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PROVISIONAL PROCESS SPECIFICATIONS
FOR THE ATTACHMENT OF SUPPORT RAILS
BY ELECTRICAL RESISTANCE SPOT WELDING

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PROVISIONAL PROCESS SPECIFICATIONS

FOR THE ATTACHMENT OF SUPPORT RAILS

BY ELECTRICAL RESISTANCE SPOT WELDING

The enclosed provisional specifications present the modifications and additions to the Lead Dip Canning Process For Heat Treated Uranium, HW-47029, for the production test fabrication of projection fuel elements by resistance spot welding. Unless otherwise noted, the Lead Dip Canning Process Specifications shall apply to the fuel elements. Future additions and revisions to these specifications, prior to issuance of a formal specification, will be made by revision to this document.

E. V. Padgett

E. V. Padgett, Engineer
Process Engineering
Fuels Preparation Department

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PROVISIONAL PROCESS SPECIFICATIONS
FOR THE ATTACHMENT OF SUPPORT RAILS
BY ELECTRICAL RESISTANCE SPOT WELDING

E. V. Padgett

Process Engineering

Fuels Preparation Department

June 22, 1960

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PROVISIONAL PROCESS SPECIFICATIONS
FOR THE ATTACHMENT OF SUPPORT RAILS
BY ELECTRICAL RESISTANCE SPOT WELDING

Specification F-1 - Uranium Fuel Elements

- F1.1 Projection fuel elements shall be fabricated according to the Lead Dip Canning Process Specifications for Heat Treated Uranium, HW-47029, with the following exceptions and additions.
- F1.2 The finished fuel elements shall be cleaned and deoxidized in such a manner as to insure strong consistent support rail spot welds.
- F1.3 Fuel element cleaning shall not alter the parts to the extent that they no longer conform to Specification F405.1, HW-47029.
- F1.4 The following end contour design may be used as an alternate for the standard tru-line contour on self-supported fuel elements, but is not suitable for "bumper" fuel elements.

	<u>CIV</u>	<u>OII</u>	<u>KIII</u>
F ± .003"	.378	.310	.385
K ± .010"	.478	.410	.485
Length			
+ .120"			
- .080"	8.865	8.865	8.865

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F1.6 All fuel elements shall pass the fuel length tube gage or plate gage specified by F405.1 (HW-47029) before rail attachment.

Specification F-2 - Aluminum Support Rails

F2.1 The support rails shall be fabricated from C-64 F and/or X-8001 aluminum alloy, meeting the chemical composition limits specified in Specification F105.1 (HW-47029).

F2.2 The aluminum support rail alloy shall be the same as the fuel element cladding alloy.

F2.3 The support rails shall conform to the following dimensions:

Item	Self Support			Bumper	
Model	OIIN	CIVN	CVN	OIIN	KIIN
Length $\pm 1/32$ "	2 1/8	2 1/8	2 1/8	2 1/8	2 1/8
Height + .000	0.076	0.078	0.082	0.040	0.060
- .002					
Mat'l Thickness $\pm .0015$ "	0.032	0.032	0.032	0.040	0.032
				0.032	
Drawing Number	H-3-7949	H-3-16619		H-3-7949	H-3-7949

F2.4 The support rails shall be cleaned and deoxidized in such a manner as to produce strong consistent spot welds.

Specification F-3 - Support Rail Welds

F3.1 An electrical resistance spot welder employing Class 1 copper alloy electrodes shall be used to attach aluminum support rails to the fuel element jacket.

F3.2 The fusion zone dimensions shall be:

a. Width - (Measured at right angles to the fuel element axis)
0.090" minimum, 0.200" maximum. There shall be uninterrupted fusion within the weld boundary.

b. Penetration -

1. Total Penetration - (Measured from the top of the fusion zone in the rail to the bottom of the fusion zone in

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the fuel element jacket, and at right angles to the fuel element axis) should not be less than 10 percent or greater than 70 percent of the total aluminum thickness. (The total aluminum thickness is the thickness of the rail tab plus the thickness of the residual fuel element jacket.)

2. Rail Penetration - Should not be less than ten percent or greater than 75 percent of rail tab thickness.
 3. Fuel Element Jacket Penetration - Should not be less than ten percent or greater than 50 percent of residual jacket thickness.
- c. Electrode Indentation - Should not be greater than ten percent of total aluminum thickness. (Measured from the original surface of the support rail tab to the bottom of the indentation.)
- F3.3 The external appearance of the weld shall be smooth, round, or oval, free from surface melting, electrode deposit, pits, cracks, holes or other conditions which indicate poor weld quality.
- F3.4 Each weld must pass a minimum static shear load of 180 pounds. The load shall be applied at right angles to the fuel element axis.
- F3.5 The support rails shall not be rewelded.

Specification F-4 - Finished Projection Fuel Element Characteristics

- F4.1 Fuel elements shall be rejected for any of the following in addition to the conditions outlined in Specification F405.1 (HW-47029):
- a. Any damage to the support rail which will reduce its overall height, structural strength, alignment or position.
 - b. Failure of the finished self-supported and bumper fuel element to conform to the following:
 1. There shall be eight (8) support rails attached to each element, aligned in rows of two (2) supports each, with rows spaced at 90 ± 2.5 degree intervals. The center lines of rows shall be aligned within ± 1.5 degrees. The centerline of each support rail shall be parallel to the axis of fuel element within ± 1.0 degree.

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2. Distance from cap end of fuel element to the center of first support in each row shall be $1.562 \pm .0625$ " for both normal and enriched uranium fuel elements.
3. Distance from cap end of element to the center of second support in a row shall be $7.404" \pm .0625$ " for normal uranium fuel elements and 5.077 ± 0.0625 " for enriched uranium fuel elements.
- c. Failure of the finished self-supported and bumper fuel elements to meet the appropriate maximum circumscribed circle dimension. (The maximum circumscribed circle is defined as the maximum diameter of the finished fuel element at any transverse section.)

<u>Model</u>	<u>Maximum Circumscribed Circle</u>
OIIE Bumper	1.530"
OIIN Bumper	1.530"
OIIIIN Bumper	1.530"
KIIIIN Bumper	1.582"
OIIN Self-Support	1.600"
CIVN Self-Support	1.660"
CVN Self-Support	1.660"

- d. Corrosive pitting or embedded foreign material on supports.
- e. Copper electrode contamination of fuel element or support surface.
- f. Evidence of a poor support weld.
- F4.2 The minimum dih values for self-supported fuel elements will be established when sufficient data has been obtained.

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