Docket No. 50-336
B17516

Attachment 4

Millstone Nuclear Power Station, Unit No. 2

Request For Permission to Apply Leak Before Break Methodology
To The Pressurizer Surge Piping

Plant Specific Information For
The Pressurizer Surge Piping

November 1998

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PLANT SPECIFIC INFORMATION

4.0 PLANT SPECIFIC CONSIDERATIONS

This attachment provides a discussion of several plant specific issues that are relevant to the Pressurizer Surge Piping LBB evaluation. It may be noted that these issues have also been discussed from an industry experience perspective in Attachment 3. The plant specific experience with water hammer, ISI of welds and pipe supports and issues, such as, thermal fatigue, thermal stratification, thermal aging and piping vibrations are addressed in the sections that follow.

4.1 WATER HAMMER CONSIDERATIONS

Pressurizer Surge Piping is part of the RCS pressure boundary. There is a very low potential for water hammer in the subcooled water solid portion of the reactor coolant system since these portions are designed to preclude void formation under all operating scenarios. FSAR Section 13.12 [Reference 4] provides a discussion of pre-operational testing for measuring the dynamic effects associated with system operation involving pump trips and valve operations. For systems where dynamic effects were considered to be insignificant, verification was made by the test program. RCS piping of which Pressurizer Surge Piping is part of was one of the systems where the dynamic effects were deemed to be negligible. This has been confirmed by Millstone Unit No. 2 operating experience.

The water hammer issue is also discussed by Structural Integrity Associates in a generic sense in Attachment 3 as part of the Pressurizer Surge Piping LBB evaluation report. The plant specific experience with system operation to date, based on a review of Plant Incident Reports (PIRs) and Licensee Event Reports (LERs), further confirms non-susceptibility to water hammer.

4.2 FATIGUE & THERMAL DESIGN CONSIDERATIONS

Fatigue considerations for the entire Pressurizer Surge Piping are addressed in ASME Class 1 design report by the use of cumulative usage factors (CUF). The design reports [Reference 1,5] show that the CUF for a 40 year service life is less than 1.0. Further piping resistance to fatigue damage is demonstrated in the flaw tolerance evaluations that have been performed by Structural Integrity Associates in Report SIR-98-096, provided as Attachment -3.

4.3 THERMAL STRATIFICATION CONSIDERATIONS

The thermal stratification concerns for the Surge Piping identified in I&E Bulletin 88-11 were addressed as part of the ABB/CE Owners Group activity in which Millstone Unit No. 2 was a participant. The details of re-evaluation of the Surge Piping for thermal stratification concerns are provided in CEOG Report CEN-387-P [Ref. 2]. This report was provided for Staff review. Staff acceptance of this report was provided via SER dated July 6, 1993 [Reference 6]. Subsequently, Millstone Unit No. 2 notified Staff via letter dated September 30, 1993 [Reference 7] that the remaining plant specific activities required by the SER and Bulletin 88-11 were completed. These activities included verification that the analysis assumptions and results from CEOG report are applicable to Millstone Unit 2 Pressurize Surge Piping. Specifically, (a) the Design loads reported in CEOG report were bounding [Reference 5], (b) the top to bottom temperature differential assumption of 350°F was bounding as a sample measurement of temperature differential for a typical heatup and cooldown did not exceed 250°F, (c) Pressurizer Surge Piping supports are capable of accommodating thermal stratification deflections, and (d) the 3/4" sample piping connected to the Surge Piping was considered not to be adversely impacted by thermal stratification. This letter also confirmed completion of Actions 1.a through 1.d and Actions 2 and 3 required by Bulletin 88-11.

The Pressurizer surge nozzle is thermal sleeved and was therefore reviewed for the thermal cycling identified by the NRC Information Notice 97-46 [Reference 8] in the Oconee high pressure injection line. The Pressurizer Surge Piping does not contain any warming or cooling line and is therefore not susceptible to the IN 97-46 type of thermal cycling concerns.

