ABC PDR

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

DEC 27 1978

Docket No: 50-341

APPLICANT: Detroit Edison Company

FACILITY: Enrico Fermi Atomic Power Plant Unit 2

SUBJECT: SUMMARY OF NOVEMBER 28, 1978 MEETING REGARDING TURBINE TRIP TRANSIENT ANALYSIS

Detroit Edison Company has proposed a revision to the design and analysis of equipment designed to reduce the severity of a main steam turbine trip or a generator load rejection transient. Currently, the safety analyses[1] assume that stop valve closure or fast closure of the turbine control valves trips the reactor control rods and the recirculation coolant pumps, and that there is no steam bypass around the turbine. The proposed revision to the analysis would assume no recirculation pump trip and account for steam bypass (a) to the steam reheater between the high pressure turbine and the low pressure turbine, and; (b) through one of the two unitized steam bypass systems. The effect of steam bypass on minimum critical power ratio (or MCPR) is expected to more than offset the effect of eliminating the recirculation pump trip. Enclosure 1 is a copy of each slide shown in the meeting.

The purpose of this meeting was to obtain comments from the staff regarding the acceptability and impact of this revision on the Fermi 2 operating license review. Enclosure 2 is a list of attendees. Previous discussions on the proposed revision are discussed in Memoranda from L. Kintner dated August 2, 1978, October 20, 1978 and December 5, 1978.

During the meeting the applicant provided the following information regarding the proposed revision to the design and analysis. (1) The turbine trip and generator load rejection transients would be analyzed assuming one of the two steam bypass valves fails to open. This results in 13% of rated steam flow through the open bypass valve and 16% through the reheater (See page 3 of Enclosure 1). (2) The transients will be deemed acceptable if the minimum critical power ratio is equal to or greater than 1.07, which is the acceptance criteria for incidents of moderate frequency[2]. (3) Deletion of the recirculation pump trip for

[1]Final Safety Analysis Report, Sections 15B.2.2 and 15B.2.3

[2]Applicant agrees that the acceptance criterion for infrequent incidents that allows fuel failure will not be used for these transients.

these transients will reduce the number of plant trips and associated thermal cycles on plant equipment. (4) The equipment used to trip the recirculation pump during an anticipated transient without scram (ATWS) is independent of the equipment used to trip the pump during the turbine trip or generator load rejection transients; therefore, deletion of the pump trip for these transients will in no way affect the capability for a pump trip to reduce the consequences of an ATWS. (5) The calculations would be made with the REDY Code using a constant bypass steam flow as input to the Code. Based on sensitivity calculations of heat transfer in the reheater, an assumed bypass flow of 10% for the first two seconds of the transient is conservative (page 6 of Enclosure 1). (6) Because of the separate bypass valves, valve actuators, valve controls, and servo oil systems, a single failure could result in one-half the rated steam flow through the bypass system (pages 7 through 13, Enclosure 1). (7) The decision to retain the recirculation pump trip in the design basis for these transients must be made soon because delivery of breakers to perform this function required 12 months from the date of purchase.

The staff provided the following comments on the proposed revision. (1) Recirculation pump trip has been used by other BWR licensees to reduce the severity of turbine trip and load rejection without bypass transients. Use of the pump trip is neither required by NRC regulations nor recommended in its regulatory guides or standard review plan. However, the analysis of turbine trip and load rejection without steam bypass has been required in BWR plants. The proposed Fermi 2 assumptions of steam bypass will require a significant amount of additional information for review, including a description of the steam bypass system and the reheater, a failure modes and effects analysis of equipment relied on for the bypass, and the methods and results of the analysis. (2) The auxiliary, electrical, instrumentation and control systems used in the safety analysis to reduce the consequences of this transient are not required to be Seismic Category I because the probability of a safe shutdown earthquake coincident with this incident is sufficiently small. However, the reliability of the systems should be discussed. Consideration should be given to technical specifications and associated surveillance tests of the systems to demonstrate availability and operability throughout plant life. Consideration should be given to common mode failures as well

as single active component failures. (3) The analysis should be performed using the ODYN Code instead of the REDY Code[3]. (4) The sensitivity of the minimum critical power ratio to steam bypass should be calculated, including the effect of partially closed turbine control valves at various power levels and loss of bypass valve but with credit for flow to the reheater.

As a result of the meeting, the staff concluded that the proposed revised analysis of the turbine trip transient, as modified by our comments, appeared to be acceptable for review. The description of the equipment, modification of the ODYN Code to incorporate bypass steam, and safety analyses should be tendered prior to docketing to minimize later questions for information.

The following schedule was established subsequent to the meeting for review of this transient. The scheduled review is about 2 months later than the approved Fermi 2 reactor system review schedule. However, it is early enough to be included in the Fermi 2 Safety Evaluation Report scheduled to be issued August 31, 1979.

[3]Subsequent to the meeting, the use of the ODYN Code rather than REDY Code was discussed with L. Schuerman (DECo) by telephone. During 1977, turbine trip tests run at Peach Bottom Unit 2 showed that the REDY Code underpredicts the minimum critical power ratio. In a March 31, 1978 letter, General Electric proposed that certain transients, including turbine trips, be calculated with the ODYN Code, which includes a better simulation of the steam line and connected bypass line for rapid pressurization events. The staff expects to complete its review of ODYN Code in February 1979. In the interim, the staff recommended in its November 21, 1978 Safety Evaluation Report on NEDE 23786-1 "Fuel Rod Prepressurization" that future code calculations follow the evaluation procedures for use of the ODYN Code as described in General Electric's March 31, 1978 letter.

