NORTHEAST UTILITIES

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HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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November 8, 1978

Docket No. 50-336

Director of Nuclear Reactor Regulation
Attn: Mr. R. Reid, Chief
Operating Reactors Branch #4
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Reference: (1) W. G. Counsil letter to R. Reid dated November 1, 1978.

Gentlemen:

Millstone Nuclear Power Station, Unit No. 2
Reactor Coolant Pump Speed Sensing System

In Reference (1), Northeast Nuclear Energy Company (NNECO) discussed its intent to incorporate a Reactor Coolant Pump Shaft Speed Trip Function as an addition to the Millstone Unit No. 2 Reactor Protection System (RPS). This trip function would replace the current steam generator differential pressure (Δp) system for protection against the four pump loss of flow incident only. Protection for all other events for which flow measurement is required will continue to be provided by the Δp sensors presently installed.

The attached system description indicates the method by which the speed sensing system will be incorporated into existing plant systems, describes the equipment to be used and system qualification, establishes system accuracy in terms of setpoint drift, system noise, and response time, and quantifies the gains in trip setpoint for the four pump loss of flow event.

As discussed in the attachment, the four pump loss of flow has been the most limiting anticipated operational occurrence (AOO) in terms of required overpower margin. The assumption that the speed sensing system will be operational and licensed at the start of Cycle 3 has been incorporated into applicable reload analyses currently underway.

This assumption is based, in part, on an informal meeting with the NRC Staff in Bethesda on August 2, 1978. During this meeting, the speed sensing system was presented conceptually and specific areas of interest to the Staff were identified. The Staff was generally receptive to the concept, and NNECO agreed to supply the details contained in the Attachment in a timely fashion, to further minimize the possibility of licensing delays with this system. Since the speed sensing system will become an integral part of Cycle 3 safety analysis and setpoints, prompt identification of relevant Staff concerns is most desirable. Therefore, your expeditious review and comment on this proposed system would be most appreciated.

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Since this proposed system will require NRC Staff review, NNECO has reviewed this proposal pursuant to the requirements of 10CFR170, and has determined that no fee is applicable in this instance. This proposed system is a key factor in the decision to increase licensed core thermal power from 2560 MWt to 2700 MWt, the FSAR design maximum power level. It is expected that the NRC Staff approval of this system will be one element of the amendment allowing an increase in power to 100 percent of the design power level. Therefore, as provided in Footnote 2 in Section 170.22, this proposal is exempt from amendment fees.

It is the determination of NNECO that future correspondence, as outlined in Reference (1), involving initial increase in power to 100 percent of the initial design power level, will similarly be exempted from the fee requirements of 10CFR170.

Very truly yours,

NORTHEAST NUCLEAR ENERGY COMPANY

W. G. Counsil

W. G. Counsil
Vice President

Attachment

MILLSTONE UNIT 2 REACTOR PROTECTION SYSTEM
REACTOR COOLANT PUMP SHAFT SPEED
TRIP FUNCTION

INTRODUCTION

Reactor protection for design basis events which result in an excessive reduction in primary coolant flow is presently provided as part of the Millstone Unit 2 (MP2) Reactor Protection System (RPS). This protection is provided by a low flow trip function which monitors coolant flow based on steam generator differential pressure (Δp) sensors. This system generates a reactor trip whenever the total primary coolant flow violates a fixed low flow setpoint. At present, the MP2 most limiting loss of flow anticipated operational occurrence (AOO), in terms of required overpower margin is the four pump loss of flow which is accommodated by the Δp trip function setpoint.

This document describes a proposed Reactor Coolant Pump Shaft Speed Trip Function to be incorporated as an addition to the MP2 RPS. The Trip Function will sense RCP speed directly and provide a reactor trip when speed reaches a fixed low setpoint. Monitoring actual pump shaft speed permits a more rapid and accurate determination of the four pump loss of flow event. This increased RPS performance will allow a higher trip setpoint without any increased risk of spurious reactor trip. The combination of a higher trip setpoint and a more rapid system response assures a reactor trip sooner during the four pump loss of flow design basis event. The benefit of this improvement will allow reduced initial required overpower margin for the four pump loss of flow event. With the RCP speed sensing system in service, the existing Δp loss of flow measurement will have its setpoint revised to recognize the most limiting loss of flow AOO excluding the four pump loss of flow event.

