



May 11, 2016

ULNRC-06302

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, DC 20555-0001

10 CFR 50.55a

Ladies and Gentlemen:

**DOCKET NUMBER 50-483  
CALLAWAY PLANT UNIT 1  
UNION ELECTRIC CO.  
RENEWED FACILITY OPERATING LICENSE NPF-30  
10 CFR 50.55a REQUEST: PROPOSED ALTERNATIVE  
TO ASME SECTION XI REQUIREMENTS FOR  
LEAKAGE TESTING OF REACTOR PRESSURE VESSEL HEAD  
FLANGE LEAKOFF LINES (RELIEF REQUEST I4R-03)**

Pursuant to 10 CFR 50.55a(z)(2), Union Electric Company (Ameren Missouri) hereby requests NRC approval of attached Relief Request I4R-03 regarding the pressure at which leakage testing of the reactor pressure vessel flange leakoff lines must be tested, as specified per Paragraph IWC-5221 of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI. Relief is requested on the basis that compliance with the Code-specified pressure requirement to test the leakoff lines at system operating pressure is impractical and would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. A proposed alternative approach to the required testing is described in the attached relief request.

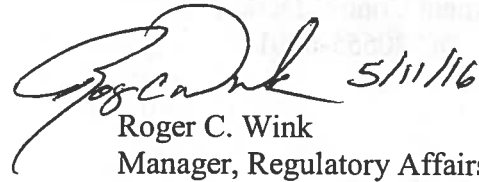
Justification for the requested relief is provided in the Relief Request document, which is provided as Attachment 1. Also provided, as Attachment 2, is an isometric drawing that shows in red the sections of piping that are inaccessible for examination, as well as the sections that are accessible for direct examination, in green.

The Code Edition applicable to this request and to the current (fourth) 10-year Inservice Inspection (ISI) interval for Callaway Plant is the 2007 Edition with the 2008 Addenda. As noted in the attached relief request, the relief is requested for the remainder of the current 10-year ISI interval which ends on December 18, 2024. Approval of the relief is respectfully requested by May 11, 2017 (one year from submittal of this request) in order to allow sufficient time for preparation of procedures and work

documents (using the proposed alternative methods) for reactor pressure vessel flange leakoff line testing that is scheduled to be performed during Refuel 22 in Fall 2017.

No new regulatory commitments have been made or identified in this letter or its attachments. For any questions you may have regarding this request, please contact Tom Elwood at 314-225-1905.

Sincerely,

 5/11/16 PIN 6381  
Roger C. Wink  
Manager, Regulatory Affairs

JPK/

- Attachments: 1. 10 CFR 50.55a Request Number I4R-03  
2. Figure 1, Reactor Vessel Flange Leakoff Piping Isometric Drawing

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**Index and send hardcopy to QA File A160.0761**

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Certrec Corporation

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Mr. John O'Neill (Pillsbury Winthrop Shaw Pittman LLP)

Missouri Public Service Commission

**Attachment 1 to  
ULNRC-06302**

**10 CFR 50.55a Request Number I4R-03**

**4 Pages**

**Attachment 1**  
**10CFR50.55a Request Number I4R-03**

**Proposed Alternative**  
**In Accordance with 10CFR50.55a(z)(2)**

--Hardship without a Compensating Increase in Quality and Safety--

**1. ASME Code Component(s) Affected**

- Component: Reactor Pressure Vessel (RPV)
- Description: RPV Head Flange O-Ring Leakoff Lines
- Component Number:
  - The following Class 2 lines are within the scope of this request: BB-075-BCB- $\frac{3}{4}$ ", BB-075-BCB-1", BB-075-BCB-2", BB-076-BCB- $\frac{3}{4}$ ", BB-076-BCB-1", BB-076-BCB-2", BB-077-BCB- $\frac{3}{8}$ "
  - The following Class 2 valves are within the scope of this request: BBV0079, BBV0080, BBV0081, BBHV8032
- Piping is ASME Class 2, SA-312, TP-304, Schedule 160
- The leakoff lines have a design pressure and service pressure of 2485 psig and 2235 psig, respectively, as well as a design temperature and service temperature of 650°F and 618°F, respectively.

