NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT NUCLEAR STATION 97-189-91

UNIT II OPERATIONS

02-REQ-001-217 2-00 Revision 5

TITLE: REACTOR CORE ISOLATION COOLING

	SIGNATURE	DATE
PREPARER		5-1-91
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Summary of Pages

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MASTER

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13pp

5/4/64

I. TRAINING DESCRIPTION

A. Title of Lesson: Reactor Core Isolation Cooling

B. Lesson Description: This lesson contains information pertaining to the Reactor Core Isolation Cooling System. The scope of this training is defined by the learning objectives and in general covers the knowledge requirements of a Licensed Control Room Operator.

C. Estimate of the Duration of the Lesson: 2 hours

D. Method of Evaluation, Grade Format, and Standard of Evaluation: Written examination; Passing grade of 80% or greater.

E. Method and Setting of Instruction: This training should be conducted in the classroom.

F. Prerequisites:

1. Instructor:
   a. The instructor shall be familiar with the lesson materials and have achieved the necessary instructor certification in accordance with NTP-16.
2. Trainee:
   a. Initial License Candidate - In accordance with eligibility requirements of NTP-10.
   b. Licensed Operator Requalification - In accordance with the requirements of NTP-11.

G. References:

1. Technical Specifications
   a. 3/4.3.5, ICS Actuation Instrumentation
   b. 3/4.7.4, RCIC System
2. Operating Procedures
   a. N2-OP-35, RCIC
   b. N2-OP-31, RHR
   c. N2-EOP-6, Attachment 4
3. FSAR
   a. Design Basis, Vol. 13, Chapter 5, Page 5.4-16
   b. Safe Shutdown System Design Bases, Vol. 16, Chapter 7, pg 7.4-13
4. 807E173TY
5. SOER 82-8

II. REQUIREMENTS

A. AP-9, Administration of Training

B. NTP-10, Training of Licensed Operator Candidates

C. NTP-11, Licensed Operator Requalification Training

III. TRAINING MATERIALS

A. Instructor Materials:

1. Training Record (TR)
2. Instructor's working copy of the lesson plan
3. Whiteboard and Markers
4. Overhead Projector
5. Transparencies as needed
6. Flip Chart (if necessary)
7. Copy of trainee handouts
8. Trainee Course Evaluation Forms

B. Trainee Materials:

1. Handouts
2. Paper or Notebook
3. Pen or Pencil

IV. EXAM AND MASTER ANSWER KEYS

A. Exam and Master Answer Keys will be on permanent file with the designated clerk.

V. LEARNING OBJECTIVES

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

A. Terminal Objectives:

TO-1.0 Initiate the ICS System from the Control Room.

TO-2.0 Operate the ICS System from the Control Room and monitor for proper operation.

TO-3.0 Control Reactor pressure using the ICS System.

TO-4.0 Manually isolate the ICS System from the Control Room.

TO-5.0 Shutdown the ICS System to standby from the Control Room.

B. Enabling Objectives:

EO-1.0 State the purpose and basic operation of each major system component, including instrumentation, controls and interlocks associated with the ICS.

EO-2.0 Describe the system initiation in terms of the setpoints, logic, and sequence of events.

EO-3.0 List and describe the automatic and manual isolations and trips associated with ICS.

EO-4.0 Describe how the ICS System is utilized during the performance of the EOP's.

EO-5.0 Explain the basis for each precaution and limitation in N2-OP-35.

EO-6.0 Given N2-OP-35, identify the appropriate actions and/or locate information related to:

- Startup
- Normal Operations
- Shutdown
- Off-Normal Operations
- Procedures for Correcting Alarm Conditions

EO-7.0 SRO ONLY: Identify the appropriate actions and/or locate information relating to Limiting Conditions for Operation, Bases, and Surveillance Requirements for the ICS System given Technical Specifications.

C. Objective Relationship to NMP-2 Task List:

TO-1

1. Manually initiate the RCIC System from the Control Room and monitor for proper operation. (2170030101)
2. Perform a manual startup of RCIC from the Control Room. (2179150101)

TO-2

1. Operate the RCIC system following an automatic initiation. (2179140101)
2. Operate the RCIC pump in the steam mode. (2170040101)

TO-3 Control Reactor Pressure using the RCIC System. (2179070401)

TO-4

1. Manually isolate the RCIC System from the Control Room. (2179060101)
2. SRO ONLY Respond to a RCIC equipment room high temperature. (3449760403)

TO-5 Shutdown the RCIC system to standby from the Control Room. (2170060101)

I. INTRODUCTION

A. Purpose

The ICS system supplies makeup water to the reactor vessel when the reactor is in a hot shutdown condition and is isolated from the main condenser with the feedwater system not in operation. — EO-1.0

- By adding low temperature makeup water to the reactor, core cooling is assured.

B. System Description

Show TP-1: Point out major system components and discuss their functions.

1. The ICS System consists of a steam-turbine driven pump and associated valves and piping capable of delivering water to the reactor vessel head spray nozzle. — EO-1.0

2. Basic System Flowpaths

Ask trainees to explain system flowpaths.

a. Water Sources

1) Condensate Storage Tank "A" — EO-1.0

2) Suppression Pool

b. Water Flowpaths

- From applicable water source, through pump, flow element and injection valve, into reactor vessel.
- From the pump discharge, some water (16-25 gallons) is passed through a lube oil cooler.

- A minimum flow line exists to prevent the ICS pump from overheating when running at low flow rates or against a shut off head.
- A full flow test return line allows flow from downstream of the flow element and returns to Condensate Storage Tank "A" or "B".

c. Steam Flowpaths

- Steam is drawn from upstream of the "B" Main Steam Isolation Valves, through an inboard set of flow elbows and isolation valves, an outboard isolation valve and flow elbows, through the steam admission valve, trip throttle valve, governor valve, and into the turbine.
- Steam is supplied to the RHS System from a connection downstream of the outboard isolation valve and upstream of the outboard flow elbows.

