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DOCKET NUMBER	50-261
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TO:	Mr. Robert W. Reid
FROM:	Carolina Power & Light Company Raleigh, North Carolina E. E. Utley
DATE OF DOCUMENT	12/16/76
DATE RECEIVED	12/20/76

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DESCRIPTION

Ltr. w/attached....re their 10/27/76 ltr. and our 8/11/76 ltr....concerning Reactor Vessell Overpressurization.

(11-P)

REACTOR VESSEL OVERPRESSURIZATION
DISTRIBUTION PER G. ZECH 10-21-76

PLANT NAME:
H. B. Robinson #2

ENCLOSURE

DO NOT REMOVE

ACKNOWLEDGED

FOR ACTION/INFORMATION 12/21/76 RJL

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Carolina Power & Light Company

December 16, 1976

FILE: NG-3514(R) SERIAL: NG-76-1602

Director of Nuclear Reactor Regulation
ATTN: Mr. Robert W. Reid, Chief
Operating Reactor Branch #4
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

H. B. ROBINSON STEAM ELECTRIC PLANT UNIT NO. 2
DOCKET NO. 50-261
FACILITY OPERATING LICENSE NO. DPR-23
REACTOR VESSEL OVERPRESSURIZATION

Dear Mr. Reid:

On October 27, 1976, we responded to your letter of August 11, 1976 addressing reactor vessel overpressurization events. In that response we stated that an analysis had been initiated to evaluate the effectiveness of the pressurizer power operated relief valves in mitigating overpressurization transients. We also noted in our letter the general design criteria for the mitigating system. Preliminary evaluations indicated that the pressurizer power operated relief valves would be adequate to mitigate overpressurization events except for inadvertent opening of the accumulator isolation valve. We stated that adequate administrative controls are available for assuring that certain valves are open during power operation and similar administrative controls would provide the necessary protection for the overpressurization event caused by the accumulator isolation valve opening. This letter is intended to provide additional clarification of our proposed course of action and design criteria for the intended mitigating system. To accomplish this clarification of our course of action and design criteria, a "Reference Mitigating System" will be described.

We are proceeding with a thorough analysis of overpressurization transient events by employing the LOFTRAN code which has previously been reviewed and accepted by the NRC staff. To utilize the LOFTRAN code, modifications internal to the code are necessary which will require a development and verification effort. The modified LOFTRAN calculational model, when complete, will provide a technically justifiable and conservative means to determine the adequacy of a relief valve system in mitigating an overpressurization event. Until the calculational model is completed and the bounding analysis is performed, size requirements and setpoints for the relief system cannot be accurately established.

Although specific setpoints and relief capacity requirements of the mitigating system are not known at present, meaningful progress towards resolution of the reactor vessel overpressurization issue can be achieved by defining the design criteria requirements of the mitigating system. If design criteria requirements are confirmed by the completion of the bounding analysis, plant specific design of modifications in accordance with specified design criteria could be implemented promptly. The time interval to complete resolution of this issue can be minimized if a parallel path of analysis and definition of design criteria are pursued.

336 Fayetteville Street • P. O. Box 1551 • Raleigh, N. C. 27602

In your letter of August 11, formal guidance as to the acceptable design criteria was provided on page three. The letter stated:

> "The basic criteria to be applied in determining the adequacy of overpressurization protection are that no single equipment failure or single operator error will result in Appendix G limitations being exceeded."

We embraced this criteria in our letter of October 27. This criteria is the basis for the "Reference Mitigating System" which incorporates the following specific design features:

a. An existing wide-range pressure transmitter is proposed as the sensor. Additional bi-stables will be added to provide an open signal to the power operated relief valves. Figure 1 provides a logic diagram of the "Reference Mitigating System". Figure 2 presents an instrumentation loop diagram of the pressure monitoring and relief valve actuating equipment. The present control/protection grading of this instrument loop will be retained.

b. The power operated relief valves, as previously stated, will be utilized as the pressure relief mechanism. These relief valves are spring loaded closed requiring air valves to open which is presently supplied by a control air source. To assure operability upon the loss of control air to the letdown isolation valves which could initiate an overpressurization event and disable the pressurizer power operated relief valves, accumulators will be utilized. The accumulators will provide a sufficient air supply to the pressurizer power operated relief valve to allow five cycles of the valve following a loss of normal control air.

