ATTACHMENT 8

GENE SPECIFICATION 25A5719, REVISION 0
FABRICATION OF SHROUD STABILIZER
FABRICATION SPECIFICATION
HATCH UNIT 2
JUNE 1995

GE Nuclear Energy

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PRINTS TO

MADE BY MAY 30, 1995 M. R. SCHRAG	APPROVALS 6.9.95 M. R. SCHRAG	GENERAL ELECTRIC COMPANY 175 CURTNER AVENUE SAN JOSE CALIFORNIA 95125
CHKD BY: JUN 1, 1995 J. L. TROVATO	ISSUED JUN 09 1995 R. J. AHMANN	CONT ON SHEET 2

1. SCOPE

1.1 This specification defines the requirements for fabrication of the shroud stabilizer hardware. These requirements apply as described herein to wrought austenitic stainless steels, types 304, 304L, 316, 316L, XM-19 and Ni-Cr-Fe alloy X-750 materials.

1.2 Definitions

Buyer - General Electric Nuclear Energy (GENE)

Fabricator - The supplier authorized by GENE to perform fabrication services for the hardware items comprising the shroud stabilizers.

2. APPLICABLE DOCUMENTS

2.1 GE Nuclear Energy Documents. The following documents form a part of this specification to the extent specified herein. In case of any conflict between this document and any of the following, the requirements of this document shall govern.

a.	P50YP102	Arc Welding of Austenitic Stainless Steels
b.	P50YP211	Cleaning and Cleanliness Control of Reactor System Components
c.	E50YP20	Determination of Carbide Participation in Wrought Austenitic Stainless Steels
d.	E50YP11	Examination for Intergranular Surface Attack
e.	E50YP22	Liquid Penetrant Examination
f.	Y1010A3	Shop Applied Practices
g.	P10JYP2	Age Hardening of Ni-Cr-Fe Alloy X-750
h.	E50YP13	Sensitization Tests for Austnitic Stainless Steel Modified ASTM A-262 Practice E
i.	P16BYP3	(Rev. 6) Chromium Alloy Coating "Electrolyzing"

2.2 Codes and Standards. The following codes and standards (issue in effect at the date of the purchase order, or as specified in this specification or its supporting documents) form a part of this specification to the extent specified herein.

2.2.1 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code

a. Section III, Subsection NG, Core Support Structure, 1989 Edition

b. deleted

2.2.2 American Welding Society (AWS) Standards

a. AWS-A2.4, Symbols for Welding and Nondestructive Testing

b. AWS-A3.0, Terms and Definitions

2.2.3 American Society for Testing and Materials (ASTM) (Year 1986 or later)

a. ASTM A-370, Specification for Mechanical Testing of Steel Products

b. ASTM A-182, Specification for Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service

c. ASTM A-240, Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels

d. ASTM A-479, Specification for Stainless and Heat-Resisting Steel Wire, Bars, and Shapes for Use in Boilers and Other Pressure Vessels

e. ASTM B-637, Specification for Precipitation Hardening Nickel Alloy Bars, Forgings, and Forging Stock for High-Temperature Service

f. ASTM A-262, Detecting Susceptibility to Intergranular Attack in Stainless Steel

g. ASTM A-336, Specification for Steel Forgings, Alloy, For Pressure and High-Temperature Parts

h. ASTM A751, Test Methods, Practices and Terminology for Chemical Analysis of Steel Products

i. ASTM E-8, Test Methods for Tension Testing of Metallic Materials

j. ASTM E-353, Test Methods for Chemical Analysis of Stainless, Heat-Resisting, Maraging and Other Similar Chromium-Nickel-Iron Alloys

2.2.4 US Federal Register Code of Federal Regulations (CFR)

a. 10 CFR 50 - Title 10, Energy; Chapter 1, Nuclear Regulatory Commission; Part 50, Licensing of Production and Utilization Facilities, Appendix B, Quality Assurance Criteria for Nuclear Power Plants.

b. 10 CFR 21, Reporting of Defects and Noncompliance

3. REQUIREMENTS

3.1 General. This specification is for use in conjunction with detail product drawings which define the requirements for each part of the shroud stabilizers. It is intended that all parts will be fabricated without welding.

3.2 Materials. Parts shall be fabricated from materials specified on the detail product drawings and the additional requirements of this specification. The material for each completed part shall be traceable to its certified material test report (CMTR). Physical and chemical overcheck tests are required for each heat number of material in accordance with: ASTM A-370, ASTM A-751, ASTM E-8 and ASTM E-353 as determined by the procurement QCE. Yield strength and ultimate tensile strength testing is to be performed at both 70°F and 550°F for all X-750 material, and for the XM-19 tie rod material.

