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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Response to U.S. EPR Design Certification Application RAI No. 278, Supplement 13

In Reference 1, the NRC provided a request for additional information (RAI) regarding the U.S. EPR design certification application. Reference 2 provided a schedule for technically correct and complete responses to RAI No. 278. References 3 through 7 provided a revised schedule for technically correct and complete responses to the eight questions. Reference 8 provided technically correct and complete responses to seven of the eight questions (05.02.03-21, 05.02.03-22, 05.02.03-23, 05.03.02-7, 05.03.02-8, 05.03.02-9 and 05.03.02-10). References 9 through 14 provided a revised schedule for a technically correct and complete response to the remaining question (05.02.03-20).

The enclosure provides a technically correct and complete FINAL response to the remaining question. AREVA NP considers some of the material contained in the attached response to be proprietary. As required by 10 CFR 2.390(b), an affidavit is enclosed to support the withholding of the information from public disclosure. Proprietary and non-proprietary versions of the enclosure to the letter are provided.

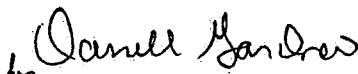
The following table indicates the respective pages in the enclosure that contain AREVA NP's final response to the subject question.

Question #	Start Page	End Page
RAI 278 — 05.02.03-20	2	2

This concludes the formal AREVA NP response to RAI 278, and there are no questions from this RAI for which AREVA NP has not provided responses.

If you have any questions related to this submittal, please contact me by telephone at 434-832-2369 or by e-mail to sandra.sloan@areva.com.

Sincerely,


for Sandra M. Sloan, Manager
New Plants Regulatory Affairs
AREVA NP Inc.

Enclosures

cc: G. Tesfaye
Docket No. 52-020

AREVA INC.
3315 Old Forest Road, P.O. Box 10935, Lynchburg, VA 24506-0935
Tel.: 434 832 3000 www.aveva.com

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NRS

References

- Ref. 1: E-mail, Getachew Tesfaye (NRC) to Leslie E. Duncan (AREVA NP Inc.), "U.S. EPR Design Certification Application RAI No. 278 (3466, 3506), FSAR Ch. 5," September 14, 2009.
- Ref. 2: E-mail, Martin C. Bryan (AREVA NP Inc.) to Getachew Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 278 (3466, 3506), FSAR Ch. 5," February 27, 2010.
- Ref. 3: E-mail, Martin C. Bryan (AREVA NP Inc.) to Getachew Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 278, FSAR Ch. 5, Supplement 1," April 9, 2010.
- Ref. 4: E-mail, Martin C. Bryan (AREVA NP Inc.) to Getachew Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 278, FSAR Ch. 5, Supplement 2," April 30, 2010.
- Ref. 5: E-mail, Martin C. Bryan (AREVA NP Inc.) to Getachew Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 278, FSAR Ch. 5, Supplement 3," May 26, 2010.
- Ref. 6: E-mail, Martin C. Bryan (AREVA NP Inc.) to Getachew Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 278, FSAR Ch. 5, Supplement 4," June 23, 2010.
- Ref. 7: E-mail, Martin C. Bryan (AREVA NP Inc.) to Getachew Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 278, FSAR Ch. 5, Supplement 5," July 27, 2010.
- Ref. 8: E-mail, Martin C. Bryan (AREVA NP Inc.) to Getachew Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 278, FSAR Ch. 5, Supplement 6," August 27, 2010.
- Ref. 9: E-mail, Martin C. Bryan (AREVA NP Inc.) to Getachew Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 278, FSAR Ch. 5, Supplement 7," September 9, 2010.
- Ref. 10: E-mail, Martin C. Bryan (AREVA NP Inc.) to Getachew Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 278, FSAR Ch. 5, Supplement 8," December 15, 2010.
- Ref. 11: E-mail, Martin C. Bryan (AREVA NP Inc.) to Getachew Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 278, FSAR Ch. 5, Supplement 9," January 17, 2011.
- Ref. 12: E-mail, Martin C. Bryan (AREVA NP Inc.) to Getachew Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 278, FSAR Ch. 5, Supplement 10," February 18, 2011.
- Ref. 13: E-mail, Martin C. Bryan (AREVA NP Inc.) to Getachew Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 278, FSAR Ch. 5, Supplement 11," March 23, 2011.

