1901 Chouteau Avenue
Post Office Box 149
St. Louis, Missouri 63166
314-554-2650

UNION ELECTRIC

Donald F. Schnell
Senior Vice President
Nuclear

May 22, 1996

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-137
Washington, D. C. 20555-0001

Gentlemen:

ULNRC-03381
TAC No. M94961

**CALLAWAY PLANT**
**DOCKET NUMBER 50-483**
**ADDITIONAL INFORMATION CONCERNING THE**
**CALLAWAY PLANT INSERVICE INSPECTION PROGRAM PLAN**

References: 1) ULNRC-03346 dated March 12, 1996
2) NRC letter dated April 15, 1996

This letter transmits the response to your request for additional information dated April 15, 1996, regarding Relief Request E-6 to the Inservice Inspection Program Plan (Reference 1). The relief request was submitted based on inspection results from Callaway Plant Refuel-7, and requests relief from ASME Section XI examination coverage requirements for reactor pressure vessel (RPV) upper shell longitudinal welds.

As requested, Relief Request E-6 has been revised to include information regarding examination coverage of the RPV intermediate shell and lower shell longitudinal welds, and provides increased estimates of the examination coverage for the RPV upper shell longitudinal welds. The increase in examination coverage was obtained by crediting coverage of portions of the longitudinal shell welds obtained during examination of the intermediate shell to upper shell circumferential weld and the nozzle to shell welds. This submittal also contains information regarding the geometry and conditions that limit the examination coverage of these welds. Due to the number and nature



A047
1/1

of the changes involved, Relief Request E-6 is retransmitted in its entirety.

10 CFR 50.55a(g)(6)(ii)(A) requires augmented examination of 100% of the RPV shell welds in accordance with ASME Boiler and Pressure Vessel Code, Section XI, 1989 Edition. Callaway's ISI program also required 100% examination coverage of the RPV shell welds at the end of the first ISI Inspection Interval in accordance with the ASME Boiler and Pressure Vessel Code, 1980 Edition through Winter 1981 Addenda. As both requirements are the same, the examination conducted at Callaway during the seventh refueling outage addresses both the ISI program and the augmented examination requirements. Union Electric believes that Relief Request E-6 satisfies the requirement of 10CFR50.55a(g)(6)(ii)(A)(5) for a proposed alternative to the RPV examination requirements.

If you have any questions concerning this information, please contact us.

Very truly yours,

Donald F. Schnell

WEK/MMR/

Attachment

cc: T. A. Baxter, Esq.
Shaw, Pittman, Potts & Trowbridge
2300 N. Street, N.W.
Washington, D.C. 20037

M. H. Fletcher
Professional Nuclear Consulting, Inc.
19041 Raines Drive
Derwood, MD 20855-2432

L. Joe Callan
Regional Administrator
U.S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive
Suite 400
Arlington, TX 76011-8064

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

Kristine M. Thomas (2)
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
1 White Flint, North, Mail Stop 13E16
11555 Rockville Pike
Rockville, MD 20852-2738

Manager, Electric Department
Missouri Public Service Commission
P.O. Box 360
Jefferson City, MO 65102

# CALLAWAY INSERVICE INSPECTION PROGRAM
## RELIEF REQUEST E-6



May 13, 1996

System: Reactor Pressure Vessel (RPV)

Examination Category: B-A

Item Number: B1.12

Component Description: RPV Upper Shell longitudinal welds (See Figure 1). These welds are carbon steel double bevel full penetration groove welds. Nominal wall thickness is approximately 11.75 inches. The inside surface has a stainless steel welded clad approximately 0.16 inches thick. The Callaway weld identification numbers are:

2-RV-101-122-A
2-RV-101-122-B
2-RV-101-122-C

Code Requirement: ASME Section XI, 1980 Edition through Winter 1981 Addenda, Table IWB-2500-1, Examination Category B-A, Item Number B1.12, requires 100% volumetric (ultrasonic) examination of the weld plus 1/2 the wall thickness of adjacent base metal on each side of the weld crown. ASME Section V, 1980 Edition through Winter 1981 Addenda, Article 4, T-441.4, specifies that this volume be examined with two angle beam scans (i.e., 45° and 60° nominal) for reflectors transverse to the weld seam, with two angle beam scans for reflectors parallel to the weld seam, and with a straight (0°) beam scan for planar and laminar reflectors.