3.2.1 X-750 Material. Nickel-chrome-iron (Ni-Cr-Fe) alloy X-750 shall be in accordance with ASTM B-637, UNS N07750, Modified Type 3 as amended by the requirements specified below.

3.2.1.1 X-750 Maximum Cobalt. The maximum cobalt content of Ni-Cr-Fe alloy X-750 material shall be 0.090 percent.

3.2.1.2 X-750 Hot Forming. Ni-Cr-Fe alloy X-750 shall be hot formed in accordance with a buyer approved fabricator's procedure.

3.2.1.3 X-750 Heat Treatment. Ni-Cr-Fe alloy X-750 shall be annealed at 1975 ± 25°F (metal temperature) and forced air cooled after hot forming operations. The center of the cross-section shall be held at this temperature for 60 to 70 minutes. Equalizing heat treatment at 1500 to 1800°F is prohibited. Product forms with cross section dimensions less than six inches by six inches may be water quenched after annealing as a vendor option, and with buyer approval. Material mechanical tests shall be performed at both 70°F and 550°F, on specimens which have been annealed and age hardened.

3.2.1.4 X-750 IGA Testing. Intergranular attack (IGA) testing per E50YP11 shall be performed, except if a minimum of 0.030 inch of material is removed from all surfaces, or it can be verified that no acid pickling procedures were used, then IGA testing is not required. IGA examination is not required after age hardening.

3.2.1.5 X-750 Age Hardening. Ni-Cr-Fe alloy X-750 shall be age hardened at 1300 ± 15°F for 20 hour minimum (21 hours maximum) and air cooled in accordance with P10JYP2D, and a buyer approved procedure. Age hardening may be performed before or after machining as long as the final part meets all dimensional requirements.

3.2.1.6 X-750 Mechanical Properties. The minimum yield strength for all X-750 material at 550 °F shall be 92.0 ksi. The minimum ultimate tensile strength for all X-750 material at 550°F shall be 142.5 ksi. Required 70 °F properties are in accordance with ASTM B-637, UNS N07750, Type 3.

3.2.2 Austenitic 300 SST. Austenitic 300 series stainless steel shall be in accordance with ASTM A-479, A-182, A-336 or A-240 type 304, 304L, 316 or 316L with a maximum carbon content of 0.020 percent. The type and applicable ASTM specification shall be as specified on the specific part drawing. The additional requirements below also apply.

3.2.2.1 Austenitic 300 SST Heat Treatment. Austenitic 300 series stainless steel shall be solution annealed at 2000 ± 100°F (metal temperature) for a minimum of 15 minutes per inch of thickness, but not less than 15 minutes total, immediately followed by quenching in circulating water or other buyer approved medium to a temperature below 400°F. The solution anneal shall be performed after completion of final reduction, sizing, and forming operations.

3.2.2.2 Austenitic 300 SST Sensitization. Austenitic 300 series stainless steel shall be tested and shall pass one or more of the following metallographic tests after solution heat treatment: ASTM A-262 Practice A, ASTM A-262 Practice E, E50YP13, or E50YP20. Samples from the stainless steel shall first be artificially sensitized by heating to 1250 ± 25°F for 15 to 20 minutes (types 304/304L) or 1 to 1-1/4 hours (types 316/316L) and air cooled before testing.

3.2.2.3 Alternatives to Water Quenching. In cases where substitute cooling methods are desired, or where the material is delivered without complete records as to heating temperature, holding time, cooling method, or finish temperature, the results of the sensitization testing of paragraph 3.2.2.2 shall be accepted as proof that the solution heat treatment, no matter how accomplished, is or was adequate.

3.2.2.4 Austenitic 300 SST IGA Testing. Intergranular attack (IGA) testing per E50YP11 shall also be performed, for each heat and heat treatment lot, except if a minimum of 0.030 inch of material is removed from all surfaces after solution heat treatment, then IGA testing is not required.

3.2.2.5 Austenitic 300 SST Hardness. The maximum hardness of austenitic 300 series stainless steel, material and completed parts, shall be R_B 90 for type 304, R_B 88 for type 304L and R_B 92 for types 316 or 316L.

3.2.2.6 Welding. Welding for fabrication, or for material repair, is prohibited.

3.2.3 XM-19 Stainless Steel. Type XM-19 stainless steel shall be in accordance with ASTM A-479, A-182, or A-240. The maximum carbon content is limited to 0.040 percent. The applicable ASTM specification shall be as specified on the specific piece part drawing. The additional requirements below also apply.

