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DISTRIBUTION SHEET

To DISTRIBUTION	From STATION 22	Page 1 of 1
Project Title/Work Order FFTF		Date
		EDT No.
		ECN No. 610570

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
OPERATIONS ANALYSIS & SUPPORT	N2-03	X			
SURV. PREVENTIVE MAINTANCE	N2-11	X			
FFTF SAFETY	N1-72	X			
TECHNICAL REFERENCE LIBRARY	N2-12	X(4)			
FFTF OPERATIONS TRAINING	N2-40	X			
FFTF QA	N1-71	X			
DM ROMRELL	N2-54	X			
MA HILL	N1-71	X			
JL MARSHALL	N2-02	X			
EJ KREJCI	N1-72	X			
OSTI	L8-04 07	X (2)			
CENTRAL FILES ORIG. +2	L8-04	X			

MASTER

ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 610570

Proj.
ECN

2. ECN Category (mark one)		3. Originator's Name, Organization, MSIN, and Telephone No.		4. Date	
Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedeure ☐ Cancel/Void ☐		D. M. Romrell, 18250, N2-54, 376 5767		08/19/94	
		5. Project Title/No./Work Order No.		6. Bldg./Sys./Fac. No.	
		FFTF Reactor Immersion Heaters WHC-SD-FF-SDS-003		4710 BLD	
		8. Document Numbers Changed by this ECN (includes sheet no. and rev.)		9. Related ECN No(s).	
		WHC-SD-FF-SDS-003 Rev. 0		NA	
				10. Related PO No.	
				Req. 426187	
11a. Modification Work		11b. Work Package No.		11c. Modification Work Complete	
☐ Yes (fill out Blk. 11b) ☒ No (NA Blks. 11b, 11c, 11d)				☐ Yes (fill out Blk. 11b) ☒ No (NA Blks. 11b, 11c, 11d)	
				Cog. Engineer Signature & Date	
				Cog. Engineer Signature & Date	
12. Description of Change					
The Test Specification (WHC-SD-FF-SDS-003) has been revised to Rev. 1. This change modifies the fabrication of approximately 25 feet of the subject heater using ceramic insulators over the heater lead wire rather than compressed magnesium oxide. Also, 304 or 316 stainless steel can be used for the heater sheath. This change should simplify fabrication and improve the heater operational reliability.					
13a. Justification (mark one)					
Criteria Change		Design Improvement		Environmental	
As-Found		Const. Error/Omission		Design Error/Omission	
13b. Justification Details					
Improve design					
14. Distribution (include name, MSIN, and no. of copies)					
D. M. Romrell, N2-54 1 M. A. Hill, N1-71 1 J. L. Marshall, N2-02 1 E. J. krejci, N1-72 1 OSTI L8-04 2					
RELEASE STAMP OFFICIAL RELEASE 31 BY WHC DATE AUG 26 1994 <i>He-33</i>					

A-7900-013-2 (06/94) GEF095

ENGINEERING CHANGE NOTICE

Page 2 of 2

1. ECN (use no. from pg. 1)

610570

15. Design Verification Required		16. Cost Impact				17. Schedule Impact (days)	
		ENGINEERING		CONSTRUCTION			
☒ Yes		Additional	[] \$	Additional	[] \$	Improvement	[]
☐ No		Savings	[] \$	Savings	[] \$	Delay	[]
18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.							
SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]		
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]		
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]		
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]		
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]		
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]		
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]		
Procurement Spec.	[X]	Operating Instruction	[]	Computer Software	[]		
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]		
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]		
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]		
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]		
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]		
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]		
Environmental Report	[]	Inspection Plan	[]		[]		
Environmental Permit	[]	Inventory Adjustment Request	[]		[]		

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision

Document Number/Revision

Document Number Revision

None

20. Approvals

Signature

OPERATIONS AND ENGINEERING

Cog. Eng. *Jim Romrell*
Cog. Mgr. *Jim Romrell*
QA M. A. Hall *MA Hall*
Safety *Joe is there*
Environ.

IEMC & Refueling Mech Eng

DESIGN REVIEW - INFORMAL

Signature

Date

8-25-94

8-25-94

8-26-94

8/25/94

8/26/94

Signature

Date

ARCHITECT-ENGINEER

PE

QA

Safety

Design

Environ.