Areas for Relief: Relief is requested from the 100% coverage requirement of the specified examination volume for the RPV Upper Shell longitudinal welds due to the following limitations.

a) Outlet nozzle protrusions limit the examination of 2-RV-101-122-B and 2-RV-101-122-C. (See Figures 1 and 2).

b) The inside radius blend of two inlet nozzles limits the examination of 2-RV-101-122-A. (See Figures 1 and 2).

c) The vessel flange inside diameter taper limits the examination of the upper portion of each weld (See Figure 1).

Table 1 lists the percentage of examination volume covered for each Upper Shell, Intermediate Shell, and Lower Shell longitudinal seam weld. This includes angle beam scans (i.e., 45° and 60°) for reflectors transverse to the weld seam, angle beam scans for reflectors parallel to the weld seam, and a 0° scan for planar and laminar reflectors.

Table 1

| Weld Number | Transverse Reflectors | Parallel Reflectors | 0° For Planar and Laminar Reflectors |
|---|---|---|---|
| 2-RV-101-122-A[1] | 71.20% | 56.50% | 50.50% |
| 2-RV-101-124-A[2] | 100% | 100% | 100% |
| 2-RV-101-142-A[3] | 100% | 100% | 100% |
| 2-RV-101-122-B[1] | 86.10% | 100% | 91.4% |
| 2-RV-101-124-B[2] | 100% | 100% | 100% |
| 2-RV-101-142-B[3] | 100% | 100% | 100% |
| 2-RV-101-122-C[1] | 62.60% | 78.00% | 69.20% |
| 2-RV-101-124-C[2] | 100% | 100% | 100% |
| 2-RV-101-142-C[3] | 100% | 100% | 100% |

[1] Upper Shell
[2] Intermediate Shell
[3] Lower Shell

Basis for Relief:

The Callaway RPV shell consists of three sections identified as the Upper Shell, Intermediate Shell, and the Lower Shell (See Figure 1). Each shell section contains three longitudinal welds. As shown in Table 1, examination coverage of all longitudinal welds in the Intermediate Shell and Lower Shell was 100% for both the angle beam scans and the 0° scan.

Table 2 indicates the estimated percentage of examination volume achieved (as determined by weighted average over weld length) considering the longitudinal welds by area at azimuths 90°, 207°, and 326° from the top of the Upper Shell to the bottom of the Lower Shell as shown in Figure 1 (i.e., the longitudinal weld area at the 90° azimuth includes welds 2-RV-101-122-A, 2-RV-101-124-A, and 2-RV-101-142-A, etc.).

Table 2

| Longitudinal Weld Area Azimuth | Transverse Reflectors | Parallel Reflectors | 0° For Planar and Laminar Reflectors |
|---|---|---|---|
| 90° | 90.94% | 86.31% | 84.42% |
| 207° | 97.15% | 100% | 98.24% |
| 326° | 91.05% | 94.74% | 92.63% |

As shown in Table 2, considering the longitudinal seam welds by area, a minimum of greater than 80% coverage was achieved for the cumulative length of longitudinal welds at each azimuth.

Table 3 indicates the estimated percentage (determined by weighted average over total weld length) of examination coverage for the total length (i.e., sum total length of all nine longitudinal welds) of longitudinal welds in the RPV shell.

Basis for Relief Continued:

Table 3

| Transverse Reflectors | Parallel Reflectors | 0° For Planar and Laminar Reflectors |
|---|---|---|
| 92.91% | 93.33% | 91.41% |

As Shown in Table 3 a minimum of greater than 90% coverage was achieved considering the total cumulative length of longitudinal seam welds in the RPV.

Table 4 shows the estimated increase in coverage achievable using manual scanning techniques applied at the inside or outside surface of the RPV. However, due to radiation levels, manual scanning techniques from the RPV inside and outside surfaces are impractical with respect to the increase in examination coverage possible. Radiation levels inside the RPV (using the best available estimate) range from approximately 500 Rem/Hour to 1000 Rem/Hour rendering manual examination from the RPV interior unacceptable. Radiation levels at the outside surface of the RPV range from .500 Rem/Hour to 1.8 Rem/Hour. Total estimated dose to increase the coverage area is at least 75 Person-Rem including removal of Ex-core Detector Shielding and necessary weld preparation.

