AmerenUE
Callaway Plant

PO Box 620
Fulton, MO 65251

July 22, 2003

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop P1-137
Washington, DC 20555-0001

ULNRC-04875

Ladies and Gentlemen:

10 CFR 50.55a

CALLAWAY PLANT
UNION ELECTRIC CO.
DOCKET NUMBER 50-483
REQUEST FOR RELIEF FROM ASME
SECTION XI REQUIREMENTS IN ORDER TO
RESTORE WALL THICKNESS OF ASME CLASS 2 CARBON STEEL
MAIN FEEDWATER PIPING BY WELD OVERLAY REINFORCEMENT

Pursuant to 10CFR50.55a(a)(3)(i), Union Electric Company (AmerenUE) hereby requests NRC approval of the request provided in the attachment to this letter.

The attached is a request to permit weld overlay reinforcement of ASME Class 2 carbon steel piping associated with the main feedwater system at Callaway. The scope of the request is limited to those areas where the extent of wall thinning, as identified from inspections to be performed under Callaway's Flow-Accelerated Corrosion (FAC) program during the next refueling outage (i.e., RF-13), would otherwise require piping replacement. The service life of any weld-overlay reinforced feedwater piping would be limited to one operating cycle, i.e., from RF-13 to RF-14, since the potentially affected feedwater pipe sections are to be replaced during the installation of new steam generators at Callaway in RF-14 (regardless of whether the pipe sections are replaced or reinforced in RF-13)

As described in the attached 10 CFR 50.55a request, the overlay reinforcement would be performed under Callaway's Repair/Replacement Program in accordance the 1989 Edition of ASME Section XI and commensurate with Construction Code for the feedwater system, (i.e., ASME Section III, 1974 with Summer 1975 addenda). The technical requirements and basis for the proposed weld overlay reinforcement are based on ASME Code Case N-516-2. As a contingency

A047

that would serve as an alternative to piping replacement (thus avoiding the potential for replacement of the same piping sections twice in consecutive outages), the proposed weld overlay reinforcement would restore wall thickness of the affected piping to a value greater than design minimum wall thickness, thereby providing adequate margin for a service life of one operating cycle and thus ensuring an adequate level of safety and quality.

Approval of the requested relief is respectfully requested by March 1, 2004. For any questions you may have or more information that you may require, please contact David Shafer at (314) 554-3104, or Thomas Elwood at (314) 554-4593.

Very truly yours,

Keith D. Young
Manager, Regulatory Affairs

TBE/mlo
Attachment

cc: U. S. Nuclear Regulatory Commission (Original and 1 copy)
Attn: Document Control Desk
Mail Stop P1-137
Washington, DC 20555-0001

Mr. Thomas P. Gwynn
Acting Regional Administrator
U.S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-4005

Senior Resident Inspector
Callaway Resident Office
U.S. Nuclear Regulatory Commission
8201 NRC Road
Steedman, MO 65077

Mr. Jack N. Donohew (2 copies)
Licensing Project Manager, Callaway Plant
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Mail Stop 7E1
Washington, DC 20555-2738

Manager, Electric Department
Missouri Public Service Commission
PO Box 360
Jefferson City, MO 65102

Request to Restore Wall Thickness of ASME Class 2 Carbon Steel Main Feedwater Piping by Weld Overlay Reinforcement

Background

As an alternative to piping replacement in accordance with ASME Section XI IWC-4000, and pursuant to the provisions of 10CFR 50.55a(a)(3)(i), Callaway Plant requests permission to restore the wall thickness of high energy ASME Class 2 feedwater piping by weld overlay. Requested service life of the weld overlay reinforcement is one operating cycle from Refuel 13 to Refuel 14. Piping reinforced by weld overlay will be cut out and replaced during installation of new steam generators during Refuel 14.

The 1989 Edition with no Addenda of ASME Section XI currently governs repair/replacement activities at the Callaway Nuclear Plant. Callaway Plant is currently in the second 10-year inservice inspection interval, which began on August 1, 1995. The 1974 Edition with Summer 1975 Addenda of ASME Section III is the Construction Code for the main feedwater piping system.