c. The present power supply alignment for the solenoid valves controlling air flow to the pressurizer power operated relief valves will be retained. Installation of the "Reference Mitigating System" will not compromise the existing separation between DC power sources.

d. A keylock switch or an equivalent administratively controlled switch will be used to enable and disable the low setpoint of each relief valve. The enable/disable switches will conform to the separation criteria requirements for the DC buses for H. B. Robinson Unit No. 2.

e. Seismic design of the electronic equipment presently installed in the H. B. Robinson Plant will be retained. Additional electronic equipment will be installed so as not to compromise the present seismic qualifications of existing safety systems.

f. The control air supply from the air accumulators will be seismically designed. Typical pressurizer power operated relief valves are designed to withstand seismic loading equivalent to 3.0g in the horizontal direction and 2.0g in the vertical direction and retain their function during such loading. The valves will not be degraded by the system modification.

g. Testability will be provided. Verification of operability is possible prior to solid system, low temperature operation by use of the remotely operated isolation valve, enable/disable switch and normal electronics surveillance procedure methodology. Testing requirements could be incorporated in the operating procedures to assure performance prior to existance of plant conditions requiring operability of the mitigating system.

h. Figure 3 presents a typical electrical schematic diagram which would be used for each pressurizer power operated relief valve. The additional pressure channel's bi-stable contact or auxiliary relay contact and the enable/disable switch addressed in "d" above are included.

i. The loss of an instrument power bus will not result in an isolation of letdown flow and disabling of the "Reference Mitigating System".

The design criteria for the "Reference Mitigating System" should be agreed to by completion of the analysis to minimize the time until complete installation of an acceptable system is accomplished. We have inquired as to the availability of electrical and mechanical equipment required for the "Reference Mitigating System". According to vendors' estimates, delivery of additional equipment needed for the "Reference Mitigating System" could be expected within six months of order placement.

Since it is our desire to resolve this matter by the end of 1977 coupled with the facts that analysis completion is scheduled for the end of March, 1977 and equipment delivery may require an additional six months, it is imperative that the design criteria include sufficient flexibility to assure accomplishment of desired prevention of overpressurization transients. Both pressurizer relief valves may be necessary to mitigate the worse case overpressurization event to be analyzed in our bounding analysis. Contingencies of this nature should be and were considered in selection of a design criteria. The "Reference Mitigating System" design includes conformance to the guidelines of your August 11, 1976 letter, provides for the maximum pressure relief possible with available mechanical equipment, and could be installed by the end of 1977.

While overpressurization events are cause for concern and modification to the operating plants is sound engineering practice in view of the events which have occurred, it should be noted that exceeding the Appendix G limit does not mean vessel damage, much less fracture, will occur. Appendix G limits are based upon conservative assumptions and safety factors which, if not exceeded, would

mean that the rupture of the reactor vessel is considered incredible. Performing an analysis which includes actual plant data and more reasonable assumptions in terms of flow size, fluence, vessel material properties, etc. for H. B. Robinson, while retaining the safety factors of the Appendix G analysis methodology, additional margin in temperature-pressure limits could be attained and the rupture of the reactor vessel would still be considered incredible. When margins are available between the conservative Appendix G analysis and similar calculations with more reasonable assumptions employing actual plant data, the vessel failure consideration retains its incredible event status, and Appendix G does not represent a Safety Limit.

The exceeding of reasonable assumption Appendix G type analysis limits does not mean that the vessel will fail, but only that the probability of failure would be increased in such an event. We believe there is a meaningful difference between accident events and events which reduce the probability of an accident occurrence for a short time interval.

In our October 27, 1976 letter, we stated that following installation of modifications, a remote possibility of exceeding Appendix G limits would still exist. It was also stated that the proper course of action following such an event would be to analyze the event employing reasonable assumptions and actual plant history. We will follow that action course if Appendix G limits are exceeded at H. B. Robinson. That analysis would assure safety to the public and assure that reactor vessel failure would remain incredible during normal operation and upset conditions following the overpressurization event.

In our October 27, 1976 letter, we also stated that administrative controls are employed to prevent inadvertent overpressurization of the reactor coolant system by the safety injection accumulators. Those administrative controls include de-energizing the accumulator isolation valve motors in the same manner utilized for power operation. Specific procedural verification of valve status and motor breaker status as now used to verify that the valves are open and de-energized for power operation are incorporated in the plant procedures to verify that the valves are closed and de-energized.