Table 4

| Weld Number | Transverse Reflectors | Parallel Reflectors | 0° For Planar and Laminar Reflectors |
|---|---|---|---|
| 2-RV-101-122-A | 23.80% | 38.50% | 44.50% |
| 2-RV-101-122-B | 13.90% | 0.00% | 8.60% |
| 2-RV-101-122-C | 37.40% | 22.00% | 30.80% |

Industry experience has shown no identified inservice failure of Pressurized Water Reactor (PWR) pressure vessel Upper Shell longitudinal welds. Reactor Pressure Vessels similar to Callaway's have operated for over 20 years with no recorded inservice induced flaws or potential degradation mechanisms.

The high cost of designing and manufacturing special tooling to achieve a modest increase in examination coverage for unusual geometries is prohibitive. These costs and the associated refueling outage costs make these specialized examinations impractical and without a compensating increase in safety.

Alternate Testing:

The extent of the ultrasonic examination performed and the Reactor Coolant System leakage detection system provide verification of the integrity of the RPV Upper Shell longitudinal welds.

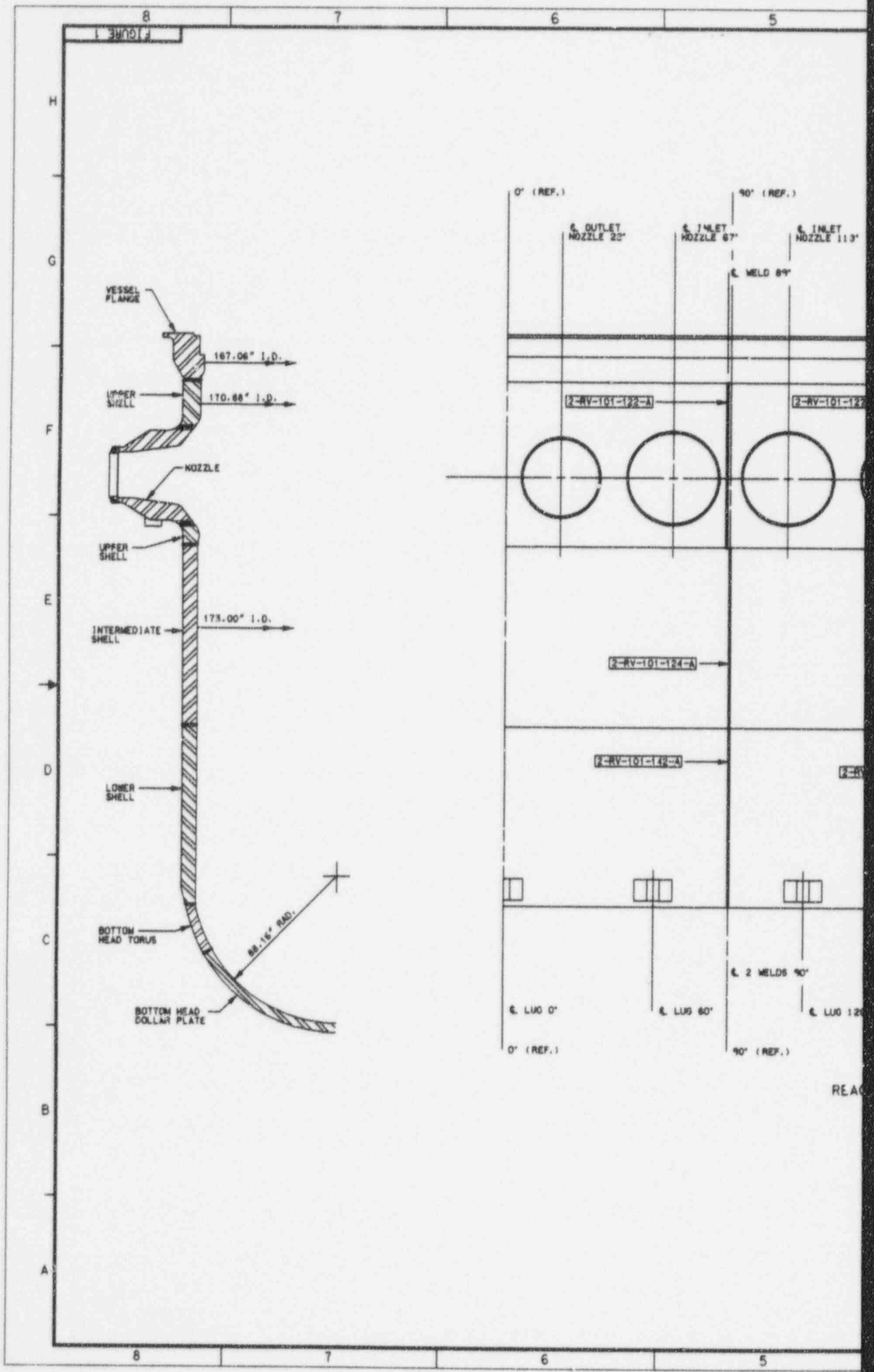
Augmented Examination of the RPV:

