EXHIBIT I

REACTOR PRESSURE VESSEL PURCHASE

SPECIFICATION 21A1111

EXHIBIT I - REACTOR PRESSURE VESSEL PURCHASE SPECIFICATION 21A1111

The power rerate design requirements are unchanged from the original design requirements specified in Exhibit I, Section 5 (i.e., design pressure of 1250 psig at bottom of the reactor vessel, design temperature of 575°F).

The power rerate normal operating pressure is increased from 1005 psig to 1035 psig at top of reactor vessel. The normal operating temperature is increased from 547°F to 551°F.

The operating shroud support pressure differentials provided in Appendix K, Exhibit I, Section 7.5.1 are increased from 34.0 and 21.85 to 35.68 and 26.32 psid for power rerate.

Estimates for reactor vessel irradiation at the end of 60 years have been recalculated based on actual data obtained from the reactor vessel surveillance specimens which were removed and analyzed. The updated information presented in Sections 4.2.4 and 4.2.5 supersede the information contained in Exhibit I Section 5.1.11.

Expected operating cycles for which fatigue has been evaluated are listed in UFSAR.

The Unit 2 and 3 TPO power rerate did not change the normal operating pressure or temperature for the reactor vessel.

The extended power uprate (EPU) did not change the normal operating pressure or temperature for the reactor vessel. The design pressure differentials across the shroud support and shroud provided in Appendix K, Exhibit I, Section 7.5.12 are not exceeded for EPU.

GENERAL ELECTRIC
ATOMIC POWER EQUIPMENT DEPARTMENT

PURCHASE SPECIFICATION - DATA SHEET	SPECIAL PROJECT SPEC. NO. 21A1111, REV. NO. 9 SH NO. 2 CONT ON SHEET 3

TITLE
REACTOR PRESSURE VESSEL

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1. SCOPE

1.1. This specification defines the engineering requirements of the equipment specified herein.

1.2. The work done by the Seller in accordance with this specification shall include all necessary design, development, analysis, drawings, evaluation of materials and fabrication methods, fabrication, shop testing, inspection and preparation for shipment.

2. RESPONSIBILITY

2.1. The Seller shall accept full responsibility for his work and for compliance with this specification. Review or approval of drawings, procedures, data or specifications by the Buyer with regard to general design and controlling dimensions does not constitute acceptance of any designs, materials or equipment which will not fulfill the functional or performance requirements established by the purchase contract.

3. GENERAL DESCRIPTION

3.1. The reactor vessel will be used as a pressure container supporting the steam generating core.

3.2. The equipment to be furnished in accordance with this specification shall be one reactor pressure vessel assembly with a removable head and nozzles and certain internal support structures, arranged as shown on Drawing 886D499 complete with:

3.2.1. Attachments for thermal insulation, vessel and core supports, brackets or legs for lifting and handling of vessel head, and mounts for outside surface thermocouples.

3.2.2. One set of necessary special tools required to remove and replace the reactor vessel head. The set of tools shall include: four hydraulic stud tensioners, stud elongation measuring device, stud and nut wrenches, one set of stud thread protectors, three head guide caps, one bushing wrench, one stud sling. Stud tensioners shall be in accordance with Specification 21A9821 and shall include a lifting device that properly spaces the tensioners over the volt circle.

3.2.3. One set of necessary special tools required to install and remove the reactor vessel head seals with manual contact. This set of tools shall include a protective cover for the reactor vessel shell flange seal surface.

3.2.4. Metal boxes for the hand tools. Boxes shall be suitable for handling with a crane and/or fork lift truck.

3.2.5. One lot of reactor vessel material test plate and material test specimens in accordance with Attachment B.

3.2.6. Deleted

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4. CODES

4.1. The reactor vessel shall be designed, fabricated, inspected, tested and stamped in accordance with the American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Code, Section III, applicable requirements for Class A Vessels as defined therein, interpretations of the ASME Boiler and Pressure Vessel Code, and all laws, rules and regulations of the state in which the reactor plant will be located which are in effect on the date of the contract.

4.2. Deviations from the applicable codes or regulations shall be avoided. Where a conflict exists among the codes or regulations, the Seller shall bring this to the Buyer's attention. It shall be the responsibility of the Seller to obtain resolution and disposition of deviation with the Buyer and other appropriate parties and authorities.

4.3. The intent of this specification is to supplement the requirements of the codes specified herein and to encompass the means whereby the design objective is satisfied.

4.4. All standards and materials specifications shall be per latest revision in effect on the date of the contract.

5. DESIGN REQUIREMENTS

5.1. Operating Conditions

5.1.1. Internal pressure. Design pressure: 1250 psig at bottom of the reactor vessel. Normal Operating Pressure: 1005 psig at top of reactor vessel.

5.1.2. Temperature. Design temperature: 575°F
Normal Operating Temperature: 547°F

5.1.3. Reactor core and internal weight. The weight of the reactor core and internal structure, centers of gravity and distribution of loadings are shown on Drawing 886D499.

5.1.4. Water weight. The weight of water contained in the vessel for various conditions of operation are presented on Drawing 886D499.

5.1.5. Pipe reactions. The Buyer shall provide the Seller with the pipe reactions which the connecting piping will apply to all nozzles with a nominal size larger than the reactor vessel wall thickness and those nozzles which in addition are subjected to significant thermal cycling. The reactions will be limited by the Buyer such that the combined stress as due to pipe reactions and design pressure in the vessel shell at the nozzle attachment will not exceed the design stress allowed by the ASME Code, Section III. These pipe reactions shall be used in the detailed stress analysis required by the Code and performed by the Seller. This analysis shall include the thin section of the nozzle in the vicinity of the weld preparation for connecting piping, any bi-metal weld and shall take into account the nozzle cladding.

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5.1.6. Control rod drive weight and reaction. The momentary reactions which are suddenly applied to each control rod drive housing in the vessel bottom head are presented on Drawing 886D499.

5.1.7. Steady state thermal conditions. Steady state metal temperatures will be computed by the Seller for no more than twelve locations on the reactor vessel. The locations will include the head and shell closure flanges, the shell adjacent to the reactor core, the bottom head and major nozzles including the control rod drive nozzles. Temperature gradients through the shell wall adjacent to the portion of the reactor core peak flux zone will be computed by the Buyer and furnished to the Seller. Data will be presented on Drawings 729E762 and 135B9990.

5.1.8. Cyclic loading. Reactor coolant temperature, pressure and flow changes at the above twelve locations, together with the expected number of cycles, will be furnished to the Seller by the Buyer. The total number of different cyclic changes which must be analyzed at any one location will be limited to six. Data will be presented on Drawings 729E762 and 135B9990.

5.1.9. Earthquake loads. Earthquake loads shall be taken into account in accordance with the criteria and load presented on Drawing 886D499.

5.1.10. Internal Heat Generation. The maximum internal heat generation due to gamma heating is 8.5×10^3 BTU/ft^3 hr at the inside of the reactor pressure vessel opposite the active fuel zone.

5.1.11. Neutron Irradiation. The maximum neutron irradiation for fast (>1 Mev) neutrons is 3.8×10^{17} nvt for 40 years at the inside of the reactor pressure vessel wall opposite the active fuel zone.

5.2. Design Considerations

5.2.1. Design objective. The objective shall be to design and fabricate this reactor vessel to have a useful life of forty years under operating conditions specified by the Buyer.

5.2.2. Reactor vessel supports. Reactor vessel supports, internal supports, their attachments and adjacent shell shall be designed to take maximum combined loads including control rod drive reactions, earthquake loads, and jet reaction thrusts as defined on Drawing 886D499. There shall be no gross yielding of the reactor vessel supports causing permanent displacement under these conditions.

5.2.3. Stress concentrations. Care shall be taken in design and fabrication to minimize stress concentrations at changes in sections or penetrations. Fillet radii shall be equal to at least half the thickness of the thinner of the two sections being joined. If reinforcement for openings (except the control rod drive and in-core flux monitor nozzles) requires local vessel shell added thickness, such reinforcement shall extend at least 1-1/2 times the diameter of the opening from the center of the opening. These requirements are not to be construed as a waiver for evaluating the stresses for use in the analysis for cyclic operation.

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5.2.4. Corrosion allowance. Exterior exposed ferritic surfaces of pressure-containing parts including heads, shell, flanges and nozzles shall have a minimum corrosion allowance of 1/16 inch. The interior surface of carbon or low alloy steel nozzles exposed to the reactor coolant shall also have a minimum corrosion allowance of 1/16 inch. If the main closure head is left unclad, its interior surface shall also have a minimum corrosion allowance of 1/16 inch.

5.2.5. Main closure seal. The reactor pressure vessel main closure seal shall be a double seal designed to have no detectable leakage through the inner or outer member at all operating conditions. These conditions include, but are not limited to: (a) cold hydrostatic pressure test at the design pressure, (b) heating to design pressure and temperature at a rate of 100°F/hr., maximum, (c) operating for extended periods of several months duration at operating conditions, and (d) cooling at a rate of 100°F/hr., maximum.

5.2.6. Design stress. Design stress values used in the calculations shall be as contained in ASME Section III and applicable interpretations of ASME Boiler and Pressure Vessel Code for materials covered therein. The design stress values for ASME, Section III calculations for other materials approved by the Buyer in accordance with Paragraph 8.1. of this specification, shall be determined per Appendix II, ASME Code, Section III.

5.2.7. Dimensional control. Seller shall show the method of controlling measuring and maintaining alignment and location of control rod drive penetrations with the vessel and core supports.

5.2.8. The reactor shall be designed to minimize retention pockets and crevices.

5.2.9. The jurisdiction of Section III of the Code shall include all attachments to pressure boundary parts. Where weld buildup pads are used to attach internal or external brackets, the vessel support skirt, the shroud sppport or the refueling bellows support skirt, the weld buildup pad shall be considered the attachment to the pressure boundary part. Section III shall be used as a guide in the design, fabrication and inspection of parts attached to the attachments to pressure boundary parts.

6. DESIGN ANALYSIS

6.1. Requirements

The Seller shall perform the design calculations and analyses as required by the applicable Standards and Codes indicated in Section 4. The requirements of Article 4, ASME Code, Section III, shall be fulfilled. The analysis required shall be performed in two divisions as follows:

6.1.1. Stress analysis. A stress analysis shall be performed in accordance with Section N-430, ASME Code Section III. Calculations shall be performed in accordance with Paragraph N-431 to verify that the minimum wall thickness is provided. A detailed stress analysis shall be performed in accordance with Paragraph N-432. This analysis shall take into account all combinations of loads in conjunction with metal temperatures, as indicated in Section 5. above, and Drawings 729E762 and 135B9990, within the Design Stress Criteria of ASME Code Section III, Article 4.

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6.1.2. Analysis for cyclic operation. The Seller shall perform an analysis in accordance with Section N-415 of the ASME Code, Section III, to determine that the vessel is suitable for the cyclic loading conditions of Paragraph 5.1.8. above. This analysis shall also be performed within the design stress criteria of Section III, Article 4, to establish whether the design objective in Paragraph 5.2.1. above is reached. The analysis will be used to determine the adequacy of any required thermal baffling used to control or limit thermal stresses and to place safe operating limits on the cyclic conditions imposed on the vessel where it is reasonable to control them, as in the startup heating rate and shutdown cooling rate.

6.2. Calculation of Stresses

6.2.1. The detailed structural analysis required to meet the requirements of 6.1. shall be made for the stresses resulting from internal pressure, external and internal loadings, and the effects of steady and fluctuation temperatures and loads for regions given in 6.3. which involve changes of shape, structural discontinuities, and points of concentrated loadings.

6.2.2. Where dimensions and loading conditions permit, the adequacy of structural elements will be verified by comparison with completely analyzed elements. The calculations shall include a complete analysis of stresses under steady state and transient conditions to determine suitability of the design with respect to the allowable stress given in ASME Code, Section III, and to determine the operational limitations with respect to fatigue of the reactor vessel materials over the life of the reactor vessel (Design Objective) using the loading conditions supplied by the Buyer.

6.3. Parts of the Reactor Vessel Assembly to be Analyzed

6.3.1. The parts of the reactor vessel to be analyzed shall include: head closure, bottom head, shell adjacent to reactor core, reactor vessel supports and stabilizers, supports for reactor vessel internals, control rod drive penetration, feedwater nozzle, poison nozzle, emergency core cooling nozzles, drive system return nozzle, and all nozzles 10 inches or larger in size.

6.4. Closure Head Seal Calculation

6.4.1. To assure meeting sealing requirements of the main closure seal as specified in Paragraph 5.2.5. above, the relative rotations of the flanges shall be calculated. These rotations shall be used to demonstrate analytically satisfactory seal performance using the following assumptions:

6.4.1.1. The mating surfaces of the flanges shall be assumed rigid.

6.4.1.2. The rotation shall be assumed to cause contact over the minimum area which will sustain the loading between the faces when stressed to the yield strength at the metal temperature.

