CAROLINA POWER & LIGHT COMPANY

BRUNSWICK STEAM ELECTRIC PLANT

UNIT 1

SYSTEM DESCRIPTION
NITROGEN PNEUMATIC SYSTEM

PRELIMINARY

(2589NEL/mss)

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1.0 General Description

1.1 System Functions

The Nitrogen Pneumatic System provides gaseous nitrogen which is dry, oil-free, and free of foreign materials to pneumatically operated instruments and controls in the primary containment.

1.2 System Description

The gaseous nitrogen for the Nitrogen Pneumatic System is provided from cryogenic tanks located in the yard area southeast of the Unit 2 Reactor Building. The tanks are located on an east-west line with the Unit 1 tank on the east end. Liquid Nitrogen is converted to gaseous nitrogen by the ambient vaporizers. Two 200% vaporizers are provided with each cryogenic tank system.

Two parallel pressure-regulating valves are provided downstream of the ambient vaporizers for improved reliability. A single pipe run is provided from the pressure regulator valves to the Reactor Building for Unit 1. At the southeast corner of the Reactor Building, the line tees to feed the Division I and Division II headers of the Reactor Building. The Nitrogen Pneumatic System supplies the following control systems:

A. Main Steam Isolation Valves

B. Safety Relief Valves

C. Reactor Building Closed Cooling Water Flow Control Valves

D. Reactor Recirculation

E. Suppression Chamber Vacuum Breaker Valves

In-line strainers are provided for each nitrogen line upstream of each pressure regulating valve.

The Nitrogen Pneumatic System is utilized during power operation, and it eliminates the introduction of oxygen into the drywell due to the operation of pneumatic controls.

The Nitrogen Pneumatic System may be isolated during outages to permit use of the non-interruptible instrument air while plant personnel are working and entering the drywell.

The Unit 1 and Unit 2 Nitrogen Pneumatic Systems are crosstied immediately downstream of the ambient vaporizers but upstream of the pressure-reducing valves. This provides a nitrogen source backup for the two systems.

1.3 Component Description

1.3.1 Cryogenic Tank

The vertical cryogenic tank has a useable storage capacity of 11,000 gallons of liquid nitrogen. The tank serves to store liquid nitrogen as well as provide the driving pressure for the system. The tank is to maintain the liquid nitrogen at 150 psig with a liquid nitrogen temperature of -350°F.

1.3.2 Ambient Vaporizers

The ambient vaporizers are sized for delivery of 80 scfm of gaseous nitrogen at 150 psig. The ambient vaporizers operate on an approach temperature within 20° of ambient. Two ambient vaporizers are provided. One is normally valved out as standby. Each vaporizer is 200% capacity to permit it to supply two systems (both Unit 1 and Unit 2 simultaneously).

The vaporizer's isolation valves will automatically close on low vaporizer outlet temperature. This prevents passage of liquid nitrogen into the piping downstream of the vaporizers. This is a self-regulating temperature control valve.

1.3.3 Pressure Regulating Valves

The pressure regulating valves will maintain the nitrogen lines at 110 psig at the regulator valve outlet. The valves are self-regulating on downstream pressure.

1.3.4 Unit Crosstie Valve

This valve is normally closed. The valve position is controlled from the control room by control switches. A control switch is provided for each RTGB.

1.3.5 Tank Fill Station

The Tank Fill Station is located adjacent to the tank.

2.0 INSTRUMENTATION AND CONTROL

2.1 Design Basis

The Nitrogen Pneumatic System is designed with the capability of supplying all the nitrogen needed to operate the instrumentation and pneumatic controls on the RNA headers in the drywell. The system is designed to operate automatically requiring a minimum of operator attention.

2.2 Functional and Operational Control

2.2.1 Cryogenic Tank Controls

The cryogenic tank pressure is maintained by the tank's pressure regulation controls. As needed, the system will bleed any excess pressure. An economizer system is used to ensure this gas is utilized by the pneumatic system feeding the drywell rather than dumping the tank boil off to atmosphere.

