

CPVC

(Chlorinated Polyvinyl Chloride) Class 23447, formerly designated Type IV, Grade 1 conforming to ASTM D 1784, has physical properties at 73°F similar to those of PVC and its chemical resistance is similar to or generally better than that of PVC. CPVC, with a design stress of 2000 psi and maximum service temperature of 210°F, has, over a period of about 30 years, proven to be an excellent material for hot corrosive liquids, hot and cold-water distribution, and similar applications above the temperature range of PVC. CPVC is joined by solvent cementing, threading, or flanging.

PTFE

PTFE (Polytetrafluoroethylene) has outstanding resistance to chemical attack by most chemicals and solvents. PTFE has a temperature rating of -200°F to 500°F. PTFE, a self-lubricating compound, is used as a seat material in NIBCO/Chemtrol® ball valves.

FPM

FPM (Fluoroelastomers or Fluorocarbons) are inherently compatible with a broad spectrum of chemicals. Because of this extensive chemical compatibility, which spans considerable concentration and temperature ranges, fluorocarbons have gained wide acceptance as a material of construction for butterfly valve "O"-rings and seats. Fluorocarbons can be used in most applications involving mineral acids (with the exception of HCl), salt solutions, chlorinated hydrocarbons, and petroleum oils.

EPDM

EPDM is a terpolymer elastomer made from ethylene, propylene and diene monomer. EPDM has good abrasion and tear resistance and offers excellent chemical resistance to a variety of acids and alkalines. It is susceptible to attack by hydrocarbons and is not recommended for applications involving petroleum oils, strong acids, or strong alkalines.

Material Selection

Plastic Piping Standards

THERMOPLASTIC PIPING MATERIALS

ASTM Test Methods	Properties	Material		
		ABS 3-2-2-2-2	PVC 12454	CPVC 23447
General D 792	Specific Gravity	1.00 - 1.08	1.38	1.55
D 570	Water Absorption % 24 Hrs. @ 73°F	0.3	0.05	0.05
Mechanical D 638	Tensile Strength psi @ 73°F	4,500	7,000	7,000
D 638	Modulus of Elasticity in Tension psi @ 73°F x 10^5	2.4	4.0	3.6
D 790	Flexural Strength psi	10,000	14,500	15,600
D 256	Izod Impact Strength @ 73°F (Notched)	4.0	0.65	1.5
Thermal D 696	Coefficient of Thermal Expansion in/in/°Fx10^{-5}	5.0	3.0	3.8
C 177	Thermal Conductivity BTU/HR/Sq. Ft./°F/in	1.35	1.2	0.95
D 648	Heat Distortion Temp. °F @ 66 psi	219	165	238
D 648	Heat Distortion Temp. °F @ 264 psi	180	158	212
	Resistance to Heat °F at Continuous Drainage	180	140	210
Flammability D 2863	Limiting Oxygen Index (%)	19	43	60
E 84	Flame Spread	150-250	15-20	15
	Underwriter's Lab Rating (Sub. 94)	94HB	94V-0	94V-0

Plastic Piping Standards

Many commercial, industrial, and governmental standards or specifications are available to assist the design engineer in specifying plastic piping systems. Standards most frequently specified in plastic piping systems are American Society for Testing and Materials (ASTM) Standards. Below is a list and description of those standards most typically applied to industrial plastic piping.

ASTM Standard D 1784

This standard covers PVC and CPVC compounds used in the manufacture of plastic pipe, valves, and fittings. It provides a means for selecting and identifying compounds on the basis of a number of physical and chemical criteria. Conformance to a particular material classification in this standard requires meeting a number of minimum physical and chemical properties.

ASTM Standards D 2665 and D 3311

These standards provide the material and test requirements as well as the fitting geometries for PVC-DWV (drain, waste and vent) fittings. These fittings are joined by threading or solvent cementing.

ASTM Standard D 2466

This standard covers Schedule 40 PVC threaded and socket pressure fittings. Included in the standard are thread and socket specifications, lay length, wall thickness, burst, material, quality, and identification requirements.

ASTM Standard D 2467

This standard covers Schedule 80 PVC threaded and socket fittings. Included in the standard are thread and socket specifications, lay length, wall thickness, burst, material, quality, and identification requirements.

ASTM Standard D 2846

This standard covers plastic hot and cold-water distribution system components made in one standard dimension ratio. This includes a series of CTS (copper tube size) CPVC fittings meant for use with SDR 11 tube and plastic-to-metal transition fittings.

ASTM Standard D 3965

This standard covers ABS compounds used in the manufacture of pipe and fittings. It identifies the chemical and physical properties of several ABS compositions based upon impact strength, deflection temperature under load, and tensile stress at yield point. These properties identify the polymers or blends of polymers that make up this rigid thermoplastic material.

ASTM Standards D 2661 and D 3311

These standards cover ABS-DWV (drain, waste and vent) by material and by physical configuration. These products are threaded or joined by solvent cement.

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Material Selection

Plastic Piping Standards and Chemical Resistance

ASTM Standard F 1498

This standard covers dimensions, tolerances, and gaging of tapered pipe threads used on plastic ends of pipe and fittings.

ASTM Standard F 1970

This standard covers fittings and appurtenances intended to be used in PVC or CPVC plastic piping, or as a transition from such systems to metal systems. These products, such as unions, flanges, or valves, are not included in the scope of other ASTM specifications.

ASME B1.20.1 (American Society of Mechanical Engineers)

This specification details the dimensions, tolerances, and gaging of tapered pipe threads used on metallic ends of pipe and fittings, plus machined plastic threaded ends.

ANSI/NSF Standard 14 (NSF International, formerly National Sanitation Foundation)

This standard establishes the minimum physical and performance requirements for plastic piping system components and related materials. It also provides a basis for certification of products to consensus standards, or other physical and performance requirements where no consensus standard exists. It requires adherence to appropriate ASTM Standards and specifies minimum quality control programs. To comply with this standard the manufacturer must allow periodic testing of product and auditing of procedures by a third-party agency.

ANSI/NSF Standard 61

At the request of the U.S. Environmental Protection Agency (EPA), a consortium led by NSF International developed this standard. It was developed to establish minimum requirements for the control of potential adverse human health effects from products which contact drinking water. This Standard complements the performance requirements that are contained within ASTM product standards. NIBCO® PVC & CPVC fitting products intended for potable water applications are tested and certified by a third-party agency for compliance to ANSI/NSF Standard 61.

CSA (Canadian Standards Association)

CSA tests piping products against Canadian standards. These standards require that products meet certain criteria such as dimensions, strength, and compatibility with potable water. Most products sold in Canada require the CSA listing.

IAPMO (International Association of Plumbing and Mechanical Officials)

IAPMO is responsible for the Uniform Plumbing Code (UPC). Products listed by IAPMO are tested by third-party organizations and/or meet PS (Product Standards) or IS (Installation Standards) which are written by IAPMO. Listed products will contain the UPC or IAPMO-T (1½" sizes for mobile home and recreational vehicle (MHRV) use) mark.

Chemical Resistance

Thermoplastics exhibit a 'GO' or 'NO-GO' type of resistance when contacted by aggressive chemicals. That is, they either resist attack completely or they deteriorate rapidly, in which case, the mechanism of attack is either solvation or reaction with the base molecule. Solvation, which is the most common form of attack, involves penetration of a chemical into the plastic causing softening, swelling, and loss of physical properties. Reaction with the base molecule involves the breakage of the molecular chain, crosslinking, or substitution reactions.

The NIBCO *Chemical Resistance Guide* contains specific chemical resistance information for the various plastic and elastomeric materials used in the NIBCO product line. When interpreting the information presented in this brochure it is important to note that it is based only on unstressed immersion testing at the temperatures noted, using pure chemicals or saturated solutions, except where otherwise specified. It is unwise to specify a plastic material without chemical resistance information relative to the specific environment of the intended application. Therefore, in situations where the aggressive environment involves a mixture of chemicals, the Chemical Resistance Guide can be used to investigate the effects of individual chemicals; however, because of possible synergisms, the suitability of a particular plastic for handling a chemical mixture should be verified. Also, since chemicals are more aggressive at higher temperatures and concentrations, chemical resistance information should not be extrapolated to higher temperatures and concentrations. Conversely, chemicals are generally less aggressive at lower temperatures and concentrations; therefore, extrapolation of chemical resistance information to lower temperatures and concentrations is generally acceptable.

When chemical resistance information is not available or a first-of-a-kind process is involved, data may be obtained through immersion testing. ASTM D 543 provides a method for conducting such tests, and the chemical, as well as, the temperature used in this test should be identical to the anticipated process condition.

Pressure Ratings

Pipe and Tube

[1]Based on water service, for more severe service, an additional correction factor may be required.

Maximum Non-Shock Operating Pressure (psi) AT 73°F[1]			
Nominal Size	**Schedule 40 PVC**	**Schedule 80 PVC**	**CPVC-CTS SDR-11**
3/8	620	920	400
1/2	600	850	400
3/4	480	690	400
1	450	630	400
1 1/4	370	520	400
1 1/2	330	470	400
2	280	400	400
2 1/2	300	425	N/A
3	260	375	N/A
4	220	325	N/A
6	180	280	N/A
8	160	250	N/A
10	140	230	N/A
12	130	230	N/A

NOTE: ABS & PVC DWV used for non-pressure applications only.
N. R. - Not Recommended
N/A - Not Available

Pipe and tube pressure ratings are based on non-shock service. As the severity of the service application increases, a service-correction factor should be considered. Specifically, for Schedule 40 applications that my experience severe cyclincal-pressure loading, such as in irrigation systems, the following maximum-suggested design pressures are suggested.

Systems with threaded Schedule 80 thermoplastic fittings shall have a maximum-suggested design pressure of 50% that of equivalent pipe size pressure rating. This reduction is because threads are formed by the removal of material. Refer to the following table for maximum-suggested design pressures.

Conversely, CPVC-CTS pipe and fittings do carry the same pressure rating, as defined by ASTM D2846. Refer to the following table for maximum-suggested design pressures.

Fittings with Service Correction Factors

NOTE: ABS & PVC DWV used for non-pressure applications only.

Maximum–Suggested Design Pressure (psi) AT 73°F[1]			
Nominal Size	**Schedule 40 PVC**	**Schedule 80 PVC**	**CPVC-CTS SDR-11**
	Socket End	**Threaded End**	**Socket End**
3/8	370	460	400
1/2	360	420	400
3/4	280	340	400
1	270	320	400
1 1/4	220	260	400
1 1/2	200	240	400
2	170	200	400
2 1/2	180	210	N/A
3	155	190	N/A
4	130	160	N/A
6	110	N.R.	N/A
8	95	N.R.	N/A
10	85	N.R.	N/A
12	80	N.R.	N/A

N. R. - Not Recommended
N/A - Not Available

The maximum-allowable non-shock pressure rating for PVC and CPVC-CTS thermoplastic piping is a function of temperature. For pipe and fitting applications above 73°F, refer to the table below for Temperature Correction Factors. To determine the maximum non-shock pressure rating at an elevated temperature, simply multiply the base pressure rating obtained from the appropriate table by the correction factor from the following table. Below 73°F the pressure rating will be the same as the base pressure in the tables above.

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Pressure Ratings (Continued)

Fittings Temperature Correction Factors

Operating Temperature, °F	FACTORS	
	PVC	CPVC-CTS
70	1.00	1.00
80	0.90	0.96
90	0.75	0.92
100	0.62	0.85
110	0.50	0.77
120	0.40	0.70
130	0.30	0.55
140	0.22	0.50
150	N.R.	0.47
160	N.R.	0.40
170	N.R.	0.32
180	N.R.	0.25
200	N.R.	0.18
210	N.R.	0.15

N.R. - Not Recommended

Valves, Flanges, and Unions

The maximum pressure rating for NIBCO® valves, flanges, and unions, regardless of size, is 150 psi at 73°F. As with all other thermoplastic piping components, the maximum non-shock operating pressure is related to temperature. Above 100°F refer to the chart below.

Temperature Correction Factors

Operating Temperature, °F	Maximum Non-Shock Operating Pressure, psi	
	PVC	CPVC
100	150	150
110	135	140
120	110	130
130	75	120
140	50	110
150	N.R.	100
160	N.R.	90
170	N.R.	80
180	N.R.	70
190	N.R.	60
200	N.R.	50

N.R. - Not Recommended

ABS & PVC-DWV Pipe & Fittings

NIBCO® ABS 5800 series fittings conform to the material and dimensions of American Society for Testing and Materials, ASTM D 2661 and D 3311. ABS pipe meets the material requirements of ASTM D 3965 and the dimensions of ASTM D 2661.

NIBCO® PVC 4800 series fittings are manufactured to meet the material and dimensional requirements of ASTM D 2665 and D 3311. PVC pipe is produced in compliance with ASTM D 2665 and D 1784.

NIBCO products have been designed to conform to the specifications listed above. Many of these products have been listed by and contain the mark of CSA, IAPMO, and NSF. For a current listing contact NIBCO INC.

ABS & PVC Schedule 40 Pipe Dimensions

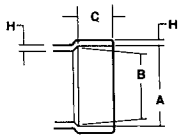
Nominal Size	Average O.D., in.	Average I.D., in.	Min. Wall Thickness, in.
1 1/4	1.660	1.380	0.140
1 1/2	1.900	1.610	0.145
2	2.375	2.067	0.154
3	3.500	3.068	0.216
4	4.500	4.026	0.237
6	6.625	6.065	0.280
8*	8.625	7.981	0.322
10*	10.750	10.020	0.365
12*	12.750	11.938	0.406

*These sizes of ABS pipe are not currently covered in ASTM D 2661.

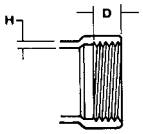
Pipe

Dimensions of NIBCO® ABS & PVC DWV Fitting Sockets, Threaded Ends and Male Ends

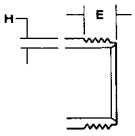
Solvent Socket (HUB)



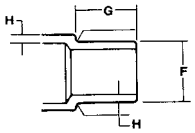
Internal (Female) Threads (FIPT)



External (Male) Threads (MIPT)



Spigot (Male) End (SPIG)



Nominal Size	A, avg.	B, avg.	C, min.	D	E	F	G, min.	H, min.
1 1/4	1.670	1.655	0.688	0.75	0.71	1.660	0.75	0.16
1 1/2	1.910	1.895	0.688	0.75	0.72	1.900	0.75	0.16
2	2.385	2.370	0.750	0.75	0.75	2.375	0.81	0.16
3	3.515	3.495	1.500	1.20	1.20	3.500	1.56	0.22
4	4.515	4.495	1.750	1.30	1.30	4.500	1.81	0.25
6	6.647	6.614	3.000	1.50	1.51	6.625	3.06	0.28
8	8.655	8.610	4.000	2.00	1.72	8.625	4.06	0.33
10	10.776	10.737	5.000	2.20	N/A	10.750	5.06	0.36
12	12.788	12.736	6.000	2.38	N/A	12.750	6.06	0.41

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PVC Schedule 40 Pipe & Pressure Fittings

PVC Schedule 40 pipe and fittings are made for use in cold water systems where the temperature does not exceed 140°F. PVC Schedule 40 fittings are made in compliance with ASTM D 2466. Schedule 40 pipe meets the requirements of ASTM D 1785. Both the pipe and fittings are manufactured from material conforming to ASTM D 1784 and meeting cell Class 12454.