**2. Applicable Code Edition and Addenda**

The applicable Code edition and addenda for the Fourth Inservice Inspection Interval at Callaway Unit 1 is the 2007 Edition with 2008 Addenda of ASME Section XI.

**3. Applicable Code Requirement**

Table IWC-2500-1, Code Category C-H, Item Number C7.10 includes requirements for subjecting Class 2 pressure retaining components to a system leakage test with a visual (VT-2) examination each inspection period. IWC-5221, "Pressure," requires the system leakage test to be conducted at the system pressure obtained while the system, or portion of the system, is in service performing its normal operating function or at the system pressure developed during a test conducted to verify system operability (e.g., to demonstrate system safety function or satisfy Technical Specification surveillance requirements).

**4. Reason for Request**

In accordance with the provisions of 10CFR50.55a(z)(2), Callaway requests relief from the Section XI code requirement for system leakage tests of the RPV head flange O-ring leakoff lines on the basis that compliance with the Code-specified pressure requirement to test the leakoff lines at system operating pressure is impractical and would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The RPV head flange O-ring leakoff lines direct leakage, if any, from the RPV head flange to the Reactor Coolant Drain Tank (RCDT) and provide alarms to alert the Control Room of leakage. These lines are separated from the reactor coolant system operating pressure by an inner and outer RPV flange O-ring. The inner O-ring,

in conjunction with the reactor vessel and reactor vessel head flange surfaces, functions to isolate the inner and outer RPV head flange leakoff lines from reactor coolant system (RCS) pressure. The outer O-ring functions as a back-up in the event of the inner O-ring failing to perform its intended function. Because of this, the affected leakoff lines are not expected to experience RCS pressure during normal operation. During normal operation, the lines are typically pressurized to RCDT pressure (approximately 4 psig).

With the RPV head flange O-rings installed and performing their intended function, the leakoff lines are not expected to be pressurized above RCDT pressure during the system pressure test following a refueling outage. Applying system pressure to the leakoff lines for the purpose of leakage testing is not practical with the RPV head installed after refueling, since it would require either intentionally failing the O-rings or pressurizing the line with a hydrostatic test pump in the direction opposite to the intended design function of the O-rings. This could unseat the installed O-rings, resulting in the need for additional maintenance which would require depressurizing and removal of the reactor vessel head or could damage O-ring sealing material with debris. Performing a leakage test during shutdown prior to the removal of the head for refueling activities would delay the shutdown, requiring the plant to be maintained in Mode 3 at normal operating temperature and pressure at higher decay heat loads, resulting in an incremental increase in core damage frequency. This would be contrary to site efforts to reduce the outage sequence/time to cold shutdown in order to minimize shutdown risk. Performing such a test also may potentially introduce damaging debris to the flange surfaces which would result in the additional radiation exposure if subsequent repairs are required.

With the RPV head removed, the configuration of the leakoff piping would require the lines to be plugged at the RPV flange to establish a boundary for leakage testing at system operating pressure. This would require a design modification to install mechanical threads into each leakoff line at the location of the reactor vessel flange. Threaded plugs would then have to be installed prior to the pressure test and removed after the test was complete. Failure of either plug during the test would result in a personnel safety hazard, in addition to creating a foreign material exclusion (FME) issue. Performing the modification, as well as installation and removal of the plugs for each pressure test, would result in significant dose, which would be contrary to keeping dose as low as reasonably achievable (ALARA), and would again present FME issues.

Purposely failing the O-rings to perform the Code-required pressure test would require purchase of a new set of O-rings and additional time and radiation exposure to remove the RPV head, install new O-rings, and reinstall the head.

##### **5. Proposed Alternative and Basis for Use**

In accordance with the provisions of 10CFR50.55a(z)(2), Callaway proposes to examine the Class 2 portions of the leak detection system consisting of accessible portions of the RPV head flange O-ring leakoff lines. The leakoff lines shall be examined using the VT-2 visual examination method. The test shall be conducted at ambient conditions after the refueling cavity has been filled to its normal refueling water level for at least four (4) hours (i.e., when the piping is subjected to the static pressure head that exists when the reactor cavity is filled). The normal refueling water level is a minimum of 23 feet above the RPV flange. This yields a pressure of approximately 10 psig at the flange and approximately 17 psig at the lowest elevation of piping. To ensure the lines are clear of air prior to performance of the VT-2 examination, surveillance instructions include a flush

of lines BB-075-BCB and BB-076-BCB. Flushing is performed for the greater of either 5 minutes or until no air is seen coming from the drain hose.