Ref. 14: E-mail, Russell D. Wells (AREVA NP Inc.) to Getachew Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 278, FSAR Ch. 5, Supplement 12," April 19, 2011.

AFFIDAVIT

COMMONWEALTH OF VIRGINIA)
) ss.
COUNTY OF CAMPBELL)

1. My name is Sandra M. Sloan. I am Manager, New Plants Regulatory Affairs for AREVA NP Inc. and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by AREVA NP to determine whether certain AREVA NP information is proprietary. I am familiar with the policies established by AREVA NP to ensure the proper application of these criteria.

3. I am familiar with the AREVA NP information contained in the enclosed Response to Request for Additional Information No. 278, Question 05.02.03-20 and referred to herein as "Document." Information contained in this Document has been classified by AREVA NP as proprietary in accordance with the policies established by AREVA NP for the control and protection of proprietary and confidential information.

4. This Document contains information of a proprietary and confidential nature and is of the type customarily held in confidence by AREVA NP and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in this Document as proprietary and confidential.

5. This Document has been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in this Document be withheld from public disclosure. The request for withholding of proprietary information is made in accordance with 10 CFR 2.390. The information for which withholding from disclosure is

requested qualifies under 10 CFR 2.390(a)(4) "Trade secrets and commercial or financial information".

6. The following criteria are customarily applied by AREVA NP to determine whether information should be classified as proprietary:

- (a) The information reveals details of AREVA NP's research and development plans and programs or their results.
- (b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.
- (c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for AREVA NP.
- (d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for AREVA NP in product optimization or marketability.
- (e) The information is vital to a competitive advantage held by AREVA NP, would be helpful to competitors to AREVA NP, and would likely cause substantial harm to the competitive position of AREVA NP.

The information in the Document is considered proprietary for the reasons set forth in paragraph 6(b,d) above.

7. In accordance with AREVA NP's policies governing the protection and control of information, proprietary information contained in this Document has been made available, on a limited basis, to others outside AREVA NP only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. AREVA NP policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

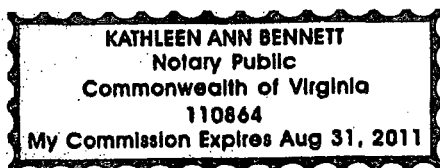
9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.

Sandra M. Sloan

SUBSCRIBED before me this 21st
day of March, 2011.

Kathleen A. Bennett

Kathleen A. Bennett
NOTARY PUBLIC, COMMONWEALTH OF VIRGINIA
MY COMMISSION EXPIRES: 8/31/2011



Response to

Request for Additional Information No. 278, Supplement 13

9/14/2009

U.S. EPR Standard Design Certification

AREVA NP Inc.

Docket No. 52-020

SRP Section: 05.02.03 - Reactor Coolant Pressure Boundary Materials

**SRP Section: 05.03.02 - Pressure-Temperature Limits, Upper-Shelf Energy, and
Pressurized Thermal Shock**

Application Section: FSAR Ch. 5

**QUESTIONS for Component Integrity, Performance, and Testing Branch 1
(AP1000/EPR Projects) (CIB1)**

Question 05.02.03-20:**POTENTIAL OPEN ITEM**

In RAI 05.02.03-18, the staff requested, in part, that the applicant modify Table 5.2-2 to list weld filler metal specifications and classifications used to weld various material types and combinations in the RCPB. The applicant responded, by letter dated April 23, 2009, and stated that weld filler material specifications are listed in U.S. FSAR Section 5.2.3.1 and that no revision to Table 5.2-2 is required. The staff notes that Table 5.2-2 lists weld filler material specifications and classifications for fabrication of the reactor coolant pump, and CRDM but does not provide weld filler material specifications and classifications for fabrication of the RCPB piping, steam generators or pressurizer. The staff requests that the applicant modify Table 5.2-2 to lists the weld filler material specifications and classifications for components listed in Table 5.2-2.