4.4 VIBRATION FAILURE CONSIDERATIONS:

The RCS main coolant loop was analyzed to verify that no part of the loop would resonate in the frequency range between 14-15 Hz and 70 to 75 Hz [Ref. 4]. The Pressurizer Surge Piping is adequately supported to minimize the steady state as well as transient vibrations.

FSAR Section 13.12 [Reference 4] discusses the measurement and acceptance criteria for the steady state vibration of piping systems. For systems listed in FSAR Table 13.12.1 (RCS piping is listed), either the transient effects were proven to be minimal or a test program was conducted. The test program measured the deflection at selected locations during warm - up. During imposed plant transients, visual observations of specific lines were made and deflections observed and recorded. Measured deflections were compared with the acceptance criteria described in the FSAR Section 13.12 for Class 1 piping systems.

Based on the above discussion, it is concluded that the Pressurizer Surge Piping system is not susceptible to failure from steady state or transient vibrations.

4.5 INSERVICE INSPECTION EXPERIENCE -Welds

The segment of RCS piping considered for LBB evaluation extends from the hot leg side safe-end of the nozzle to the Pressurizer safe end. Figure 5-1 shows the weld designations for the Pressurizer Surge Piping. The attached Table 4-1 presents the summary of the second 10 year ASME Section XI In-Service Inspections performed for these pressure boundary welds. Note that due to the sampling approach employed, not all welds have been inspected within this time frame. No ASME XI, IWB-3500 unacceptable indications have been found.

4.6 INSERVICE INSPECTION PLANS - Welds

Based on the LBB evaluation in the Structural Integrity Report provided as Attachment-3, weld numbers BPS-C-1005, 1007, 1013, 1015 and 1021 (refer to figure 5.1) and the bimetallic welds are considered to be the most fatigue sensitive locations. Even though, all of the welds were demonstrated to remain structurally acceptable through the end of life of the plant for 6:1 aspect ratio flaws, NNECO intends to inspect these welds once per inspection period (i.e. once every 10 years). This will provide additional assurance that fatigue cracking will not challenge the structural integrity of the Pressurizer Surge Piping through its remaining plant life.

4.7 INSERVICE INSPECTION - Pipe Supports

Table 4-2 presents a summary of the in-service inspection of the piping supports on the Surge Piping. It should be noted that the Pressurizer Surge Piping has no rigid supports or snubbers. The piping is supported on spring hangers as shown in Figure 2.1. Thus, based on a review of the available inspection data of the spring hangers, there appears no indications of support degradation or distress.

The spring supports were also visually inspected in response to I&E Bulletin 88-11 to verify that the available support travel enveloped the limits noted in CE analyses CEN - 387- P. The inspection concluded [see Reference 3] that adequate travel was available as necessary.

4.8 REFERENCES

1. CE-1192, Analytical Report for Northeast Utilities Service Company Millstone Point Station Unit No. 2 Piping, C-E , September 1973.

2. CEN-387-P, Rev 0 and Rev 1, Pressurizer Surge Line Thermal Stratification Evaluation, Combustion Engineering Owners Group, July 1989.

3. Memo PSE-CE-90-241, dated April 23, 1990.

4. Millstone Unit No. 2 FSAR Section 13.12, "Piping Operational Testing."

5. NU Calculation MP2-LOE-380-EM, Rev. 0, Pressurizer Surge Line Analysis Considering Thermal Stratification.

6. USNRC Letter to J. F. Opeka, "Safety Evaluation for Combustion Engineering Owners Group Report CEN-387-P, Rev 1, Pressurizer Surge Line Thermal Stratification Evaluation," Dated July 6, 1993.

7. Letter from J. Opeka to USNRC, "Response to NRC Staff for Additional Information on Pressurizer Surge Line Thermal Stratification Evaluation," Dated September 30, 1993.

