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HIGH-TEMPERATURE BRAZING

Nickel Brazing Alloy Procedures and Techniques for Torch Brazing

(revised 2015-10-06)

USES OF TORCH BRAZING

Nickel Brazing Flux works on stainless steels and alloys high in chromium, aluminum, and titanium. It also works on non-stainless steels. Brazing can be done by oxyacetylene torch. The Nickel Brazing Flux and Nickel filler metals (powdered with flux, or filler metal in rod form) depends on the nature of the job.

Use torch brazing: (1) To braze thin sections where welding is not practical, (2) To braze stainless assemblies requiring a filler metal able to provide strong, heat and corrosion resistant joints, (3) To braze assemblies of complex design, (4) To braze assemblies where the size, the design, or the quantities involved are not suitable for furnace brazing, (5) To braze dissimilar base metals such as copper tubes or sheets (or copper-nickel alloys) to stainless steel.

TORCH BRAZING METHODS AND FILLER METALS

When Torch Brazing, the flux may be used separately, with filler metal in rod or powder form (brazing paste). You should select the form depending on: joint clearance, size of fillet desired, and accessibility of joint. Using the rod form is often the easiest choice.
Nickel Brazing (Low Melt) and Nickel Brazing 135 are the filler metal grades recommended for most torch applications : Nickel Brazing L.M. for its low melting point (1830°F, or 1000°C), and Nickel Brazing 135 for its low hardness, athough it has a higher melting point (1935°F, or 1055°C).

USING NICKEL BRAZING FLUX-POWDER PASTE

Nickel Brazing Flux-Powder Paste (a mixture of filler metal powder and Nickel Brazing Flux) can be purchased already mixed, in quantities of 24 pounds or more. For smaller quantities it is suggested that the user hand mix his requirements. The standard flux-filler metal ratios are: Type B (Std.), 50% filler metal (by weight). Type C, 75% filler metal (by weight). Other ratios may be used. Apply the paste to the work by brushing, dipping, or mechanical application. Paste may be diluted with water, but carefully: too much dilution can cause separation of filler metal and flux. You should apply plenty of paste to the edges of the joint to insure that there is sufficient filler metal. Apply additional Nickel Brazing Flux to adjacent surfaces (and reverse side) that are to be kept oxide-free.

Dry the paste thoroughly to remove water. This may be accomplished by air or oven drying or by using the torch carefully to warm the paste. Continue to warm slowly until frothing stops.

After drying the paste, heat the base metal at the end of the joint until a high enough temperature is reached to melt and flow the brazing filler metal. Move slowly along joint line as the brazing filler metal melts and flows into joint. Note: Paste should always be heated indirectly by applying torch to base metal. Melting must start on base metal at end of joint. Do not heat top of paste; base metal and paste must be evenly heated.

Torch brazed joints can usually be disassembled by fluxing again and reheating to a temperature slightly higher than the initial brazing temperature. If the joint was initially heated to a very high temperature and for a long period of time, however, this disassembly technique will not work.

Hardenable base metals should be slowly cooled after torch brazing to prevent hardening.

After brazing or quenching, the flux residue may be removed with hot water, steam or with a commercial flux remover. The choice depends on the speed or removal desired.

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FLOW PROBLEMS: SUGGESTED ANSWERS

Filler metal not melting: Insufficient brazing heat due to improper application of heat. Paste should always be heated indirectly by applying torch to base metal.

Filler metal not flowing out: Insufficient heat in base metal. Base metal not clean, or flux oxidized because heated too long.

Filler metal and flux blowing off: Torch flame velocity is too high because torch flame is too large or torch is held too close to work. The paste becomes overheated before base metal reaches brazing temperature.

USING NICKEL BRAZING ROD

Nickel Brazing Flux cleans and wets the metal to be joined and prevents or removes oxides during the brazing operation. The flux is a smooth, creamy paste. It may be thinned with water, and can be applied by brushing or dipping. Nickel Brazing Flux should be liberally applied to the joint area and any adjacent surface that needs protection from oxidation. Allow flux to dry (drying may be speeded by heating slowly).

After flux is dry, heat it gently with a neutral flame (keep flame well away) until flux stops frothing. Do not overheat flux or hold at heat too long. Flux's capacity to prevent oxidation is limited. Once that limit is reached, the flux turns into a dark glass-like coating that is difficult to remove.

Next, bring the flame closer (but keep flame cone away from work) and continue heating until base metal has bright orange color and flux is melted. Touch the Nickel Brazing rod to the base metal next to the flame. Allow the heat in the base metal to melt the rod and cause it to flow out. Heat the joint uniformly across its width and move along joint line.

Torch brazed joints can usually be disassembled by fluxing again and reheating to a temperature slightly higher than the initial brazing temperature. If the joint was initially heated to a very high temperature and for a long period of time, however, this disassembly technique will not work.

Flux residue that remains after brazing or quenching may be removed with hot water, steam, or with a commercial flux remover. The choice of method depends on the speed of removal desired.