

BENDING COPPER REFRIGERATION TUBING

SUMMARY

Field bending of copper refrigeration tubing necessitates the tube be “Bending Quality”. For “drawn” tubing, ASTM states the following.

1. Tube in the H55 temper is recommended when a tube of some stiffness is required yet capable of being bent when necessary.
2. Tube in the H58 temper is recommended for general application where there is no specific need for high strength or bending qualities.
3. Tube in the H80 temper is recommended for applications where there is a need for a tube as strong as technically feasible for the size indicated.

For drawn tempers, Light Drawn (H55) is a consistent bending quality temper. Drawn General Purpose (H58) does not have consistent elongation to make this temper suitable for field bending. Soft annealed tube (O60) is suitable for bending.

When buying ACR tubing from a refrigeration wholesale outlet in the United States, you will get either soft annealed (O60) or drawn general purpose (H58) tubing. It may be physically possible to bend drawn general purpose (H58) tubing, but the result will be unpredictable. Bending H58 is not recommended.

When field bending ACR Type L or Type K copper tube use only Soft Anneal (O60) or Light Drawn (H55).

ADVANTAGES

Field bending of brazed copper tubing has many advantages over the use of fittings for each change of direction.

- Create custom offsets and cross-overs particularly advantageous for VRV/VRF systems.
- Larger bend radius resulting in reduced refrigerant pressure drop.
- Significantly reduced number of brazed joints resulting in less potential leak points.
- Reduced quantity of brazing filler, brazing fuel, and nitrogen purge.

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 ASTM B-280, ASTM B-88, and/or ASTM B-75. These are the standards that refrigeration tube is manufactured to in the United States.

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 either O60 (soft annealed) 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. No reference to bending is made in this standard.

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 or bending are also factors which affect the selection of the type of tube to be used”.

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 since 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 anneal 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. It has a slightly better maximum allowed stress rating than H58 in the tempered condition and identical maximum allowable stress in the annealed condition.

CONCLUSION

There are many terms in use for 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). They are sometimes referred to as, “soft” copper and “hard” copper. Line sets are “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 used. 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.

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