8. NRC Information Notice 97-46, "Unisolable Crack in High - Pressure Injection Piping," July 9, 1997.

9. Rev. 13, Pressurizer Specification, Combustion Engineering

TABLE 4 - 1

SUMMARY OF ISI RESULTS

Reference ID Number	Zone	Exam Year	Exam Results	Code Category
BPS-C-1025A	1-16	1989	A	B-F (Bimetallic)
BPS-C-1025	1-16	1989	A	B-J
BPS-C-1023	1-16	--------		B-J
BPS-C-1021	1-16	1992Y	A	B-J
BPS-C-1019	1-16	--------		B-J
BPS-C-1017	1-16	1990Y	A	B-J
BPS-C-1015	1-16	1990Y/92N	A/A	B-J
BPS-C-1013	1-16	1990Y	A	B-J
BPS-C-1011	1-16	---------		B-J
BPS-C-1009	1-16	1992Y	A	B-J
BPS-C-1007	1-16	---------		B-J
BPS-C-1005	1-16	---------		B-J
BPS-C-1003	1-16	---------		B-J
BPS-C-1001	1-05	1994	A	B-F (Bimetallic)

A --- Acceptable per ASME XI, IWB - 3500

TABLE 4 - 2

SUMMARY OF SUPPORT INSPECTION RESULTS

Reference ID Number	Zone	Exam Year	Exam Results	Code Category
408018	1-16	1986Y	A	IWF 1
508003	1-16	1986Y	A	IWF 1
408015	1-16	1989Y	A	IWF 1
408013	1-16	1989Y	A	IWF 1
408017E	1-16	1992Y	A	IWF 1

A --- Code Acceptable

Attachment 5

Millstone Nuclear Power Station, Unit No. 2

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Material And Weld Processes

November 1998

5.0 MATERIAL & WELD PROCESSES

This attachment discusses the materials and welding processes aspect of the surge piping. Reference 5.2 documents all information pertinent to surge piping materials and welding.

5.1 BASE MATERIALS

The surge piping and the nozzles were designed and fabricated per Design Specification 18767-31-5 Rev. 13 [5.1] and 1968 Edition of ASME Section III Code including Summer 1968 Addendum and the draft 1968 edition of ANSI B31.7, Class 1 per Ref. 5.3. The surge piping and safe ends material is type 316 stainless steel SA 351 Grade CF8M. All the piping and safe ends materials were produced by using centrifugal casting process as documented in Reference 5.2. The surge nozzle material is low alloy steel forging SA 508 class 2 and the piping surge nozzle is carbon steel forging A 105 grade 2. The certified material test reports of all surge piping components are documented in Reference 5.2.

5.2 SHOP WELDING OF SURGE PIPING

The surge line was shipped to Millstone in three assemblies from the ABB/CE shop. Figures 5.1 and 5.2 depict the shop and field welds locations. Table 5.1 presents weld identifications, welding process, and the primary filler material employed for the surge piping. ABB/CE welding related information in Table 5.1 is based on the documentation in Ref. 5.2. Based on Table 5.1, it is evident that all the shop welds on the surge line used shielded metal arc welding (SMAW) as a primary welding process. In some cases gas tungsten arc (GTA) welding was employed for the root passes. None of the surge line shop welds used submerged arc welding (SAW) process.

5.3 FIELD WELDING OF SURGE PIPING

Figure 5.2 shows field welds locations. The field welding was performed per References 5.4 and 5.5. Welding process and filler material related information is presented in Table 5.1. The field welding was performed per Bechtel welding process P8-AT-Ag, Rev. 9. [5.3, 5.4]. Based on this information, it is evident that GTA welding process was employed for the root pass (first two layers) and the SMAW for the remaining passes. The submerged arc welding process was not employed for any of the field welds.

5.4 PRECAUTIONS EMPLOYED TO PRECLUDE IGSCC

All piping components employed are cast 316 Grade stainless steel with a ferrite level in the range of 15 to 30%. Average ferrite level is approximately 22%. With such a high ferrite level, the cast stainless used for the surge line piping components are considered immune to IGSCC by the nuclear industry. There are no furnace sensitized stainless steels used in the subject piping components.