SYSTEM DESCRIPTION

General

The Reactor Coolant Pump Shaft Speed trip system consists of a Reactor Coolant Pump Shaft Speed Sensing System (RCPSSS), the existing MP2 RPS trip logic and Reactor Trip Switchgear. The RCPSSS consists of a speed sensor and mounting fixture (one on each pump), signal transmitters located inside containment, signal processing equipment, and analog bistable trip units. A RCPSSS system functional block diagram is provided in Figure 1. The RPS trip logic and Reactor Trip Switchgear remain the same as previously presented in the MP2 Final Safety Analysis Report. Thus, only the RCPSSS will be described next.

Reactor Coolant Pump Shaft Speed Sensing System

The speed of each reactor coolant pump motor is measured to provide a basis for the determination of a flow condition requiring reactor trip. A metal disc with 44 uniformly spaced holes about its periphery and attached to the reactor coolant pump shaft is scanned by a proximity device. Each scanning device (proximity probe and transmitter) produces a voltage pulse signal with a frequency proportional to pump speed. Signal processing equipment modifies the pulse train signal from the scanning devices and provides input to a frequency to voltage converter which generates an analog voltage proportional to pump speed. This analog voltage is compared to a fixed trip setpoint in the bistable trip unit. A trip signal is generated whenever the analog speed signal reaches or goes below the low trip setpoint. The trip signal outputs are in the RPS trip logic (refer to Millstone Point - Unit 2 FSAR for additional information on trip logic and actuated devices.)

Design Bases

The Reactor Coolant Pump Shaft Speed trip function is designed to provide a rapid and reliable reactor trip for the four pump loss of flow event resulting from a loss of electrical motive power to all four reactor coolant pump motors. Other loss of flow design basis events (e.g., two pump loss of flow) are accommodated by the present low flow trip function based on steam generator Δp.

The (RCPSSS) is designed on the following bases to assure adequate performance of its protective function:

a. The trip function is designed in compliance with the applicable criteria of the General Design Criteria for Nuclear Power Plants, Appendix A of 10CFR50, July 15, 1971.

b. Instrumentation, function, and operation of the trip logic conform to the requirements of IEEE Standard 279-1971, Criteria for Protective Systems for Nuclear Power Plants.

c. The trip function is designed consistent with the recommendations of Regulatory Guide 1.53, Application of the Single-Failure Criterion to Nuclear Power Plant Protective Systems, and Regulatory Guide 1.22, Periodic Testing of Protection System Actuation Functions.

d. Four independent measurement channels are provided.

e. The protective system ac power is supplied from four separate vital instrument buses.

f. The RCPSSS can be tested with the reactor in operation or shut down.

g. Trip signal is preceded by a pretrip alarm to alert the operator of undesirable operating conditions in cases where operator action can correct the abnormal condition and avoid a reactor trip.

h. The RCPSSS components are qualified for environmental and seismic conditions in accordance with IEEE Standard 323-1971, and IEEE Standard 344-1975. The operation of the RCPSSS is not required during or subsequent to any Design Basis Event which significantly alters the containment environment (LOCA, Main Steam Line Break, or Feedwater Line Break), and, therefore, it is not required that in-containment equipment be qualified for the adverse environments associated with these events.

i. The trip function is designed so that protective action will not be initiated due to normal operation of the generating station.

Reactor Coolant Pump Shaft Speed Trip Function Performance Requirements

The selection of a trip setpoint is such that adequate protection is provided when all sensor and processing time delays and inaccuracies are taken into account. Final determination of an equipment setpoint is based, in part, on the characteristics of the equipment. The nominal setpoint, uncertainties, and response times are provided in Table I. The corresponding values for the low flow trip on steam generator Δp are also provided so that the gains in system performance for the four pump loss of flow event may be quantified.