Mr. Schuerman said that the limiting transient for Fermi 2 would be reanalyzed using the ODYN Code. However, the transients that have been submitted for Fermi 2 were calculated with the REDY Code and the reanalyses of transients for prepressurized fuel parameters are currently being made with the REDY Code. The selection of the limiting transient will be based on the REDY Code calculations for Fermi 2.

The staff advised Mr. Schuerman that it is likely several transients will be required to be run with ODYN to demonstrate that the most severe transient has been selected. One of these transients should be the turbine trip with steam bypass because the REDY Code has known deficiencies in the modeling of the steam line and correct modeling of the main steam line, reheater line, and bypass steam lines may be significant for the analysis proposed for Fermi 2.

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Applicant tenders information	January 15, 1979
Staff sends letter to applicant accepting information for review	February 16, 1979
Applicant files information as an appendix to the FSAR with applicable changes in the FSAR	April 27, 1979
Safety Evaluation Input to LPM	June 22, 1979

Lester L. Kintner, Project Manager
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Enclosures:
1. Slides from Meeting
2. Attendees List

cc:
See next page

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TURBINE TRIP WITHOUT BYPASS

- NOT VALID TRANSIENT FOR FERMI 2

- FAILURE OF CONTROLLED BYPASS RESULTS IN A BYPASS FLOW OF 23% NBR

- BYPASS FLOWS RESULT FROM SPECIFIC DESIGN CHARACTERISTICS OF THE GEC TURBINE

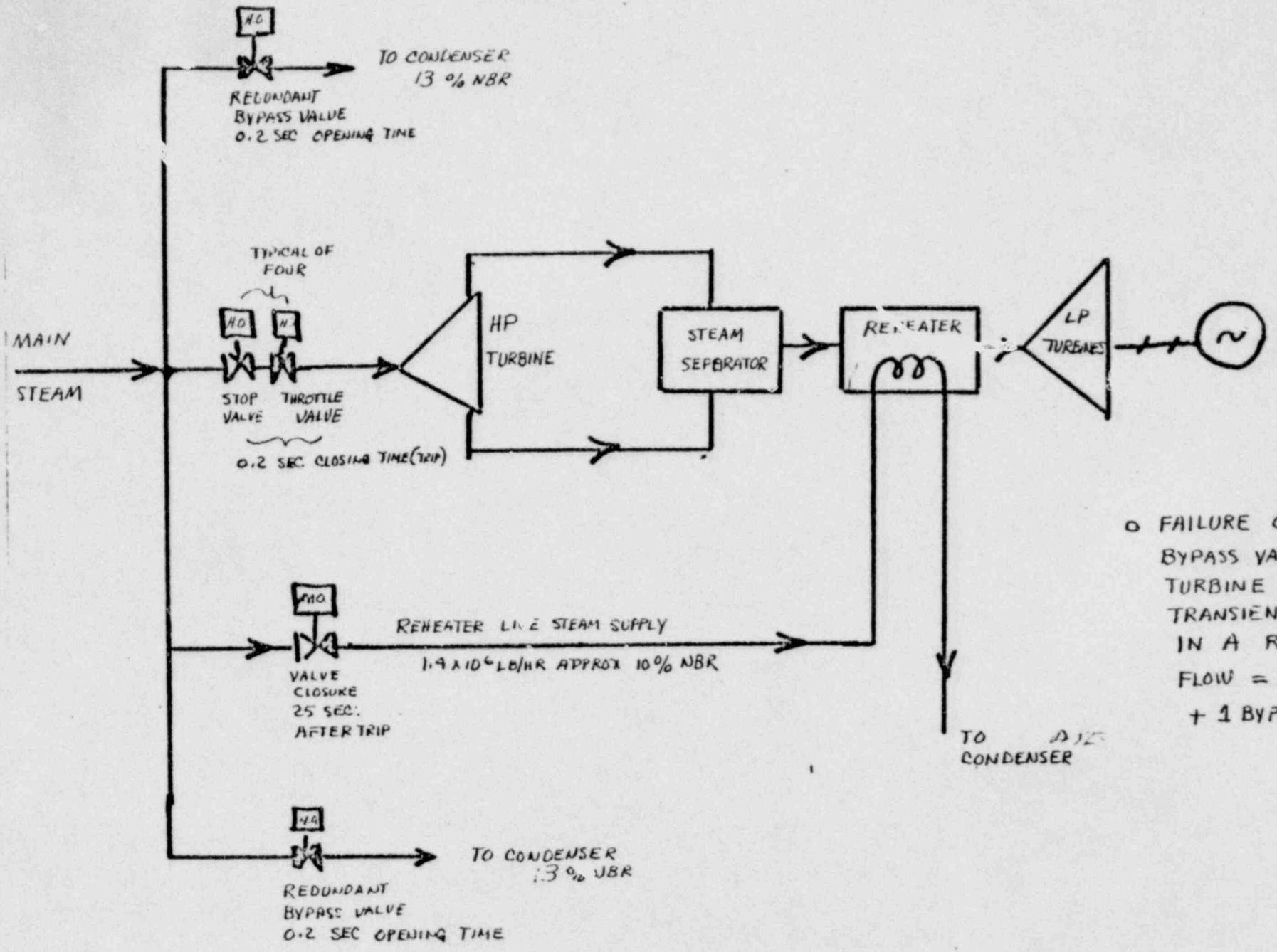
FERMI 2 BYPASS STEAM SYSTEM

TWO INDEPENDENT BYPASS SYSTEMS

- INHERENT LIVE STEAM FLOW TO TURBINE REHEATERS 10% NBR

- EHC CONTROLLED BYPASS - TWO INDEPENDENT VALVE SYSTEMS WITH A COMBINED CAPACITY OF 26.5% NBR

FERMI 2 BYPASS SYSTEM



- FAILURE OF ONE BYPASS VALVE ON TURBINE TRIP TRANSIENT RESULTS IN A REACTOR FLOW = LIVE STEAM + 1 BYPASS VALVE

3.1-1

REHEATER BYPASS

- PASSIVE SYSTEM, NOT SUBJECT TO FAILURE

- TURBINE WILL NOT [redacted] BE [redacted] OPERATED AT HIGH POWER LEVELS WITHOUT REHEAT