The tank is protected from extreme overpressure by a safety relief valve and rupture disc.

An alarm in the control room signals low tank pressure. Local and control room indication is provided for tank level and pressure.

2.2.2 Ambient vaporizers

Since the vaporizers have no moving parts, no controls are required. Radiant and convective heat transfer to the environment ensure boil off of the liquid nitrogen in the vaporizer.

To prevent passing liquid nitrogen, the vaporizer is automatically isolated by low vaporizer outlet temperature.

Control room and local indication of the vaporizer outlet temperature are provided. Vaporizer outlet temperature is alarmed for a low setpoint.

2.2.3 Pressure Regulating Valves

The valve is self-regulating based on the downstream pressure. The rise in downstream pressure will cause the valve to close as the pressure is satisfied.

Local indication of the downstream pressure is provided at pressure regulating valves.

2.2.4 Unit Crosstie Valve

The unit crosstie valve will be normally closed. Upon loss of a storage tank the remaining tank will be used to supply both units with nitrogen.

The control room operator can open or close the crosstie valve from the control room by an override switch.

Until the Unit 2 Nitrogen Pneumatic System is operational, the crosstie valve will be open at all times. This is necessary to utilize the normal boil-off of the Unit 2 tank.

2.2.5 Annunciators

The following are annunciators associated with the Nitrogen Pneumatic System:

Annunciator	Unit(s)	Annunciator Panel No
Cryogenic Tank 1 Pressure Low	1	(Later)
Cryogenic Tank 2 Pressure Low	2	(Later)
Vaporizer Outlet Temp. Low	and 2	(Later)
Nitrogen Header Pressure Low Division I	1	(Later)
Nitrogen Header Pressure Low Division II	1	(Later)

2.3 Monitoring Instrumentation

Table 2.3.1 is a table of instrumentation that provides monitoring functions for the safe operation of this system. Instruments listed in this section that also provide trip functions are again listed in Section 2.4, Instrument and Control Setpoints.

TABLE 2.3.1 MONITORING INSTRUMENTATION

Function	Instrument Designation	Indicator/Recorder Location
Cryogenic Tank 1 Pressure	(Later)	RTGB
Cryogenic Tank 2 Pressure	(Later)	RTGB
Vaporizer Outlet Temp. Unit 1	(Later)	RTGB
Vaporizer Outlet Temp. Unit 2	(Later)	RTGB
Nitrogen Header Press. Division I	(Later)	RTGB
Nitrogen Header Press. Division II	(Later)	RTGB
Cryogenic Tank 1 Pressure Low	(Later)	XU
Cryogenic Tank 2 Pressure Low	(Later)	XU
Vaporizer Outlet Temp. Low Unit 1	(Later)	XU
Vaporizer Outlet Temp. Low Unit 2	(Later)	XU
Nitrogen Header Press. Low Division I	(Later)	XU
Nitrogen Header Press. Low Division II	(Later)	XU
Cryogenic Tank 1 Pressure	(Later)	Local
Cryogenic Tank 2 Pressure	(Later)	Local
Cryogenic Tank 1 Level	(Later)	Local
Cryogenic Tank 2 Level	(Later)	Local
Cryogenic Tank 1 Level	(Later)	RTGB
Cryogenic Tank 2 Level	(Later)	RTGB
Vaporizer Outlet Temp. Unit 1	(Later)	Local
Vaporizer Outlet Temp. Unit 2	(Later)	Local
PCV Outlet Pressure (Unit 1)	(Later)	Local
PCV Outlet Pressure (Unit 2)	(Later)	Local

2.4 Instrument and Control Setpoints

Table 2.4.1 is a list of all instrumentation that provides trip functions.