Q: If operating ICS while injecting into the vessel <u>and</u> sending flow through the test return line: if turbine speed is approaching minimum and FV-108 is opened, will turbine speed increase or decrease? EO-1.0

A: Turbine speed will go down in an attempt to maintain the desired flow rate through the flow element.

Point out RHS connections into the ICS System.

- Steam is exhausted from the ICS turbine through a discharge isolation valve to the suppression pool.

d. System Use

- In addition to its use in supplying makeup water to the reactor vessel, the ICS System is also used in conjunction with the RHS system to:
  1) Return condensate to the vessel from the RHS heat exchangers when operating RHS in the Steam Condensing mode.
  2) Inject water to the vessel through the ICS head sprayline to complete plant cooldown when operating RHS in the Shutdown Cooling Mode.

e. ICS Initiation

- The ICS System will automatically initiate on RPV Level 2 (108.8")

Show TP of P-601. Point out initiation P.B. and white seal in light.

EO-2.0

- ICS can be manually initiated by operators in the Control Room using the "armed collar" initiation pushbutton on P-601.
- The ICS can also be initiated using valve by valve manipulations from the Control Room.

C. Component Description

1. Condensate Storage Tank "A"
   - normal water supply to ICS pump
   - tank capacity of 450,000 gallons
   - 135,000 gallons reserved for ICS by having all other suctions above the ICS suction
2. Suppression Pool
   - Alternate source of water
   - Minimum of about one million gallons of water
   - Utilizes a packed-disk strainer which prevents foreign objects from entering the system
3. Suction Header
   a. CST Suction Valve (MOV-129)
      - Normally open, motor operated gate valve

Q: Does the automatic main turbine trip occur if RCIC is initiated valve by valve?

A: No

EO-2.0

EO-1.0

EO-1.0

MOV-129 receives a close signal when MOV-136 is fully open.

EO-1.0

b. Suppression Pool Suction Valve (MOV-136)
   - Normally closed, motor operated gate valve

c. Relief Valve (RV-114) — EO-1.0
   - Protects suction header from over-pressure

d. Water Leg Pump (P-2) — EO-1.0
   - Keeps piping filled and pressurized up to the discharge isolation valve (MOV-126)
   - Minimizes injection time and hydraulic shock on system initiation
   - There is an orificed recirc line from P-2 pump discharge to the pump suction to prevent pump overheating during continuous operation near its shutoff head.

e. ICS Pump P-1 is a turbine driven centrifugal pump rated at 625 gpm (600 gpm for injection, 25 gpm for lube oil cooling). The pump injection rate of 600 gpm is approximately equal to the boil off rate 15 minutes after S/D.

Q: How many stage pump is this?
A: 4 stage — EO-1.0

Show TP of ICS pump and point out each stage and flowpaths.

f. Lube Oil Cooling Loop cools ICS turbine lube oil using water from discharge of ICS pump through PCV-115 which maintains cooling water pressure to the cooler at 110 psig. A restricting orifice maintains cooling water flow rate between 16 and 25 gpm.

EO-1.0

g. Minimum Flow Bypass Line (MOV-143) protects the ICS pump from overheating when running at low flow rates or against a shut off head. Flow is directed to the suppression pool through a restricting orifice which ensures a minimum flowrate of 75 gpm with MOV-143 full open and the ICS pump at maximum speed.

Q: What conditions are required to cause the min. flow valve to open?

A: ICS pump discharge pressure above 125 psig and flow less than 110 GPM.

EO-1.0

h. Full Flow Test Recirculation Line permits testing ICS system at full flow rate without injecting into vessel. Full flow test flow control valve FV108 and full flow test valve MOV124 direct flow back to CST. A restricting orifice simulates a reactor vessel backpressure of 150 psig at rated flow.

EO-1.0

Use TP of system and point out that flow will be directed to both CST's.

i. Injection Valve (MOV-126) isolates pump discharge from the Rx vessel. The injection piping penetrates Rx vessel head and terminates in spray nozzle at top of steam dome.		EO-1.0
1) RHS loop B connects to ICS injection piping for head spray cooling in RHS shutdown cooling mode.		
2) Testable check Valves - AOV156 and 157 prevent back flow from reactor vessel when the isolation valve is open.	Point out these components on TP of system.	EO-1.0
3) Each valve is provided with an air operator for remote testing from Control Room to verify freedom of movement. (When tested, the air operator swings check valve disc off seat.)		
j. Steam Line Isolation Valves	Q: Where is the isolation pushbutton for ICS?	EO-1.0
1) Steam supplied to ICS from "B" Main Steam line-upstream of inboard isolation valve.	A: On the vertical section of P-601.	
2) Normally open MOV128 and MOV121 serve as inboard and outboard ICS steam line containment isolation valves.	Ask trainees to list all ICS isolation signals. Write each one out on the board and assist as necessary: 1) Steam supply press 75 psia	EO-3.0

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
3) Normally shut MV-170 used to bypass around MOV128 for warmup and pressurization of the ICS steam line.	2) RCIC steam line high flow 167.1" H_2O/-275" H_2O 3) RHR/RCIC Steam Flow High 37.4" H_2O/ -275" H_2O 4) Exhaust diaphragm high pressure 10 psig 5) RCIC equip area hi temp 135°F 6) RHR pump room A/B hi temp 135°F 7) Rx Building pipe chase hi temp 135°F 8) RCIC pipe chase hi temp 135°F 9) Rx Building gen area hi temp 130°F	
k. Steam Admission Valves	MOV 159 goes shut 15 seconds after the initiation if level is above level 2.	EO-1.0
1) Normally shut valve MOV-120 opens on initiation to supply steam to ICS turbine. Normally shut valve MOV-159 is a 1" bypass valve that opens on an auto initiation ten seconds prior to MOV-120 to prevent turbine overspeed.	Show TP of system initiation. Point out when MOV-159 opens.	
2) Steam line drain pots collect condensate from the ICS turbine steam supply and exhaust lines. Supply line drains to Rx Bldg Equip Drns. and exhaust line drains to Rx Bldg Floor Drns.	These isolate on system initiation.	EO-1.0

