SIL-FOS® 15
(SILVALOY® 15, SILVALOY® 15 EXCEL)

NOMINAL COMPOSITION

<table>
<thead>
<tr>
<th>Element</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver</td>
<td>15.0% ± 0.5%</td>
</tr>
<tr>
<td>Copper</td>
<td>80.0% ± 1.0%</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>5.0% ± 0.2%</td>
</tr>
<tr>
<td>Other Elements (Total)</td>
<td>0.15% Max</td>
</tr>
</tbody>
</table>

PHYSICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Gray</td>
</tr>
<tr>
<td>Melting Point (Solidus)</td>
<td>1190°F (643°C)</td>
</tr>
<tr>
<td>Flow Point</td>
<td>1300°F (705°C)</td>
</tr>
<tr>
<td>Brazing Temperature Range</td>
<td>1300°F - 1500°F (705°C - 815°C)</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>8.38</td>
</tr>
<tr>
<td>Density (lbs/in³)</td>
<td>0.303</td>
</tr>
<tr>
<td>Electrical Conductivity (%IACS)</td>
<td>9.90</td>
</tr>
<tr>
<td>Electrical Resistivity (Microhm-cm)</td>
<td>17.4</td>
</tr>
</tbody>
</table>

(1) The true liquidus for Sil-Fos 15 is 1475°F (802°C). The alloy will flow freely and make strong joints at 1300°F (705°C).
(2) IACS = International Annealed Copper Standard

PRODUCT USES

Sil-Fos 15 and was developed primarily for use on copper, but its use has extended to other nonferrous copper base alloys. It is used extensively on refrigeration units, air conditioning apparatus, electrical conductors, copper and brass pipe fittings, and other copper and brass equipment.

BRAZING CHARACTERISTICS

Sil-Fos 15 is a copper rich, filler metal that is self-fluxing on copper by virtue of its phosphorus content. The self-fluxing property of this filler metals is effective on copper only. With copper-base alloys, such as brass or bronze, the joints should be fluxed with Handy Flux®. Sil-Fos 15 should not be used on nickel-base and iron-base alloys, as the phosphorus reacts with the nickel or iron to form brittle compounds at the interface of the joints.

Sil-Fos 15 has a strong tendency to liquate (i.e. to separate into low and high melting constituents) if heated slowly through its melting range, as normally occurs in furnace brazing. The results in leaving a “skull” of unmelted alloy behind may objectionable from the standpoint of appearance. In furnace brazing it is preferable to pre-place the alloys inside the joint where the skull is not visible.
Technical Data Sheet

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. The following information, however, should serve as a guide for estimating the results that can be achieved with either Sil-Fos 15 or Sil-Fos 5 on copper and copper base alloys.

Table 1. Brazed butt joints tested at room temperature

<table>
<thead>
<tr>
<th>Material</th>
<th>Tensile Strength (lbs/in²)</th>
<th>Elongation % in 2 in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>30,000 - 35,000</td>
<td>15.0 - 20.0</td>
</tr>
<tr>
<td>Brass</td>
<td>35,000 - 40,000</td>
<td>20.0 - 25.0</td>
</tr>
<tr>
<td>Nickel-Silver</td>
<td>35,000 - 40,000</td>
<td>2.00 - 5.00</td>
</tr>
</tbody>
</table>

Table 2. Brazed butt joints tested at elevated temperatures gave the following average values (short time tests)

<table>
<thead>
<tr>
<th>Test Temperature</th>
<th>Tensile Strength (lbs/in²)</th>
<th>Elongation % in 2 in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>°F</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>95</td>
<td>32,050</td>
</tr>
<tr>
<td>300</td>
<td>150</td>
<td>29,500</td>
</tr>
<tr>
<td>400</td>
<td>205</td>
<td>28,100</td>
</tr>
<tr>
<td>500</td>
<td>260</td>
<td>23,600</td>
</tr>
<tr>
<td>600</td>
<td>315</td>
<td>22,700</td>
</tr>
<tr>
<td>700</td>
<td>370</td>
<td>17,700</td>
</tr>
<tr>
<td>800</td>
<td>425</td>
<td>15,800</td>
</tr>
<tr>
<td>Brass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>95</td>
<td>34,000</td>
</tr>
<tr>
<td>300</td>
<td>150</td>
<td>34,700</td>
</tr>
<tr>
<td>400</td>
<td>205</td>
<td>30,700</td>
</tr>
<tr>
<td>500</td>
<td>260</td>
<td>28,500</td>
</tr>
<tr>
<td>600</td>
<td>315</td>
<td>22,500</td>
</tr>
<tr>
<td>700</td>
<td>370</td>
<td>16,700</td>
</tr>
<tr>
<td>800</td>
<td>425</td>
<td>11,600</td>
</tr>
</tbody>
</table>