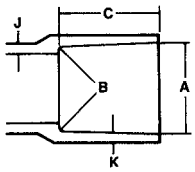
Schedule 40
*Pipe Dimensions and References

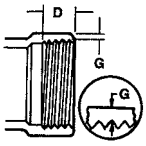
(20 ft. lengths)

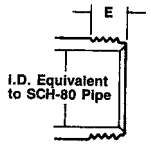
Nominal Size	Average Outside Diameter Inches	Average Inside Diameter Inches	Wall Thickness Inches		Pipe Wall Cross-Sectional Area Inches^2	Inside Diameter Area Inches^2
			Nom.	Min.		
1/2	0.840	0.602	0.119	0.109	0.270	0.285
3/4	1.050	0.804	0.123	0.113	0.358	0.508
1	1.315	1.029	0.143	0.133	0.527	0.832
1 1/4	1.660	1.360	0.150	0.140	0.712	1.453
1 1/2	1.900	1.590	0.155	0.145	0.850	1.986
2	2.375	2.047	0.164	0.154	1.139	3.291
2 1/2	2.875	2.445	0.215	0.203	1.797	4.695
3	3.500	3.042	0.229	0.216	2.353	7.268
4	4.500	3.998	0.251	0.237	3.351	12.554
6	6.625	6.031	0.297	0.280	5.904	28.567
8	8.625	7.942	0.341	0.322	8.887	49.539
10	10.750	9.976	0.387	0.365	12.599	78.164
12	12.750	11.889	0.430	0.406	16.662	111.015

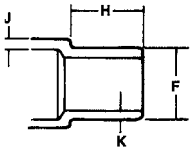
* Do not thread Schedule 40 pipe. Use appropriate fittings for threaded assembly.

Fittings[1]









Nominal Size	Average Outside Diameter Inches	Solvent Socket (Hub)			Internal Threads (FIPT)		External Threads (MIPT)	Male End (Spg)		Wall Thickness	
		A	B	C^2 Min.	D	G Min.	E	F	H Min.	J^2 Min.	K^2 Min.
1/2	0.840	0.848	0.836	0.688	0.463	0.072	0.463	0.840	0.688	0.136	0.109
3/4	1.050	1.058	1.046	0.719	0.482	0.079	0.482	1.050	0.719	0.141	0.113
1	1.315	1.325	1.310	0.875	0.574	0.087	0.574	1.315	0.875	0.166	0.133
1 1/4	1.660	1.670	1.655	0.938	0.594	0.098	0.594	1.660	0.938	0.175	0.140
1 1/2	1.900	1.912	1.894	1.094	0.594	0.106	0.594	1.900	1.094	0.181	0.145
2	2.375	2.387	2.369	1.156	0.610	0.123	0.610	2.375	1.156	0.193	0.154
2 1/2	2.875	2.889	2.868	1.750	0.932	0.139	0.932	2.875	1.750	0.254	0.203
3	3.500	3.516	3.492	1.875	1.016	0.160	1.016	3.500	1.875	0.270	0.216
4	4.500	4.518	4.491	2.000	1.094	0.194	1.094	4.500	2.000	0.296	0.237
6	6.625	6.647	6.614	3.000	1.208	0.280	1.513	6.625	3.000	0.350	0.280
8	8.625	8.655	8.610	4.000	1.313	0.322	1.723	8.625	4.000	0.403	0.322
10	10.750	10.776	10.737	5.375	-	-	-	10.750	5.375	0.487	0.402
12	12.750	12.765	12.700	6.875	-	-	-	12.750	6.875	0.532	0.465

[1]With exception of thread lengths, dimensions shown are listed in ASTM D 2466 for PVC Schedule 40 Fittings.
[2]NIBCO fittings may exceed certain minimum ASTM dimensional requirements shown in order to ensure functional satisfaction.

General Storage, Handling, and Safety Considerations for Thermoplastic Piping Components

STORAGE

Thermoplastic piping components are designed and manufactured for use in systems involving the transport of aggressive liquids as well as potable water. In order to ensure their integrity, they must be handled with reasonable care prior to installation.

Pipe

When pipe is received in standard lifts it should remain in the lift until ready for use. Lifts should not be stacked more than three high and should always be stacked wood-on-wood. Loose pipe should be stored on racks with a minimum support spacing of three feet. Pipe should be shaded but not covered directly when stored outside in high ambient temperatures. This will provide for free circulation of air and reduce the heat build-up due to direct sunlight exposure.

Fittings

Fittings should be stored in their original cartons to keep them free of dirt and reduce the possibility of damage. If possible, fittings should be stored indoors.

Solvent Cements and Primers

Solvent cements have a definitive shelf life and each can and carton is clearly marked with a date of manufacture. Stock should be rotated to insure that the oldest material is used first.

HANDLING

Pipe and Fittings

Care should be exercised to avoid rough handling of thermoplastic pipe and fittings. They should not be dragged over sharp projections, dropped, or have objects dropped upon them. Pipe ends should be inspected for cracks resulting from such abuse. Transportation by truck or pipe trailer will require that the pipe be continuously supported and all sharp edges on the trailer bed that come in contact with the pipe must be padded.

Solvent Cements and Primers

Keep containers for solvent cements tightly closed except when in use. Avoid prolonged breathing of solvent vapors, and when pipe and fittings are being joined in partially enclosed areas use a ventilating device to attenuate vapor levels. Keep solvent cements, primers, and cleaners away from all sources of ignition, heat, sparks, and open flames. Avoid repeated contact with the skin by wearing proper gloves impervious to the solvents. Application of the solvents or cements with rags and bare hands is not recommended; natural fiber brushes and other suitable applicators can produce satisfactory results.

IMPORTANT FACTS TO KNOW ABOUT ABS, PVC, AND CPVC SOLVENT CEMENT

1. ABS solvent cement should be used only for joining ABS pipe and fittings.
2. PVC solvent cement should be used only for joining PVC Pipe and fittings.
3. CPVC solvent cement should be used only for joining CPVC pipe and fittings.
4. A good joint is as strong as the pipe, since the solvent chemically welds the fitting to the pipe.
5. The solvent cement containers should always be covered when not in use to prevent excessive evaporation. Do not use thinner. Cement that shows signs of thickening and is lumpy should be discarded.
6. PVC solvent cement and primer can be used for both PVC pressure and DWV piping systems.

SAFETY CONSIDERATIONS

Pipe and Fittings

ABS, PVC, and CPVC products contained within this catalog are intended for use in the distribution of media that are chemically compatible with the piping materials. **Due to the inherent hazards associated with testing these components and piping systems with compressed air or other compressed gases, NIBCO does not allow pneumatic testing or use of these products in compressed air or gas piping systems.**

Note: Pressurized (compressed) air and other compressed gases contain large amounts of stored energy, which present serious safety hazards should the system fail for any reason.

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General Storage, Handling, and Safety Considerations for Thermoplastic Piping Components (continued)

Solvent Cements and Primers

DANGER:

- Solvent cements and primers are extremely flammable.
- Vapors from solvent cements and primers may be harmful if inhaled for prolonged periods of time.
- Solvent cements and primers may be harmful if swallowed.
- Solvent cements and primers may cause skin or eye irritation.

CAUTION: Solvent cements and primers are composed of various solvents and as such require special conditions for storage. Because of their flammability they must not be stored in an area where they might be exposed to ignition, heats, sparks, or open flames.

Solvent Welding Instructions for ABS, PVC, & CPVC-CTS FlowGuard Gold® Pressure & DWV Piping Systems

Scope

The solvent welding procedure detailed herein applies to all NIBCO® ABS-DWV, PVC-DWV, PVC, and CPVC-CTS pressure piping systems including molded fittings and valves. Belled-end pipe and sewer pipe can also be joined in this manner. NIBCO TECHNICAL SERVICES is available for additional solvent-welding guidance and recommendations.

Joining Equipment and Materials

- Cutting Tool
- Rags (non-synthetic, i.e., cotton)
- Deburring Tool
- Cement and Primer Applicators
- Applicator Can or Bucket
- Purple Primer
- Solvent Cement
- Tool Tray
- Notched Boards

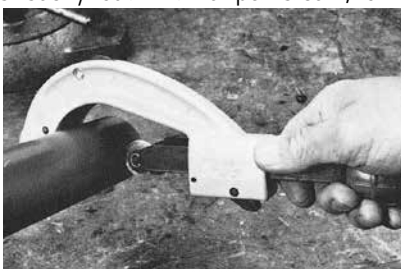
TYPES OF CEMENT

- PVC Solvent Cement - Light Duty Industrial Grade is for use with all Sch. 40, DWV and SDR pipe through 6".
- PVC Solvent Cement - Heavy Duty Industrial Grade is for use with all Sch. 80 and SDR pipe through 6".
- PVC Solvent Cement - Extra Heavy Duty Industrial Grade is for use with all PVC pipe 6" and larger.
- ABS Solvent Cement - For use in joining Sch. 40, SDR, and DWV pipe through 12" size.
- CPVC-CTS, Orange Colored Solvent Cement is for use with all sizes of Copper Tube Size tube and fittings.
- Purple Primer is for use with all PVC and CPVC pipe/tube and fittings.

NOTE: Do not take shortcuts - follow instructions completely.

PIPE/TUBE PREPARATION

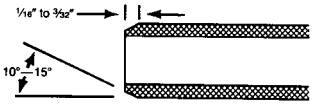
1. Cutting



Plastic pipe/tube can be easily cut with a powersaw, circular saw, band saw, or handsaw. For best results, use a fine-toothed blade (16-18 teeth per inch) with little or no set (maximum 0.025 inch). A circumferential speed of about 6,000 ft./min. is suitable for circular saws; band saw speed should be approximately 3,000 ft./min. Carbide-tipped blades are preferable when quantities of pipe/tube are to be cut. To insure square-end cuts, a mitre box, hold-down, or jig should be used. Pipe or tubing cutters can be used for smaller diameter pipe/tube when the cutting wheel is specifically designed for plastic pipe.

2. Deburring and Beveling

All burrs, chips, filings, etc., should be removed from both the pipe/tube I.D. and O.D. before joining. Use a knife, deburring tool, or a half-round, coarse file to remove all burrs. All pipe/tube ends should be beveled to approximately the dimensions shown below for ease of socketing and to minimize the chances of wiping the solvent cement from the I.D. of the fitting as the pipe/tube is socketed:



The beveling can be done with a coarse file or a beveling tool such as that manufactured by Reed Manufacturing Company, Erie, Pennsylvania.

FITTING PREPARATION

Prior to solvent welding, all fittings and couplings should be removed from their cartons and exposed for at least one hour to the same temperature conditions as the pipe/tube in order to assure that they are thermally balanced before joining.

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Solvent Welding Instructions for ABS, PVC, & CPVC-CTS FlowGuard Gold® Pressure & DWV Piping Systems (continued)

CLEANING

Using a clean, dry cotton rag, wipe away all loose dirt and moisture from the I.D. and O.D. of the pipe/tube end and the I.D. of the fitting. DO NOT ATTEMPT TO SOLVENT-WELD WET SURFACES.

DANGER: Solvent cements and primers are extremely flammable and harmful if swallowed. Vapors are harmful. May cause eye irritation and repeated or prolonged skin contact causes skin irritation.
Keep away from heat, sparks and open flame. Use only with adequate ventilation. Avoid contact with eyes, skin, and clothing. Avoid prolonged breathing of vapor. Close container after each use.
FIRST AID: In case of skin contact, flush with water; for eyes, flush with water for at least 15 minutes and seek medical attention. Wash contaminated clothing before reuse. If swallowed, DO NOT INDUCE VOMITING, call a Physician immediately.

PRIMING

The function of purple primer is to penetrate and soften the bonding surfaces of PVC and CPVC pipe/tube and fittings. (Primer is not required with ABS.) It is a product that penetrates rapidly. It is very effective on the hard-finished, high-gloss products now being produced.

Apply primer to the pipe/tube with a paint brush approximately 1/2 of the pipe/tube diameter. A rag is not recommended as repeated contact with skin may cause irritation or blistering.

Apply primer freely in the socket, keeping surface and applicator wet and in motion 5 to 15 seconds. Redip applicator as necessary. Avoid puddling in the socket.

Apply again to the fitting socket. The second application is especially recommended for belled-end pipe and fittings fabricated from pipe stock, for many of them have especially hard inside-surfaces.

For checking penetration, you should be able to scratch or scrape a few thousandths of an inch of the primed surfaces away. Repeated application to either or both surfaces may be necessary. Weather conditions affect priming action. In cold weather more time is required for proper penetration.

NOTE: The pipe/tube ends can be rested on notched boards to keep them clean and for ease of solvent cement application.

Note: There are "one-step" cements available for CPVC that eliminate the need to use a primer. Cements approved for use with FlowGuard Gold® CPVC will produce pressure-tight joints when used with NIBCO® CPVC pipe and fittings. NIBCO recommends that the use of "one-step" cements be limited to applications where established temperatures are 40°F or higher, following the cement manufacturer's instructions.

SOLVENT CEMENT APPLICATION

Using the proper applicator (see chart - page 80 for specific recommendations) proceed as follows:

1. Apply a full even layer of cement on the pipe O.D. for a distance slightly greater than the depth of the socket of the fitting.

2. Coat the fitting socket with a medium layer, avoiding puddling. On belled-end pipe or fabricated fittings, do not coat beyond the socket depth or allow cement to run beyond the bell.

3. Put a second full even layer on the pipe/tube O.D. Cement layers must be without voids and sufficient to fill any gap in the joints.

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Solvent Welding Instructions for ABS, PVC, & CPVC-CTS FlowGuard Gold® Pressure & DWV Piping Systems (continued)

HANDLING OF PRIMER AND CEMENT

NOTE: Observe the "use prior to" date. Cement has a limited shelf life. Do not permit solvent cement cans to stand open. Do not use cement that has dried to the point where it becomes lumpy and stringy. Dispose of properly. Do not attempt to thin out sluggish cement with thinner or primer. The solvents in the primer and cement are highly flammable, like a fast drying lacquer, and should not be used near an open flame. Use them in a well ventilated area and avoid prolonged breathing of the fumes. Prolonged contact with the skin could cause minor irritation.

JOINING

1. Immediately upon finishing cement application and before it starts to set, insert the pipe/tube to the full socket depth while rotating the pipe or fitting a 1/4 turn to insure complete and even distribution of the cement. Hold joint together for a minimum of 10 to 15 seconds to make sure that pipe/tube does not move or back out of the socket.

2. For pipe sizes 6" and larger, a joining crew consisting of two persons is recommended and the following additional steps necessary:
   a. Rotation of the pipe in the fitting may be omitted.
   b. Hold joint together for 1 to 3 minutes depending on pipe size.
   c. As an aid for joining in these larger sizes it is recommended that a come-along or pipe joining tool similar to that manufactured by Reed Manufacturing Company be used.

EXCESS CEMENT

Immediately after joining and before joint is set, gently place it back onto a level surface, wipe off all excess cement from the circumference of the pipe and fitting.

