Soldering of Apollo Lead-Free Alloys

The last decade has witnessed an increasing demand for both domestic and foreign produced lead-free brass and bronze alloys. Apollo has been careful to select alloys for use in our products that retain the ease of soldering of the standard brass and bronze alloys we have been using for years and years. We have conducted extensive soldering tests in our R&D Laboratory in search of alloys that would make the transition from leaded brass and bronze alloys to lead-free alloys as transparent as possible to our customers. A critical element of this change was to have the lead-free alloys capable of being soldered in the same manner and with the same solders commonly used for the standard brass and bronze alloys.

Alloys

Apollo has used C36000 free machining brass for nearly all of its 85 years of existence. We have poured both C83600 and C84400 bronze in our US based foundry operations for decades. C84400 is the most commonly used alloy in many plumbing applications.

Our Brass Foundry, Machining, Assembly & Test, and R&D facilities are located in Pageland, SC, allowing for a team based approach to process and product development of lead-free casting alloys. Extensive research led us to select C89836 as our material of choice for our lead-free cast bronze products.

Apollo purchases brass bar from US suppliers for our brass machining operation, also located in Pageland. We worked closely with the suppliers to find a lead-free material that was similar in performance to the C36000. Again, after extensive testing, C27451 lead-free yellow brass was selected.

Thermal Conductivity

A consideration in selecting lead-free materials was to have the thermal conductivity of the lead free alloy close to the standard alloy being replaced by the lead-free material. Maintaining similar thermal conductivity equates to a negligible change in the soldering process when compared to leaded alloys. Note the similarity of the thermal conductivity for the lead-free alloys and standard alloys shown below.

Alloy	Thermal Conductivity
C84400 Cast Bronze	41.80 Btu · ft/(hr · ft2 ·°F) at 68°F[2]
C89836 Cast Lead-Free Bronze	41.00 Btu · ft/(hr · ft2 ·°F) at 68°F[3]
C36000 Brass Bar	67.00 Btu · ft/(hr · ft2 ·°F) at 68°F[2]
C27451 Brass Lead-Free Bar	67.00 Btu · ft/(hr · ft2 ·°F) at 68°F[2]

Soldering Requirements

The same procedures and lead-free solders used on standard products can be used on Apollo lead-free alloys. Installation, Operation, and Maintenance Instructions are located at www.apollovalves.com.

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[1] 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%. Complies with Section 116875 of the California Health and Safety Code, Vermont Act 193, Maryland HB 372, Louisiana HB 471, and Federal Public Law 111-380.

[2] "Properties of Wrought and Cast Copper Alloys"; Copper Development Association. 2013. Web. 17 April 2013.

[3] "C89836 Technical Data Sheet"; SiPi Metals Corporation; Web. 8 March 2012

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