DIMENSIONS OF BRAZING SOCKETS VS SOLDER SOCKETS

SUMMARY

Refrigerant piping for R410A must be brazed, not soldered to meet working pressure requirements. ASME B16.50 WROUGHT COPPER AND COPPER ALLOY BRAZE-JOINT PRESSURE FITTINGS defines dimensions for brazed fittings and applies to joints assembled with brazing materials conforming to ANSI/AWS A 5.8.

Most commercially available copper fittings are manufactured to ASME B16.22 WROUGHT COPPER AND COPPER ALLOY SOLDER JOINT PRESSURE FITTINGS. This standard defines dimensions for soldered fittings and applies to joints assembled with soldering materials conforming to ASTM D 32, and brazing materials conforming to ANSI/AWS A 5.8.

Even though solder joint fittings per ASME B16.22 are suitable for brazing, there are several advantages to utilizing fittings constructed per ASME B16.50 for brazed joints.

The following illustration shows the socket depths of fittings constructed to ASME B16.50 for brazed fittings as compared to the socket depths of commercially available fittings manufactured to ASME B16.22 for soldered fittings.

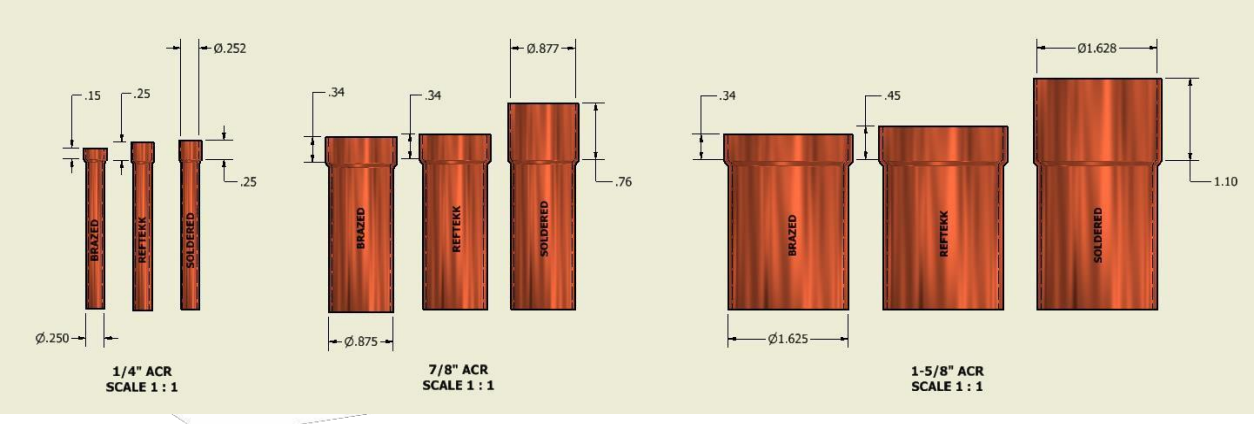

FIGURE 1. SOCKET DEPTHS OF BRAZING FITTINGS VS. SOLDER FITTINGS

ANALYSIS

A high quality brazed joint requires full penetration of the brazing filler metal, a fillet at both the outside and inside terminations of the base metal overlap and as few voids as possible in the brazing filler. The brazing filler is drawn into the joint by capillary action. For proper capillary action to occur, the joint must be heated consistently and to the right temperature for the full length of the overlap or socket depth. As the socket depth and circumference of the fitting increases, the chance of making a high quality braze decreases. Deeper sockets and larger tube contribute to partial joint penetration of the brazing filler along with increased chance of voids. Testing has shown that the length of the brazing overlap (socket depth) needs to be only 2 times the thickness of the material being joined to create a brazed joint that is equal to the strength of the base metal. Increasing the overlap or socket depth does NOT further increase the strength of the joint. Increasing the length of the joint makes it

more difficult to produce a leak free joint, increases the time to braze the joint and uses more brazing rod.

ASME B16.50 specifies a minimum and maximum socket depth by tube size which is more than 2 times the wall thickness of Type L copper tube, but is much less socket depth than commercially available solder joint fittings.

RECOMMENDED SOCKET DEPTHS

Reftekk recommends the socket depth shown in RED in the following TABLE 1. This table compares the socket depths of commercially available solder joint fittings and the minimum and maximum socket depth of brazed joint fittings as defined by ASME B16.50. The socket depth recommended by Reftekk is the minimum socket depth per ASME B 16.50 plus the thickness of pre-formed brazing rings. Even though solder joint fittings are approved for brazing, it seems inconsistent with the maximum socket depth for brazed fittings per ASME B16.50.

Nominal		Socket	Socket Depth per B16.50		Socket	Nominal	Ratio of Solder Socket Depth to:		
Tube Size	WT	Solder	Minimum	Maximum	Reftekk	Tube Size	ASME B16.50		Reftekk
inches	inches	inches	inches	inches	inches	inches	Minimum	Maximum	
1/4	0.030	**0.25**	**0.15**	**0.23**	**0.25**	1/4	1.67	1.09	0.99
3/8	0.030	**0.31**	**0.17**	**0.26**	**0.28**	3/8	1.82	1.19	1.09
1/2	0.035	**0.38**	**0.20**	**0.30**	**0.31**	1/2	1.90	1.27	1.23
5/8	0.040	**0.50**	**0.22**	**0.33**	**0.32**	5/8	2.27	1.52	1.56
3/4	0.042	**0.62**	**0.24**	**0.36**	**0.32**	3/4	2.58	1.72	1.94
7/8	0.045	**0.75**	**0.25**	**0.38**	**0.34**	7/8	3.00	1.97	2.21
1 1/8	0.050	**0.91**	**0.28**	**0.42**	**0.39**	1 1/8	3.25	2.17	2.33
1 3/8	0.055	**0.97**	**0.31**	**0.47**	**0.42**	1 3/8	3.13	2.06	2.31
1 5/8	0.060	**1.09**	**0.34**	**0.51**	**0.45**	1 5/8	3.21	2.14	2.42
2 1/8	0.070	**1.34**	**0.40**	**0.60**	**0.50**	2 1/8	3.35	2.23	2.68

TABLE 1. COMPARISON OF SOLDER SOCKET DEPTHS TO BRAZED SOCKET DEPTHS

CONCLUSION

Quality brazed joints are much easier to make with shallower brazing sockets. Full penetration, reduction of voids, and filleting on both ends of the overlap are much easier to accomplish with shorter brazing sockets. These things greatly reduce the potential for leaks at the brazed joint. Combined with the reduction of brazing filler metal and reduced time for heating the joint, there is no disadvantage to shorter socket depths.

ADDITIONAL RECOMMENDATION

To visually check for full penetration of the filler metal in the joint and further reduce the quantity of brazing filler, Reftekk recommends the use of pre-formed brazing rings. This places the brazing filler at the inside termination of the joint to start the brazing process. The fitting is then heated and the brazing filler is drawn to the outside termination of the brazed joint. When a fillet is formed at the outside of the joint for the full circumference, the joint has achieved full penetration of the filler metal with minimal voids and fillets on both ends of the overlap.

The combination of shorter brazing socket depth and pre-formed brazing rings provides the best chance of creating a strong, leak free joint. This method is also easier for the pipe installer.

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