JOINT INTEGRITY

ABS, PVC, and CPVC-CTS piping joint integrity depends greatly upon following exactly and by intent NIBCO specific handling, inspection, storage, shipping, fabrication, installation, testing, and operating instructions. Joint integrity also depends greatly upon an infinitely wide, unpredictable, and uncontrollable set of product and environmental conditions that go into determining the length of drying times, before a joint should be moved, handled, or whether intended for low or high working-pressure applications. These conditions include size of pipe, surface temperature of the joint, dry joint interference fit, and relative humidity. Drying times will be faster with smaller pipe/tube, higher surface temperatures, tighter interference fits, and lower relative humidity. Drying times will be slower when these conditions are reversed.

Because of the uncontrollable and unpredictable variety of drying conditions that can exist from job-to-job and moment-to-moment, NIBCO recommends only the drying times and solvent-welding conditions specified below:

1. When exposed to direct sunlight, solvent-welding joining should not be done in atmospheric temperatures below 40°F or above 90°F.

2. NIBCO recommends that 24 hours of joint drying time should elapse for all sizes of pipe and drying temperatures, before the joint is moved or subjected to any appreciable internal or external pressure.

HANDLING

During the initial setting of the cement, which begins about two minutes after application, (on small sizes) be careful not to move or disturb the joint. NIBCO offers, as a non-liability supplier, the following drying times as a guide in aiding the installer, engineer, owner, or other decision making party in deciding at his own risk when the joints are sufficiently dry for movement, handling, low pressure, initial joint testing, application of high pressure tests, and introduction of working pressure. These drying times are based upon a combination of past field experience and laboratory tests.

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Solvent Welding Instructions for ABS, PVC, & CPVC-CTS FlowGuard Gold® Pressure & DWV Piping Systems (Continued)

ABS, PVC, and CPVC-CTS Joint Movement Times

Nominal Size	HOT WEATHER* 90°-150°F Surface Temperature	MILD WEATHER* 50°-90°F Surface Temperature	COLD WEATHER* 10°-50°F Surface Temperature
1/2 - 1 1/4	12 Min.	20 Min.	30 Min.
1 1/2 - 2 1/2	30 Min.	45 Min.	1 Hr.
3 - 4	45 Min.	1 Hr.	1 Hr. & 30 Min.
6 - 8	1 Hr.	1 Hr. & 30 Min.	2 Hrs. & 30 Min.
10 -12	2 Hrs.	3 Hrs.	5 Hrs.

*The temperatures above are only ***drying*** temperatures and should not be confused with atmospheric, joining-temperature recommendations and limitations. See Section on "Joint Integrity."

PRESSURE TESTING

CAUTION: AIR OR COMPRESSED GAS ARE *NOT* RECOMMENDED AS MEDIA FOR PRESSURE TESTING OF PLASTIC PIPING SYSTEMS.

1. Initial joint testing: Initial joint testing of PVC and CPVC-CTS pipe/tube could possibly be accomplished to 10% of its hydrostatic pressure rating after the below drying times have been observed:

PVC and CPVC-CTS Joint Drying Times at 10% Pressure.

Nominal Size	HOT WEATHER* 90°-150°F Surface Temperature	MILD WEATHER* 50°-90°F Surface Temperature	COLD WEATHER* 10°-50°F Surface Temperature
1/2 - 1 1/4	1 Hr.	1 Hr. & 15 Min.	1 Hr. & 45 Min.
1 1/2 - 2 1/2	1 Hr. & 30 Min.	1 Hr. & 45 Min.	3 Hrs.
3 - 4	2 Hrs. & 45 Min.	3 Hrs. & 30 Min.	6 Hrs.
6 - 8	3 Hrs. & 30 Min.	4 Hrs.	12 Hrs.
10 -12	6 Hrs.	8 Hrs.	72 Hrs.

*The temperatures above are only ***drying*** temperatures and should not be confused with atmospheric, joining-temperature recommendations and limitations. See Section on "Joint Integrity."

2. The PVC pipe and CPVC-CTS tube could possibly be pressure tested up to 100% of its hydrostatic pressure rating after the below drying times:

PVC and CPVC-CTS Joint Drying Times For 100% Pressure

Nominal Size	HOT WEATHER* 90°-150°F Surface Temperature	MILD WEATHER* 50°-90°F Surface Temperature	COLD WEATHER* 10°-50°F Surface Temperature
1/2 - 1 1/4	4 Hrs.	5 Hrs.	7 Hrs.
1 1/2 - 2 1/2	6 Hrs.	8 Hrs.	10 Hrs.
3 - 4	8 Hrs.	18 Hrs.	24 Hrs.
6 - 8	12 Hrs.	24 Hrs.	48 Hrs.
10 -12	18 Hrs.	36 Hrs.	72 Hrs.

*The temperatures above are only ***drying*** temperatures and should not be confused with atmospheric, joining-temperature recommendations and limitations. See Section on "Joint Integrity."

DO'S AND DON'TS

DO:

- Use the proper applicator.
- Use the proper type of solvent cement for the job.
- Follow the instructions completely.

DON'T:

- Attempt to solvent weld under the following conditions:
  1. If it is raining.
  2. If the atmospheric temperature is below 40°F.
  3. If under direct exposure to sun at atmospheric temperatures above 90°F
- Discard empty cans of solvent, primer or rags in trench or near piping. Concentrated fumes or dripping cement or primer can cause piping failure.

Solvent Welding Instructions for ABS, PVC, & CPVC-CTS FlowGuard Gold® Pressure & DWV Piping Systems (Continued)

HOT WEATHER CEMENTING

Since cement contains a solvent, certain precautions or steps should be taken when the atmospheric temperature is above 90°F, to avoid evaporation of the solvent from the cement just prior to joining. Such evaporation will cause the cement to prematurely set before joining, thus, adversely affecting the joint integrity. Use one or a combination of the list below to reduce the chances of this condition occurring:

1. Shade or shelter the joint surfaces from direct exposure to the sun's rays for at least one hour prior to joining and during the joining process.
2. Make cement joints during early morning hours.
3. Apply cement quickly. On 6" and larger pipe, it is recommended that two persons apply cement to pipe sur face while the third applies it to the fitting socket.
4. Join pipe to fittings as quickly as possible after applying cement.

COLD WEATHER CEMENTING

Because the solvents in the cement will not evaporate as readily when the temperature is below 40°F, the pipe joints will not set up as rapidly in cold weather. If solvent cementing must be done when the temperature is below 40°F the following suggestions are offered:

1. Store pipe, fittings, cement and primer in a heated area.
2. Prefab as much of the system as possible in a heated work area.
3. Joints that must be made outside should be protected with a portable shelter and heated with indirect heat to surface temperatures above 40°F prior to joining. The shelter and heat should remain in place for at least two hours after joint assembly.
4. Pipe and fittings must be dry prior to joining and the joints should be kept dry until the cement has had sufficient time to set.

CAUTION: DO NOT ATTEMPT TO SPEED THE SETTING OR DRYING OF THE CEMENT BY APPLYING DIRECT HEAT TO THE SOLVENT WELDED JOINT. Forced rapid drying by heating will cause the cement solvents to boil off, forming porosity, bubbles, and blisters in the cement film.

Applicators

Nominal Size	Roller Size	Recommended Brush Width*, in.
1/4	Not Recommended	1/2
3/8		1/2
1/2		1/2
3/4		1/2
1		1/2
1 1/4		1
1 1/2		1
2		1
2 1/2		1 1/2
3	3	1 1/2
4		2
6		3
8	7	4
10		4, 6, or 8
12		4, 6, or 8

*Natural bristle brushes should always be specified. It is recognized that the recommended brush width may not always be readily available. However, the selection should come as close as possible to the recommended width in order to insure complete coverage with a minimum number of brush strokes.

REQUIREMENTS

The below estimated PVC, CPVC, and ABS IPS pipe solvent cement requirements should only be considered as a guideline for usage and could vary according to a wide variety of installation conditions. Further, these estimates should in no way be used to restrict the liberal cement application instructions recommended for the pipe.

Number of Joints Per...*

*Each joint represents one socket in a fitting.

Nominal Size	Pint	Quart	Gallon
1/2	130	260	1040
3/4	80	160	640
1	70	140	560
1 1/4	50	100	400
1 1/2	35	70	280
2	20	40	160
2 1/2	17	34	136
3	15	30	120
4	10	20	80
5	8	16	64
6	N/R	8	24
8	N/R	3	12
10	N/R	N/R	10
12	N/R	N/R	6

N/R - Not Recommended

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Solvent Welding Instructions for ABS, PVC, & CPVC-CTS FlowGuard Gold® Pressure & DWV Piping Systems (Continued)

The estimated CPVC-CTS solvent cement requirements listed below should only be considered as a guideline for usage and could vary according to a wide variety of installation conditions. Further, these estimates should in no way be used to restrict the liberal cement application instructions recommended for the tube.

Number of Joints Per Pint

Nominal Size	Joints
1/2	255
3/4	170
1	138
1 1/4	95
1 1/2	68
2	38

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Threading Instructions for Thermoplastic Pipe

Scope

The procedure presented herein covers threading of all IPS Schedule 80 or heavier thermoplastic pipe. These tapered threads are National Pipe Threads (NPT) which are cut to the dimensions outlined in ANSI B1.20.1.

Thread Dimensions

PIPE		THREADS					
Nominal Size	Outside Diameter D, in.	Number of Threads Per Inch	Normal Engagement By Hand C, in.	Length of Effective Thread A, in.	Total Length: End of Pipe to Vanish Point B, in.	Pitch Diameter at End of Internal Thread E, in.	Depth of Thread (Max.) in.
1/4	0.540	18	0.228	0.4018	0.5946	0.49163	0.04444
1/2	0.840	14	0.320	0.5337	0.7815	0.77843	0.05714
3/4	1.050	14	0.339	0.5457	0.7935	0.98887	0.05714
1	1.315	11 1/2	0.400	0.6828	0.9845	1.23863	0.06957
1 1/4	1.660	11 1/2	0.420	0.7068	1.0085	1.58338	0.06957
1 1/2	1.900	11 1/2	0.420	0.7235	1.0252	1.82234	0.06957
2	2.375	11 1/2	0.436	0.7565	1.0582	2.29627	0.06957
2 1/2	2.875	8	0.682	1.1375	1.5712	2.76216	0.10000
3	3.500	8	0.766	1.2000	1.6337	3.38850	0.10000
4	4.500	8	0.844	1.3000	1.7337	4.38713	0.10000

Note: Do not thread Schedule 40 pipe.

THREADING EQUIPMENT AND MATERIALS

- Pipe Dies
- Pipe Vise
- Threading ratchet or power machine
- Tapered plug
- Cutting lubricant (soap and water)
- Strap wrench
- PTFE tape
- Cutting tools
- Deburring tool

PIPE PREPARATION

Plastic pipe can be easily cut with a powersaw, circular saw, band saw, or handsaw. For best results, use a fine-toothed blade (16-18 teeth per inch) with little or no set (maximum 0.025 inch). A circumferential speed of about 6,000 ft./min. is suitable for circular saws; band saw speed should be approximately 3,000 ft./min. Carbide-tipped blades are preferable when quantities of pipe are to be cut. To ensure square-end cuts, a mitre box, holddown, or jig should be used. Pipe or tubing cutters can be used for smaller diameter pipe when the cutting wheel is specifically designed for plastic pipe. Such a cutter is available from the Reed Manufacturing Co. or Ridge Tool Company.

THREADING DIES

Thread-cutting dies should be clean, sharp, and in good condition, and should not be used to cut materials other than plastics. Dies with a 5° negative front-rake angle are recommended when using power threading equipment and dies with a 5° to 10° negative front-rake angle are recommended when cutting threads by hand. When cutting threads with power threading equipment, self-opening die heads and a slight chamfer to lead the dies will speed production.

1. Hold pipe firmly in a pipe vise. Protect the pipe at the point of grip by inserting a rub- ber sheet or other material between the pipe and vise.

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Threading Instructions for Thermoplastic Pipe (Continued)

2. A tapered reinforcing plug must be inserted in the end of the pipe to be thread- ed. This plug pro- vides additional support and pre- vents distortion of the pipe in the threaded area. Distortion of the pipe during the thread- ing operation will result in eccentric threads, non-uniform circumferential thread depth or gouging and tearing of the pipe wall. See table below for approx- imate plug O.D. dimensions.

Reinforcing Plug Dimensions*

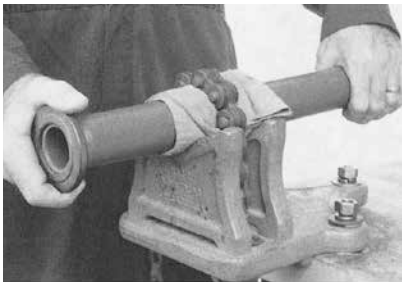
Nominal Size	Plug O.D.*
1/2	0.526
3/4	0.722
1	0.935
1 1/4	1.254
1 1/2	1.476
2	1.913
2 1/2	2.289
3	2.864
4	3.786

These dimensions are based on the median wall thicknesses and average outside diameter for the respective pipe sizes. Variations in wall thickness and 0. D. dimensions may require alteration of the plug dimensions.

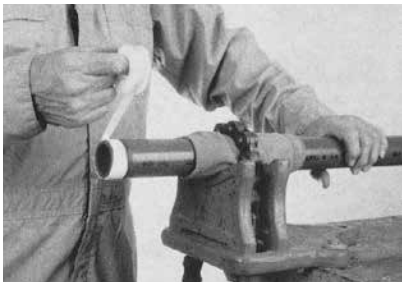
3. Use a die stock with a proper guide that is free of burrs or sharp edges, so that the die will start and go on square to the pipe axis.

4. Push straight down on the han- dle, avoiding side pressure that might distort the sides of the threads. If power threading equipment is used, the dies should not be driven at high speeds or with heavy pressure. Apply an external lubricant liberally when cut- ting the threads. Advance the die to the point where the thread dimensions are equal to those listed in the table on Thread Dimensions above. Do not over-thread.

5. Periodically check the threads with a ring gage to insure that proper procedures are being fol- lowed. Thread dimensions are listed in the table on Thread Dimensions. The gauging tolerance is ± 1 1/2 turns.



6. Brush threads clean of chips and ribbons. Then starting with the second full thread, and continuing over the thread length, wrap PTFE thread tape in the direction of the threads. Overlap each wrap by one half the width of the tape. Thread lubricant/sealant may be used if approved by the manufacturer.



Threading Instructions for Thermoplastic Pipe (Continued)

7. Thread the fitting onto the pipe and tighten by hand. Using a strap wrench only, further tighten the connection an additional one to two threads past hand tightness. Avoid excessive torque as this may cause thread damage or fitting damage.

Pressure Testing

Threaded piping systems can be pressure tested up to 100% of their hydrostatic pressure rating as soon as the last connection is made.

CAUTION: AIR OR COMPRESSED GAS ARE NOT RECOMMENDED AS MEDIA FOR PRESSURE TESTING OF PLASTIC PIPING SYSTEMS. FAILURE TO FOLLOW THIS WARNING MAY RESULT IN PERSONAL INJURY OR PROPERTY DAMAGE.

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Flanged Joints

Scope
Flanging is used extensively for plastic process lines that require periodic dismantling. Plastic flanges and factory flanged valves and fittings in PVC, CPVC, PVDF and polypropylene are available in a full range of sizes and types for joining to pipe by solvent welding, threading, or thermosealing as in the case with polypropylene and PVDF. Gasket seals between the flange faces should be an elastomeric full flat-faced gasket with a hardness of 50 to 70 durometer A. NIBCO can provide polychloroprene (CR) gaskets nominal sizes 1/2 through 8 having a 1/8 inch thickness. For chemical environments too aggressive for polychloroprene other more resistant elastomers should be used.

