



Contributed by
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Are you planning to solder in a couple of dozen 1-1/2 inch brass control valves in that heating system you are installing in that high-rise building? Brass valves, of course, are castings and all the castings you buy today are lead-free. Does your journeyman who can solder a wrought 1-1/2 inch copper coupling with ease make the same quality joint when one side is a heavy-wall cast valve body? How about if the castings you bought are alloyed with silicon for machinability improvement rather than with bismuth?

Soldering lead-free valves? Beware!

Last year, an NCPWB contractor in Atlanta and I decided to find out. Since cast brass couplings are not available, the contractor was able to find suppliers who “donated” some 1-1/2 inch brass valves for testing. Some of the valves were alloyed with bismuth and some with silicon.

The shop foreman read NCPWB SPS-107-1 and soldered the first valve to long lengths of copper tube. Both joints were split longitudinally, and the halves were beaten with a hammer until the casting and the copper tube separated, revealing the faying surfaces. See Figure 1. A journeyman also read SPS-1 and soldered copper tube to a valve. The results of testing of those joints are shown in Figure 2. After some coaching on the importance of heating the tube rather than the casting, the journeyman produced the joints in Figure 3, and with more coaching plus the feedback he got from seeing how good his earlier joints were, he finally produced the result shown in Figure 4.

We soldered and tested 22 joints using a mix of silicon-alloyed and bismuth-alloyed castings, and we used Oatey #5 and #95 (tinning) flux and Superior Fluxes 141, 142-5 (tinning), 144 and 520B. We observed the following:

1. If the journeyman’s technique was poor, it did not matter if the castings were bismuth nor silicon alloyed; the joint did not fill.
2. Silicon-alloyed brass was more difficult for the solder to wet properly than bismuth-alloyed brass, so proper heating was more important when the castings were silicon-alloyed.
3. The flux did not seem to matter, but a more controlled study is needed to confirm that observation.
4. As our journeyman made more joints *and got feedback*, the percentage of fill in the joint increased to 100%.

Contractors should test their journeymen first using 1-1/2 inch copper fittings following UA-SS1 or NCPWB SPQT-1. If your journeymen are going to solder cast brass valves, test them following UA-SS2 or NCPWB SPQT-2, which uses 1-1/2 inch B16.18 C87600 (silicon alloyed) cast brass couplings. If you want to test your journeymen find suppliers who will “donate” some valves to destroy, or you can buy the above couplings at www.brazingdimpler.com.

Peel test results for soldered joint between copper tube and a silicon-alloyed valve castings.

Figure 1



Faying surfaces exhibit some incomplete fill.

Figure 2



Faying surfaces exhibit grossly incomplete fill.

Figure 3



Faying surfaces exhibit lots of incomplete fill on one side due to non-uniform heating.
Figure 4



Faying surfaces exhibit complete fill.