The **Essentials** of NITROGEN **Purging** and **Brazing**

Understand the importance of nitrogen purging when brazing and some tips for the best results.

BY BOB HENSON

Images courtesy of Harris Products Group.

[*Editor's Note: This article is in response to a question that was asked of the Manufacturers' Service Advisory Council that read "Is it necessary to do nitrogen purging during brazing." MSAC Member, Bob Henson decided the question required a more in-depth response beyond what was answered. This was done to provide our readers with the best possible data on the subject given more extensive research.*]

In the day-to-day life of an HVAC technician, there are some jobs that are often overlooked; an important one is the task of nitrogen purging during brazing. Most HVAC installation instructions require flowing nitrogen through the copper tube during brazing. This is an important step in producing a quality HVAC system.

Why nitrogen purge?

Oxygen in the air combines with copper to form surface copper oxide. We see this on copper tubes as a light to dark brown discoloration. You have probably seen ACR/medical gas copper tube supplied from the tube mill nitrogen charged and capped. This is designed to prevent this oxide formation inside the tube. Once the caps are removed and the tube is cut for installation, the nitrogen protection is lost.

Copper-tube brazing scale.

Inside oxidation scale from 5/8-in. tube.

At high brazing temperature a heavier black oxide called "cupric oxide" forms. After cooling, this oxide flakes off to form "scale." While mostly cosmetic on the tube exterior, inside the tube the oxide flakes are carried by the refrigerant through the system. This contaminant can restrict flow through small orifices, such as metering devices or the pilot valve capillary tube in a reversing valve.

This problem has long been an issue in brazing HVAC tube. It has become more important with the change from HCFC refrigerants, such as R-22 which uses mineral oil, to the new HFC refrigerants, such as R-410A which uses POE oils. Due to their polar nature, POE oils have a solvent effect and can "scrub" the copper tube walls. Oxide from tube walls and loose scale can circulate through the system.

The procedure

To prevent oxidation, flow dry nitrogen through the tube during brazing. Nitrogen is inert (non-reactive) and will displace the oxygen to prevent scale formation.

» Nitrogen-purged tubes at the top compared to the bottom tubes that did not receive nitrogen purging.

Nitrogen is typically introduced into the system through the Schrader valve (after removing the core) or other system opening. Connect a hose or tube from the nitrogen cylinder to one end of the pipe. The cylinder will be equipped with a regulator or flow-control valve. There is no universal requirement for the delivery pressure setting, but the goal is to use low volume/pressure to displace the oxygen. A suggested starting point is 2 cfh–3 cfh or 1.5 psi–2 psi. Some users will set pressure until they feel a slight flow at the exit point on the back of their hand. It is good practice to initiate flow before heating and continue to flow nitrogen until the part has cooled.

Avoid an excessive flow rate that builds pressure inside the tube. A high flow rate will tend to cool the tube reducing brazing heat efficiency. Excess nitrogen pressure can build up inside the tube and reduce braze alloy penetration. A small hole in a cap at the end of the line will allow the nitrogen to escape.

« Nitrogen regulator.

It is a good idea to experiment with flow rates by test-brazing parts on the bench. Section the finished assemblies and inspect for a clean inner-tube wall. Take this step during installation and eliminate problems down the road.

Bob Henson is Technical Director for Harris Products Group and has 35 years of metal-joining experience. He is a member of the American Welding Society, and chairs the A5H committee that writes brazing filler metal and flux specifications. Henson is a member of the AWS Brazing Manufacturers Committee; the US Technical Activities Group that reviews International ISO brazing documents; as well as the National SkillsUSA HVACR Technical Committee. He is also a Member of RSES and the MSAC.