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RDT Standard

RADIAL REFLECTOR ASSEMBLY FOR LIQUID METAL FAST BREEDER REACTORS

MARCH 1978

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Division of Nuclear Power Development

Send copy and distribution inquiries to:

RDT Standards Office
Oak Ridge National Laboratory
Building 1000, Room 138-A
P. O. Box X
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FOREWORD

This standard supersedes the August 1972 issue of RDT E 6-19T and incorporates those changes to that issue of the standard that were approved and published as Amendment 1 and those changes that were approved for publication in this revision. Due to extensive changes in format and the text, the location of the changes in this revision are not identified.

Significant changes that have been incorporated in this revision are summarized as follows:

1. Incorporation of FFTF procurement experience.
2. Addition of RDT F 6-2T for welding requirements and deletion of similar ASME requirements.
3. Revision of the text to be more concise and generally applicable by referencing the Ordering Data for certain technical specifications.
4. Deletion of certain quality assurance requirements that are adequately covered by reference to RDT F 2-2, RDT F 2-4T, and RDT F 3-15T.
5. Updating to delete or replace reference standards.
6. Addition of Systeme International (SI) metric units.
7. Format changes in accordance with RDT F 1-1.

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RADIAL REFLECTOR ASSEMBLY FOR LIQUID METAL FAST BREEDER REACTORS

1. SCOPE

This standard sets forth the requirements for the fabrication, inspection, and quality assurance of core radial reflector assemblies for use in liquid metal fast breeder reactors.

2. APPLICABLE DOCUMENTS

The following documents are a part of this standard to the extent specified in Sections 3 through 5. The issue of a document in effect on the date of the invitation to bid, including any amendments or other published changes also in effect, shall be as specified in the Ordering Data. Where this standard appears to conflict with the requirements of a referenced document, such conflict shall be brought to attention of the purchaser for resolution.

2.1 RDT Standards.

RDT E 6-38T	Low Friction Hard Surfaces for Core Components
RDT F 2-2	Quality Assurance Program Requirements
RDT F 2-4T	Quality Verification Program Requirements
RDT F 3-2T	Calibration Program Requirements
RDT F 3-6T	Nondestructive Examination (Supplement to ASME Boiler and Pressure Vessel Code, Section V)
RDT F 3-15T	Requirements for Inspection of Dimensional Characteristics
RDT F 5-1T	Cleaning and Cleanliness Requirements for Nuclear Components
RDT F 6-2T	Welding of Reactor Core Components and Test Assemblies
RDT F 7-2T	Packaging, Packing, and Marking of Components for Shipment and Storage
RDT F 7-3T	Marking of Components and Parts
RDT F 8-1T	Preloaded Threaded Fasteners and Closures
RDT F 8-6T	Hoisting and Rigging of Critical Components and Related Equipment

2.2 American National Standards (ANSI).

ANSI B46.1 Surface Texture

2.3 American Society for Testing and Materials (ASTM) Publications.

ASTM E 29 Indicating Which Places of Figures are to be Considered Significant in Specified Limiting Values

3. TECHNICAL REQUIREMENTS

3.1 Radial Reflector Assembly. Radial reflector assemblies and components thereof shall be fabricated and assembled using components meeting the requirements of the standards, specifications, and drawings as specified in the Ordering Data.

3.1.1 Heat Treatment. All heat treatment for starting materials shall be in accordance with applicable material standards. The heat treatments which shall be applied after welding or machining, bending, forming, and straightening operations shall be as specified in the Ordering Data.

Austenitic stainless steel which has undergone sensitization during heat treatment, welding or hot forming shall be solution heat treated in accordance with the applicable standard unless otherwise specified in the Ordering Data. If the structure is of such geometry as to preclude solution heat treatment, the proposed heat treatment or corrosion protection plans shall be submitted for approval.

3.2 Radial Reflector Welds. Radial reflector assembly weld types and configurations shall meet the requirements of the drawings as specified in the Ordering Data.

Welding procedure qualification, performance qualification, and production welding shall meet the requirements of RDT F 6-2, Sections 1, 2, 3, and 6 as applicable. All welds shall be examined in accordance with the requirements and acceptance criteria as specified in the Ordering Data.

3.3 Surface Conditions.

3.3.1 Cleanliness and Cleaning. Finished radial reflector assemblies and components thereof shall be visually clean and free of chips, weld splatter, contamination, and other foreign material. Shop

practices and restrictions on the use of materials shall be in accordance with RDT F 5-1. Procedures and acceptance criteria for cleanliness and cleaning shall comply with RDT F 5-1 and additional cleaning and cleanliness requirements as specified in the Ordering Data.