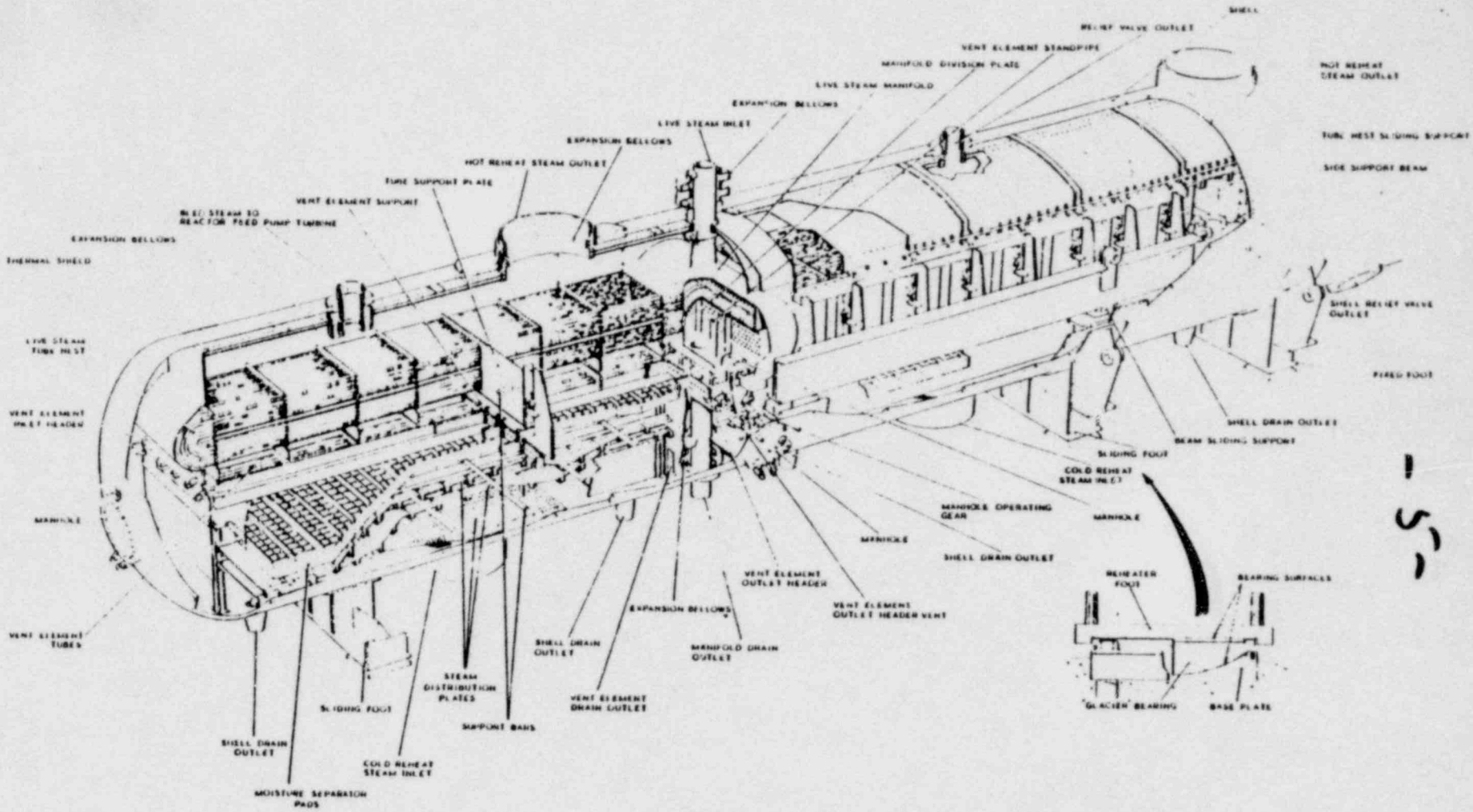
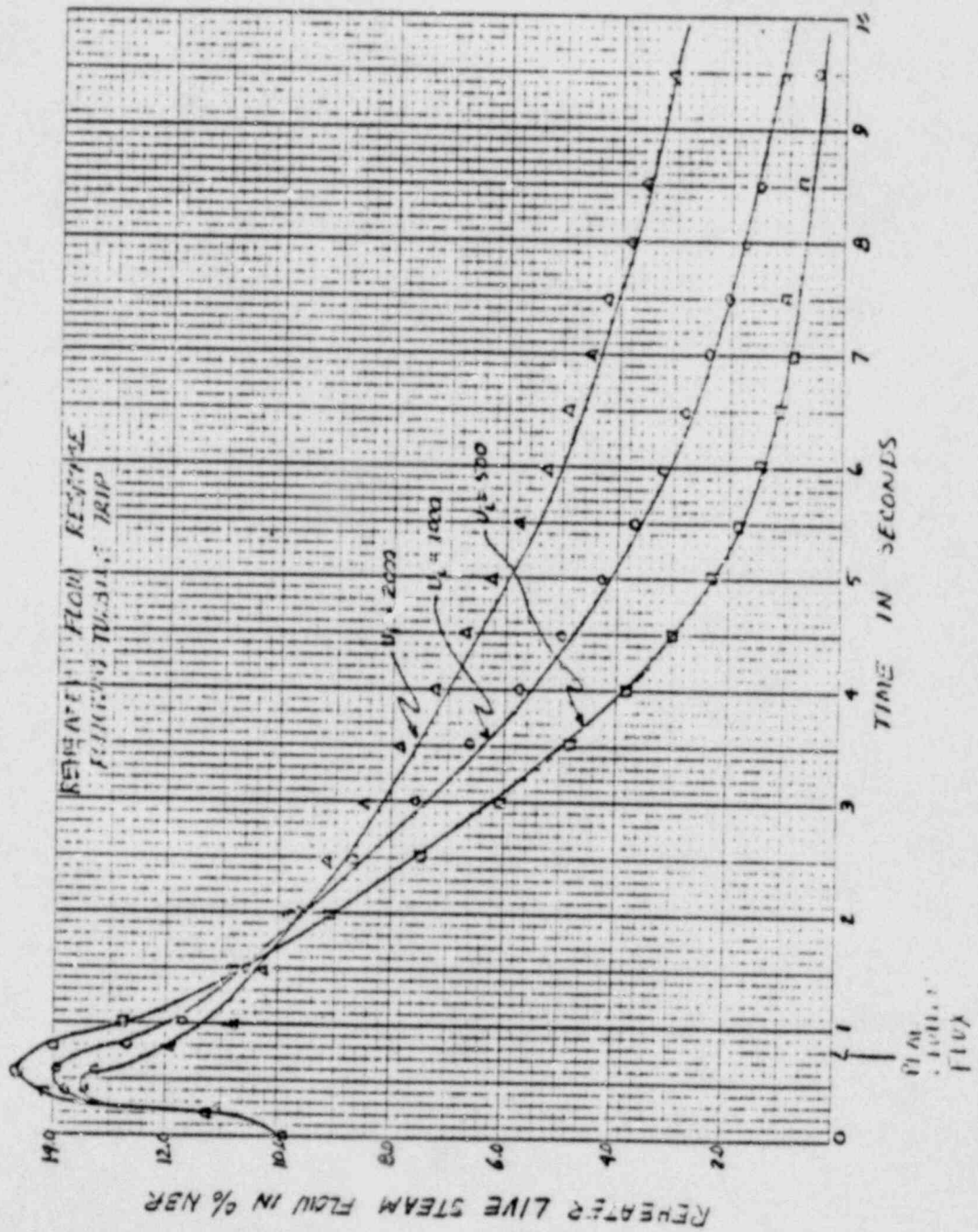
