

Example of Nicrogap™ alloy used to fill a joint gap of 0.063mm (1/16”).

Nicrogap™ Alloys

Powdered High-Melting Materials Assist Brazing Filler Metals in Filling Large Joint Clearances in Protective Atmosphere Furnace Brazing

Description:

Highest brazed-joint strength is achieved when joint clearances are within the limits recommended for a specific Brazing Filler Metal. However, when brazing must be done on parts having clearances that exceed recommendations, Nicrogap™ alloys can be very helpful. Using the alloys, strong, ductile, nonporous joints can be brazed in parts having clearance gaps ranging from 0.25 - 2.5 mm (.010 - .100”). They are effectively used with a wide variety of base metals and Brazing Filler Metals. Correctly employed, Nicrogap™ alloys will eliminate the problems of underfill, voids in the joint, excessive filler metal flow, and excessive erosion.

Nominal Composition - % by Weight:

Several compositions are currently available, formulated for use with almost any copper, silver, gold, or nickel-based Brazing Filler Metal. The base metal can be any type of carbon steel, alloy steel, stainless steel or heat-resistant alloy. Nicrogap™ 108 alloy is available in powder form, -140 mesh (-106 µm) and Nicrogap™ 100 as -325 mesh (-45 µm), in the following nominal compositions by % weight:

Nicrogap™	B	Cr	Fe	Si	Ni
100	-	-	-	-	99.0 min
108	0.2	15.0	7.0	0.75	Bal

Physical Properties:

Nicrogap™ alloys are oxidation resistant at room temperature and are resistant to many corrosive media. The corrosion resistance of joints brazed with the aid of Nicrogap™ alloys can be made equal to pure nickel, stainless steel, or Inconel base metals. These alloys are very soft and ductile, and can be used to produce strong, crack free joints even when brazed with high-hardness Brazing Filler Metals.

The melting point of Nicrogap™ alloys is above 1315°C (2400°F). The joint remelt temperature will depend upon the Brazing Filler Metal and brazing cycle used. When nickel-based filler metals are used with Nicrogap™ alloys, the joint remelt temperature can be made to exceed 1205°C (2200°F). The usable service temperature of Nicrogap™ alloys will depend upon the service temperatures possible with the Brazing Filler Metal and base metal used.

Recommended Uses:

In most brazing operations, joint clearances are accurately controlled. But, if the joint gaps are too large, the Brazing Filler Metal may flow profusely and leave voids. If joint clearances are too small, incomplete flow of the Brazing Filler Metal may occur. Nicrogap™ alloys are valuable when brazing structures and components in which wide or variable joint gaps cannot be economically avoided. Joints up to 2.5mm (.100”) clearance can be brazed with a

suitable Brazing Filler Metal using Nicrogap™ 108 alloy on any stainless steel or heat resistant alloy.

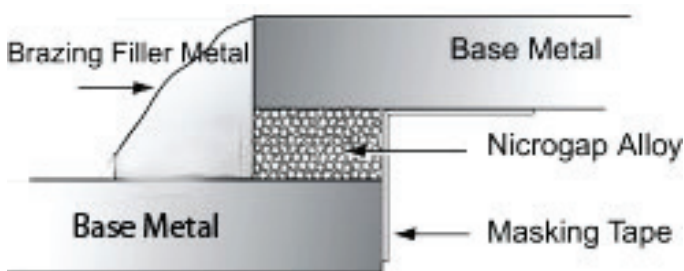
Nicrogap™ 100 is a fine mesh -325 (-45 µm), pure nickel powder that can be added directly to the brazing filler metal up to about 15% by weight to make a filler metal more sluggish during brazing, to aid in the filling of variable joint clearances. Use on mild and low-alloy steel, any stainless or heat-resistant alloy, especially 300 and 400 series.

Nicrogap™ alloys can also be used to aid in filling large flaws in castings. Choose a grade matching the base metal composition and size of flaw to be repaired.

