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SUBJECT: Forwards request for relief from ASME Section XI hydrostatic pressure test requirements involving SG.Relief necessary to install two,7-inch diameter SG secondary side handholes.

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WILLIAM F. CONWAY
EXECUTIVE VICE PRESIDENT
NUCLEAR

102-02368-WFC/TRB/JRP
December 10, 1992

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
Relief Request from ASME, Section XI
Hydrostatic Pressure Test Requirements
File: 92-056-026

Enclosed is a request for relief from American Society of Mechanical Engineers (ASME), Section XI, hydrostatic pressure test requirements involving the steam generators for Units 1, 2, and 3. This relief is necessary for Arizona Public Service Company (APS) to install two, seven-inch diameter steam generator secondary side handholes. The handholes would provide access to the secondary tube bundle and tubesheet for the removal of loose parts, the performance of tubesheet inspections, and sludge lancing.

APS proposes that in the case of this handhole modification, the secondary hydrostatic pressure test consist of an In-Service Leak Test (ISLT) at normal secondary operating pressure in Mode 3, as opposed to the 1.25 times design pressure test currently required by ASME Code IWA-5000/IWC-5222.

Pursuant to 10 CFR 50.55a(a)(3) and 10 CFR 50.55a(f)(5)(iii), APS has determined that conformance to the code would be impractical and result in undue hardship without a compensating increase in the level of quality and safety.

Enclosure 1 contains the relief request from ASME, Section XI hydrostatic pressure test requirements (Relief Request No. 9). Enclosure 2 contains a description of the steam generator handhole modification. APS intends to install the steam generator handholes in each of the PVNGS units beginning with Unit 2 during the upcoming refueling outage which is scheduled to begin in March 1993. Therefore, APS respectfully requests that the NRC review and approve this relief request in an expeditious manner. The handholes will be installed in Units 1 and 3 during each unit's subsequent refueling outage.

If you have any questions, please contact Thomas R. Bradish at (602) 393-5421.

Sincerely,

WFC/TRB/JRP/pmm

Enclosures

cc: J. B. Martin
J. A. Sloan
C. M. Trammell

ENCLOSURE 1

ASME SECTION XI
RELIEF REQUEST

ENCLOSURE 1

ASME SECTION XI CODE REQUIREMENT

After repairs by welding on the ASME Class 2 pressure retaining boundary, a system hydrostatic pressure test shall be performed in accordance with ASME, Section XI, Code IWA-5000. IWA-5000/IWC-5222 requires a test pressure of 1.25 times system (design) pressure.

PROPOSED ALTERNATIVE TESTING

Arizona Public Service Company (APS) proposes that in the case of the steam generator handhole modification, the secondary hydrostatic pressure test consist of an In-Service Leak Test (ISLT) at normal secondary operating pressure in Mode 3, as opposed to the 1.25 times design pressure test currently required for Class 2 components by IWC-5222. The Mode 3 secondary pressure of approximately 1170 psig is the highest seen on the secondary side during normal operation, when the Reactor Coolant System (RCS) is at Normal Operating Pressure and Normal Operating Temperature. As reactor power is increased, the secondary pressure drops until the normal operating pressure of 1060 psig is reached at 100% reactor power.

BASIS FOR RELIEF

APS will install two, seven-inch diameter steam generator secondary side handholes to provide access to the secondary tube bundle and tubesheet for the removal of loose parts, to perform tubesheet inspections, and sludge lancing. For vessel reinforcement, the physical modification will require a weld pad build-up, deposited by the temper bead process in a ring geometry. The weld pad ring will be machined flat and holes drilled and tapped to accommodate the handhole cover plate (i.e., blind flange), gasket, studs and nuts. The ASME Code Section XI, IWA-5000/IWC-5222 requires that a 1.25 times design pressure/full secondary hydrostatic pressure test be performed as a result of the use temper bead welding on the steam generator shell for the purpose of adding reinforcement. Enclosure 2 contains a detailed description of the steam generator handhole modification.

Per 10 CFR 50.55a(a)(3). . . " Proposed alternatives to the requirements of paragraphs (c), (d), (e), (g), and (h) of this section or portions thereof may be used when authorized by the Director of Nuclear Reactor Regulation. The applicant must demonstrate that (i) the proposed alternatives would provide an acceptable level of quality or safety, or (ii) compliance with the specified requirements of this section would result in hardship or unusual difficulties without a compensating increase in the level of quality or safety."

The Code required 1.25 times design pressure hydrostatic pressure testing for this modification presents undue hardship on APS for the following reasons:

1. The hydrostatic pressure test must be performed with the Reactor Vessel (RV) defueled due to the testing prerequisites and design and operational limitations. A 1.25 times design pressure secondary side hydrostatic pressure test will result in test parameters of 1569 to 1620 psig and 120° F (minimum). Due to a reverse secondary to primary pressure differential limitation of 820 psig imposed by the steam generator stress report, the RCS must be maintained at a minimum of 875 psig and 291° F to support the secondary hydrostatic pressure test. Since the RCS pressure of 875 psig exceeds the design pressure of the Shutdown Cooling System (SDCS), the SDCS cannot be utilized for decay heat removal. Since the SDCS cannot be used, Technical Specifications require two RCS loops and associated steam generators to be operable for decay heat removal in Mode 4. This Technical Specification requirement cannot be met while hydrostatic pressure testing the secondary side of the steam generators. Therefore, it is concluded that performance of the secondary hydrostatic pressure test with the reactor fueled is not a viable option. Section IWA-5214(d) states, "where the system hydrostatic pressure test of (b) above (reference IWC-5222) imposes system conditions which conflict with limitations included in the plant Technical Specifications, a system inservice test (IWA-5211(c)) at normal operating temperature shall be acceptable in lieu of the system hydrostatic test."

