

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION

UNIT II OPERATIONS

07-191-91

02-REQ-001-259-2-02 Revision 5

TITLE: FEEDWATER CONTROL SYSTEM

	SIGNATURE	DATE
PREPARER	<i>[Signature]</i> MASTER	9/17/90
TRAINING SUPPORT SUPERVISOR		9-18-90
TRAINING AREA SUPERVISOR	<i>[Signature]</i> CONTROLLED	9/24/90
PLANT SUPERVISOR/ USER GROUP SUPERVISOR		<i>[Signature]</i>

DOCUMENT

Number of Pages: 12

<u>Date</u>	<u>Pages</u>
September 1990	1 - 12

THIS LESSON PLAN IS A GENERAL REWRITE
 THIS LESSON PLAN SUPERSEDES LESSON PLAN #N2-OLP-54

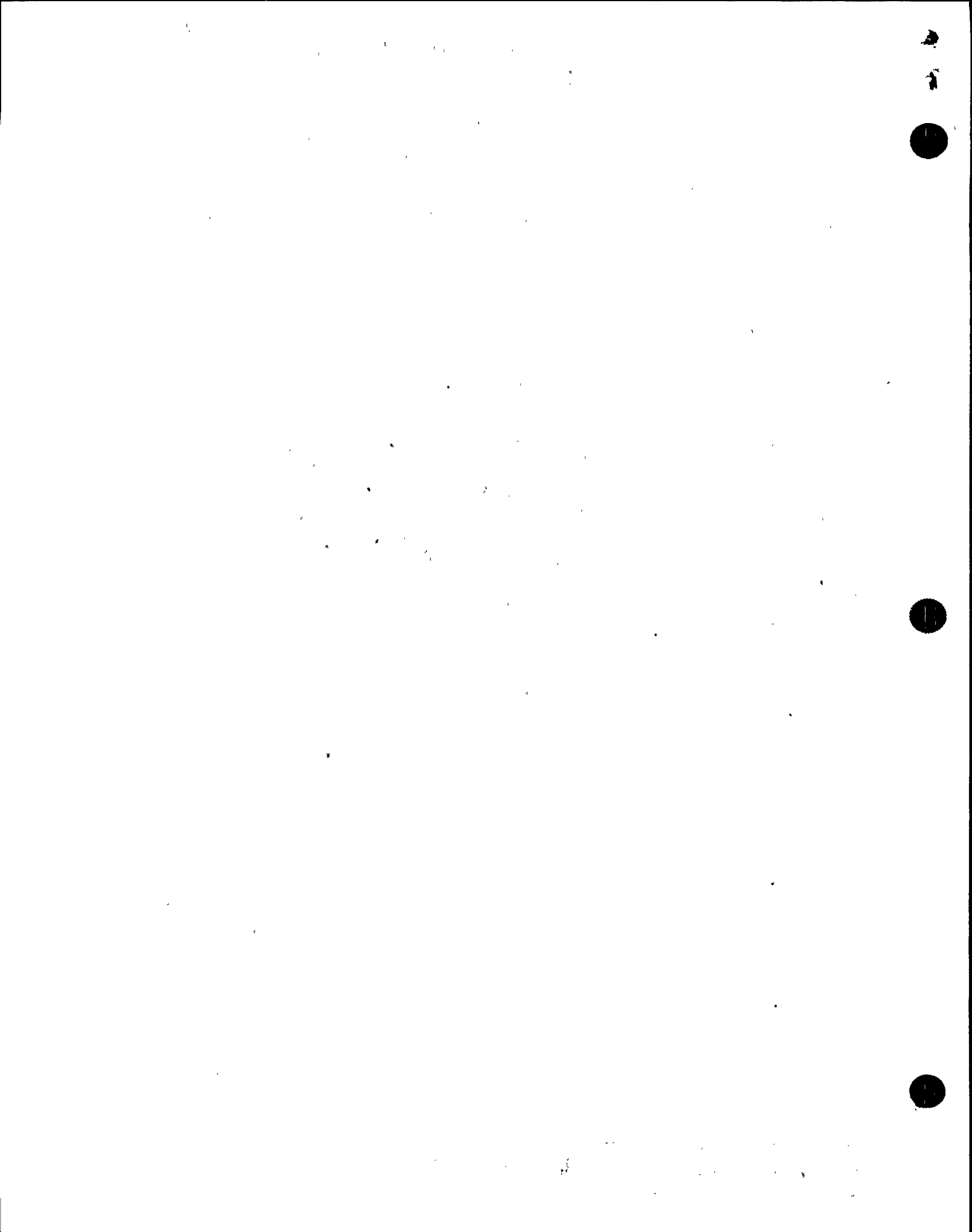
TRAINING DEPARTMENT RECORDS ADMINISTRATION ONLY:

VERIFICATION: _____

DATA ENTRY: _____

RECORDS: _____

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ATTACHMENT 3
LESSON PLAN TEMPORARY/PUBLICATION/ADDENDUM CHANGE FORM

The attached change was made to:

Lesson plan title: Feedwater Control System

Lesson plan number: 02-REG-001-259-2-02

Name of instructor initiating change: David Pettit

Reason for the change: Add 50ER 84-4 to the reference section

as requested by TRR 600801-15

Type of change:

- 1. Temporary change
- 2. Publication change
- 3. Addendum change

Disposition:

- 1. Incorporate this change during the next scheduled revision.
- 2. Begin revising the lesson plan immediately. Supervisor initiate the process.
- 3. To be used one time only.

