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POWER SYSTEMS

50-470

March 3, 1981
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RECEIVED MAR 06 1981 U.S. NUCLEAR REGULATORY COMMISSION

Mr. C. I. Grimes
Standardization and Special Projects Branch
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Confirmatory Piping Analysis Information

Dear Mr. Grimes:

In a telephone conversation with Messrs. G. A. Davis and T. E. Natan on February 20, 1981, you requested information on the System 80 Reactor Coolant System (RCS) cold leg piping, for use by Pacific Northwest Laboratory in performing a confirmatory piping analysis of the PVNGS Safety Injection System (SIS) piping. The requested information is provided in the enclosures.

As we stated earlier, we have serious reservations as to whether the simplified analysis you are planning will yield sufficiently accurate results. Combustion Engineering performs a very lengthy and complex analysis of Reactor Coolant System (RCS) piping, which includes the interactions of the major components and their supports.

If we can be of any additional assistance, please feel free to contact either myself or Mr. T. J. Price of my staff at (203)688-1911, Ext. 2803.

Very truly yours,

COMBUSTION ENGINEERING, INC.

A. E. Scherer
Director
Nuclear Licensing

B001 s/1 ORIG DRWGS AVAIL IN FILE

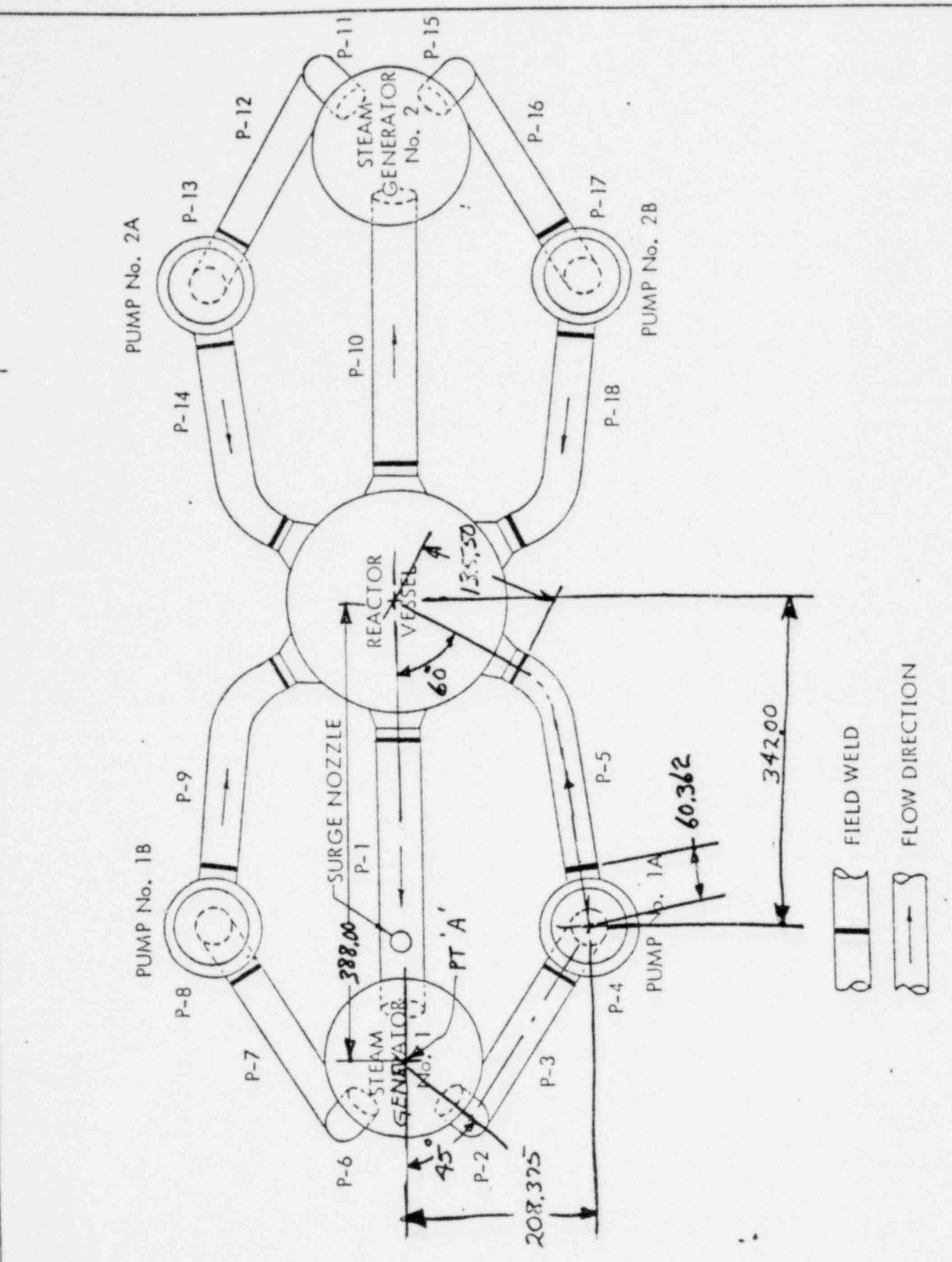
AES:dac

cc: Gordon Beeman (PNL) (with enclosure)