Dimensions
Bolt circle and number of bolt holes for the flanges are the same as Class 150 metal flanges per ANSI B16.5. Threads are tapered iron pipe size threads per ANSI B1.20.1. The socket dimensions conform to ASTM D 2467, which describes nominal sizes 1/2 thru 8. Internal NIBCO specifications have been established for the size 10 and 12 PVC patterns.

Pressure Rating
As with all other thermoplastic piping components, the maximum non-shock operating pressure is a function of temperature. Maximum pressure rating for NIBCO® valves, unions and flanges is 150 psi. Above 100°F refer to the chart.

Maximum Operating Pressure (psi)

Operating Temp. °F	PVC
100	150
110	135
120	110
130	75
140	50
150	N/R
160	N/R
170	N/R
180	N/R
190	N/R
200	N/R
250	N/R
280	N/R

N/R Not Recommended

ANSI B16.5 Dimensional Data for Flanges and Flanged Fittings
(Dimensions and Bolts Conform to Class 150 Steel Flanges)
Sealing

Dimensions				
		Drilling		
Nominal Size	Outside Diameter (inches)	Number of Holes	Diameter of Bolt (Inches)	Diameter of Bolt Circle (inches)
1/2	3.50	4	1/2	2.38
3/4	3.88	4	1/2	2.75
1	4.25	4	1/2	3.12
1 1/4	4.62	4	1/2	3.50
1 1/2	5.00	4	1/2	3.88
2	6.00	4	5/8	4.75
2 1/2	7.00	4	5/8	5.50
3	7.50	4	5/8	6.00
4	9.00	8	5/8	7.50
6	11.00	8	3/4	9.50
8	13.50	8	3/4	11.75
10	16.00	12	7/8	14.25
12	19.00	12	7/8	17.00

The faces of the flanges are tapered back away from the orifice area at a 1/2 to 1° pitch, so that when the bolts are tightened, the faces will be pulled together generating a force in the water way area to improve the sealing.

INSTALLATION TIPS
Once a flange is joined to the pipe, the method for joining two flanges together is as follows:

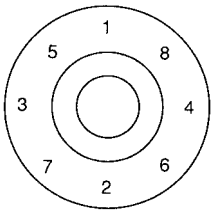
1. Make sure that all the bolt holes of the mating flanges match up. It is not necessary to twist the flange and pipe to achieve this.
2. Insert all bolts.
3. Make sure that the faces of the mating flanges are not separated by excessive distance prior to bolting down the flanges.
4. The bolts on the plastic flanges should be tightened by pulling down the nuts diametrically opposite each other using a torque wrench. Complete tightening should be accomplished in stages and the final torque values shown in the table should be followed for the various sizes of flanges. Uniform stress across the flange will eliminate leaky gaskets.

Flanged Joints (continued)

Flange Size	Recommended Torque*
1/2 - 1 1/2	10- 15 ft. lbs.
2 - 4	20- 30 ft. lbs.
6 - 8	33- 50 ft. lbs.
10	53- 75 ft. lbs.
12	80-110 ft. lbs.

*For a well-lubricated bolt with flat washers under bolt head and nut.

The following tightening pattern is suggested for the flange bolts:



5. If the flange is mated to a rigid and stationary flanged object, or a metal flange, particularly in a buried situa- tion where settling could occur with the plastic pipe, the plastic flange must be supported to eliminate potential stressing.

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Adapting Plastic Piping to Other Piping Materials

THREADED CONNECTIONS - ABS, CPVC, & PVC pipe less than Schedule 80 wall should not be threaded. Most codes require transition from one material to another by use of appropriate adapter fittings. NIBCO offers a complete line of adapters for ABS, CPVC, & PVC.
Common thread sealants should not be used on threaded ABS, CPVC, or PVC joints. When necessary, PTFE pipe tape can be used.

CONNECTING CPVC TO METAL PIPE OR FITTINGS - The recommended methods of joining CPVC tube to metal threaded valves or piping are to use one of the special transition unions or a CPVC adapter with a threaded-brass insert. Threaded plastic-to-metal connections are not recommended. The difference in the rates of expansion of CPVC and metal may cause leakage in threaded joints.

CONNECTING CPVC TO HOT WATER HEATER
An approved temperature/pressure relief valve should be assembled to the hot water heater so that the probe or sensing element enters the water at the top of the heater. Using metal nipples, extend the metal piping at least 12 inches from the water heater on both the cold water supply and the hot water discharge lines. Special transition unions or CPVC adapters with a threaded-brass insert must be used to join the CPVC tube to the nipples. Do not use CPVC pipe and fittings with commercial type non-storage water heaters.

Pipe Support Spacing

ABS & PVC piping should be supported just as any other piping system. Ordinary hanger straps may be used for suspending below floor systems. The light weight of ABS & PVC may lead one to believe that wider hanger spacing could be permitted. Four or five foot spacing is recommended, with proper support at the base of each stack. CPVC Pressure pipe should be supported every three feet.

Since ABS, CPVC, & PVC are non-metallic, they are not as "stiff" as their metal counterparts, therefore the installer must exercise care to assure proper alignment of required grades.

Branch fittings serving trap arms should also be secured to the framing to prevent movement. Hanger straps should not be so tight as to compress, distort, cut, or abrade the piping.

ALLOWING FOR EXPANSION-In Pressure piping, allowance for expansion due to changing temperature is important. It is good practice to include a 12-inch offset every ten feet in a straight run. Illustrated below are several methods for providing off sets.

Specific Gravity	Correction Factor
1.1	0.98
1.2	0.96
1.4	0.93
1.6	0.90
2.0	0.85
2.5	0.80

The above data is for un-insulated lines. For insulated lines reduce spans to 70% of table values. For spans of less than 2 feet continuous support should be used.

Pipe Support Spacing, ABS-DWV, Ft.			
Nominal Size	70°F	100°F	140°F
1 1/4	4 1/2	4 1/2	4
1 1/2	5	5	4 1/2
2	5	5	4 1/2
3	6	6	5 1/2
4	6 1/4	6 1/4	5 3/4
6	6 3/4	6 3/4	6
8	7	7	6 1/2
10	7	7	6 1/2
12	7	7	6 1/2

Pipe Support Spacing, CPVC-CTS, Ft.				
Nominal Size	70°F	100°F	140°F	180°F
1/2	3	3	2 1/2	2 1/2
3/4	3	3	2 1/2	2 1/2
1	3	3	2 1/2	2 1/2
1 1/4	4	4	3 1/2	3 1/2
1 1/2	4	4	3 1/2	3 1/2
2	4	4	3 1/2	3 1/2

Pipe Support Spacing, PVC-Schedule 40, Ft.			
Nominal Size	70°F	100°F	140°F
1/2	4 1/2	4	2 1/2
3/4	5	4	2 1/2
1	5 1/2	4 1/2	2 1/2
1 1/4	6	5	3
1 1/2	6	5	3
2	6	5	3
2 1/2	7	6	3 1/2
3	7	6	3 1/2
4	7 1/2	6 1/2	4
5	7 1/2	6 1/2	4
6	8 1/2	7 1/2	4 1/2
8	9	8	4 1/2
10	10	8 1/2	5
12	10	8 1/2	5

Pipe Support Spacing, PVC-Schedule 80, Ft.			
Nominal Size	70°F	100°F	140°F
1/2	5	4 1/2	2 1/2
3/4	5 1/2	4	2 1/2
1	6	5	3
1 1/4	6 1/2	5 1/2	3 1/2
1 1/2	6 1/2	5 1/2	3 1/2
2	7	6	3 1/2
2 1/2	8	7	4
3	8	7	4
4	9	7 1/2	4 1/2
6	10	9	5
8	11	9 1/2	5 1/2

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Expansion and Contraction of Plastic Pipe

CALCULATING STRESS

Plastics, like other piping materials, undergo dimensional changes as a result of temperature variations above and below the installation temperature. If movement resulting from these dimensional changes is restricted by adjacent equipment or by a vessel to which the pipe may be rigidly attached, the resultant stresses and forces may cause damage to such items or even to the pipe itself. In such a case, where compensation is not provided for these dimensional changes and where the piping system is rigidly held or restricted at both ends, an estimate of the magnitude of the resultant stresses can be obtained with the following formula. This formula relates the temperature differential to the temperature dependent modulus and the expansion coefficient for the particular plastic material.

$S = EC(T_1-T_2)$

Where:
S = Stress (psi)
E = Modulus of Elasticity (psi) (See table below for specific values at various temperatures)
C = Coefficient of Expansion (in/in/°Fx10^5) (See physical property chart on page 68 for values)
T_1-T_2 = Temperature differential between the installation temperature and the maximum or minimum system temperature
N/A = Not Applicable

Temperature Vs. Modulus (x 10^5) psi						
Temperature, °F	73	90	100	140	180	210
PVC	4.20	3.75	3.60	2.70	N/A	N/A
CPVC	4.23	4.00	3.85	3.25	2.69	2.20
ABS	2.71	2.43	2.40	1.90	1.54	N/A

The magnitude of the resultant longitudinal forces can be determined by multiplying the stress, times the plastic cross-sectional area.

Example 1:
Assuming the temperature extremes are from 70°F to 100°F, what would be the amount of force developed in nominal size 2 Schedule 40 PVC pipe with the pipe rigidly held and restricted at both ends?

$S = EC(T_1-T_2)$
$S = EC(30)$
$S = (3.60 \times 10^5) \times (3.0 \times 10^{-5})(30)$
$S = 324$ psi

The magnitude of the resultant longitudinal forces:
$F = S \times A$

Where:
F = Force (lbs)
S = Stress (psi)
A = Cross-sectional Area (in^2)

Nominal size 2 Schedule 40 PVC Pipe has:
OD = 2.375 in
ID = 2.047 in

$$\text{Cross-sectional area (A)} = \left[\left(\frac{OD}{2}\right)^2 - \left(\frac{ID}{2}\right)^2\right] \times 3.14 = 1.14 in^2$$

Therefore, the magnitude of the resultant longitudinal force is:
F = SA
F = 324 x 1.14
F = 369 lbs.

The extent of expansion or contraction is dependent upon the piping material of construction and its coefficient of linear expansion which, for convenience, is listed below for several materials in units of inches of expansion per 10°F temperature change per 100 feet of pipe or tube.

Expansion Coefficient	
Material	**Y, in/10°F/100ft**
PVC	0.360
CPVC	0.380
ABS	0.500

The degree of thermal expansion or contraction is also dependent upon the system temperature differential, as well as, the length of pipe run between changes in direction and it can be calculated using the following formula:

$$\Delta L = \frac{Y(T_1 - T_2)}{10} \times \frac{L}{100}$$

Expansion and Contraction of Plastic Pipe (Continued)

Where:

ΔL = Dimensional change due to thermal expansion or contraction (in.)

Y = Expansion coefficient (in/10°F/100ft) (See Table on previous page)

$(T_1\text{-}T_2)$ = Temperature differential between the installation temperature and the maximum and minimum system temperature, which ever provides the greatest differential (°F)

L = Length of pipe run between changes in direction (ft)

Example 2:

How much expansion can be expected in a 200 foot straight run of nominal size 3 PVC Pipe that will be installed at 75°F when the piping system will be operated at a maximum of 120°F and a minimum of 40°?

$$\Delta L = \frac{0.360(120 - 75)}{10} \times \frac{200}{100}$$

ΔL = .360 x 4.5 x 2.0 = 3.24 inches

Stresses and forces that result from thermal expansion and contraction can be reduced or eliminated by providing for flexibility in the piping system through frequent changes in direction or introduction of loops as graphically depicted in the figures below.

Normally, piping systems are designed with sufficient directional changes which provide inherent flexibility to compensate for expansion and contraction. However, when this is not the case or when there is reasonable doubt as to the adequate flexibility of the system, expansion loops or expansion joints should be designed into the system. If an expansion loop (which is fabricated with 90° elbows and straight pipe as depicted in Fig. 1) is to be used, the leg length (R) should be determined by using the following formula to insure that it is of sufficient length to absorb expansion and contraction movement without damage.

$$R = 1.44 \sqrt{D\Delta L}$$

Where:

R = Expansion loop leg length (ft)

D = Nominal outside diameter of pipe (in)

ΔL = Dimensional change due to thermal expansion or contraction (in)

Example 3:

How long should the expansion loop legs be in order to compensate for the expansion in Example 2?

$$R = 1.44 \sqrt{D\Delta L}$$

Flexibility, through the introduction of flexural off-sets, must be inserted into a piping system design in situations where straight runs of pipe are long or the ends of a straight run are restricted from movement and also in situations where the system is restrained. Several examples of methods for inserting flexibility in these situations are graphically presented below. In each case, rigid supports or restraints should not be placed within the leg length of an expansion loop, off-set, or bend.

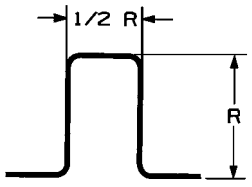

Fig. 1

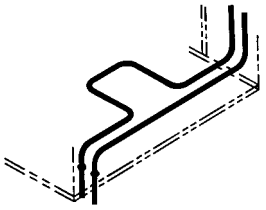

Fig. 2

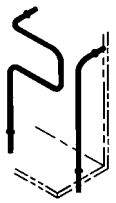

Fig. 3

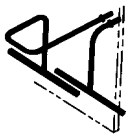

Fig. 4

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NIBCO® Plastic Fittings Warranty

NIBCO INC. LIMITED WARRANTY
Applicable to NIBCO INC. Plumbing Plastic Fittings and Valves

NIBCO INC. warrants each NIBCO® plumbing plastic fitting (including plumbing valves) to be free from defects in material and workmanship under normal use and service for a period of five (5) years from the date of purchase.

In the event any defect occurs which the owner believes is covered by this warranty, the owner should immediately contact NIBCO Technical Services, either in writing or by telephone at 1.888.446.4226 or 1.574.295.3000. The owner will be instructed to return said fitting or valve, at the owner's expense, to NIBCO INC. or an authorized NIBCO INC. representative for inspection. In the event said inspection discloses to the satisfaction of NIBCO INC. that said fitting or valve is defective, a replacement shall be mailed free of charge to the owner, and NIBCO INC. shall further pay the installing contractor the sum of ten ($10.00) dollars to apply on the cost of installation of said replacement fitting or valve.

TO THE EXTENT PERMITTED BY APPLICABLE LAW, THIS WARRANTY SPECIFICALLY EXCLUDES INCIDENTAL AND CONSEQUENTIAL DAMAGES OF EVERY TYPE AND DESCRIPTION RESULTING FROM ANY CLAIMED DEFECT IN MATERIAL OR WORKMANSHIP, INCLUDING BUT NOT LIMITED TO, PERSONAL INJURIES AND PROPERTY DAMAGES.

Some states do not allow the exclusion or limitations of incidental or consequential damages, so these limitations my not apply to you.

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This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and country to country.

How to Order

State quantity, figure number and size for each valve or fitting you wish to order. See individual catalog pages for specific or special product designations.