TABLE 2.4.1 Instrument and Control Setpoints

Nitrogen Pneumatic System

Instrument Trip Function	Inst. Designations	Trip Setpoint and Function
Cryogenic Tank 1 Pressure Low	(Later)	140 psig decreasing
Cryogenic Tank 2 Pressure Low	(Later)	140 psig decreasing
Vaporizer Outlet Temp. Low Unit 1	(Later)	-10°F decreasing
Vaporizer Outlet Temp. Low Unit 2	(Later)	-10°F decreasing
Nitrogen Header Press. Low Division I	(Later)	95 psig decreasing
Nitrogen Header Press. Low Division II	(Later)	95 psig decreasing

3.0 SYSTEM AND COMPONENT DESIGN PARAMETERS

3.1 System Design Data

Nitrogen Output	40 SCFM, moisture-free, no particulates at each interface

location

3.2 Component Design Data

3.2.1 Cryogenic Tank

Type	Vertical
Capacity	11,000 Gallons
Media	Liquid Nitrogen
Design Pressure	250 psig
Temperature	-350°F
Average Time between refuel	7 days
Tank Refuel Level	5,500 Gallons
Manufacturer	(Later)
Diameter/Length	8'-8"/39'-6$\frac{1}{2}$"
Shell Thickness	1/4 inches
Head Thickness	1/4 inches

3.2.2 Ambient Vaporizer

Type	(Later)
Capacity	80 SCFM
Operation	Ambient Temp. Difference
Design Pressure	235 psig
Fin Material	Aluminum

3.2.3 Relief Valves

Valves	Setpoints
Cryogenic Tank 1 Relief valve	175 psig
Cryogenic Tank 2 Relief valve	175 psig

3.2.4 Pressure Control Valves

Valve	Setpoint
Press. Control Valve A (Unit 1)	110 psig
Press. Control Valve B (Unit 1)	110 psig
Press. Control Valve A (Unit 2)	110 psig
Press. Control Valve B (Unit 2)	110 psig

