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SCIENTIFIC AND TECHNICAL INFORMATION

CAMERON STATION, ALEXANDRIA, VIRGINIA



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GENERAL DYNAMICS | CONVAIR

Report No. 8926-171

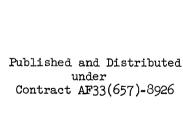
Material - Nickel Base Alloy - Hastelloy R-235 (Haynes Stellite Co.)

Fusion Weld Strengths

(An Abstract Report)

C. W. Alesch

19 April 1963



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Report No. 8926-171

Material - Nickel Base Alloy - Hastelloy R-235 (Haynes Stellite Co.)

Fusion Weld Strengths

(An Abstract Report)

Abstract:

Hastelloy R-235 nickel base alloy sheet in the thicknesses and conditions listed below was tungsten inert gas fusion but welded and tested with the following results.

	Weld	Joint
	Strength	Efficiency
	KSI	Percent
0.016", 10% cold worked, welded	117.6	89
0.040", solution heat treated, * welded	128.3	98
0.020", solution heat treated, aged, ** welder	d 137.9	86
0.040", solution heat treated, welded, aged	132.0	94

^{* 1975°}F, water quench ** 1500°F, 2 hours, air cool

Reference: Alesch, C. W., 'Material - Nickel Base Alloy - Hastelloy R-235 (Haynes Stellite Co.). Fusion Weld Strengths (An Abstract Report)," General Dynamics/Convair Report 8926-171, San Diego, California, 19 April 1963. (Reference attached). MODEL DATE PAGE 1 REPORT NO. 8926-171

Report No. 8926-171

Material - Nickel Base Alloy - Hastelloy R-235 (Haynes Stellite Co.)

Fusion Weld Strengths

(An Abstract Report)

Reference: Vermilyea, E. J., Green, E. D., Carr, W. L., Margitan, E.,
"Fabricability of Materials R-235, L-605, Rene 41, M-252
and J-1650 as Pertaining to Part No. 8-26054," General
Dynamics/Convair Report AMR-PR 889, San Diego, California,
April 1961.

Haynes Stellite Co. Hastelloy Alloy R-235 in the thicknesses, conditions and strength conditions listed in Table 1 was fusion butt welded by the tungsten inert gas method. The fusion welding schedules employed are given in Tables 2 and 3. The strengths of the welds are given in Table 4. "Five radiographs of fusion welded coupons were studied for porosity and weld continuity. No porosity in or around weldments could be detected on any of the weld specimens, and all welds exhibited good thickness continuity." The efficiencies of the fusion welded R-235 joints were found to be:

- 1. Ten per cent cold work then welded, 89%
- 2. Solution heat treated then welded, 98%
- 3. Solution heat treated, aged then welded, 86%
- 4. Solution heat treated, welded then aged, 94%

The solution heat treatment was done at the mill, and consisted of heating at 1975°F and quenching in water. Aging consisted of heating at 1500°F for 2 hours, and air cooling.

Prepared by C. W. Alesch 19 April 1963

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GENERAL DYN	AMICS	CONVAIR
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MODEL DATE				I#NERAL		·		PAGE 2 REPORT NO. 8926-171
			Elong.	25.7	12.8	15.8	39.0	
		Average	Ultimate Strength (1b)	131,900	146,500	153,100	130,000	
	R-235		Yield Strength (1b)	97,000	107,100	101,000	77,700	
Table 1	Properties of		Elong.	27.0 26.9 23.2	14.5 13.0 11.0	16.4 15.8 15.1	38.0 42.0 37.0	
Ta	echanical	Ultimate	Strength (1b)	129,200 131,600 134,800	152,400 145,100 141,000	153,400 151,200 154,600	132,100 126,200 131,600	erial
	, M	Yield	Strength (.2%)	89,700 90,100 92,200	108,600 107,400 105,200	101,100 99,400 104,000	77,400 79,600 76,100	% Cold Worked Material ged Material Solution Heat Treated Material
			Cond.	G.W.	4 4 4	य ४ ४	ਜ਼•ਸ਼• ਜ਼•ਸ਼•ਸ਼•	10% Cold Work Aged Material - Solution He
			Gage (in.)	0.016	0.020	0,040	0 1 0°0	S.H.T.

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GENERAL DYNAMICS | CONVAIR

MODEL DATE PAGE 3 REPORT NO. 8926-171

Table 2

Schedule for Welding 0.020 inch to 0.020 inch Annealed

R-235

Current: DCSP 30 amperes

Voltage: 10 volts
Torch Speed: 15 inches/min.

Electrode: 0.040" diam. 2% thoriated tungsten

Cup Size: #8

Back-up Gas: argon
Flow Rate: 16 cu ft/hr
Torch Gas: argon
Flow Rate: 16 cu ft/hr
Clamp Spacing: 0.125"

Clamp Pressure: 55 lb

Back-up Bar Material: 0.010" copper insert

Table 3

Schedule for Welding 0.040 inch to 0.040 inch Annealed R-235

Current: DCSP 50 amperes Voltage: 10 volts

Torch Speed: 30 inches/min.

Electrode: 1/16" diam. 2% thoriated tungsten Cup Size: #8

Back-up Gas: argon
Flow Rate: 20 cu ft/hr

Torch Gas: 17% argon - 83% Helium

Flow Rate: 50 cu ft/hr'

Clamp Spacing: 5/32"

Clamp Pressure: 80 1b

Back-up Bar Material: 0.010" copper insert

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GENERAL	DYNAMICS	CONVAIR
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- [· · · · · · ·							PAGE 4 REPORT NO. 892
		Failure	Weld " "	Adj. Weld *P.M. Weld Adj. Weld	Adj. Weld P.M. P.M. Weld	Weld Weld Weld Adj. Weld	
		ge Elong.	5.9	27.5	6.	13.7	
	elded R-235	Average Ultimate Strength (1b)	117,600	128,300	137,900	132.000	
Table 4	of Fusion W	Yield Strength	88,900	78,300	97,900	86,100	
Tab	roperties	Elong,	6.5	31.0 30.0 21.5 27.5	10.4 9.9 11.2 8.1	18.0 13.7 10.4 12.6	
	Mechanical Properties of Fusion Welded R-235	Ultimate Strength (lb)	120,000 120,100 111,900 118,400	131,700 126,000 124,300 131,100	138,100 142,700 137,300 133,600	134,200 127,400 130,800 135,700	treat then weld treat, age then weld treat, weld then age
		Yield Strength (.2%)	91,100 86,200 87,900	82,000 76,400 77,700 77,100	99,400 101,000 93,400 97,700	91,400 78,800 90,100 84,000	cold worked then weld tion heat treat, age then tion heat treat, weld then
		Cond.	H===	0 = = =	4:::	m= = =	% cold plution plution
		Gage in.	0.016	0,040	0.020 	0,040,0	1.0.6.4

FORM 1812 D (REV. 12/61)