American Standard

HEATING & AIR CONDITIONING

Technique for Repairing Aluminum Tubing

Materials needed:

- Torch type and consequent use of will be discussed later
- All State #31, 1/16" Brazing Rod of All State Sealcor (R)
- Flux specifically formulated for use with All State #31
- Sanding Cloth

The brazing of aluminum tubing is not as difficult as many believe. It merely requires the proper materials, slightly different techniques and hands-on practice.

Two particular characteristics of aluminum make it a bit tricky to work with. The first is its 1200°F melting temperature. The other is that the corrosion resistance for which aluminum is well known is credited to the formation of oxide on the surface of the metal. The oxide forms a crust which has a higher melting temperature than the metal itself. Therefore, if the oxide is not broken down by chemical action, the base melts before the brazing material can flow. Cleaning by mechanical means, i.e. sanding, will remove the oxide but it immediately returns upon the application of heat.

Brazing aluminum requires the same surface preparation as many other materials. The area to be brazed should be clean and oil-free. In other words, use sanding cloth on the areas to be brazed. CAUTION: DO NOT USE A WIRE BRUSH OR STEEL WOOL TO CLEAN ALUMINUM, FOR IT WILL LEAVE SMALL STEEL PARTICLES IMBEDDED IN THE TUBING, PREVENTING PROPER BRAZING.

Now one asks, "What type of torch should be used?" The torch selection is not incredibly important, for any torch that will braze will do the job: however, some do indeed perform better than others. The following are the three most often selected torches:

- **OXY-ACETYLENE** . . . This is the most commonly used torch of the trade. Three flame types are available. The first, and hottest, is an oxidizing flame created by burning an excess of oxygen over acetylene. It is used when brazing or welding bearing alloys. The second is a neutral or reducing flame which burns an equal amount of oxygen and acetylene. This flame destroys metal oxides which may form when welding. The third, and coolest, is a carburizing flame formed by burning more acetylene than oxygen. It is primarily used where close temperature control is necessary, specifically in aluminum cases. Thus, the carburizing type

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SERVICE TRAINING INFORMATION

is our flame of choice. The tip size is very important, for one that is either too large or too small may cause melting of the base metal. **All State** recommends a **#1** or **#10** tip for aluminum brazing.

- **TURBO-TORCH** or any **JET-SWIRL** type . . . With a turbo-torch we would recommend using an **A #3** tip. We believe that this type of torch is the easiest to use and performs excellently with the All State #31 braze rod.

- **PRESTO-LITE** . . . This torch is simply slow but adequate.

On to discussing the actual brazing technique. You will use the same technique regardless of the torch used. After the surface to be repaired has been properly prepared as described earlier, one must do the following:

1. Use the torch to heat the brazing rod.
2. Dip the rod in the flux.
3. Cover the end of the rod with flux.
4. Apply heat to the tubing, by sweeping the torch flame across the tubing, at a slow, even pace. **IT IS VERY IMPORTANT THAT THE FLAME IS KEPT MOVING AT ALL TIMES DURING THIS STAGE!**
5. After a short period of time, touch the flux covered rod to the metal area for repair.
6. If the flux liquifies and runs, apply the brazing rod to the area for repair.
7. At this time, rotate the torch flame 90° and apply heat directly to the rod.
8. When the rod melts, remove the rod and torch.
9. Repair is complete.
10. Check the repaired area for holes.
11. Using a rag soaked in warm water, remove the flux **(ONLY AFTER A THOROUGH CHECK HAS BEEN MADE).**
12. The job is completed.