2. A hydrostatic pressure test performed with the reactor defueled results in the following hardships and technical concerns:

   a) An unwarranted reactor reassembly in that it requires the Reactor Vessel (RV) Head and Upper Guide Structure (UGS) to be placed and tensioned following defueling for performance of the hydrostatic pressure test, then removed, then reinstalled and retensioned, following refueling of the reactor.

   b) With the reactor defueled, the Reactor Coolant Pumps (RCPs) would be used to raise and maintain temperature of the RCS. Consequently, this requires reconnecting the power supplies and position indication for each Control Element Drive Mechanism (CEDM), venting of each CEDM and reinstallation of all associated CEDM cooling equipment to allow the Control Element Assemblies (CEAs) to be withdrawn up into the UGS during RCP operations.

   c) Even with the UGS installed, running the RCPs in "precore" configurations places the RCPs at their upper design limit. This would impose stresses on the shafts and impellers (as well as high amps on the motors) that will never be seen during normal or transient operation at PVNGS. Regulatory concerns over RCP shaft cracking has imposed a Licensing required shaft vibration monitoring system with associated action statements that require immediate plant shutdown. APS also conducts ultrasonic inspection (UT) of the RCP shafts every refueling as a preventative measure. To expose these shafts to the excessive "precore" stresses would seem to be in conflict with the intent of the regulatory requirements and is considered an unnecessary hardship upon the RCPs.

d) Analysis would be required on the Resistance Temperature Detector's (RTDs) that protrude into the RCS flow. Flow induced stresses on the RTDs were a concern during the precore start-up testing. The RTDs would have to be analyzed to determine if they could withstand the high flow that would exist with RCP operation in the defueled condition.

e) All Main Steam Safety Valve's (MSSVs) and Atmospheric Dump Valve's (ADVs) will have to be removed and replaced with blind flanges (note that ADV block valves may be used if leaktight).

f) Due to the safety concerns and supply considerations of pneumatically pressurizing the main steam lines, the lines from the steam generator's in containment to the Main Steam Isolation Valve's in the Main Steam Support Structure will be filled with water for the hydrostatic pressure test. This will require pinning/strengthening of existing supports as well as additional temporary hangers to support the additional weight.

g) All boundary valves must be verified to be leaktight.

h) Temporary relief valves will be required on the secondary side as the system will be water solid, with minimum temperature requirements of 120° F and heat addition from the RCS.

In summary, the hardships and technical issues resulting from a secondary hydrostatic pressure test are numerous:

- The only feasible time to perform this hydrostatic pressure test will be with the reactor defueled. This will result in up to approximately 3 weeks delay in critical path time with an estimated lost generation cost to the utility =$12M.

- Imposes unwarranted use and movement of the UGS and RV Head.

- Imposes undo stress on the RCP shafts.

- Imposes the highest and most limiting fatigue cycle the steam generators will encounter.

3. The increase in safety or quality afforded by the Code-required hydrostatic pressure testing, above that of the proposed alternative, is not commensurate with the above described hardships and expenses. The proposed alternative ISLT would provide an acceptable level of quality and safety sufficient to demonstrate the integrity of the modification and the intent of the ASME Code. This is based on:

a. Reg. Guide 1.147 and Code Case N-498 allow alternate rules for the ten-year hydrostatic pressure testing for Class 1 and Class 2 systems. As outlined in the Code Case, the Committee considers an acceptable alternative to the hydrostatic pressure test to be an ISLT that is conducted after the system has been pressurized to normal operating pressure for four hours. The proposed ISLT is consistent with the line of reasoning and intent of the Code Case to utilize a system leakage test (IWB-5221) in lieu of the unnecessary challenge of a 1.25 times design pressure hydrostatic pressure test.

b. Per conversation with the ASME Section XI Chairman, the ASME Code is pursuing action to modify ISI requirements of Class 2 systems so as to eliminate the hydrostatic pressure testing in lieu of an ISLT and conform to the Class 1 requirements. (It is APS Engineering's understanding that the reasoning behind this pursuit is that nothing detrimental has ever been discovered during these hydrostatic pressure tests which in turn imposes the highest and most limiting fatigue cycle that the steam generator's can experience. A hydrostatic pressure test of 1.25 times of design pressure places the highest strain that the material will experience. The existing stress report's cumulative fatigue usage factors are indicative of this by only allowing 10 hydrostatic pressure test cycles in the design life of the component. The steam generators have been hydrostatic pressure tested in the manufacturers shop and in the field during construction/start-up, which has used up two of these 10 cycles. From the information gathered so far from the industry, there have been no failures of any of the 10-year, 1.25 times design pressure hydrostatic pressure testing of the secondary side. Therefore, it would be good engineering practice to limit such testing unless it were shown to be absolutely essential. It is APS' understanding that the Code recognizes that the current Class 2 hydrostatic pressure test requirements are more stringent than the Class 1 requirements and that steps are being taken to rectify this situation.)

c. The majority of the Class 2 side of the PVNGS steam generators was originally analyzed using Class 1 analytical techniques (NB-3000).

d. The analysis to support the handhole modification will be performed using analytical techniques comparable to the Class 1 analysis, including a detailed fatigue analysis.

e. Non-Destructive Examination (NDE) requirements will utilize magnetic particle (MT) and ultrasonic examination (UT) of the base metal, progressive magnetic particle examination of each weld pass, and final magnetic particle and ultrasonic examination to verify weld reinforcement quality.

f. The ISLT will demonstrate that the modification is sound through the pressure ranges the handholes will normally experience during plant operation, as pressure on the secondary side is ultimately controlled through the MSSVs.

g. Weld reinforcement/temper bead welding will be qualified to ASME Section XI requirements.

From the above statements and the detailed design analysis performed, the manufacturing and installation techniques for the steam generator(s) for this modification are conservative and comparable to the quality and safety requirements of a Class 1 system and instills the basis that excessive testing is not required. Hence, APS believes that the Section XI required hydrostatic pressure test of 1.25 times design pressure is overly conservative, more detrimental than beneficial, and thus an unnecessary challenge to the structural integrity of the steam generator and secondary steam piping systems. The proposed ISLT will be consistent with the ASME Code Case N-498 and will provide the assurance that the modification is structurally sound.

RELIEF REQUEST NO. 9 UNIT 1

COMPONENT OR ITEM	CODE CLASS	PROGRAM TABLE	CODE ITEM	EXAM CATEGORY
STEAM GENERATOR	2	IWA-5000 IWC-5000	N/A N/A	N/A N/A

CODE REQUIREMENT

Perform hydrostatic pressure tests (1.25 times the system design pressure) after repairs by welding.

BASIS

A detailed basis is provided under separate cover. The following is a brief summary:

- -The hydrostatic pressure test must be performed with the reactor vessel defueled due to the testing prerequisites.
- -This would require an additional reactor reassembly
- -The reactor coolant pumps would be used to raise and maintain temperatures in a precore type configuration at their upper design limit.
- -All main steam safety valves and atmospheric dump valves would require removal and replacement with blind flanges.
- -Additional supports would be required due to filling the steam lines with water.

ALTERNATE EXAMINATION

A system inservice test will be performed at normal operating pressures.

SCHEDULE FOR IMPLEMENTATION

First Ten Year Inspection Interval

APPROVAL

Pending NRC review of revision one.