3.2.3.1 XM-19 SST Heat Treatment. XM-19 stainless steel shall be solution annealed at 1950°F to 1975°F (metal temperature) for 15 to 20 minutes for each inch of thickness, but not less than 15 minutes regardless of thickness. The material shall be quenched in circulating water to a temperature below 800°F. As a vendor option to avoid distortion, the XM-19 tie rods may be air cooled so that the metal temperature is below 800°F within 20 minutes of removal from the furnace. Successful completion of the sensitization testing of paragraph 3.2.3.2 shall be accepted as evidence of the correct solution heat treatment, if time and temperature charts are not available. Material mechanical tests shall be performed at both 70°F and 550°F, on specimens which have been annealed, for tie rod material.

3.2.3.2 XM-19 SST Sensitization. Each heat and heat treatment lot of XM-19 material shall be tested for sensitization in accordance with the requirements of ASTM A-262 Practice E.

3.2.3.3 XM-19 SST IGA Testing. Intergranular attack (IGA) examination shall be performed for each heat and heat treatment lot in accordance with the requirements of E50YP11. IGA examination is not required if a minimum of 0.030 inch of material is removed from all surfaces of the product form after final heat treatment.

3.2.3.4 XM-19 SST Hardness. The maximum hardness of XM-19 stainless steel material and completed parts shall be R_B 100.

3.2.3.5 XM-19 SST Welding. Welding, for any reason, is prohibited.

3.3 Cutting, Forming, and Cleaning

3.3.1 Mechanical Cutting Methods. Methods such as machining, grinding (see also paragraph 3.6) and sawing are acceptable. Methods such as shearing or punching that form a hardened layer on the metal surface shall not be used, except where the cold-worked material is subsequently and completely removed by machining, grinding, or solution heat treatment.

3.3.2 Thermal Cutting Methods. Plasma arc cutting may be used with the following restrictions: Interpass temperature control shall be in accordance with P50YP102 for stainless steels. If a minimum of 0.12 in of the cut surface is subsequently removed by machining or grinding, the interpass temperature control is not required. Surfaces shall be machined or ground to a bright metal finish following the cutting operation. Preventive measures shall be taken to assure that spatter will not enter areas that are inaccessible to cleaning operations.

3.3.3 Bending and Forming Control for Stainless Steel. There shall be no cold forming, bending, or cold reduction for austenitic stainless steel, unless otherwise specified in the paragraphs below, or the component is subsequently solution heat treated.

3.3.4 Prohibited Processes. Processes such as shot peening, hammering, or power deslagging of final surfaces are prohibited.

3.3.5 Straightening. Straightening or reforming shall be performed in accordance with an approved procedure. Minor straightening authorized by manufacturing criteria are authorized provided deformation is controlled in accordance with paragraph 3.3.6.

3.3.6 Control of Deformation. For parts that are straightened, reformed, or otherwise subjected to deformation as part of the normal fabrication process, the following controls shall be met: (1) Hardness of any wrought stainless steel in the final fabricated condition shall not exceed the hardness requirements of paragraph 3.2.2.5 or 3.2.3.4 as determined by an approved procedure. The buyer approved procedure shall include the specification of locations for hardness testing. If the dimensions of the part permit, the hardness shall be measured with a tester specifically designed to perform Rockwell B measurements. (2) Cold bending strain, after solution annealing, shall be limited to two and one-half percent maximum.

3.3.7 Cleaning and Control of Miscellaneous Process Materials. Miscellaneous process materials include such things as machining lubricants, liquid penetrants, solvents, tapes, ultrasonic testing couplant, abrasive grit, packing materials, marking materials, and other materials which will be in contact with the part being fabricated. The known contaminants of concern are chlorides, fluorides, sulfur, lead, mercury and all metals with low melting points. In addition, when heat treating is involved, all carbonaceous material and phosphates must be considered harmful on stainless steel which can pick up these contaminants. An evaluation of all miscellaneous material is not required provided all machined parts/surfaces are cleaned in accordance with P50YP211 to control contamination.

3.4 Heating Control for Stainless Steel. Austenitic stainless steel shall not be heated above 800 °F except by thermal cutting unless the process will be followed by solution heat treatment.