The Class 2 portions from the reactor vessel flange to the Class 2 boundaries are required to be examined. Lines BB-075-BCB and BB-076-BCB run parallel to each other and are inaccessible for the first 32 feet due to being located in the annulus area between the reactor vessel and primary shield wall. The annulus can only be accessed by way of the refueling cavity, which is filled with water during the test, or by way of the incore tunnel underneath the reactor vessel, which during refueling operations is prohibited from being entered due to high radiation dose rates from the incore flux mapping thimbles being withdrawn from the reactor vessel. Accessible portions of the lines subject to VT-2 visual examination include 22 feet of piping that is not insulated and 2 feet of piping that is insulated.

Callaway's work history, as well as corrective action history, was reviewed for service-related failures of the subject piping and components. The review identified no occurrences of leakage or other failures on these components.

The flange seal leakoff lines are essentially a leakage collection/detection system and would only function as a Class 2 pressure boundary in the event of failure of the O-rings that separate the lines from reactor coolant system operating pressure. Any significant leakage due to this condition would be expected to clearly exhibit boric acid accumulation that would be discernible during the proposed alternate VT-2 visual examination that will be performed. The static head developed with the leak detection line filled with water will allow for the detection of any gross indications in the line.

#### **6. Duration of Proposed Alternative**

Callaway will implement the proposed alternative requirements during the fourth Inservice Inspection interval which began on December 19, 2014.

#### **7. Precedents**

Similar relief requests have been previously approved by the NRC for the following (with ADAMS Accession No. references):

- (1) Callaway Plant Unit 1, "Proposed Alternative to ASME Section XI Requirements for Leakage Testing of Reactor Pressure Vessel Head Flange Leakoff Lines (Relief Request I3R-14)," as approved by NRC letter dated August 13, 2013 (ML13221A091)
- (2) STP Nuclear Operating Company (STPNOC) Units 1 and 2, Third Inspection Interval Relief Request RR-ENG-3-10, "Request for Relief from ASME Section XI Code Requirements for Reactor Pressure Vessel Head Flange O-Ring Leakoff Lines Non-Destructive Examination," as approved by NRC letter dated March 12, 2013 (ML12312A234).
- (3) Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, and 3, "Request for Relief from the American Society of Mechanical Engineers (ASME) Code, Section XI, Reactor Vessel Head Flange Seal Leak Detection Piping – Relief Request No. 49," as approved by NRC letter dated April 4, 2013 (ML13085A254).



- (4) Comanche Peak Nuclear Power Plant, Second Inspection Interval Relief Request C-9, "Alternative Pressure Testing Requirements for the Reactor Pressure Vessel Flange Leak-Off Piping," as approved by NRC letter date December 19, 2011 (ML113110092).
- (5) LaSalle County Station, Third Inspection Interval Relief Request 13R-08, "Request for Relief for Inservice Inspection Impracticality of Pressure Testing the RPV Head Flange Seal Leak Detection System," as approved by NRC letter dated January 30, 2008 (ML073610587)

Note: The following precedent was for similar lines designated Class 1:

- (6) Millstone Power Station Unit 3, Relief Request IR-3-11, "Alternative Pressure Testing Requirements for the RPV Flange Leak-Off Piping," approved by NRC letter dated April 29, 2010 (ML101040042).

#### 8. **References**

Code Case N-805, *Alternative to Class 1 Extended Boundary End of Interval or Class 2 System Leakage Testing of Reactor Vessel Head Flange O-ring Leak Detection System*, was issued to the 2010 Edition of the ASME Section XI Code and is listed in Supplement 6 for Code Cases. Code Case N-805 has not been approved by the NRC and is not identified in Regulatory Guide 1.147, *Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1*.

