Technical Data Sheet

EASY-FLO®
(SILVALOY® 50)

NOMINAL COMPOSITION

Silver	50.0% ± 1.0%
Copper	15.5% ± 1.0%
Zinc	16.5% ± 2.0%
Cadmium	18.0% ± 1.0%
Other Elements (Total)	0.15% Max

PHYSICAL PROPERTIES

Color	Light Yellow
Melting Point (Solidus)	1160°F (627°C)
Flow Point (Liquidus)	1175°F (635°C)
Brazing Temperature Range	1175°F - 1375°F (635°C - 746°C)
Specific Gravity	9.18
Density (Troy oz/in^3)	4.84
Electrical Conductivity (%IACS) (1)	23.9
Electrical Resistivity (Microhm-cm)	7.00

(1) IACS = International Annealed Copper Standard

PRODUCT USES

Easy-Flo is a general purpose braze filler metal. The alloy can be used successfully on nearly all nickel, iron and copper base alloys. In certain instances, special fluxes may be required to obtain good wetting and bonding. In brazing gray cast iron it is necessary to treat the surface prior to brazing to remove graphite, in order to assure good wetting by the brazing filler metal. A complete list of the uses of Easy-Flo would include practically all applications for which silver brazing filler metals have been used.

BRAZING CHARACTERISTICS

Easy-Flo is a eutectic type, free-flowing filler metal that, because of its narrow melting range, is less sensitive to the rate of heating and should not liquate (i.e. separate into low and high melting constituents). This high fluidity makes well-fitted joints essential and prevents 'bridging' or large fillet formation. Handy® Flux should be used with either of these filler metals. Some base metals when brazed under high stress may crack during brazing when the stressed base metal is wetted by the brazing filler metal. This is a form of stress corrosion cracking. The low flow temperature of Easy-Flo is below the stress relaxation temperature of some nickel base alloys. The cure is to relieve the stress before the brazing alloy is applied. A higher melting brazing filler metal may be preferred since stress relief will then occur before the filler metal melts.

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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. Butt joints of the listed metals have been tested at room temperature with the following typical results:

Metal	Tensile Strength of Base Metal (lbs/in^2)	Tensile Strength of Butt Joints (lbs/in^2)
Armco Iron (0.05%C)	50,000	55,000
SAE 1020 Steel	65,000	65,000
1095 (Drill Rod)	90,000	110,000
4140 Steel	135,000	
High Speed Steel (18%W, 4%Cr, 1%V)	NA	90,000
18-8 Stainless Steel		
Annealed	80,000	60,000
Cold Rolled	160,000	130,000

Table I.
Average Tensile Strength of Butt Joints brazed with Easy Flo Alloys

Copper:
Butt joints as strong as annealed copper can be made consistently (33,000 lbs/in^2 tensile strength). Failure should occur in the base metal on both butt and lap joints.

Brass:
Butt joints should have tensile strengths of 35,000-45,000 lbs/in^2. Failure usually occurs in the brass rather than in the brazing filler metal. Brasses vary widely in composition and the presence of certain constituents may adversely affect the strength of a silver brazed joint. A high lead content in brass may result in lead evolution to the base metal/filler metal joint interface with resultant joint embrittlement. Brasses or bronzed containing aluminum will require the use of Handy® Flux Type A-1.

Steel:
The tensile strength of Easy-Flo brazed joints in steel will vary considerably with the type of steel and its physical condition. Approximate values for butt joints are given in Table I below. The strength of the Armco joints is slightly higher than the un-brazed Armco because the brazing operation actually increases the strength of this base metal. Most of the Armco iron and 1020 steel specimens broke in the base metal outside the joint area. Although High Speed Steel has higher strength than 4140 steel, the strength of brazed joints is less with the former steel. This appears to be the result of poorer wetting on this grade.

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PROPERTIES OF BRAZED JOINTS (CONT)

Shear strengths of brazed joints in various steels vary in values from approximately 20,000 to 50,000 lbs/in^2 depending upon joint design, materials, etc. The relationship between the shear strength of steel and the shear strength of a brazed joint is not as pronounced as with the tensile strengths, and for design purposes it is not safe to assume brazed joint shear strengths greatly exceeding 25,000 lbs/in^2. Shear tests on flange type joints indicate that fillet size exerts considerable influence on the breaking load, a large fillet being beneficial. Tests of brazed joints show that shear in torsion is somewhat higher than direct shear. Torsion shear tests on brazed joints in steel have indicated an average value of about 40,000 lbs/in^2.