HOW MANY TO ORDER
NIBCO® valves and fittings are decimal packed for your convenience in handling, shipping and stock-keeping. Number in master carton varies with item.

POLICY ON RETURNS TO FACTORY
No NIBCO valves and fittings are to be returned without prior written agreement. Transportation must be prepaid. A 20% charge will be made to cover cost of rehandling and reinspection.

TECHNICAL ASSISTANCE
Engineers, contractors, wholesalers or manufacturers may obtain special or technical assistance from any factory representative of NIBCO. Write, fax or phone.

NIBCO INC.
World Headquarters
1516 Middlebury Street
Elkhart, IN 46516-4740
USA

PH: 1.574.295.3000 or 1.888.446.4226
FAX: 1.574.295.3307 or 1.888.336.4226

NIBCO® Accessory Products

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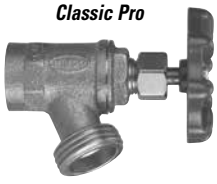
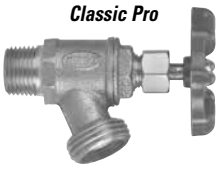
Bronze Boiler Drain Screw-in Bonnet 125 lb. CWP ***Classic Pro***  **73-CL** Sizes ½" - ¾" FIP to Hose page 100	Bronze Boiler Drain Screw-in Bonnet 125 lb. CWP ***Classic Pro***  **74-CL** Sizes ½" - ¾" ½ Cup or MIP to Hose ¾ MIP to Hose page 100	Quarter-Turn Hose Bibb 125 lb. CWP  **QT56X** Size ½" - ¾" Cup or Male to Hose Male Thread to Hose page 100

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Air Conditioning & Refrigeration Accessory Products Illustrated Index

Quarter-Turn Angle Sillcock  **QT63X** Size ½" - ¾" Threaded to Hose page 101	Quarter-Turn Angle Sillcock  **QT763X** Size ½" - ¾" Solder to Hose page 101	Lead Free* Stop & Waste Valve with Drain 125 lb. CWP  **76-LF** Sizes ½" - ¾" FIP x FIP page 102
Lead Free* Stop & Waste Valve with Drain 125 lb. CWP  **726-LF** Sizes ½" - ¾" Cup x Cup page 102	Bronze Gate Valve Screw-in Bonnet • Full Port 200 lb. CWP  **S or T29** Non-Rising Stem • Solid Wedge Sizes ½" - 2" Threaded or Solder Ends page 103	Brass Gate Valve Screw-in Bonnet • Full Port 200 lb. CWP  **S or TI-8** Non-Rising Stem • Solid Wedge Sizes ¼" - 4" Threaded or Solder Ends page 104
Brass Gate Valve Screw-in Bonnet 200 lb. CWP  **S or T113** Non-Rising Stem • Solid Wedge Sizes ¼" - 3" Threaded or Solder Ends page 105	Bronze Check Valve Inline Lift Type 200 lb. CWP  **S or T480** Sizes ⅜" - 2" Threaded or Solder Ends page 106	Brass Check Valve Swing Type 200 lb. CWP  **S or TI-3** Sizes ½" - 3" Threaded or Solder Ends page 107
Bronze Check Valve Horizontal Swing 200 lb. CWP  **S or T413** Sizes ¼" - 3" Threaded or Solder Ends page 108		

*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% per the Safe Drinking Water Act (Sec. 1417) amended 1-4-2011 and other equivalent state regulations.

Brass Ball Valves

Two-Piece Body • Full Port • Blowout-Proof Stem • PTFE Seats

¼"-2" 600 PSI/41.4 Bar Non-Shock Cold Working Pressure
2½"-4" 400 PSI/27.6 Bar Non-Shock Cold Working Pressure

CSA CERTIFIED TO ASME B16.44
AND CR91-002 (THREADED ¼"-4") • UL LISTED (THREADED ¼"-4")
• IAPMO LISTED TO NSF/ANSI 61-8
• FM APPROVED (THREADED ¼"-2")

Threaded

CSA (¼" - 4"):
- CR91-002: ½ psig, 2 psig, and 5 psig (these are specific approved categories)
- ASME B13.44: 125 psig (maximum)
- Temperature is -4° F to 194° F

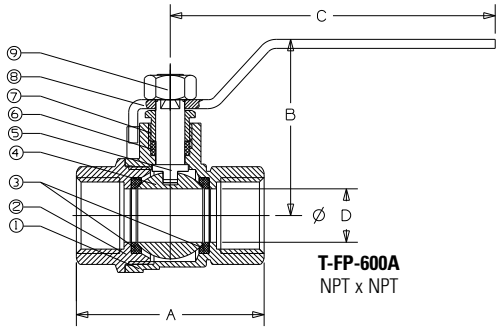
Threaded

FM (1/4" - 2"):
- 175wwp Threaded

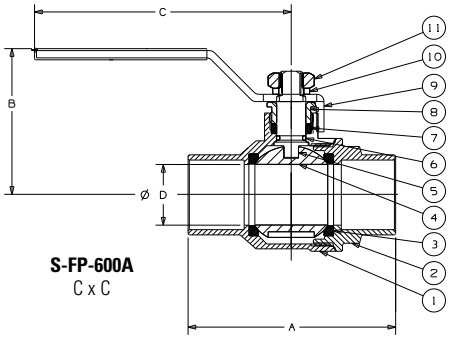
UL, Gas and Oil (¼" - 4"):
- YQNZ, Compressed Gas Shutoff Valves: 250 psi
- YRBX, Flammable Liquid Shutoff Valves: 250 psi
- YRPV, Gas Shutoff Valves: 250 psi
- YSDT, LP-Gas Shutoff Valves: 250 psi
- MHKZ, Manual Valves: 250 psi

T-FP-600A
Threaded

S-FP-600A
Solder



T-FP-600A
NPT x NPT



S-FP-600A
C x C

MATERIAL LIST

	PART	SPECIFICATION
1.	Body	Forged Brass[2] CU > 57%
2.	End Cap	Forged Brass[2] CU > 57%
3.	Ball Seat	PTFE
4.	Ball	Brass, Chrome Plated
5.	Stem	Brass
6.	O-Ring (Stem Seal)*	Fluorocarbon (FKM)
7.	Stem Packing	PTFE
8.	Packing Nut	Brass
9.	Lever Handle[1]	Steel, Plated
10.	Lock Washer*	Stainless Steel
11.	Handle Nut[1]	Stainless Steel

Note: * Parts 6 and 10 are applicable of S-FP-600A only.
[1] Due to Standard Approvals, Lever Handles and Nuts are not interchangeable between Solder and Threaded.
[2] For Material Certification, contact NIBCO Technical Services.

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions T-FP-600A A		S-FP-600A A		T-FP-600A B		S-FP-600A B		T-FP-600A C		S-FP-600A C		Port D		T-FP-600A		S-FP-600A		T-FP-600A	S-FP-600N
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Lbs.	Kg.	Ctn. Qty.	Ctn. Qty.
¼	8	1.76	45	—	—	1.73	44	—	—	3.54	90	—	—	.39	10	.33	.15	—	—	18	—
⅜	10	1.76	45	1.75	44	1.73	44	1.58	40	3.54	90	3.78	96	.39	10	.30	.14	.38	.17	18	18
½	15	2.05	52	2.01	51	1.92	49	1.78	45	3.54	90	3.78	96	.59	15	.44	.20	.40	.18	18	18
¾	20	2.36	60	2.74	70	2.09	53	2.13	54	3.78	96	3.98	101	.75	19	.66	.30	.67	.30	12	12
1	25	2.76	70	3.35	85	2.56	65	2.52	64	4.53	115	4.41	112	.98	25	1.10	.50	1.12	.51	6	6
1¼	32	3.31	84	3.78	96	2.95	75	2.65	67	4.53	115	5.04	128	1.26	32	1.57	.71	1.49	.67	4	4
1½	40	3.66	93	4.42	112	3.35	85	3.12	79	5.51	140	6.22	158	1.57	40	2.40	1.09	2.38	1.08	2	2
2	50	4.18	106	5.34	136	3.68	93	3.41	87	5.51	140	6.22	158	1.97	50	3.37	1.53	3.62	1.64	2	2
2½	65	5.38	137	6.28	160	4.76	121	4.76	121	8.66	220	8.66	220	2.56	65	7.60	3.45	6.36	2.88	3	3
3	75	6.04	153	7.15	182	5.08	129	5.08	129	8.66	220	8.66	220	2.95	75	9.36	4.24	8.32	3.77	2	2
4	100	7.39	188	—	—	5.87	149	—	—	9.61	244	—	—	3.89	99	16.85	7.64	—	—	1	—

FM APPROVED

UL

CSA C US

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Brass Ball Valves

Two-Piece Body • Full Port • Blowout-Proof Stem • PTFE Seats • w/ Drain

600 PSI/41.4 Bar Non-Shock Cold Working Pressure

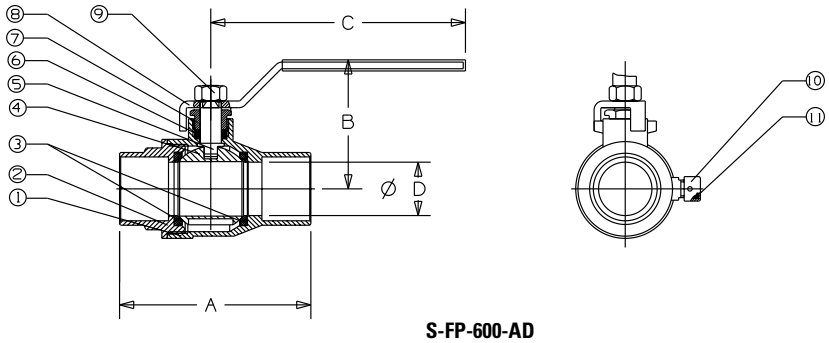
IAPMO LISTED TO NSF/ANSI 61-8

MATERIAL LIST

PART		SPECIFICATION
1.	Body	Forged Brass[1] CU > 57%
2.	End Cap	Forged Brass[1] CU > 57%
3.	Ball Seat	PTFE
4.	Ball	Brass, Chrome Plated
5.	Stem	Brass
6.	Stem Packing	PTFE
7.	Packing Nut	Brass
8.	Lever Handle	Steel, Plated
9.	Handle Nut	Stainless Steel
10.	Drainable Cap	Brass
11.	Rubber Seat	Silicone

Note: [1] For Material Certification, contact NIBCO Technical Services.

S-FP-600-AD
Solder



S-FP-600-AD
C x C

DIMENSIONS—WEIGHTS—QUANTITIES

Size		A		B		C		D		Weight		
		Dimensions										
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Ctn Qty.
½	15	2.16	55	1.67	42	3.54	90	.58	15	.54	.24	20
¾	20	2.85	72	2.03	52	4.47	114	.75	19	.76	.34	12
1	25	3.38	86	2.24	57	4.47	114	.95	24	1.07	.49	6

Gas Ball Valve

GB1A Female x Female, Lever Handle

- CSA Certified to ½ PSI for indoor appliance connections per ANSI Z21.15/CSA 9.1
- 5 PSI for indoor shutoff per CGA CR91-002 and ASME B16.44
- 600 PSI CWP Rated

MATERIAL LIST

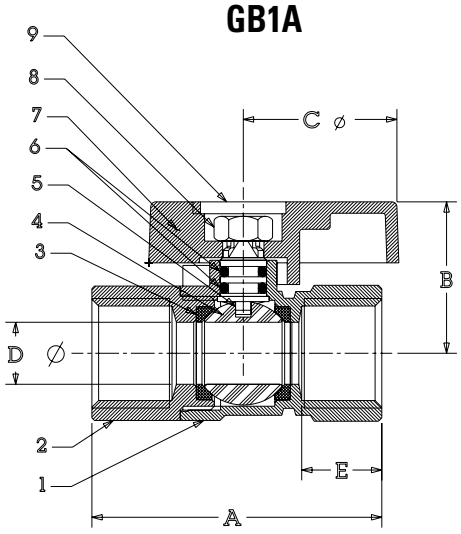
	PART	SPECIFICATION
1.	Body	Forged Brass[1] CU>57%
2.	End Piece	Forged Brass[1] CU>57%
3.	Seat	PTFE, Glass Reinforced
4.	Ball	Brass, Chrome Plated
5.	Stem	Brass
6.	O-Ring	Nitrile
7.	Handle	Aluminum, Painted Red
8.	Nut	Steel, Plated
9.	ID Plate	Aluminum

DIMENSIONS—WEIGHT

Size (In.)	A	B	C	D	E	Wgt
⅜	1.91	1.14	1.19	0.39	0.51	.31
½	2.21	1.19	1.19	0.47	0.61	.36
¾	2.45	1.26	1.19	0.59	0.67	.47
1	2.76	1.36	1.19	0.75	0.71	.91

Note: [1] For Material Certification, contact NIBCO Technical Services.

GB1A



GB2A Female x Female, Square Head

- CSA Certified to ½ PSI for indoor appliance connections per ANSI Z21.15/CSA 9.1
- 5 PSI for indoor shutoff per CGA CR91-002 and ASME B16.44
- 600 PSI CWP Rated

MATERIAL LIST

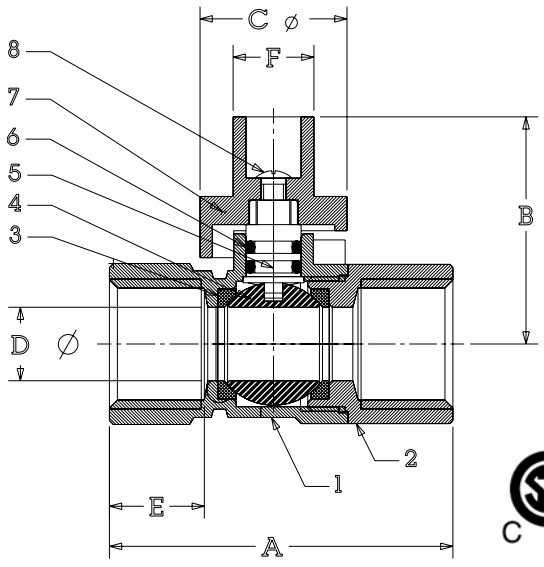
	PART	SPECIFICATION
1.	Body	Forged Brass[1] CU>57%
2.	End Piece	Forged Brass[1] CU>55%
3.	Seat	PTFE, Glass Reinforced
4.	Ball	Brass, Chrome Plated
5.	Stem	Brass
6.	O-Ring	Nitrile
7.	Handle	Copper Alloy Painted Red
8.	Screw	Steel, Plated

DIMENSIONS—WEIGHT

Size (In.)	A	B	C	D	E	Wgt
½	2.21	1.44	.95	.47	.61	.34
¾	2.45	1.56	.95	.59	.67	.45

Note: [1] For Material Certification, contact NIBCO Technical Services.