The steady state flow capacities of typical pressurizer power operated relief valves and the mass injection rates for a typical 4-loop Westinghouse plant are provided in Figures 4 and 5 respectively. It can be noted that the steady state relief capacity of single pressurizer power operated relief valves is of the approximate capacity necessary to compensate for steady state safety injection flow. Although the steady state flow rates appear consistent, transient analysis will be necessary to assure capability of the system. Figure 6 presents the typical flow vs valve plug position relationships which will be incorporated in the analysis.

We have selected a "Reference Mitigating System" design which incorporates the guidance of your letter, the use of installed plant equipment to avoid equipment procurement delays to the extent possible and provides the maximum pressure relief

available. The "Reference Mitigating System" with the ability to verify its functional status prior to establishment of plant conditions where operability of the system is required coupled with increased administrative control requirements on the accumulator isolation valves will provide assurance that consequences of an overpressurization event will be mitigated.

Yours very truly,

E. E. Utley
Vice President
Bulk Power Supply

MFP/jc

FIGURE 1

LOGIC DIAGRAM

POWER OPERATED RELIEF VALVE

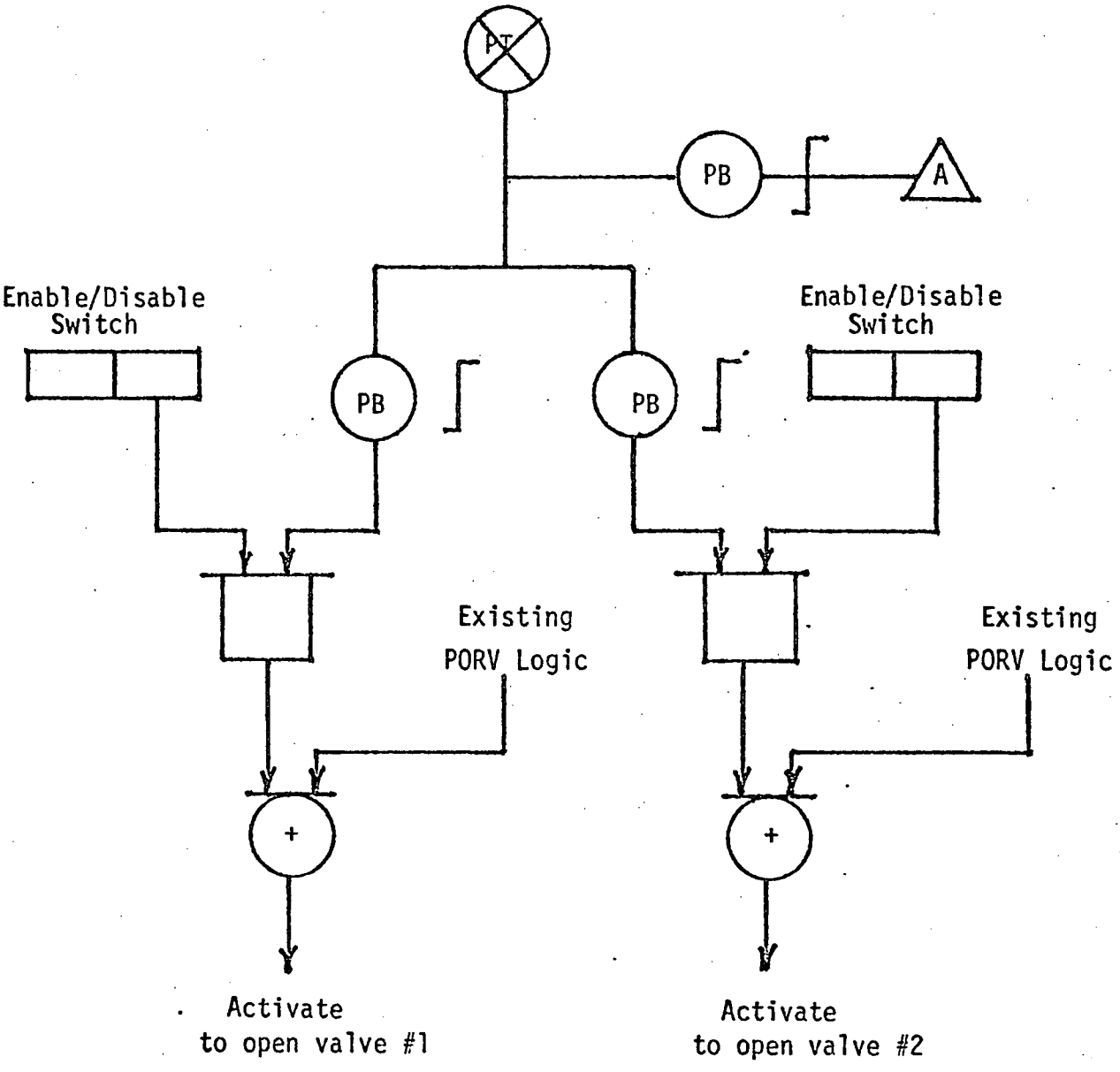


FIGURE 2

WIDE RANGE PRESSURE SIGNAL

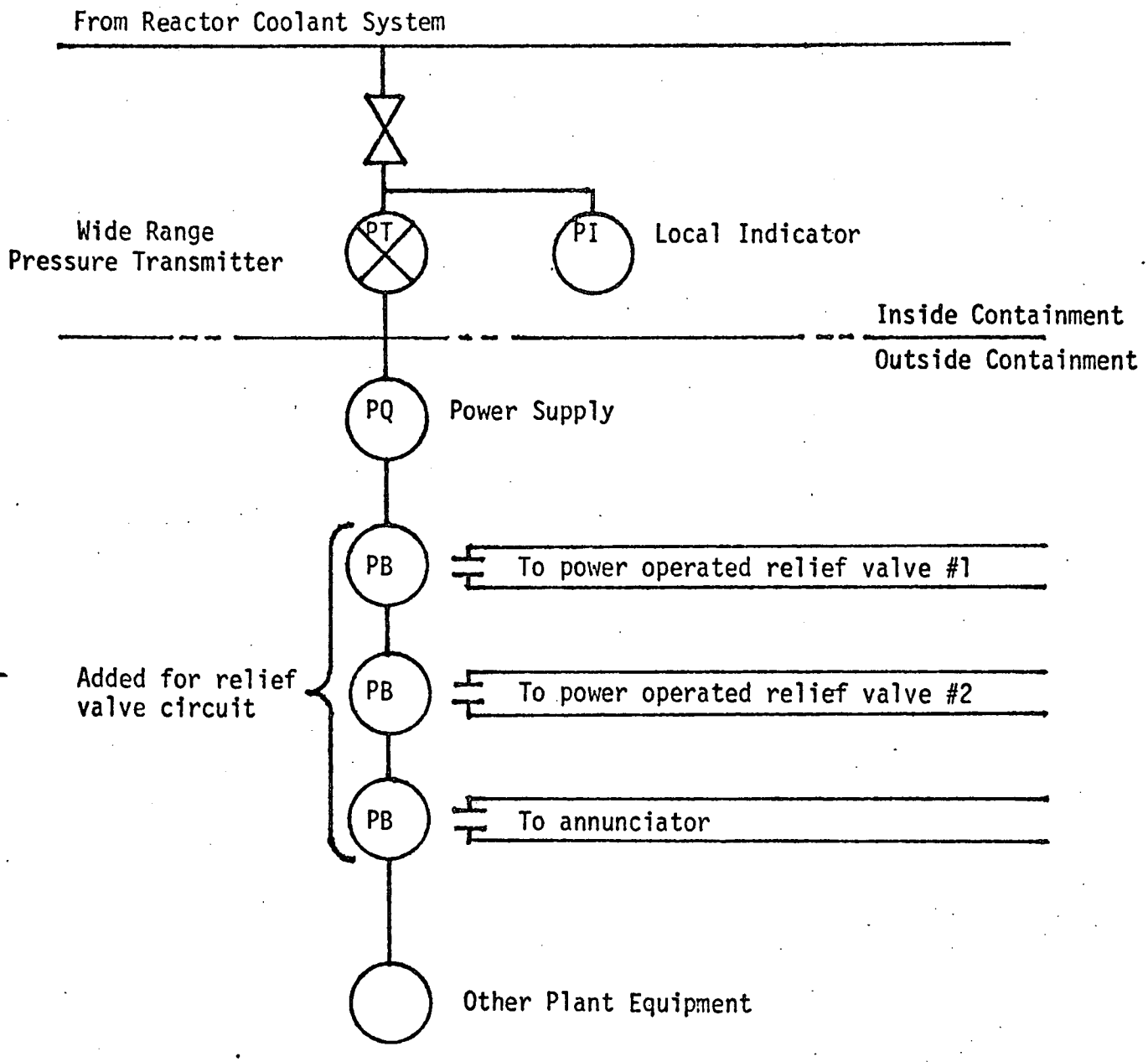
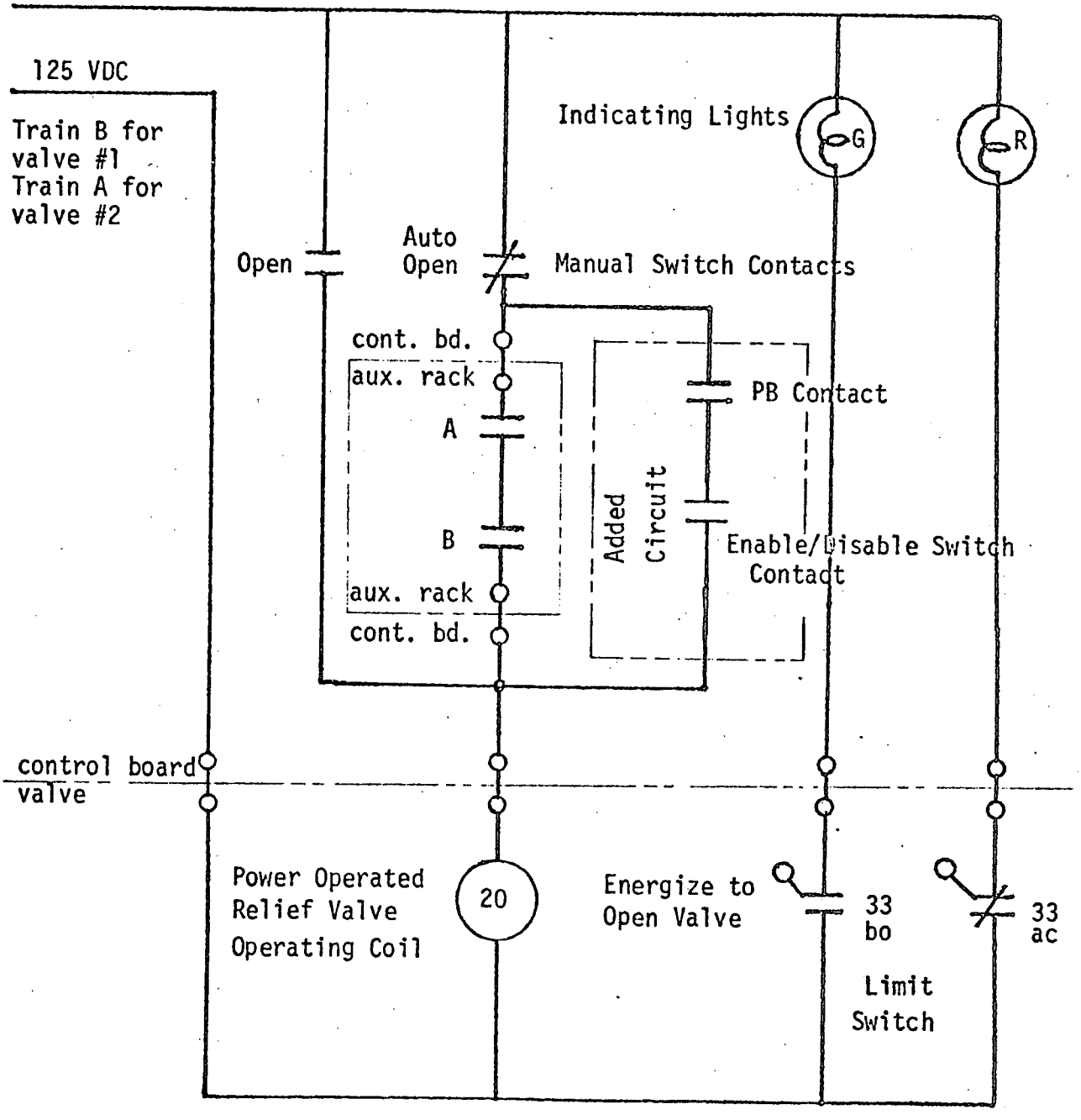