The impact strength of silver brazed butt joints decreases as the strength of the steel increases. For instance, impact values for standard Charpy butt brazed test specimens of Armco iron gave average values of about 40 ft. lbs. while similar joints on 4140 steel averaged about 2 ft. lbs. This is because the softer material deforms before the joint fails and absorbs part of the impact, while hard steels do not deform and most of the effect of the impact is concentrated at the joint itself.

No broad generalizations can be made in order to establish joint strengths for all cases. An accurate evaluation, for a specific case, can only be arrived at by a test of the actual joint geometry in question. Additional test data are given in Table II for short time elevated temperature conditions.

Test Temperature		Inconel Alloy		Monel		18-8 Stainless Steel	
		Tensile Strength	Elongation	Tensile Strength	Elongation	Tensile Strength	Elongation
°F	°C	(lbs/in^2)	% in 2 in.	(lbs/in^2)	% in 2 in.	(lbs/in^2)	% in 2 in.
Room		45,000	0	70,000	7.30	101,000	0
200	95	43,000	0	60,000	5.10	NA	NA
300	150	45,000	0	58,000	7.30	94,000	0
400	205	NA	0	NA	NA	76,000	0
500	260	38,000	0	48,000	3.10	49,000	0
600	315	29,000	0	NA	NA	30,000	0
700	370	27,000	0	31,000	0.00	26,000	0
800	425	14,000	0	19,000	0.00	12,000	0
900	480	8,000	0	13,000	0.00	NA	NA

Table II.
Strength of Easy-Flo Brazed Butt Joints at Elevated Temperatures

CORROSION RESISTANCE

The Easy-Flo filler metals have corrosion characteristics resembling those of the brasses. They are generally useful in applications for which copper, copper base alloys, and carbon steel are suited, and with stainless steels and nickel alloys with certain limitations.

The filler metals are unsuited for use with the strong mineral acids on any base metal, although the attached is slow enough to allow pickling in sulphuric or hydrochloric acids after brazing to clean up the part without destructive attack. Nitric acid is not recommended for use with Easy-Flo filler metals. They are also not suited for continuous use with aqueous ammonia, wet SO_2, and strong chlorine bleach solutions.

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CORROSION RESISTANCE (CONT)

The filler metals may be used in salt water, on copper, brass, Monel, nickel silver, Inconel, and the like, to the extent that these base metals are satisfactory. Hot salt water may cause dezincification of the filler metals. In such applications, zinc free brazing filler metals such as Silvaloy®603 or Silvaloy®630 would be better choices.

Easy-Flo filler metals should not be used on the 400 series of stainless steels because in water (even tap water) interface corrosion occurs, the braze metal separates cleanly at the bond line. In acids, other than the strong mineral acids, or in any other corrosive media whose specific effects on the filler metals are not known, the prospective use should be tested with the base metals to be joined, under the conditions of the proposed use. It is not possible to predict how various base metals may react with the filler metals under all corrosive conditions. Therefore, while the guidelines presented here are reliable to the best of our knowledge, the burden of determining suitability for any specific application rests exclusively on the user of the filler metal.

AVAILABLE FORMS

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

SPECIFICATIONS

Easy-Flo alloy conforms to the following specifications:

- American Welding Society (AWS) A5.8/A5.8M BAg-1a
- ASME Boiler & Pressure Vessel Code, Sec II-C, SFA-5.8 BAg-1a
- Society of Automotive Engineers (SAE) / AMS 4770
- Federal Specification QQ-B-654 GR IV
- International Organization for Standardization (ISO) 17672 Ag 350
- JIS Z 3261 BAg-1a

APPLICABLE PRODUCT CODE(S)

The applicable Lucas-Milhaupt product code(s) for this technical data sheet: A00000003, Legacy Codes: 31-500, 232.

SAFETY INFORMATION

Easy-Flo contains cadmium. Cadmium fumes are poisonous. This alloy should be used only in well-ventilated spaces with air movement which will carry brazing fumes away from the worker's face. Refer to ANSI Z49.1 entitled "Safety in Welding and Cutting", and the Lucas-Milhaupt Material Safety Data Sheet for detailed information.

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