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
l. Turbine Trip and Throttle Valve (MOV150) provides for rapid turbine isolation.	Ask trainees to list RCIC turbine trips. Assist as necessary:	EO-3.0
1) Operation	1) Mechanical overspeed 120% 2) Any isolation 3) Low pump suction press 20" Hg 4) Hi turbine exhaust pressure 25 psig	
a) Electric motor open, spring close.	Show TP of MOV150 and point out each part. Have trainees explain the direction of movement of parts when a trip occurs.	EO-1.0
b) To open the trip throttle valve from the electrically tripped position it must first be reset.		
c) A mechanical (overspeed) trip releases the same latch but is independent of the electrical trip and must be reset locally.	Discuss trip valve closure and reset on overspeed.	
m. Turbine Governor Valve (HYV 151) regulates steam flow to ICS turbine.		EO-1.0
1) Operation		
a) Opened by spring pressure.	When the RCIC turbine is in standby the turbine governor will be open because there is no oil pressure to shut the valve.	
b) Closed by ICS turbine governor control oil pressure.		

c) Signal from ICS flow controller adjusts the oil pressure signal to match actual ICS pump discharge flow rate set at the flow controller.	Show TP of governor control circuit. Discuss its operation with trainees.	EO-1.0
n. ICS Turbine provides motive force to drive pump.		
1) Details		
a) Type - horizontal, single stage.	Show TP of Terry Turbine. Point out flow-path of steam.	
b) Turbine one piece wheel construction minimizes the effects of water slugging. It can accelerate rapidly from a cold standing start.		
c) Turbine can provide full flow within 30 seconds.		
d) 4550 rpm with steam inlet pressure 135-1135 psig.	System isolates at < 75 psia	EO-3.0
o. Turbine Lube Oil System provides lube oil to bearings and control oil to the turbine governor. A small gear pump driven from turbine shaft through a worm gear supplies oil to the bearings.		EO-1.0
1) Oil pressure also supplies the governor valve control system.	Show TP cutaway of turbine assembly. Point out oil pump and slinger rings.	

2) During S/U and coastdown the journal bearings are lubricated by slinger rings with oil from a reservoir beneath the bearing.

p. Gland Seal System prevents leakage of radioactive steam around the turbine shaft. EO-1.0

1) Four sets of close fitting carbon seal ring packings are installed in the turbine casing around the shaft. Discuss SIL #434 (High gland seal temperature).

2) ICS gland seal air compressor supplies air at 12 psig between first and second seal rings to seal the steam in the turbine casing.

3) Turbine Governor and trip throttle valve stems also provided with seal air.

q. Turbine Exhaust piping directs turbine exhaust to suppression pool.

1) Exhaust piping rupture discs. EO-1.0

a) Rupture discs are located between the ICS turbine and the turbine exhaust isolation valve, MOV-122. Turbine isolation and trip result from a blown rupture disc.

b) To improve reliability of the rupture discs, a 1/8" orifice between inner and outer rupture discs prevents pressure cycling of other disc.

D. Flowpaths/Interconnections

1. Using a system drawing transparency trace through the important system flowpaths.

Outline each flowpath with a colored marker.

a. Steam supply flow path.
b. Normal flow path with suction from CST.
c. Flowpath with suction from Suppression pool.
d. Suction from RHS during steam condensing mode.
e. Lube oil cooling water flow.
f. Minimum flow line.
g. Test return line.

II. INSTRUMENTATION, CONTROL, AND INTERLOCKS

A. RCIC Manual Initiation (pushbutton switch with collar).

1. When the collar is turned to the armed position the RCIC pushbutton is prepared for a RCIC initiation and an annunciator sounds to alert operators that the switch is in the armed position.

Point out that manual initiation and initiation on level 2 are the same. EO-2.0

Use 807E173TY Sh. 4 and point out K2 and K3 are energized from manual initiation or L2.

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
2. When the pushbutton is pushed RCIC will initiate and the following will occur simultaneously.	Use transparency of basic system piping to show effects of manual initiation.	EO-2.0
a. The initiation seals in.	•K5 on Sheet 4	
b. The gland seal air compressor starts.	•K5 Sh. 4, K99 Sh. 7	
c. The turbine lube oil cooling water valve MOV-116 opens.	•K2 Sh. 4, MOV-116 Sh. 8	
d. The suction valve from the CST opens, if shut (if the suppression pool suction valve, MOV-136 is already open, it will stay open).	•K3 Sh. 4, MOV-129 Sh. 8 •K21 Sh. 5	
e. The full flow test return to CST (flow control and stop valves FV-108 and MOV-124 shut, if open.	•K2, K3 Sh. 4 •K21 Sh. 5	
f. The pump injection valve (MOV-126) opens after a 10 second time delay.	•K20 Sh. 5, K40 Sh. 5, K97 Sh. 4	
g. The steam admission bypass valve (MOV-159) opens, and	•K96 Sh. 4, MOV159 Sh. 8A	
h. The steam admission valve (MOV-120) opens after a 10 second time delay.	•K95 Sh. 4, K97 Sh. 4	
i. The pump minimum flow valve (MOV-143) will open until flow is greater than 220 gpm.	•K73 Sh. 12, K70 Sh. 12, MOV143 Sh. 8	
3. When turbine steam admission valve (MOV-120) begins to open the following occur:		EO-2.0
a. Inboard and outboard exhaust drain isolation valve close.		

