LucasMilhaupt®
A Handy & Harman Company
Global Brazing Solutions®

Technical Data Sheet

HI-TEMP® 933

NOMINAL COMPOSITION

Nickel	Remainder
Phosphorous	10.1% ± 0.4%
Chromium	14.0% ± 1.0%
Boron	0.02% Max
Silicon	0.10% Max
Iron	0.2% Max
Carbon	0.06% Max
Sulfur	0.02% Max
Titanium	0.05% Max
Aluminum	0.05% Max
Manganese	0.04% Max
Zirconium	0.05% Max
Cobalt	0.10% Max
Selenium	0.005% Max
Other Elements (Total)	0.50% Max

PHYSICAL PROPERTIES

Color	Iron Gray
Melting Point (Solidus)	1630°F (888°C)
Flow Point (Liquidus)	1630°F (888°C)
Brazing Temperature Range	1700°F - 2000°F (927°C - 1093°C)
Specific Gravity	6.24
Density (Lbs/in^3)	0.225
Electrical Conductivity (%IACS) [(1)]	N/A
Electrical Resistivity (Microhm-cm)	N/A

[(1)] IACS = International Annealed Copper Standard

PRODUCT USES

Hi-Temp 933 is a nickel-chromium-phosphorus brazing alloy powder used in high temperature strength and oxidation applications. Typically, this alloy is used for joining super alloys, stainless steels, and alloys requiring good joint strength at high temperatures while maintaining good corrosion and oxidation resistant characteristics. Typical applications would include brazing of honeycomb structures, thin-walled tube assemblies, and nuclear applications where additions of boron are not permitted.

BRAZING CHARACTERISTICS

Hi-Temp 933 melts and flows at uniform temperature of 1630°F (888°C). It exhibits excellent flow characteristics when tighter clearances are maintained. Due to its uniform temperature of 1630°F (888°C), Hi-Temp 933 is less likely to liquate. In atmosphere brazing, base metals containing more than 0.5% aluminum and/or titanium (i.e. Inconel X and A286) are often nickel-plated (0.0005 in. to 0.0015 in. thick depending upon brazing temperature and cycle), if difficulties in wetting and bonding are encountered. On thinner sections or less ductile base metals, brazing should be done at the low end of the brazing range with small clearances with fast heating/cooling cycles and a minimum quantity of brazing alloy to minimize erosion. Recommended joint clearance at brazing temperature for Hi-Temp 933 is 0.000 in. – 0.001 in. (0.00 mm – 0.025 mm).

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PROPERTIES OF BRAZED JOINTS

The properties of a brazed joint are dependent upon numerous factors including base metal properties, joint design, metallurgical interaction between the base metal and the filler metal. Joint ductility, strength and high temperature properties, and alloy re-melt temperature increase with increasing temperature and heating cycles, and decreasing joint clearances. This alloy shows satisfactory oxidation resistance at temperatures as high as 1550°F (843°C). The addition of chromium (Cr) gives Hi-Temp 933 better corrosion properties than Hi-Temp 932 (AWS A5.8/A5.8M BNi-6) alloy.

AVAILABLE FORMS

Powder and paste.

Available mesh sizes for powder:

140F	325
+100 Mesh: 0.5% Max	+200 Mesh: 0.5% Max
+140 Mesh: 10% Max	+325 Mesh: 10% Max
-325 Mesh: 55% Max	-325 Mesh: 90% Min

**Mesh sizes per AWS A5.8M/A5.8*

SPECIFICATIONS

Hi-Temp 933 alloy conforms to the following specifications:

- American Welding Society (AWS) A5.8/A5.8M BNi-7

APPLICABLE PRODUCT CODE(S)

The applicable Lucas-Milhaupt product code(s) for this technical data sheet: 77-933.

SAFETY INFORMATION

The operation and maintenance of brazing equipment or facility should conform to the provisions of American National Standard (ANSI) Z49.1, "Safety in Welding and Cutting". For more complete information refer to the Material Safety Data Sheet for Hi-Temp 933.

WARRANTY CLAUSE

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