RELIEF REQUEST NO. 9 UNIT 2				
COMPONENT OR ITEM	CODE CLASS	PROGRAM TABLE	CODE ITEM	EXAM CATEGORY
STEAM GENERATOR	2	IWA-5000 IWC-5000	N/A N/A	N/A N/A

CODE REQUIREMENT

Perform hydrostatic pressure tests (1.25 times the system design pressure) after repairs by welding.

BASIS

A detailed basis is provided under separate cover. The following is a brief summary:
- -The hydrostatic pressure test must be performed with the reactor vessel defueled due to the testing prerequisites.
- -This would require an additional reactor reassembly
- -The reactor coolant pumps would be used to raise and maintain temperatures in a precore type configuration at their upper design limit.
- -All main steam safety valves and atmospheric dump valves would require removal and replacement with blind flanges.
- -Additional supports would be required due to filling the steam lines with water.

ALTERNATE EXAMINATION

A system inservice test will be performed at normal operating pressures.

SCHEDULE FOR IMPLEMENTATION

First Ten Year Inspection Interval

APPROVAL

Pending NRC review of revision one.

RELIEF REQUEST NO. 9 UNIT 3

COMPONENT OR ITEM	CODE CLASS	PROGRAM TABLE	CODE ITEM	EXAM CATEGORY
STEAM GENERATOR	2	IWA-5000 IWC-5000	N/A N/A	N/A N/A

CODE REQUIREMENT

Perform hydrostatic pressure tests (1.25 times the system design pressure) after repairs by welding.

BASIS

A detailed basis is provided under separate cover. The following is a brief summary:
- -The hydrostatic pressure test must be perfomed with the reactor vessel defueled due to the testing prerequisites.
- -This would require an additional reactor reassembly
- -The reactor coolant pumps would be used to raise and maintain temperatures in a precore type configuration at their upper design limit.
- -All main steam safety valves and atmospheric dump valves would require removal and replacement with blind flanges.
- -Additional supports would be required due to filling the steam lines with water.

ALTERNATE EXAMINATION

A system inservice test will be perfomed at normal operating pressures.

SCHEDULE FOR IMPLEMENTATION

First Ten Year Inspection Interval

APPROVAL

Pending NRC review of revision one.

ENCLOSURE 2
STEAM GENERATOR HANDHOLE MODIFICATION

ENCLOSURE 2
STEAM GENERATOR HANDHOLE MODIFICATION

A. BACKGROUND

The steam generators installed at PVNGS do not have the capability for secondary side tube sheet visual inspection, removal of loose parts, nor the removal of sludge accumulations that lead to long-term tube degradation. Industry experience has demonstrated that failure to control and limit the accumulations of sludge leads to long term degradation such as tube corrosion, wastage, and cracking of the tubes.

To provide the desired access to the tubesheet, APS intends to install steam generator handholes in each of the PVNGS units, beginning with Unit 2 during the upcoming refueling outage in March 1993. The handholes will be installed in the remaining units during each unit's subsequent refueling outage.

B. STEAM GENERATOR DESIGN

Each Palo Verde unit utilizes two steam generators which are vertical tube and shell heat exchangers approximately 68 feet in height with a steam drum diameter of 20 feet. The steam generator arrangement is shown in Figure 1.

The steam generator is constructed of low alloy steel (P3) pressure containing members and Inconel 600 tubing. The primary side (high pressure) of the steam generator consists of the hemispherical lower head, the tubesheet and the tubes. A primary side divider plate with tongue and groove construction separates the head into inlet and outlet chambers. A 42-inch nozzle provides entrance of reactor coolant into the steam generator which passes through the heat transfer tubes and exits through two, 30-inch outlet nozzles. The unit is supported by a skirt attached to the bottom head. The secondary side of the steam generator consists of two cylindrical shells, joined by a conical section to the steam drum.

The tube bundle is enclosed by a baffle which forms the downcomer annulus just inside the shell. The top of the baffle serves to support the separator deck. The tube bundle is comprised of 11,012, 3/4" diameter tubes of various lengths. The tubes are arranged in rows with all tubes in a given row having the same length. The rows are staggered, forming a triangular pitch arrangement. The shorter tubes which have 180° bends are at the center of the tube bundle in the first 18 rows. All subsequent rows have double 90° bends. The vacant space (4 1/4") between the tubes in the first row is called the tube lane which is open through the tube bundle. The tube lane is the boundary between the hot leg side and the cold leg side of the secondary side of the steam generator.

The Palo Verde steam generators are equipped with axial economizers (preheater) to enhance thermal efficiency. Details of the economizer arrangements are shown in Figures 2 and 3. The preheater design is such that only incoming feedwater enters the economizer. All recirculating water from the downcomer either enters the evaporator above the economizer or on the hot leg side of the steam generator. Both the hot leg side and the cold leg side are equipped with flow distribution baffles. These baffles are located immediately above the tubesheet. Figure 3 depicts a divider plate which separates the economizer from the hot leg side of the steam generator.

C. HANDHOLE DESIGN

Because of the integral economizer design, the size and location of the handholes becomes critical to ensure the desired access to the entire tubesheet region is obtained. Therefore, the handhole design consists of two, seven-inch ID holes penetrating the secondary shell at each end of the secondary side divider plate on each steam generator. The seven-inch hole size allows inspection and retrieval and sludge lancing equipment to access both the hot and cold leg sides of the tubesheet, including the annulus around the outer periphery and down the tube lane. Because of the presence of the economizer central cavity stay cylinder support, two holes are required to provide access down the tube lane on each side of the stay cylinder.

The physical arrangement of the handhole modification is shown in Figures 4 through 8. The modification will be performed using a 4-step process as follows:

1. Weld pad build-up using temper bead technique to provide the required vessel reinforcement.

2. Flatten the top of the pad, grind the radius, and tap the stud holes.

3. Machine the seven-inch diameter hole through the majority of the steam generator shell thickness and Electrode-Discharge Machine (EDM) through the remainder of the steam generator wall and divider plate.