b. Inboard and outboard steam line drain isolation valves close.		
c. Turbine governor control ramp generator signal is started to accelerate the turbine.	Show TP of governor valve control circuit.	
4. Ramp generator signal brings the turbine to rated speed in about 12 seconds.	Show TP of RCIC system initiation. Point out and explain each function line.	EO-1.0
5. AOV-156 and AOV-157 open when discharge pressure exceeds reactor vessel pressure.		
6. Full rated flow will be reached within 30 seconds of initiation.		
7. If CST level decreases to its low level setpoint ($\geq$ 102"), the ICS pump suction is automatically shifted to the suppression pool and the CST suction valve closes.	•K126 Sh. 5, MOV136 Sh. 8	EO-1.0
B. RCIC Manual Isolation (pushbutton switch with momentary contacts)		EO-3.0
1. Will isolate the RCIC system by shutting MOV-121, MOV-128, and MOV-170.	•K15 Sh. 4	
2. Manual isolation will only occur if an initiation signal is sealed in. This prevents inadvertant isolation of the RCIC system while in standby status.	•Point out K5 contact in series with K15 relay.	
C. RCIC initiation seal in/reset (pushbutton switch, momentary contacts)	•K5, K98 Sh. 4	

1. Will reset an automatic start signal when pushed. White light (which indicates a sealed in start signal is present) will extinguish.		
D. RCIC Isolation DIV I & II Seal in/reset pushbuttons	Use transparency of basic system piping to show effects of manual isolation.	EO-3.0
1. Resets the appropriate divisional isolation signal in the "reset" position.		
2. Permits RCIC Divisional isolations in the "normal" position.		
E. RCIC Flow Controller		
1. Indicates RCIC flow (0-800 gpm)	Show TP of flow controller. Question trainees on its operation.	EO-1.0
2. Deviation meter		
a. Indicates difference between setpoint and process variable signals.		
3. Transfer switch		
a. Auto and manual modes allow turbine speed to be controlled by either injection flow setpoint circuity or front panel pushbuttons.		
4. Open/close pushbutton		
a. Controls turbine steam flow valve when in the manual mode.		
F. Pump suction from CST (MOV-129) control switch (open, close, spring return to auto)	Q: Is this valve normally open or closed? A: OPEN	EO-1.0

1. In auto the valve will open if an initiation signal is present and the pump suction valve from the suppression pool (MOV-136) is shut.		
2. Valve will close anytime the pump suction valve from the suppression pool (MOV-136) is fully open.	•K21 Sh. 5, MOV136 Sh. 8	
G. Pump suction from Suppression Pool (MOV-136) control switch (open, close, spring return to auto		
1. In auto valve will open on low CST tank level.	•K80 Sh. 12, K126 Sh. 5, MOV136 Sh.8	
H. Other importation valve interlocks		EO-1.0
1. The suppression pool suction valve (MOV-136) and CST test return valves (FV-108 and MOV-124) are interlocked to prevent having both paths open at the same time. If the CST test return valve are open the suppression pool suction valve will not open (manual or automatic). If the suppression pool suction valve is open, the CST test return valves may be opened, but they will automatically shut once the control switch is released.	Use transparency to show how CST and suppression pool water could mix if not for interlock.	
2. The injection valve (MOV-126) automatically closes if the steam admission valve (MOV-120) or the turbine trip and throttle valve go closed.	•K40 Sh. 5, K20 Sh. 5, MOV126 Sh. 8 Prevents overpressurizing pump suction line in the event check valves leak.	EO-1.0

LESSON CONTENT	DELIVERY NOTES	OBJECTIVES/ NOTES
3. The steam admission valve (MOV-120) will not open (manual or automatic unless the steam exhaust valve MOV-122 is open). It automatically closes on an RPV level of 202.3" (Level 8). If level again drops down to 108.8" (Level 2), the steam admission bypass valve (MOV-159) will open, and ten seconds later the steam admission valve (MOV-120) will open.	•LS2 and MOV122 Sh. 8 •Prevents overpressurizing exhaust line. •K95 Sh. 4 Point out that this is another complete system initiation.	EO-1.0
III. INSTRUMENTATION REVIEW		EO-1.0
A. Instruments		
1. Temperature		
a. Leak Detection System temperature elements monitor ICS area, ICS pipe chase, and RHS system area temperatures to initiate an ICS isolation on high area temperatures indicating a steam line break.	Use handouts of system P&IDs to show location of detectors.	
2. Pressure		
a. Pump suction pressure transmitter inputs to Control Room for indication and low suction pressure annunciator.		
b. A second pump suction pressure transmitter trips the ICS turbine on low suction pressure.		

c. ICS pump discharge pressure transmitter provides pressure indication in the Control Room and inputs to auto open the minimum flow bypass valve if pump discharge pressure discharge pressure is above 125 psig and flow is below 110 gpm.

•K70 Sh. 12, K73 Sh. 12

EO-1.0

d. 4 ICS turbine steam supply pressure transmitters upstream of MOV-128 initiate ICS system isolation if steam pressure is less than 75 psia.

e. Turbine exhaust pressure transmitters (2) actuate high turbine exhaust pressure annunciator in the Control Room and initiate a turbine trip at 25 psig.

f. Pressure between the turbine exhaust rupture diaphragms is sensed by 4 pressure transmitters, two for Div. 1 and two for Div. 2.

•K68, K69 Sh. 12, K87, K88 Sh. 13

1) One trip in either Div. actuates an annunciator; if both transmitters trip in either Div., ICS isolates (at 10 psig).

If rupture diaphragms break, exhaust steam dumps into RCIC Room.