6.4.1.3. The flange faces shall be assumed to diverge from the contact area, specified in Paragraph 6.4.2., through the angle of calculated relative rotation less any radial taper machined on the ce(s) to accommodate the flange rotations.

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6.4.1.4. It may be assumed that the seal will be maintained if, at both O-ring seal locations, the separation between flanges is less than the minimum elastic spring-back of the O-ring.

6.5. Calculations

6.5.1. The calculations shall be clear and in sufficient detail to permit independent checking. Specific references shall be given for all formulas and methods used or the formulas and methods shall be derived independently. Calculation shall be submitted to the Buyer for approval.

6.6. Descriptions of Computer Programs

6.6.1. If computer programs are used to obtain solutions to design problems, the Seller shall furnish the Buyer the description of each different computer program used. These descriptions shall be furnished with the first issue of the design calculations incorporating such programs. The computer program description shall include computer type, program capabilities, assumptions, limitations and statement of availability.

6.7. Measurement Reports

6.7.1. Measured values of strain, deflections or stresses resulting from tests on models or actual reactor vessels shall be supplied to the Buyer by the Seller. These reports shall include all information necessary to duplicate the conditions required to obtain the results reported.

6.8. Summary Report

6.8.1. After completion of the reactor vessel design, the Seller shall furnish the Buyer additional copies of all calculations plus a summary report of results of all computations. Each copy shall be bound in a suitable paper binding and indexed.

7. CONSTRUCTION

The reactor vessel body including all components which contain pressure including the shell, lower and upper heads shall be made of rolled plate and/or forgings welded with full penetration welds throughout except as noted in 7.3.5. The shell and head flange and nozzles shall be forged.

7.1. Shell and Heads

7.1.1. Longitudinal and circumferential weld joints in the reactor vessel shall be oriented so as not to intersect openings or penetrations, wherever practical. Circumferential weld seams should avoid regions of highest neutron flux in the core region, if practical. The region of highest neutron flux occurs between the mid-plane and top of the core.

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7.1.2. Bottom head. The section of the bottom head which encompasses the penetrations for the control rod drives and in-core flux monitors shall be either a single forging or dished plate, if practical. If this is not practical and a weldment is used, the orientation of the weld sections shall as far as practical minimize the number of intersections of weld seams with penetrations.

7.1.3. Top head. The top head shall be either a single forging or dished plate or shall be fabricated of sections welded together, with the orientation of the weld seams such that no seams intersect openings or penetrations.

7.1.4. Weld joints. Weld joints shall be designed to facilitate a maximum of radiographic examination per the ASME Boiler and Pressure Vessel Code, Section III, Paragraph N-624.

7.2. Head Closure

7.2.1. Assembly and disassembly

7.2.1.1. The head closure shall be designed for removal and reassembly, using 4 or more hydraulic stud tensioners.

7.2.1.2. It shall be the design objective to replace and remove the head within 16 hours elapsed time. Specifically, the cycle shall include placing the head over the studs, tightening the studs to operating bolt-up loads, unbolting and removal of the head over the studs. It is expected that 120 such cycles will be performed during the life of the reactor vessel.

7.2.2. Seals

7.2.2.1. The head seal shall be a double seal with a vent between the seals through which leakage of the inner ring can be detected. The seal vent shall be designed for full design pressure of the reactor vessel.

7.2.2.2. The seal shall be metal O-ring type with pressure equalizing vents on I.D.

7.2.2.3. The grooves for the O-rings shall be placed in the reactor head flange. Suitable fasteners shall be provided to hold the O-rings in the grooves during head removal and assembly operations.

7.2.2.4. Provisions shall be made for installation of a low pressure leak detection system outside of the second seal, and may be outside of the bolt circle. The provisions shall include a vent through the vessel flange with extended 1 inch nipple and socket weld fitting and either a shallow groove or other suitable backing to retain a soft asbestos braided packing. There shall be no protruding parts of this low pressure seal beyond the O.D. of the head and vessel flange.

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7.2.3. Bolting

7.2.3.1. Studs shall be used to secure the reactor vessel head. Stud, nut and bushing threads shall be in accordance with Drawing 885D911.

7.2.3.2. The stud bolt holes in the reactor vessel flange shall be bushed with removable bushings. Keys shall be provided for each bushing to prevent rotation of the bushings when removing studs.

7.2.3.3. Spherical washers shall be used with the studs to minimize bending of the studs.

7.2.3.4. It shall be possible to remove and replace the head with the studs installed. To facilitate head removal and replacement, three special guide caps shall be provided to couple onto three studs. The lengths of the guiding surfaces of the guide caps shall be staggered so that the shorter of the three guide caps shall extend above the top of the installed studs for a minimum distance of 4 inches. The length of the three guide caps shall be staggered in 3 inch minimum increments. The internal threads of the guide caps shall be similar to the stud nuts threads. The upper end of the guide caps shall be provided with a conical leak-in taper and a horizontal through-hole bored to accommodate a round bar for wrenching.

7.2.3.5. Flange hole, bushing, and stud designs shall be such that the studs stand perpendicular to the flange surface when the studs and bushings are bottomed in the holes to facilitate removal and replacement of vessel head over studs as called for in Paragraph 7.2.3.4.

7.2.3.6. The surface of all threads in the studs, nuts and bushings shall be given a phosphate coating to act as a rust inhibitor and to assist in retaining lubricant on the surfaces. An approved lubricant should be applied to the stud threads as soon as possible after coating.

7.2.3.7. A stud sling for the main closure studs shall be provided. The stud sling shall include a swivel and counter-weight spring to support the weight of the stud during turning of stud into vessel flange. Studs are to be provided with a wrenching surface accessible when suspended on sling.

7.2.3.8. All main load-carrying threads and spherical washers shall be assembled only after cleaning, gaging, and lubricating. In no case during fabrication or testing shall these parts be assembled without lubricant. Only thread lubricant approved by the Buyer shall be used.

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7.2.4. Flanges

7.2.4.1. The top head flange surface shall be machined or the area around each stud hole spot faced. Spot facings shall be complete and extend beyond washer O.D. to accommodate maximum eccentricity of stud in head flange bolt hole.

7.3. Nozzle Ends

7.3.1. The ends of all nozzles other than flanged nozzles shall be prepared for welding in accordance with Drawing 107C5305. Nozzle safe ends are considered to be part of the vessel, not part of the connecting piping but in no case shall the safe end wall thickness be less than the wall thickness of the connecting pipe.

7.3.2. Where thermal sleeve nozzles are specified to a nominal size, the size of the pipe through the nozzle as well as the nozzle external end shall be the nominal size specified for the nozzle. Thermal sleeves shall be supplied by the Seller.

7.3.3. The Buyer will furnish information on the wall thickness, t_p, of all piping connections and will set the inner bore diameter including tolerances and allowances of the connecting piping will follow ASA Standards. The Buyer will use the formulas and allowable stresses of B31.1 for establishing the required piping wall thicknesses. Nozzle safe end wall thickness shall be governed by Drawing 107C5305 and will in general be greater than required by Section III.

7.3.4. Details of the transition weld preparation shall be submitted to the Buyer for approval.

7.3.5. Nozzles of 3 inches nominal size or larger shall be full penetration welded to the vessel. Nozzles less than 3 inches nominal size may be partial penetration welded if permitted by ASME Code, Section III.

7.4. The vessel top head nozzles shall be provided with flanges with small groove facing. Match marked mating flanges with small tongue facing gaskets and a complete set of studs and nuts shall also be provided. The loose flanges for the 6 inch instrument nozzles shall be blind, the remainder shall be weld neck. The flanges and gaskets shall be in accordance with ASA Standards B16.5. The threads on studs and nuts shall be 8-pitch series in accordance with ASA Standard B1.1.

7.5. Reactor Vessel Supports

7.5.1. External and internal supports shall be provided as an integral part of the reactor vessel. The location and design of the supports shall be such that stresses in the reactor vessel and supports will be within ASME Code limits due to reactions at these supports. The pressure differentials across the shroud support and shroud shall be as tabulated below (higher pressure under the support). The design of the core shroud support shall take into account the restraining effect of the components attached to the supports and the weight and earthquake and jet loadings as shown on Drawing 886D499, Sheet 7. The design parameters given in Notes 1-8 of the above Drawing apply to components other than the shroud support, legs. The design parameters tabulated below shall be applied to the shroud support legs only.

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7.5.1. (Continued)

SHROUD SUPPORT DIFFERENTIAL PRESSURE

Pressure (psid)		Pressure Area
Design	Operating	
57.0	34.0	≥ 98.375"R
39.0	21.85	< 98.375"R

SHROUD SUPPORT LEG DESIGN PARAMETERS

a. S max ≤ Sm for tensile stresses at design pressure and temperature without seismic loads.

b. S max ≤ Sm for tensile stresses at operating pressure and temperature with seismic loads.

c. S max ≤ 1.5 Sm for tensile stresses at operating pressure and temperature with max. seismic + jet loads.

d. S max ≤ 2.0 Sm for tensile stresses at design pressure and temperature with max. seismic + jet loads.

e. S max ≤ 0.4 Sy for compressive stresses at zero pressure and room temperature with seismic loads.

f. S max ≤ 0.6 Sy for compressive stresses at operating pressure and temperature with max. seismic + jet loads.

g. S max ≤ 0.8 Sy for compressive stresses at zero pressure and room temperature with max. seismic + jet loads.

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7.5.2. The anchor bolts and the sole plate on which the reactor vessel rests will be furnished by the Buyer.

7.5.3. The drain nozzle shall extend 16 inches vertically below the bottom outside surface of the reactor vessel and shall be of the full penetration design.

7.6. External Attachments

7.6.1. Brackets to support insulation shall be provided on the exterior of the reactor vessel in accordance with Drawing 886D499.

7.6.2. Provisions shall be made for the attachment of at least 36 thermocouples in mounts on the reactor vessel exterior as specified on Drawing 886D499. Exact location and number will be specified by the Buyer. The thermocouples shall not be furnished by the Seller.

8. MATERIALS

8.1. All materials to be used shall be indicated on the Seller's drawings. The Seller shall submit for the Buyer's approval, all material selections and material purchasing specifications.

8.2. Records

8.2.1. The Seller shall maintain complete records showing use of all materials so that it will be possible to relate every component of the finished reactor vessel to the original certification of the material and the fabrication history of the component. The Seller shall prepare a summary of the heat number, chemical composition and mechanical properties for each reactor vessel component.

8.3. Forgings

8.3.1. Low alloy steel forgings for pressure parts shall be made in accordance with ASTM A-508, in accordance with ASME Code Case 1332-2, Paragraph 5. Nozzles which are partial penetration welded as specified in 7.3.5. may be nickel-chromium-iron forgings made in accordance with ASME SB-166 modified in accordance with Code Case 1336 or SA-182, Grade F304. Forging ingots shall be produced by vacuum degassed pouring.

8.4. Plate

8.4.1. Plate for pressure parts shall be in accordance with ASME SA-302, Grade B, Firebox Quality, or as modified in accordance with ASME Code Case 1339, Para. 1.

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8.5. Castings

8.5.1. The use of castings will be considered by the Buyer but specific Buyer approval shall be required. Castings for pressure parts shall be made in accordance with ASME SA-356, Grade 10, Code Case 1333, Paragraph 1.

8.6. Material for pressure parts shall be selected and worked to produce as fine a grain size as practical. It shall be an objective of the fabrication technique to retain a grain size of 5 or finer in all material. Grain size shall be determined by the method in ASME E112.

8.7. Heat Treatment

8.7.1. Heat treatment of carbon and low alloy steel pressure parts shall consist of normalizing and then tempering at not less than 1200°F. For section thickness over 3 inches nominal, heat treatment shall consist of accelerated cooling from the austenitizing temperature to below the martensite finish temperature followed by tempering at not less than 1200°F to obtain tensile and impact properties comparable to those developed by normalizing and tempering section thickness of less than 3 inches nominal.

8.8. Mechanical Properties

8.8.1. The low alloy steel forging, plate and castings for pressure parts shall be tested in accordance with Paragraph 10.3. and shall have the mechanical properties required therein in addition to those required by the applicable ASME Specification.

8.9. Studs, Nuts, Bushings, and Washers for Main Vessel Closure

8.9.1. Studs shall conform to ASTM A540, Grade B23 or B24 and ASME Code Case 1335-2, Paragraph 4, Class 3, 4 or 5.

8.9.2. Nuts, bushings and washers shall conform to ASTM A540, Grade B23 or B24 and Code Case 1335-2, Paragraph 4, Class 3, 4 or 5 but to suit the stud material used and to have a minimum difference in hardness of Rockwell C points from the stud material.