FIGURE 3

TYPICAL POWER OPERATED RELIEF VALVE CIRCUIT



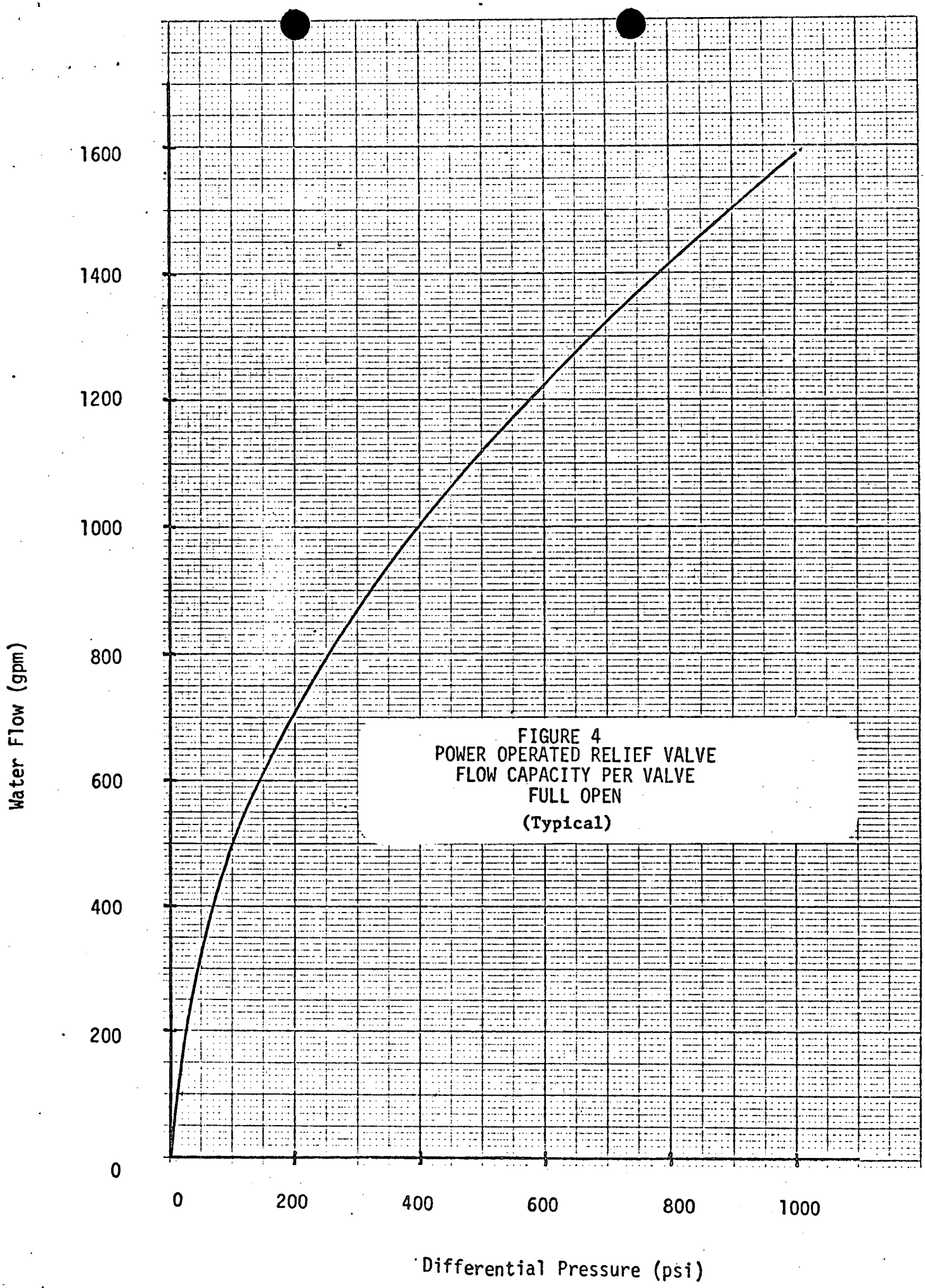


FIGURE 4
POWER OPERATED RELIEF VALVE
FLOW CAPACITY PER VALVE
FULL OPEN
(Typical)