Approvals:

Instructor: David W. Pettit /Date 8/12/91

Training Area Supervisor
(or designee): Ed Leary for J. Reid /Date 8/12/91



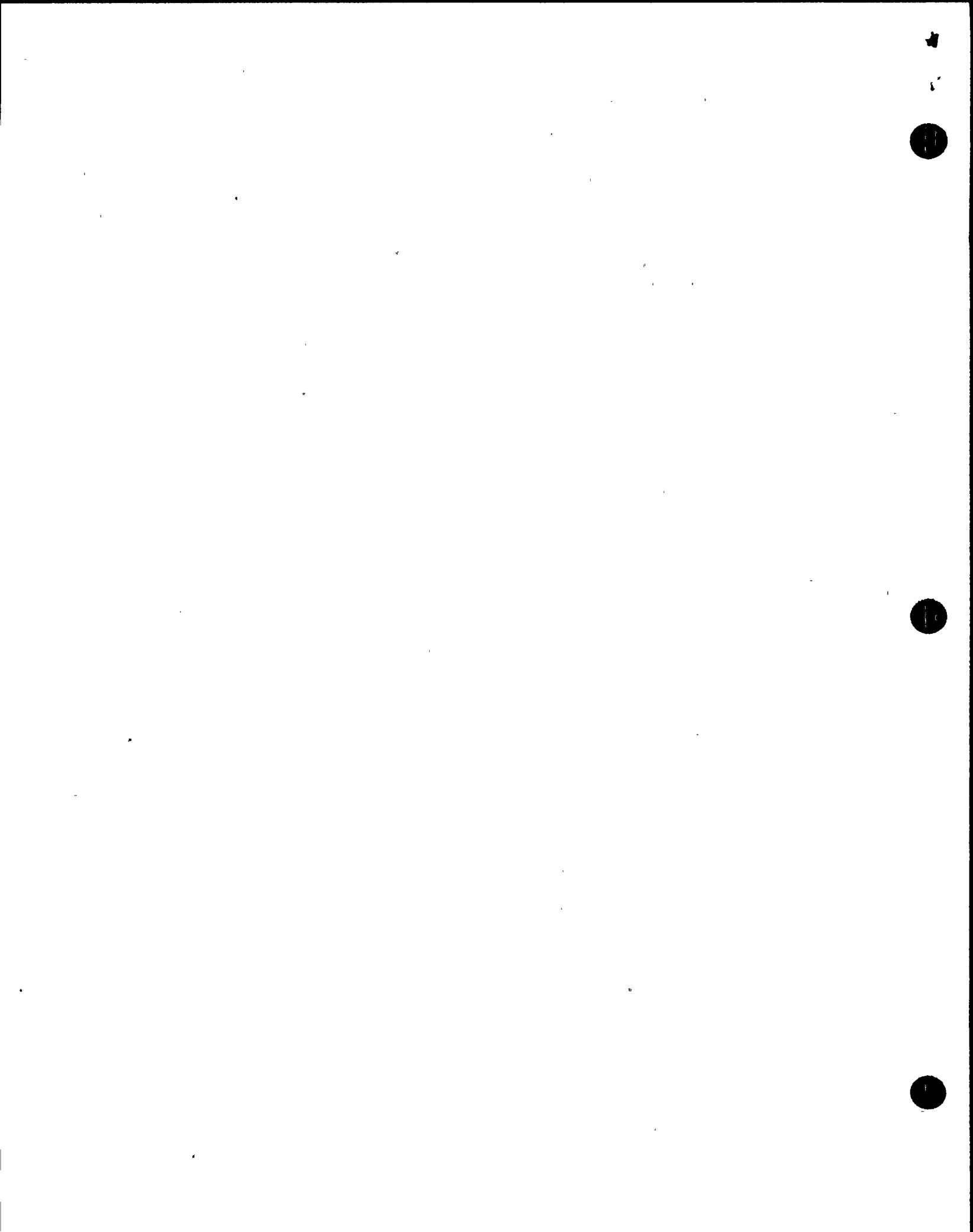
I. TRAINING DESCRIPTION

- A. Title of Lesson: Feedwater Control System
- B. Lesson Description: Provide a review for Licensed Operators of the Feedwater Control System.
- C. Estimate of the Duration of the Lesson: 2 Hours
- D. Method of Evaluation, Grade Format, and Standard of Evaluation: Open reference written exam $\geq 80\%$.
- E. Method and Setting of Instruction: Classroom Lecture
- F. Prerequisites:
 - 1. Instructor:
 - a. Shall be qualified for the material being delivered in accordance with NTP-16.
 - b. Qualified in instructional skills as certified by NTP-16.
 - 2. Trainees:
 - a. Meet eligibility requirements per 10CFR55, or
 - b. Be recommended for this training by Operations Superintendent or his designee.
- G. References:
 - 1. N2-OP-3, Condensate and Feedwater System
 - 2. USAR Section 7.7.1.3
 - 3. GE 732E120AF
 - 4. GE 807E160TY
 - 5. GEK-83315A
 - 6. GE FDDR KG1-6200, Limitorque LV-10 Instruction Manual.
 - * 7. SOER 84-4

*TRR 609801-15

II. REQUIREMENTS

- A. Requirements For Class:
 - 1. AP-9, Administration of Training
 - 2. NTP-11, Licensed Operator Retraining and Continuing Training



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III. TRAINING MATERIALS

A. Instructor Materials:

1. Copy of this lesson plan
2. N2-OP-3
3. GE 807E160TY
4. GE 732E120AF

B. Trainee Materials:

1. N2-OP-3
2. Print package ad designated by instructor

IV. EXAM AND MASTER ANSWER KEYS

- A. Exam and master answer key(s) filed with the official records.