FIGURE 1

REACTOR COOLANT PUMP SHAFT SPEED SENSING SYSTEM
(TYPICAL CHANNEL)

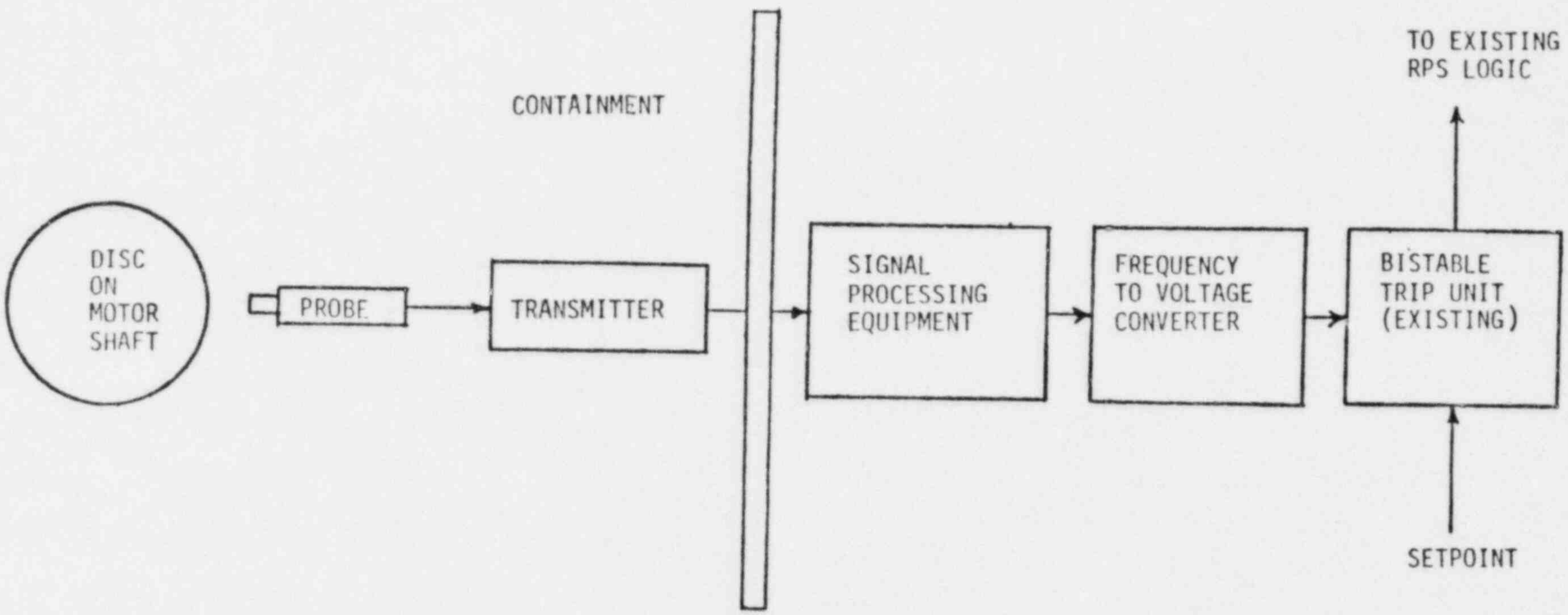

TABLE I

LOW FLOW TRIP FUNCTION NOMINAL CHARACTERISTICS

PERFORMANCE CHARACTERISTICS	LOW FLOW TRIP FUNCTION (STEAM GENERATOR ΔP)	RCPSS TRIP FUNCTION
System Overall Accuracy	2.7%	1.5%
Bistable Drift Allowance	0.8%	0.8%
System Noise	2.25%	1.0%
Nominal Trip Setpoint	91.7%	93%
Overall System Response Time	650 msec	450 msec