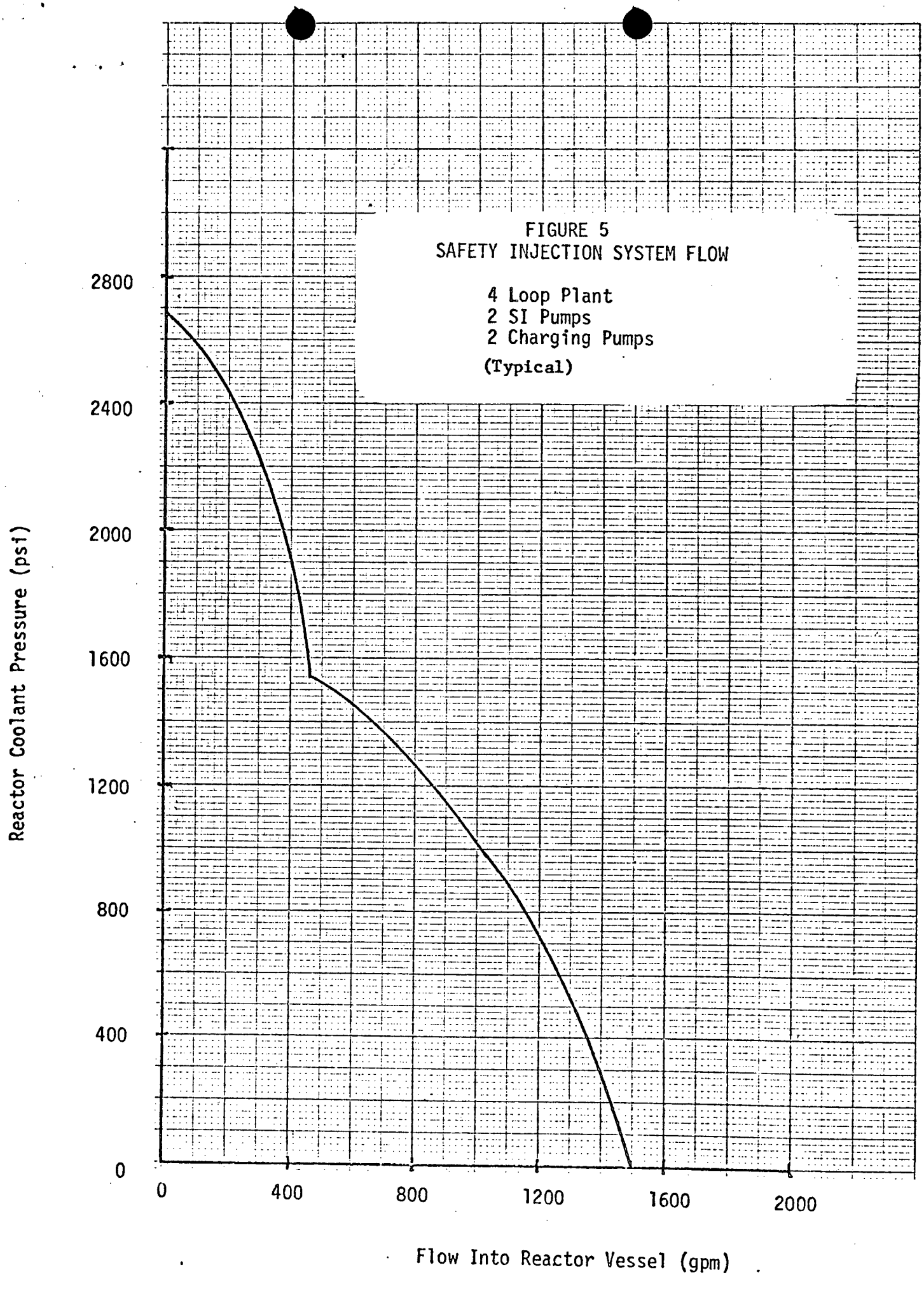


FIGURE 5
SAFETY INJECTION SYSTEM FLOW
4 Loop Plant
2 SI Pumps
2 Charging Pumps
(Typical)
Reactor Coolant Pressure (psi)
2800
2400
2000
1600
1200
800
400
0
0
400
800
1200
1600
2000
Flow Into Reactor Vessel (gpm)

FIGURE 6
POWER OPERATED RELIEF VALVE
FLOW CHARACTERISTICS

(Typical)