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Report No. 8926-173

Material - Cobalt Base Alloy - L-605

Spot Weld Strengths

(An Abstract Report)

Abstract:

Spot welding procedures and test results obtained from tests with 0.031" and 0.050" thick L-605 cobalt base alloy sheet are summarized. Pertinent test data are as follows.

<u>Material Thickness and Condition</u>	<u>Tensile</u>	<u>Cross</u>	<u>TS.1</u>
	<u>Shear</u> <u>Strength</u>	<u>Tension</u> <u>Strength</u>	<u>C.T.</u> <u>Ratio</u>
0.031" mill annealed,* welded	1674 lb/spot	894 lb/spot	.53
0.031" weld, heat treat**	1680	706	.42
0.050" mill annealed,* welded	3244	1974	.61
0.050" weld, heat treat**	3290	1081	.33

* 2250°F, water quench

** 1975°F, air cool

Reference: Alesch, C. W., "Material - Cobalt Base Alloy - L-605. Spot Weld Strengths (An Abstract Report)," General Dynamics/Convair Report 8926-173, San Diego, California, 19 April 1963. (Reference attached).



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Material - Cobalt Base Alloy - L-605

Spot 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.

Annealed, 0.031" and 0.050" thick, mill annealed (2250°F, water quench), L-605 (Haynes Alloy No. 25, Haynes Stellite Co.) was cleaned by the methods given in Table 1 and then spot welded. The 0.031" thick sheet was welded according to the schedule given in Table 2, and the 0.050" thick according to the Table 3 schedule. The results from tests with spot welds in mill annealed and re-annealed (1975°F, 30 minutes, rapid air cool) conditions are shown in Table 4. These data show that spot weld strengths optimize when mill annealed material is welded without subsequent heat treatment. Annealing (1975°F, 30 minutes, air cool) generally reduces weld strengths, especially the cross-tension strength, and thus contributes to reductions in tension-shear to cross-tension strength ratios.

Prepared by C. W. Alesch
19 April 1963

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Table 1

Cleaning Method for Annealed R-235

<u>Operation</u>	<u>Cleaning Components</u>	<u>Temp °F</u>	<u>Time (Min.)</u>
Vapor Degrease	Stabilized Tri- chloroethylene (per Mil-T-7003)	180 - 195	1
Alkaline Clean	Oakite 61A, 5-6 ounces per gallon	150 - 180	5
Hot Water Rinse	Steam Condensate	130 - 180	1
Pickle	1.5-20% Hydrofluoric Acid, 25-35% Nitric Acid	Room Temp.	Varied
Water Rinse	Tap Water	Room Temp.	1
Dry	Hot Air	120 - 150	2

Mach. Make SCIAPY Rated Capacity 100 KVA

	Top Sheet	2nd Sheet	3rd Sheet	Electrodes	Top	Bottom
Material	L-605	L-605				
Gage	0.031"	0.031"		RWMA Class and Group	Class 3	Class 3
Condition	as received (annealed)			Diameter	5/8 to 1/2	5/8 to 1/2
Material	chem etch			Contour	4 R	4 R
Preparation	(4104)			SWAC No.		

Throat depth	37	Squeeze cycles	25
Distance between arms	6	Weld interval imp	5
Const. high and vari. press	OFF	Hold cycles	25
Vari. press	OFF	Off cycles	26
Const. low press	ON	Preheat interval imp	4
Co press	ON	Quench cycles	1
Mu. imp	ON	Postheat interval imp	4
Sing. imp	OFF	Quench and postheat	ON
Mult. imp weld	SW	Preheat	ON
With preheat and postheat	ON	Electric contact gauge	52
With current decay	OFF	Pressure gauge 2	53
Tha. group	ON	Pressure gauge 1	28
Th. group	ON	2 tubes	ON
Decades	OFF	1 tube	OFF
Forge delay vernier	OFF	1 or 2 phase	OFF
Forge delay cycles	OFF	3 phase	ON
At beginning of weld interval	ON	Preheat	20
At end of weld interval	OFF	Preheat vernier	0
Forge delay initia. point	SW	Weld	20
Cool cycles	1, 5	Weld vernier	1
Heat cycles	5	Post heat and current decay	20
Current decad. cycles	OFF	Post heat and current decay vernier	1
Current decay	OFF		

Table 2 Resistance Spot Weld Schedule to Weld 0.031 inch L-605 to 0.031 inch L-605
in the Annealed Condition

CONVAIR-SD

Mach. Make Solaky Rated Capacity 100 KVA

	Top Sheet	2nd Sheet	3rd Sheet	Electrodes	Top	Bottom
Material	L-605	L-605				
Gage	0.050	0.050		RWMA Class and Group	II	II
Condition	as received (annealed)			Diameter	1/2	1/2
Material	chem etch			Contour	4 R	4 R
Preparation				SWAC No.		

Throat depth	37	Squeeze cycles	25
Distance between arms	6	Weld interval imp	5
Const. high and vari. press	off	Hold cycles	25
Vari. press	off	Off cycles	26
Const. low press	on	Preheat interval imp	4
Const. press	on	Quench cycles	1
Mult. imp	on	Postheat interval imp	4
Sing. imp	off	Quench and postheat	on
Mult. imp weld	4	Preheat	on
With preheat and postheat	on	Electric contact gauge	60
With current decay	off	Pressure gauge 2	60
Tha. group	on	Pressure gauge 1	27
Th. group	on	2 tubes	on
Decades	0	1 tube	off
Forge delay vernier	0	1 or 2 phase	off
Forge delay cycles	off	3 phase	ON
At beginning of weld interval	on	Preheat	20
At end of weld interval	OFF	Preheat vernier	2
Forge delay initia. point	SW	Weld	20
Cool cycles	1-5	Weld vernier	3
Heat cycles	4.	Post heat and current decay	20
Current decad. cycles	OFF	Post heat and current decay vernier	2
Current decay	OFF		

Table 3 Resistance Spot Weld Schedule to Weld 0.050 inch L-605 to 0.050 inch L-605
in the Annealed Condition

Table 4 Tensile Results of Resistance Spot Welded L-605

Coupon No.	Gage Inches	Tensile Shear Results			Cross Tension Results			Cross Tension to Tensile Shear Ratio	Standard Deviation	
		Annealed Then Weld	Weld Then *Heat Treat	Avg.	Anneal Then Weld	Weld Then *Heat Treat	Avg.		Tensile Shear	Cross Tension
J1	0.031	1700		1674	900		894	53%	63.6	63.1
2	0.031	1710			910					
3	0.031	1740			790					
4	0.031	1640			900					
5	0.031	1580			970					
K1	0.031		1250	1680		770	706	42%	360.5	53.2
2	0.031		2200			690				
3	0.031		1780			640				
4	0.031		1720			750				
5	0.031		1450			680				
L1	0.050	2840		3244	2000		1974	61%	230.9	287.2
2	0.050	3270			2140					
3	0.050	3370			2180					
4	0.050	3340			1475					
5	0.050	3400			2075					
M1	0.050		3320	3290		850	1081	33%	51.4	348.8
2	0.050		3330			950				
3	0.050		3250			960				
4	0.050		3220			1700				
5	0.050		3330			945				

*1975°F 30 Minutes rapid air cool