Hard surfaced areas of components and finished reflector assemblies shall be maintained in a clean condition. Cleaning of such surfaces shall be in accordance with RDT E 6-38.

3.3.2 Surface Roughness. The reflector assembly surfaces shall not exhibit roughness greater than that specified on the applicable component and assembly drawings.

3.3.3 Surface Defects. Exterior surfaces of completed reflector assemblies and surfaces of reflector component parts shall be free of scratches, dents, or mars except of the dimensions and types described herein, unless otherwise specified on the applicable drawings and in the Ordering Data. Localized surface imperfections shall not be considered injurious provided they are less than 0.010 in. (0.25 mm) in depth [0.002 in. (0.05 mm) for surfaces less than 32 μ in. (0.8 μ m)] and do not reduce the wall thickness of tubular components beyond the minimum specified on the applicable drawings. The bottom of such defects shall be rounded and well faired in as confirmed by visual inspection. Rework or repair of defects by grinding, buffing, or polishing to meet the above requirements is permitted subject to the requirements of 3.5.4.

3.4 Identification. Each radial reflector assembly and components thereof shall be identified in conformance with drawing requirements and as specified in the Ordering Data. The method of identification shall conform to RDT F 7-3 as specified in the Ordering Data and shall be submitted for purchaser approval prior to use.

3.5 Fabrication.

3.5.1 Threaded Elements and Bolts. Torqueing and thermal straining of threaded connections shall be in accordance with RDT F 8-1.

3.5.2 Assembly. Assembly is any operation for joining together two or more parts. Assembly procedures shall be approved before the start of work. Any changes to the purchaser-approved assembly procedures shall be submitted for purchaser approval prior to use. The procedures shall contain the following as a minimum:

1. Assembly sequence.
2. Cleaning procedures, sequence, and precautionary rules.
3. Any special machining or fitting-at-assembly instructions.
4. Intermediate and final inspection criteria and hold points.

5. Handling methods, equipment, and precautions.
6. Procedures for the locking of locking devices.
7. Drawings or photographs required to illustrate assembly problem areas or assembly techniques.
8. Special data, measurements, or observations to be recorded in quality control records.
9. Tightening torques for threaded parts.
10. Heat treatment procedures.
11. Nondestructive examination procedures.

An assembly sequence shall show the steps and operations that are a part of the radial reflector assembly or component fabrication effort and shall be submitted for purchaser approval. The assembly sequence shall include a process flow diagram which shows the inspection hold points.

3.5.3 Handling and Storage During Processing. Completed and partially completed reflector assemblies shall be handled and stored in a manner to maintain conformance with this standard, the Ordering Data, and RDT F 8-6. Handling and storage procedures shall be approved by the purchaser prior to use.

3.5.4 Repair and Rework. Nonconforming reflector assemblies and components may be repaired or reworked. Repair and rework shall be in accordance with RDT F 2-2 and with purchaser-approved procedures. All areas affected by repair or rework shall be reinspected (by methods acceptable to the purchaser) to demonstrate compliance with the requirements of this standard.

3.6 Surveillance and Archive Samples. The requirements for surveillance and archive samples shall be as specified in the Ordering Data.

4. QUALITY ASSURANCE REQUIREMENTS

4.1 Quality Assurance Program. A documented quality assurance program shall be established and implemented that fulfills all requirements of Sections 1, 2, 4, 5, and 8 of RDT F 2-2 and any additional requirements as specified in the Ordering Data. For items within the scope of RDT F 2-4, a quality verification program meeting the requirements of RDT F 2-4 may be implemented by subcontractors.

4.2 Quality Assurance Documents. The quality assurance documents tabulated in the Ordering Data shall be prepared and submitted for approval or information. The number of copies, the purpose, and the time of submittal for these documents shall be as specified in the Ordering Data.

4.3 Records. Records showing complete assembly sequence shall be maintained for each assembly and shall be traceable to components, design documents and revision numbers, material heat, and operating procedure and revision number. Such information shall be provided with the reports on tests made on each delivered assembly.

Minimum records shall include special processes or nondestructive examination (NDE) qualifications, nonconformance reports, certifications of material NDE records, and other inspections records as specified in the Ordering Data which verify conformance with specifications. Records of all tests and examinations shall be kept complete and available to the purchaser.

4.3.1 Certification Records Reviews. Before assemblies are released for shipment, certification records shall be reviewed for compliance with Sections 3 and 4. Specific records shall be as specified in the Ordering Data.

4.4 Inspection Requirements. Inspection requirements are listed in Table 1. Additional inspection requirements (if any) shall be as specified in the Ordering Data. Test methods used shall be the reference method or an equivalent method approved by the purchaser before use.