3. Flow

EO-1.0

a. Pump discharge flow monitored by two flow transmitters.

1) One transmitter sends a signal to open Minimum Flow Valve MOV-143 when flow is below 110 gpm (and pump discharge pressure is above 125 psig.) It closes the valve when flow is above 220 gpm.

2) The second transmitter provides flow indication and a signal to the ICS flow controller.

b. Steam flow to the ICS turbine monitored by 4 differential pressure transmitters through elbow flow detectors. These are part of the Leak Detection System.

1) Two transmitters sense flow upstream of the inboard steam isolation valves to detect ruptures in either ICS turbine or RHS heat exchangers. A differential pressure of 37.4" H_2O will cause an isolation.

Transmitters also have loss of detection signal (sensing line break) at -273" H_2O

2) Two transmitters sense flow in the ICS turbine piping, downstream of the branch line to the RHS system. Causes isolation if differential pressure exceeded 167.1" H_2O.

4. Level — EO-1.0
   a. 4 reactor water level transmitters are used for ICS.
   b. Reactor vessel water level low-low (108.8") initiates ICS. — Show these contacts on sheet 4.
   c. High level trip (202.3") automatically closes the turbine stop valve, MOV-120, isolating steam to the turbine. — Show contacts on sheet 4.
   d. CST tank "A" level transmitter sends a signal to annunciate in the Control Room and shift ICS pump suction to the suppression pool on low level.
   e. Condensate drain pot level switches.
5. Turbine Speed — EO-1.0
   a. Sensed by magnetic pickup which senses the rotation of a spur gear on turbine shaft. — Point this out on TP of ICS turbine (trainee handout #4)
   b. Speed signal used by governor control circuit to control turbine speed during startup.

B. Controls

1. Turbine Speed Control governor has three purposes:
   a. Limits the turbine speed to its maximum normal operating value, preventing an overspeed.
   b. Controls transient acceleration during turbine startup.
   c. Maintains constant pump discharge flow rate over the normal range of steam supply pressure.

   Ask trainees to list purposes. Assist as necessary.

   EO-1.0

2. Turbine speed control governor receives its input signal through a low value gate which passes the lowest of the following signals:
   a. ICS flow controller flow demand signal.
   b. Ramp generator output.

   Show operation of governor control circuit using TP.

3. Ramp generator provides a linearly increasing turbine speed demand signal to control turbine speed during startup-prevents overspeed trip on speed overshoot.

4. With system in Standby:
   a. System flow is zero.
   b. Flow controller flow demand output is saturated at its maximum value, because of zero system flow.

c. In standby, the ramp generator output initially calls for a turbine speed demand of 700 to 1000 rpm.

5. System Startup

a. Ramp generator starts its ramp function when the steam admission valve leaves the fully closed position.

b. Low signal selector transmits this increasing ramp signal to the governor.

c. Turbine speed increases until the actual pump flow rate satisfies the flow controller setpoint (normally 600 gpm).

d. The low signal selector then transmits the flow controller setpoint.

Use 807E173TY Sh. 4 through 12 as necessary to step through system startup.

IV. RELATIONSHIP TO EOPs

EO-4.0

A. EOP-RPV Control

1. Section RL and RP

a. Use RCIC to maintain water level between 159.3 and 202.3 inches, or to help maintain pressure control

1) Maintain turbine speed greater than 1500 RPM.

2) If CST water level drops to the low level setpoint, verify auto suction transfer to the suppression pool.

Provides sufficient cooling to the pump internals.

3) Elevated suppression chamber pressure may trip the RCIC turbine on high turbine exhaust pressure.

2. Section RQ

a. If turbine is on line prevent an auto initiation of RCIC to prevent a turbine trip.

B. EOP-C5 Level/Power Control

1. Use RCIC to slowly inject during an ATWS to raise water level.
2. Once power level is stabilized RCIC may be used to maintain Reactor Water level.
3. The RCIC system may also be used following an ATWS when emergency depressurization is required. The RCIC low pressure interlock may be defeated.

C. EOP-C2 Emergency RPV Depressurization

1. If SRVs cannot be opened to emergency depressurization, RCIC and other associated steam systems may be used to aid in emergency depressurization.

D. EOP - Primary Containment Control

1. Section SPL

a. If SP level is high and cannot be maintained below the Suppression Pool load limit RCIC suction should be swapped over to the SP or the system should be shutdown.

E. EOP - Secondary Containment

1. High water level, high temperature, or high radiation levels in the RCIC room is an entry condition into EOP Secondary Containment Control.
2. If levels are high in conjunction with a primary system discharging into the area, emergency depressurization may be required.

F. EOP-6

1. Review EOP-6, Attachment 4 with trainees.

V. PROCEDURE REVIEW

Using a current approved revision of N2-OP-35, review the following.

Discuss reasons for the precautions and limitations.

EO-5.0

A. Precautions and limitations

EO-6.0

B. Startup

1. Startup from inoperable to standby.
2. Fill and vent of system.
3. Manual startup.

C. Normal Operation

1. Standby Condition Status Checks
2. Auto/Manual Initiation

D. Shutdown

1. Shutdown from operating to standby.
2. Shutdown to inoperable.

E. Off Normal Operations
   1. Steam Condensing Mode
   2. RCIC turbine reset following overspeed or local manual trip.
   3. Manual isolation
   4. RPV Pressure Control

VI. SURVEILLANCE TESTING
   A. Review select surveillance tests with trainees.

VII. TECHNICAL SPECIFICATIONS — EO-7.0
   A. RCIC steam line isolation actuation instrumentation (3/14.3.2).
   B. RCIC actuation instrumentation (3/4.3.5).
   C. Div III action statements (3/4.5.1).
   D. RCIC operability statement (3/4.7.4).