4. Final machine all surfaces.

<u>1. WELD BUILD-UP PAD</u>

The centerlines of the handhole will be determined and marked on the outer shell of the Steam Generator A small pilot hole 0.75" deep will be drilled to mark this location and for use by the subsequent equipment. The affected areas will be NDE inspected with UT and MT. The machining mounting plate will be installed in the pilot hole and tack welded into place. Thermocouples and heat treat equipment will be tack welded onto the shell to establish the 400° F preheat conditions required for welding. Once the preheat requirements are met for the approved P3 to P3 weld process, 3/32" diameter electrodes

will be utilized to establish the first weld layer. Fifty percent of the first layer will be ground away and an MT performed. The second layer will be deposited using 1/8" diameter electrodes. Fifty percent of the second layer will be ground away and MT inspected. All subsequent layers will be deposited using no larger than 5/32" electrodes, and MT inspected. Maximum height of the weld build-up pad will be 2.5". After completion of the weld build-up pad, temperature will be raised to 500° F and held for a minimum of two hours. Note the weld build-up pad will also be NDE examined 48 hours after the pad has cooled to ambient temperature.

2. **PAD MACHINING**

After the welding machine has been removed, the facing equipment will be installed. The OD face of the pad will be machined flat radiused and the preliminary 6" ID of the pad will be machined. The pad will then be NDE inspected utilizing UT and liquid penetrant (PT). The handhole stud holes will be drilled and tapped.

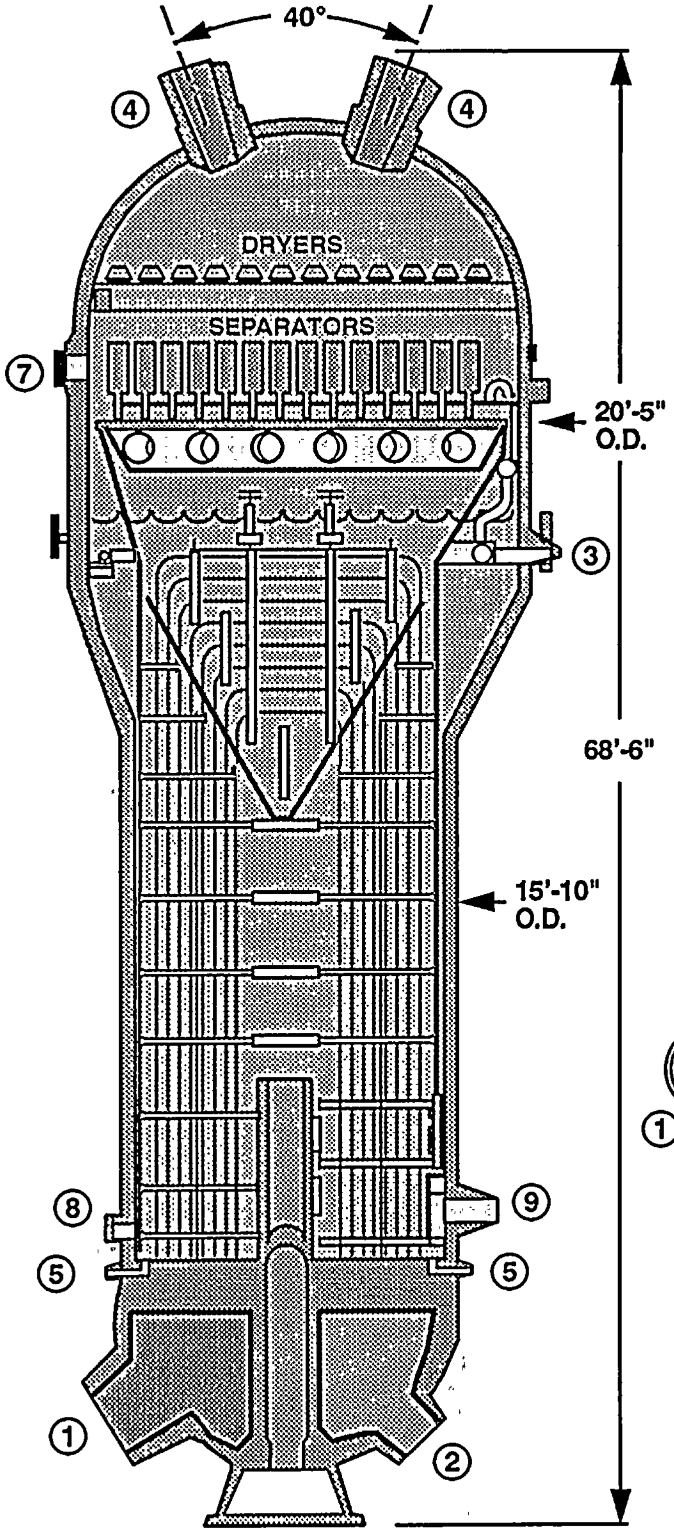
3. **SHELL MACHINING**

The pad equipment will be removed and the boring equipment for machining the preliminary hole in the shell installed. A 6.75" diameter hole will be machined to within approximately 1" of the steam generator ID surface. The EDM equipment will be installed next. The remainder of the steam generator shell thickness will be removed via EDM. The equipment will also be used to EDM through the divider plate. This will effectively "notch-out" a section of the divider plate directly behind the handhole for access requirements. The EDM process is used to eliminate the Foreign Material Exclusion (FME) concerns of steel shavings falling into the steam generator. The EDM equipment will complete the machining of all the final diameters and dimensions through the steam generator shell and divider plate.

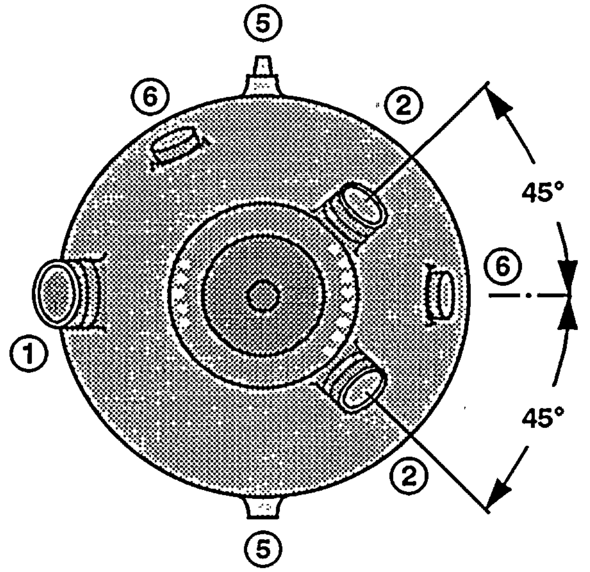
4. **FINAL MACHINING**

After the EDM equipment is removed, the equipment to cut the gasket sealing surface will be installed. Appropriate FME measures will be taken. The handhole seating surface for the closure gasket will then be final machined and inspected. The bore ID and seating surface will be PT inspected. All final inspections will be performed. The handhole cover will then be assembled.