Other

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

RELEASE AUTHORIZATION

Document Number: WHC-SD-FF-SDS-003, Revision 1

Document Title: FFTF Reactor Immersion Heaters

Release Date: August 26, 1994

* * * * *

**This document was reviewed following the
procedures described in WHC-CM-3-4 and is:**

APPROVED FOR PUBLIC RELEASE

* * * * *

WHC Information Release Administration Specialist:

M. N. Boston
(Signature)

M. N. Boston

8/26/94
(Date)

SUPPORTING DOCUMENT		1. Total Pages <i>9 pgs</i>
2. Title FFTF Reactor Immersion Heaters	3. Number WHC-SD-FF-SDS-003	4. Rev No. 1
5. Key Words FFTF Reactor Heaters	6. Author Name: D. M. Romrell <i>D. M. Romrell</i> 8-25-94 Signature Organization/Charge Code W18250/B1033	
7. Abstract HEATER SPECIFICATION FOR THE FFTF REACTOR VESSEL.		
<p>8. PURPOSE AND USE OF DOCUMENT - This document was prepared for use within the U.S. Department of Energy and its contractors. It is to be used only to perform direct or integrate work under U.S. Department of Energy contracts. This document is not approved for public release until reviewed.</p> <p>PATENT STATUS - This document copy, since it is transmitted in advance of patent clearance, is made available in confidence solely for use in performance of work under contracts with the U.S. Department of Energy. This document is not to be published nor its contents otherwise disseminated or used for purposes other than specified above before patent approval for such release or use has been secured. Upon request, from the Patent Counsel, U.S. Department of Energy Field Office, Richland, WA.</p> <p>DISCLAIMER - This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or any third party's use or the results of such use of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.</p>		<p>10. RELEASE STAMP</p> <div style="border: 1px solid black; padding: 5px;"> <p>OFFICIAL RELEASE 31</p> <p>BY WHC</p> <p>DATE AUG 26 1994</p> <p><i>At 3:30</i></p> </div>
9. Impact Level SQ		

**APPROVED FOR
PUBLIC RELEASE**

M. Boston 8/26/94

Information Release Authorization

A-7320-005 (08/91) WEF168

WHC-SD-FF-SDS-003
Revision 1

**SPECIFICATION FOR FFTF
REACTOR VESSEL IMMERSION HEATERS**

AUGUST 19, 1994
D. M. Romrell

**SPECIFICATION FOR FFTF
REACTOR VESSEL IMMERSION HEATERS**

TABLE OF CONTENTS

1. SCOPE.....	1
2. APPLICABLE DOCUMENTS.....	1
3. TECHNICAL REQUIREMENTS	
3.1 Design Requirements.....	1
3.2 Material Requirements.....	1
3.3 Fabrication Requirements.....	2
4. QUALITY ASSURANCE AND TEST REQUIREMENTS.....	3
5. SHIPPING	4
6. HEATER DETAILS (FIGURE).....	5

SPECIFICATION FOR FFTF
REACTOR VESSEL IMMERSION HEATERS

1. SCOPE

This specification establishes requirements for design, testing, and quality assurance for electric heaters that will be used to maintain primary Sodium temperature in the Fast Flux Test Facility (FFTF) reactor vessel.

2. APPLICABLE DOCUMENTS

2.1 ASME, Section III, Div. 1, NB-5350 - Liquid Penetrant Acceptance Standards.

2.2 ASME, Section V, Article 6 - Liquid Penetrant Examination

2.3 MIL-I-45208A, NE-F2-4(L) or equivalent - Inspection System Requirements.

2.4 Tank Heater Elements: See diagram page 5.

3. TECHNICAL REQUIREMENTS

3.1 Design Requirements

3.1.1 Heaters rated 28 kW at 480 VAC, single phase.

3.1.2 Heater dimensions and tolerances per sketch, page 6.

3.2 Material Requirements

3.2.1 Sheath materials must be compatible with 1000°F liquid sodium and argon and be resistant to both neutron and gamma radiation. Inconel 600, Incoloy 800, 316 SS, or 304 SS are suitable materials. If alternate materials are used, the supplier shall submit material specification to Westinghouse Hanford Co. WHC, FFTF Engineering, for approval prior to fabrication.

3.2.2 Weld filler materials used to attach sheath end pieces, sleeves and splices shall contain compounds compatible with the heater sheath and

SPECIFICATION FOR FFTF
REACTOR VESSEL IMMERSION HEATERS

liquid sodium at 1000°F. Microbrazed and TIG welding processes are acceptable. The supplier shall submit material specifications and methods to WHC, FFTF Engineering, for approval prior to fabrication.