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V. LEARNING OBJECTIVES

Upon completion of this training the trainee will have gained the knowledge to:

A. Terminal Objectives:

- TO-1.0 Perform the actions required for a loss of feedwater or a system failure. (2569060101)
- TO-2.0 Place feedwater control in automatic. (2590110101)
- TO-3.0 Reset a level setpoint setdown. (2599030101)
- TO-4.0 Perform the actions required for a reactor water level high. (2000060501)
- TO-5.0 Perform the actions required for a reactor water level low. (2000310501)
- TO-6.0 Respond to a LCV lockup/hydraulic failure. (2599110401)

B. Enabling Objectives:

- EO-1.1 State the purpose of the Feedwater Control System.
- EO-2.1 Describe the operation of the low flow and high flow controllers.
- EO-2.2 Explain single element and three element control in terms of what it is and when its used.
- EO-3.1 Describe the operation of the feed flow steam flow summer.
- EO-4.1 Explain the function of setpoint setdown.
- EO-4.2 Describe the response of the Feedwater Control System to a loss of feed flow signal.
- EO-5.1 Describe the response of the Feedwater Control System to a loss of steam flow signal.
- EO-5.2 Describe the response of the Feedwater Control System to a loss of level signal.
- EO-6.1 Given N2-OP-3, Condensate and Feedwater System, identify the appropriate actions and/or locate information related to:
 - a. Startup
 - b. Normal operations
 - c. Shutdown
 - d. Off-normal
 - e. Procedures for correcting alarms

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I. INTRODUCTION

A. Recent Plant Events

Instructor shall review with class any recent plant events associated with the system.

B. Objective Review

Review learning objectives.

C. Purpose

Controls the flow of feedwater into reactor vessel to maintain water level during all modes of operation.

EO-1.1

D. General Description

1. Using GE 732E120AF provide an overview of the system.

Discuss major components and their functions. This diagram will be used for the remainder of discussion.