Response to Question 05.02.03-20:

U.S. EPR FSAR Tier 2, Table 5.2-2—Material Specifications for RCPB Components will be revised to include weld filler metal specifications and classifications. This includes material specifications and classifications for ferritic steel, austenitic stainless steel, and nonferrous weld materials. Classifications will be compatible with base material and have appropriate mechanical properties for the intended application. Two new notes (Notes 11 and 12) will also be added to U.S. EPR FSAR Tier 2, Table 5.2-2.

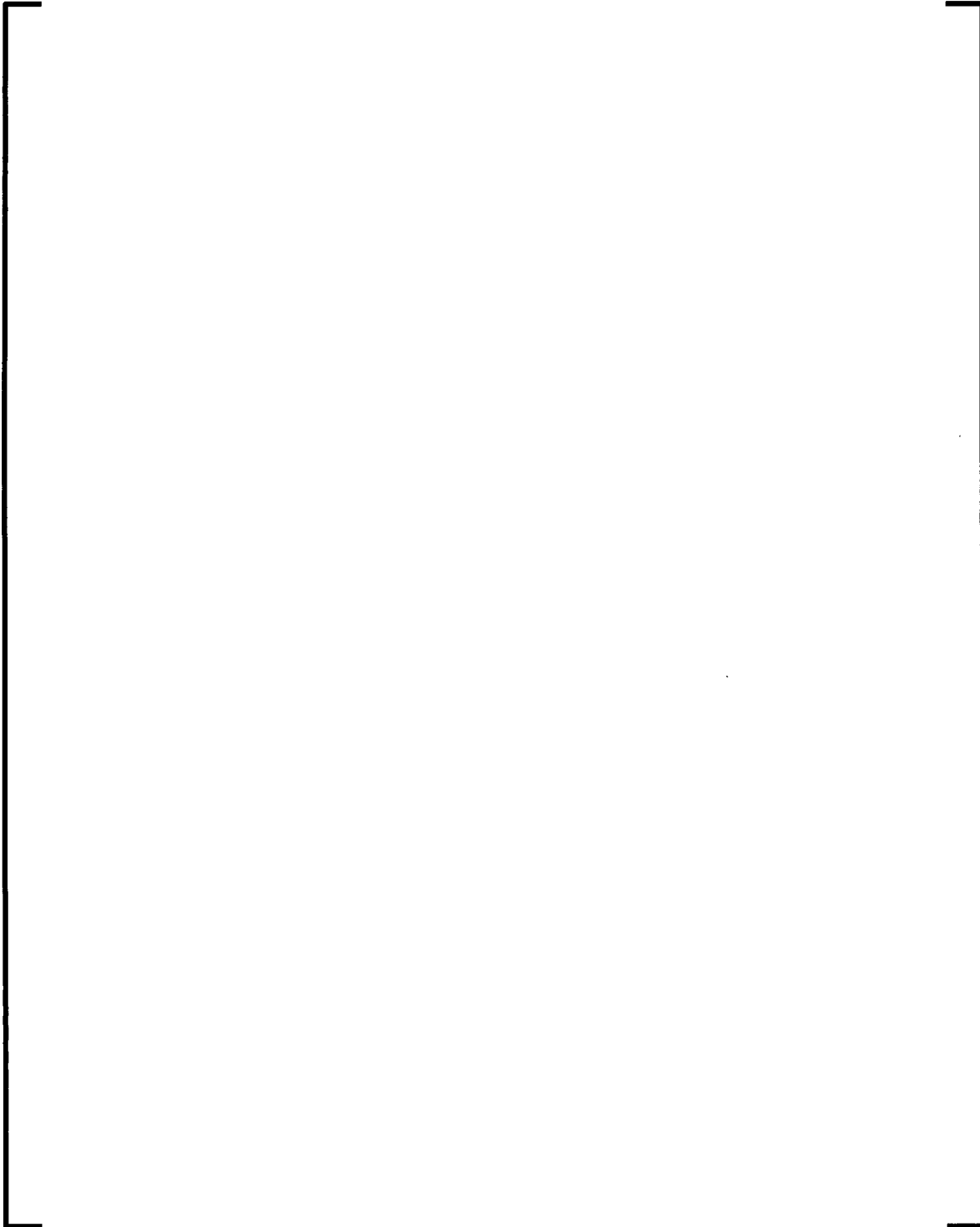
In some instances, "G" classification filler materials may be used based on experience gained from previous use or possible improvements in weldability. In these applications, the welding procedures utilizing these filler materials are qualified to the same requirements of ASME Section III and IX to maintain acceptable properties of the weld. Table 05.02.03-20-1 provides the specific chemical compositions for "G" classification filler materials currently considered for use in the U.S. EPR NSSS components.