3.5 Solution Heat Treatment. Solution heat treatment of complete 300 series stainless steel assemblies, if required, shall be performed in accordance with qualified procedures approved by the buyer and meet the following requirements:

a. Parts and any fixtures used in the heat treatment shall be visibly clean prior to heat treatment.

b. Heat up and cool down rates shall be controlled to prevent distortion.

c. Parts shall be heated from 1900°F to 2100°F for not less than 15 minutes.

d. Parts shall be water quench-cooled or gaseous nitrogen quenched from 1900°F to 800°F quickly enough to assure passing the tests required by subparagraph "f" below.

e. All surfaces shall appear reasonably bright and clean after heat treatment.

f. Solution heat treated parts shall be tested by demonstrating with a mockup that the temperature is obtainable at a location in the center thickness, farthest from all heated surfaces or perform at least one (1) sensitization test in accordance with E50YP13 or E50YP20.

g. Perform IGA testing per E50YP11 for each heat of material.

3.6 Control of Grinding. Where possible, grinding shall be performed prior to any solution heat treatment. Grinding should be restricted to instances required by fit-up or nondestructive testing needs. Where practical, machining should be used in place of grinding. Specific exception: the XM-19 tie rods shall be centerless ground after solution heat treatment.

3.7 Repair. Minor surface grinding or machining may be performed to remove surface defects or to change contour provided the following conditions are met:

a. The thickness of the section is not reduced to less than minimum required thickness.

b. The depression or ground area is blended uniformly into the surrounding surface with not less than a 4 to 1 taper.

c. If aggressive grinding was utilized, the final surface shall be polished using successively finer abrasives to 220 grit.

d. After final grinding or machining, the surfaces are examined by liquid penetrant to insure that no unacceptable defects remain.

3.8 Electrolyzing. Electrolyzing, when specified on a fabrication drawing, shall be in accordance with P16BYP3A.

3.9 Final Surfaces. All nicks and scratches in excess of the applicable surface finish criteria are to be removed by blending into the surrounding surface. Surface finishes shall be uniform in appearance.

3.10 Shop Applied Practices. The buyer's specification Y1010A3, Shop Applied Practices, shall be considered an integral part of the fabrication drawings, and be so implemented during fabrication and inspection.

3.11 Identification and Marking. Finished parts shall be marked as specified on the detail product drawings. Low stress interrupted dot stamping is an acceptable method of marking.

Parts which are too small for practical marking may be identified by individual bagging and tagging.

4.0 deleted

5. QUALITY ASSURANCE

5.1 Submittals. Submittal requirements shall apply to the Fabricator and the Fabricator's subcontractors. The Fabricator shall be responsible for all submittals including those of the Fabricator's subcontractors. If any changes are made to the submittals, the Fabricator shall send revisions to the Buyer.

5.1.1 Required Submittals. The following items shall be submitted for approval prior to use:

a. Bending and forming procedures

b. Heat treating procedures

c. deleted

d. Nondestructive examination procedures

e. Packaging procedure

5.2 Material Control. Material shall be controlled within the fabricator's shops under a quality assurance program which has been determined by survey/audit to meet material traceability and safety grade manufacturing practices as required by the Code of Federal Regulations 10 CFR 50, Appendix B, and 10 CFR, Part 21.

5.3 Inspection and Tests. All materials, part final surfaces, and welds (if any) shall be inspected for quality and cleanliness prior to the last operation which results in inaccessibility. Following such inspection, measures shall be taken to prevent the entry of soils into inaccessible areas during subsequent fabrication steps.

5.3.1 Liquid Penetrant Examination. All final part surfaces, except small inaccessible openings, shall be examined by the liquid penetrant method in accordance with E50YP22A, except that no cracking is permissible and linear indications shall not exceed 0.06 inch in length. Liquid penetrant materials shall be in accordance with E50YP22 or buyer approved equivalent. Provision shall be made to avoid the entrapment of liquid penetrant materials in any inaccessible areas.

5.3.2 deleted

5.3.3 Ultrasonic Examination. Material (forgings, bars and plates) shall be ultrasonically examination in accordance with ASME Code Subsection NG, paragraph NG-2540, or a buyer approved equivalent procedure.

5.3.4 NDE Personnel Certification. Certification for personnel performing NDE examinations shall be reviewed as part of the approval of the vendor/fabricator during the vendor qualification audit.

6. PREPARATION FOR SHIPMENT

6.1 General Requirement. Components fabricated to this specification shall be prepared and packaged for shipment in such a manner that the components will not be damaged or lost by handling or environment during transit.

6.2 Procedure. The Fabricator shall package product in accordance with approved procedures.

6.3 Identification. The component(s), when prepared for shipment, shall be identified by the purchase order number and other pertinent information in such a manner that component(s) identity shall be maintained during shipment. When more than one component is included in a crate or package, the marking on the packaging shall indicate both the identity and quantity of parts.