As stated above, even though sensitization is not an issue for cast stainless steel materials, additional precautions were taken through control of welding heat input. For field and shop welding operations, Bechtel and ABB/CE used welding procedures that limit heat input to the weld areas [5.2, 5.4, 5.5]. Majority of the welds on the subject line are of the manual SMAW process and a minor amount of GTA welding was used for root pass welds. Neither one of these processes would be classified as an excessively high heat input welding procedure in comparison with the submerged arc welding (SAW) process.

5.4 CONCLUSIONS

This attachment demonstrated that the no furnace sensitized stainless steel has been used in the subject surge piping components. In combination with controlled welding processes, the casting materials employed had adequate ferrite to preclude sensitization during welding. As discussed in Paragraph 3.2 of Attachment 3 in this report, IGSCC is not typically a problem for the primary loop of a PWR since the environment has relatively low concentration of oxygen. Also, high heat input type SAW welding process that would result in lower fracture toughness properties has not been used for any of the surge piping welds.

REFERENCES:

5.1 Engineering Specification for a Reactor Coolant Pipe and Fittings for Millstone Point Station, Unit No. 2, Specification No. 18767-31-5, Rev. 13.

5.2 Engineering Record Correspondence (ERC) 25203-ER-98-0115, Rev. 2. (This ERC contains material and welding data from MEMO MP2-DE-98-0221, R. Terry to M. Ahern, NGP 6.05 Review of ABB/CE Inputs to Surge Line LBB Evaluation.)

5.3 ABB/CE Report CENC-1192 dated September 1973, Analytical Report for Northeast Utilities Service Company Millstone Point Station, Unit No. 2.

5.4 Bechtel Specification for Field Fabrication and Installation of Piping and Instrumentation in Nuclear Service, 7604-M-292, Rev. 11.