4.0 SYSTEM DESIGN DATA

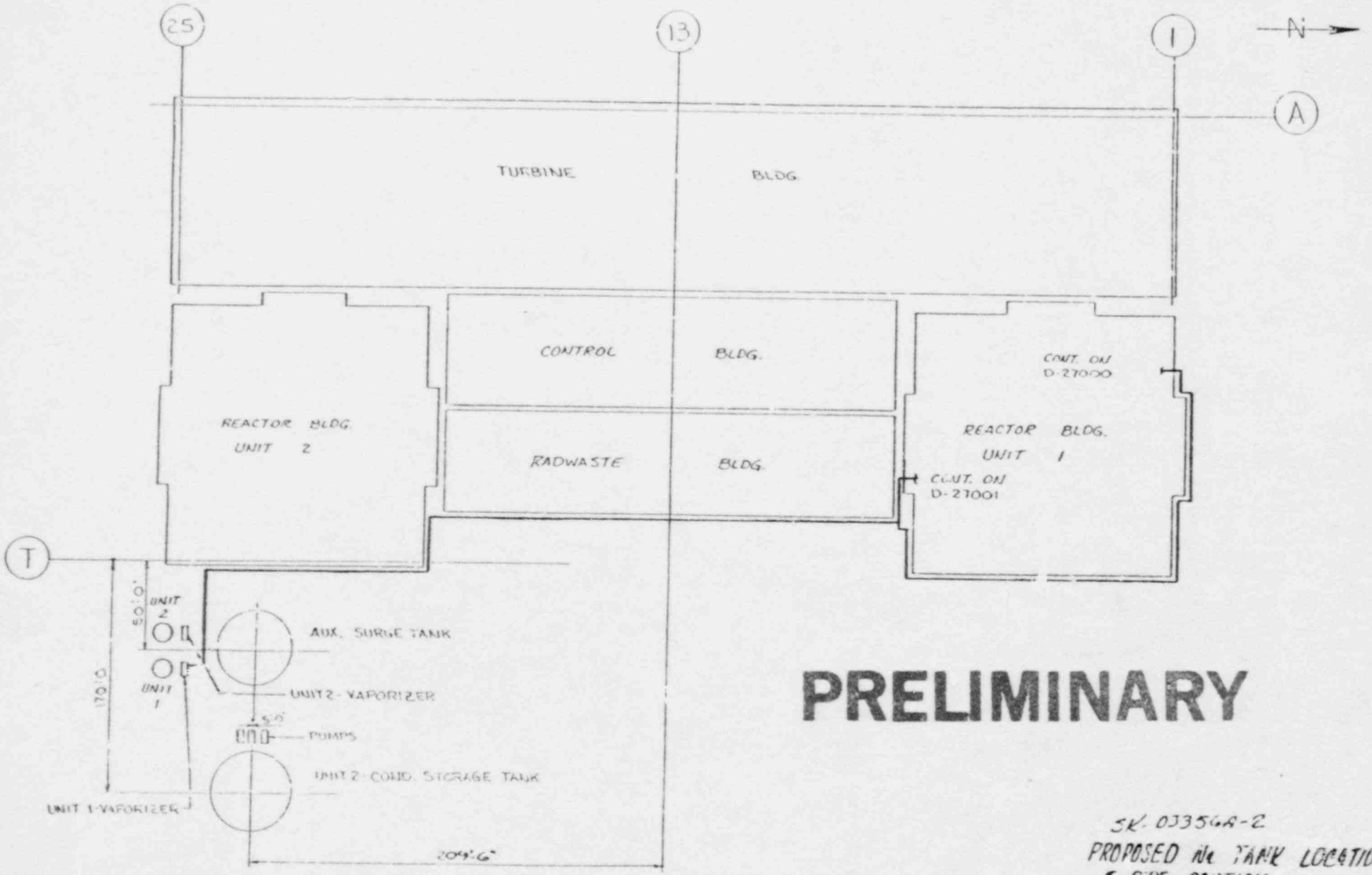
The Nitrogen Pneumatic System is designed with the capability of supplying all nitrogen requirements in the drywell required for plant safety. The Nitrogen Backup System provides an independent pneumatic source of bottled nitrogen to selected safety-related loads in the drywell in the event of either a LOCA or the loss of the Nitrogen Pneumatic System. During a LOCA, the Nitrogen Pneumatic System to the drywell is isolated and the Nitrogen Backup System is used. The control operator may override the Nitrogen Pneumatic System isolation and open the isolation valves by control switch.

The Nitrogen Pneumatic System is designed to operate during any design basis event and is designed to Class I Seismic requirements. (Applicable to portions of the system inside the Reactor Building.)

The piping system was designed in accordance with the Power Piping-Code, American National Standards Institute (ANSI) B31.1.0-1967. The cryogenic tank system piping was designed in accordance with the Petroleum Refinery Piping Code, ANSI B31.3.0. The cryogenic tank was designed in accordance with ASME Section VIII, Division 1, Boiler and Pressure Vessel Code. Due to system leakage, and operation discharge in the drywell; the drywell will require atmosphere pressure adjustments on an estimated three-day basis.

Fencing with lockable gate is provided around the storage tank facility to prevent tampering with the system controls.