II. DETAILED DESCRIPTION

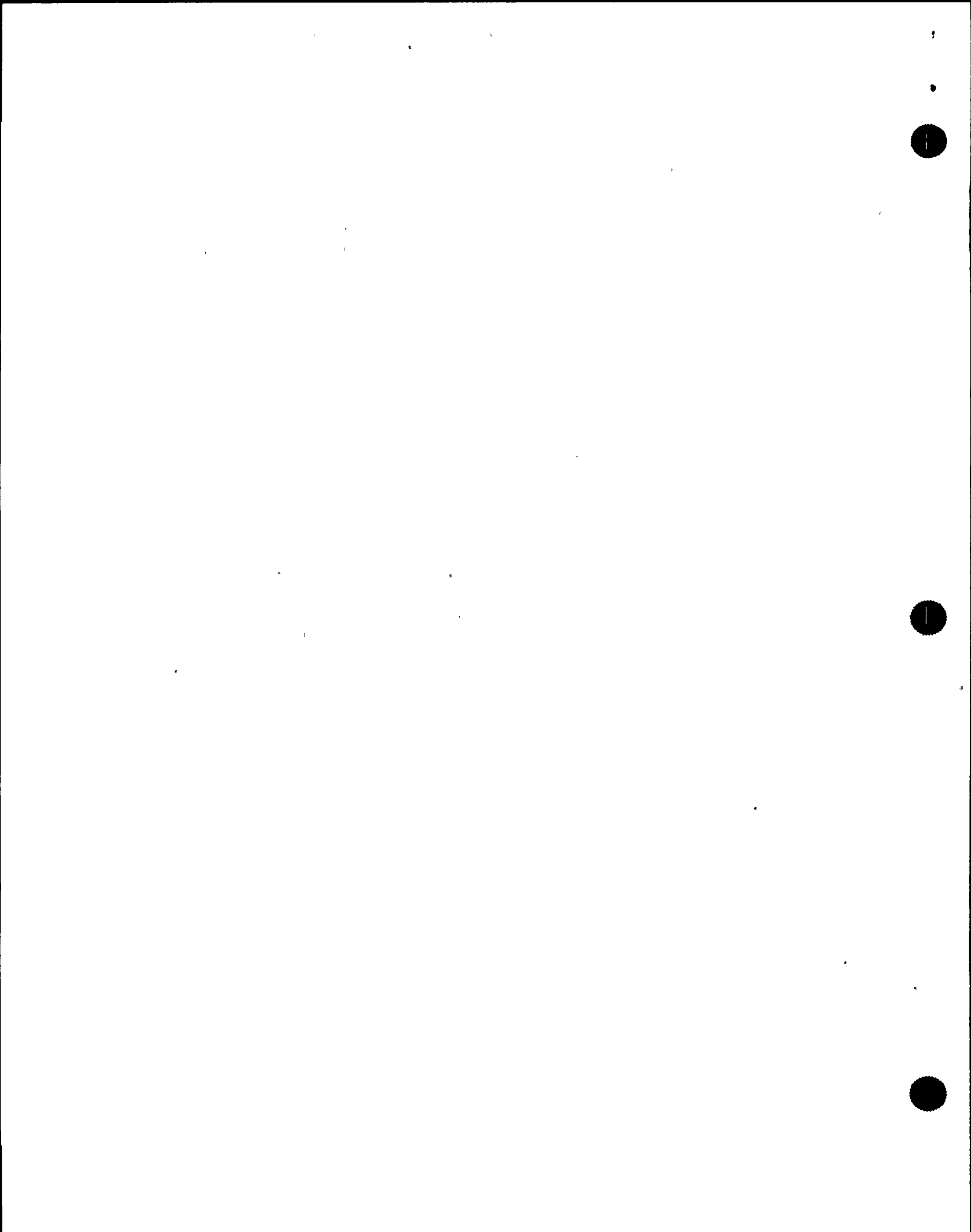
A. Low Flow Controller

Low flow controller provides control signals to: EO-2.1

1. Function - used for automatic control of either low pressure-low flow control valve or the high pressure--low flow control valves.

LV-137
LV-55A(B)

2. Can receive input signals from reactor level, feed flow and steam flow for control. Normally operated in single element control (level signal only).



.3. Controller may be operated in either single element or three element control using selector switch.

a. Single element control - uses level as only control signal since steam and feedwater flow rates are both low.

b. Three element control - in addition to level, steam and feedwater flow inputs are used.

4. Only one of the three low flow control valves may be controlled by the low flow controller.

5. Low flow control valves will shift to manual (TCO-02-REQ-90-015) on a level 8 trip.

EO-2.2

B. High Flow Controller

1. Function - controls the position of the high pressure-high flow control valves.

2. The high flow controller sends a signal to the high pressure-high flow valve controller which in turn controls the position of the high pressure-high flow control valve.

3. Two methods of manual control of the high pressure-high flow control valves.

Using GE 732E120AF discuss operation of the high flow controller.

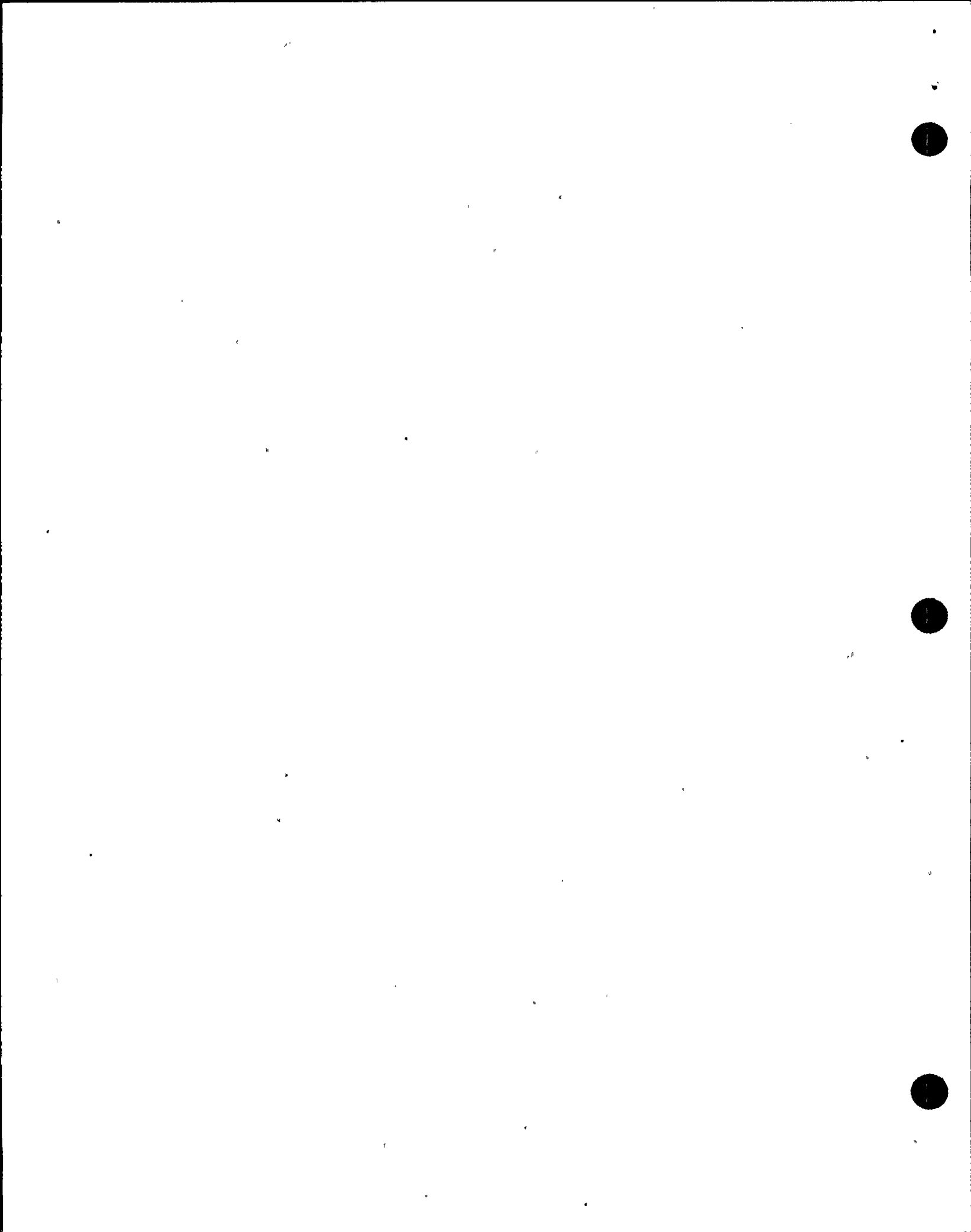
- K602 is biased for an output = 50% when $W_s = W_f$

- K616 is biased so that when $W_f = W_s$ the output is equal to the level signal input.