5.5 Bechtel Form 7604-MS-11, Rev. 12, sheet 2 of 17, Welding Standards.

5.6 NU Dwg. No 25203-29527 sheet 16, Rev. 2, Pressurizer Surge Line.

5.7 ABB/CE Dwg. No. E- 234 -000, Rev. 4.

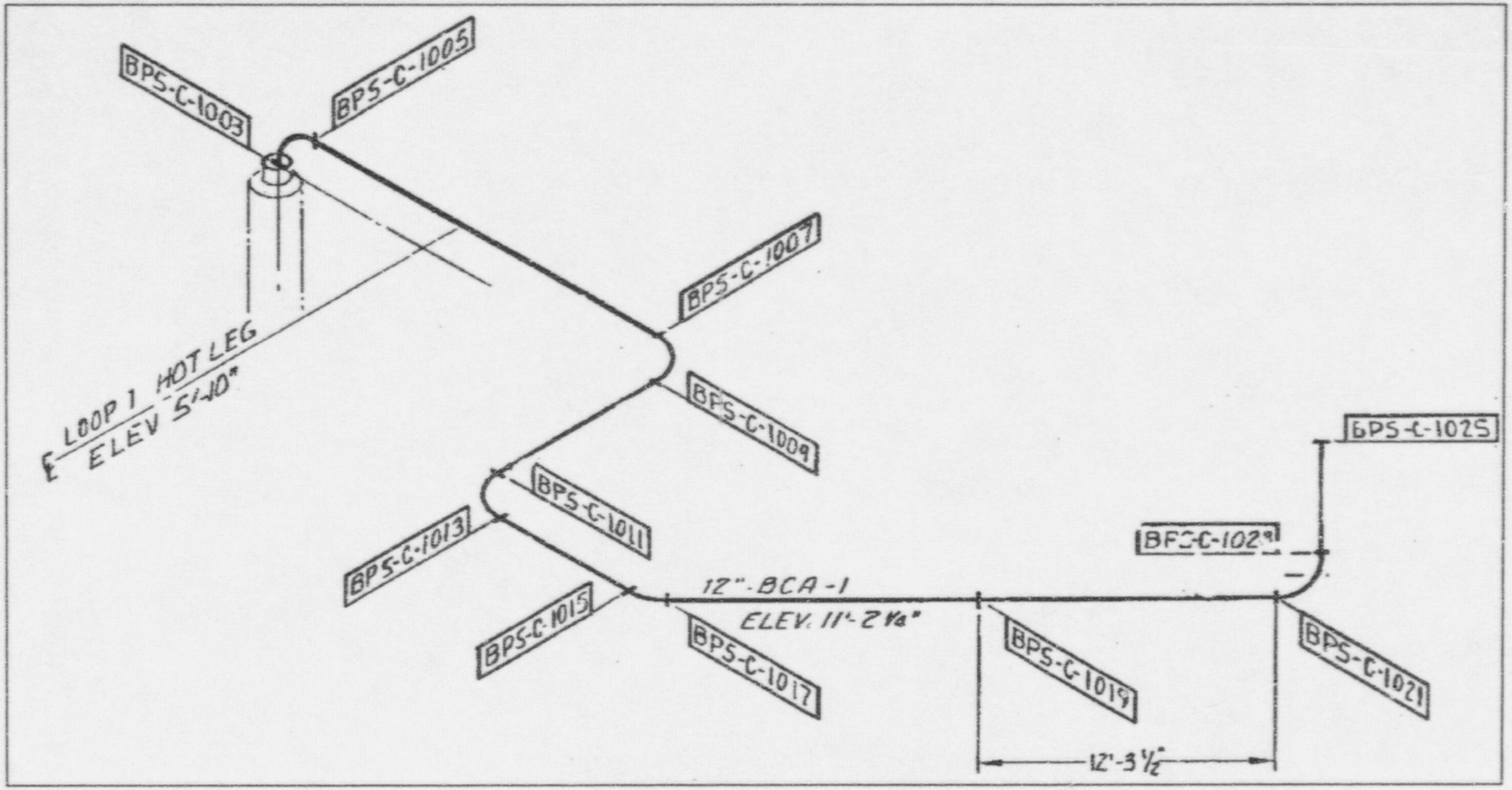

Figure 5-1 Surge Line Weld Locations and Identifications

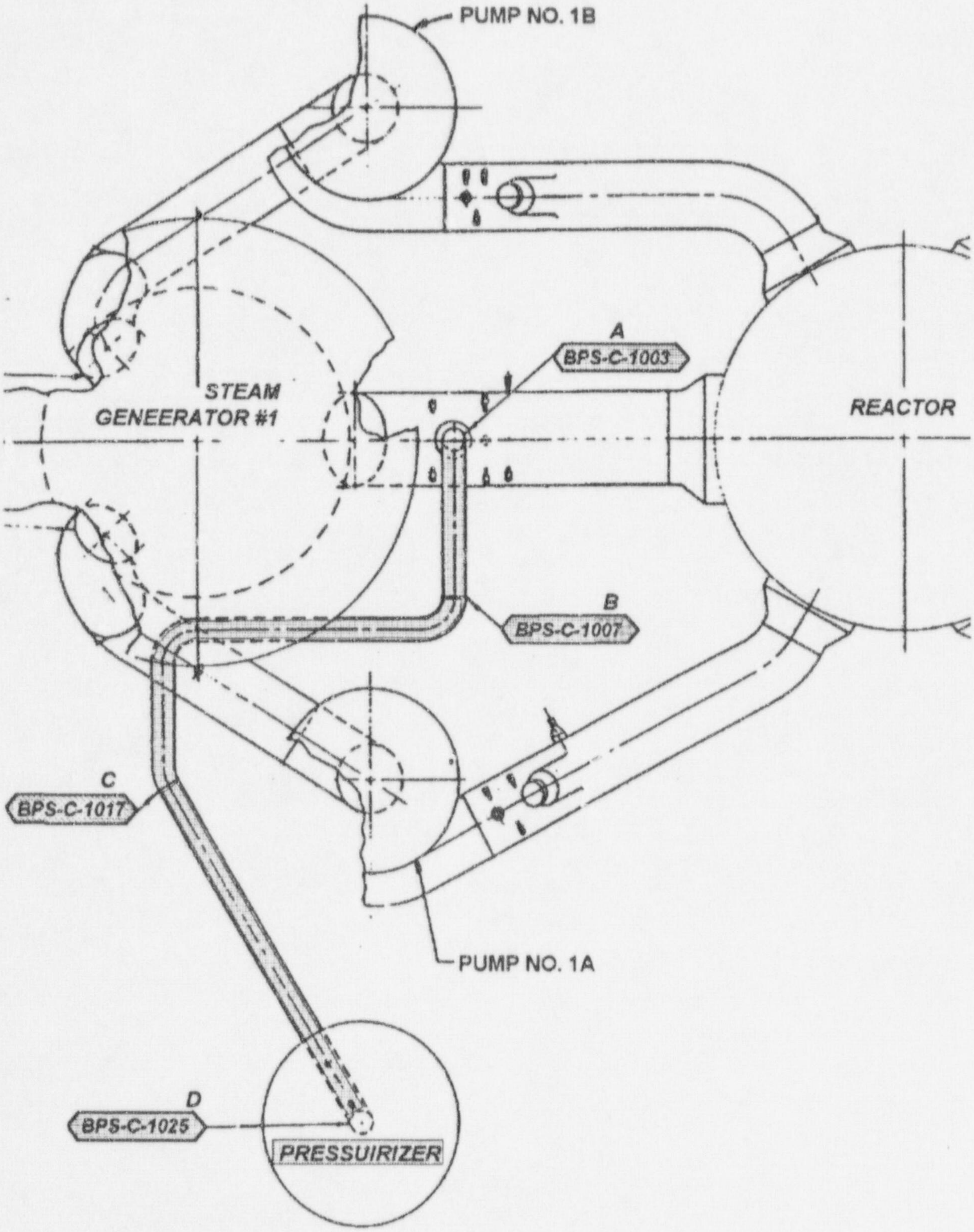

Figure 5.2 Surge Line Plan View and Field Weld Locations

Table 5-1 Surge Line Welding Processes and Filler Material Information

No.	CE Drawing No.	Weld Location	ABB/CE Weld ID	Millstone II Weld ID	Primary Filler Material	Primary Welding Process
1	E-234-005	Hot Leg Surge Nozzle to Safe-end	6-506	BPS-C-1001	Inconel 182	Shielded Metal Arc (SMAW)
2	E-234-000	Surge Line Field Weld*	4-501	BPS-C-1003	316SS	Shielded Metal Arc (SMAW)
3	E-234-004	Surge Line Shop Weld	5-505	BPS-C-1005	308SS	Shielded Metal Arc (SMAW)
4	E-234-000	Surge Line Field Weld*	4-505	BPS-C-1007	316SS	Shielded Metal Arc (SMAW)