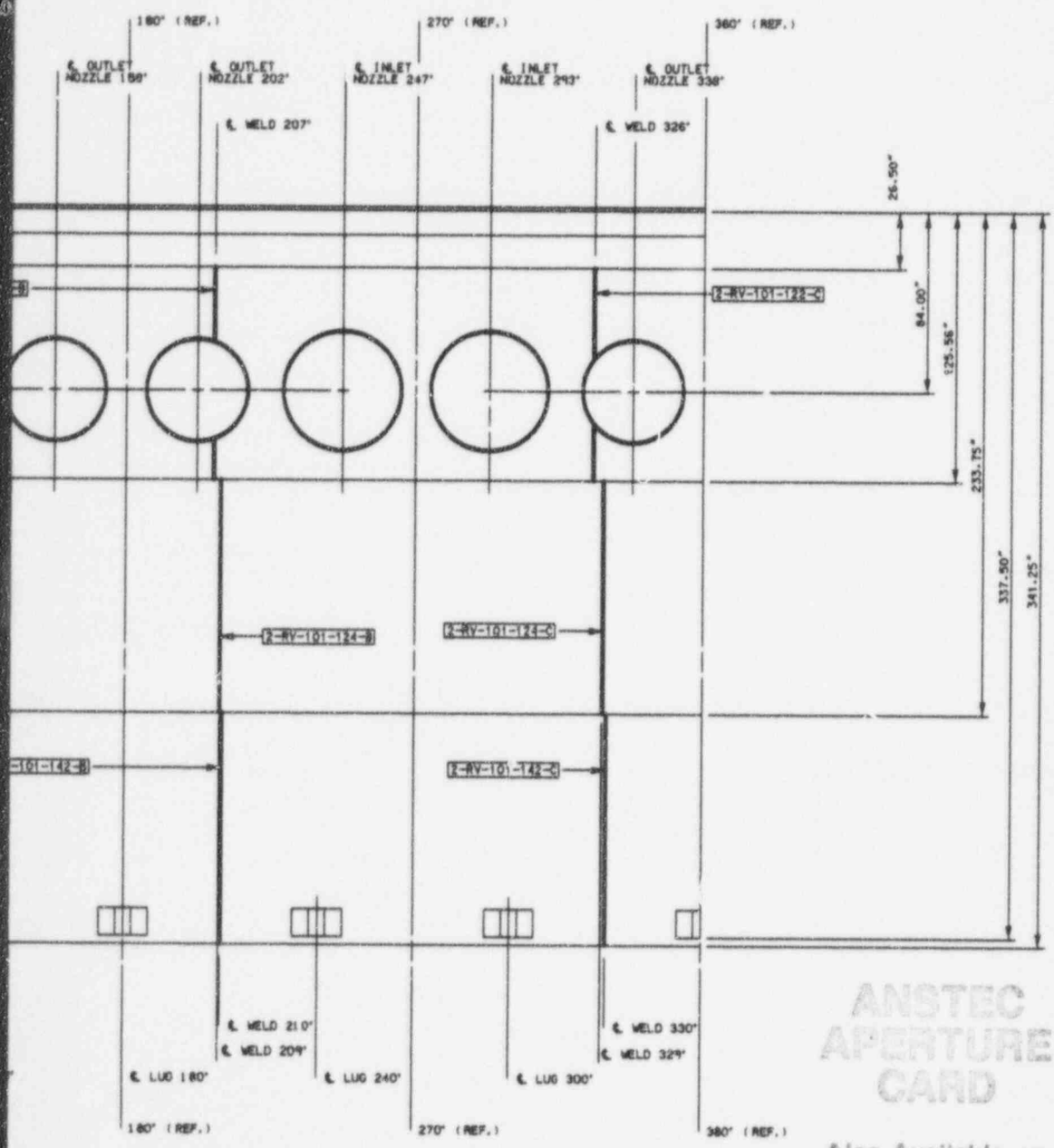
10 CFR 50.55a(g)(6)(ii)(A) requires examination of essentially 100% of the RPV shell welds in accordance with ASME Boiler and Pressure Vessel Code, Section XI, 1989 Edition. Callaway's ISI program also required 100% examination coverage of the RPV shell welds at the end of the first ISI Inspection Interval in accordance with the ASME Boiler and Pressure Vessel Code, 1980 Edition through Winter 1981 Addenda. As both requirements are the same (100% examination coverage of RPV shell welds), the examination conducted at Callaway during the seventh refueling outage satisfies both the ISI program and the Augmented examination requirements.