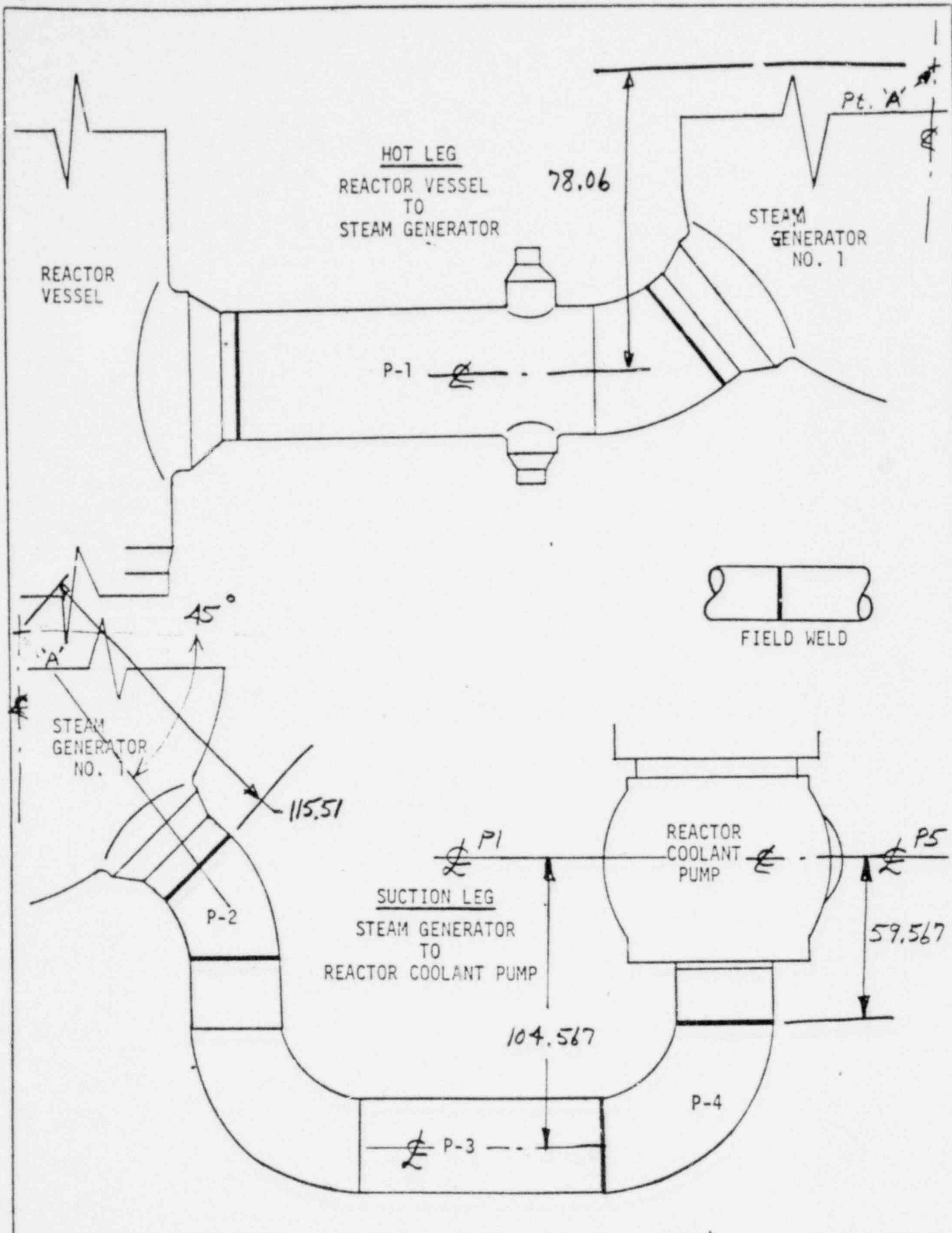
Enclosures

8103090621

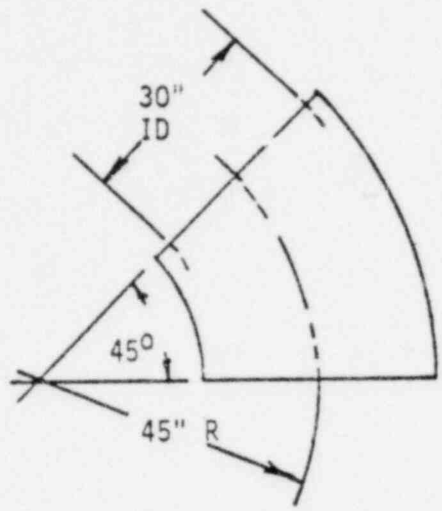
A



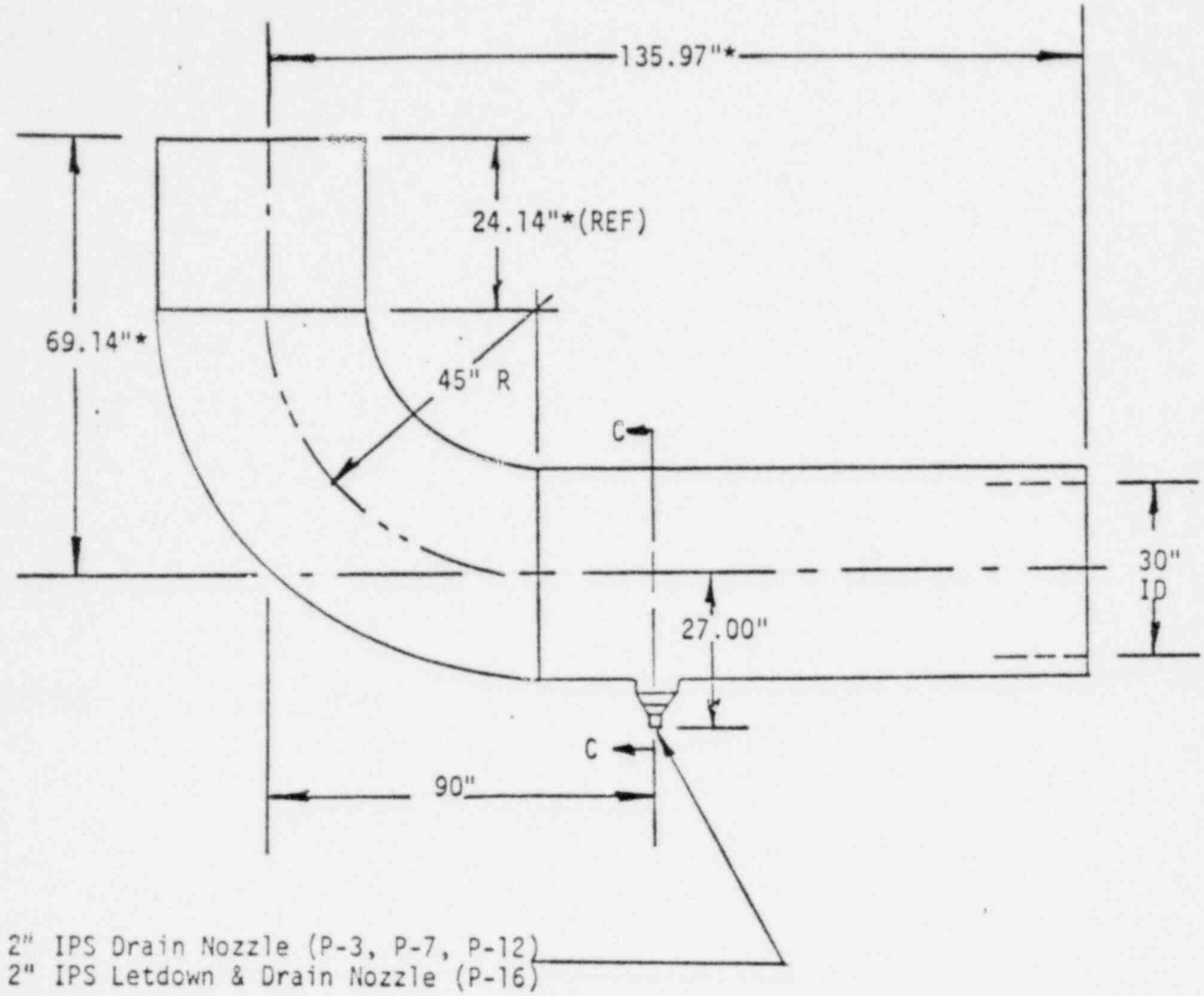
Title: REACTOR COOLANT PIPING ARRANGEMENT - PLAN VIEW



Title: REACTOR COOLANT PIPING - TYPICAL ELEVATIONS

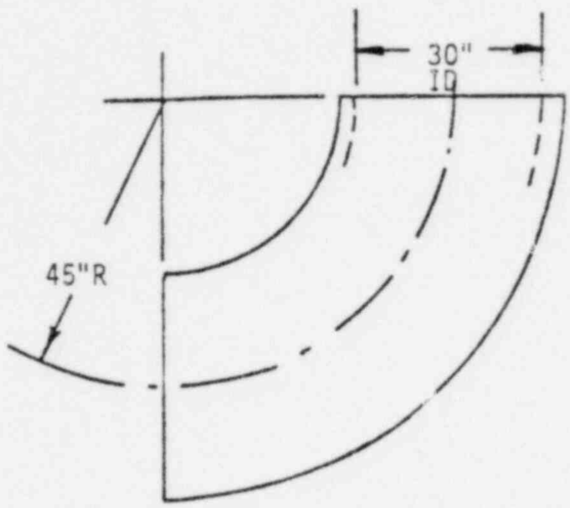


Title: REACTOR COOLANT PIPING DETAILS - Assemblies P-2, 6, 11, 15

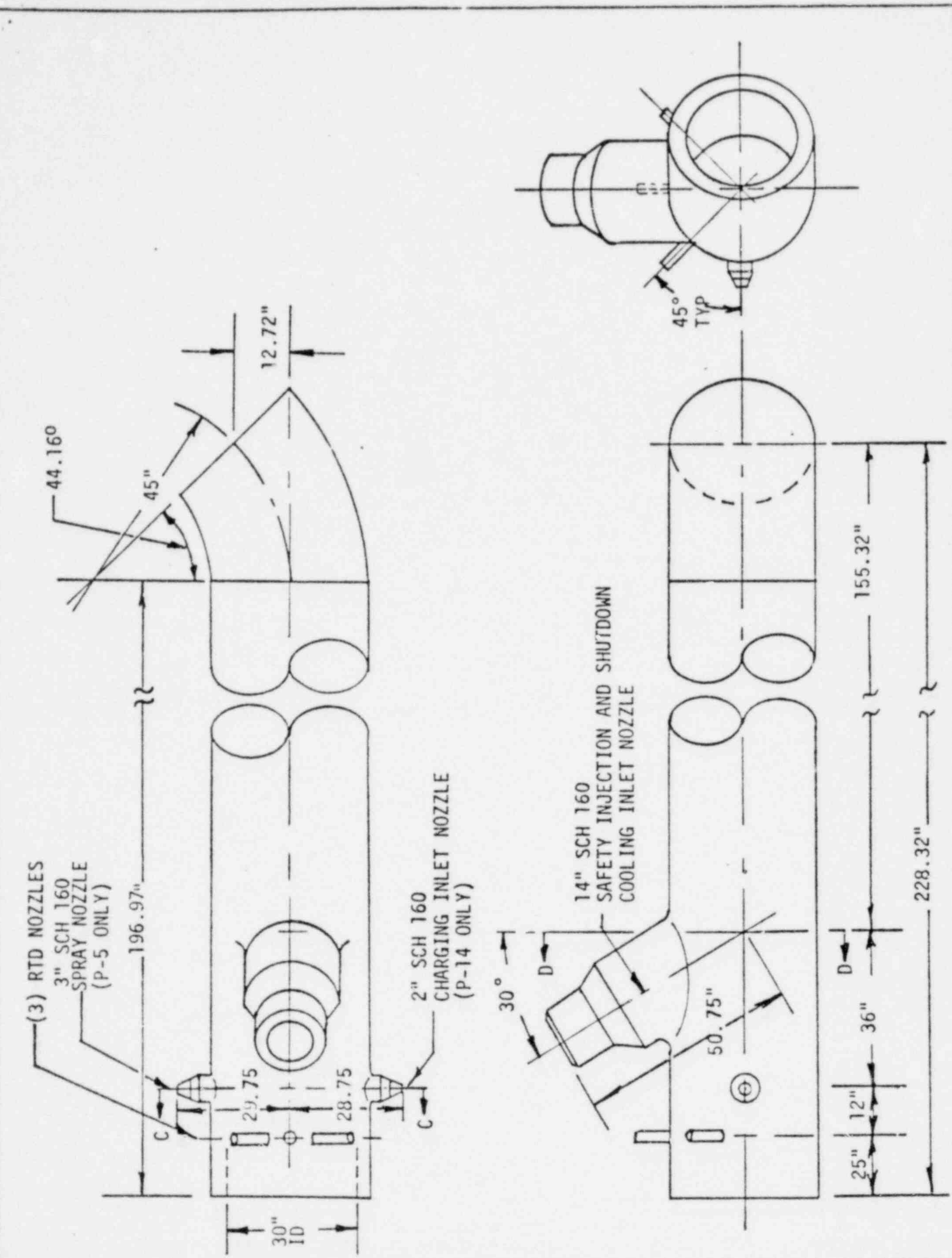


NOTE: THIS IS THE LOOP CLOSURE ASSEMBLY. THIS ASSEMBLY WILL BE PROVIDED WITHOUT WELD END PREPARATIONS AND 2" EXTRA LENGTH ADDED TO THE CALCULATED DIMENSIONS DENOTED BY AN ASTERISK (*). SEE PARA. 4.10.2.