Review each Tech Spec. with trainees.

VIII. WRAP UP
   A. Review trainee objectives.
   B. Answer any questions.

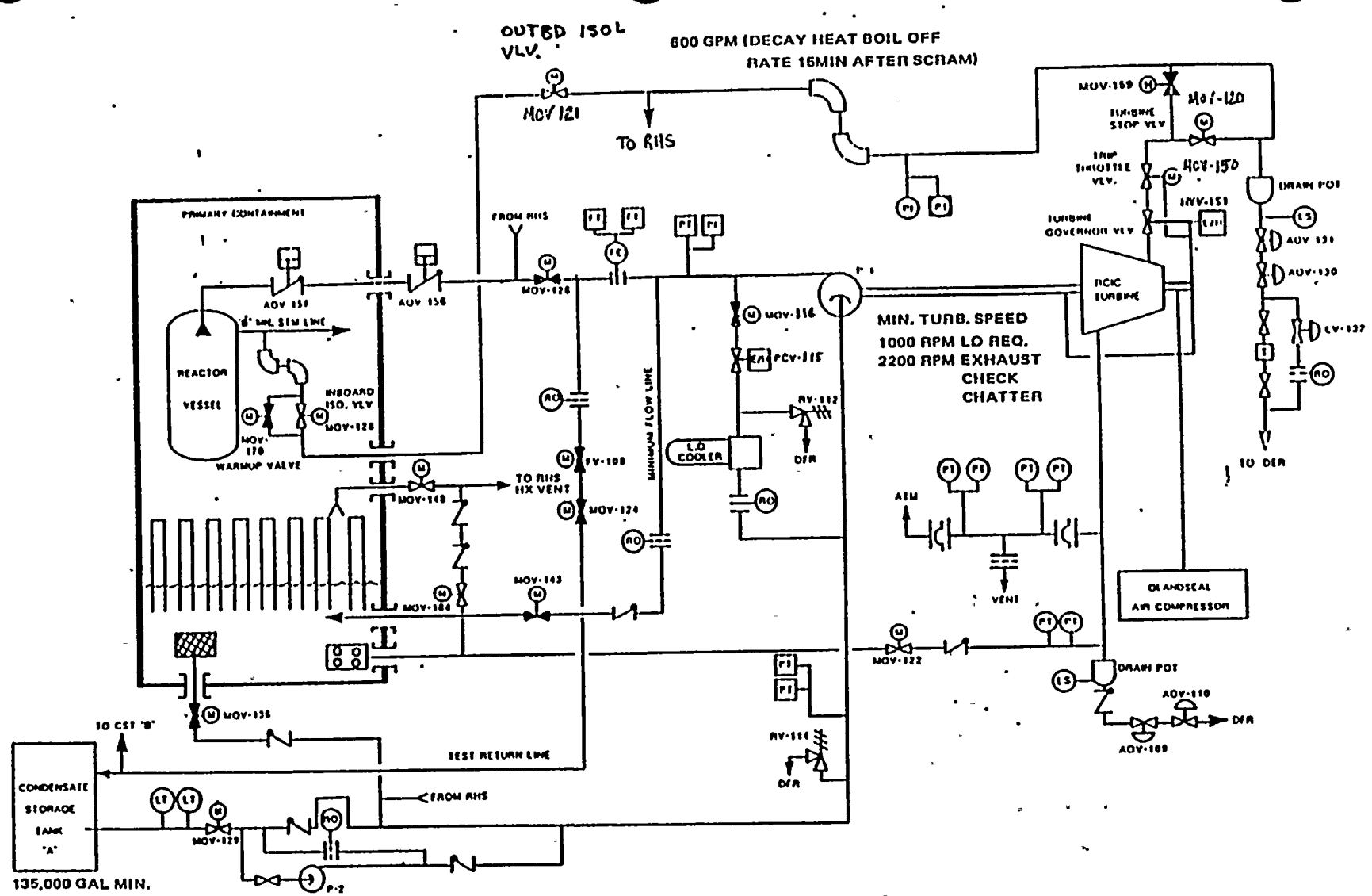


TABLE 1
ICS SYSTEM TRIPS AND ISOLATIONS

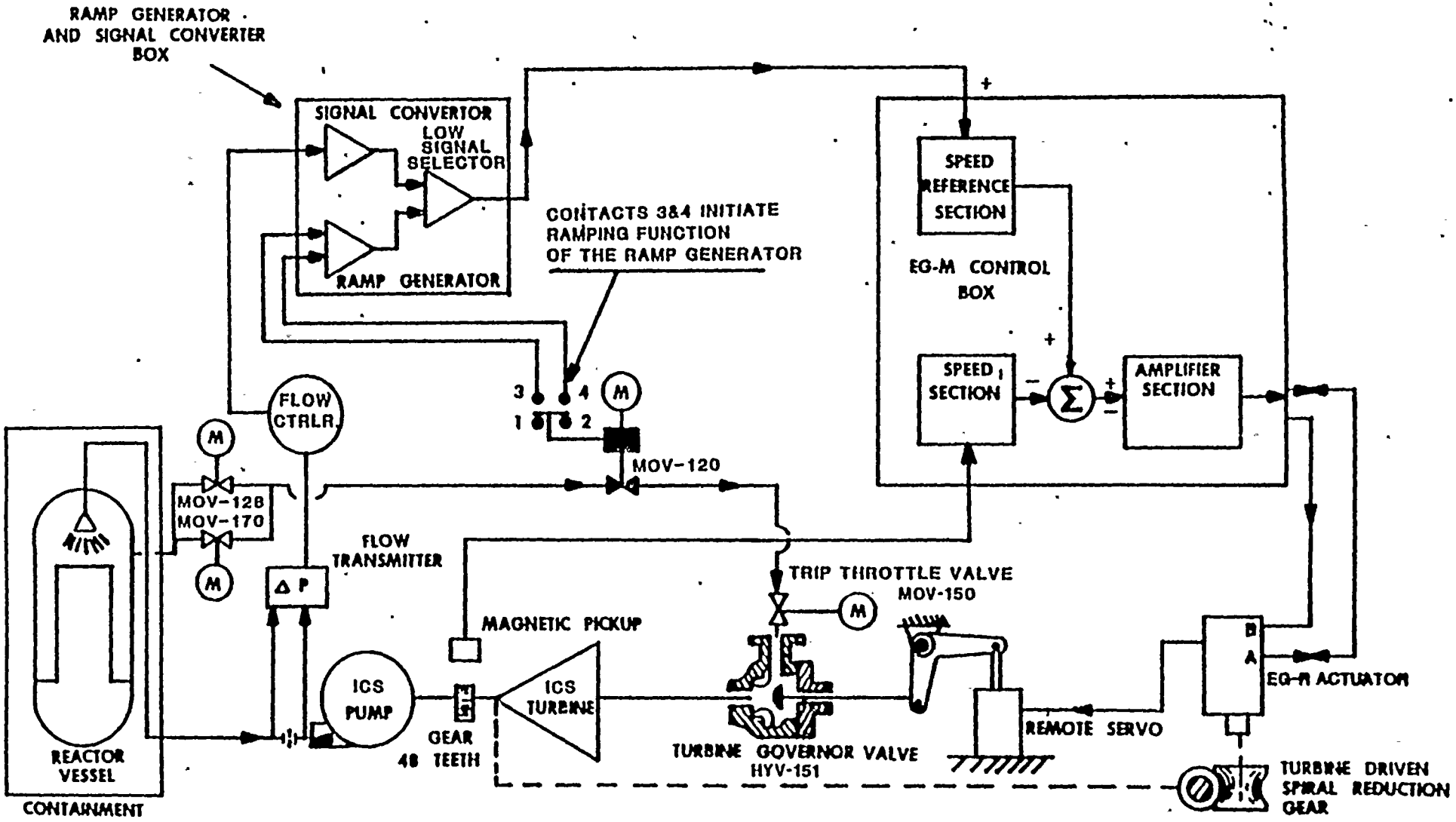
AUTOMATIC TURBINE TRIPS	
HIGH EXHAUST PRESSURE	25 PSIG
LOW PUMP SUCTION PRESSURE	20 IN. HG
TURBINE OVERSPEED (MECHANICAL)	120%
ANY DIVISIONAL ISOLATION	

MIN FLOW VALVE (MOV-143)	
OPENS	125 PSIG AND * 110 GPM
SHUTS	220 GPM

AUTOMATIC ISOLATIONS	
GROUP 10 ICS	