SYSTEM 80 STEAM GENERATOR



NO.	SERVICE	NO. REQ'D
1	Primary Inlet	1
2	Primary Outlet	2
3	Downcomer Feedwater	1
4	Steam Outlet	2
5	Blowdown	2
6	Primary Manway	2
7	Secondary Manway	2
8	Handhole	2
9	Economizer Feedwater	2



BOTTOM VIEW OF
STEAM GENERATOR

FIGURE 1

Economizer Elevation View

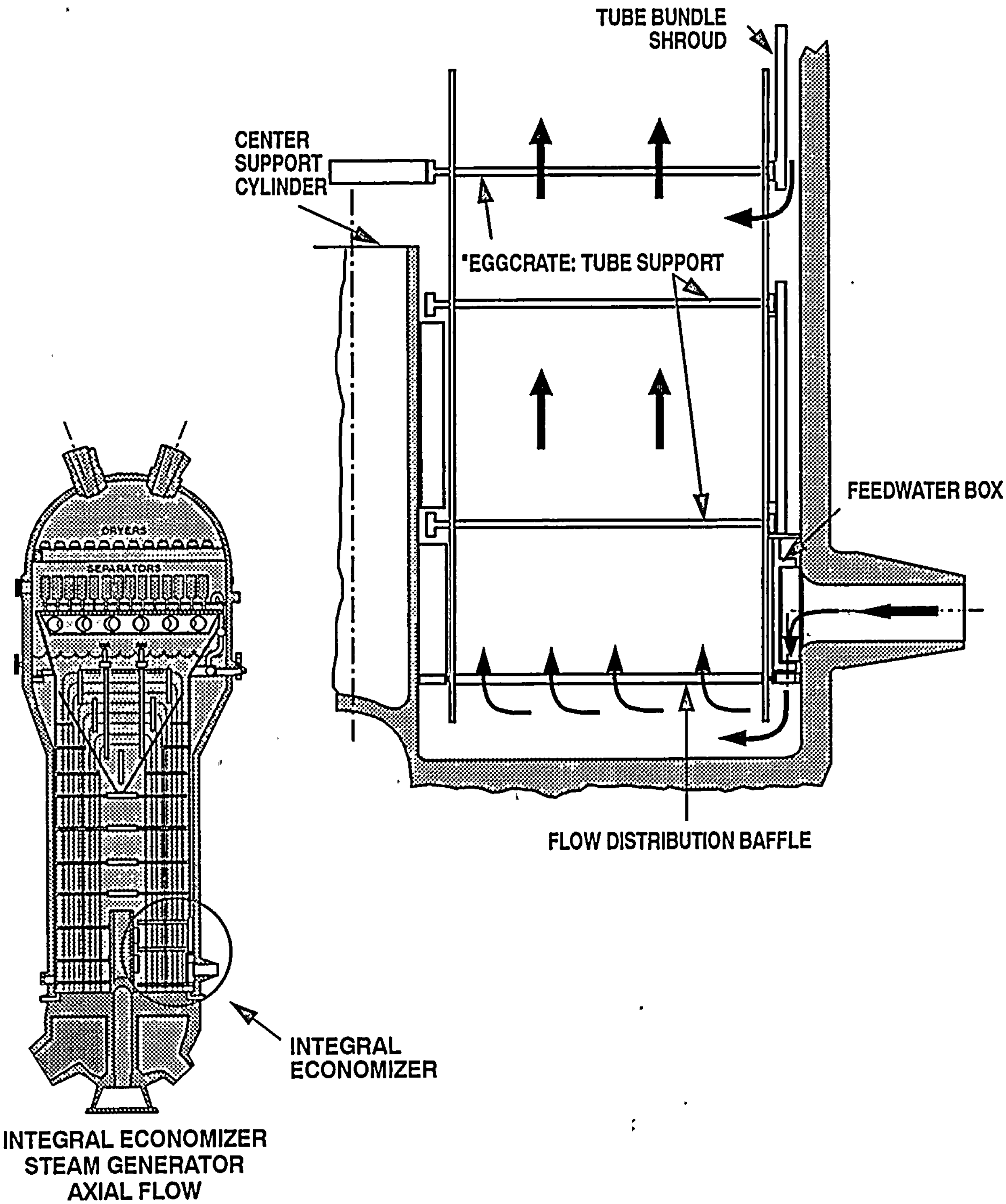


FIGURE 2

ECONOMIZER

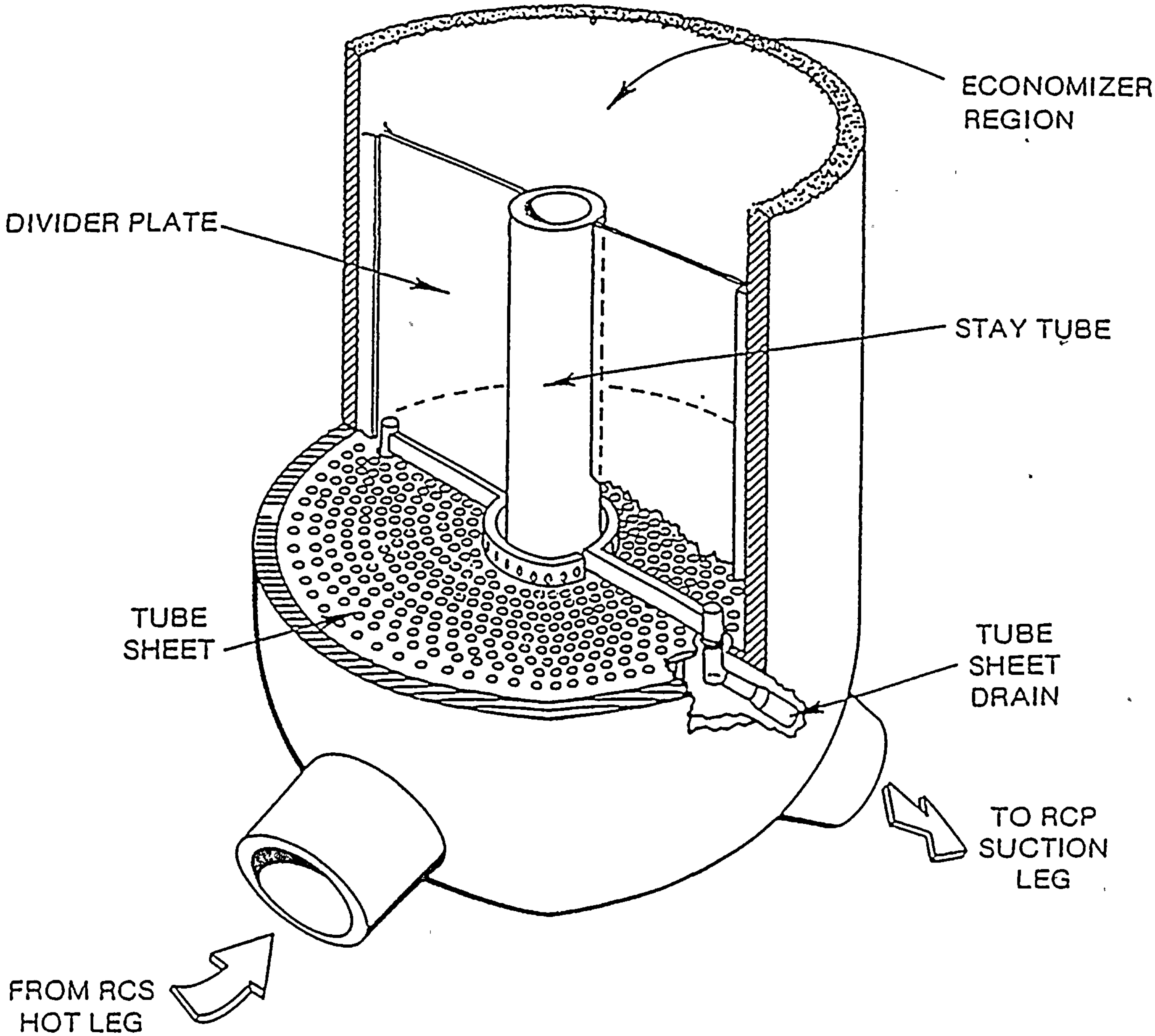


FIGURE 3

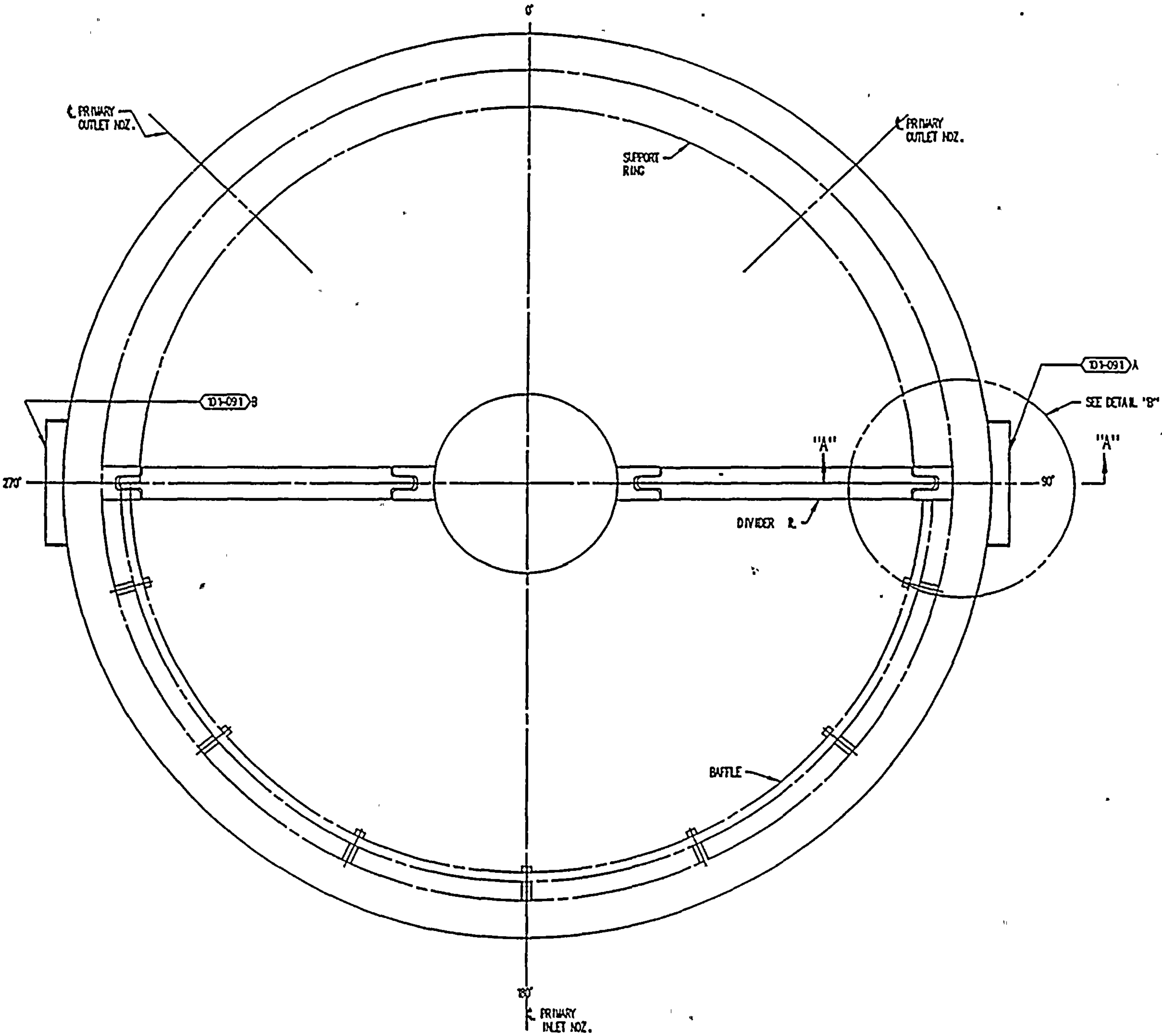
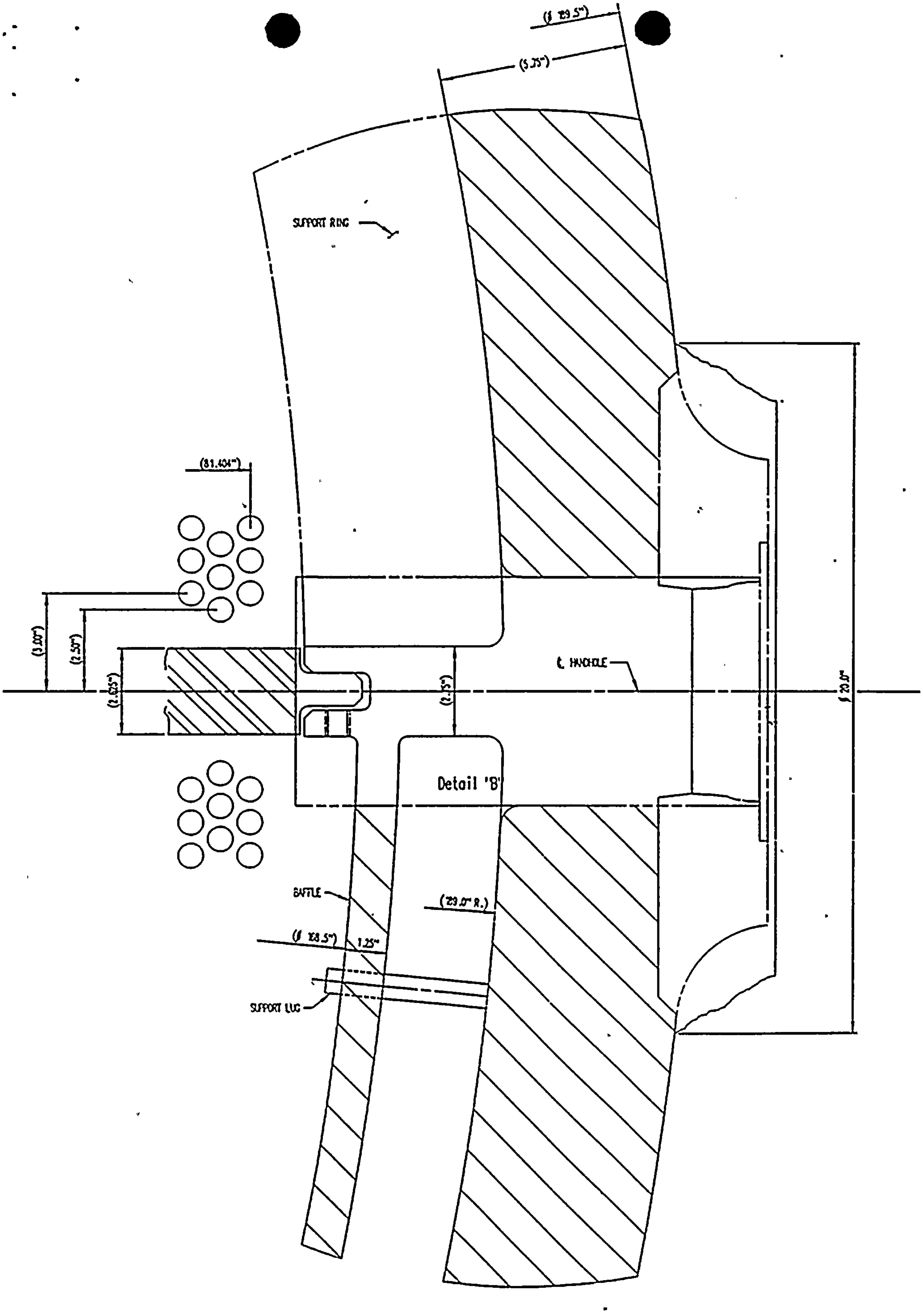