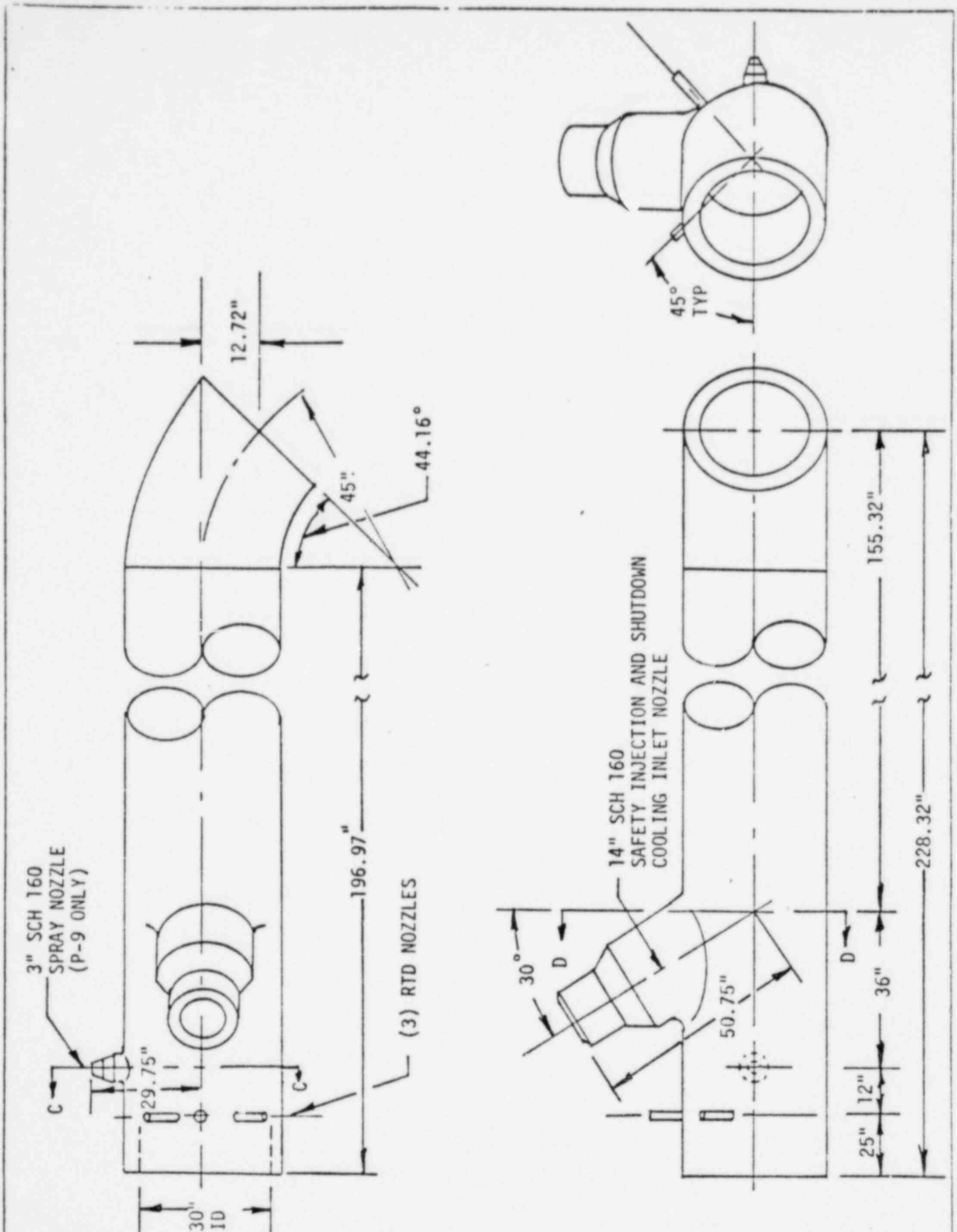
Title: REACTOR COOLANT PIPING DETAILS - Assemblies P-3, 7, 12, 16



Title: REACTOR COOLANT PIPING DETAILS - Assemblies P-4, 8, 13, 17



Title: REACTOR COOLANT PIPING DETAILS - Assemblies P-5, 14



Title: REACTOR COOLANT PIPING DETAILS - Assemblies P-9, 18

RCS SUPPORT SYSTEM

1.0 PURPOSE

The purpose of this document is to describe the purpose and function of the reactor coolant system supports and restraints.

2.0 SCOPE

Supports and restraints for the components and piping of the reactor coolant system are covered by this document.

3.0 REFERENCES

3.2 ASME B&PV Code Section III (applicable addenda)

4.0 DESCRIPTION

4.1 Definitions

The following definitions apply to this document and its references.

Support - a device which provides support to a component or pipe during normal and abnormal plant operations and conditions.

Restraints - a device which is inactive during all plant normal operations and conditions but acts to restrain a pipe for excessive motion following a postulated pipe rupture.

Stop - a device which is inactive during all plant normal operations and conditions but acts to stop a component from excessive motion following a postulated pipe rupture.

4.2 General Description

4.2.1 Reactor Coolant System Supports

The purpose of reactor coolant system supports is to provide support to the reactor coolant system during all normal and abnormal plant operations and conditions. Their function is to limit the stresses imposed on components and supports by the pressure, thermal and mechanical loadings to those allowed by Reference 3.2.

This function is accomplished by minimizing the resistance to thermal expansion and contraction while providing sufficient supports to raise the natural frequency of the reactor coolant system above the resonant frequency of the containment interior structures which interface with the component supports. This is accomplished by judicious use of low friction bearings, spherical bearings, hydraulic snubbers, and stops which limit the deflection of components following postulated pipe breaks.

4.2.2 Reactor Coolant System Restraints

The purpose of the reactor coolant system restraints is to restrain the pipes of the reactor coolant system following a postulated pipe rupture. Their function is to limit the flow of reactor coolant from the ruptured pipe and/or to prevent the ruptured pipe from damaging components or structures required for the orderly shut-down of the plant.

4.2.3 Reactor Coolant System Stops

The purpose of the reactor coolant system stops is to limit the motion of components following a postulated pipe rupture. Their function is to maintain the stresses in the components, pipes and supports resulting from forces generated by the pipe rupture within the limits prescribed by Reference 3.2.

4.3 Detailed Description

4.3.1 Reactor Vessel Supports

The reactor vessel supports are shown in Figure 1. The reactor vessel is supported by four vertical columns located under the vessel inlet nozzles. A pad welded to each nozzle provides a surface to which the column is bolted. This pad also acts as a horizontal key to positively locate the vertical centerline of the vessel. It is designed to mate with the owner's structure and allows free radial growth of the vessel during thermal expansion while supporting the vessel horizontally during earthquakes and following a postulated pipe rupture.

Figure 2 shows the interface at the upper horizontal reactor vessel supports. Low friction bearings are used to minimize resistance to thermal expansion. The clearance between the nozzle pad and the upper horizontal supporting structure must be shimmed to a specified size and verified during hot functional testing.

The vertical columns are designed to support the vessel and resist vertical motion during earthquakes and following a pipe rupture.

At the bottom of each column is a baseplate which is drilled to accept anchor bolts. Shear bars attached to this plate and preloaded anchor bolts are the mechanism by which column loads are transmitted to the foundation. The baseplate also acts as a keyway for a horizontal key welded to the lower vessel head. An energy absorbing material is used between the key and keyway to provide horizontal seismic support, while limiting the load on the vessel head during a pipe rupture.

Low friction bearings are used at each sliding surface on the lower keyways to minimize friction loads to the supporting structure. Figure 3 shows the interface at the reactor vessel lower supports.

4.3.2 Steam Generator Supports and Stops

The steam generators supports are shown on Figure 4. The steam generator is supported by a conical skirt welded to the steam generator lower head. The skirt provides a bolting surface for a heavy steel sliding base. Four low friction spherical head bearings under the plate are the sliding interface which allows horizontal motion parallel to the hot leg due to thermal expansion. Machined cutouts in the sliding base act as keyways for embedded keys which support the generator horizontally. In addition, the cutouts provide a mating surface for a stop that limits motion parallel to the hot leg following a postulated reactor coolant pipe rupture. Slotted holes are provided in the sliding base to accept anchor bolts.