GB2A



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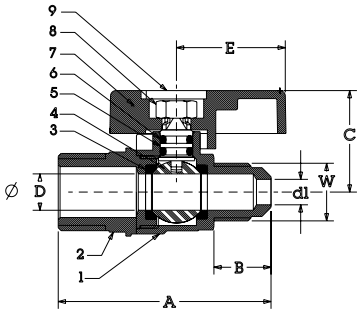
Gas Ball Valve

GBVA38M/GBVA12M — Flare x MPT, Lever Handle

- CSA Certified to ½ PSI for indoor appliance connections per ANSI Z21.15/CSA 9.1
- 5 PSI for indoor shut-off per ASME B16.44 and CGA CR91-002

MATERIAL LIST

	PART	SPECIFICATION
1.	Body	Forged Brass[1] CU>57%
2.	End Piece	Forged Brass[1] CU>57%
3.	Seat	PTFE, Glass Reinforced
4.	Ball	Brass, Chrome Plated
5.	Stem	Brass
6.	O-Ring	Nitrile
7.	Handle	Aluminum, Painted Red
8.	Nut	Steel, Plated
9.	ID Plate	Aluminum



DIMENSIONS—WEIGHT

Size (In.)	A	B	C	d[1]	D	E	W	Wgt
⅜	2.35	.62	1.14	.28	.39	1.19	⅝-18 UNF	.34
½	2.47	.75	1.14	.39	.39	1.19	¾-16 UNF	.36

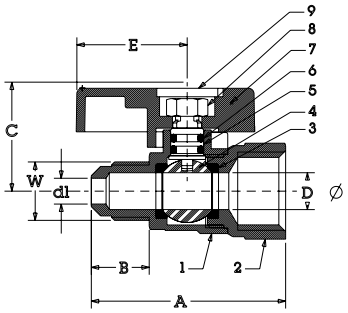
Note: [1] For Material Certification, contact NIBCO Technical Services.

GBVA — Flare x FPT, Lever Handle

- CSA Certified to ½ PSI for indoor appliance connections per ANSI Z21.15/CSA 9.1
- 5 PSI for indoor shut-off per ASME B16.44 and CGA CR91-002

MATERIAL LIST

	PART	SPECIFICATION
1.	Body	Forged Brass[1] CU>57%
2.	End Piece	Forged Brass[1] CU>57%
3.	Seat	PTFE, Glass Reinforced
4.	Ball	Brass, Chrome Plated
5.	Stem	Brass
6.	O-Ring	Nitrile
7.	Handle	Aluminum, Painted Red
8.	Ball Seat	PTFE
9.	Nut	Steel, Plated
10.	ID Plate	Aluminum



DIMENSIONS—WEIGHT

Size (In.)	A	B	C	d[1]	D	E	W	Wgt
⅜	2.13	.62	1.14	.28	.39	1.19	⅝-18 UNF	.35
½	2.25	.75	1.14	.39	.39	1.19	¾-16 UNF	.44

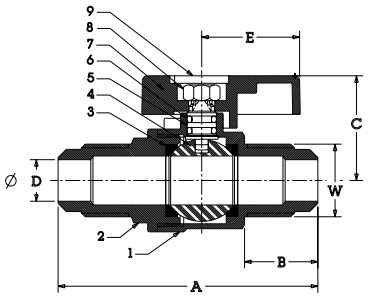
Note: [1] For Material Certification, contact NIBCO Technical Services.

GBVA38FL/GBVA12FL — Flare x Flare, Lever Handle

- CSA Certified to ½ PSI for indoor appliance connections per ANSI Z21.15/CSA 9.1
- 5 PSI for indoor shut-off per ASME B16.44 and CGA CR91-002

MATERIAL LIST

	PART	SPECIFICATION
1.	Body	Forged Brass[1] CU>57%
2.	End Piece	Forged Brass[1] CU>57%
3.	Seat	PTFE, Glass Reinforced
4.	Ball	Brass, Chrome Plated
5.	Stem	Brass
6.	O-Ring	Nitrile
7.	Handle	Aluminum, Painted Red
8.	Ball Seat	PTFE
9.	Nut	Steel, Plated
10.	ID Plate	Aluminum



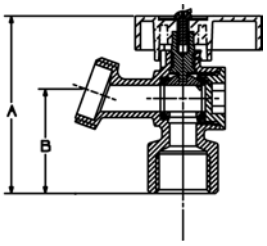
DIMENSIONS—WEIGHT

Size (In.)	A	B	C	D	E	W	Wgt
⅜	2.37	.62	1.14	.28	1.19	⅝-18 UNF	.36
½	2.62	.75	1.14	.39	1.19	¾-16 UNF	.47

Note: [1] For Material Certification, contact NIBCO Technical Services.

Boiler Drains

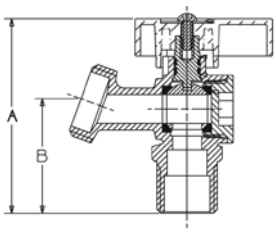
125 lb. CWP to 100°F
Maximum Temperature 180°F



QT73X

DESCRIPTION	NOM. SIZE	DIMENSIONS A	DIMENSIONS B	APPROX. NET WT.
BOILER DRAIN FIP to Hose	½	2.64"	1.57"	.42 lb
	¾	2.72"	1.65"	.46 lb

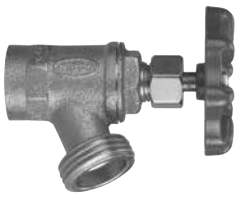
IAPMO Listed to cUPC® and NSF/ANSI 61-9

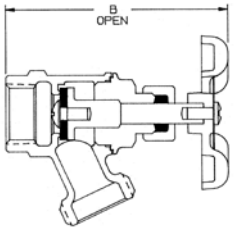


QT74X

DESCRIPTION	NOM. SIZE	DIMENSIONS A	DIMENSIONS B	APPROX. NET WT.
BOILER DRAIN Cup or MIP Threads to Hose	½"	2.64"	1.57"	.40 lb
	¾"*	2.72"	1.65"	.42 lb

IAPMO Listed to cUPC® and NSF/ANSI 61-9
*** ¾" furnished in male threads only**

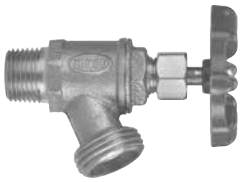


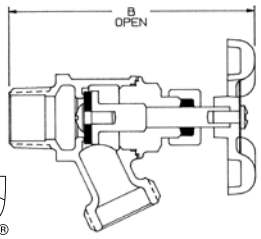


73-CL

DESCRIPTION	NOM. SIZE	DIMENSIONS B	APPROX. NET WT.
Boiler Drain Threaded to Hose	½"	3¼"	.50 lb
	¾"	3 5/16"	.60 lb

IAPMO Listed to cUPC®





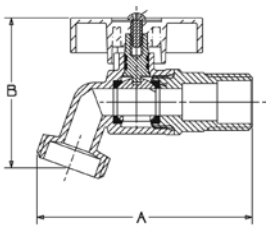
74-CL

DESCRIPTION	NOM. SIZE	DIMENSIONS B	APPROX. NET WT.
Boiler Drain Copper or Male Threads to Hose	½"	3 11/16"	.4 lb
	¾"*	3¾"	.45 lb

IAPMO Listed to cUPC®
*** ¾" furnished in male threads only**

Hose Bibbs

125 lb. CWP to 100°F
Maximum Temperature 180°F



QT56X

DESCRIPTION	Nom. Size	DIMENSIONS A	DIMENSIONS B	APPROX. NET WT.
HOSE BIBB Cup or Male to Hose Male Thread to Hose	½	3.15"	2.17"	.40 lb
	¾	3.15"	2.14"	.42 lb

IAPMO Listed to cUPC® and NSF/ANSI 61-9

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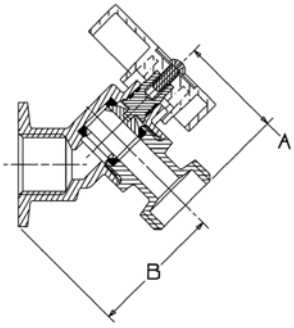
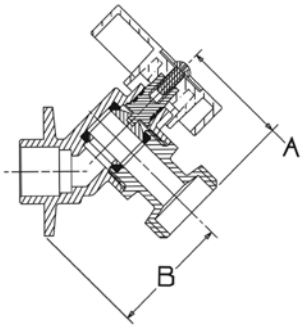
QTX Series Quarter-Turn Low Pressure Sillcocks

- IAPMO Listed to cUPC® and NSF/ANSI 61-9



QT63X

DESCRIPTION	Nom. Size	DIMENSIONS		APPROX. NET WT.
		A	B	
ANGLE SILLCOCK Threaded to Hose	½	1.38"	1.77"	.44 lb
	¾	1.38"	1.85"	.48 lb



QT763X

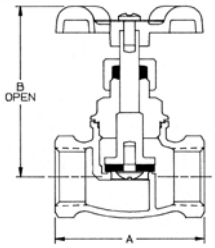
DESCRIPTION	Nom. Size	DIMENSIONS		APPROX. NET WT.
		A	B	
ANGLE SILLCOCK Solder to Hose	½	1.38"	1.54"	.43 lb
	¾	1.38"	1.69"	.48 lb

MATERIAL LIST

PART	SPECIFICATION
Screw	Steel
I.D. Tag	Aluminum
Handle	Zinc
Stem	Brass ASTM B 16 UNS C36000
O-Ring	Nitrile
Seat	PTFE
Ball	Brass ASTM B 16 UNS C36000
Adapter	Brass ASTM B 283 UNS C37700
Body	Brass ASTM B 283 UNS C37700

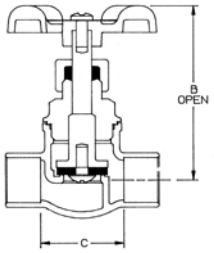
Lead Free* Stop & Stop Waste Valves

125 lb. CWP to 100°F
Maximum Temperature 180°F



76-LF

DESCRIPTION	NOM. SIZE	DIMENSIONS		APPROX. NET WT.
		A	B	
Stop & Waste Valve FIP x FIP	1/2"	$2^{3}/_{16}$"	$2^{9}/_{16}$"	.54 lb
	3/4"	$2^{5}/_{16}$"	$2^{9}/_{16}$"	.60 lb



726-LF

DESCRIPTION	*NOM. SIZE	DIMENSIONS		APPROX. NET WT.
		B	C	
Stop & Waste Valve Cup x Cup	1/2"	$2^{9}/_{16}$"	$1^{3}/_{16}$"	.42 lb
	3/4"	$2^{9}/_{16}$"	$1^{3}/_{16}$"	.49 lb

*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% per the Safe Drinking Water Act (Sec. 1417) amended 1-4-2011 and other equivalent state regulations.

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200 PSI CWP Bronze Gate Valves

Dezincification Resistant

Bronze Body •Screw-in Bonnet • Non-Rising Stem • Solid Wedge • Compact Design• Full Port

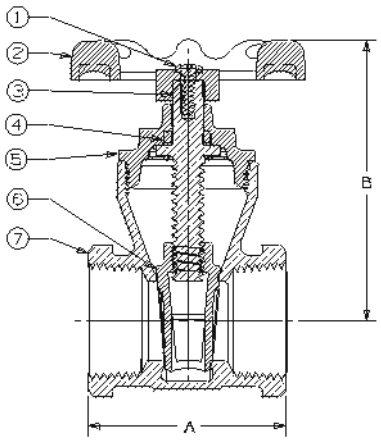
200 PSI/14 Bar Non-Shock Cold Working Pressure

T-29
Threaded

S-29
Solder

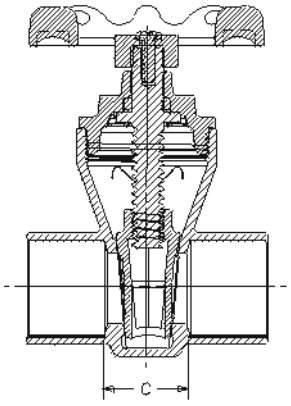
MATERIAL LIST

	PART	SPECIFICATION
1.	Handwheel Screw	Stainless Steel, Type 430
2.	Handwheel	Aluminum
3.	Stem	Bronze ASTM B 99 Alloy C65100 H04
4.	Stem O-Ring	EPDM
5.	Bonnet	Cast Brass ASTM B 584 Alloy C84400
6.	Wedge	Cast Brass ASTM B 584 Alloy C84400
7.	Body	Cast Brass ASTM B 584 Alloy C84400



T-29
NPT x NPT

Size		Dimensions A		B		C		Weight T-29		S-29	
In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Lbs.	Kg.
½	15	1.81	46	2.52	64	0.81	21	.48	.22	.42	.19
¾	20	2.00	51	2.83	72	0.88	22	.75	.34	.65	.30
1	25	2.31	59	3.27	83	1.06	25	1.22	.55	1.11	.50
1¼	32	2.63	69	3.64	92	1.13	29	1.62	.74	1.38	.63
1½	40	2.75	70	4.16	106	1.19	29	2.12	.96	1.98	.90
2	50	2.88	73	4.88	124	1.31	33	3.29	1.49	3.23	1.47



S-29
Cup x Cup

Brass Gate Valve

Brass Body • Non-Rising Stem • Full Port

200 PSI/14 Bar Non-Shock Cold Working Pressure
Truesdail LAB listed to NSF/ANSI 61-8

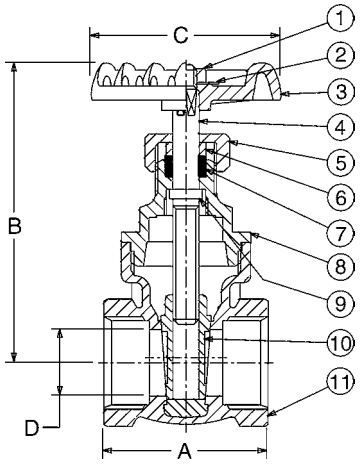
TI-8
Threaded

SI-8
Solder

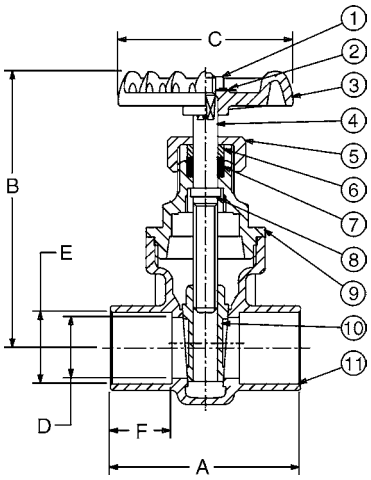
MATERIAL LIST

	PART	SPECIFICATION
1.	Nut	Steel, Plated ASTM A 108 Alloy G10100
2.	Name Plate	Aluminum ASTM B 209 Alloy 1100
3.	Handwheel	Cast Iron ASTM A 48 Class No. 35
4.	Stem	Brass ASTM B 16 Alloy C36000
5.	Packing Nut	Brass ASTM B 16 Alloy C36000 or B 584 Alloy C85700
*6.	Gland	Brass ASTM B 16 Alloy C36000
7.	Packing	Graphite/Rubber Non-Asbestos
8.	Bonnet	Brass ASTM B 584 Alloy C85700
9.	Lock Nut	Brass ASTM B 16 Alloy C 36000
10.	Wedge	Brass ASTM B 584 Alloy C85700
11.	Body	Brass ASTM B 584 Alloy C85700

*** Packing gland only for valves 1½" and larger.**
† Available with Drain in sizes ½" and ¾" for TI-8. Specify TI-8D on order.