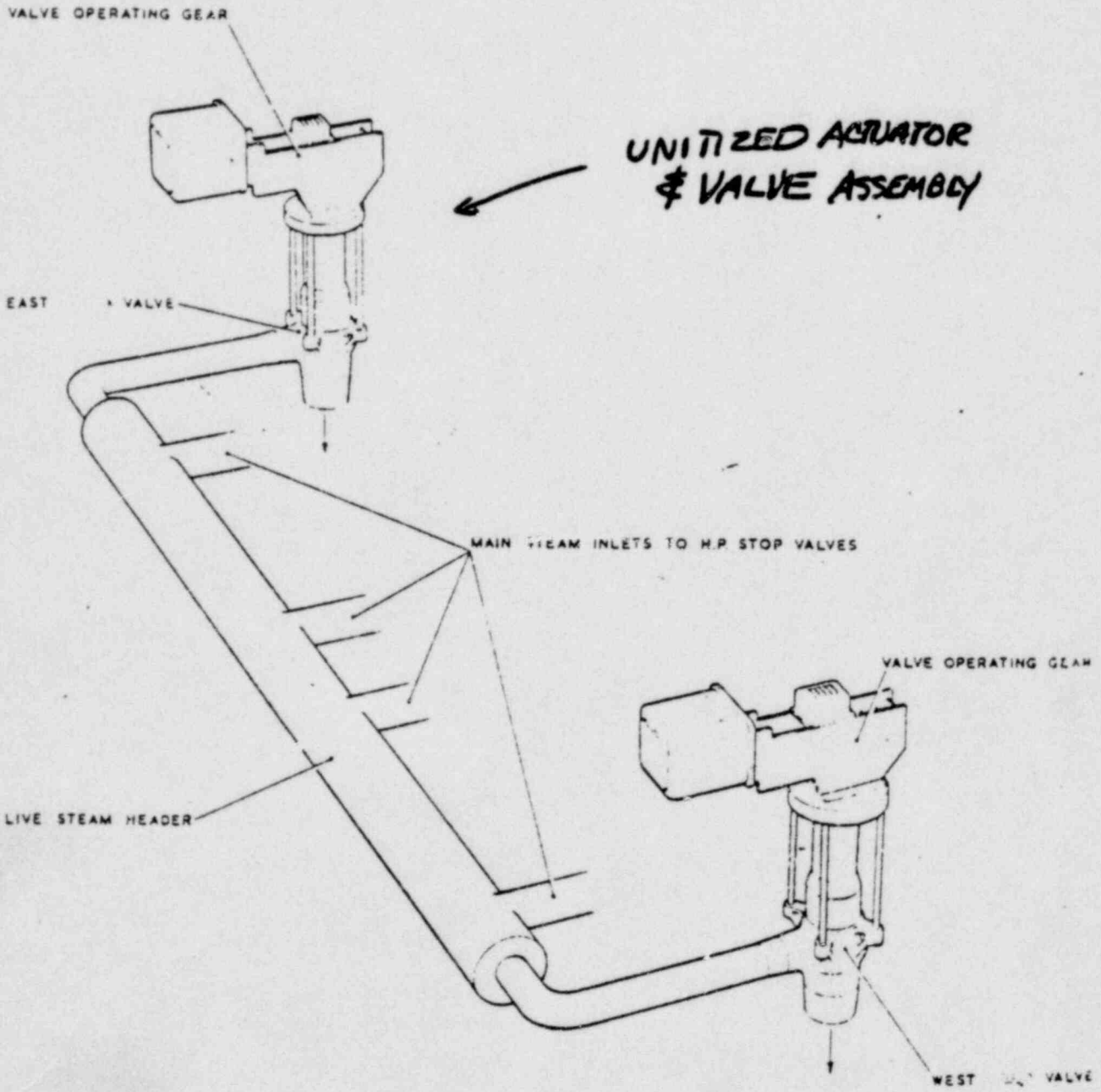


