William J. Cahill, Jr.
Vice President

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York, N Y 10003
Telephone (212) 460-3819

DOCKETED USNRC
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U.S. NUCLEAR REGULATORY COMMISSION Mail Section

December 10, 1976

Re: Indian Point Unit. No. 2
Docket No. 50-247

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

Gentlemen:

On October 25, 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.

On November 4, 1976 the NRC met with the UTILITY Group (Owners/Operators of Westinghouse PWR's) in order to discuss the schedule and criteria for a system to mitigate overpressurization of the Reactor Coolant System. The NRC informed the UTILITY Group that operational hardware would have to be installed by December 31, 1977. In order to accomplish the December 31, 1977 objective, agreement must be reached on the design criteria by the NRC and the members of the UTILITY Group on a timely basis. Therefore, we have attached a "Reference Mitigating System and Design Criteria" based on guidance provided in the NRC letter of August 11, 1976. It should be noted that the "Reference Mitigating System," does not necessarily represent a

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proposed system to be installed at Indian Point Unit No. 2, but rather is a reference system to elicit NRC comments.

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. We therefore request prompt review of the attached "Reference Mitigating System and Design Criteria" with your comments provided back to us by January 31, 1977, so that final design criteria can be agreed upon shortly thereafter.

Very truly yours,

William J. Cahill Jr.

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PP/mmg

Attachment - "Reference Mitigating System and Design Criteria"

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 these criteria in our letter of October 25, 1976. These criteria are 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 bistable(s) will be added to provide an open signal to the power operated relief valve(s). 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 to open, which is presently supplied by an instrument air source. To assure operability upon the loss of instrument air, accumulator(s) will be utilized.

The accumulator(s) 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 instrument air.

c. The present power supply aligment 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 the Indian Point Unit No. 2 plant.

e. Seismic design of the electronic equipment presently installed in the Indian Point Unit No. 2 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 instrument 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 existence of plant conditions requiring operability of the mitigating system.

h. Figure 3 presents a typical electrical schematic diagram which could 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 coincident with disabling of the "Reference Mitigating System".

We have investigated 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.

It is our objective to resolve the matter of overpressure transients by the end of 1977. Since 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 the design criteria. The "Reference Mitigating System" design includes conformance with 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 to preclude them 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 upon conservative assumptions and safety factors which, if not exceeded, would mean that the rupture of the reactor vessel is considered incredible. An analysis which includes actual plant data and more reasonable assumptions in terms of flaw size, fluence, vessel material properties, etc. for the Indian Point Unit No. 2 plant, while retaining the safety factors of the Appendix G analysis methodology, shows that additional margin in temperature--presure limits could be attained and the rupture of the reactor vessel would still be considered highly unlikely. 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 "highly unlikely" event status and, Apendix G does not represent a Safety Limit.

The exceeding of reasonable assumption Appendix "G" type analysis limits does not mean that the vessel integrity will be compromised, but only that the margins available to real safety limits would be reduced in such an event. We believe there is a meaningful difference between accident events and events which reduce margins for a short time interval.

In our October 25, 1976 letter, we stated that with the administrative controls and the necessary design modifications for pressure relief, the overpressurization of the reactor coolant system will either be avoided, or else the consequences of such an event will be greatly mitigated. However, in the unlikely event that the 10 CFR 50 Appendix G limits should be exceeded, an analysis would be performed to determine the long term consequences of the event and the impact on plant safety. The analysis would be similar to the analysis presented by Virginia Electric Power Company in Abnormal Occurrence Report AO-S1-73-01-10 dated February 13, 1973.

The steady state flow capacities of typical pressurizer power operated relief valves and the mass injection rates for 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 valve 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.

The "Reference Mitigating System" is based upon the criteria of the NRC letter of August 11, 1976, and utilizes the existing power operated relief valves as the pressure relieving mechanism. The "Reference Mitigating System" as described above, coupled with increased administrative control requirements on the accumulator isolation valves will provide assurance that consequences of an overpressurization event will be mitigated.

