

## DISCUSSION

Field bending of copper tubing requires the tube be Bending Quality tube. For drawn tubing, ASTM states the following.

- Tube in the H55 temper is recommended when a tube of some stiffness is required yet capable of being bent when necessary.
- Tube in the H58 temper is recommended for general application where there is no specific need for high strength or bending qualities.

Light Drawn (H55) tube is a bending quality temper with an elongation at break of >25%. Drawn General Purpose (H58) does not have consistent elongation to make this temper suitable for field bending. Drawn General Purpose (H58) tubing with an elongation at break of 8%, will not allow field bending with normal tube benders. Soft annealed tube (O60) is suitable for field bending.

Only soft annealed (O60) or drawn general purpose (H58) tubing is readily available from most refrigeration wholesale distributors. It is possible to physically bend drawn general purpose (H58) tubing, but the result is not acceptable. Bending H58 is not recommended by the tubing manufactures.

**Only Soft Anneal (O60) or Light Drawn (H55) should be used when field bending ACR Type L or Type K copper tube.**

For successful field bending, it is important to understand the bending properties of each type and temper of copper available and approved for refrigeration use. Most specifications for refrigeration tubing require meeting standards ASME B31.5, ASTM B-75, ASTM B-88, and/or ASTM B-280. These are the standards that refrigeration tube is manufactured to in the United States.

## TUBING STANDARDS

**ASTM B 75:** ASTM B 75 is titled “Standard Specification for Seamless Copper Tube”. This standard is more general than either ASTM B 280 or ASTM B 88 given that more alloy designations are allowed. This standard also describes light drawn (H55), hard drawn (H80), and light anneal (O50) in addition to the H58 and O60 tempers described in ASTM B 280. Tubing manufactured to ASTM B 75 utilizing UNS C12200, light drawn temper (H55), Type L or Type K dimensions, cleaned, eddy current tested, and capped per ASTM B280 is the proper choice for field bent refrigeration tubing.

**ASTM B 88:** ASTM B 88 is titled “Standard Specification for Seamless Copper Water Tube”. This standard is more general than ASTM B280, and adds dimensional information for Type K tubing. Tubing manufactured to this standard can be used for refrigeration piping provided the tube material is UNS C12200 and is cleaned and capped per ASTM B280. Again, two tempers are shown; O60 (soft annealed) and H58 (drawn general purpose). The only reference to bending in this standard is a sentence in the Standards SCOPE paragraph. “Means of joining and bending are also factors which affect the selection of the type of tube to be used”.

**ASTM B 280:** ASTM B 280 is titled “Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service”. This standard specifies the type of copper as UNS C12200, and the temper to be O60 (soft annealed), H55 (Light Drawn), or H58 (drawn general purpose). The sizes, wall thickness and tolerances for each size are also specified for both annealed coils and drawn straight lengths and correspond to copper Type L dimensions. Additionally, the tube must meet a cleanliness standard, be eddy current tested and be capped or plugged.

## **CONCLUSION**

- Field bending of copper tubing has many advantages over the use of fittings.
- Fittings are not required for changes of direction.
- Significantly reduced number of joints for less potential leak points.
- Custom offsets and cross-overs; useful for VRF systems.
- Larger bend radius for reduced refrigerant pressure drop.

There are several terms to describe ACR copper tubing tempers. In the United States, there are only two readily available tempers for refrigeration use; Soft Anneal (O60) and Drawn General Purpose (H58). These are sometimes referred to as, “soft” copper and “hard” copper respectively. Line sets are O60 “soft” copper.

Straight Lengths are sometimes referred to as “hard stick” copper. In other parts of the world, copper is manufactured to different standards and are generally referred to as “soft”, “half hard” and “hard”.

These are generic terms for actual temper designations by whatever standard is referenced. In the case of ASTM standards, these three terms correspond to Soft Annealed (O60), Light Drawn (H55), and Drawn General Purpose (H58) when applied to refrigeration piping.

**Light Drawn (H55) or Soft Anneal (O60), Type L and Type K copper tube are suitable for bending. Drawn General Purpose (H58) temper is NOT suitable for field bending.**