Prolonged heating should be avoided due to the erosion of Sil-Fos into the base metal. Small clearances should also be avoided. Excessive heat times at brazing temperature and small clearances can lead to the erosion seen in the picture below:
**Figure 1: Erosion of Sil-Fos into Copper base metal**

**CORROSION RESISTANCE**

Normally the corrosion resistance of Sil-Fos 15 is of the same order as copper, but under certain conditions it may corrode more rapidly. Sil-Fos 15 should not be used where the joints are exposed to sulfur compounds, especially in gasses or oils at temperatures above normal room temperature. As the corrosion by sulfur is cumulative, even very small percentages will eventually cause failure of the joint by disintegration. Exposure to pressured steam can also result in accelerated corrosion.
CORROSION RESISTANCE (CONT.)

The following table lists the results of corrosion tests on brazed copper joints in several media:

<table>
<thead>
<tr>
<th>Solution</th>
<th>Test Temp.</th>
<th>Conditions</th>
<th>Loss in Weight Mgs./Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>10% Acetic Acid</td>
<td>Room</td>
<td>Constant Immersion</td>
<td>33.3</td>
</tr>
<tr>
<td>10% Acetic Acid</td>
<td>212°F (100°C)</td>
<td>Constant Immersion</td>
<td>243.0</td>
</tr>
<tr>
<td>5% Hydrochloric Acid</td>
<td>Room</td>
<td>Constant Immersion</td>
<td>50.6</td>
</tr>
<tr>
<td>5% Hydrochloric Acid</td>
<td>212°F (100°C)</td>
<td>Constant Immersion</td>
<td>395.0</td>
</tr>
<tr>
<td>5% Lactic Acid</td>
<td>Room</td>
<td>Alternate Immersion 22 times per minute</td>
<td>48.4</td>
</tr>
<tr>
<td>5% Lactic Acid</td>
<td>130°F (55°C)</td>
<td>Alternate Immersion 22 times per minute</td>
<td>381.0</td>
</tr>
<tr>
<td>Sodium Chloride (N/10)</td>
<td>Room</td>
<td>Constant Immersion</td>
<td>9.1</td>
</tr>
<tr>
<td>Sodium Chloride (N/10)</td>
<td>212°F (100°C)</td>
<td>Constant Immersion</td>
<td>143.0</td>
</tr>
<tr>
<td>5% Sulphuric Acid</td>
<td>Room</td>
<td>Constant Immersion</td>
<td>36.3</td>
</tr>
<tr>
<td>5% Sulphuric Acid</td>
<td>212°F (100°C)</td>
<td>Constant Immersion</td>
<td>178.0</td>
</tr>
</tbody>
</table>

AVAILABLE FORMS

Wire, strip, engineered preforms, specialty preforms per customer specification, powder and paste.

SPECIFICATIONS

Sil-Fos 15 alloy conforms to the following specifications:

- American Welding Society (AWS) A5.8/A5.8M BCuP-5
- ASME Boiler & Pressure Vessel Code, Sec II-C, SFA-5.8 BCuP-5
- Federal Specification QQ-B-654 BCuP-5 Grade III
- International Organization for Standardization (ISO) 17672 CuP 284
- British Standard (BS) EN 1044 CP 102
- Deutsches Institut für Normung (DIN) 8513 Part 2 L-Ag15P

APPLICABLE PRODUCT CODE(S)

The applicable Lucas-Milhaupt product code(s) for this technical data sheet: A00000026, Legacy Codes: 71-150, 7153, 29538, 35528.

Distribution P/N: 95150, 95161, 95168, 95177, 95166, 95162, 95151, 95152, 95154, 95158, 98700, 98701, 98702, 98703, 98704, 98705, 98706, 99710, 95090.

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 Sil-Fos 15.
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