Areas Identified that May Require Weld Overlay Reinforcement

The Callaway Flow Accelerated Corrosion (FAC) program is used to monitor and evaluate life of the ASME Class 2 feedwater piping at Callaway plant. Evaluation and ultrasonic wall thickness examinations have revealed a small number of areas that will require repair and/or replacement in the future. Feedwater piping areas where repair by overlay is requested are listed in Table 1. This table lists the piping/part description, Callaway location identifier, nominal pipe size, pipe schedule, and base material specification for each area.

Justification for Weld Overlay Reinforcement

Projections based on expected wear rates and ultrasonic examination data obtained during Refuel 12 indicate weld overlay reinforcement may be necessary to ensure adequate structural integrity for the additional operating cycle. The piping areas that may require weld overlay reinforcement are relatively small localized areas. Additionally, adjacent areas have been inspected and verified to have wall thickness that meets all design requirements.

The proposed alternative weld overlay reinforcement will restore wall thickness of the piping to a value greater than design minimum wall thickness, with enough margin and consideration of predicted wear rates to provide a service life of one operating cycle. This will ensure a sufficient level of safety and quality and will provide adequate structural integrity for one operating cycle. The weld overlay is not predicted to become exposed to feedwater during the cycle.

The weld overlay reinforcement alternative will result in a significant reduction in personnel radiation exposure during refueling outage maintenance work. In addition, refueling outage duration and costs will be reduced by decreasing the overall scope of work.

Requirements for Restoration of Internal Wall Thinning by Weld Overlay

Weld overlay reinforcement on the outside surface of the piping shall be installed in accordance with the following requirements and rules:

1. **General Requirements**

   1.1. The weld overlay(s) installed to restore wall thickness shall be performed in accordance with the Callaway Repair/Replacement Program [1].

   1.2. The wall thickness restoration shall meet all requirements of the Callaway Repair/Replacement Program except as permitted in this relief request.

---

[1] The Callaway Repair/Replacement Program is in accordance with the 1989 Edition of ASME Section XI.

2. Initial Evaluation

2.1. The piping base material where the weld overlay is to be installed shall be evaluated to establish the existing average wall thickness and the extent and configuration of degradation to be reinforced by the weld overlay.

2.2. Areas of piping, parts, or components, adjacent to the identified overlay area shall be examined to verify that the entire defect area will be encompassed as necessary by the weld overlay and to validate any design assumptions relative to the structural integrity of the piping.

3. Weld Overlay Design

3.1. The thickness of the weld overlay reinforcement shall not exceed 1/4 inch. See thickness dimension w in Figure 1.

3.2. Evaluation of areas that require restoration by weld overlay shall consider the design life of the piping, future internal wall thinning in the weld overlay area, and shall be based on the design thickness as prescribed by ASME Section III [2].

3.3. Unless otherwise established by design analysis, the weld overlay shall extend a distance of at least s in each direction beyond the area that requires restoration, where s is defined as:

$$s \geq \frac{3}{4}\sqrt{\overline{R}t_{nom}}$$

$\overline{R}$ = *average outer radius of the component*

t_{nom} = *nominal wall thickness of the component*

3.4. Edges of the weld overlay shall be tapered to the existing piping surface to a maximum angle of 45°. See angle α shown in Figure 1.

3.5. Final configuration of the weld overlay reinforcement shall permit nondestructive examination as required in 5.1 and 5.2.

3.6. Except for the tapered edges, the weld overlay reinforcement shall have a uniform thickness.

3.7. Tensile strength of the weld filler metal used for the overlay shall be at least that specified for piping base material.

3.8. Design shall be in accordance with ASME Section III [2] and shall consider the weld overlay as an integral portion of the piping upon which it is applied (not as a weld).

3.9. The allowable stress values of the base metal shall apply to the design of the deposited weld metal.

3.10. The following factors shall be considered in design of the weld overlay reinforcement:

3.10.1. The effects of the piping system on radial and longitudinal shrinkage caused by application of the overlay;

3.10.2. The effects on flexibility, stress concentration, and section properties of the added section thickness;

3.10.3. Stress concentrations resulting from existing and predicted piping internal surface configuration;

---

[2] ASME Section III, 1974 with Summer 1975 Addenda is the Construction Code for the feedwater system.