Figure 5 shows the interface at the lower steam generator supports. In the keyways, low friction bearings are used to minimize resistance to thermal motion. The clearance between the stop mating surface and the key must be shimmed to a specified size and verified during hot functional testing. Also the gap between the top of the sliding base and the anchor bolt nuts must be set to a specified size during hot functional testing.

Horizontal support at the top of the steam generator is provided by two keys and two interconnected hydraulic snubber assemblies. They act as horizontal supports for the steam generator during earthquake and following a postulated pipe rupture, while allowing motion parallel to the hot leg due to thermal expansion.

Figure 6 shows the upper steam generator supports. Low friction bearings are bolted to the sides of the owner's keyway. Each snubber assembly consists of a lug welded to the steam generator, a lever, two links, two snubbers, one clevis pinned to the lever and two clevises pinned to snubbers. Each clevis, through which loads are transmitted to the owner's structure, is drilled to accept anchor bolts.

4.3.3 Reactor Coolant Pump Supports and Stops

The supports and stop control movement of the reactor coolant pump in the horizontal and vertical planes during accidents but accomodates thermal growth during plant heat up.

The reactor coolant pump supports and stop are shown in Figure 7. The reactor coolant pump and motor assembly is supported by four vertical columns pinned to the pump mounting ring. It is supported for seismic and loss of coolant accident loads by two horizontal columns pinned to the top of the motor mount, two horizontal columns pinned to the pump mounting ring, and a horizontal snubber system attached to the top of the motor mount. In addition horizontal restraint is provided, following a postulated pipe rupture, by a stop located at the pump casing at the elevation of the discharge nozzle.

Each column, horizontal and vertical, and the snubber assembly ends in a clevis, through which loads are transmitted to the owners structure. Each clevis is drilled to accept anchor bolts.

The pump stop mates directly with the pump casing. The clearance between the mating surface and the stop must be shimmed to a specified size and verified during hot functional testing.

4.3.4 Pressurizer Supports

The pressurizer supports are shown in Figure 8. The pressurizer is supported by a cylindrical skirt welded to the bottom head of the pressurizer. The skirt ends in a flange drilled to accept anchor bolts. Although most thermal growth will be in the vertical direction, the pressurizer skirt design will accomodate radial growth without bolt slippage.

Four keys welded to the upper portion of the pressurizer shell give additional support to the pressurizer during seismic and following a postulated pipe rupture.

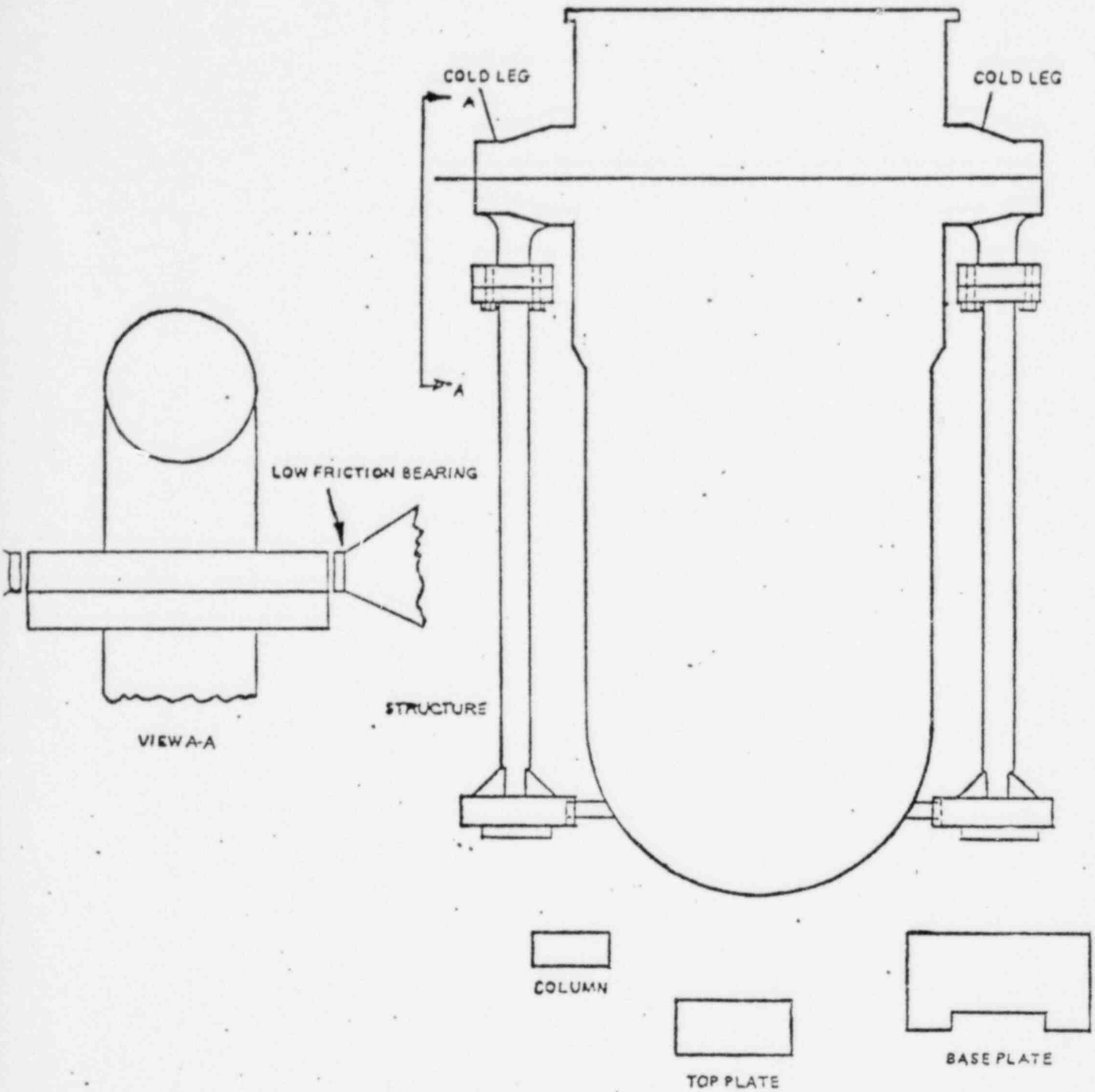
4.3.5 Reactor Coolant Piping (Main Loop) Restraints

Pipe restraints are located to prevent excessive movement of reactor coolant pipes as a consequence of postulated guillotine pipe ruptures. Restraint for slot type ruptures is provided by the normal component support system. The restraints also limit the mechanical loads transmitted to the components and limit the size of postulated guillotine rupture flow areas in order to minimize the magnitude of the subcompartment pressures.

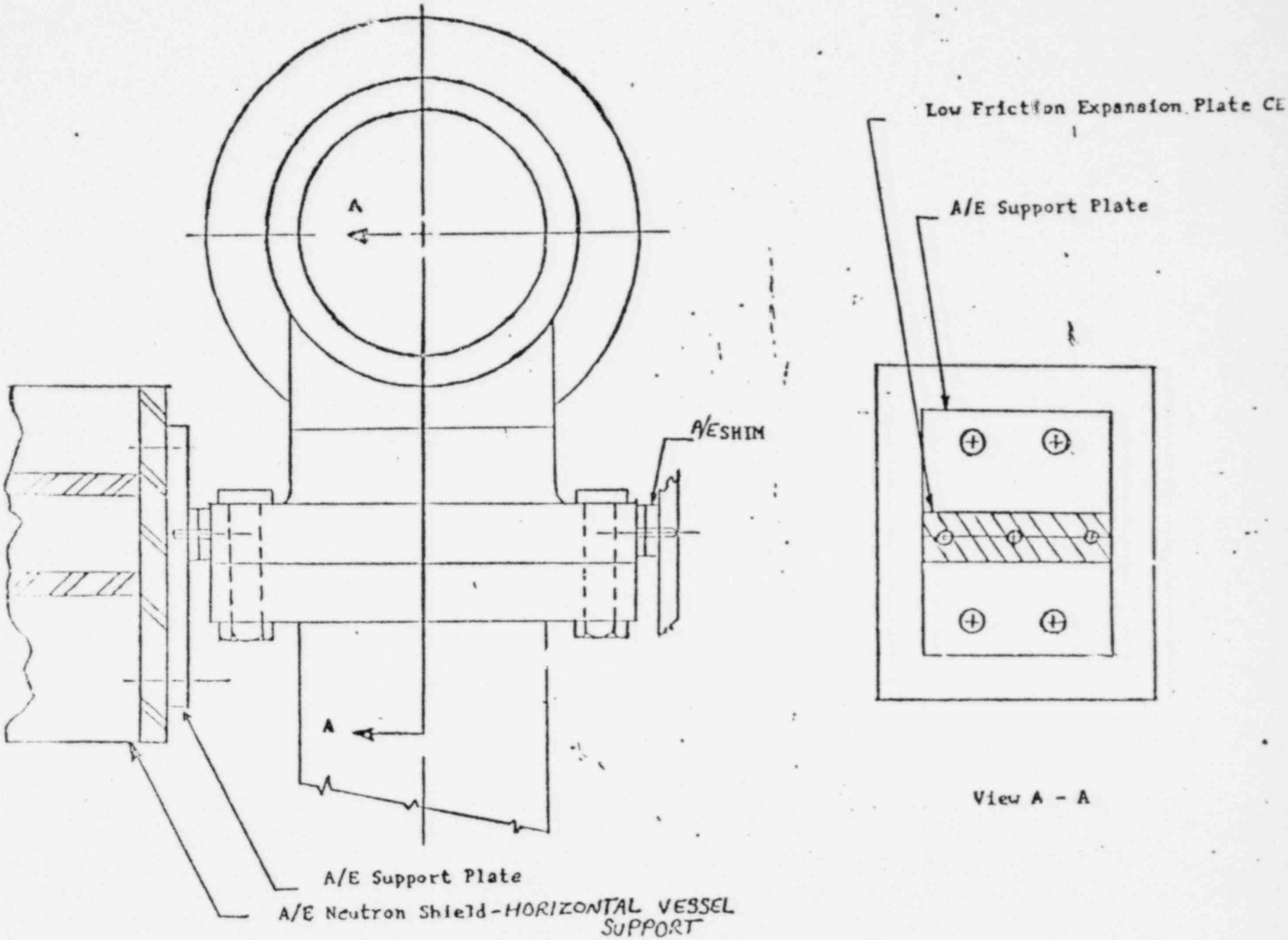
One horizontal restraint is located on each discharge leg elbow for a postulated discharge leg terminal end guillotine at the reactor vessel inlet nozzle terminal end. A vertical restraint is located beneath each hot leg elbow to protect against a postulated guillotine rupture at the steam generator inlet nozzle terminal end. Two vertical restraints and one horizontal restraint are located on the suction leg. The vertical restraint under the pumps is provided for a guillotine rupture of the suction leg at the pump suction nozzle terminal end. The other vertical and the horizontal restraint, together, restrain the pipe following a postulated circumferential pipe break at the steam generator outlet nozzle terminal end. Pipe stop locations are shown in Figure 9.