EO-2.1



- a. Individual valve controller in manual.
 - b. Individual valve controller in automatic and high flow controller in manual.
4. In automatic operation, both the individual valve controller and the master high flow controller are in "auto", which maintains vessel level at setpoint.
 5. High flow controller receives a three element control signal which is compared to the high flow controller tape setpoint.
 6. The high flow controller output is proportional to the differences of the two signals.
- C. MOV LV10's
1. LV10 uses a variable frequency limitorque motor.
 2. When valve position deviation is 5% or greater, the motor operates at 100% speed.
 3. When valve position deviation is 2.5% or less the motor operates at 10% motor speed.
 4. Between 2.5% and 5% deviation motor speed is variable.
- Signal polarities are biased so that when $W_s > W_f$ K616 output is less than the level input signal which will increase W_f .



III. INSTRUMENTATION, CONTROLS AND INTERLOCKS

A. Inputs

1. Reactor water level

- a. Three transmitters PDT14A, B, C
- b. Operator can select PDT14A or B as level input to Control System with selector switch on Panel 603.

Q: What level transmitter provides the input signal for the recirc flow control valve runback.

A: The selected transmitter.

- c. The selected transmitter provides a high level alarm at level 7 (187.3) and the transmitters supply a high level trip signal to the turbine/feedwater pumps at level 8 (202.3).

L4 (178.3") RCS runback

L3 (159.3") RCS downshift input to recorder.

2. Total feed flow is calculated by summing the flows from the two feedwater supply lines.

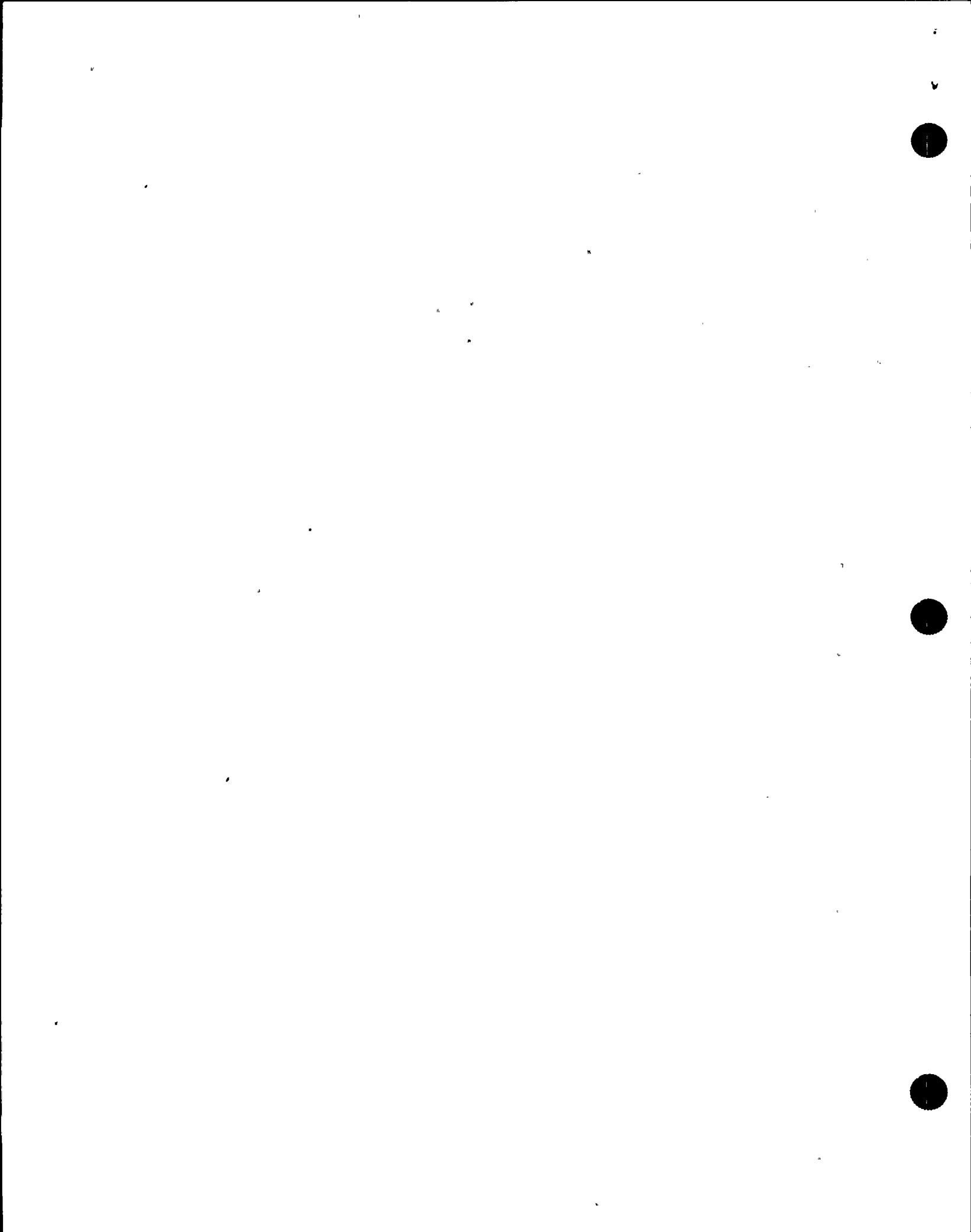
- a. Signal is also supplied to the Reactor Recirculation System for:

1) Recirc pump low power starting interlock.