FIGURE 1

LOGIC DIAGRAM

POWER OPERATED RELIEF VALVE

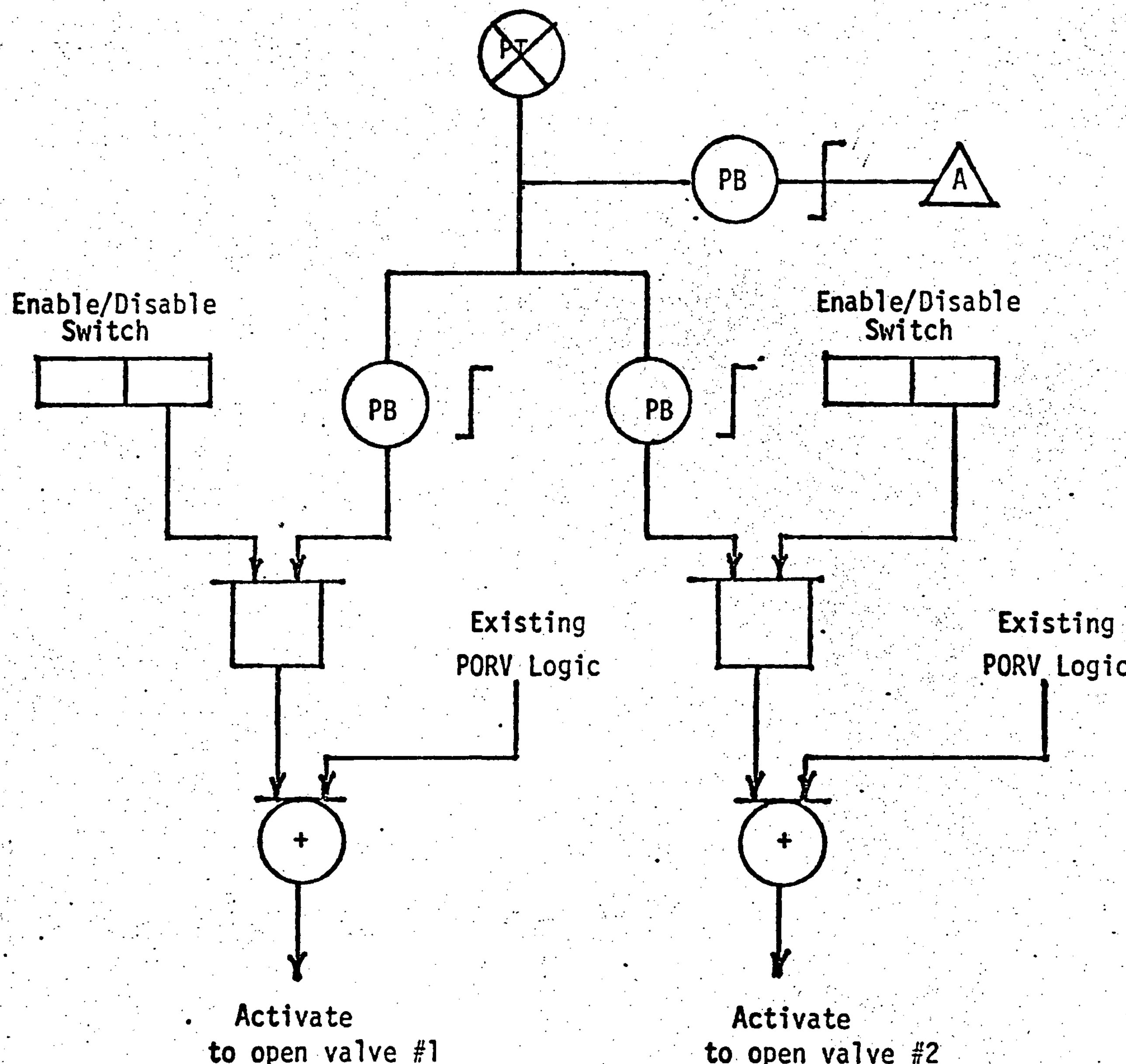


FIGURE 2

WIDE RANGE PRESSURE SIGNAL