In order to allow unrestrained thermal movements of the pipe, a specified gap will exist between the pipe and the restraint at all restraint locations. This clearance must be shimmed to a specified size and verified during hot functional testing.

Two lugs welded to each discharge leg elbow provide a mating surface for each discharge leg restraint. At all other restraint locations restraints mate with the pipe itself.



Reactor Vessel Supports	FIG. 1



* (Exact gap will be given in installation drawing)

UPPER REACTOR VESSEL HORIZONTAL SUPPORTS

FIG. 2

LOWER REACTOR VESSEL SUPPORTS

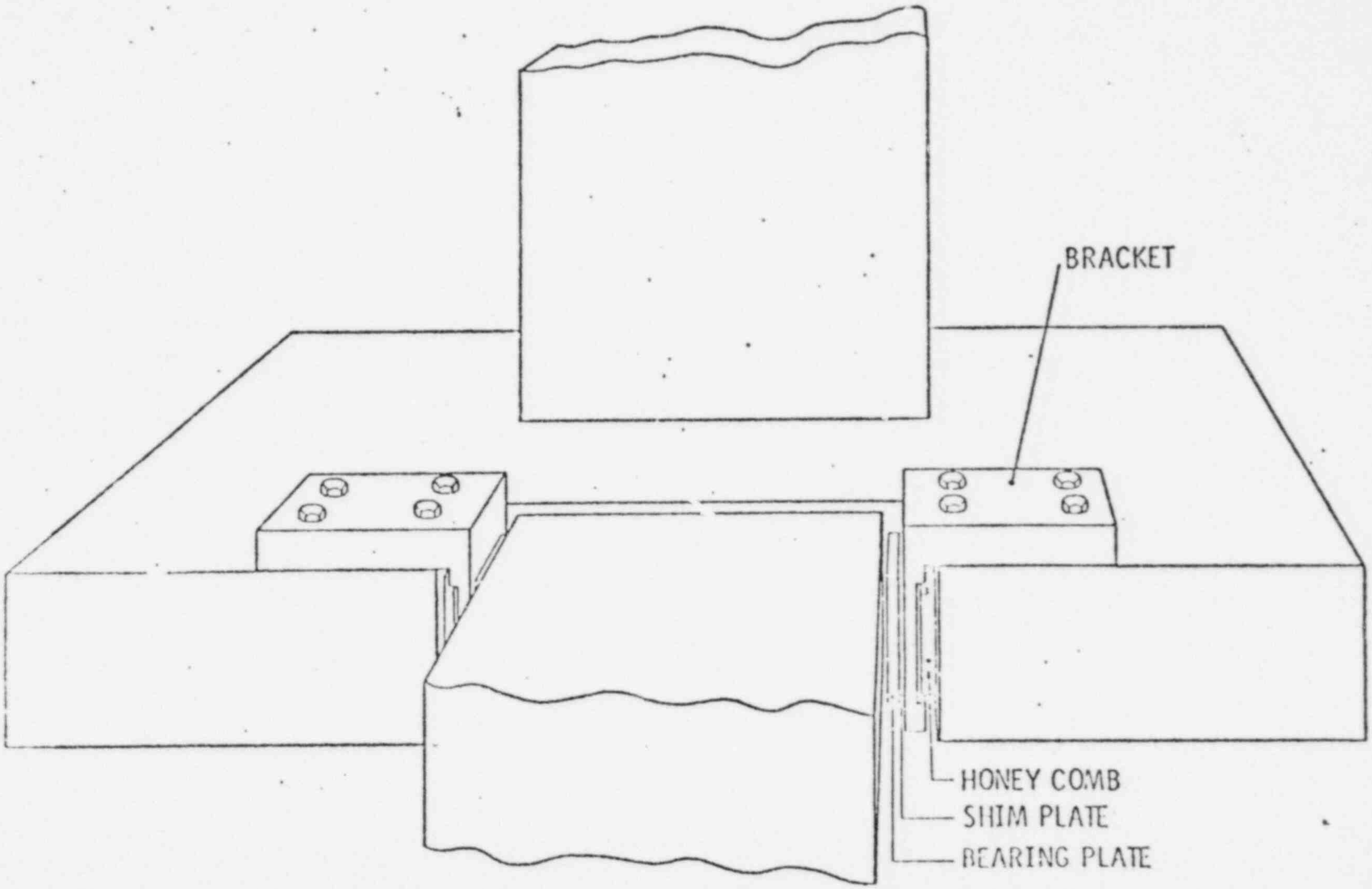
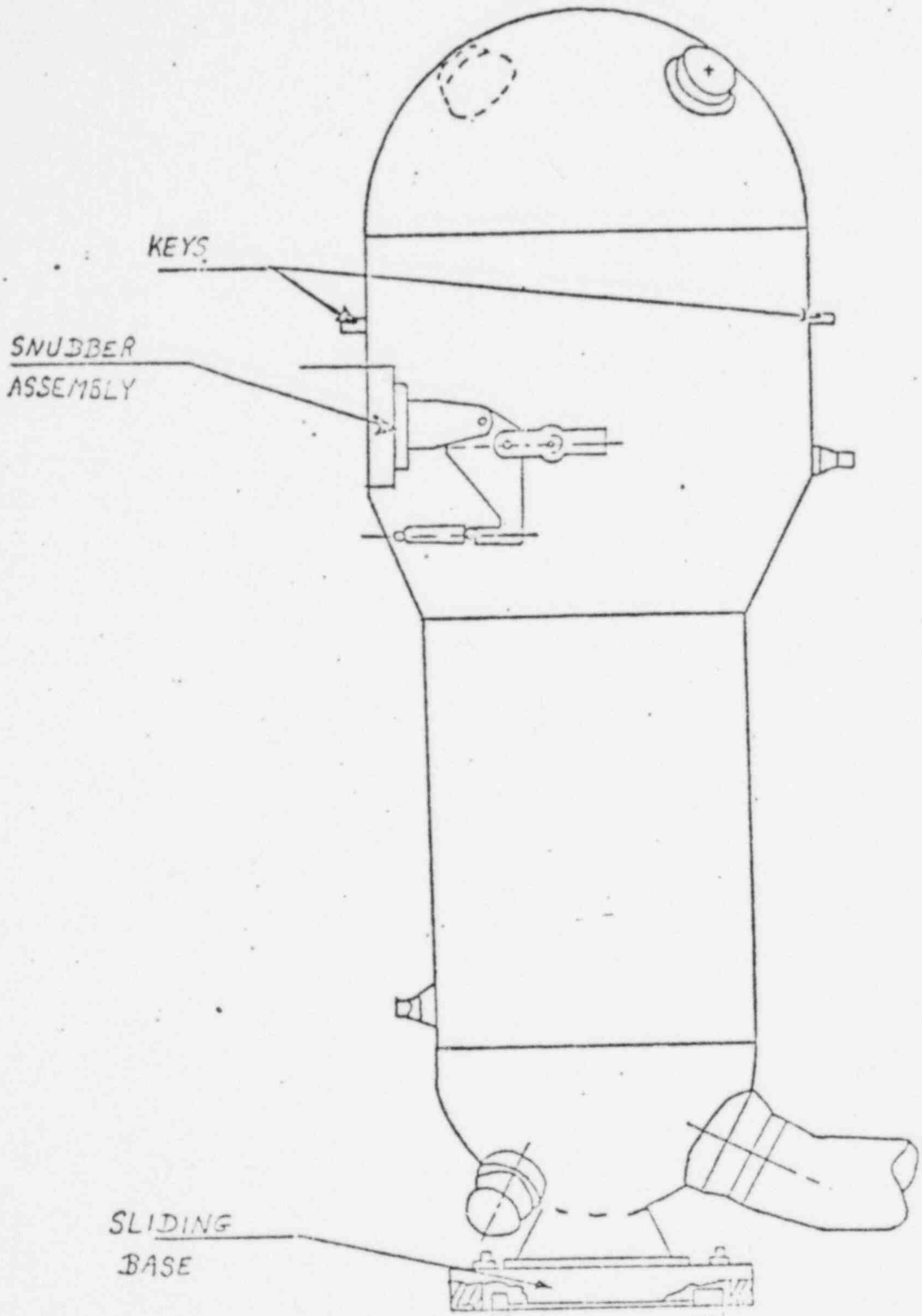