8.9.3. Hardness and impact properties shall meet the requirements of Paragraph 10.3.2.5.

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8.10. Cladding Material

8.10.1. All internal carbon and low alloy steel surfaces of the reactor vessel, including the shell, bottom head, vessel flange (but not including top head and flange), nozzles for connecting stainless steel piping, and internal attachments, shall be clad with weld overlay meeting the following requirements:

8.10.1.1. Weld overlay cladding shall be a minimum of 0.125 inches total thickness. The finished surface shall have a composition equivalent to ASTM A371, Type ER308 or A240 - Type 304 except the carbon content shall not exceed 0.08 percent. (Exception - the lower head may be clad with Inconel 82 or 182).

8.10.1.2. Cladding in the "as-clad" condition is acceptable, provided the resulting surface finish does not interfere with the ultrasonic and liquid penetrant test requirements.

8.10.1.3. The sealing surfaces of the reactor vessel head and shell flanges shall be weld overlay clad with austenitic stainless steel which consists of a minimum of two layers and a minimum of 0.25 inch total thickness. The first layer shall be deposited with an analysis equivalent to ASTM A371, Type ER309. The second and subsequent layers shall have a composition equivalent to ASTM A371, Type ER308, except the carbon content shall not exceed 0.08 percent. Minimum thickness of 1/4 inch shall apply after all machining including area under groove.

8.10.1.4. Six cladding examination patches shall be prepared to meet the examination requirements of Paragraph I-1 of the ASME Code for Inservice Inspection of Nuclear Reactor Coolant Systems.

8.10.2. Nozzles for connecting carbon steel piping (except for the top head nozzles which shall be unclad) shall be clad through at least the thickness of the vessel wall or one-half the diameter of the nozzle bore, whichever is less.

8.11. Attachments

8.11.1. Internal attachments other than the weld clad ferritic attachments (and the steam dryer hold-down brackets which may be carbon steel) shall be annealed stainless steel, Type 304 per ASTM A240 or ASTM A276, or Type F304 per ASTM A182. The core support structure shall be stainless steel clad low alloy or carbon steel or solid nickel-chromium-iron alloy per ASME SB166, SB167 or SB168.

8.11.2. External attachments to the reactor vessel shall be of the same material as the reactor vessel base material, or shall be of a material which has mechanical and impact properties compatible with the base material. Where welds must be made to the attachments in the field, the material selected shall not require preheat or post-weld heat treatment.

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8.12. Nozzle Safe Ends and Flanges

8.12.1. Nozzle ends for austenitic pipe shall be ASTM A336, Class F8 or F8M; A240, Type 304, or Type 316; or A376, Type 304 or Type 316 solution heat treated stainless steel, depending upon the mating pipe material selected by the Buyer. Nozzle ends for carbon steel pipe shall be ASTM A105, Grade II, forgings except phosphorous content shall be 0.035 percent maximum and sulphur 0.040 percent maximum. Proportions shall be as shown on Drawing 107C5305.

8.12.2. Standard flanges for flanged nozzles shall be ASTM A105, Grade II, except 0.035 percent maximum phosphorus and 0.040 percent maximum sulphur.

8.12.3. Studs for standard flanges shall be SA193, Grade B7. Nuts for standard flanges shall be SA194, Grade 2H.

8.13. Pipes and tubes shall be ASTM A213, A249, A312, A376, solution heat treated, Grade TP304 or TP316; or A240, Type 304 plate welded and radiographed in accordance with ASME Code, Section III, Paragraph N624.

8.14. Miscellaneous bolting material shall be subject to the Buyer's approval.

8.15. Weld Electrodes and Rods

8.15.1. Material for weld electrodes and rods shall be selected from ASTM A233, A298, A316, A371 or equivalent for other processes and reported to the Buyer for approval.

8.15.2. All austenitic stainless steel welds and weld cladding shall contain controlled amounts of ferrite, confirmed by quantitative tests. The procedures for control of, and testing for the ferrite content of welds and weld cladding shall be submitted to the Buyer for approval. The acceptance standard for quantitative tests shall be either % Cr = 1.9 x % Ni, or 5 percent ferrite minimum.

8.16. Alternate Materials

The Seller shall be free to suggest alternate materials during preparation of detailed drawings and shall bring such alternates to the attention of the Buyer, but shall not make substitutions without approval of the Buyer. Request shall include:

8.16.1. Reason r substitution

8.16.2. Identification of the component or parts involved.

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8.16.3. Either the complete material specification similar to ASTM for each type and form of proposed material, or the information as follows:

a. Type of Service (structural, high/low pressure, temperature, weldable)

b. Manufactured Form (pipe, plate, tube, bar, bolting)

c. Size, thickness limits

d. Alloy Grades (C-steel, Alloy Steel, Stainless Steel Designations)

e. Steel-Making Process (Open hearth, basic electric)

f. Forming Process (Hot forged, hot/cold rolled, drawn, seamless welded, cast)

g. Heat Treatment, Stress Relief Parameters

h. Type, Location and Number of Mechanical Tests (Tensile, Bend Homogeniety, Hydrostatic)

i. Mechanical Property Acceptance Limits

j. Chemical Composition Acceptance Limits

k. Inspection Requirements such as: Radiography, Liquid Penetiant, Magnetic Particle, Ultrasonic including acceptance limits

l. Surface Finish acceptance limits

8.16.4. Allowable Stresses (if not an ASME material)

8.16.5. For major pressure parts, additional information will be required regarding details of previous applications of the material, impact strength, NDT temperature, micro-structure variations, creep, stress rupture, hardness, radiation damage, welding, forming, corrosion and temperature effects as applicable for engineering evaluation of the application and as required for code purposes.

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8.17. Sensitization of Stainless Steel. All furnace sensitized wrought stainless steel base metal shall be eliminated by either of the following:

a. Schedule the manufacturing sequences such that wrought stainless steel is not subjected to furnace heat treatment above 800°F after final solution heat treatment.

b. If any wrought stainless steel base metals have been furnace sensitized after they have been fabricated and installed in the reactor pressure vessel, they shall be removed and replaced per a. above or overlayed with 308L stainless steel cladding.

9. FABRICATION

9.1. Procedures

9.1.1. The Seller shall submit for the Buyer's approval, all of the following procedures and procedure specification.

9.1.1.1. Heat treatment procedures for all thermal processes exceeding 800°F after the mill rolling or forging or foundry casting operation.

9.1.1.2. Forming and bending procedures for all forming during fabrication subsequent to mill forging or rolling or foundry forming and cladding.

9.1.1.3. Welding and weld repair procedures including temporary welds as required in accordance with the ASME Code, Section IX, Paragraphs Q-10 and 11, and QN-10 and 11, Section III, Paragraph N-540.

9.1.1.4. Method of qualifying welding procedures and performance, if other than ASME Code, Section IX and III.

9.1.1.5. Repair procedures for major and minor defects as defined in Paragraph 9.4.

9.1.1.6. Drawings showing location and preparation of test specimens, including specimens required in Attachment B.

9.1.1.7. Fabrication schedule including the detailed sequence to be followed in fabrication of the vessel.

9.1.2. All work by the Seller or his sub-suppliers shall be performed in accordance with Buyer approved drawing, and fabrication and test procedures.

9.2. Material Cutting

9.2.1. Stainless steel and carbon steel shall be cut to size or shaped by machining, shearing or thermal cutting.

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9.2.2. Thermal cutting of stainless steel shall be followed by the removal of approximately 1/32 inch depth from the cut surface. Thermal cutting of carbon steel shall be followed by the removal of oxides.

9.3. Welding

9.3.1. The reactor vessel base material pre-heat and interpass temperature shall be as specified in the welding procedures, but in no case less than 300°F, except weld overlay pre-heat which shall be no less than 200°F. Pre-heat temperature shall be maintained after welding until start of post-weld heat treatment. Pre-heating techniques shall be such as to ensure that the full thickness of the weld joint preparation and adjacent base material is at the specified temperature for the distance of "T" or two inches, whichever is greater, where "T" is the material thickness.

9.3.2. When stainless steel or nickel-chromium-iron alloy is welded to itself or to each other, no pre-heat is required, except when the heat-affected zone reaches ferritic base material as in the cases of welding to buttered nozzle ends or cladding. When the buttering or cladding is less than 1/4 inch thick, pre-heat to at least 200°F is required, followed by post-weld heat treatment except that subsequent welding to cladding greater than 1/8 inch thick may be done without pre-heat if the specific welding procedure is qualified to show that the heat affected zone does not reach the base metal.

9.3.3. All surfaces (to be welded) shall be free of cavities or protrusions which may interfere with the welding procedure.

9.3.4. Pre-heat, welding and post-weld treatment shall be planned and conducted to minimize undue distortion or warping of the parts and preclude cracking.

9.3.5. Machined surfaces and threads shall be protected against weld splatter.

9.3.6. Stainless steel welds shall be cleaned with stainless steel wool or stainless steel brushes before adding the next bead and following the final bead to facilitate inspection. The light oxide discoloration which forms on the weld surface need not be removed.

9.3.7. Welds shall be cleaned of slag and flux between passes and following the final deposit.

9.3.8. Any cracks, blow holes, or other defects which appear on the surface of weld beads shall be removed by machining, chipping, grinding, or arc gouging. Austenitic weld repairs, if arc gouged shall be followed by grinding. Austenitic welds shall not be peened; ferritic welds may be peened under controlled conditions with the approval of the Buyer.

9.3.9. Wide welds to overcome poor fit are not permissible. Poor fits shall be remedied by suitable means such as regrooving, and approved by the Buyer. Except for small cavities, the Seller shall not correct a plate edge deficiency unless approved by the Buyer. The Buyer may require radiography or other methods of examination of welds used to correct plate edge deficiencies.

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9.3.10. Post-weld heat treatment temperature shall be 1100°F-1150°F. Interstage post-weld heat treatment holding time shall be 15 minutes minimum. Final post-weld heat treatment holding time shall be one hour per inch of thickness, minimum.

9.4. Repair of Defects

9.4.1. Repair procedures shall be prepared for the repair of all defects. Major defects shall require prior approval by the Buyer and may require witnessing by the Buyer's representative. Major repair is defined as (1) a repair to material other than weld metal which requires an excavation greater than 3/8 inch deep or 10 percent of the wall thickness, whichever is less; (2) the repair of any cracks, other than crater cracks, in any material or weld metal; and (3) the repair of any defect which is indicative of either a fundamental material problem or a process out of control. A minor repair is defined as all other repairs.

10. INSPECTION AND TEST

10.1. General

The Seller shall submit for the Buyer's approval, the following inspection and test procedures:

10.1.1. Ultrasonic Examination Procedure for the following:

a. Forgings
b. Plate
c. Welds
d. Weld build-ups
e. Cladding
f. Tubular Products

10.1.2. Magnetic Particle Examination Procedures for the following:

10.1.2.1. Carbon steel and low alloy steel forgings

10.1.2.2. Carbon steel and low alloy steel welds

10.1.2.3. Weld Build-ups

10.1.2.4. Bolting

10.1.2.5. Carbon steel and low alloy steel tubular products

10.1.2.6. Carbon steel and low alloy steel castings

10.1.2.7. Edge preparations of carbon steel and low alloy steel materials

10.1.3. Liquid Penetrant Examination Procedures for the following:

10.1.3.1. Austenitic Forgings

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10.1.3.2. Austenitic Welds

10.1.3.3. Austenitic Weld Buildup

10.1.3.4. Cladding

10.1.3.5. Austenitic Tubular Products

10.1.3.6. Austenitic Castings

10.1.3.7. Edge Preparations of Austenitic Materials

10.1.4. Radiographic examination procedures for welds, castings, for each type of radiographic source above and below 2 MEV.

10.1.5. Hydrostatic Examination Procedures

10.1.6. Leak Check Procedures

10.1.7. Methods, processes and equipment to be used in establishing "as-built" dimensions and alignment checks which are not normally used in the shop.

10.2. Definitions

10.2.1. "As-Fabricated" Specimens. "As-fabricated" specimens are mechanical test specimens taken from carbon and low alloy steel forgings and plates used in the vessel fabrication from each heat and heat treatment lot and from welds between base material made by each welding procedure used and in a thickness equal to or greater than the thickest weld made with each procedure. Coupons for "as-fabricated" specimens shall be taken from the forgings or plates following all hot working or forming and all heat treatment except post-weld heat treatment. These coupons shall then be subjected to a post-weld heat treatment equivalent to the treatments which the parts it represents will receive in the completed vessel. Thi- shall consist of holding the coupon at the post-weld heat treatment temperature for a time equal to or greater than the longest accumulated time any part it represents shall be at the post-weld heat treatment temperature.

10.2.2. "1/4T x T" Location. The "1/4T x T" location of specimens is defined as a location within the material no closer than "1/4T" from one quenched surface, and no closer than "T" from any other quenched edge, where "T" is the nominal thickness of the material.

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10.2.3. NIL-ductility transition (NDT) temperature. The nil-ductility transition (NDT) temperature is defined as the temperature at which a specimen is broken in a series of tests in which duplicate no-break performance occurs at a temperature 10°F higher, when tested in accordance with ASTM E208.