U.S. EPR FSAR Tier 2, Section 5.2.3.1 will be revised to reference U.S. EPR FSAR Tier 2, Table 5.2-2 for applicable specifications and classifications, instead of duplicating the information in the text. Also, U.S. EPR FSAR Tier 2, Section 5.2.3.1 will be revised to clarify that carbon and low alloy steel weld filler materials are limited to non-reactor coolant exposed applications.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 5.2.3.1 and Table 5.2-2 will be revised as described in the response and indicated on the enclosed markup.

**Table 05.02.03-20-1—Chemical Compositions for "G" Classification Filler
Materials (Proprietary)**



U.S. EPR Final Safety Analysis Report Markups

RCPB materials are handled, protected, stored, and cleaned according to recognized and accepted methods that are designed to prevent damage or deterioration. Process specifications stipulate the procedures covering these controls in compliance with 10 CFR 50, Appendix B, Criterion XIII.

5.2.3.1 Material Specifications

Table 5.2-2 lists the materials for Class 1 primary components incorporated into the design of the RCPB (excluding the reactor pressure vessel), including grade or type and final metallurgical condition. Table 5.2-2 includes the materials specified for the steam generators, PZR, RCPs, RCPB piping, and control rod drive mechanism. ASME Boiler and Pressure Vessel Code, Section II material specifications are used for materials in the RCPB, including weld materials.

05.02.03-20

~~The weld filler materials used for joining the ferritic-base materials of the RCPB conform to ASME Section II Part C material specifications SFA 5.5, 5.17, 5.18, 5.20, 5.23, 5.28, and 5.29. The including the weld filler materials used for joining the austenitic stainless steel base materials of the RCPB conform to ASME Section II Part C material specifications SFA 5.4, 5.9, and 5.22. The weld filler materials used for joining nickel-chromium-iron (NiFeCr) alloys in similar base material combination and in dissimilar ferritic or austenitic base material combination conform to ASME Section II Part C material specifications SFA 5.11 and 5.14 and classifications listed in Table 5.2-2. Carbon and low alloy steel weld filler materials are limited to non-reactor coolant exposed applications.~~

Low alloy steel pressure boundary forgings have limited sulfur content not exceeding 0.008 wt%, (wt = weight). Clad low alloy steel pressure boundary materials have ASTM grain size 5 or finer.

Austenitic stainless steel base metal conforms to RG 1.44. Austenitic stainless steel base metal and weld metal have limited carbon content not exceeding 0.03 wt%. Austenitic stainless steel base metal and weld filler metal in contact with RCS primary coolant has limited cobalt content not exceeding 0.05 wt%. Austenitic stainless steel base metal in contact with RCS primary coolant has limited sulfur content not exceeding 0.02 wt%. When supplementary chemical analysis is performed which would be more complete than the analysis used to check the content of specific elements, the results will show that the sample contains no more than residual antimony. In addition, the carbon portion of the reactor coolant pump journal bearings will have no antimony.