Figure 4

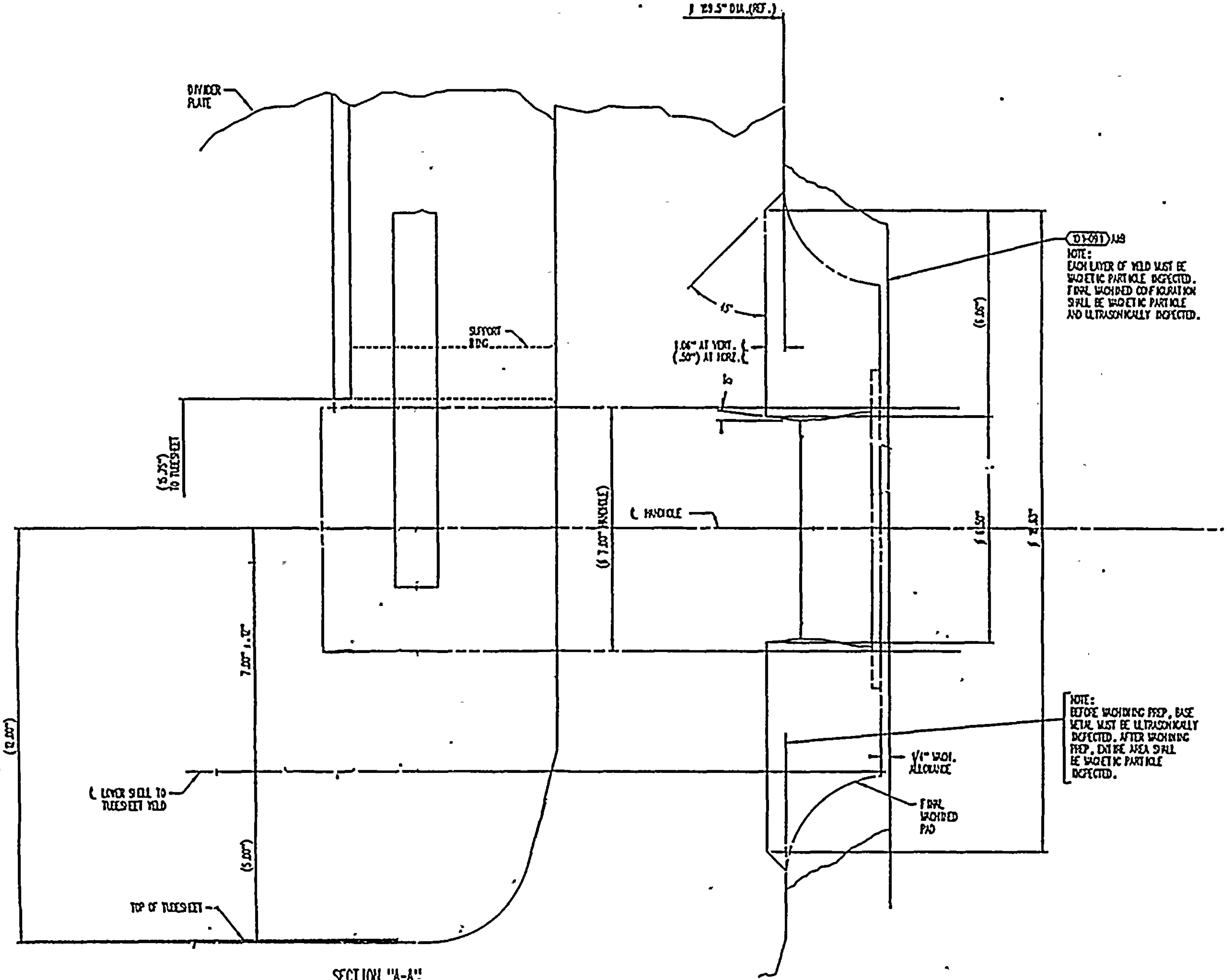
Plan View of Steam Generator



Detail 'B'