10.2.4. Impact transition curve. A curve representing breaking energy vs temperature from at least twelve Type A Charpy-V specimens, tested in accordance with ASTM A370, except each specimen tested at a different temperature. The temperature range of testing shall establish the upper plateau, the transition region, and the lower plateau. Each plateau shall be determined by at least one, but not more than two points. The remaining specimens shall be used to develop the transition region. The lower plateau need not be developed if it occurs below -80°F.

10.2.5. A "lot of material" consists of all material from one heat (one melt) in one heat treatment furnace charge.

10.3. Material Mechanical Tests

10.3.1. Mechanical properties

10.3.1.1. Impact properties of all as-fabricated carbon and low alloy steel used in the main closure flanges and the shell and head materials connecting to these flanges shall meet the requirements of the ASME Code, Section III, Paragraph N-330 at a temperature no higher than 10°F. In addition, this material shall have an NDT temperature no higher 10°F as determined per ASTM E208.

10.3.1.2. Impact properties of all other "as-fabricated" carbon and low alloy steel pressure containing material and the vessel support skirt material shall meet the requirements of the ASME Code, Section III, N-330 at a temperature no higher than 40°F. In addition, this material shall have an NDT temperature no higher than 40°F as determined per ASTM E208. The actual NDT temperature of all material opposite the center of the active fuel of the core as indicated on Drawing 886D499 shall be determined.

10.3.1.3. Tensile test properties of all materials shall be inspected and tested to meet the requirement of the applicable ASME Code or ASTM specification.

10.3.1.4. Test data shall be reported to the Buyer.

10.3.2. Required number and specimen location. The number and location of tensile and impact test specimens required shall be per ASME Code, Section III, N-313.2 and the following depending on the form of the material. The following tests may be integrated with the tests required by the ASME Code and ASTM Specification wherever possible.

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10.3.2.1. Vessel flange and head flange forgings. Tangential specimens, as-fabricated, shall be taken from locations per ASME Code, Section III, N-313.2 (d) (2). A total of at least 2 tensile, 6 Charpy-V impact and 4 drop weight specimens shall be tested for each flange from which 1 tensile, 3 Charpy-V impact and 2 drop weight specimens shall be located approximately 180° from the other specimens. The material shall meet the requirements of Paragraph 10.3.1.

10.3.2.2. Low-alloy steel nozzle forgings. Specimens, as-fabricated, shall be taken from locations per ASME Code, Section III, N-313.2 (d) for forged nozzles. At least 2 tensile, 3 Charpy-V and 2 drop weight specimens shall be tested for each heat and heat treatment charge. The material shall meet the requirements of Paragraph 10.3.1.

10.3.2.3. In addition to the tests required by the ASME Boiler and Pressure Vessel Code, longitudinal specimens (parallel to the primary rolling direction), as-fabricated, shall be taken from the 1/4T x T location. At least 2 drop weight specimens shall be tested from the top end (top as determined by ingot pouring) of each mill rolled plate and each heat treatment charge. The material shall meet the requirements of Paragraph 10.3.1. Additional drop weight specimens shall be required for NDT temperature determination per Paragraph 10.3.1.2. for plates located opposite the center of the core.

10.3.2.4. Castings. Tangential specimens, as-fabricated, shall be taken from locations per ASME Code, Section III, N-313.2 (d). Castings 1000 lb weight and under shall have a total of 1 tensile specimen, 1 metallographic specimen, and 3 Charpy-V and 2 drop weight specimens, tested for each heat and heat treatment charge. Castings over 1000 lb weight shall have a total of 2 tensile specimens, 2 metallographic specimens, 6 Charpy-V and 4 drop weight specimens tested from which 1 tensile specimen, 1 metallographic specimen, 3 Charpy-V and 2 drop weight specimens shall be taken 180° apart and/or diagonally opposite. The metallographic specimens shall be for reference only. Additional drop weight specimens shall be required in accordance with Paragraph 10.3.1.1. if the casting is located in the core area. The material shall meet the requirements of Paragraph 10.3.1.

10.3.2.5. Studs, nuts, bushings and washers for main vessel closure. Hardness tests shall be made on all main vessel closure bolting to demonstrate that heat treatment has been performed. Studs, nuts and bushings shall be hardness tested individually. One sample from each lot of washers shall be hardness tested. Impact tests required by ASME Code, Section III, Paragraph N-330 shall meet the Code requirements at a temperature no higher than 10°F. In addition the the magnetic particle or liquid penetrant acceptance standards specified in ASME Code, Section III, Paragraph N-325, axial defects of less than thread depth shall be investigated to determine their nature. Any cracks or sharply defined linear indications are unacceptable.

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10.4. Welded Base Material - Mechanical Tests

10.4.1. ASME code weld test plates. The Seller shall prepare and test weld coupons of Category A and B joints in accordance with ASME Code, Section III N-713. The impact test temperatures shall be determined in accordance with Paragraph 10.3.1. of this specification. In addition to the tests required by the Code, 6 drop weight specimens shall be taken from the 1/4T x T location from these plates and, if different welding procedures are used, from plates for base material to base material welds of Category D joints as defined in ASME Code, Section III, N-461. Two each of the drop weight specimens shall represent the base metal, heat affected zone and weld metal. The specimens shall meet the requirements of Paragraph 10.3.1.2. Additional drop weight specimens shall be required in accordance with Paragraph 10.3.1.2. if the welding procedure is to be applied in the area opposite the core.

10.4.2. One of the test plates of Category A or B required in 10.4.1. above shall be selected by the Buyer for the fabrication tests required in Attachment B, Paragraph 2. The Seller shall perform all required tests and reports. These tests are for information only, but time is of the essence and the tests should be performed and the results reported as early as practical.

10.4.3. The Seller shall prepare and ship, but not test, Surveillance Test Program material and specimens in accordance with Attachment B, Paragraph 3.

10.4.4. Flange forging weld test plate. In the event the vessel and head flanges are made by welding two or more forged segments, the Seller shall prepare a weld test plate from the forging material. Impact and tensile specimens shall be prepared and tested. The specimens shall be prepared from material in the weld-heat-affected zone and from the weld metal. Test results shall meet the requirements of Paragraph 10.3.1.

10.5. Ultrasonic Inspection

10.5.1. Ultrasonic inspection of plate and forged material shall be performed in accordance with ASME Code, Section III, except that ASME Case Interpretation 1338-2, Alternate 2 shall not be acceptable, and the plate material testing shall be a 100 percent volumetric inspection and shall be performed after forming and heat treatment. The following acceptance criteria shall apply in addition to Code requirements. A defect which causes any echo indication that exceeds 50 percent of the indication from the calibration standard and that is continuous during movement of the transducer more than 3 inches in any direction shall be unacceptable. A chart shall be maintained of defects with 50 percent or greater loss of back reflection.

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10.5.2. Prior to connecting any attachment, support or bracket, except insulation and thermocouple brackets, to the interior or exterior of plate portions of the vessel by means other than groove welds below the plate, the plate shall be ultrasonically inspected. The plate shall be inspected to a depth at least equal to the thickness of the part being joined, and over the entire area of the subsequent connection plus a band all around this area of width equal to half the thickness of the part being joined. The inspection shall be in accordance with ASME Code, Section III, Paragraph N-321, using longitudinal wave technique. The surface shall be 100 percent inspected with the transverse interval being no greater than 90 percent of the crystal diameter.

10.5.2.1. Reference standard. The Seller shall prepare a reference standard which consists of a flat bottom hole having a diameter equal to one-quarter of the thickness of the part being joined or 1/4 inch diameter whichever is greater. The bottom of the hole shall be one thickness of the part being joined below the plate surface. This reference standard shall be used for calibration purposes.

10.5.2.2. Acceptance standards. Any defect which produces a trace line pattern equal to or in excess of the appropriate reference standard shall be unacceptable.

10.5.3. The main closure stud, nut, bushing and washer material shall be ultrasonically tested following heat treatment and rough machining to 250 rms or better finish using both longitudinal and shear wave techniques. Longitudinal wave examination shall be performed on 100 percent of the cylindrical surface, and in addition on stud material from both ends of each stud. The longitudinal wave transducer shall have a maximum diameter of 1/2 inch. Shear wave examination shall be performed on 100 percent of the outer cylindrical surface in both axial and circumferential directions.

10.5.3.1. Reference standards. The Seller shall prepare a reference standard of the same material thickness and curvature as the part being examined. The reference standard shall contain calibration features as follows:

a. Longitudinal Wave-Radial Scan: 1/2 inch diameter flat-bottom hole having a depth equal to 10 percent of the material thickness.

b. Longitudinal Wave-End Scan: Flat-bottom hole with area equal to 1 percent of stud cross-section or 1/4 inch diameter, whichever is smaller, having a depth of 1/2 inch.

c. Shear Wave: Square bottomed notches 1 inch long and 3 percent of the part thickness in depth, both axial and circumferential.

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10.5.3.2. Acceptance standards. Any defect which produces a trace line pattern (echo indication) greater than the indication from the applicable calibration feature shall be unacceptable. A distance-amplitude curve may be used for the longitudinal wave examination. The curve may be a line established by plugging the hole and examining it from both sides of the material. For end examination of studs the curve may be established for half the stud length and applied to an examination from each end to the center.

10.6. Cladding

10.6.1. Ultrasonic inspection - cladding general.

10.6.1.1. The cladding bond shall be tested with the transducer on the clad side using a suitable couplant. The entire clad surface shall be inspected at intervals 1.4 times the base material thickness, but not greater than 12 inches, transverse to the direction of welding.

10.6.1.2. Reference standard. The Seller shall prepare a reference standard which consists of a flat bottom groove in typical clad plate. The groove shall be 0.35 inch maximum width by at least one crystal diameter long, parallel to the direction of welding. The groove shall be formed by machining the base metal within 1/32 inch of the cladding interface and etched with nitric acid to remove excess ferritic material from the interface. This reference standard shall be used for calibration purposes.

10.6.1.3. Acceptance standards. Cladding which produces a trace line pattern equal to or in excess of the appropriate Reference Standard shall be unacceptable if a continuous pattern occurs during movement of the transducer more than three inches in any direction or if one or more patterns occur during movement of the transducer less than one inch in any one pattern.

10.6.2. Liquid penetrant inspection - cladding general.

10.6.2.1. All clad areas and clad repairs shall be liquid penetrant inspected per ASME Code, Section III, N-627. The following indications shall constitute unacceptable defects and shall be repaired.

10.6.2.2. Any crack-like indications or incomplete fusion.

10.6.2.3. Linearly-disposed spot indications of 4 or more spots spaced 1/4 inch or less from edge to edge of the indications.

10.6.2.4. Spot indications which are indicative of defects greater than 1/32 inch deep as revealed by bleed-out.

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10.6.3. Ultrasonic inspection - cladding special areas.

10.6.3.1. The flange seal surfaces shall be inspected for bond to the flanges as per 10.6.1. except that the inspection shall be over 100 percent of the area. Prior to final machining the volume 1/8 inch above and below the surfaces on which the double seals will seat shall be 100 percent inspected for defect using longitudinal wave technique. The acceptance criteria shall be that any defect which produces a trace line pattern equal to or in excess of a 1/16 inch flat bottom hole may be unacceptable.

10.6.3.2. The final machined surfaces on which the double seals seat shall be inspected by surface wave technique. Any defect producing a signal greater than the signal produced by the 0.002 inch deep by 1/8 inch long spark machined groove in a reference standard which the Seller shall furnish may be cause for rejection.

10.6.4. Liquid penetrant inspection - cladding special areas.

10.6.4.1. The area of the flange seal surfaces on which the double seals seat shall be liquid penetrant inspected per ASME Code, Section III, N-627, except that any indication of any type shall be unacceptable.

10.6.5. Magnetic particle inspection - plate material.

10.6.5.1. Both internal and external surfaces of all low alloy steel plate material shall be magnetic particle inspected per ASME Code, Section III, Paragraph N-626 following forming and heat treatment. The acceptance standard of ASME Code, Section III, Paragraph N-625.5 shall apply.

10.6.6. Openings in pressure parts.

10.6.6.1. The entire surface of all openings for partial penetration nozzles, regardless of size, except for the seal leak detection connection, shall be examined in accordance with ASME Code, Section III, N-513.

10.6.6.2. The entire surface of the finished stud holes in the head flange and the holes in the vessel flange prior to tapping shall be examined by the methods of ASME Code, Section III, N-513. Any indication of cracks or linear indications shall be reported to the Buyer for information. Any crack or linear indication may be subject to removal and repair if required.

10.7. Welds

10.7.1. Radiographs.

10.7.1.1. Gamma rays shall not be used unless approved by the Buyer.

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10.7.1.2. Films shall be suitably marked to identify the weld. Film identification markings shall coincide with the detail drawing markings for each weld.

10.7.2. Ultrasonic Testing. All full-penetration pressure carrying welds shall be 100 percent ultrasonically tested as described in Paragraph N-625 of Section III of the Code. Both shear wave and longitudinal wave techniques shall be used.