The Use Of Dry Nitrogen During Brazing

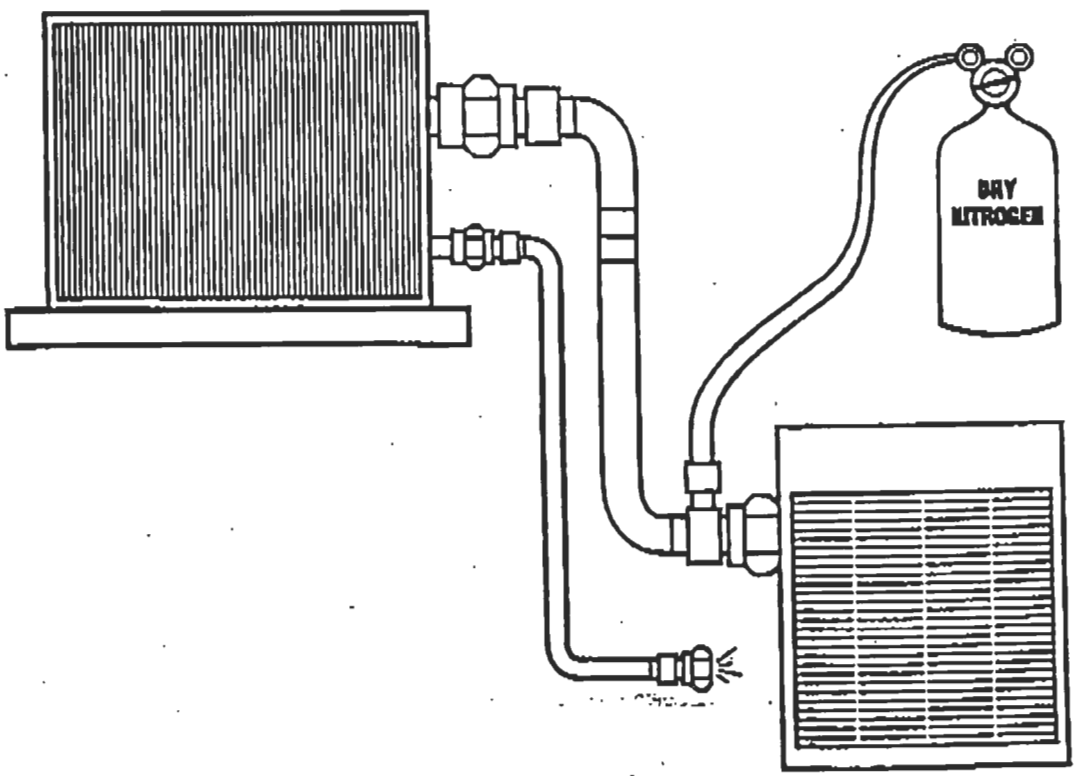
Everyone in the service business is aware of the importance of keeping a refrigerant system clean and dry. There has been a lot of publicity concerning the effects of moisture in a system; however, what is to be said about copper oxidation?

Copper oxidation, often referred to as scale, occurs when heat from a torch burns the oxygen inside the system and forms black scale on the inside of the copper tube. This scale can now circulate with the refrigerant, clogging strainers and dryers, restricting capillary tubes and expansion valves and hanging up switch-over valves. Furthermore, once the oxides are exposed to high temperatures discharge gas off the compressor, they can decompose the oil and refrigerant.

The above effect can be eliminated through the use of dry nitrogen. During brazing, blowing a small amount of nitrogen through the system forces out oxygen, leaving nothing combustible in the system.

The following safety practices should be observed when using dry nitrogen or any other pressurized gas:

- Always use a regulator on the nitrogen bottle.
- Two or three PSIG will be sufficient to purge the system of oxygen. Pressures higher than that may blow the solder out of the brazed joint.



Commercially Available Solder and Brazing Materials

DESIGNATION	COMPOSITION	TEMPERATURE °F	
Tin-Lead Solders		Melting	Flow
Fifty-Fifty	50% lead, 50% tin	360	415
Sixty-Forty	60% lead, 40% tin	360	459
Eutectic	37% lead, 63% tin	360	360
Stay-Brite	—	—	400
Stay-Brite No. 8	—	430	535
Tin-Antimony Solders			
Ninety-five-Five	95% tin, 5% antimony	450	450

The above materials have melting points below 700° and therefore should NOT be used for refrigerant connections.

Easy-Flow (45)	45% silver	1120	1145
Mueller (122)	—	—	—
Safety Silv No. 1200	75% silver	—	1145
Stay-Silv No. 45	45% silver	—	1175
Easy-Flow Original	50% silver	1160	1175
Sil-Fos	15% silver, 80% copper,		
	5% phosphorous	1185	1300
Phos-Copper	93% copper, 7% phosphorous	1317	1470

Sil-Fos and Easy-Flo are tradenames of Handy and Harman.
Phos-Copper is a tradename of Westinghouse Electric Company.

NOTES:

Copper to Copper:
Sil-Fos is probably the best material to use copper to copper as it requires no flux. It should not be used for any joints that involve iron or steel, as the phosphorous reacts with the iron to form iron phosphate, which is extremely brittle.

Copper to Steel:
Copper to steel requires the use of Easy-Flo 35 or 45 and a flux. The joint after brazing should be wirebrushed and tapped to break away any slag that may form that has only temporary bonding strength.

COUPLING KIT OPTION FOR ALUMINUM REPAIR

3/8" OD Kit 1146 ..... About $20 each

1/2" OD Kit 1147

(R410A) - 5/16" KIT ~~0148~~ 8157

P.J. (L)