FIG. 3



STEAM GENERATOR SUPPORTS

FIG. 4

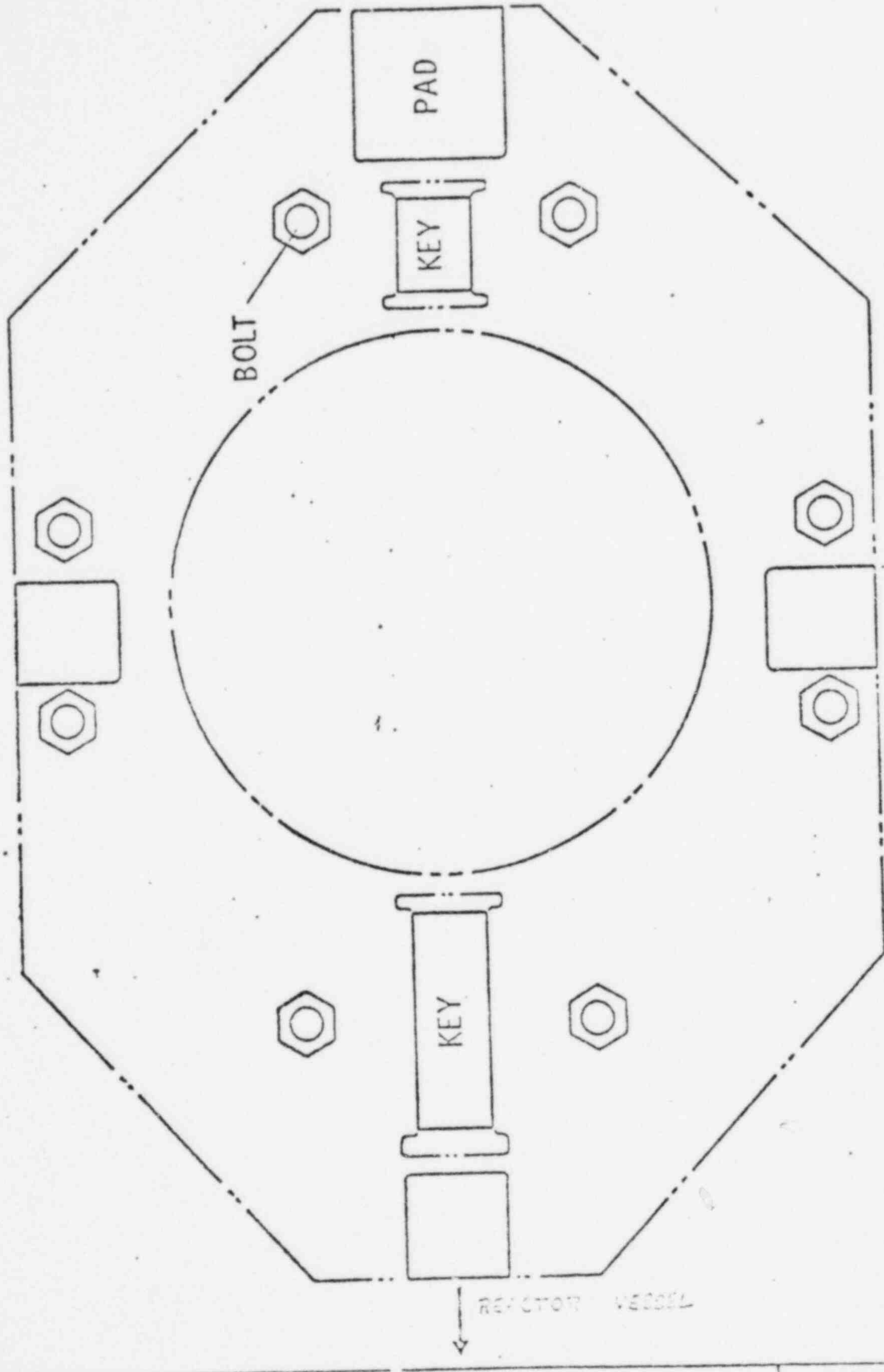
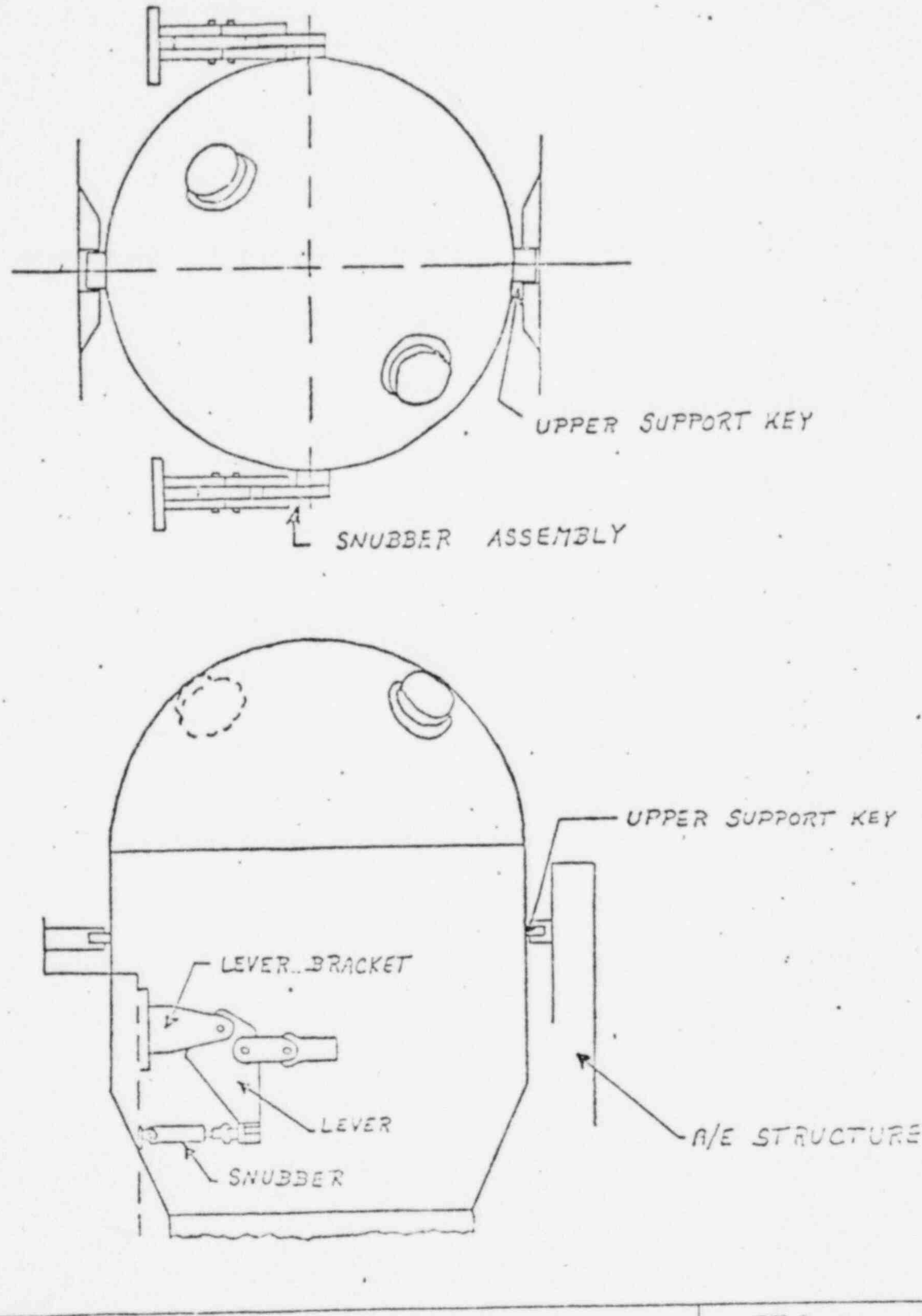
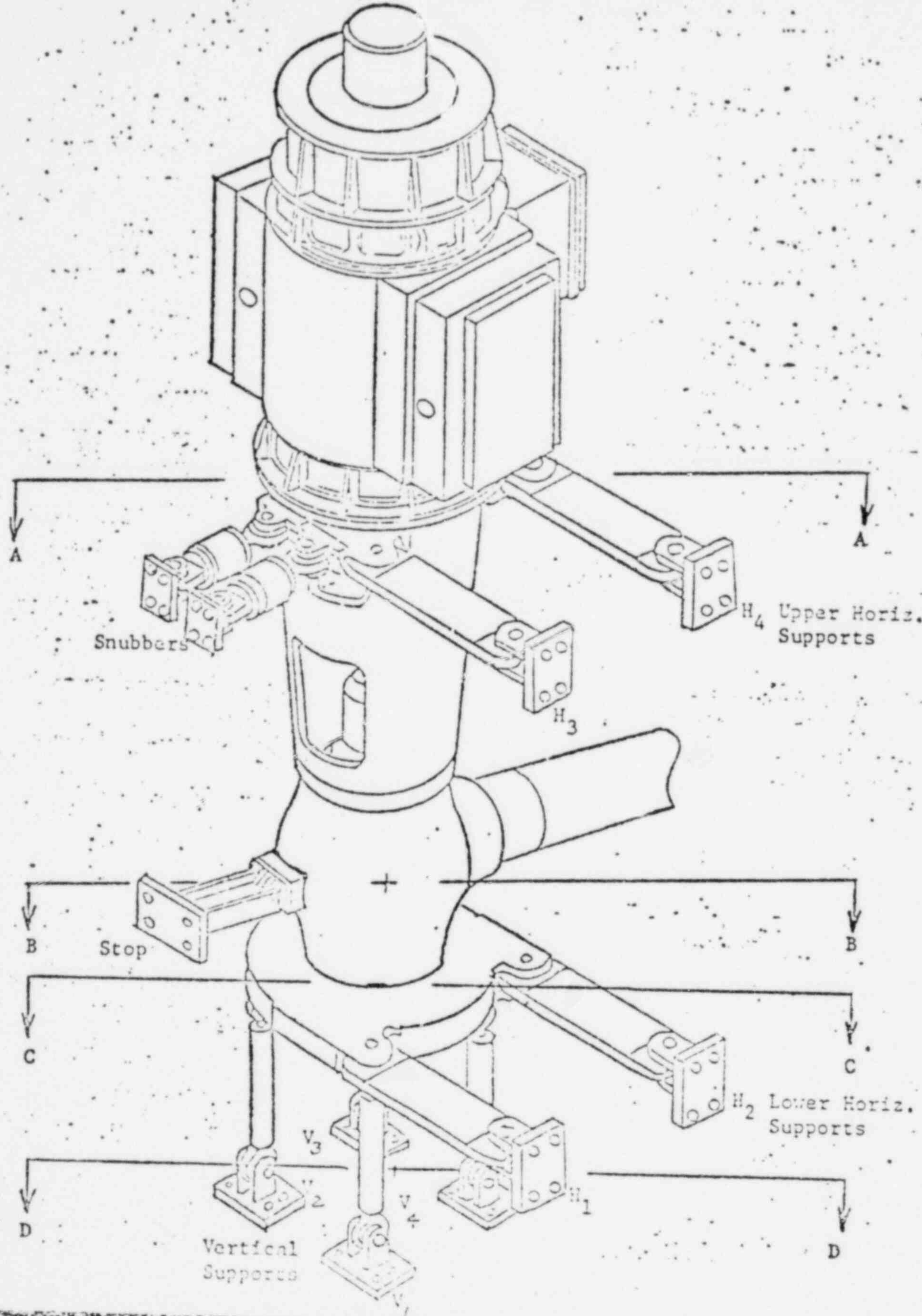