5	E-234-004	Surge Line Shop Weld	1-505	BPS-C-1009	308SS	Shielded Metal Arc (SMAW)
6	E-234-004	Surge Line Shop Weld	1-505	BPS-C-1011	308SS	Shielded Metal Arc (SMAW)
7	E-234-004	Surge Line Shop Weld	1-505	BPS-C-1013	308SS	Shielded Metal Arc (SMAW)
8	E-234-004	Surge Line Shop Weld	1-505	BPS-C-1015	308SS	Shielded Metal Arc (SMAW)
9	E-234-000	Surge Line Field Weld*	4-501	BPS-C-1017	316SS	Shielded Metal Arc (SMAW)
10	E-234-004	Surge Line Shop Weld	2-505	BPS-C-1019	308SS	Shielded Metal Arc (SMAW)
11	E-234-004	Surge Line Shop Weld	2-505	BPS-C-1021	308SS	Shielded Metal Arc (SMAW)
12	E-234-004	Surge Line Shop Weld	2-505	BPS-C-1023	308SS	Shielded Metal Arc (SMAW)
13	E-234-000	Surge Line Field Weld*	4-501	BPS-C-1025	316SS	Shielded Metal Arc (SMAW)
14	E-233-746	Pressurizer surge Nozzle to Safe-end	6-404	BPS-C-1025A	Inconel 182	Shielded Metal Arc (SMAW)

* Field welding was performed under Bechtel Specification (References 5.4 and 5.5).