10.7.2.1. Indications with 50 percent or greater loss of back reflection or 50 percent of indication from the calibration standard shall be recorded on charts "to scale" so that they can be used as a basis for comparison with subsequent "in-service" ultrasonic tests.

10.7.2.2. Any work (additional investigation and testing or repair of welds) which is requested by the Buyer as a result of the ultrasonic testing shall be subject to mutual Buyer-Seller agreement.

10.8. Hydrostatic Tests

10.8.1. After completion of fabrication but prior to shipment, while the vessel is supported on its normal supports, the reactor vessel shall be pressure tested in accordance with the ASME Boiler and Pressure Vessel Code, Section III, Paragraph N-712. (Paragraph numbering as per Winter 1966 Addenda.) Reactor vessel material temperature shall be at least 100°F. In no case, however, shall the water temperature be higher than 180°F. Suitable gasket material instead of metal O-rings may be used for this test. Hydrotest water shall be either potable tap water with addition of TSP, or demineralized water. Water may be heated with steam provided that the source of feedwater is potable or demineralized water.

10.8.2. Following the Code test, the vessel shall be hydrostatically tested at design pressure with new O-rings. This test shall demonstrate that the head seal meets the sealing requirements.

10.8.3. Alternative Procedures. As an alternative to 10.8.1 and 10.8.2, the second hydrostatic test may be combined with the Code test if metal O-rings are used and the stud tension used is normal operating bolt-up tension. A permissible variation on the above would be to perform the Code hydrostatic test of 10.8.1 using metal O-rings and hydrostatic test bolt-up tension. After this test has been completed, the pressure is to be dropped to zero psi and stud tension decreased to normal bolt-up tension. The leak testing of 10.8.2 is then to be performed.

10.9. The placing of the head, tightening the studs to operating bolt-up loads, unbolting and removal of the head over the studs shall be demonstrated. The elapsed times for each step shall be recorded.

10.10. Final inspection after hydrostatic test per ASME Code, Section III, N-618 shall include seal surfaces and the nozzle weld preps.

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10.11. Immediately prior to hydrostatic testing of the reactor vessel, all interior surfaces that will contact water during the hydrostatic test, all nozzle fixtures, all piping which will be used to fill the reactor vessel, and all surfaces of stainless steel and Ni-Cr-Fe components shall be cleaned to remove all halide-bearing soils, grease, oil, penetrant materials, inks, chalk or crayon marks, and all dirt and debris. All loose dirt and other foreign materials shall be removed by sweeping or vacuuming. Deposits of grease and oil shall be removed with an appropriate solvent. Tightly adhering soils may be removed with the aid of stainless steel brushes which have not been previously used on carbon steel, or by grinding. The vessel shall then be cleaned with high-pressure water containing a minimum of 500 ppm of phosphate added as TSP. The vessel and water temperature shall be less than 180°F during the TSP cleaning step. The water pressure shall be a minimum of 5,000 psi. The trisodium phosphate shall be reagent grade per American Chemical Society standards. Water shall be potable water containing less than 50 ppm chlorides, 10 ppm fluorides, and 1 ppm sulfides, or demineralized water containing not more than 1 ppm chlorides, 1 ppm fluorides and 1 ppm sulfides. The TSP solution may be left on the surface of the vessel. However, the vessel must be completely drained so that no puddles of TSP solution remain. The cleanliness of the vessel shall be checked visually and with the aid of an ultraviolet light to assure that the vessel is clean. The ultraviolet examination shall be conducted under darkened conditions with a lamp having a minimum brilliance of 100-foot candles. A permissible variation on the above ultraviolet light cleanliness examination will be to wipe the vessel with clean rags as an inspection method for determining cleanliness.

10.11.1. It is intended that hydrostatic testing follow immediately after cleaning and that all plumbing, welding, or testing work be performed prior to cleaning. During any entry of personnel into the vessel after cleaning has been completed shoe covers shall be worn and clean-room conditions maintained in the reactor vessel.

10.12. The water used to fill the vessels for the hydrostatic test may be either tap water or demineralized water. For vessels filled with tap water plus a minimum phosphate addition of five times the chloride content of the test water in the vessel (but not less than 100 ppm phosphate), TSP shall be added as reagent-grade trisodium phosphate (TSP) . The water used to fill the vessel shall meet the following requirements:

pH = 5.8 to 8.0
Cl = less than 50 ppm
Fl = less than 10 ppm
S = less than 1 ppm

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10.12.1. For vessels filled with demineralized water, the water in the vessel shall meet the following requirements:

pH = 5.8 to 8.0
Cl = not more than 1 ppm
Fl = not more than 1 ppm
S = not more than 1 ppm

10.2.2. The conductivity of the fill water shall be 3 micro mho/cm maximum. The vessel shall be dried as soon as practical after hydro. TSP shall be washed, using demineralized water, from any surface which is heated to above 500°F.

11. PREPARATION FOR SHIPMENT

11.1. Cleaning Procedures

11.1.1. The Seller shall submit for the Buyer's approval, all cleaning procedures, preserving procedures and a list of cleaning agents and preservatives together with their chemical content which shall be used during fabrication and in preparation for shipment. In lieu of a complete chemical analysis, the Buyer shall accept a report which states the chlorides, fluorides and sulfur content. Other harmful elements should also be reported.

11.2. Interior Surfaces

11.2.1. Interior surfaces of the reactor vessel shall be thoroughly cleaned to be visibly free of lubricant, weld spatter, chips, imbedded iron particles and other foreign materials. The vessel shall then be cleaned in accordance with Paragraph 10.11 except that demineralized water with 500 ppm phosphate shall be used. After the vessel and head interior surfaces are cleaned, they shall be dried with hot air or other suitable means and the vessel and head sealed to prevent entry of moisture, dirt, and other harmful materials. The coating of TSP from the final wash may be left on the surface.

11.3. Exterior Surfaces

11.3.1. Where vessels are to be shipped over salt water (i.e., Peachbottom 2 & 3 and Browns Ferry 2 & 3) the following requirements apply: Exterior carbon steel surfaces sh be cleaned of oil and grease after which mill scale, rust, rust scale, paint and other foreign matter shall be thoroughly removed by such means as sandblasting. All surfaces shall be brushed or air cleaned to remove all traces of sand or grit and shall then be dried and painted. Sufficient coats of an approved paint (approved by the Buyer - Superior Primary Lead #1746 is not approved) shall be applied to all exterior carbon steel surfaces (stainless steel and Ni-Cr-Fe surfaces shall not be painted) to assure complete coverage and sufficient protection from the weather. Exterior stainless steel and Ni-Cr-Fe surfaces shall be coated with a suitable material to prevent moisture contact with the surfaces. The vessel and

ISSUED:

11.3.1. (Continued)

closure head shall be purged with dry nitrogen until the gas within the vessel and closure head has attained a dew point of 32°F. The vessel and closure head shall be fitted with a suitable nitrogen pressure system to maintain a positive pressure of nitrogen within the vessel and closure head. In lieu of the nitrogen purge requirements for the vessel and closure head, it will be acceptable to coat the interior surfaces with tectyl (or other Buyer approved preservatives) provided the Seller assumes this additional cleanup responsibility once the vessel and closure head are received at the site. Where vessels are to be shipped over inland routes (i.e., Brown Ferry 1) no painting, nitrogen purge or nitrogen pressure system will be required. Protection of exterior stainless steel surfaces will be required, as above.

11.4. Small Parts

11.4.1. Small, loose pieces, including bolting, tools, gaskets, etc., shall be adequately crated or boxed for protection during shipment. Parts subject to rusting shall be suitably protected. All boxes, crates and shipments shall be marked with the equipment piece number.

11.5. Shipping Weight and Dimensions

11.5.1. Estimated shipping weights and overall clearance dimensions shall be shown on the drawings when submitted to the Buyer for approval.

11.6. Shipping Skids

11.6.1. The reactor vessel body shall be shipped on a skid which supports the reactor vessel in a horizontal position. The top head shall likewise be shipped on a skid. The skids shall be designed to support the reactor vessel adequately and securely during shipment to the site and to permit movement on rollers (not supplied by Seller) at the erection site.

12. SUBMITTALS

12.1. Tabulation (for Information Only)

12.1.1. Fabrication, qualification and inspection procedures, reports processes, and calculations are tabulated below (all of which require submittal to the Buyer in quantities as shown on Attachment A). This tabulation shall in no way be construed as being complete or limiting the documents necessary to meet the requirements of this specification.

a. Heat treatment procedure
b. Forming and bending procedure
c. Welding and weld repair procedure specification
d. Repair procedures
e. Cleaning and preserving procedures
f. Ferrite content or Ni/Cr ratio control procedure
g. Ultrasonic examination procedure
h. Magnetic particle examination procedure

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12.1.1. (continued)

i. Liquid penetrant examination procedure
j. Radiographic examination procedure
k. Hydrostatic examination procedure
l. Leak check procedure
m. Measurement reports
n. Summary reports
o. "As-built" dimensions and alignment checks procedures
p. Design analysis calculations
q. Material purchase specifications
r. Material selections

12.2. The following shall be submitted in accordance with Attachment A:

12.2.1. Drawings

12.2.1.1. Outline Drawings - A drawing depicting the outline of the reactor vessel indicating overall dimensions, location and size of nozzles, location of supports, shipping and operating weights.

12.2.1.2. Assembly Drawings - A section drawing depicting the arrangement of the functional parts, parts list and material designations.

12.2.1.3. Detail Drawings - Drawings for details of construction such as weld preparations, surface finishes, finished dimensions, nozzles, lifting attachments, insulation attachments, thermocouple pads, flanges and supports.

12.2.1.4. Drawings for Approval - Outline, assembly and detail drawings shall be submitted for approval. The detail drawings submitted shall be for design details enumerated in 12.2.1.3. which are required for coordination with piping and structure and design details which are at variance with the code or the requirements of this specification.

12.2.1.5. Controlling location arrangement drawings. One or more drawings shall be devoted exclusively to outline dimensions such that mating components designed and supplied by others such as piping, anchor bolts, instruments, etc., may be procured for an exact fit with the reactor vessel assembly. These drawings shall show reference to the controlling detail drawings and show overall dimensions and locations on reactor vessel.

12.2.1.6. Drawings to be Certified - Outline, assembly and detail drawings for design coordination shall, upon completion of the design, be certified to be correct with no further changes required. No alterations may be made to the design after certification without the approval of the Buyer.

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12.2.1.7. As-Built Drawings - Prior to shipment of the reactor vessel, the Seller shall provide an outline drawing with the previously designated actual measured significant dimensions. The accuracy of as-built measurements shall be at least 25 percent of the tolerance of the dimensions measure. If the final construction differs from the previously submitted assembly and detail drawings, corrected drawings shall be provided by the Seller.

12.2.2. Instruction Manuals.

12.2.2.1. Instruction manuals shall present the following basic categories of information in a practical, complete and comprehensive manner, prepared for use by operating and/or maintenance personnel:

a. Instructions for making up the head closure seal for:
   1. Normal operation and,
   2. Hydrostatic tests

b. Instructions for opening up the head closure

c. Instructions for operation, maintenance and repair of all tools provided

d. Recommended maximum heating and cooling rates with maximum allowable temperature differences between the various thermocouple locations.

e. Recommended inspection points and period of inspection

f. Ordering instructions for all replaceable parts, gaskets, etc.

12.2.2.2. The information shall be organized in a logical and orderly sequence. A general description of the equipment including significant technical characteristics shall be included to familiarize operating and maintenance personnel with the equipment.

12.2.2.3. Necessary drawings and/or other illustrations shall be included or copies of appropriate certified drawings may be bound into the manual. Test, adjustment and calibration information, as appropriate, shall be specified and identified to the specific equipment. Safety and other warning notices and installation, maintenance and operating cautions shall be emphasized.

12.2.2.4. A parts list shall be included showing part nomenclature, manufacturer's part number and/or other information necessary for accurate identification and ordering of replacement parts. Common hardware items or other parts to be locally procured shall be adequately identified by Technical description.

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12.2.2.5. Instructions and parts list shall be clearly legible and prepared on good quality paper; carbon copies and tissue copies of other flimsy material are not acceptable. Multiple page instructions shall be securely bound.

12.2.2.6. In a standard manual is furnished covering more than the specific equipment purchased, the applicable model (or other identification) parts and other information for the specific equipment purchased shall be clearly identified.

12.2.3. Photographs. The Seller shall provide the Buyer with sets of progress photographs of the vessel at each significant stage of fabrication. One set shall consist of one negative and three glossy 8" x 10" prints.