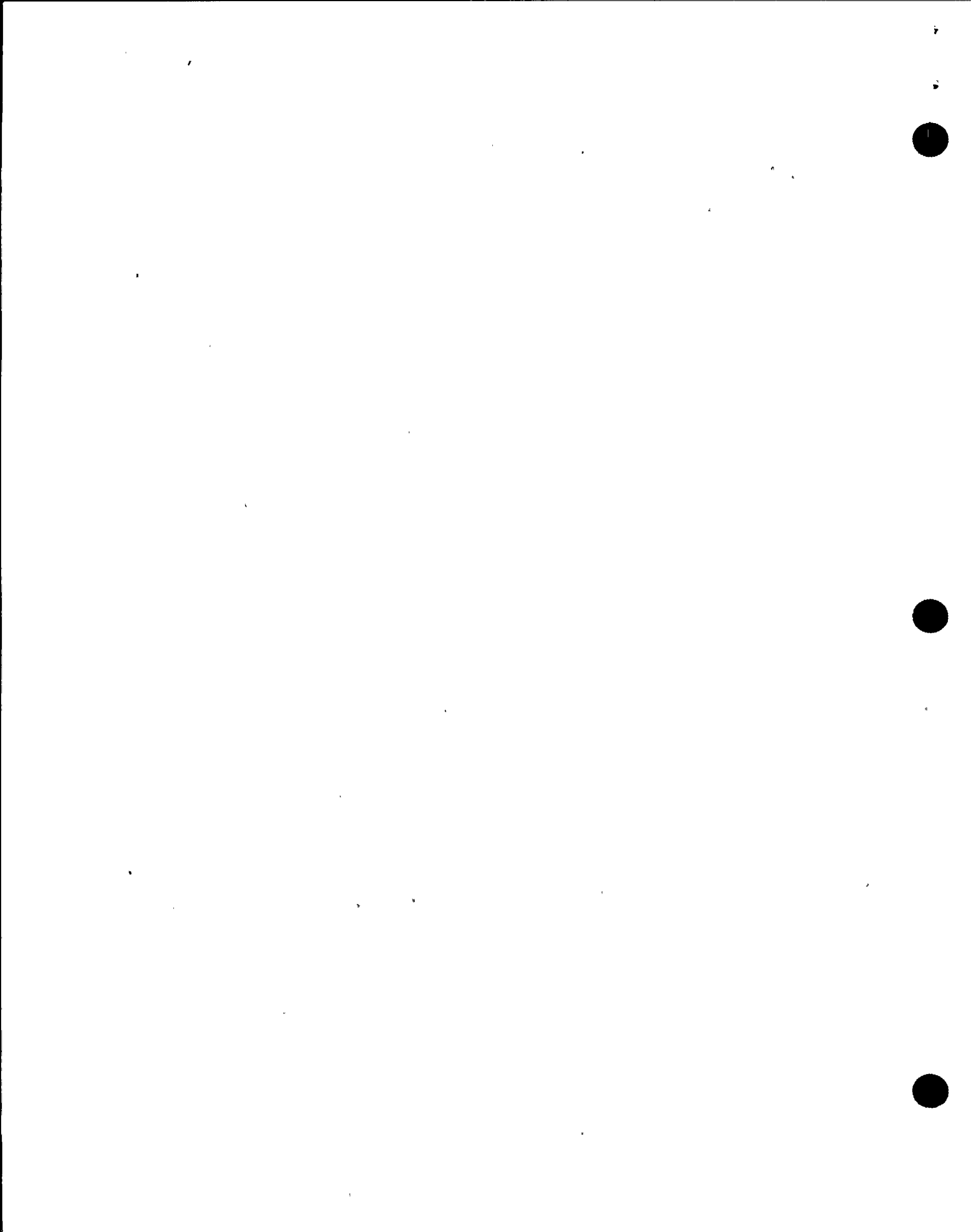
2) Recirc pump high/low speed transfer (power interlock).



3. Total steam flow is produced by summing the steam flows in the four main steam lines.
 - a. Signal is also supplied to
 - 1) Process computer-reactor power input.
 - 2) Rod Worth Minimizer power input.
- B. Steam Flow-Feed Flow Summer EO-3.1
 1. Steam mass flow rate (+) and feedwater mass flow rate (-) are fed into an amplifier.
 2. This amplifier output (inventory rate of change) is added to the level input signal so that
 - a. With balanced flows level in=level out.
 - b. With higher steam flow, level in level out, smaller level signal then compared to level setpoint, calls for more flow.
 - c. With higher feed flow level in level out, larger level signal then compared to level setpoint, calls for less flow.
- C. Interlocks
 1. High pressure - high flow control valves (LV10A-C) will fail in the "as is" position on a loss of control signal. Valves stay locked up until reset by switches on PNL-603. Control signal goes below a minimum level causing the trip unit to trip.