3.10.4. The effects of different coefficients of thermal expansion between the weld overlay filler metal and the base metal.

3.11. The effect of the weld overlay shall be reconciled with the original flexibility analysis required by ASME Section III [2]. Unless a lower stress intensification factor (SIF or i) is established, an SIF(i) of 2.1 shall be applied for overlays on straight pipe and adjacent welds; a stress multiplier of 1.7 shall be applied to the SIF(i) for standard elbows; and an SIF(i) of 2.1 shall be applied for tees and branch connections when the toe of the overlay is not less than $2.5\sqrt{Rt_{nom}}$ from any branch reinforcement.

4. Installation

4.1. The entire surface area to which the weld overlay is to be installed shall be examined using either the liquid penetrant (PT) or magnetic particle (MT) test method. Acceptance criteria shall be in accordance with NC-2500/5300 [3] for the specific product form that was examined (e.g., base material or weld metal).

4.2. The weld overlay reinforcement shall be installed in accordance with the Callaway Repair/Replacement Program.

4.3. The overlay weld metal shall be installed using a groove weld procedure qualified in accordance with ASME Section IX and Section III [3].

4.4. The surface of the final overlay reinforcement shall be prepared by machining or grinding as necessary to permit performance of surface and wall thickness examination.

5. Examination

5.1. The completed weld overlay reinforcement shall be examined using liquid penetrant (PT) or magnetic particle (MT) test method. The acceptance criteria shall be in accordance with ASME Section III, NC-5300 [3].

5.2. The weld overlay reinforcement and the base material below the reinforcement shall be examined by ultrasonic examination to verify acceptable wall thickness.

6. Documentation

6.1. Use of this relief request shall be documented as specified in the Callaway Repair/Replacement Program.

---

[3] ASME Section III, 1974 with Summer 1975 Addenda

Table 1: Feedwater Piping Areas That May Require Weld Overlay Reinforcement

Area Description	FAC ID No. [1&2]	NPS [3]	Sch.	Mat.
Downstream area of A S/G 14" by 16" expander	AE04-DE7E	16	80	CS
Downstream area of C S/G 14" by 16" expander	AE05-B5E	16	80	CS
Downstream area of D S/G 14" by 16" expander	AE05-CD7E	16	80	CS
Upstream area of 45° elbow upstream of AEV0122	AE05-E645	14	80	CS
Upstream area of 90° elbow downstream of AEV0123	AE05-AB590	14	80	CS
Midspan area of A S/G 5D bend	AE04-E890	14	80	CS
Midspan area of B S/G 5D bend	AE04-C4590	14	80	CS
Midspan area of C S/G 5D bend	AE05-B590	14	80	CS
Midspan area of D S/G 5D bend	AE05-D890	14	80	CS

Notes:
1. *Listed FAC ID Numbers are those currently identified in the Callaway FAC Program.*
2. *Figures 2 and 3 show location of areas by FAC ID No.*
3. *NPS is pipe size in area for weld overlay reinforcement.*

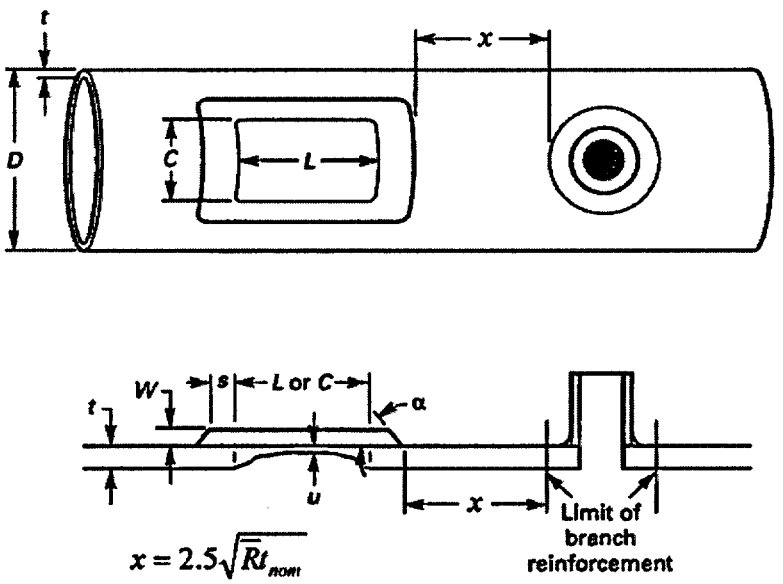

Figure 1: Schematic of overlay configuration and branch reinforcement.