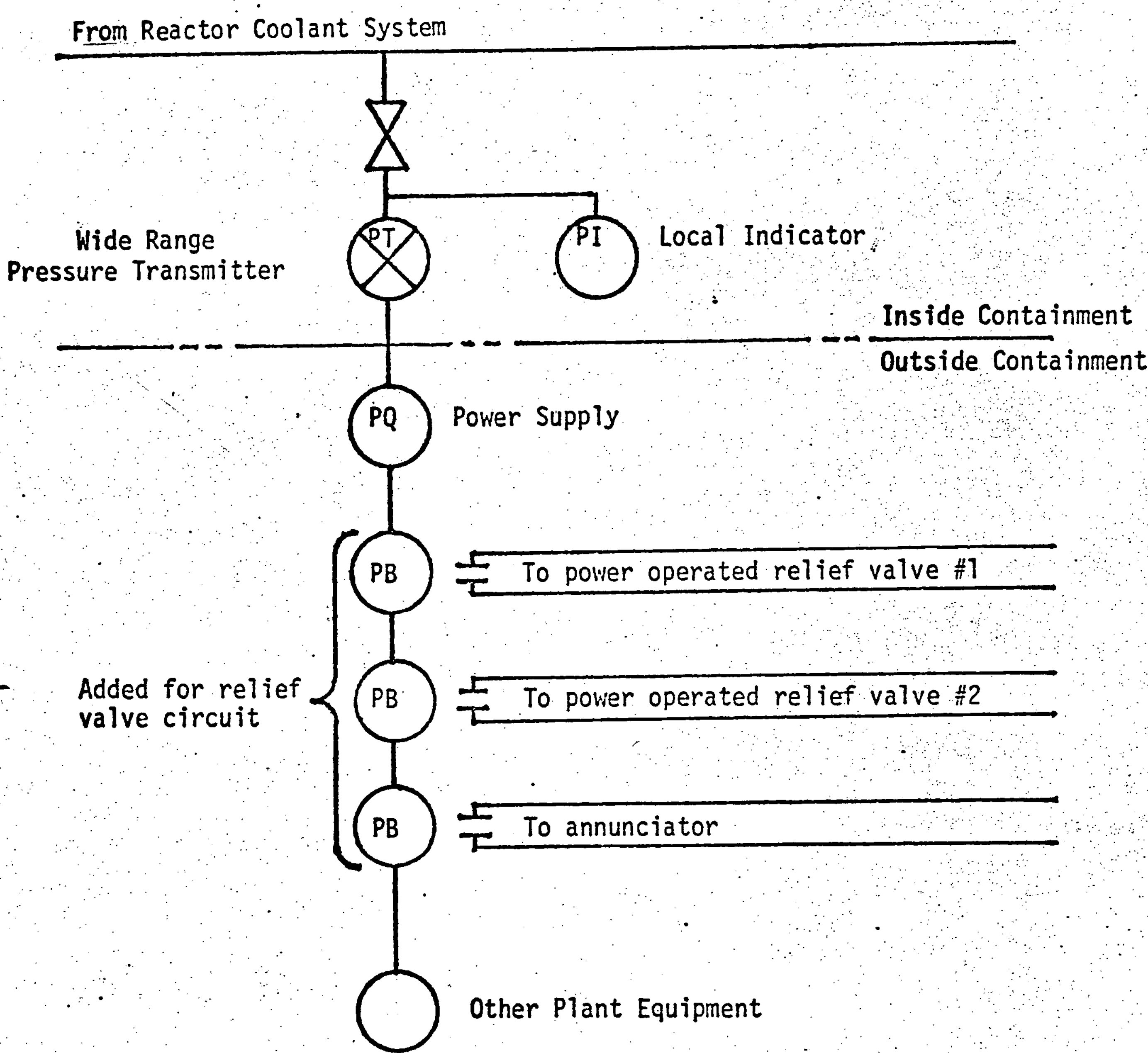
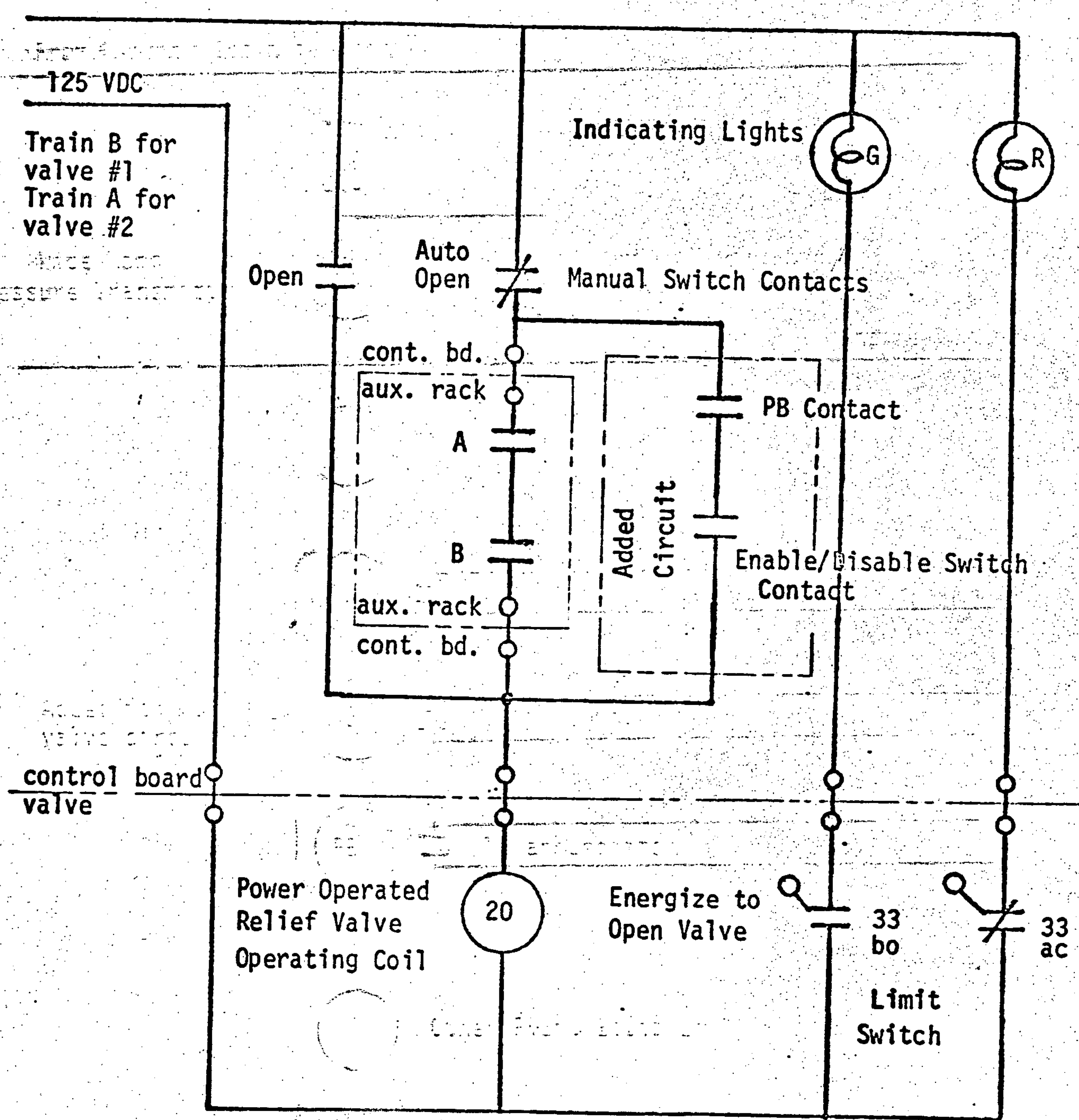