TI-8
NPT x NPT



SI-8
Cup x Cup

DIMENSIONS—WEIGHTS

Size		Dimensions TI-8 A		SI-8 A		TI-8 B		SI-8 B		TI-8 C		SI-8 C		TI-8 D		SI-8 D		SI-8 E		SI-8 F		WEIGHT TI-8		SI-8	
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Lbs.	Kg.
¼	8	1.61	41	—	—	2.76	70	—	—	2.13	54	—	—	0.39	10	—	—	—	—	—	—	0.55	0.25	—	—
⅜	10	1.61	41	1.57	40	2.76	70	2.76	70	2.13	54	2.13	54	0.39	10	0.39	10	.50	13	0.38	10	0.55	0.25	0.55	0.25
½	15	1.69	43	1.77	45	2.83	72	2.83	72	2.13	54	2.13	54	0.50	12	0.50	13	.63	16	0.50	13	0.59	0.27	0.59	0.27
¾	20	1.85	47	2.32	59	3.31	84	3.31	84	2.13	54	2.13	54	0.75	19	0.75	19	.88	22	0.75	19	0.77	0.35	0.77	.035
1	25	2.13	54	2.76	70	3.86	98	3.86	98	2.40	61	2.40	61	0.94	24	0.94	24	1.13	29	0.91	23	1.06	0.48	1.06	0.48
1¼	32	2.40	61	2.87	73	4.57	116	4.57	116	3.03	77	3.03	77	1.25	32	1.25	32	1.38	35	0.97	25	1.54	0.70	1.54	0.70
1½	40	2.56	65	3.19	81	4.92	125	4.92	125	3.03	77	3.03	77	1.48	38	1.48	38	1.63	41	1.09	28	2.11	0.96	2.11	0.96
2	50	2.83	72	3.90	99	6.02	153	6.02	153	3.27	83	3.27	83	1.94	49	1.94	49	2.13	54	1.34	34	3.17	1.44	3.17	1.44
*2½	65	3.50	89	4.61	117	7.32	186	7.32	186	4.13	105	4.13	105	2.48	63	2.48	63	2.63	67	1.47	37	3.79	2.63	5.79	2.63
*3	80	3.98	101	5.20	132	8.70	221	8.70	221	4.41	112	4.41	112	2.95	75	2.95	75	3.13	80	1.66	42	8.10	3.68	8.10	3.68
*4	100	4.57	116	—	—	10.16	258	—	—	6.67	172	—	—	3.62	92	—	—	—	—	—	—	20.94	9.52	—	—

***Conventional Port only**

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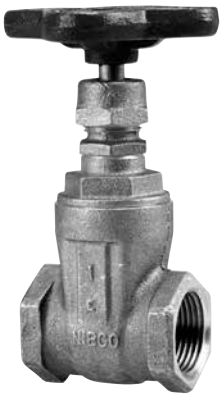
Class 125 Bronze Gate Valves

Screw-in Bonnet • Non-Rising Stem • Solid Wedge

125 PSI/8.6 Bar Saturated Steam to 353° F/178° C
200 PSI/13.8 Bar Non-Shock Cold Working Pressure

Dezincification Resistant



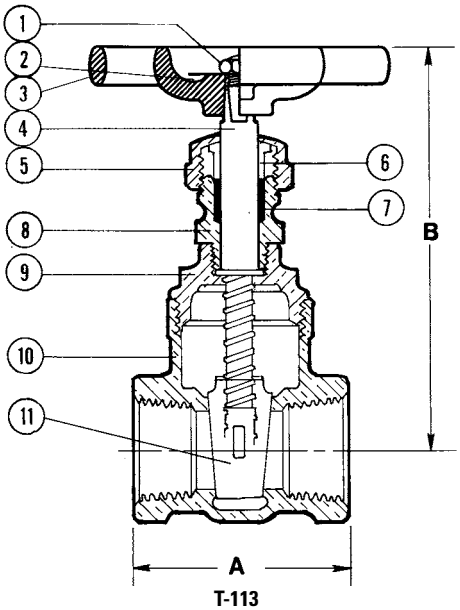
T-113
Threaded

S-113
Solder

CONFORMS TO MSS SP-80

MATERIAL LIST

	PART	SPECIFICATION
1.	Handwheel Nut	300 Series Stainless Steel
2.	Identification Plate	Aluminum
3.	Handwheel	a. Malleable Iron ASTM A 47 (T-113) b. Bronze (T-113-BHW) c. Bronze Cross (T-113-K)
4.	Stem	Silicon Bronze ASTM B 371 Alloy C69400/C69430 or ASTM B99 Alloy C65100
5.	Packing Nut	Bronze ASTM B 62 or ASTM B 584 Alloy C84400 or Brass ASTM B 16
6.	Packing Gland	Bronze ASTM B 62 or ASTM B 584 Alloy C84400 or Brass ASTM B 16
7.	Packing	Aramid Fibers with Graphite
8.	Stuffing Box	Bronze ASTM B 62
9.	Bonnet	Bronze ASTM B 62
10.	Body	Bronze ASTM B 62
11.	Wedge	Bronze ASTM B 62

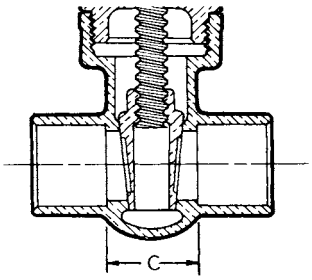


T-113
NPT x NPT

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		B		C		T-113		S-113		Master
In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Lbs.	Kg.	Ctn. Qty.
¼ †	8	1.69	43	3.38	86	x	x	0.74	0.33	x	x	50
⅜ †	10	1.69	43	3.38	86	.69	18	0.71	0.32	0.65	0.29	50
½ †	15	1.94	49	3.63	92	.75	19	0.82	0.37	0.67	0.31	50
¾	20	2.06	54	3.91	99	.88	22	1.10	0.50	0.99	0.45	50
1	25	2.44	62	4.69	119	1.00	25	1.82	0.82	1.60	0.72	30
1 ¼	32	2.63	67	5.22	133	1.19	32	2.40	1.09	2.25	1.02	20
1 ½	40	2.88	72	6.25	159	1.25	33	3.51	1.59	3.17	1.44	10
2	50	3.06	78	7.06	179	1.31	34	4.93	2.24	4.60	2.09	10
2 ½	65	4.13	105	8.41	224	1.81	46	9.96	4.52	8.78	3.98	5
3	80	4.50	114	10	254	1.94	49	14.40	6.53	12.84	5.82	4

† No packing gland, packing only in these sizes.
x Not available this size.



S-113
C x C

FREEZING WEATHER PRECAUTION: Subsequent to testing a piping system, valves should be left in an open position to allow complete drainage.

Bronze Ring Check® Valve

Dezincification Resistant

Inline Lift Type • Resilient Discs • Spring Actuated

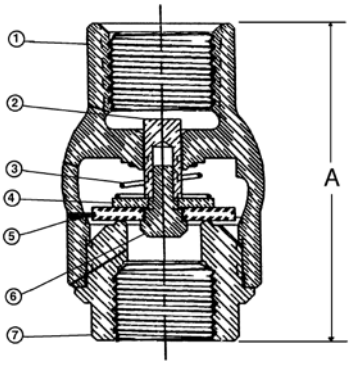
125 PSI/9 Bar Saturated Steam (PTFE Disc only)
200 PSI/14 Bar Non-Shock Cold Working Pressure

T-480
Threaded

S-480
Solder

MATERIAL LIST

	PART	SPECIFICATION
1.	Body	Bronze ASTM B 584 Alloy C84400
2.	Stem	Stainless Steel ASTM A 582 Alloy C30300
3.	Spring	316 Stainless Steel
4.	Disc Holder	Stainless Steel Type 301
5.	Disc	Buna-N
6.	Seat Screw	Stainless Steel ASTM A 276 Alloy S43000
7.	Body End	Bronze ASTM B 584 Alloy C84400

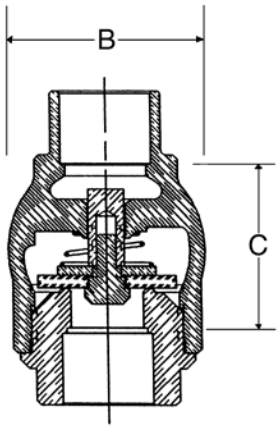


T-480
NPT x NPT

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		B		C		T-480		S-480	
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.
⅜	10	2.00	51	1.38	35	1.44	37	0.41	10	0.44	0.20
½	15	2.06	52	1.38	35	1.19	30	0.36	9	0.40	0.18
¾	20	2.25	57	1.63	41	1.31	33	0.48	12	0.52	0.24
1	25	2.63	67	2.00	51	1.50	38	0.77	29	0.85	0.39
1 ¼	32	2.94	75	2.38	60	1.69	43	1.14	25	1.28	0.58
1 ½	40	3.31	84	2.75	70	2.00	51	1.63	41	1.75	0.79
2	50	3.69	94	3.38	86	2.31	59	2.27	58	2.70	1.23

Ordering: The T-480 and S-480 both have standard Buna-N Discs.
Also available with PTFE (Y) Discs; specify T-480-Y or S-480-Y.
Note: ⅜" thru 2" require ½ PSI pressure to open.



S-480
Cup x Cup

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Brass Check Valves

Brass Body • Swing Type Check

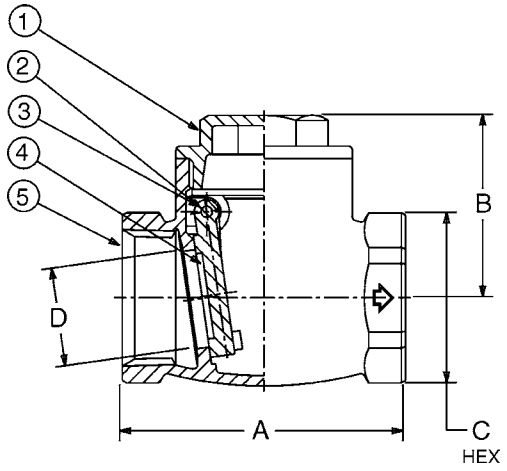
200 PSI/14 Bar Non-Shock Cold Working Pressure
Truesdail LAB listed to NSF/ANSI 61-8

MATERIAL LIST

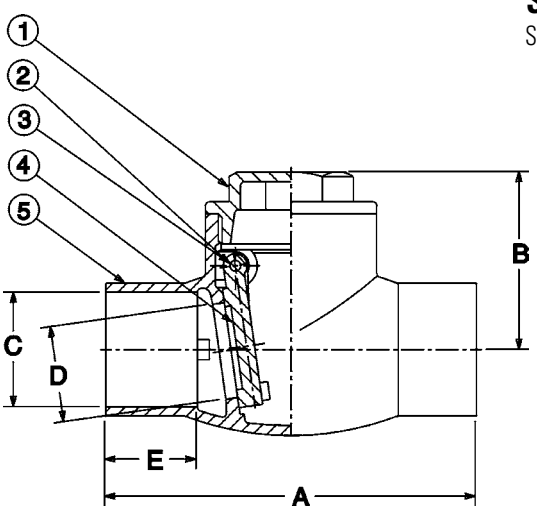
	PART	SPECIFICATION
1.	Bonnet	Brass ASTM B 584 Alloy C85700
2.	Plug	Brass ASTM B 16 Alloy C36000
3.	Pin	Brass ASTM B 16 Alloy C37700
4.	Disc	Brass ASTM B 124 Alloy C37700
5.	Body	Brass ASTM B 584 Alloy C85700 or Alloy C83600

TI-3
Threaded

SI-3
Solder



TI-3
NPT to NPT



SI-3
Cup x Cup

DIMENSIONS—WEIGHTS

Size		Dimensions TI-3 A		SI-3 A		TI-3 B		SI-3 B		TI-3 C		SI-3 C		TI-3 D		SI-3 D		SI-3 E		WEIGHT TI-3		SI-3	
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Lbs.	Kg.
½	15	2.05	52	2.13	54	1.50	38	1.50	38	1.00	25	0.63	16	0.52	13	0.52	13	0.50	13	0.46	0.21	0.46	0.21
¾	20	2.32	59	2.99	76	1.57	40	1.57	40	1.22	31	0.88	22	0.70	18	0.70	18	0.75	19	0.66	0.30	0.66	0.30
1	25	2.72	69	3.66	93	1.77	45	1.77	45	1.50	38	1.13	29	0.94	24	0.94	24	0.91	23	0.92	0.42	0.92	0.42
1¼	32	3.11	79	4.09	104	2.01	51	2.01	51	1.85	47	1.38	35	1.24	32	1.24	32	0.97	25	1.60	0.73	1.60	0.73
1½	40	3.50	89	4.57	116	2.17	55	2.17	55	2.11	54	1.63	41	1.42	36	1.42	36	1.09	28	1.79	0.81	1.79	0.81
2	50	4.29	109	5.51	140	2.64	67	2.64	67	2.60	66	2.13	54	1.81	46	1.81	46	1.34	34	2.87	1.30	2.87	1.30
2½	65	5.31	135	—	—	3.31	84	—	—	3.23	82	—	—	2.26	57	—	—	—	—	5.29	2.40	—	—
3	80	6.30	160	—	—	3.78	96	—	—	3.78	96	—	—	2.70	69	—	—	—	—	8.82	4.01	—	—
4	100	7.38	190	—	—	4.45	113	—	—	4.80	122	—	—	3.78	96	—	—	—	—	13.23	6.01	—	—

Warning – Do Not Use For Reciprocating Air Compressor Service.