As previously discussed, Union Electric examined the Callaway RPV shell welds using current examination technology. However, 100% examination coverage was not achievable for three RPV Upper Shell longitudinal welds, (see Table 1), due to limitations caused by the inlet and outlet nozzle configurations and the RPV flange inside diameter taper. Manual examinations from the inside or outside surface are impractical due to radiation levels.

The beltline region of the RPV experiences more radiation fluence and is more susceptible to weld degradation due to radiation. As shown by Table 1, examination of the six RPV longitudinal shell welds within the RPV beltline region achieved 100% examination coverage. The three RPV Upper Shell longitudinal welds for which 100% examination coverage was not possible, (2-RV-101-122-A, 2-RV-101-122-B, and 2-RV-101-122-C), are not within the RPV beltline region, and are thus less likely to experience radiation induced degradation. Also, as the examination of the six longitudinal shell welds within the RPV beltline region revealed no rejectable indications, it is reasonable to conclude that the inaccessible volumes of the three RPV Upper Shell longitudinal welds also contain no rejectable indications.

Considering the above, 100% examination coverage of the three RPV Upper Shell longitudinal welds (2-RV-101-122-A, 2-RV-101-122-B, and 2-RV-101-122-C), is impractical. The examinations performed for the accessible portions of the RPV Upper Shell longitudinal welds provide reasonable assurance that public safety is not reduced due to the physical limitation of examination coverage. Based upon the information contained in the relief request, Union Electric believes that the examination coverage achieved for the three RPV Upper Shell longitudinal welds using state of the art examination technology, and the 100% examination coverage achieved for the six remaining longitudinal shell welds within the RPV beltline region provide an acceptable alternative to the augmented RPV examination regulation.


8
7
6
5
H
G
F
E
D
C
B
A
FIGURE 1
VESSEL FLANGE
167.06" I.D.
UPPER SHELL
170.88" I.D.
NOZZLE
UPPER SHELL
INTERMEDIATE SHELL
173.00" I.D.
LOWER SHELL
BOTTOM HEAD TORUS
88.16" RAD.
BOTTOM HEAD COLLAR PLATE
0° (REF.)
90° (REF.)
℄ OUTLET NOZZLE 22°
℄ INLET NOZZLE 67°
℄ INLET NOZZLE 113°
℄ WELD 89°
2-RV-101-122-A
2-RV-101-124-A
℄ 2 WELDS 90°
℄ LUG 0°
℄ LUG 60°
0° (REF.)
90° (REF.)