FIGURE 3

TYPICAL POWER OPERATED RELIEF VALVE CIRCUIT



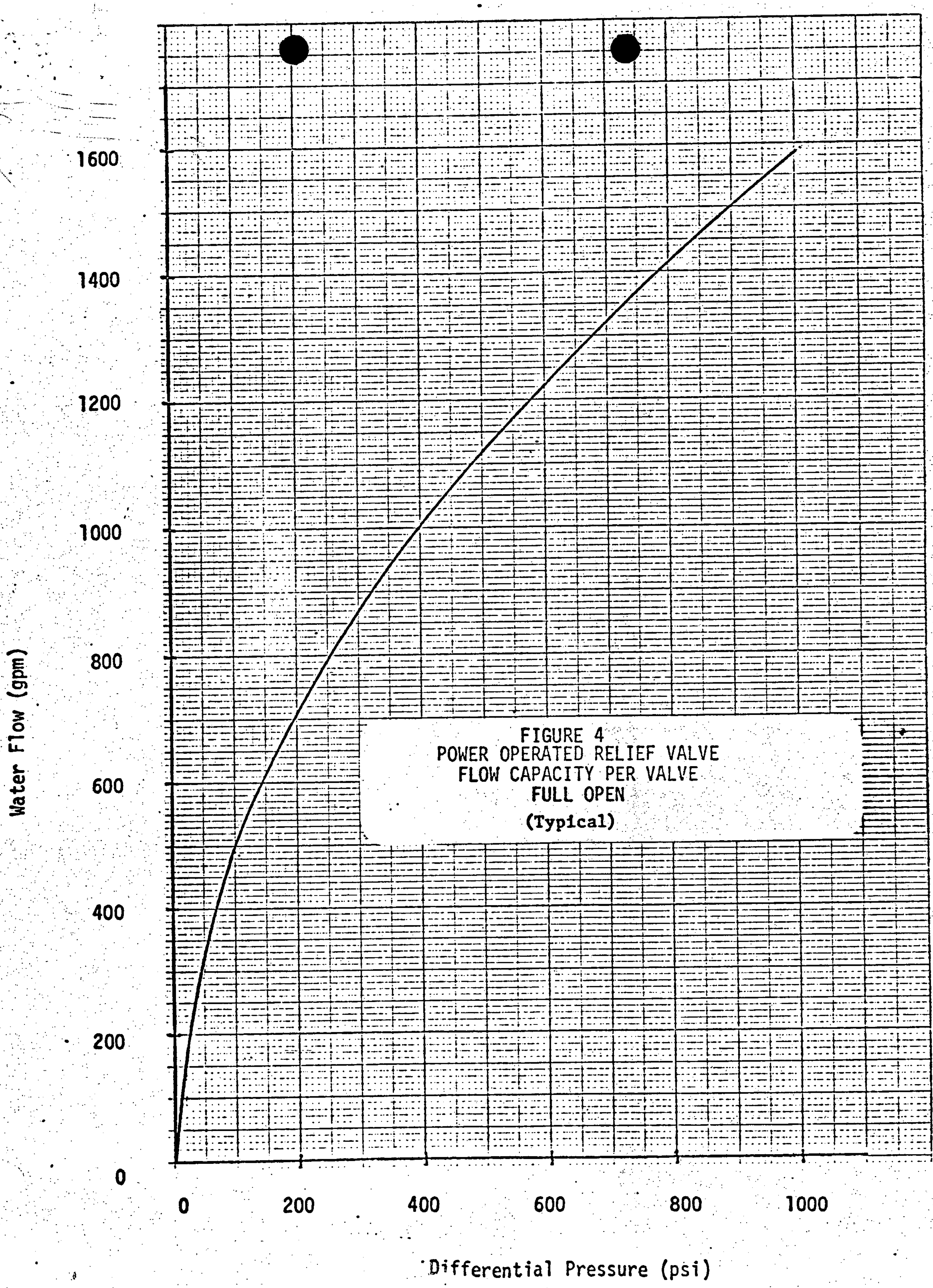


FIGURE 4
POWER OPERATED RELIEF VALVE
FLOW CAPACITY PER VALVE
FULL OPEN
(Typical)