12.2.4. Engineering schedule

12.2.5. Fabrication schedule

12.3. Records

The Seller shall maintain records of all material qualifications, all weld and weldor qualifications and all process qualifications required by this specification and the material specifications. In addition, the Seller shall maintain records of all tests and inspections (e.g., ultrasonic, radiography and hydrostatic). A list of the records shall be submitted to the Buyer on completion of the job. The Buyer shall be able to obtain certified copies of such records for a five year period. Where the Seller considers the actual test records to be proprietary, he shall submit certified reports containing all pertinent test data excerpted from the actual test reports. These certified test reports shall also be available for a 5 year period. At the end of the 5 year period, both the vessel user and the Buyer shall be notified at least 120 days prior to disposal of the records, so that a request can be made (if either the vessel user or the Buyer so desires) to have these records sent to either the vessel user or the Buyer.

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TITLE
ATTACHMENT B - MATERIAL TESTS AND TEST SPECIMENS

1. SCOPE

The Seller shall retain selected portions of the material used to fabricate the reactor vessel of this contract. He shall process some of this material into finished mechanical specimens which shall be in metallurgical conditions representative of the following as-fabricated reactor vessel material: Base-plate, welds and heat-affected zone. The Seller shall test some of these specimens for "Fabrication Tests" to determine the effect of thickness on the mechanical properties of the material. The remainder of the specimens and the remainder of the selected test material shall be prepared for shipment. These latter specimens will be used for "Surveillance Tests" to monitor the effect of neutron irradiation on the mechanical properties of the reactor vessel steel.

2. FABRICATION TEST PROGRAM (DELETE)

3. SURVEILLANCE TEST PROGRAM

3.1. Base Metal - Figure 1

3.1.1. The Seller shall furnish two plates, as shown in Figure 1, from the plate used to make the reactor vessel in the reactor core region, or from a similar plate from the same heat.

3.1.2. The Seller shall heat treat these plates with the reactor vessel, or in similar fashion, to insure that they represent the metallurgical condition of the vessel steel, in the core region of the completed reactor vessel including all post weld heat treat cycles seen by that region.

3.1.3. The Seller shall furnish documents to the Buyer, showing the location of the test plates and detailing all metallurgical data concerning the test plates.

3.1.4. The Seller shall make mechanical test specimens, as outlined below, from one of these plates and send the other to the Buyer.

3.2. Welded Plate - Figure 2

3.2.1. The Seller shall furnish a welded plate representative of a reactor vessel longitudinal weld, in the base of reactor vessels formed from plate or representative of a reactor vessel girth weld in the case of reactor vessels formed from forged rings, as shown in Figure 2, from the plate used to make the reactor vessel in the reactor core region, or from a similar plate from the same heat.

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3.2.2. The Seller shall heat treat the plate with the reactor vessel, or in similar fashion, to insure that it and the weld represent the metallurgical condition of a vessel weld, in the core region of the completed reactor vessel including all post weld heat treatment cycles seen by that weld.

3.2.3. The Seller shall furnish documents to the Buyer showing the location of the test plates, detailing all metallurgical data and demonstrating that the weld was made in a manner similar to a reactor vessel weld. X-rays of the weld shall be furnished.

3.2.4. The Seller shall make mechanical test specimens, as outlined below, from half of the plate and shall supply the other half to the Buyer.

3.3. Surveillance Specimen Fabrication

3.3.1. The Seller shall provide a detailed plan of specimen preparation for the Buyer's approval prior to the start of any work required by this attachment. The Buyer can furnish a plan which the Seller may use as a guide. He shall be specific in indicating how the notch location of the Heat-Affected Zone Charpy specimens will be determined.

3.3.2. All specimen cutting shall be done by machining.

3.3.3. Specimen marking and mark orientation are of upmost importance. Each specimen shall be marked serially with the FAB Code series provided.

3.3.4. The Seller shall apply rust preventative to all specimens, shall arrange them in serial groups of like materials, and shall wrap them to prevent mechanical damage.

3.3.5. The Seller shall provide drawings showing all specimen locations with respect to the plate.

3.4. Preparation of Base Metal Charpy Test Specimens (Refer to Figure 3 and Drawing 117B1549)

The Seller shall prepare 53 standard Charpy V-Notch impact specimens (ASTM E23, Type A, G.E. Drawing 117B1549) from the base plate material described in previous paragraphs. The specimens shall be taken from 1/4 thickness positions in the plate and at least 1T from any asquenched edge. The long axes of the specimens shall be parallel to the plate rolling direction, or principal forging direction. The specimen notches shall be perpendicular to the original plate surface and shall be controlled by the orientation of the end marking on the specimen blanks.

3.5. Presparation of Base Metal Tensile Specimens (Refer to Figure 3 and G.E. Drawing 117B1550)

The Seller shall prepare 14 1/4-inch gage diameter tensile specimens as per G.E. Drawing 117B1550, from the base plate material previously described. The specimens shall be taken from 1/4 thickness positions in the plate and at least 1T from any as-quenched edge. The long axes of the specimens shall be parallel to the plate rolling direction or principal forging direction.

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3.6. Preparation of Weld Charpy Specimens (Refer to Figure 4 and G.E. Drawing 117B1549)

The Seller shall prepare 53 Charpy impact specimens, per G.E. Drawing 117B1549 and Figure 4, from the weld deposit material of the furnished plate. The long axes of the specimens shall be perpendicular to the weld direction and parallel to the plate surface, with the middle of the specimen at the mid-plane of the weld, as shown in Figure 4. The specimen location in the stock material shall be recorded, approximately, by the numbering system. The notch shall be parallel to the plate surface and its orientation shall be controlled by the orientation of the marking symbols.

3.7. Preparation of Weld Tensile Specimens (Refer to Figure 5 and G.E. Drawing 117B1550)

The Seller shall prepare 13 tensile specimens, per G.E. Drawing 117B1550 from the weld deposit material of the furnished plate. The long axes of the specimens shall be parallel to the length of the weld and parallel to the top surface of the plate (See Figure 5). The gage length of the specimens shall be of weld-deposit metal only. The treaded ends of the specimens may include Heat-Affected Zone or base metal. The approximate location of the specimens in the stock material shall be recorded by the marking system.

3.8. Preparation of Heat-Affected Zone Tensile Specimens (Refer to Figure 6 and G.E. Drawing 117B1550)

The Seller shall prepare 13 tensile specimens, per G.E. Drawing 117B1550, from the welded material of the furnished plate. The long axes of the specimens shall be perpendicular to the length of the weld and parallel to the top surface of the plate (See Figure 6). The center of the specimen shall be in the Heat-Affected Zone adjacent to the edge of the weld metal. The approximate location of the specimens in the stock material shall be recorded by the marking system.

3.9. Preparation of Heat-Affected Zone Charpy Specimens (Refer to Figure 7 and G.E. Drawing 117B1549)

The Seller shall prepare 53 Charpy specimens, per G.E. Drawing 117B1549, from the welded material of the furnished plate. The long axes of the specimens shall be perpendicular to the length of the weld and parallel to the top surface of the plate (See Figure 7). The radius of the notch of the specimen shall be at one outer edge of the weld. The axis of the notch shall be parallel to the original plate surface. The notch orientation shall be controlled by the marking orientation. The location of the specimen in the stock material shall be recorded, approximately, by the marking system.

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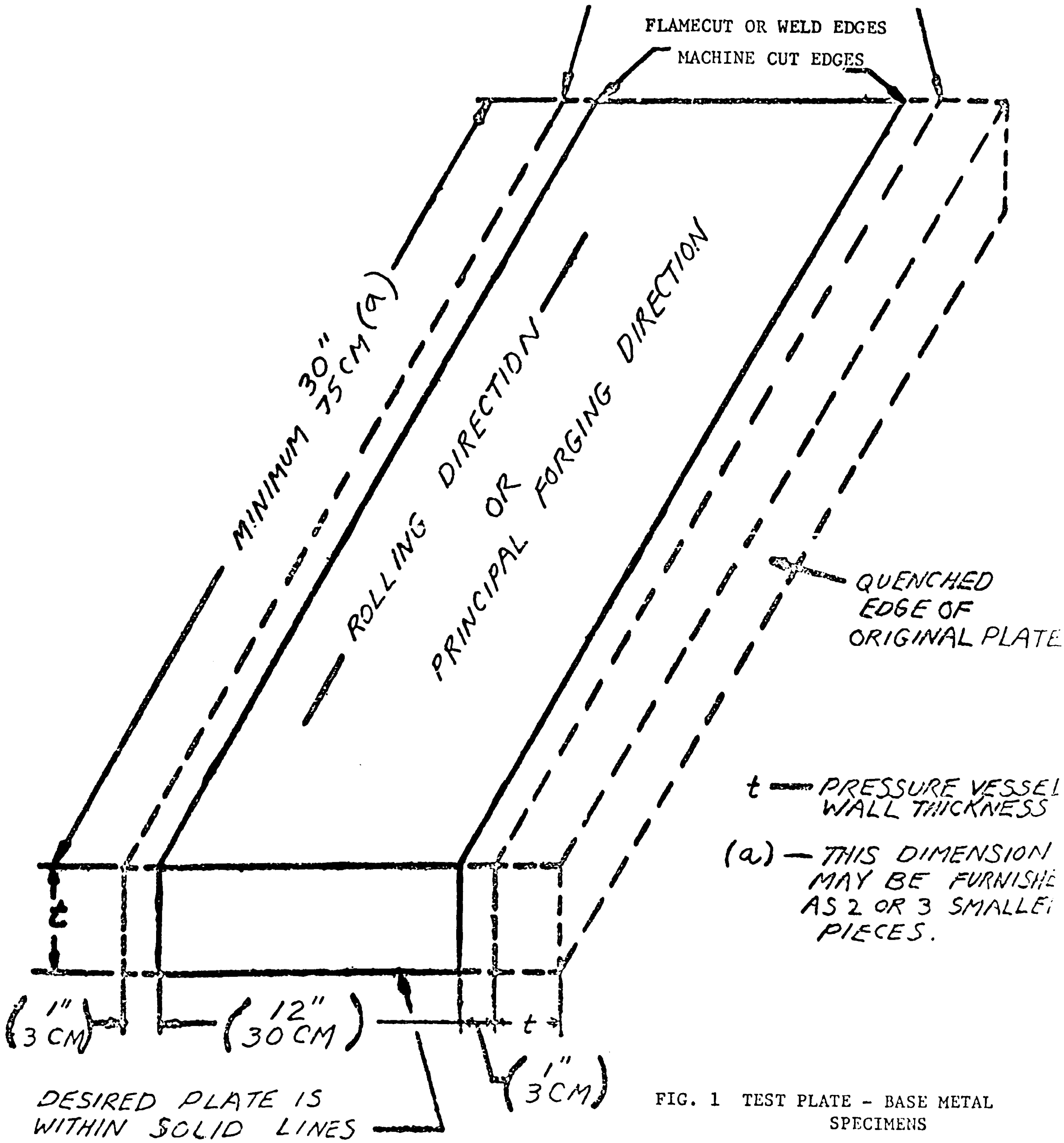