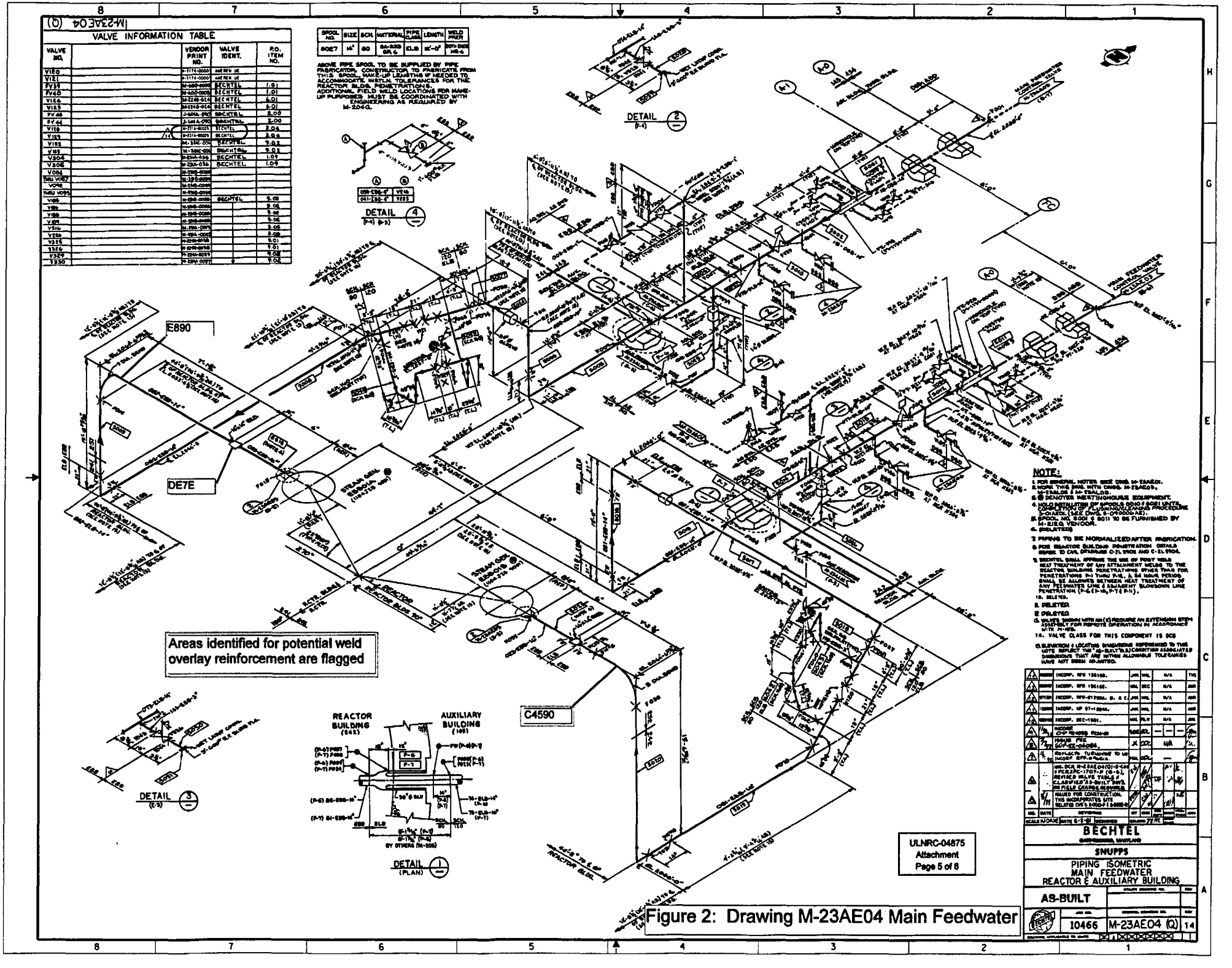

Figure 2: Drawing M-23AE04 Main Feedwater