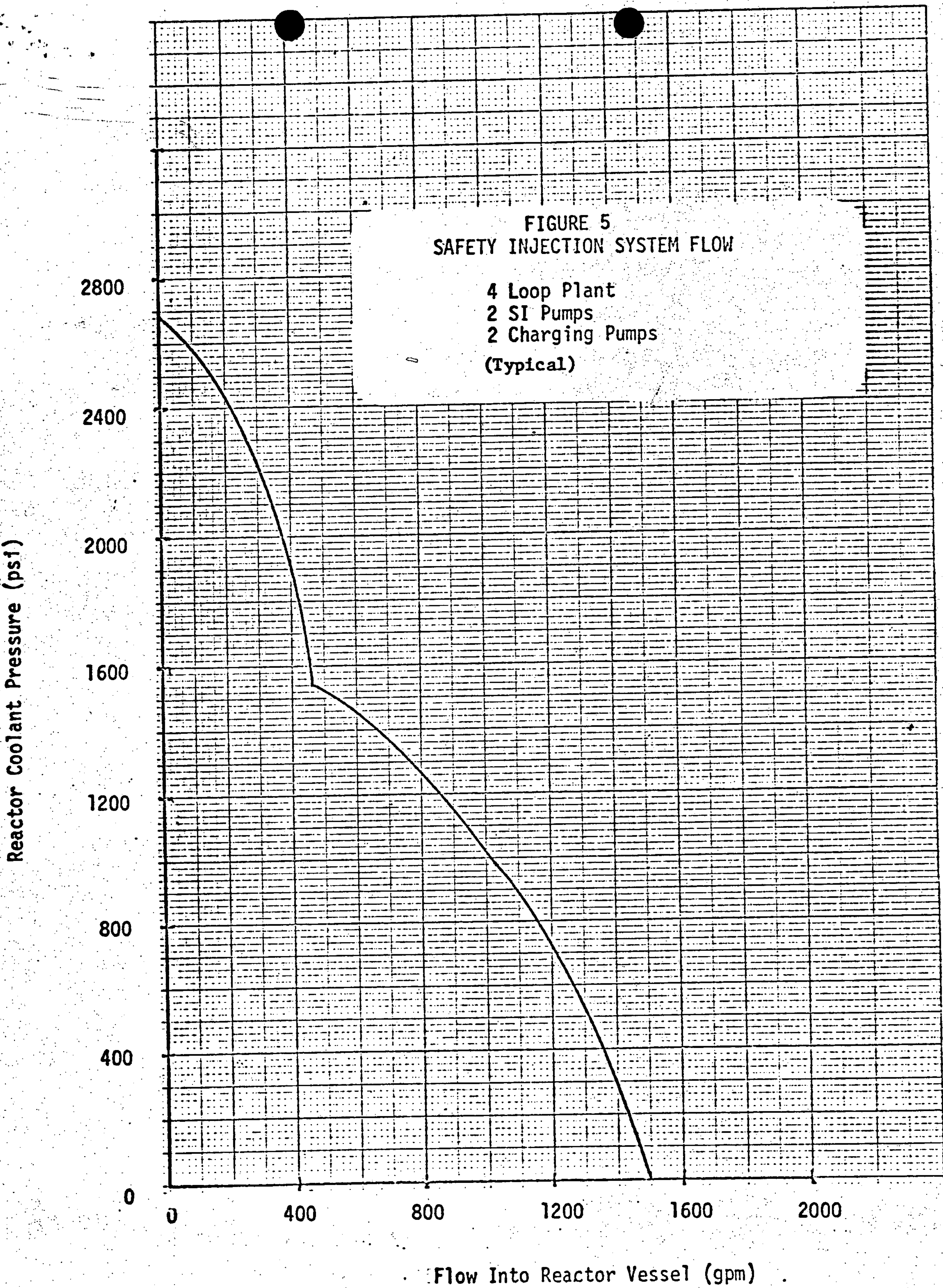


FIGURE 5
SAFETY INJECTION SYSTEM FLOW
4 Loop Plant
2 SI Pumps
2 Charging Pumps
(Typical)
Reactor Coolant Pressure (psi)
2800
2400
2000
1600
1200
800
400
0
0
400
800
1200
1600
2000
Flow Into Reactor Vessel (gpm)