FIG REHEATER


REHEATER LIVE STEAM FLOW IN % NOR
TIME IN SECONDS
REHEATER FLOW RESPONSE FOLLOWING TURBINE TRIP
V1 = 2000
V1 = 1000
V1 = 500

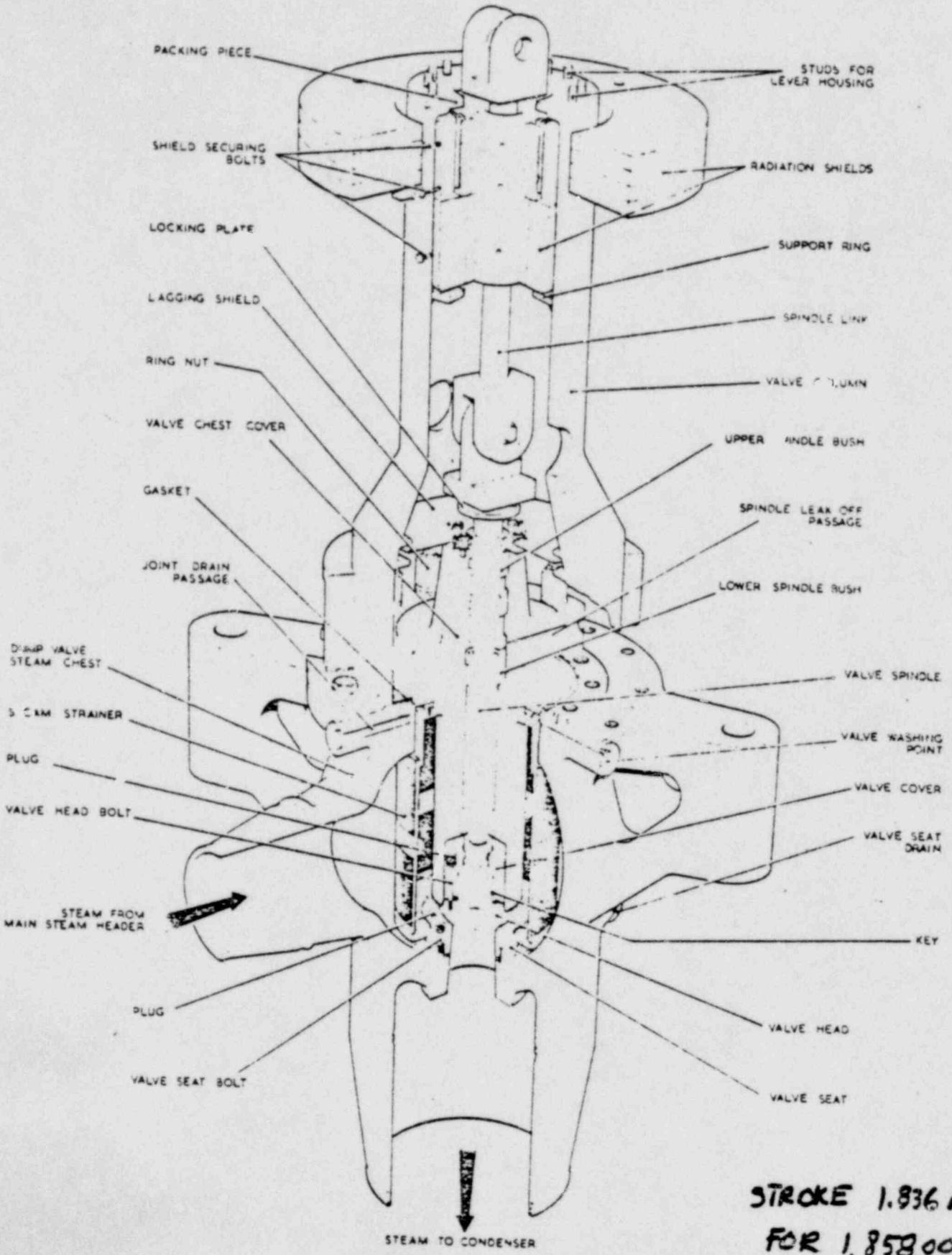
EHC CONTROLLED BYPASS

- CAPACITY 26.5% NBR
- REDUNDANT