Application:

The following procedure is recommended as a guide for the use of Nicrogap™ alloys in brazing wide-gap joints or repairing flaws in castings:

1. Close one side of the joint or casting flaw with masking tape.
2. Fill the gap as full as possible with the desired Nicrogap™ alloy. Shake or tap to settle the alloy as much as possible.
3. Apply Nicrobraz® Cement to compact and secure the powder.
4. If needed, add more powder and cement until the gap is filled.



5. Apply desired Brazing Filler Metal to only one side of the joint (see diagram). Use slightly more than the amount of Nicrogap™ alloy used. (The essentially spherical Nicrogap™ powder only produces a 50 - 60 percent dense fill. Upon brazing, the molten Brazing Filler Metal will fill the spaces between the Nicrogap™ powder particles by capillary attraction.) Remove masking tape after cement has dried.

a. Although silver and copper Brazing Filler

Metals are not recommended for use with gaps over .010" (0.25mm), such gaps (for low-pressure sealing applications) can be filled with these alloys in combination with a Nicrogap™ alloy.

- b. High-manganese, high-phosphorus, or similar free flowing Brazing Filler Metals are not recommended when gaps exceed .020" (0.50mm). Instead use Nicrobraz® 150 because of its melting point and unique flow properties.

6. Braze at the temperature recommended for the Brazing Filler Metal used. Use the controlled atmosphere recommended for the base metals and filler metal used.

If the recommended brazing temperature produces excessive flow, it may be necessary to lower it by 15 - 55°C (25 - 100°F). If flow is insufficient, the brazing temperature should be raised accordingly. On some joint designs it may be necessary to experiment to find the proper amount of Brazing Filler Metal.

Typical Example:

Specimens were made of AISI 304 stainless steel, brazed with Nicrogap™ and Nicrobraz® 150 filler metal at 1120°C (2050°F), 30 minutes at heat, in a pure dry hydrogen atmosphere.

A certain amount of "lumpiness" on the top (alloy application side) and concave fillets on the bottom side are desirable on very large joint gaps, to eliminate base metal erosion and shrinkage or "sponginess" in the joint.

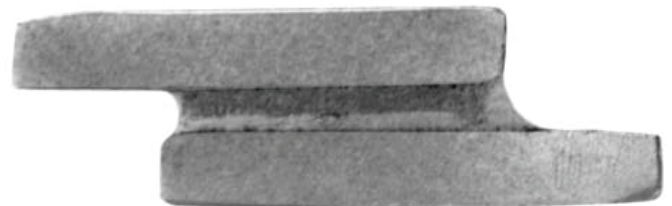


Figure shows typical example of joint preparation. The amount of Brazing Filler Metal should equal or exceed that of the Nicrogap alloy used.

Brazed specimens are of 3.17mm (1/8") thickness (T) AISI 304 stainless steel, having a gap of 1.57mm (1/16") and an overlap of 12.7mm (1/2") (4T). Nicrogap™ 108 and Nicrobraz® 150 filler metal were used. Brazing temperature was 1121°C (2050°F). Hardnesses: Base metal, Rb 75; joint metal, Rb 95 (after brazing).

Safety:

When handling metal powder alloys, avoid inhalation or contact with the skin or eyes. Conduct application operations in a properly ventilated area. For more information, consult, OSHA Safety and Health Standards available from U. S. Government Printing Office, Superintendent of Documents, P. O. Box 371054, Pittsburgh, PA 15250, and the manufacturer's Material Safety Data Sheet (MSDS). Read and understand the manufacturer's material safety data sheet before use.

The information provided herein is given as a guideline to follow. It is the responsibility of the end user to establish the process information most suitable for their specific application(s). Wall Colmonoy Corporation (USA) assumes no responsibility for failure due to misuse or improper application of this product, or for any incidental damages arising out of the use of this material.

updated October 2022