Austenitic stainless steel welds in RCS piping, including surge line piping, have delta ferrite content limited to a ferrite number (FN) between 5 and 10, measured as determined by ASME Section III, NB-2433. Austenitic stainless steel weld materials for stainless steel welds joints in the balance of the RCPB system have delta content

Table 5.2-2—Material Specifications for RCPB Components
Sheet 1 of 7

Component	Material
RCPB Piping	
Reactor coolant piping & surge line	ASME SA-182 Grade F304 (see Notes 3 & 4) ASME SA-336 Grade F304 (see Notes 3 & 4)
Reactor coolant piping & surge line fittings & nozzles	ASME SA-182 Grade F304 (see Notes 3 & 4) ASME SA-336 Grade F304 (see Notes 3 & 4)
Reactor coolant piping other than loop & surge line	ASME SA-213 Grade TP304L (Seamless) (see Notes 3 & 4) ASME SA-312 Grade TP304L (Seamless) (see Notes 3 & 4) ASME SA-312 Grade TP316LN (Seamless) (see Notes 3 & 4)
Reactor coolant piping fittings & nozzles other than loop & surge line fittings & nozzles	ASME SA-182 Grade F304L (see Note 3) ASME SA-182 Grade F316LN (see Notes 3 & 4) ASME SA-403 Grade WP304L Class S (see Notes 3 & 4) ASME SA-403 Grade WP316LN Class S (see Notes 3 & 4)
Pressure boundary welds <div style="border: 1px solid black; padding: 2px; display: inline-block;">05.02.03-20</div> →	SFA-5.4 SFA-5.9 SFA-5.11 SFA-5.14 SFA-5.22 SFA-5.4 (Note 4): E308-XX, E308L-XX, E309-XX, E309L-XX, E316-XX, E316L-XX SFA-5.9 (Notes 4, 12): ER308, ER309, ER316 SFA-5.9 (Note 12): ER308L, ER309L, ER316L SFA-5.11: ENiCrFe-7 SFA-5.14: ERNiCrFe-7, ERNiCrFe-7A SFA-5.22 (Note 4): E308TX-X, E308LTX-X, E316TX-X, E316LTX-X
Steam Generators	
Pressure boundary forgings (including shells, heads, tubesheet, nozzles, & openings)	ASME SA-508 Grade 3 Class 2 (see Note 1)
Small nozzles	ASME SA-105 (see Note 6)
Secondary nozzle safe ends (except emergency feedwater nozzle safe end)	ASME SA-508 Grade 3 Class 1 (see Note 1)
Emergency feedwater nozzle safe end	ASME SA-403 Grade WP316L (Seamless) (see Notes 3 & 4) ASME SA-182 Grade F316L (see Note 3)
Inlet & outlet nozzle safe ends	ASME SA-182 Grade F316 (see Notes 3 & 4) ASME SA-336 Grade F316 (see Notes 3 & 4)
Tubes	ASME SB-163 Alloy 690 (see Note 2)
Openings covers (for manways, inspection holes, & handholes)	ASME SA-533 Type B Class 2 (see Note 1)

Table 5.2-2—Material Specifications for RCPB Components
Sheet 2 of 7

Component	Material
Openings studs (for manways, inspection holes, & handholes)	ASME SA-193 Grade B16 (see Note 1) ASME SA-193 Grade B7 (see Note 1)
Primary manway studs	ASME SA-193 Grade B16 (see Note 1)
Openings nuts (for manways, inspection holes, & handholes)	ASME SA-194 Grade 16 (see Note 1) ASME SA-194 Grade 7 (see Note 1)
Pressure boundary welds <div style="border: 1px solid black; display: inline-block; padding: 2px;">05.02.03-20</div> →	SFA 5.4 SFA 5.5 SFA 5.9 SFA 5.11 SFA 5.14 SFA 5.17 SFA 5.18 SFA 5.20 SFA 5.22 SFA 5.23 SFA 5.28 SFA 5.29 <u>SFA-5.1 (Note 11): E7018</u> <u>SFA-5.4 (Note 4): E308-XX, E308L-XX, E309-XX, E309L-XX, E316-XX, E316L-XX</u> <u>SFA-5.5 (Note 11): E9018-XX</u> <u>SFA-5.9 (Note 4): ER308, ER309, ER316</u> <u>SFA-5.9: ER308L, ER309L, ER316L</u> <u>SFA-5.11: ENiCrFe-7</u> <u>SFA-5.14: ERNiCrFe-7, ERNiCrFe-7A</u> <u>SFA-5.17 (Note 11): F7PX-EXX</u> <u>SFA-5.18 (Note 11): ER70S-X</u> <u>SFA-5.22 (Note 4): E308TX-X, E308LTX-X, E309TX-X, E309LTX-X, E316TX-X, E316LTX-X</u> <u>SFA-5.23 (Note 11): F7PX-EXX, F8PX-EXX, F9PX-EXX</u> <u>SFA-5.28 (Note 11): ER70S-XX, ER80S-XX, ER90S-XX</u> <u>SFA-5.29 (Note 11): E71TX-XX, E81TX-XX, E91TX-XX</u>
Pressurizer	
Upper head	ASME SA-508 Grade 3 Class 2 (see Note 1)
Bottom head	ASME SA-508 Grade 3 Class 2 (see Note 1)
Cylindrical shells	ASME SA-508 Grade 3 Class 2 (see Note 1)
Manway	ASME SA-508 Grade 3 Class 2 (see Note 1)
Manway cover	ASME SA-533 Type B Class 2 (see Note 1)
Surge nozzle	ASME SA-508 Grade 3 Class 2 (see Note 1)
Safety valve nozzles	ASME SA-508 Grade 3 Class 2 (see Note 1)