HIGH STEAM FLOW TO RHS AND ICS	37.4 H_2O
HIGH STEAM FLOW TO ICS	167.1 H_2O
ICS EQUIPMENT AREA HIGH TEMPERATURE	135°F
EXHAUST DIAPHRAGM HIGH PRESSURE	10 PSIG
LOW STEAM SUPPLY PRESSURE	25 PSIG
ICS STEAM LINE HIGH TEMPERATURE	135°F
RHS AREA HIGH TEMPERATURE	135°F
HIGH REACTOR BUILDING TEMPERATURE	130°F
HIGH REACTOR BUILDING PIPE CHASE TEMPERATURE	135°F

REACTOR CORE ISOLATION COOLING SYSTEM HANDOUT

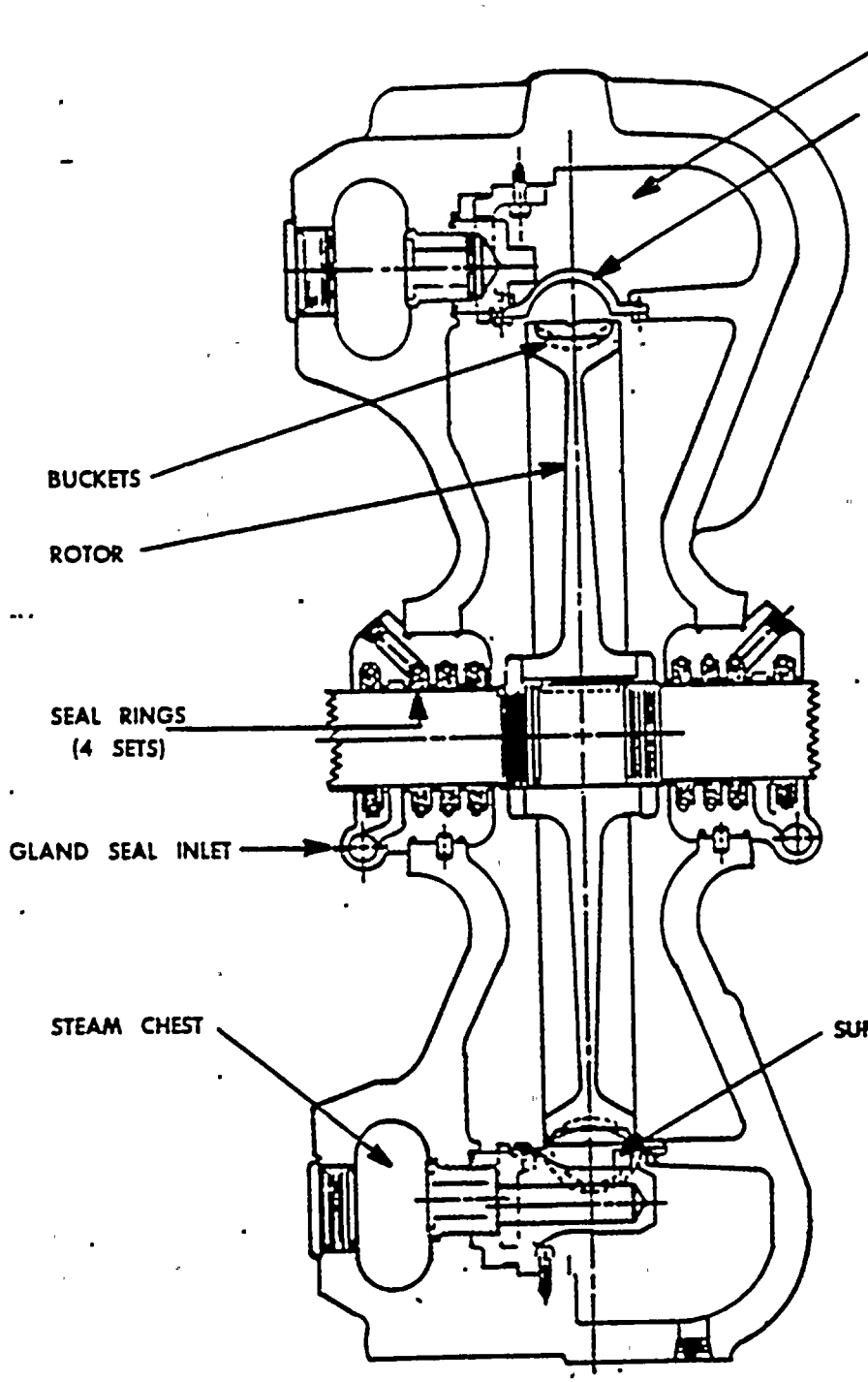
U-2 TEXT	FIGURE	DATE
SYSTEM ICS	1	4-12-91
TITLE: RCIC System		