FIG. 1 TEST PLATE - BASE METAL SPECIMENS

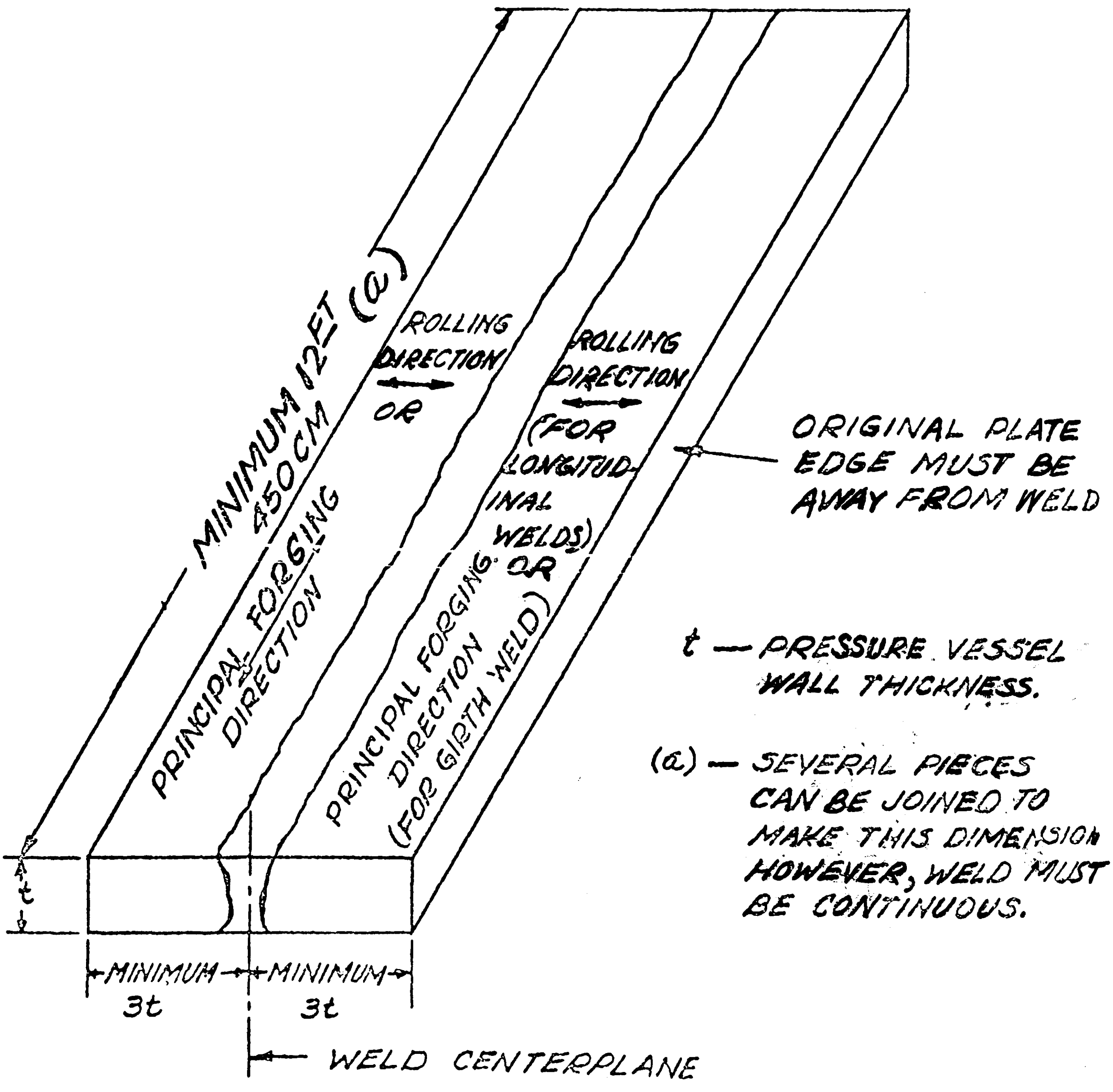

FIG. 2, TEST WELD FOR WELD & HEAT AFFECTED ZONE SPECIMEN

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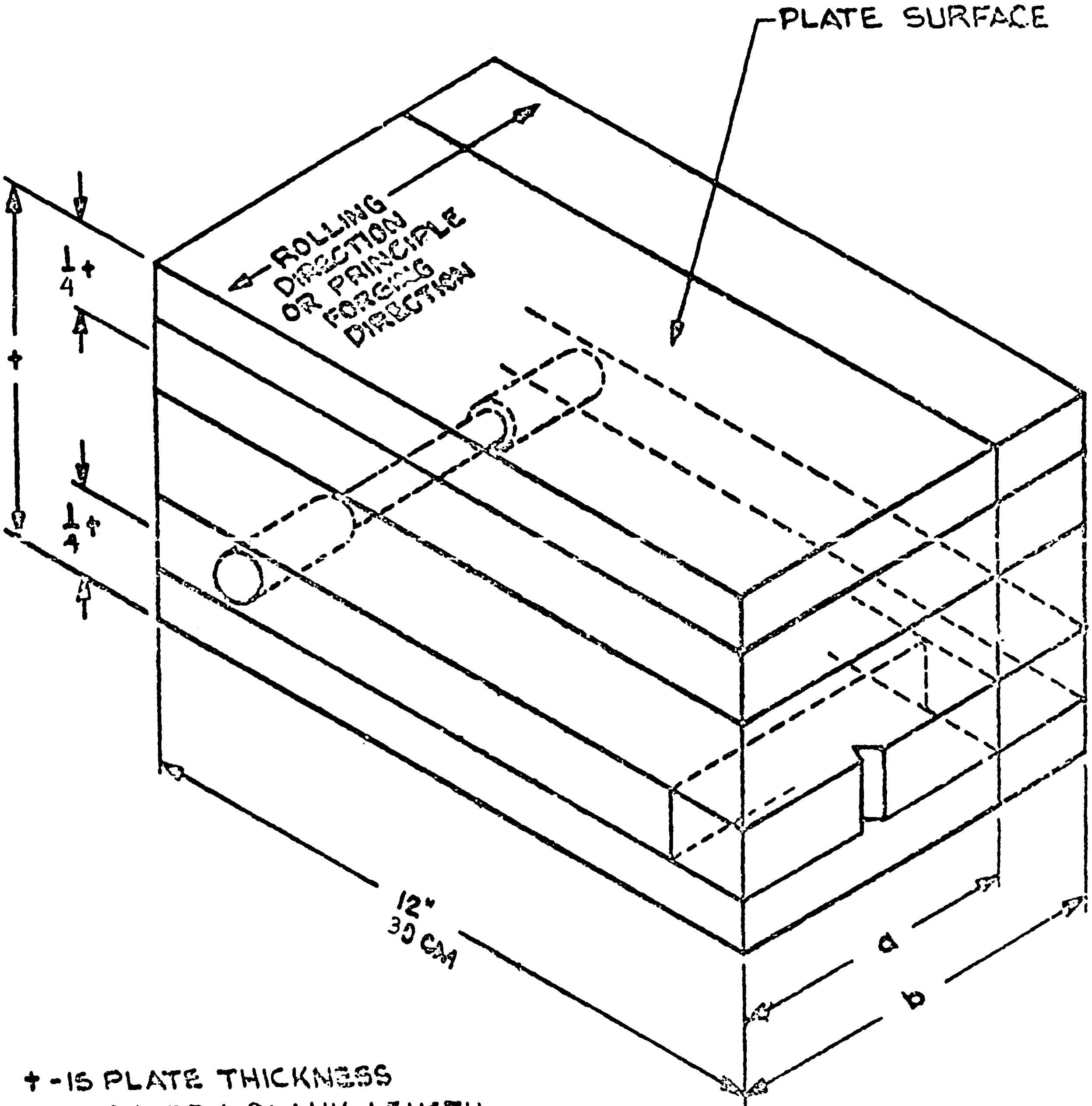

t - IS PLATE THICKNESS
a - IS CHARPY BLANK LENGTH
b - IS TENSILE BLANK LENGTH

FIG. 3 BASE METAL CHARPY & ENSILE SPECIMEN LOCATION

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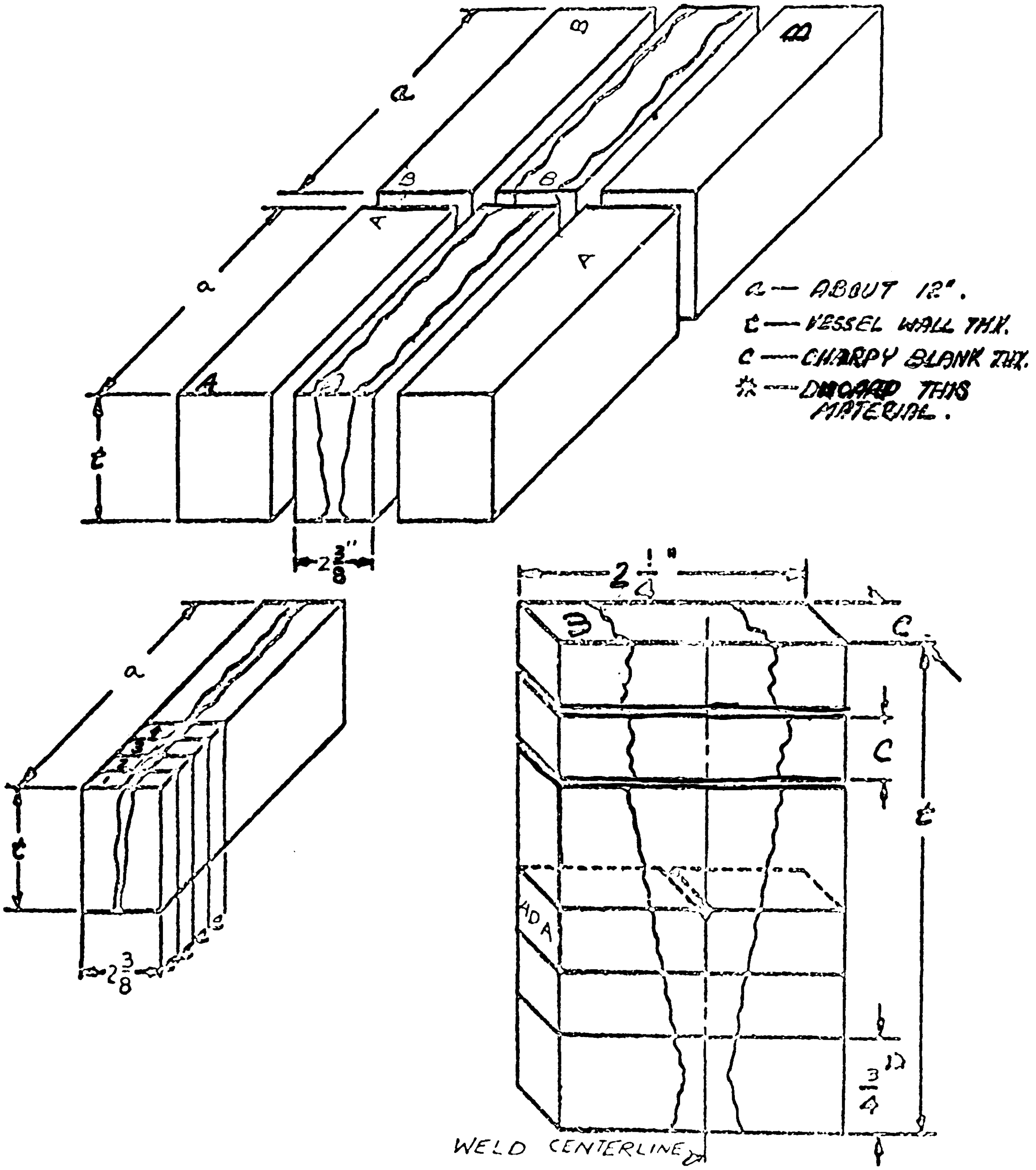

FIGURE 4 WELD CHARPY

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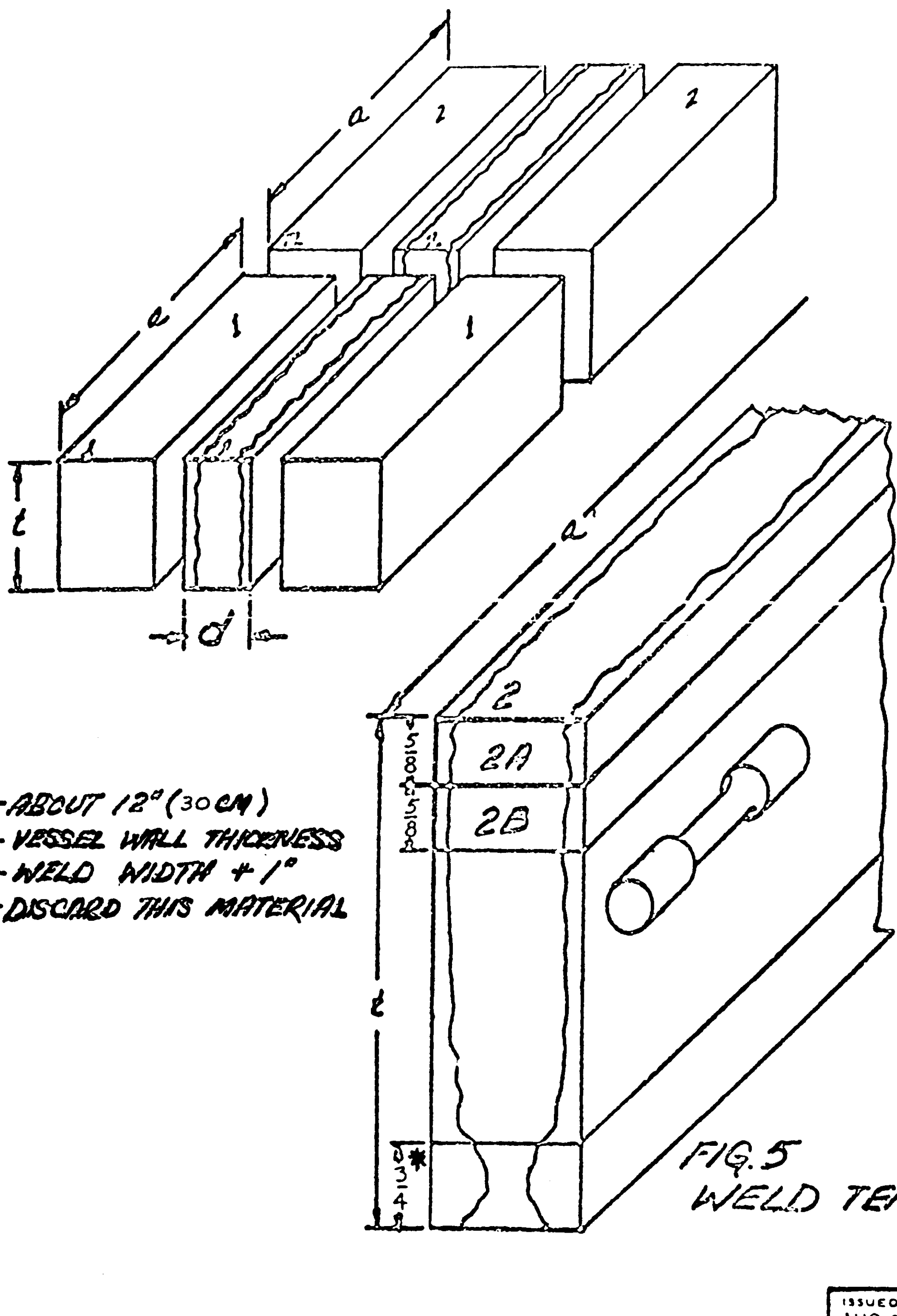