Table 5.2-2—Material Specifications for RCPB Components
Sheet 4 of 7

Component	Material
Pressure boundary welds <div style="border: 1px solid black; padding: 2px; display: inline-block;">05.02.03-20</div> →	SFA 5.4 SFA 5.5 SFA 5.9 SFA 5.11 SFA 5.14 SFA 5.17 SFA 5.18 SFA 5.20 SFA 5.22 SFA 5.23 SFA 5.28 SFA 5.29 SFA-5.1 (Note 11): E7018 SFA-5.4 (Note 4): E308-XX, E308L-XX, E309-XX, E309L-XX, E316-XX, E316L-XX SFA-5.5 (Note 11): E9018-X SFA-5.9 (Note 4): ER308, ER309, ER316 SFA-5.9: ER308L, ER309L, ER316L SFA-5.11: ENiCrFe-7 SFA-5.14: ERNiCrFe-7, ERNiCrFe-7A SFA-5.22 (Note 4): E308TX-X, E308LTX-X, E309TX-X, E309LTX-X, E316TX-X, E316LTX-X SFA-5.23 (Note 11): F9PX-EXX SFA-5.28 (Note 11): ER90S-XX SFA-5.29 (Note 11): E91TX-XX
Reactor Coolant Pump	
Pressure forgings	ASME SA-182M Grade F304 (see Notes 3 & 4)
Cooler tubes	ASME SA-213M Grade TP316 (see Notes 3 & 4)
Support stand flange – integral part of casing closure bolted assembly	ASME SA-216M Grade WCC
Pressure casting	ASME SA-351M Grade CF3 (see Notes 3, 5 & 10)
Bolting	ASME SA-453M Grade 660 Class B (see Note 7)
Thermowell	ASME SA-479M Type 304 (see Notes 3 & 4)
Flange – integral part of pressure boundary casing closure bolted assembly	ASME SA-508M Grade 3 Class 2 (see Note 1)
Pressure boundary stud bolts & nuts	ASME SA-540M Grade B24 Class 1 (see Note 1)
Pressure boundary casing closure stud & nuts	ASME SA-540M Grade B24 Class 3 (see Note 1)
Shaft seal pressure boundary parts	ASME SA-705M Type 630 H1150 (see Note 7)

10. For cast austenitic stainless steel components that experience service temperatures greater than 482°F, the delta ferrite content is limited to less than or equal to 20 percent for low molybdenum content statically cast materials, less than or equal to 14 percent for high molybdenum content statically cast materials, and less than or equal to 20 percent for high molybdenum content centrifugally cast materials. Low molybdenum content is defined as 0.5 wt% maximum and high molybdenum content is defined as 2.0-3.0 wt%.

05.02.03-20



11. Weld filler material is compatible with base material, and mechanical properties are appropriate for the application, while meeting applicable ASME Section II Part C, Section III, and Section IX requirements.
12. The main coolant lines and surge line weld filler material are dual certified SFA-5.9 ER308/308L.