FIG. 5

STEAM GENERATOR LOWER SUPPORTS

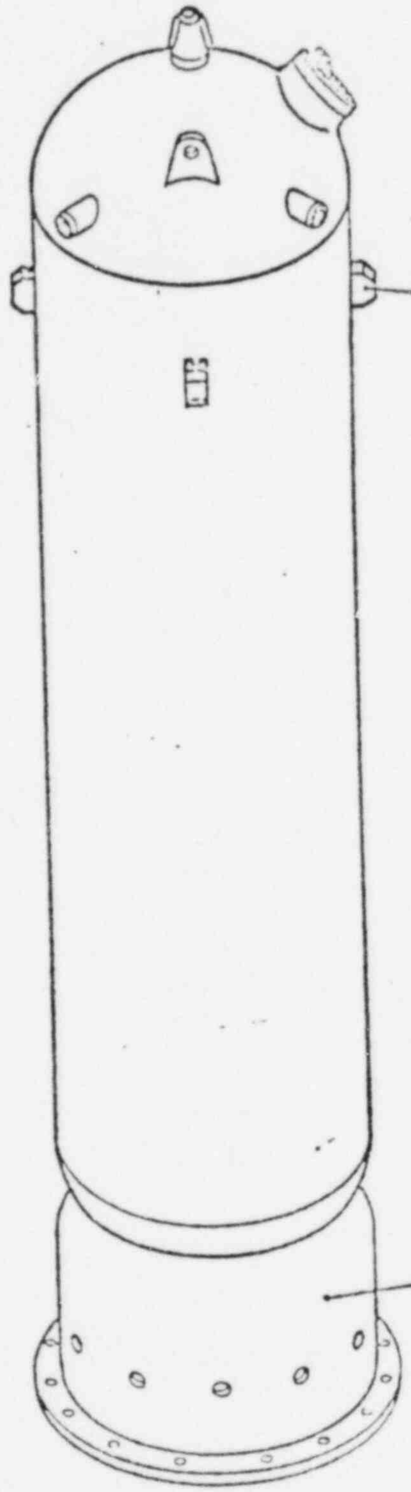


STEAM GENERATOR UPPER SUPPORTS	FIG. 6



RCP Support Scheme

FIG # 7



PRESSURIZER SUPPORTS	FIG. 8

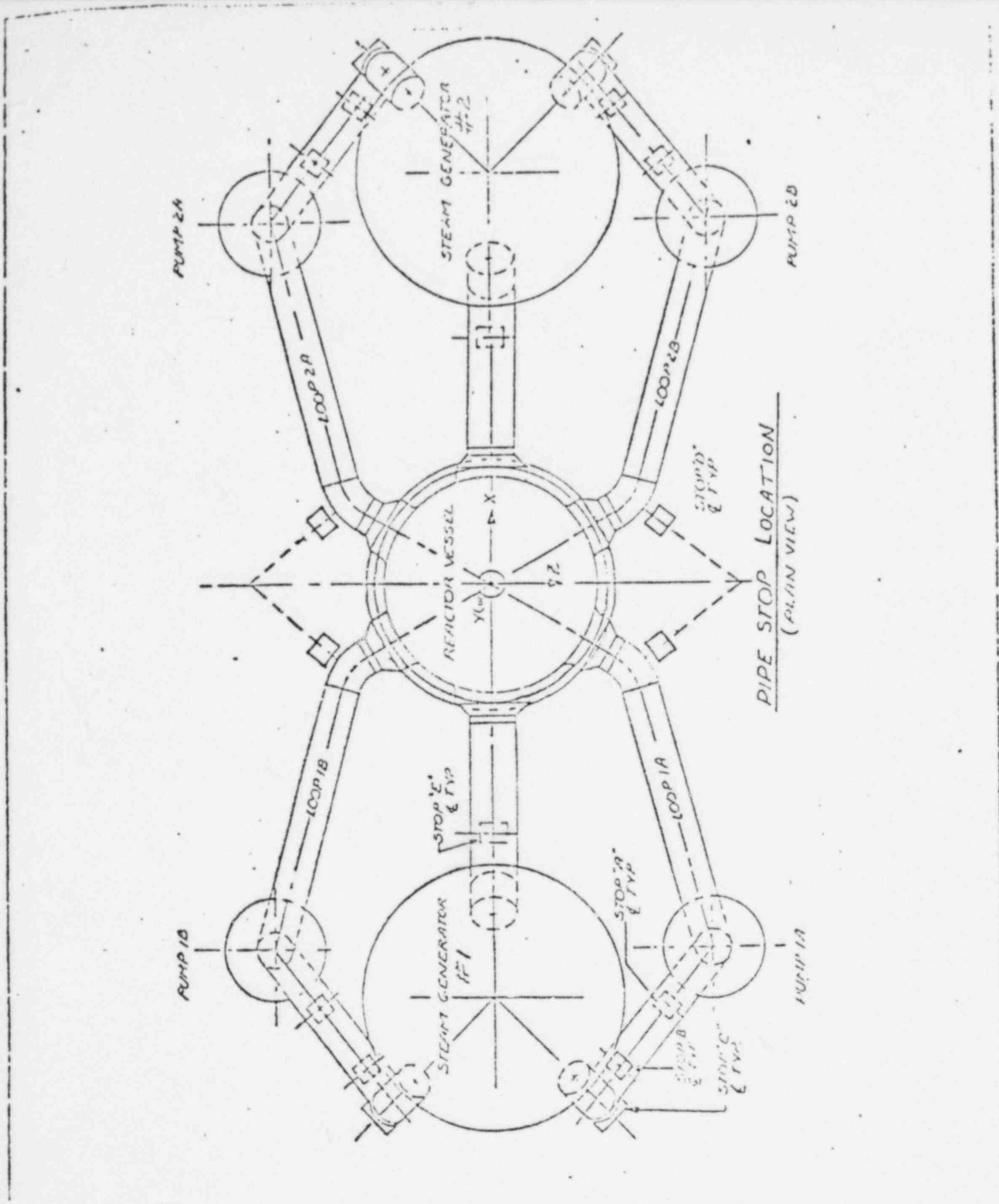
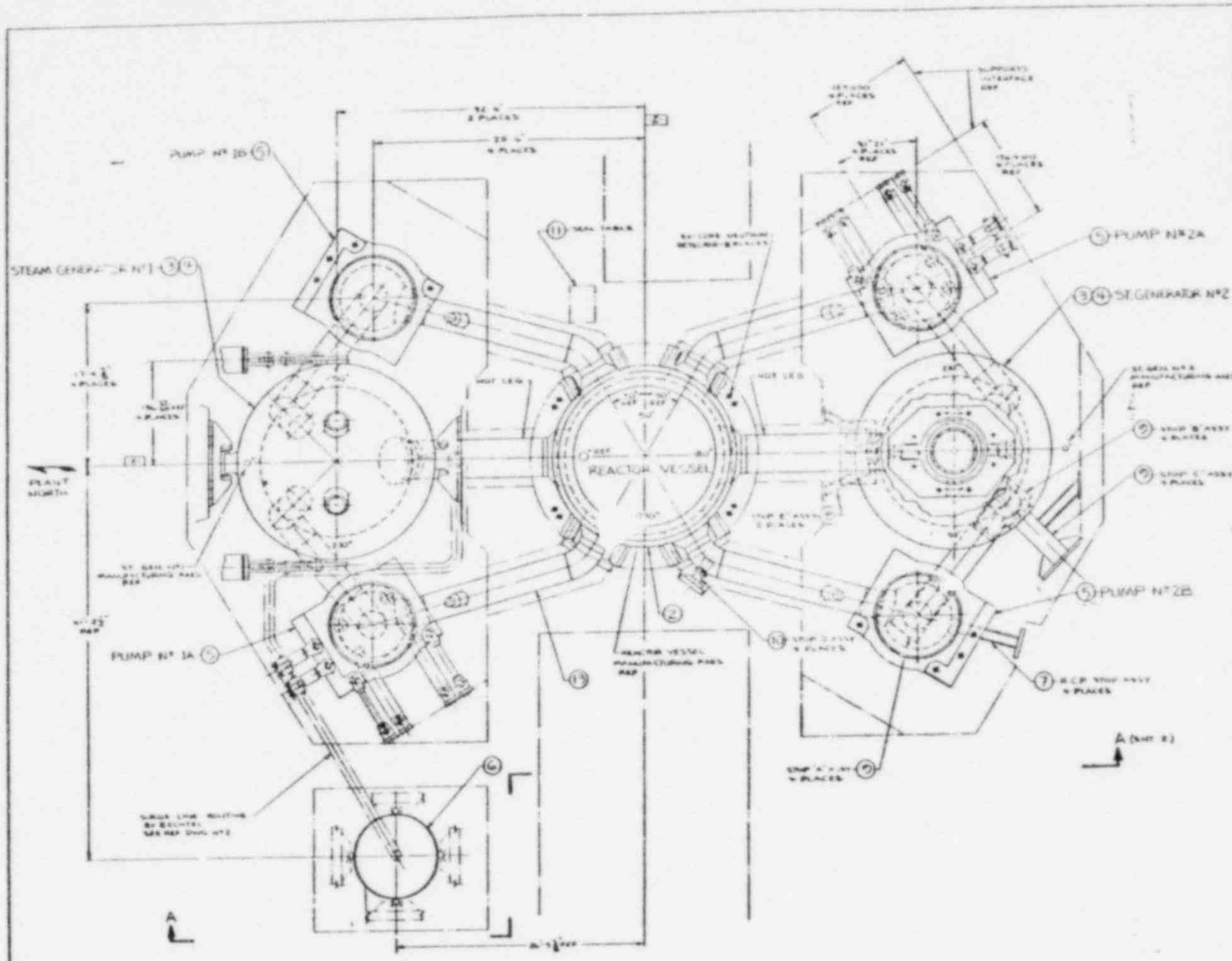
