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DESIGN CRITERIA
STORAGE, HANDLING AND INSPECTION
EQUIPMENT - 333 BUILDING

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AUTHOR

D. C. Lehfeldt

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DESIGN CRITERIA

STORAGE, HANDLING, AND INSPECTION

EQUIPMENT - 333 BUILDING

by

D. C. Lehfeldt
Design & Projects
FUELS PREPARATION DEPARTMENT

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DESIGN CRITERIA
STORAGE, HANDLING, AND INSPECTION
EQUIPMENT - 333 BUILDING

I. INTENT

The intent of this document is to establish criteria for equipment for:

Receiving, Handling and Component Inspection
Miscellaneous Handling and Storage
Final Inspection
Finished Storage

in the New Fuel Cladding Facility.

II. GENERAL DESCRIPTION

A. Receiving, Handling and Component Inspection

This equipment will include scales, work benches, storage cabinets, handling equipment, and inspection gages.

B. Miscellaneous Handling and Storage

This equipment will include carts and conveyor for inter-station transfer, handling devices, and lag storage racks for inter-station storage.

C. Final Inspection

This equipment will include the gages, borescopes, and work benches necessary to inspect for O.D., I.D., warp and surface condition.

D. Finished Storage

This equipment includes the pallets required for storage of finished fuel elements and transfer of finished fuel elements to the reactor.

III. DESCRIPTION OF PIECES TO BE HANDLED

Pieces to be handled throughout the facility are as follows:

Billet Components

Outer Fuel Tube	-	Drawing No. H-3-16604, Sheet 1, attached.
Inner Fuel Tube	-	Drawing No. H-3-16605, Sheet 1, attached.

Finished Fuel Element

The finished fuel element is described in HW-57042-RD4, Design Criteria, NPR Fuel Element, A. C. Callen. Carts and handling devices will be provided for outer tubes, inner tubes, and assembled fuel elements.

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IV. OPERATIONS TO BE PERFORMED

Operations to be performed are shown in Exhibit I, Preliminary Process Flow Sheet, NPR Fuel Cladding, attached.

V. EQUIPMENT LAYOUT

Tentative layouts for the various areas are illustrated in H-3-18479, attached.

VI. DETAILS OF OPERATION

Equipment will be standard "off-the-shelf" items whenever practical.

A. Receiving, Handling and Component Inspection

Components will generally be checked for dimensional accuracy as received, then stored for later transfer to processing.

A scale of approximately 4,000 pound capacity will be provided for billet weighing.

A scale of approximately 500 pound capacity will be provided for pre-irradiation measurements.

In view of the low piece rate through the component area, virtually no mechanization or mechanical aids will be provided, except as necessary for material movement.

B. Miscellaneous Handling and Storage

Handling between stations will be principally by means of carts, with hoists provided as required to transfer from station to cart and cart to station.

Carts will be loaded to a maximum of 750 pounds. Hoists will generally be provided when required lifts are in excess of 50 pounds.

Lag storage will generally be provided on the above carts, except where large amounts of storage are required to reduce frequency of equipment changeover. In the latter instances, storage racks will be provided which are designed to be critically safe with 1.1% enriched material fully immersed in water.

Conveyor will be provided only where little or no lag storage is required between stations.

C. Final Inspection

Finished fuel elements will be checked to required dimensional tolerances. A low degree of mechanical aid, such as warp gages, will be provided.

Lights and borescopes will be provided to permit overall surface inspection.

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D. Finished Storage

Pallets will be provided to store maximum material in available space consistent with limitations imposed by the requirements of criticality and surface protection.

Pallets will be designed for infinite stacking and fork lift handling.

Maximum load per pallet will be 2,000 pounds.

Pallets will be provided for a minimum of one reactor load.

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EXHIBIT I

PRELIMINARY PROCESS FLOW SHEET
NPR FUEL CLADDING

1. Uranium Billets: Received from vendor machined to size
 2. Inspection: ND for internal flaws, dimensions
 3. Nitric Acid Etch: Degrease, HNO_3 immersed, hot and cold rinse, warm air dry
 4. Inspection: Visual for surface defects
-
5. Zircaloy Tubing Components: Received from vendor machined to size
 6. Inspection: Dimensional, ND for flaws, visual for flaws
 7. Clean: Degrease, alkaline detergent wash, hot and cold rinse, methanol dry
-
8. Copper Can: Received from vendor machined to size
Inner and outer tubing machined to length; copper end plates machined to size; evacuation tube
 9. Inspection: Visual for flaws : dimensional
 10. Nitric Acid Etch: Flash etch, rinse, methanol dry
 11. Weld base to inner and outer can tube
 12. Weld evacuation tube into can lid
 13. Inspect: Visual for flaws
 14. Nitric Acid Etch: Immersed etch, hot and cold rinse, methanol dry
 15. Assemble Billet: Uranium billet, two zircaloy sleeves, copper can and lid
 16. Weld lid to can
 17. Evacuate billet

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18. Leak Test: Helium
19. Seal Billet: Crimp evacuation tube flat and cut off with heliarc torch
-
20. Lubricate Billet
21. Preheat Billet
22. Coextrude Billet to tubing
-
23. Crop tubing ends, power saw
24. Beta Heat Treat: Horizontal induction scanning; axial loading if needed to maintain straightness. Copper on
25. Crop tube ends to good stock, cut to fuel element lengths
26. Degrease: Trichloroethylene
27. Mask Ends: Lead tape
28. Copper Removal: Hot HNO_3 strip, second HNO_3 to remove plateback, hot and cold rinse, dry
29. Bright Etch: (to remove Zr-Cu alloy layer) HNO_3 -HF, rinse, dry
30. Face ends, piece to length: Lathe or equivalent
31. Degrease
32. Chemically mill end recesses for welding: HCl , stop bath, rinse, HNO_3 , HF- HNO_3 , hot and cold deionized rinses, dry
-
33. Zircaloy End Rings: Received from vendor
34. Inspect: Visual for flaws, dimensional
35. Degrease
36. Bright Etch: HF- HNO_3 , stop bath hot and cold deionized rinses, methanol dry

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EXHIBIT I (Continued)

37. Crimp ring into recessed fuel element end
38. Weld
39. Inspect Weld: Visual, and non-destructive
40. Non-destructive Test: Clad thickness, bonding
41. Weld Supports: Resistance spot, or ultrasonic
42. Bright Etch: HF-HNO₃, stop bath, hot and cold deionized rinses
43. Autoclave: Wet transfer to autoclave; high pressure high temperature steam
44. Final Inspection
45. Storage and/or ship

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