2. During ATWS, RRCS initiation will cause all feedwater control valves to go closed and FV 2's to open. (After 25 seconds can be manually controlled) This will occur on 1050 psig in RPV after a 25 second TD and power >4%. (TCO-02-REQ-90-057, NRC identified knowledge deficiency.)
Note: Recent modification allows the RRCS FW run-back to be inhibited during testing. (TCO-02-REQ-90-018)
3. Setpoint setdown prevents overfeeding the Rx vessel after a scram. EO-4.1
- a. Void collapse occurring during a scram will cause a large level decrease for the same vessel inventory.
- b. The setpoint setdown circuit reduces the operator selected setpoint by half it's set value when the low level trip point is reached. The setpoint setdown circuit must be reset by the operator on PNL-603.
4. LV10A, B, C will automatically shut to 48% flow position (80% open) if a feedpump low suction pressure occurs following a main turbine trip. This will prevent feedpump cavitation. (TCO-02-REQ-90-015)
5. FCV lockups
- a. Auto/Man SW in manual
- b. Local/Rem SW in local
- c. MOV thermal overload
- Note: LV-10B is an MOV. LV10A/C are to be modified during the fall 1990 outage. This applies to LV10A/C when mod is complete to make them MOV's.



- d. Variable frequency controller in a fault condition.
- e. Value stuck
- f. Loss of power
- g. The value will fall as is and will reset by itself upon clearance of the fault.

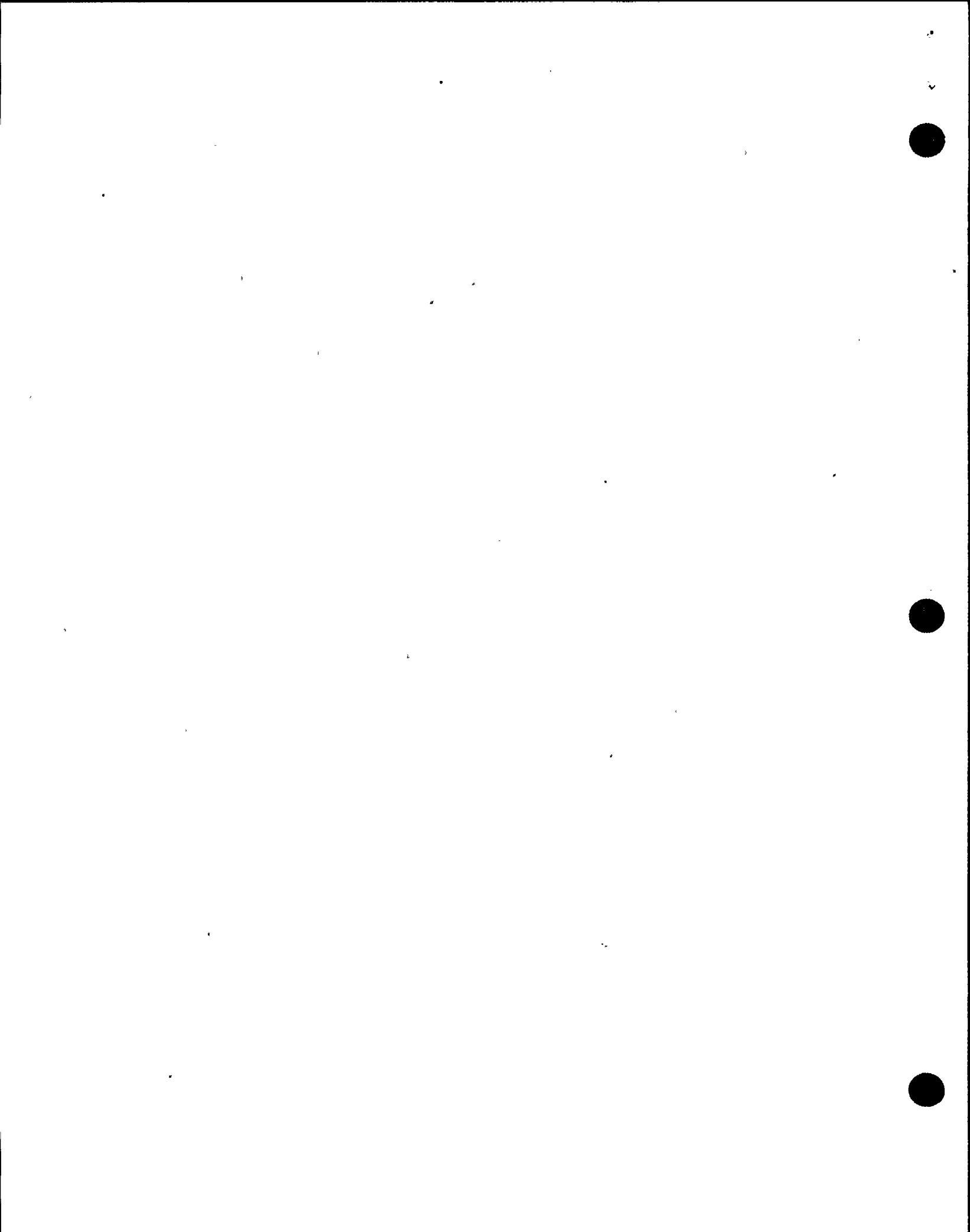
IV. SYSTEM OPERATIONS

A. Normal Operation

- 1. One or two feed pumps in operation.
- 2. High flow controller in operation automatically controlling level by adjusting the flow control valve of the pumps in use.

B. Startup/Shutdown

- 1. With low flow at low pressure (reactor feed pump is not in operation) level controlled by the low pressure-low flow control valve in either manual or automatic modes.
- 2. At high pressure with low flow (less than 2 feed pumps) the level is controlled by the high pressure-low flow valve in manual or automatic.