- INDEPENDENT
- SINGLE FAILURE CAPACITY ½ NOMINAL



EHC CONTROLLED
BYPASS STEAM SYSTEM

FERMI 2 BYPASS VALVE DESIGN



STROKE 1.836 INCHES
FOR 1,858,000 #/

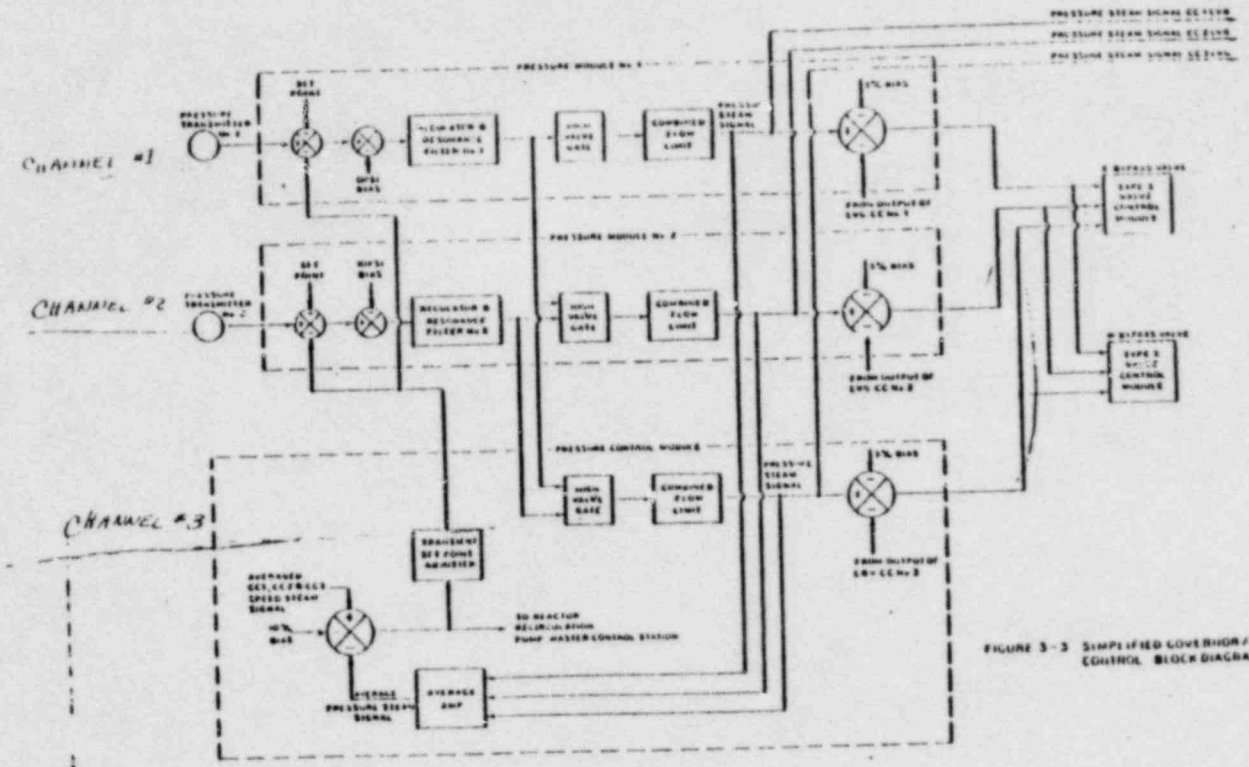
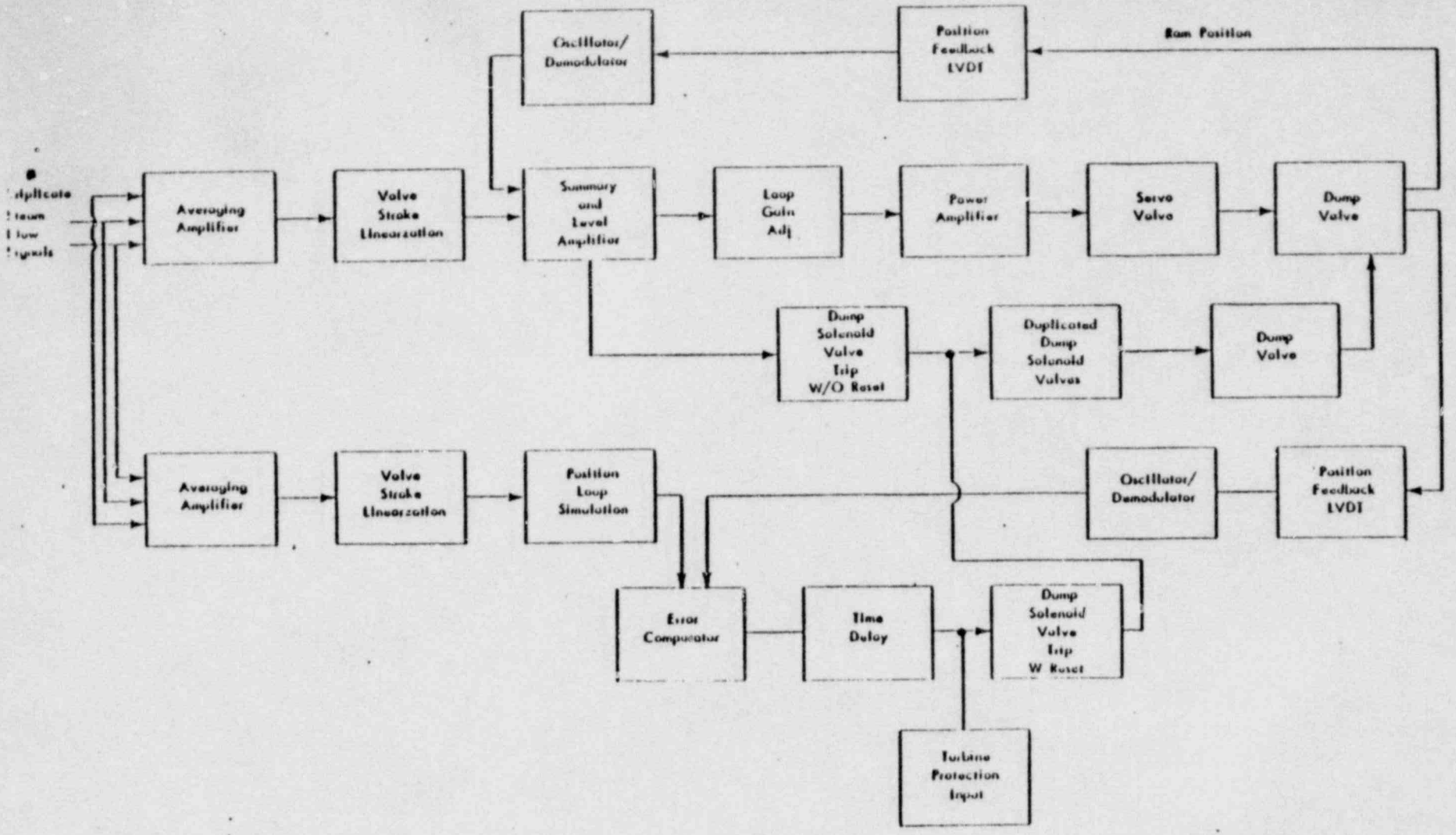