4.5 Inspection and Test Responsibility. Unless otherwise specified, the supplier shall be responsible for the performance of all tests and inspections required prior to submission to the purchaser of any item for acceptance. The performance of such tests and inspections does not limit the right of the purchaser to conduct such other tests and inspections as the purchaser deems necessary to assure that all items are in conformance with all requirements of this standard.

4.4.1 Tolerance Limit Interpretation.

a. Chemical Composition. For purposes of determining conformance with chemical composition requirements, an observed value or a calculated value shall be rounded off "to the nearest unit" in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding-off method of ASTM E 29.

b. Tensile Requirements. For purposes of determining conformance with tensile requirements, an observed value or a calculated value shall be rounded off to the nearest 100 psi (700 kPa) for tensile strength and to the nearest 0.1% for elongation, in accordance with the rounding-off method of ASTM E 29.

Table 1. Quality Conformance Inspection

Characteristic	Requirement	Inspection Plan	Reference Test Method
1. Materials	3.1	Each heat of material	Material certifications and certification of supplier's records.
2. Dimension			
a. Components	3.1	Each component	Standard gaging.
b. Finished assembly	3.1	Each assembly	Standard gaging.
c. Concentricity	3.1	Each reflector assembly	Standard gaging.
d. Straightness	3.1	Each reflector assembly	Standard gaging.
3. Reflector assembly welds	3.2	Each weld	Supplier's records and test results in accordance with RDT F 6-2.
4. Cleanliness	3.3.1	Each component and finished assembly	Visual inspection at 1X. Inspect all external surfaces by wipe test per RDT F 5-1 and internal surfaces with a boroscope.
a. Hard surface areas	3.3.1	Each component and assembly	Certification of supplier's records and visual inspection.
5. Surface roughness	3.3.2	Each component and finished assembly	Visual inspection and comparison with roughness standards (ANSI B46.1).

(continued)

Table 1. Quality Conformance Inspection (continued)

	Characteristic	Requirement	Inspection Plan	Reference Test Method
6.	Surface defects	3.3.3	Each component and finished assembly	Visual inspection at 1X or as specified in the component standards and the Ordering Data (3.3.3).
7.	Identification	3.4	Each assembly	Visual inspection at 1X and standard gaging for readability and compliance with specifications.
8.	Repair and rework	3.5.4	Certifications	Supplier's records.
9.	Surveillance and archive samples	3.6	Certifications	Supplier's records.
10.	Fabrication records	4.3	Certifications	Supplier's records.

c. Dimensional Requirements. The method for determining conformance with dimensional requirements shall be the absolute method as defined in ASTM E 29. Measuring equipment accuracy shall comply with RDT F 3-15.

4.6 Measuring and Test Equipment. Measuring and test equipment and measuring standards shall be calibrated and controlled in accordance with RDT F 3-2.

5. PREPARATION FOR DELIVERY

A packaging and packing plan shall be submitted for approval. The plan shall describe the materials, methods, procedures, containers, and marking to be used to meet the requirements of RDT F 7-2 and any additional requirements as specified in the Ordering Data. Finished reflector assemblies shall be handled in accordance with RDT F 8-6 as specified in the Ordering Data.

5.1 Packaging. Each reflector assembly shall be packaged in water-vaporproof envelopes in accordance with RDT F 7-2 for Level A methods. The assembly shall be packaged in dry air or nitrogen before sealing. Desiccants and humidity indicators shall not be used.

5.2 Packing. Packaged assemblies shall be packed and shipped in special containers as specified in the Ordering Data.

5.3 Marking. The packaging and shipping containers shall be marked in accordance with RDT F 7-2. Special marking includes the following.

5.3.1 Special Package Marking.

1. Reflector assembly serial number.
2. Reflector assembly type.

5.3.2 Special Container Marking.

1. Number of assemblies.
2. Serial numbers of assemblies.
3. Drawing number, revision, and item.

6. NOTES AND ORDERING DATA CHECKLIST

6.1 Ordering Data Checklist. The following technical and procurement data will be furnished by the purchaser. Any necessary data not furnished with the purchase document shall be requested from the purchaser before submitting a bid.

<u>Item</u>	<u>Refer to Paragraph</u>
1. Applicable documents	2
2. Radial reflector assembly	3.1
3. Heat treatment	3.1.1
4. Radial reflector welds	3.2
5. Cleanliness and cleaning	3.3.1
6. Surface defects	3.3.3
7. Identification	3.4
8. Handling and storage during processing	3.5.3
9. Surveillance and archive samples	3.6
10. Quality assurance program	4.1
11. Quality assurance documents	4.2
12. Records	4.3
13. Certification records review	4.3.1
14. Inspection requirements	4.4
15. Preparation for delivery	5.
16. Packing	5.2