3. When second feed pump started, shift to high pressure-high flow control valves in manual.

C. Abnormal Operations (3 Element Control)

EO-4.2

1. Loss of Feedwater flow signal will generate a flow mismatch in the flow comparator. Steam flow-feed flow mismatch biases the level signal to produce a signal to open the flow control valves. The Flow Control valves open until an equilibrium is reached with the level signal off-setting the loss of feedwater flow signal.

Note: Loss of one feed flow signal will cause level to increase above the level 8 setpoint.

2. Loss of steam flow signal is similar to feed flow except it will result in lower level.

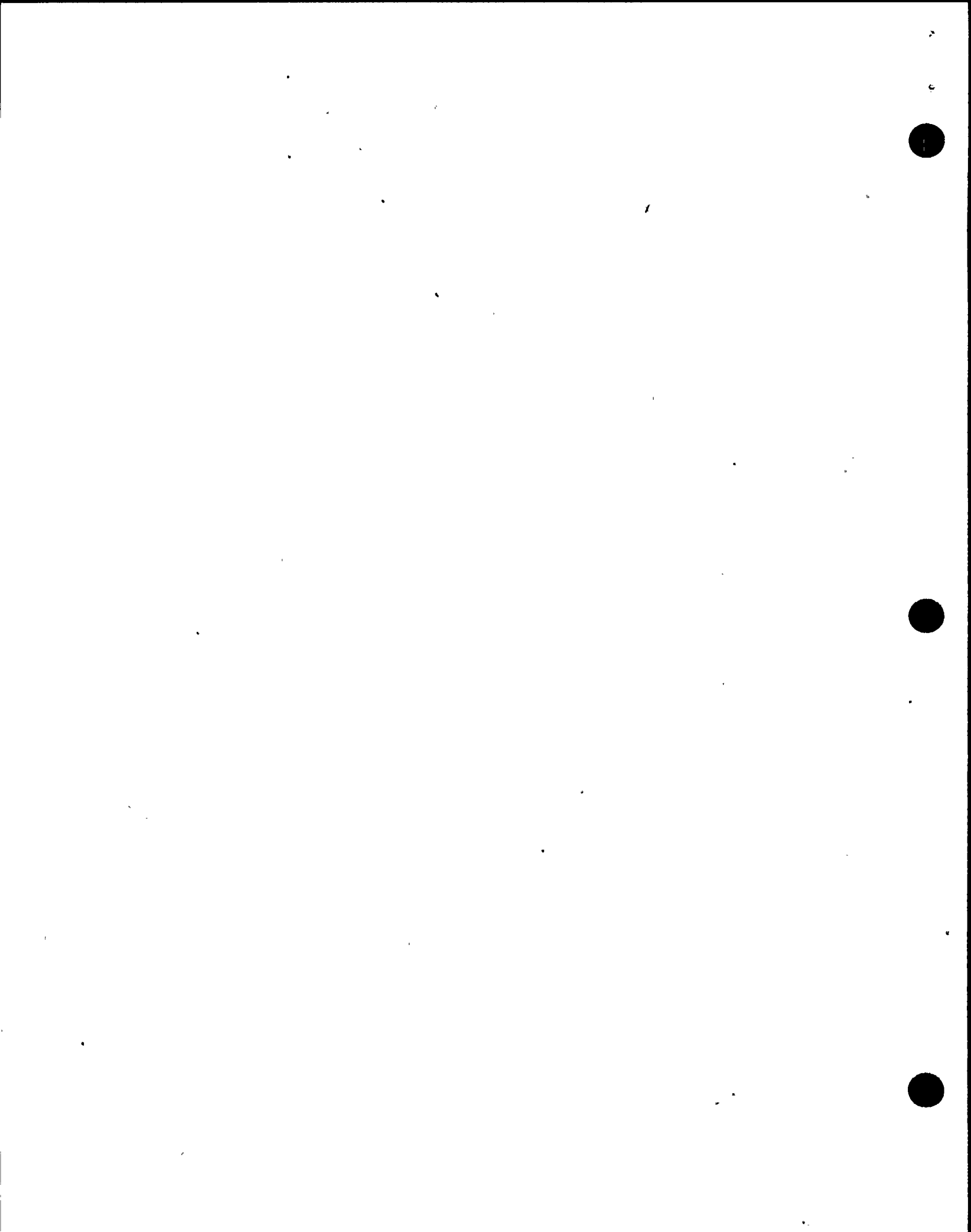
EO-5.1

3. Loss of reactor level signal. The circuit sees a low level and responds by increasing feedflow.

EO-5.2

Feedflow increases to maximum or until the mismatch between the feedwater flow and steam flow signal balances the loss of level signal.

Reactor level will continue to increase until the high level trip is reached.



V. SYSTEM INTERRELATIONS

Reactor Recirculation System

The Reactor Recirculation System receives inputs from the selected reactor level instrument for the feedwater pump trip interlock/recirculation loop A/B flow reduction circuitry and the recirculation pump trip to LFMG circuitry. The recirculation loop A/B recirculation valve low power and the recirculation loop A/B LFMG transfer circuitry receive signals from the total feed flow summer.

Instrument Air System

The Instrument Air System provides the motive force used by the Feedwater Control System to position the low flow control valves and FV 2's.

VI. PROCEDURE REVIEW

- A. Review N2-OP-3 as it relates to operation of the Feedwater Control System.

EO-6.1