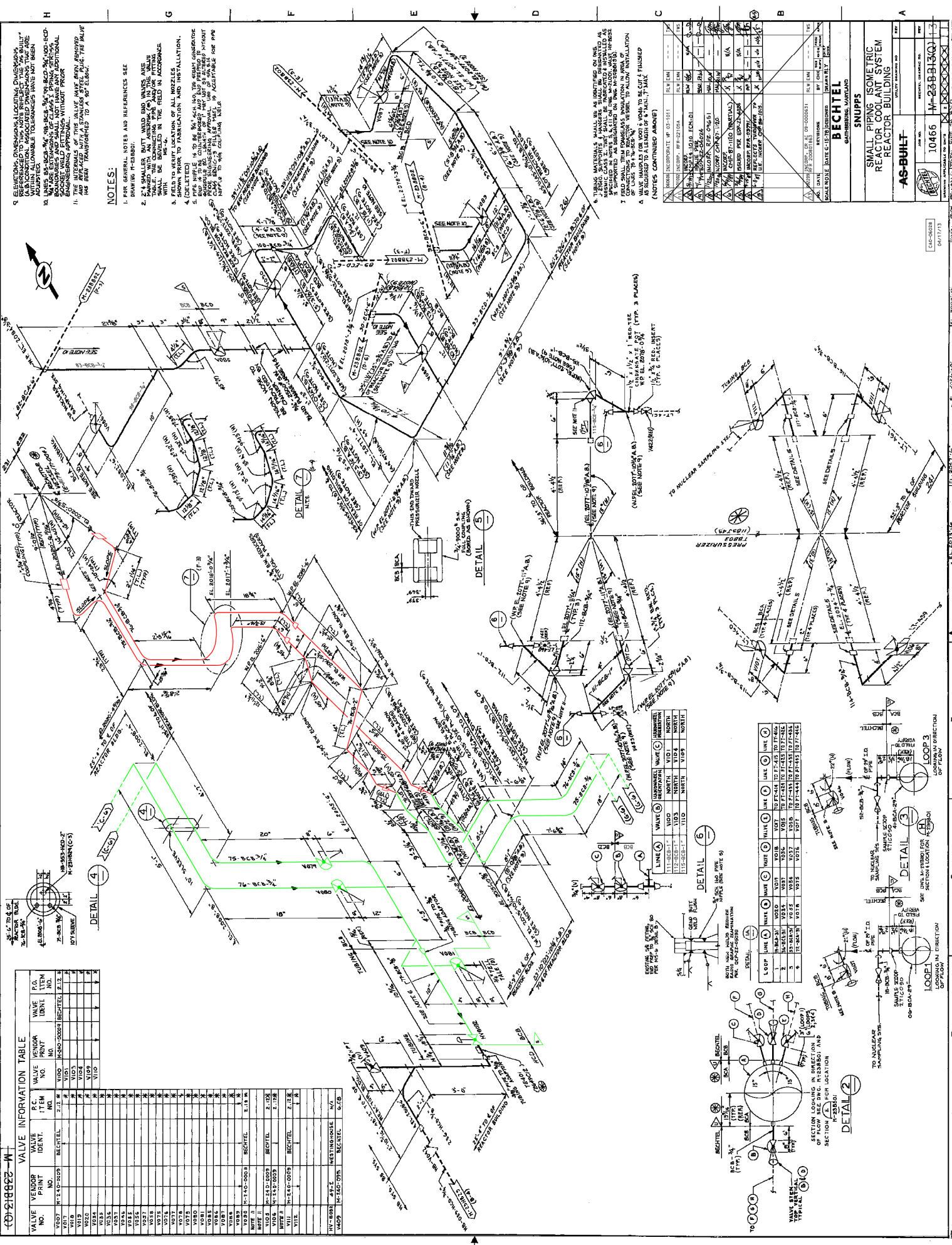
#### 9. **Figures**

Figure 1, Reactor Vessel Flange Leakoff Piping Isometric Drawing

**Attachment 2 to  
ULNRC-06302**

**Figure 1,  
Reactor Vessel Flange Leakoff Piping Isometric Drawing**

**1 Page**



**REVISIONS**

NO.	DATE	DESCRIPTION
1	11-01-82	ISSUE FOR PERMIT
2	01-22-83	REVISED TO ADD 12" NPS 304 SS PIPING
3	03-22-83	REVISED TO ADD 12" NPS 304 SS PIPING