GENERAL SYSTEM ARRANGEMENT



PRELIMINARY

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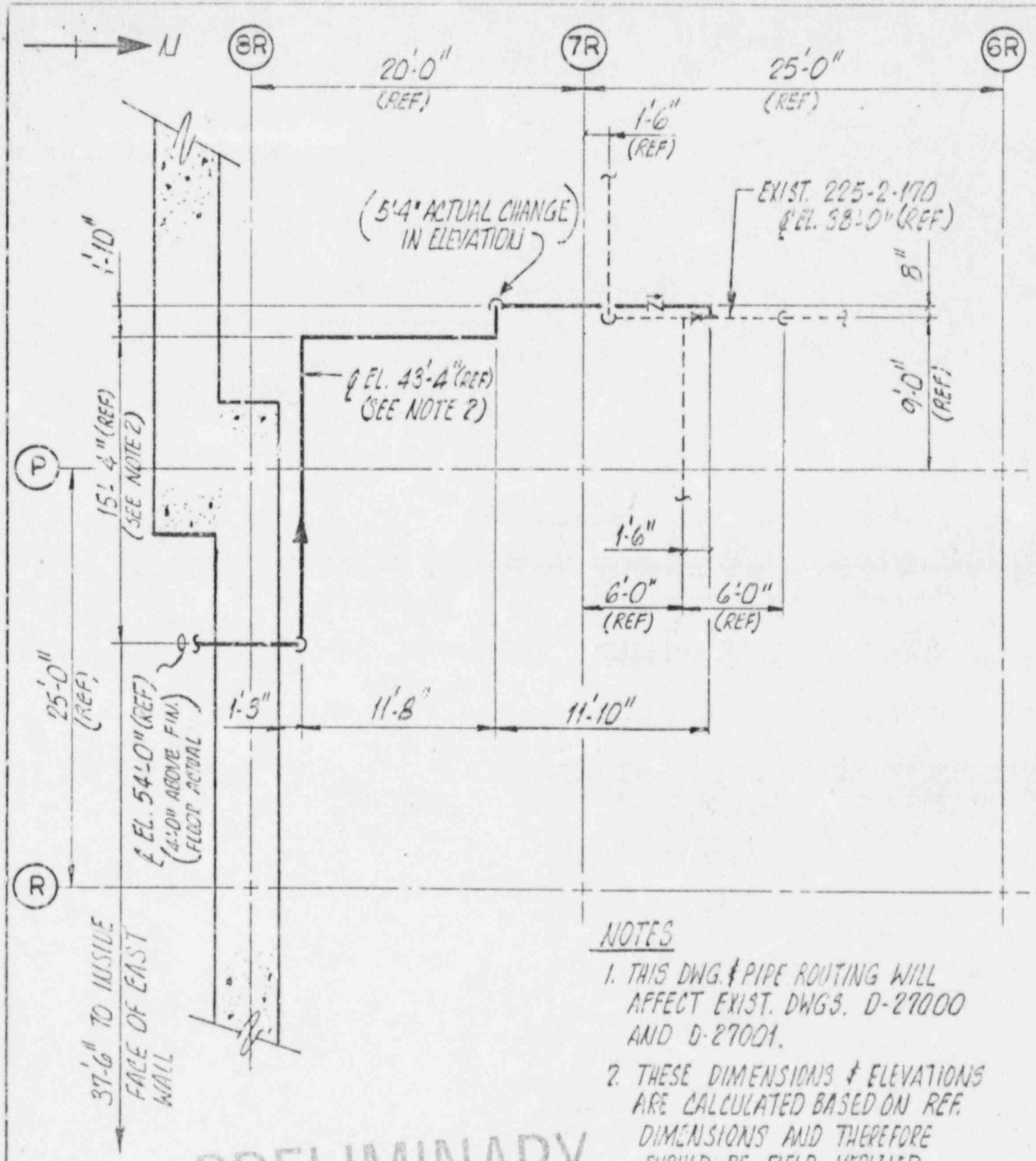
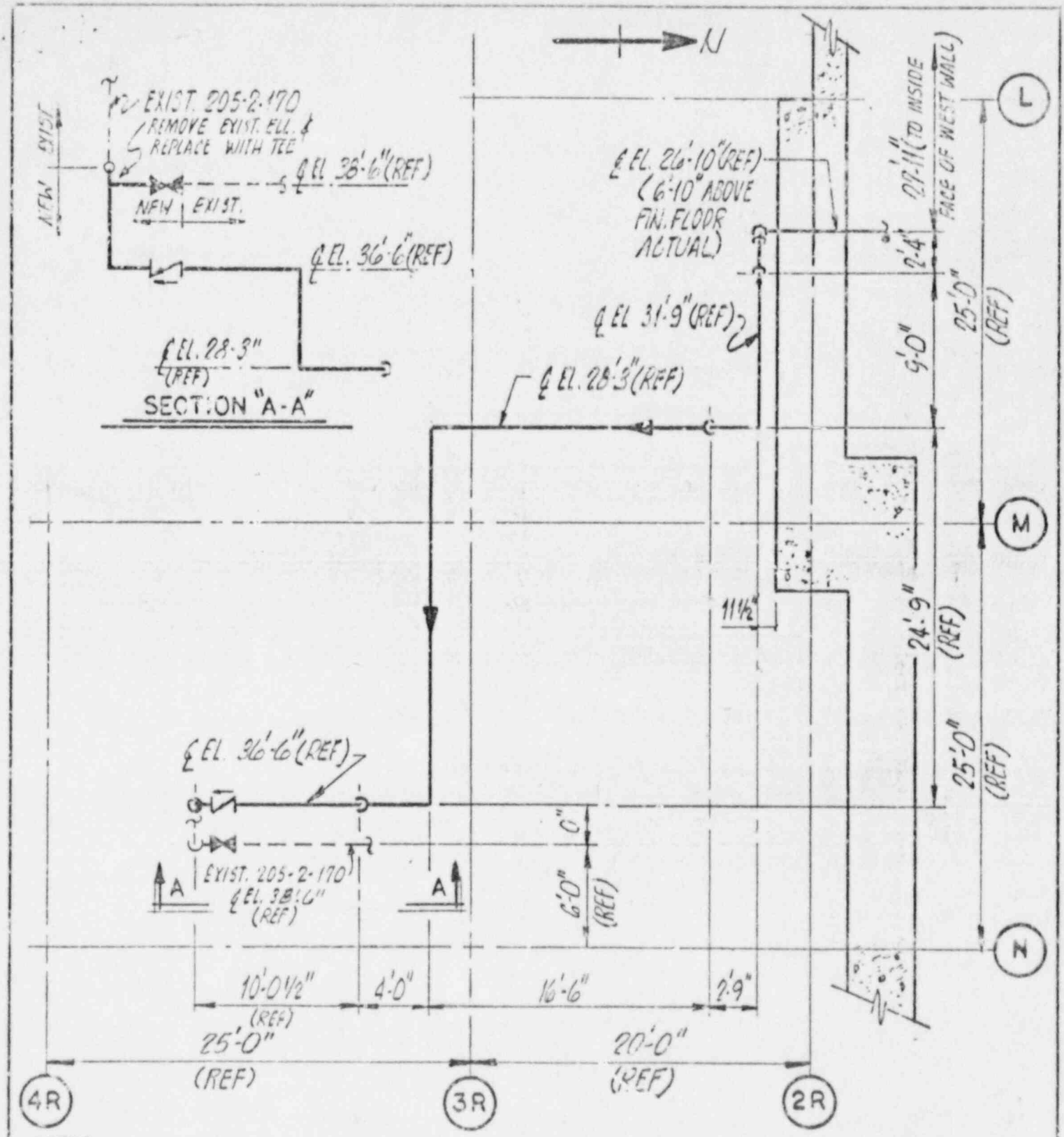
PROPOSED LNG TANK LOCATION
& PIPE ROUTING

PIPE ROUTING PLAN INSIDE THE REACTOR BUILDING



NOTES

1. THIS DWG. & PIPE ROUTING WILL AFFECT EXIST. DWGS. D-27000 AND D-27001.
2. THESE DIMENSIONS & ELEVATIONS ARE CALCULATED BASED ON REF. DIMENSIONS AND THEREFORE SHOULD BE FIELD VERIFIED.



NOTES

1. THIS DWG & PIPE ROUTING AFFECTS EXIST. DWG D-27000.
2. ALL ELEVATIONS ARE BASED ON A 20'-0" FIN. FLOOR ELEV. (REF)

PIPING AND INSTRUMENTATION DRAWING

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