TOR VESSEL I.D. ROLL-OUT

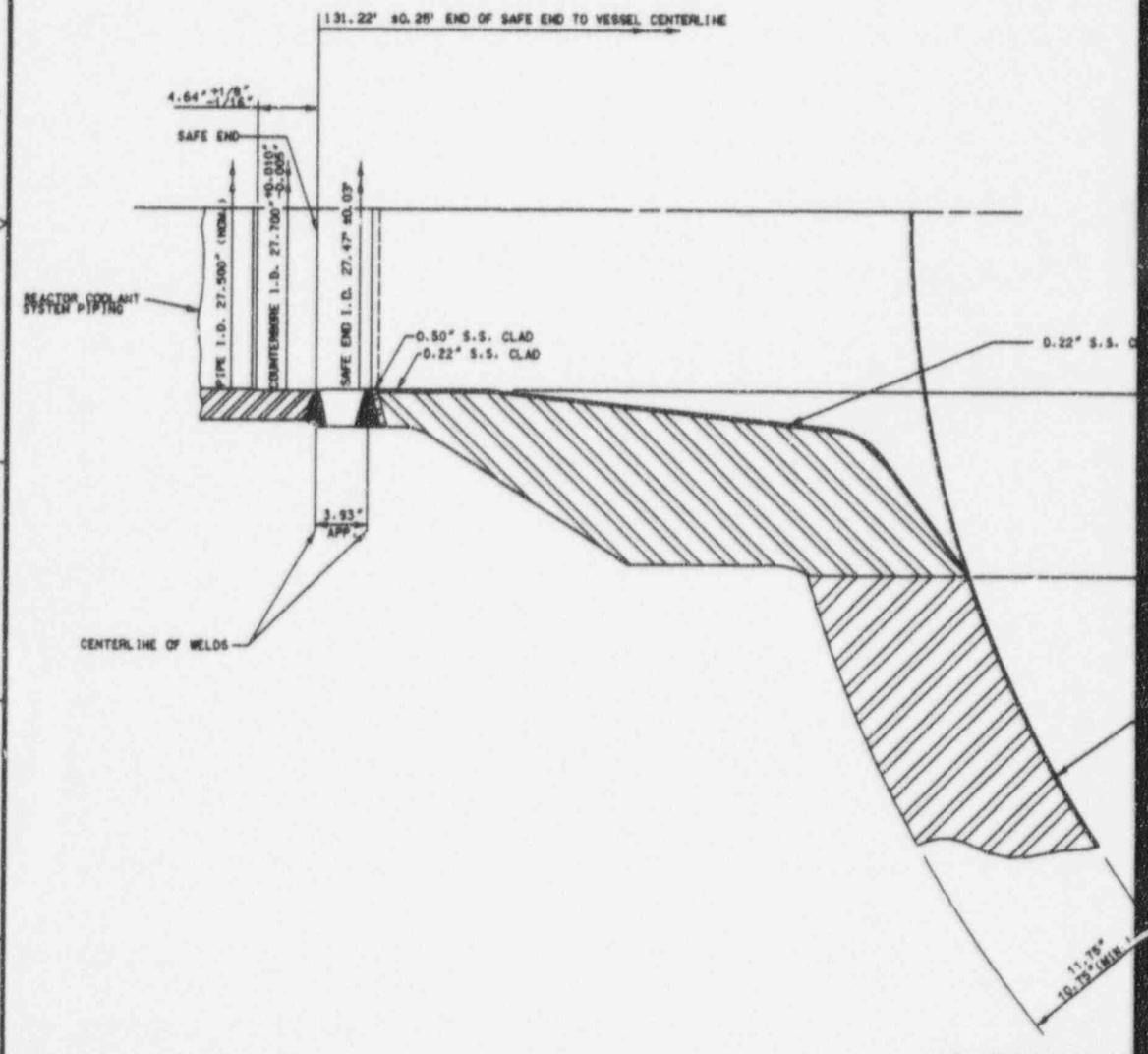


NOTES:
1. ALL DIMENSIONS ARE IN INCHES.
2. VESSEL REF. 90° CORRESPONDS TO REACTOR BUILDING REF. 0° (PLANT NORTH).