3.2.3 Insulation in the heater section and the adjacent 6 inches of the cold leg shall be Magnesium Oxide. The extended cold leg (more than 6 inches above the heater) shall use ceramic insulators in a fiberglass sleeve, over heater leads, to keep the lead wires separated and in place. If alternate materials are used, the supplier shall submit material specification to WHC, FFTF Engineering, for approval prior to fabrication.

3.2.4 The electrodes shall be sealed in-place with a nonconductive material such as epoxy (rated for 400 °F). A vent hole shall allow venting of the air surrounding the ceramic beads. This vent shall be covered, except when the heater is being heated, to prevent moisture from entering into cold leg insulation. The supplier shall submit the material specification and the installation method to WHC, FFTF Engineering, for approval prior to fabrication.

3.3 Fabrication Requirements

Note: A Visual Inspection by the vendor QC personnel shall be conducted and recorded for each of the steps in this section.

3.3.1 All surfaces on all metallic components shall be thoroughly cleaned prior to assembly to remove all lubricants, particulate matter and extraneous surface contamination. Cleaning or process materials containing halogen compounds in excess of 200 ppm may not be used. Freon TF is an acceptable cleaning agent for grease and oil followed by an ethanol rinse. Components shall be dried before assembly. Alternate cleaning and rinsing agents shall be approved by WHC, FFTF Engineering.

SPECIFICATION FOR FFTF
REACTOR VESSEL IMMERSION HEATERS

3.3.2 Curvature or bow of the heater shall not exceed 0.05 inches per foot as measured in a horizontal, unrestrained position on a flat surface. Local bends or kinks are unacceptable.

3.3.3 Pits or scratches on sheath material (outside wall) in excess of 10% of the wall thickness (0.035 in.) shall be unacceptable.

3.3.4 Each heater shall be identified with a serial number indelibly marked on the heater connection electrodes (at least 1 electrode on each heater assembly) prior to assembly testing.

4. QUALITY ASSURANCE AND TEST REQUIREMENTS

4.1 The heater manufacture shall prepare a fabrication and test procedure. Each step shall include a sign-off for the performer and a supplier quality assurance observer. This procedure, when completed, shall be submitted to WHC Quality Assurance (QA) for review and approval prior to heater fabrication.

4.2 The completed heater assembly, including all boundary welds, shall be leak tested using a "Hydro Test". The assembly shall be hydrostatically pressurized with a conductive fluid to 100 psig for 2 hours while monitoring the sheath-to-electrode resistance. The final acceptable resistance is 20 megohms or greater when measured (meggered) at 500 volts.

4.3 All welds shall be liquid penetrant inspected per the standard ASME, Section V, Article 6. Acceptance shall be per standard ASME, Section III, Division I, NB-5350.

4.4 Heat flux uniformity shall be determined for each heater by an infra-red technique or alternate method approved by WHC, FFTF Engineering. Axial heat flux uniformity for 100% of the heated zone shall be within $\pm 25^{\circ}\text{F}$. with the heaters operating at a nominal 500°f .

SPECIFICATION FOR FFTF
REACTOR VESSEL IMMERSION HEATERS

4.5 Sheath-to-electrode hot resistance shall be greater than 2 megohms when measured with a megger at 500 volts. Hot and cold legs shall be simultaneously heated to the following temperatures during measurement.

Hot leg = 500 +/- 25°F.

Cold leg = 350 +/- 25°F.

4.6 The supplier shall have an established Quality Assurance verification program that fulfills the requirements of MIL-I-45208A, NE F2-4 or equivalent.

4.7 The supplier shall submit design drawings to WHC, FFTF Engineering, for approval prior to manufacturing the subject heaters.

4.8 The supplier shall provide material certification for sheath, end plug, splice and filler material.

4.9 The supplier shall provide WHC, FFTF Engineering, test data for steps 4.2 through 4.5 for acceptance. The Visual Inspection records for section 3.0, shall also be submitted to WHC QC for review.

4.10 The supplier shall notify WHC, FFTF Engineering, of the test schedule at least 10 working days prior to the start of testing. WHC FFTF Engineering and QA shall reserve the right to witness testing at the suppliers facility.

5. SHIPPING

5.1 Each heater shall be packaged in a polyethylene sleeve with moisture absorption material and with the sleeve taped close to the assembly to minimize enclosed air.

5.2 Heaters shall be shipped in a "strong back" wooden box and supported in packing material to prevent heater damage during shipment. If more than one box is required heater serial numbers shall be marked on the outside of each boxes.

SPECIFICATION FOR FFTF

REACTOR VESSEL IMMERSION HEATERS

**DATE
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10 / 17 / 94

END