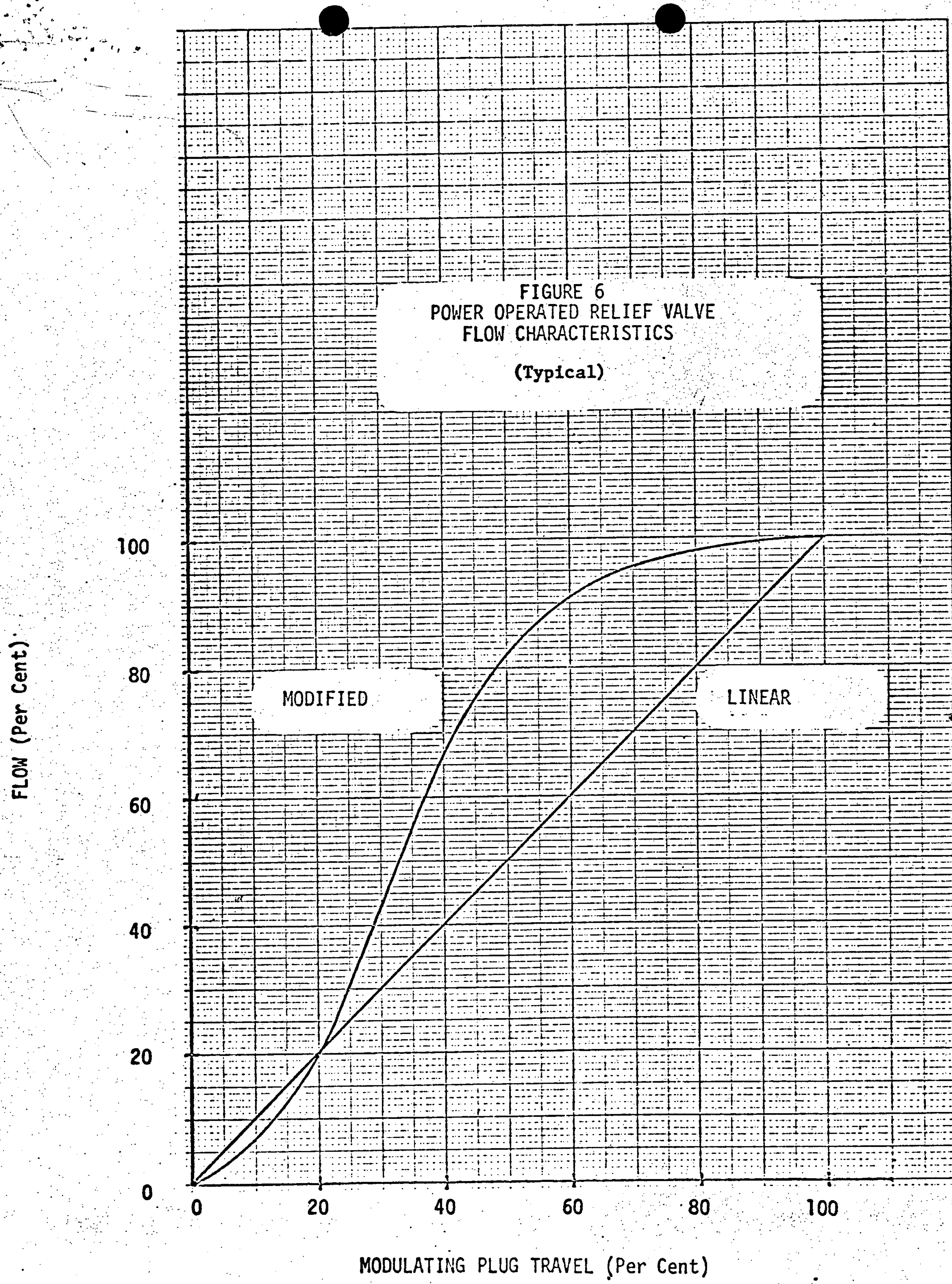


FIGURE 6
POWER OPERATED RELIEF VALVE
FLOW CHARACTERISTICS
(Typical)
MODIFIED
LINEAR
FLOW (Per Cent)
0
20
40
60
80
100
MODULATING PLUG TRAVEL (Per Cent)