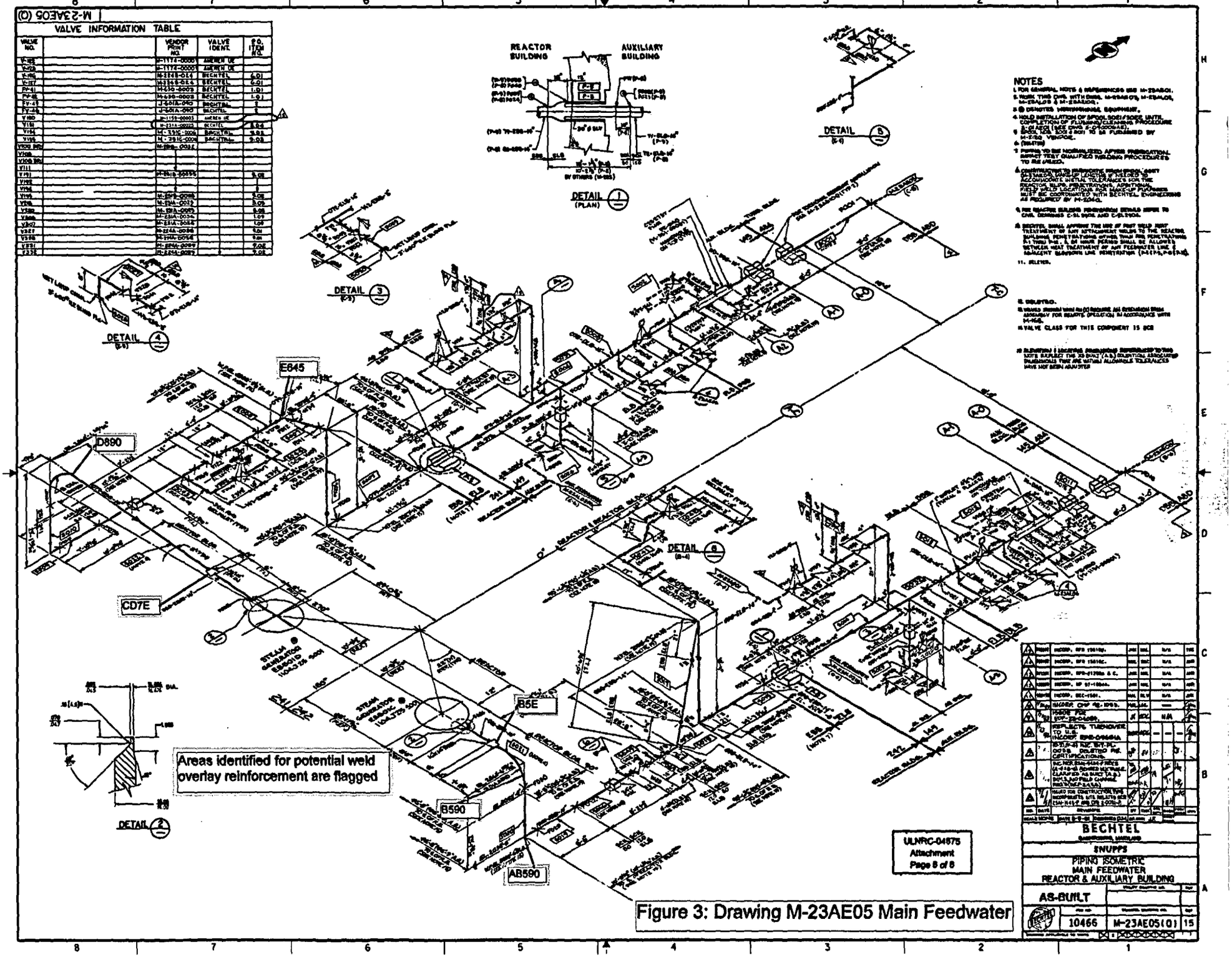

Figure 3: Drawing M-23AE05 Main Feedwater