**VALVE INFORMATION TABLE**

VALVE NO.	VENDOR	PRINT	NO.	VALVE	ITEM NO.	F.L.O.	ITEM
V007	M-140-002	BEUTEL	2.13	V007	BEUTEL	2.13	2
V008	M-140-003	BEUTEL	2.14	V008	BEUTEL	2.14	2
V009	M-140-004	BEUTEL	2.15	V009	BEUTEL	2.15	2
V010	M-140-005	BEUTEL	2.16	V010	BEUTEL	2.16	2
V011	M-140-006	BEUTEL	2.17	V011	BEUTEL	2.17	2
V012	M-140-007	BEUTEL	2.18	V012	BEUTEL	2.18	2
V013	M-140-008	BEUTEL	2.19	V013	BEUTEL	2.19	2
V014	M-140-009	BEUTEL	2.20	V014	BEUTEL	2.20	2
V015	M-140-010	BEUTEL	2.21	V015	BEUTEL	2.21	2
V016	M-140-011	BEUTEL	2.22	V016	BEUTEL	2.22	2
V017	M-140-012	BEUTEL	2.23	V017	BEUTEL	2.23	2
V018	M-140-013	BEUTEL	2.24	V018	BEUTEL	2.24	2
V019	M-140-014	BEUTEL	2.25	V019	BEUTEL	2.25	2
V020	M-140-015	BEUTEL	2.26	V020	BEUTEL	2.26	2
V021	M-140-016	BEUTEL	2.27	V021	BEUTEL	2.27	2
V022	M-140-017	BEUTEL	2.28	V022	BEUTEL	2.28	2
V023	M-140-018	BEUTEL	2.29	V023	BEUTEL	2.29	2
V024	M-140-019	BEUTEL	2.30	V024	BEUTEL	2.30	2
V025	M-140-020	BEUTEL	2.31	V025	BEUTEL	2.31	2
V026	M-140-021	BEUTEL	2.32	V026	BEUTEL	2.32	2
V027	M-140-022	BEUTEL	2.33	V027	BEUTEL	2.33	2
V028	M-140-023	BEUTEL	2.34	V028	BEUTEL	2.34	2
V029	M-140-024	BEUTEL	2.35	V029	BEUTEL	2.35	2
V030	M-140-025	BEUTEL	2.36	V030	BEUTEL	2.36	2

**NOTES**

- FOR GENERAL NOTES AND REFERENCES SEE DRAWING P-30000.
- VALVE MATERIAL AND CONSTRUCTION TO BE IN ACCORDANCE WITH THE CONNECTION PIPE AND/OR FITTINGS WITH THE PIPE.
- FIELD TO RELOCATION OF ALL INSTALLATION.
- (DELETED)
- PIPE SIZES 12" TO 24" NPS TO BE 304 SS UNLESS OTHERWISE SPECIFIED.
- VALVE SIZES TO BE 1/2" TO 2" UNLESS OTHERWISE SPECIFIED.
- PIPE SIZES 12" TO 24" NPS TO BE 304 SS UNLESS OTHERWISE SPECIFIED.
- VALVE SIZES TO BE 1/2" TO 2" UNLESS OTHERWISE SPECIFIED.

**6. TUBING MATERIALS SHALL BE AS BUILT UNLESS OTHERWISE SPECIFIED. THE FOLLOWING TABLE SHALL BE REFERENCED FOR MATERIALS TO BE SPECIFIED IN CONNECTION WITH THIS DRAWING.**

**7. CONNECTIONS TO REACTOR SHALL BE TO ALLOW INSTALLATION AND DISASSEMBLY AS REQUIRED.**

**8. WELDING SHALL BE TO A MINIMUM OF 3/16" TO BE CUT, FINISHED AND REWORKED TO A MINIMUM OF 1/8" MAX.**

(NOTES CONTINUED ABOVE)

NO.	DESCRIPTION	DATE	BY	CHKD.
1	ISSUE FOR PERMIT	11-01-82	...	...
2	REVISED TO ADD 12" NPS 304 SS PIPING	01-22-83	...	...
3	REVISED TO ADD 12" NPS 304 SS PIPING	03-22-83	...	...

**BECHTEL**  
ENGINEERING, WASH DC

**SNUPPS**

**SMALL PIPING ISOMETRIC REACTOR COOLANT SYSTEM REACTOR BUILDING**

**AS-BUILT**

DATE: 10-23-83  
DRAWN: HW-23BB13(Q)  
CHECKED: HW-23BB13(Q)  
APP'D: HW-23BB13(Q)