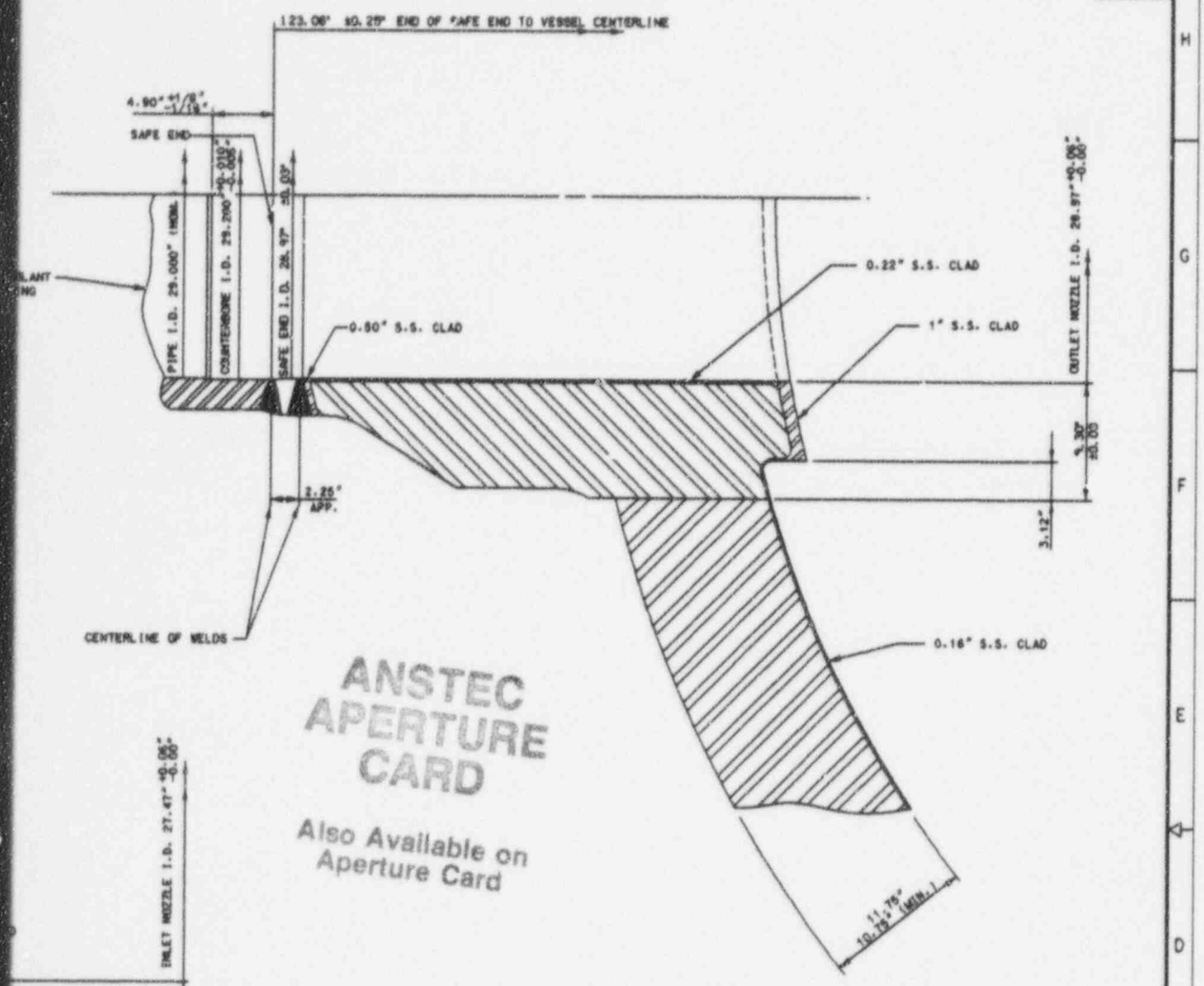
| | |
|---|---|
| REACTOR VESSEL RPV01 ISI EQUIPMENT WELDS SHEET 2 | |
| CALLAWAY PLANT | |
| UNION ELECTRIC COMPANY ST. LOUIS, MO | FIGURE 1 REV. A |

9605280091-01

FIGURE 2




INLET NOZZLE WELD DET
TYP. FOR 4 INLET NOZ




OUTLET NOZZLE WELD DETAILS
TYP. FOR 4 OUTLET NOZZLES



INLET NOZZLE I.D. 27.47"

14.20"
±0.03"

0.16" S.S. CLAD

NOTES:
1. ALL DIMENSIONS ARE IN INCHES.
2. VESSEL REF. 90° CORRESPONDS TO REACTOR BUILDING REF. 0° (PLANT NORTH).

REACTOR VESSEL
RB001
ISI EQUIPMENT WELDS
SHEET 4

CALLAWAY PLANT

UNION ELECTRIC COMPANY
ST. LOUIS, MO

FIGURE 2

REV. A

9605280091-02