Figure 5

Figure 6



SECTION "A-A"

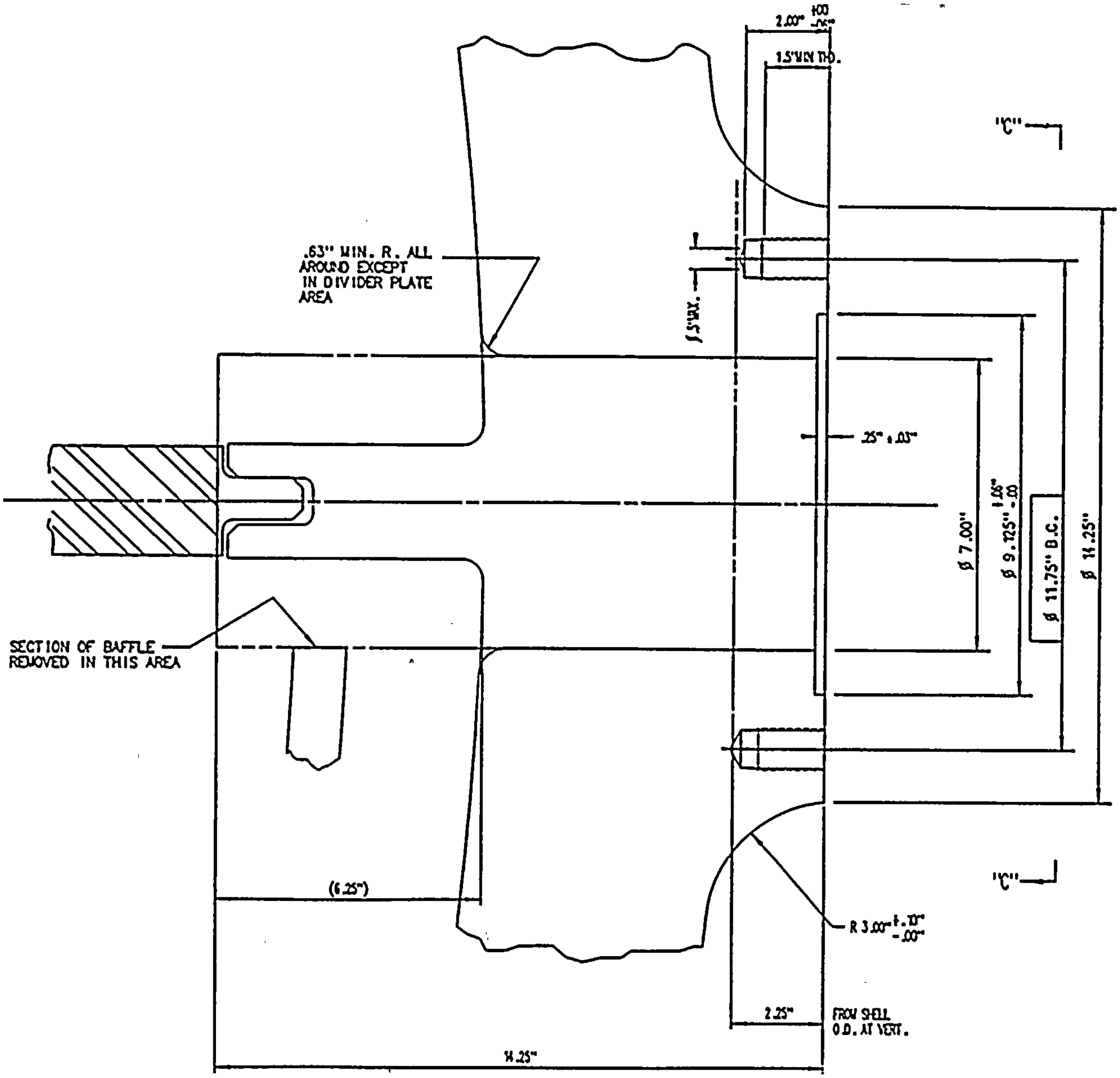
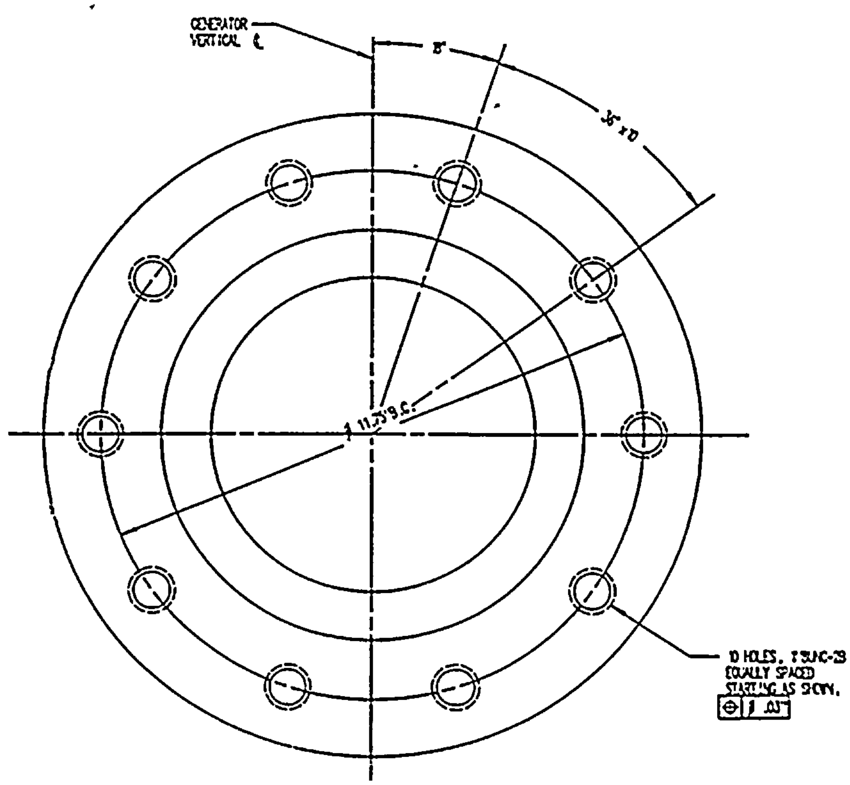


Figure 7

Section "A-A"



VIEW "C-C"

Figure 8

Elevation of Handhole Cover

[illegible]