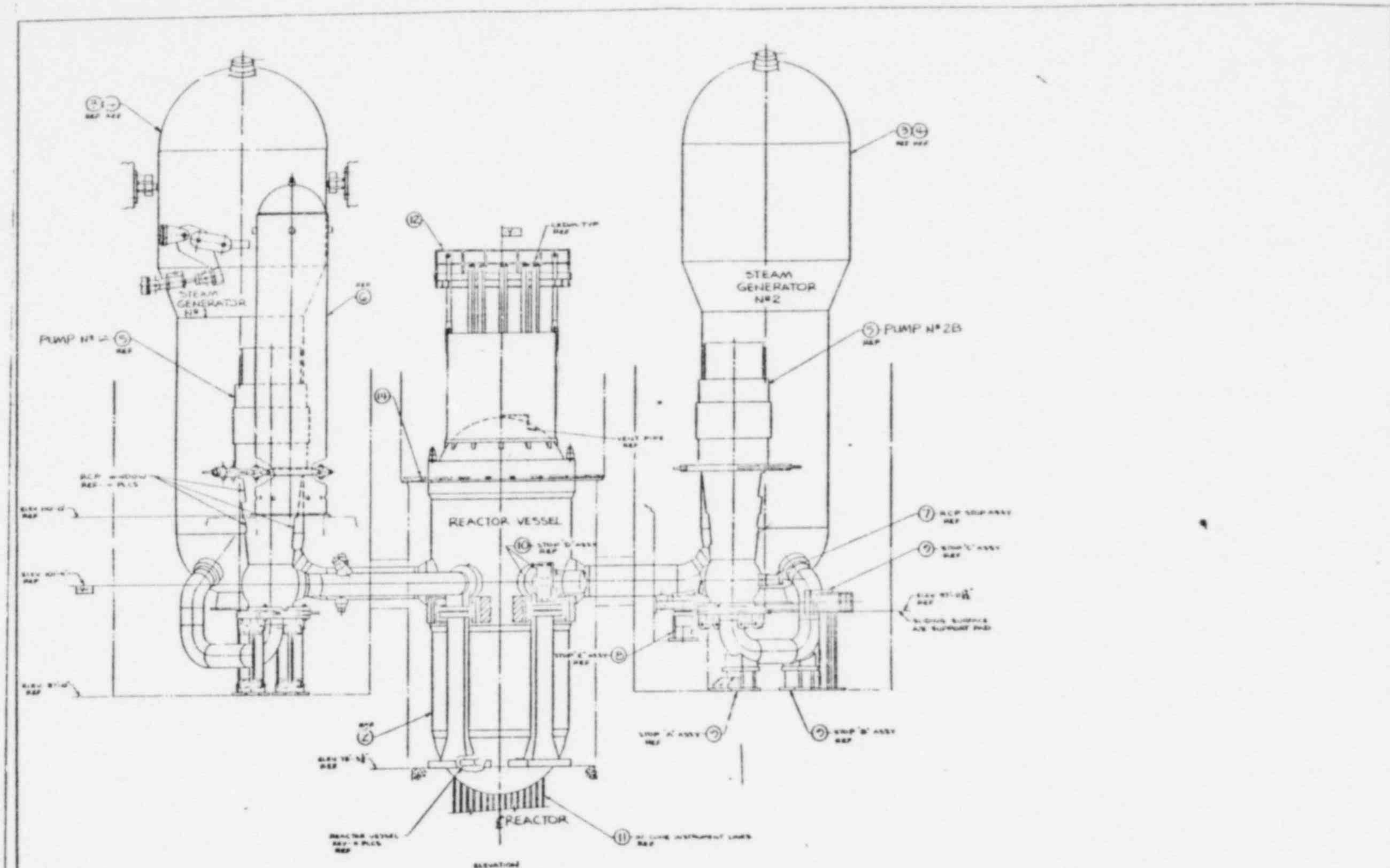


FIG. 9

PIPE STOP PLAN VIEW


DRAWING LIST
PUMP Nº 1B
STEAM GENERATOR Nº 1
SEAL TABLE
HOT LEG
REACTOR VESSEL
PUMP Nº 1A
PLANT NORTH
PUMP Nº 2A
S.GENERATOR Nº 2
PUMP Nº 2B
R.C.P. SNUB ASSY 4 PLACES
A

PLAN VIEW



ELEVATION

VIEW A-A