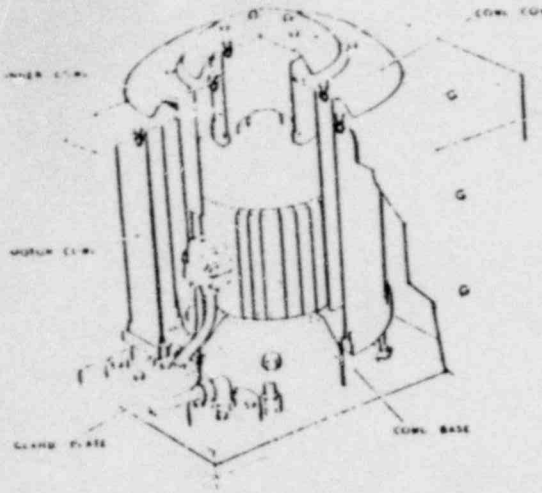
FIGURE 3-3 SIMPLIFIED GOVERNOR/PRESSURE CONTROL BLOCK DIAGRAM

(2.3)
REDUNDANT CONTROL LOGIC

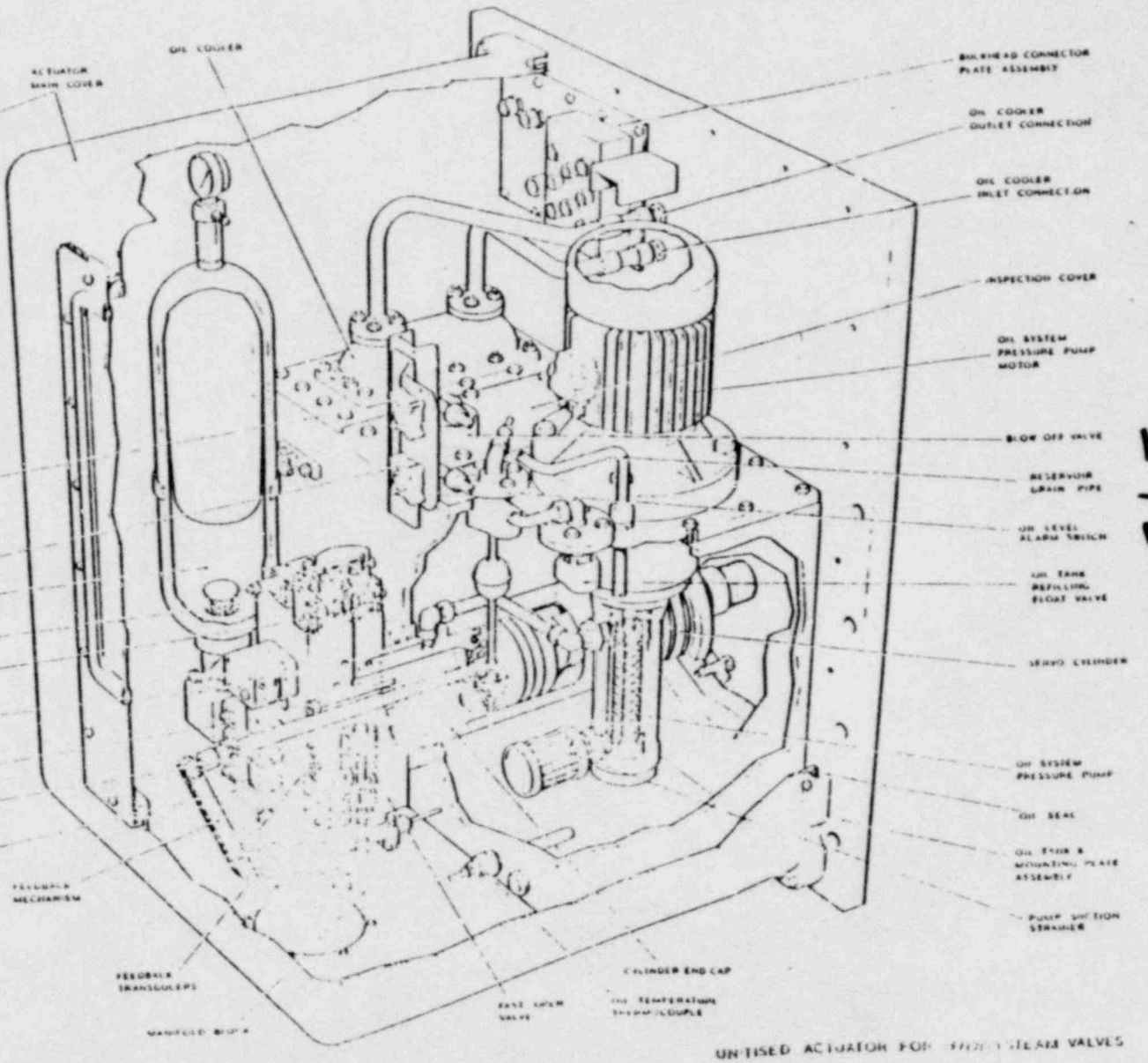
1-10-1



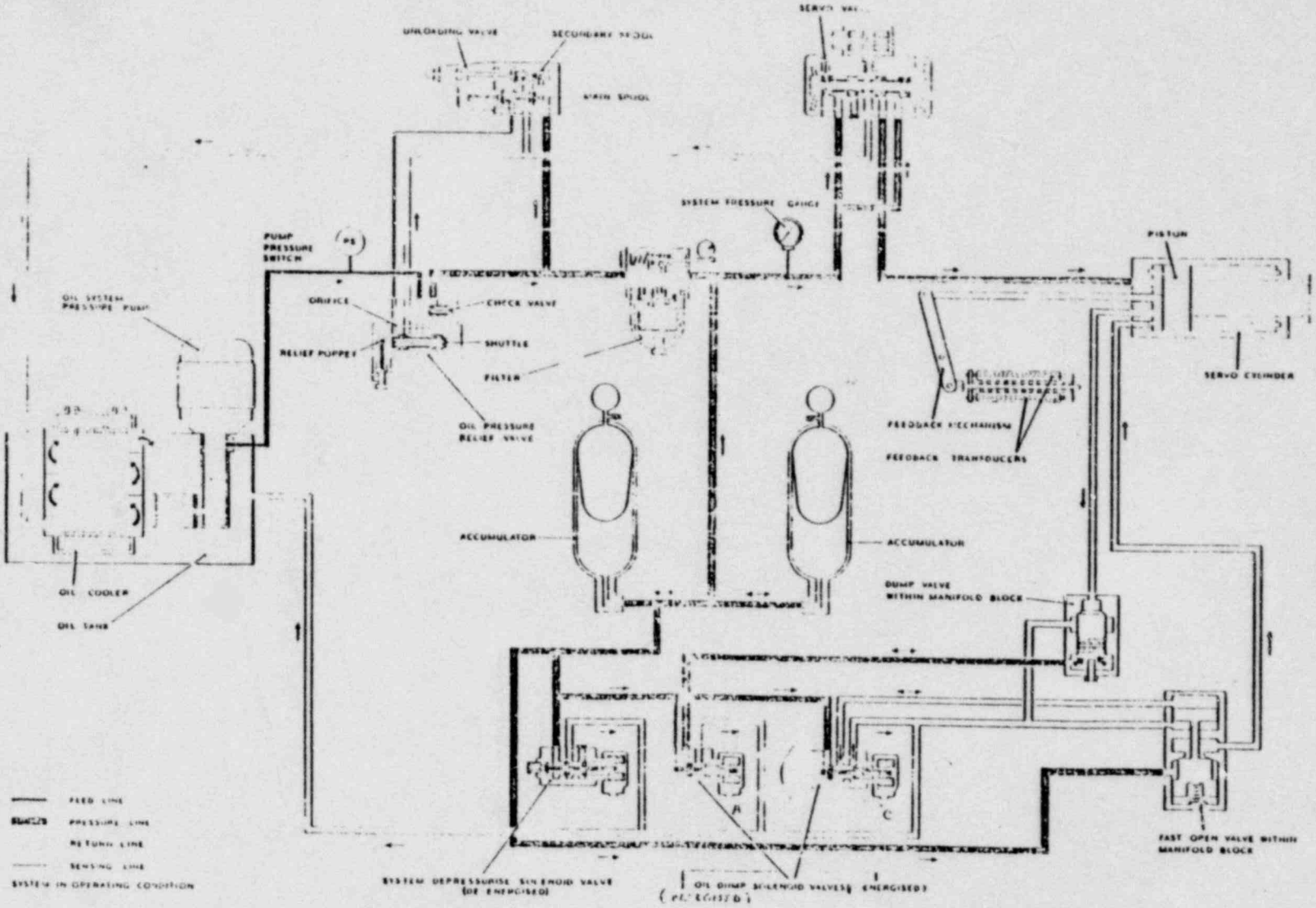
TYPE 3 VALVE CONTROL MODULE
(TYPICAL OF EACH BYPASS VALVE)



DETAILS OF MOTOR COWL ASSEMBLY



UNTISED ACTUATOR FOR [illegible] STEAM VALVES



A [illegible] VALVE

C [illegible] VALVE

FIG 5 SERVO OIL SYSTEM FOR [illegible] VALVE ACTUATOR
(TYPICAL OF EACH UNITIZED ACTUATOR)

ENCLOSURE 2

ATTENDEES LIST

DETROIT EDISON COMPANY MEETING

NOVEMBER 28, 1978

NRC

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R. R. Bellamy

D. H. Beckham

J. F. Stolz

C. Graves

F. Odar

J. Wermiel

F. Fitzpatrick

T. M. Novak

P. Norian

P. Matthews

Detroit Edison Company

L. E. Schuerman

L. F. Wooden

E. Lusis