a — ABOUT 12" (30 CM)
t — VESSEL WALL THICKNESS
d — WELD WIDTH + 1"
* — DISCARD THIS MATERIAL

FIG. 5
WELD TENSILE

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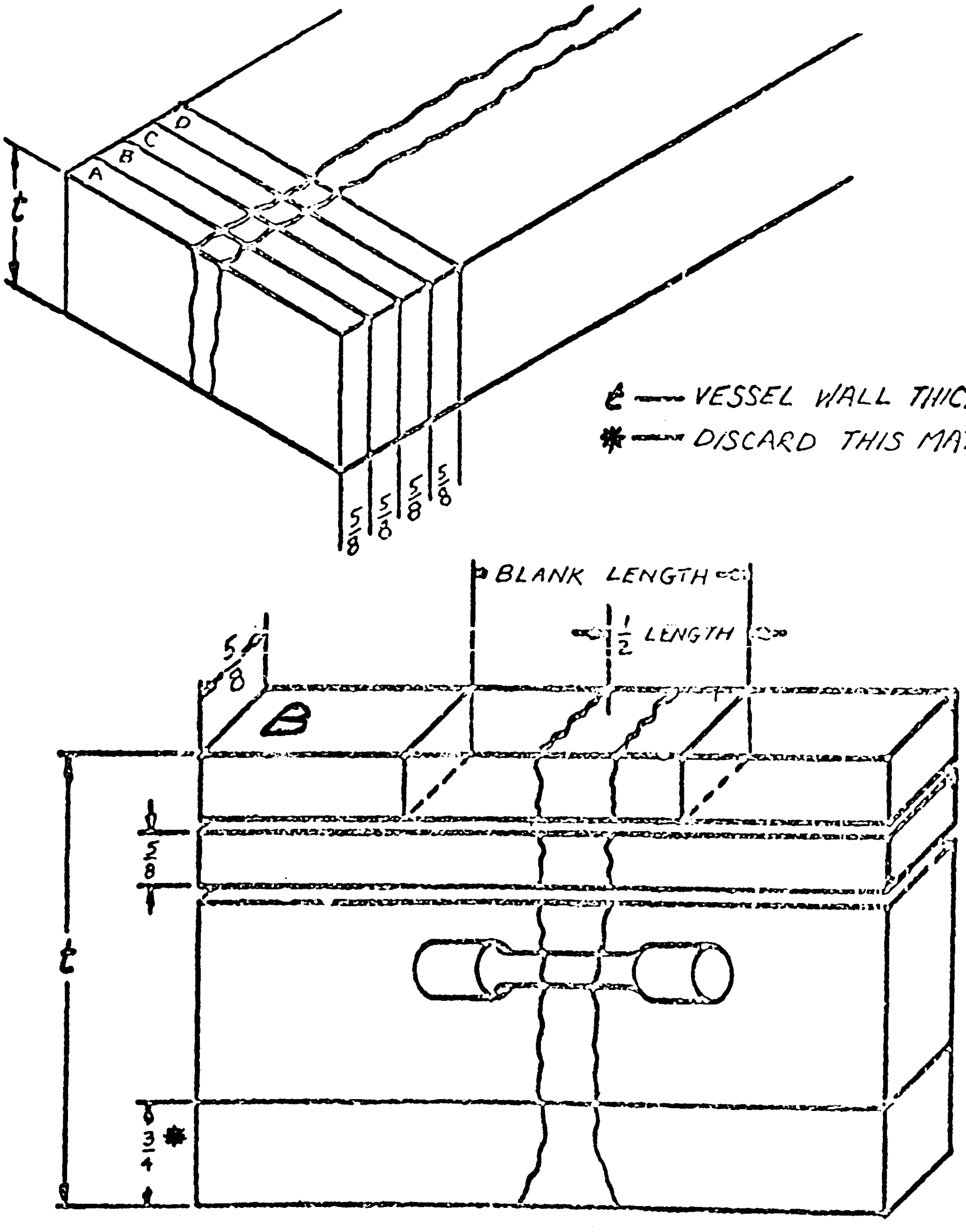

FIG. 6 HEAT AFFECTED ZONE TENSILE

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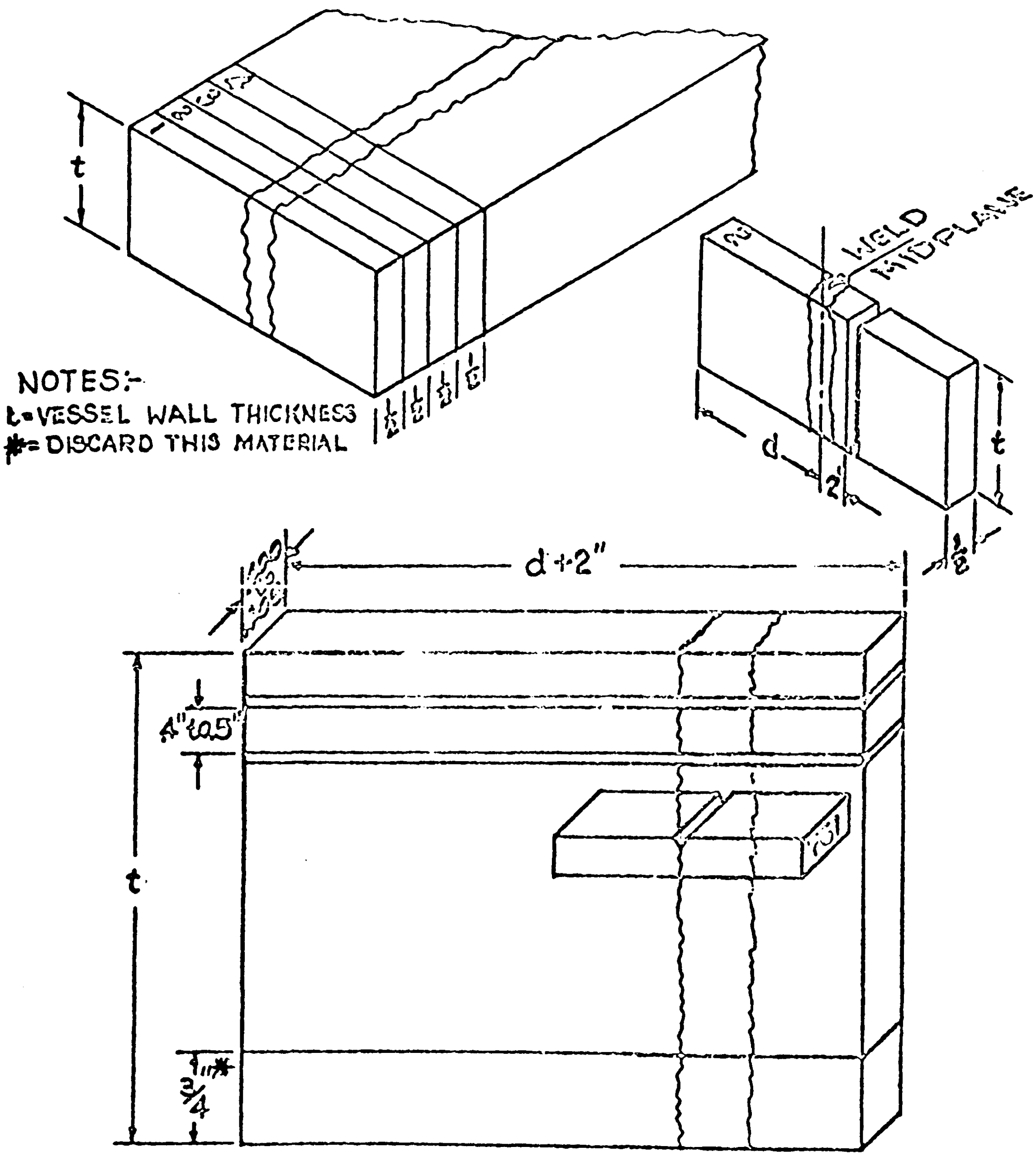

FIG. 7 *HEAT AFFECTED ZONE CHARPY*

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22 October 1970

Project:	TVA 1 & 2	Project:	TVA 3	Project:	PB 2 & 3
Contract:	610-0127	Contract:	610-0145	Contract:	610-0139
P. O:	205-55577	P. O:	205-H0397	P. O:	205-B1156
Date:	10/23/70				

CLARIFICATIONS OF SPECIFICATION 21A1111, REVISION 9

8.7.1 Tempering at 1175°F meets the intent of the specification provided the post weld heat treatment maximum temperatures do not exceed 1150°F.

9.3.1 The provisions for preheat and maintenance of preheat in B&W Specification #WS-129, Rev. 4, dated 3/31/69, are acceptable alternate requirements.

10.5.3.1 The V-notch calibration standard described in B&W Specification #UT-82, Rev. 0, dated 4/19/67, is an acceptable alternate standard to the square bottomed notch.

10.6.2 The acceptance standard of B&W Specification #S-102C, Rev. 5, Paragraph 8.2.2 - All rounded indications with dimensions greater than 3/16 inch, is an acceptable alternate standard to spot indications which are indicative of defects greater than 1/32 inch deep as revealed by bleed-out.

10.6.3.2 The 0.006 inch deep calibration groove described in B&W Specification #UT-68, Rev. 0, dated 4/19/67, is an acceptable alternate standard when used for testing Nickel-Chromium-Iron clad flange seal surfaces.

10.6.6.1 The following alternate acceptance standard may be applied to the openings for partial penetration nozzles not required to be examined by Paragraph N-513 of the Section III Code: Cracks and linear indications which are non-laminar shall be repaired.

(B&W) J. W. Marshall, Jr. — 10-23-70 Date

(GE) K. S. Bennett — 10/23/70 Date

G. R. Hanson — 10/23/70 Date

J. A. Clem — 10/23/70

G. T. Haugland — 10/23/70

GENERAL ELECTRIC
COMPANY

175 CURTNER AVE., SAN JOSE, CALIF. 95125 . . . AREA CODE 408, TEL. 297-3000
TWX NO. 910-338-0116

NUCLEAR ENERGY
DIVISION

ATOMIC POWER EQUIPMENT DEPARTMENT

August 6, 1970

TO WHOM IT MAY CONCERN:

This letter of certification lists the specification and drawings which comprise the Design Specification for the reactor pressure vessels for Units 2 & 3 of the Philadelphia Electric Company's Peach Bottom Atomic Power Station as required by Paragraph N-141 of the ASME Boiler and Pressure Vessel Code, Section III, Nuclear Vessels. The specification and drawings are:

21A1111, Rev. 9 - Reactor Pressure Vessel

886D499 - Reactor Vessel Purchased Part

Sheet No.	Rev. No.	Sheet No.	Rev. No.
1	11	5	3
2	8	6	4
3	3	7	6
4	6	8	0

729E762, Rev. 0 - Reactor Thermal Cycles

135B9990 - Nozzle Thermal Cycles

Sheet No.	Rev. No.	Sheet No.	Rev. No.
1	1	5	0
2	0	6	0
3	0	7	0
4	0	8	0

885D911, Rev. 2 - Vessel Flange Bolting

107C5305, Rev. 2 - Nozzle End Preparation

GENERAL ELECTRIC

This certification is issued in order that design and fabrication of the reactor pressure vessels identified by General Electric Company Purchase Orders No. 205-B1156, No. 205-H4641 and No. 205-H4642, may proceed in accordance with the requirements of Section III of the ASME B&PV Code. The certification is issued solely for the purpose of complying with the requirements of Paragraph N-141 of Section III and is not to be construed as involving, modifying, or changing contractual relations or legal liabilities.

The Design Specification is certified to be in compliance with the requirements of Paragraph N-141 of Section III of the ASME B&PV Code and is correct and complete with respect to functions and operating conditions in accordance with Section III, 1965 Edition with addenda to and including Winter 1965 Addenda.

REGISTERED PROFESSIONAL ENGINEER
R. L. CALL
No. 13540
8-6-70
MECHANICAL
STATE OF CALIFORNIA

CERTIFIED BY: R L Call
Registered Professional Engineer

DATE: August 6, 1970

STATE: California BRANCH: Mechanical NO: 13540

RLC/jf