Class 125 Bronze Check Valves

Horizontal Swing • Regrinding Type • Y-Pattern
• Renewable Seat and Disc

125 PSI/8.6 Bar Saturated Steam to 353º F/178º C
200 PSI/13.8 Bar Non-Shock Cold Working Pressure

Dezincification Resistant

T-413
Threaded

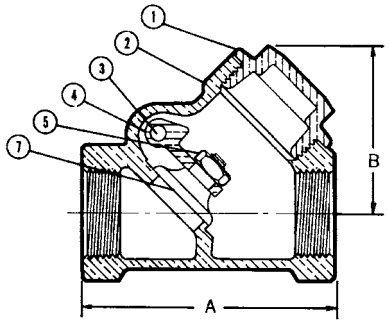
S-413
Solder

CONFORMS TO MSS SP-80

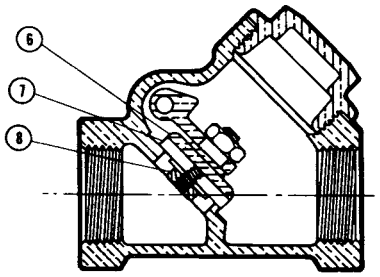
MATERIAL LIST

PART		SPECIFICATION
1.	Bonnet	Bronze ASTM B 62
2.	Body	Bronze ASTM B 62
3.	Hinge Pin	Bronze ASTM B 140 Alloy C31400 or B 134 Alloy C23000
4.	Disc Hanger	Bronze ASTM B 62 or 304 Stainless Steel ¼" thru ¾" sizes
5.	Hanger Nut	Bronze ASTM B 16
6.	Disc Holder	Bronze ASTM B 62
7.	Seat Disc	Water, Oil or Gas (Buna-N) (W) Steam (PTFE) (Y) Bronze ASTM (B) FKM (V) B 62 C83600
8.	Seat Disc Nut	Bronze ASTM B 16 or B 62
9.	Hinge Pin Plug	Bronze ASTM B 140 Alloy C31400 (not shown)
10.	Seat Disc Washer*	ASTM B 98 Alloy C65500 or ASTM B 103

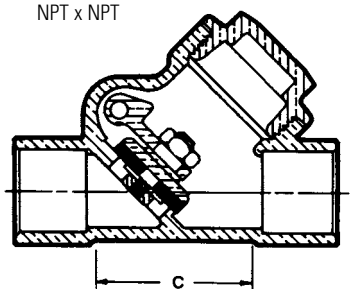
*** Sizes ¾", 1", 1¼", 1½" and 2" only.**



T-413-B
NPT x NPT



T-413-Y
NPT x NPT



S-413-W
C x C

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		B		C		T-413		S-413		Master
In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Lbs.	Kg.	Ctn. Qty.
¼	8	2.13	54	1.63	41	1.38	35	0.50	0.23	0.51	0.23	50
⅜	10	2.13	54	1.63	41	1.31	33	0.47	0.22	0.48	0.22	50
½	15	2.44	62	1.69	43	1.50	38	0.55	0.25	0.55	0.25	50
¾	20	2.94	75	1.88	48	1.88	48	0.90	0.41	0.88	0.40	50
1	25	3.56	90	2.31	59	2.25	57	1.46	0.66	1.48	0.67	30
1 ¼	32	4.19	106	2.69	68	2.75	70	2.17	0.99	2.22	1.01	20
1 ½	40	4.50	114	2.94	75	1.13	79	2.95	1.34	3.00	1.36	10
2	50	5.25	133	3.94	100	3.75	95	4.79	2.17	4.87	2.21	10
2 ½*	65	8.00	203	5.06	129	5.06	129	11.48	5.21	10.48	4.76	5
3*	80	9.25	235	6.25	159	6.25	159	17.53	7.96	15.29	6.94	4

Ordering: T-413 and S-413 normally furnished with Bronze Disc (T-413-B) or (S-413-B). Both available with PTFE Steam Disc (T-413-Y), (S-413-Y), or CWP Disc (T-413-W), (S-413-W) or 300º F 67 PSI steam FKM Disc (T-413-V).

*** Class 150 (433) furnished for these sizes.**

NIBCO® Check Valves may be installed in both horizontal and vertical lines with upward flow or in any intermediate position. They will operate satisfactorily in a declining plane (no more than 15º).

Warning – Do Not Use For Reciprocating Air Compressor Service.

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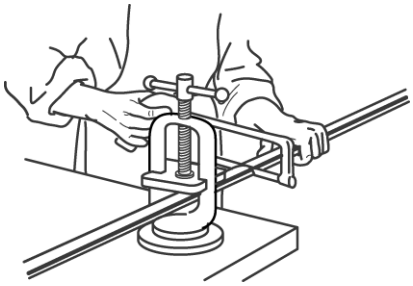
Installations Instructions for Metal Connections

Analyze the application to determine which valve is best suited for installation, keeping in mind the service for which the valve is recommended. Before installing the correct valve, review the following installation instructions to prevent damage to the valve and assure its maximum efficiency.

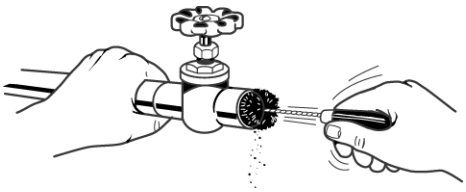
For Plastic Installation Instructions, contact Technical Services at 1.888.446.4226.

SOLDERING

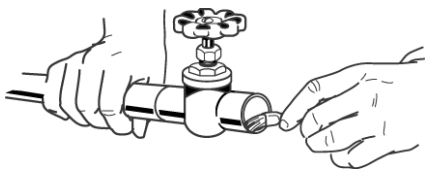
1. Cut tube end square. Ream, burr and size.



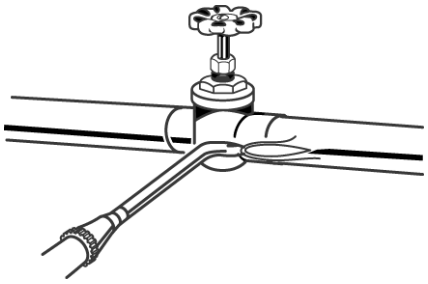
2. Use sand cloth or steel wire brush to clean both tube and cup to a bright metal. Steel wool is **not** recommended.



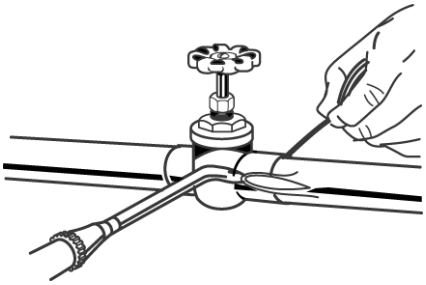
3. Apply flux to outside of tube and inside of solder cup. Surfaces to be joined must be completely covered. Use flux sparingly.



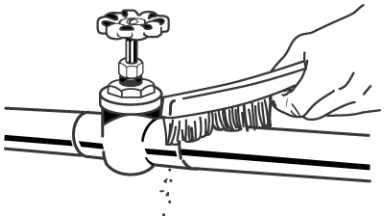
4. Be sure that valve is fully open. This applies only to globe and gate valves. Apply heat to tube first. Transfer as much heat as possible through the tube into the valve. Avoid prolonged heating of the valve itself. **For ball valves,** consult the installation instruction sheet or contact NIBCO Technical Services for assistance.



5. Use just enough solder: with wire solder, use 1" for ¾" valve, etc. If too much solder is use, it may flow past tube and clog seating area. **The correct amount of solder is 1½ times the diameter of the fitting or valve.**



6. Remove excess solder with small brush while plastic (soft), leaving a fillet around end of valve as it cools.



BRAZING

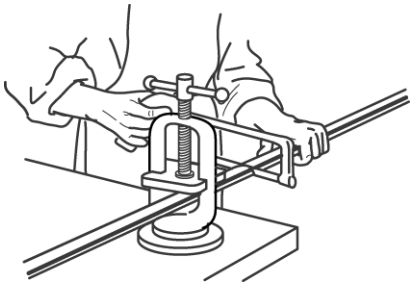
The strength of a brazed joint does not vary appreciably with the different brazing materials, but depends to a large extent upon the maintenance of proper clearance between the outside of the tube and the valve socket. The interior dimensions of brazing valve sockets are machined to the closest tolerances and finished smooth to promote full capillary attraction.

NOTE: Care should be observed in cleaning and in removing residues of the cleaning medium. Attempting to braze a contaminated or improperly cleaned surface will result in an unsatisfactory joint. Brazing alloys will not flow over or bond to oxides. Oily or greasy surfaces repel fluxes, leaving bare spots that oxide and result in voids and inclusions.

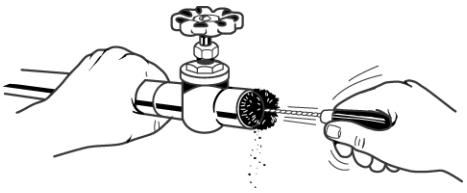
NOTE: The installer is responsible for proper brazing and installation and must follow industry best practices when brazing components.

Installation Instructions for Metal Connections (cont.)

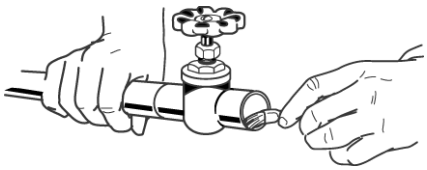
1. Cut tube end square to exact length needed, so that tube will enter valve socket all the way to the shoulder. Ream, burr and file.



2. Clean tube to a distance slightly more than what will fit into the socket, and clean valve socket. Wire brushes may be used, but avoid removing an excessive amount of metal. Fine sand cloth or emery cloth may be used with the same precautions. Steel wool is **not** recommended.



3. Apply flux to tube and socket sparingly and with a fairly thin consistency. Avoid flux on areas not cleaned, particularly inside of tube.

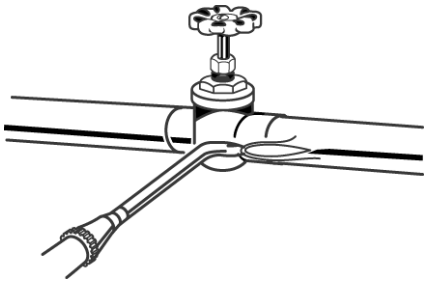


4. Assemble parts to be brazed. If fluxed parts are allowed to stand, the water in the flux will evaporate. Dried flux is liable to flake off, exposing metal surfaces to oxidation. Assembly joint by inserting tube into socket hard against the stop. The assembly should be firmly supported so that it will remain in alignment during the brazing operation. **Removal of bonnet is recommended when installing globe valves with soft seats.**

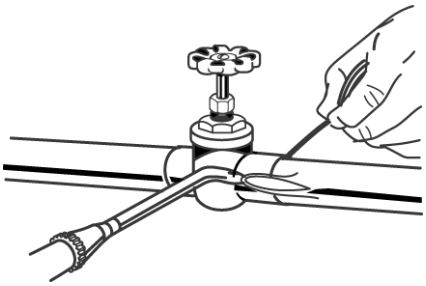
5. Apply heat to parts to be joined. The preferred method is by oxy-acetylene flame. Heat tube first, beginning one inch from edge of valve. Sweep flame around tube in short strokes up and down at right angles to run of tube. To avoid burning through tube, the flame should be in continuous motion and not allowed to remain on any one point.

Apply flame to valve at base of socket. Heat uniformly, sweeping flame from fitting to tube until flux on fitting becomes quite. Avoid excessive heating of valve.

When flux appears liquid and transparent on both tube and valve, start sweeping flame back and forth along axis of joint to maintain heat on parts to be joined, especially toward the base of the valve socket.



6. Apply brazing wire or rod at point where tube enters valve socket. Keep flame away from rod or wire at it is fed into the joint. Move flame back and forth as alloy is drawn into joint. When the proper temperature is reached, alloy will flow readily into space between tube outer wall and valve socket. When joint is filled, a continuous rim of brazing alloy will be visible.



THREADING

Grit, dirt or any foreign matter accumulated in the pipe can hinder efficient valve operation and seriously damage vital valve parts. Thoroughly clean pipe internally with air or steam.

When threading pipe, gauge pipe threads for size and length to avoid jamming pipe against seat and disc. Thoroughly clean threaded end to remove any harmful steel or iron deposits. Apply pipe dope sparingly on pipe threads, never on valve threads. Do not allow any pipe dope into valve body in order to avoid damage to disc and seat.

Before installation, check line of flow through valve so that valve will function properly. Close valve completely before installation. Apply wrench to hex next to pipe and guard against possible distortion. After installation of valve, support the pipe line; a sagging pipe line can distort the valve and cause failure.

COMPRESSION

For compression end connection, first slide compression nut onto copper tube, then slide on ferrule. Install the valve onto the copper tube and gently slide compression nut and ferrule up to the valve to engage. Do not use pipe dope. Tighten nut until resistance is felt. Tighten additional ½ turn. *DO NOT OVER TIGHTEN!*

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Figure Number Comparison

Brass Ball Valves

For use as a guide only — some differences in design and materials are possible

NIBCO	AY McDonald	B&K	Hammond	Jomar	Legend	Matco-Norca	Red & White	Watts
SFP-600A	2032S	107-500	8911	T100C-E	T-2000	757C	5044F	FBVS3C
TFP-600A	2032T	107-700	8901	S100C-E	S-2000	757T	5049F	FBV3C
SFP-600-AD	2033S	107-550	8711		S-1100	754D	5063	

Figure Number Comparison

Gas Valves and Log Lighters

For use as a guide only — some differences in design and materials are possible

NIBCO	AY McDonald	B&K	Hammond	Jomar	Legend	Red & White	Watts
GB1A	10709/10710	110-120	875	T-204/T-205	T3005	RW5200L	GBV
GB2A	10711				T-3001	RW5200S	
GBVA38M/GBVA12M	10716	116-510			T-300FLxMIP		
GBVA	10712	114-000	879	T-204	T-300FLxFIP		GBV-FL

Figure Number Comparison

Low Pressure Plumbing Valves

For use as a guide only — some differences in design and materials are possible

NIBCO	Arrowhead	AY McDonald‡	B&K‡	Hammond‡	Legend‡	Mansfield	Matco-Norca‡	Red & White‡	Watts‡
QT56X	301/302					44.42		RW303	
QT63X	255/355	2015	108-100	1032	T-541	34.40	206H	RW252	SC4
QT763X	255SW	2014	108-500	1034	S-541		206C	RW272	SC3
73CL	222/220	2004	102-100	712	T-522	526.40	204F	RW503	BD3F
74CL	221/223	2003	102-000	710	T-521	526.42	204M	RW502	BD1
SI3		2050S	101-500	968	S-451		521C	247	WCVS
TI3		2050T	101-000	967	T-451		521T	246	WCVS
S480				947	S-455				
T480				943	T-455				
SI8		2035T	100-500	668	S-401		514C	268	WGVS
TI8		2035S	100-000	667	T-401		514T	267	WGV
S29									
T29									

‡ Indicates Valve Line is Import ONLY.

NIBCO® Plumbing Specialty Products Warranty

NIBCO INC. LIMITED WARRANTY

Applicable to NIBCO INC. Plumbing Specialty Products Only

NIBCO INC. warrants each NIBCO® plumbing and heating valve to be free from defects in materials and workmanship under normal use and service for a period of two (2) years from date of purchase.

In the event any defect occurs which the owner believes is covered by this warranty, the owner should immediately contact NIBCO Technical Services, either in writing or by telephone at 1.888.446.4226 or 1.574.295.3000. The owner will be instructed to return said valve, at the owner's expense, to NIBCO INC., or an authorized representative for inspection. In the event said inspection discloses to the satisfaction of NIBCO INC. that said valve is defective, a replacement shall be mailed free of charge to the owner, and NIBCO INC. shall further pay the installing contractor the sum of fifty ($50.00) dollars to be applied toward the cost of installation of the replacement valve.

TO THE EXTENT PERMITTED BY LAW, THIS WARRANTY SPECIFICALLY EXCLUDES INCIDENTAL AND CONSEQUENTIAL DAMAGES OF EVERY TYPE AND DESCRIPTION RESULTING FROM ANY CLAIMED DEFECT IN MATERIAL OR WORKMANSHIP, INCLUDING BUT NOT LIMITED TO, PERSONAL INJURIES AND PROPERTY DAMAGES.

Some states or countries do not allow the exclusion or limitation of incidental or consequential damages so these limitations may not apply to you.

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HOW MANY TO ORDER

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POLICY ON RETURNS TO FACTORY

No NIBCO valves and fittings are to be returned without prior written agreement. Transportation must be prepaid. A 20% charge will be made to cover cost of rehandling and reinspection.

TECHNICAL ASSISTANCE

Engineers, contractors, wholesalers or manufacturers may obtain special or technical assistance from any factory representative of NIBCO. Write, fax or phone.

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1516 Middlebury Street
Elkhart, IN 46516-4740
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Notes

Notes

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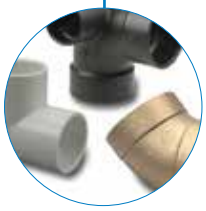

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FAX: 800.234.0557

TECHNICAL SERVICE
PHONE: 888.446.4226
FAX: 888.336.4226

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