U-R SYSTEM	TEXT	FIGURE	DATE
ICS		2	4-12-91

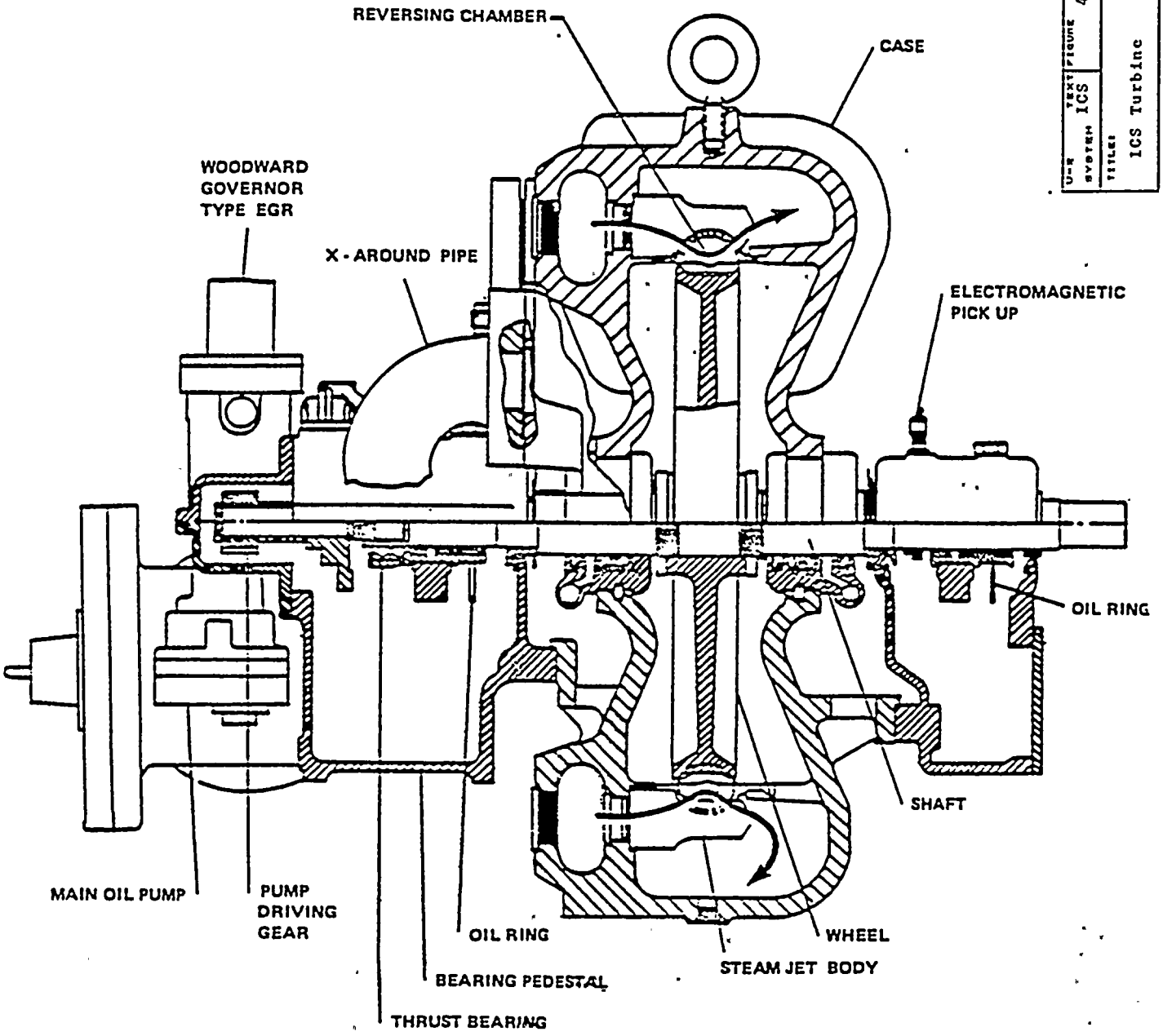
TITLE: Turbine Governor Control System

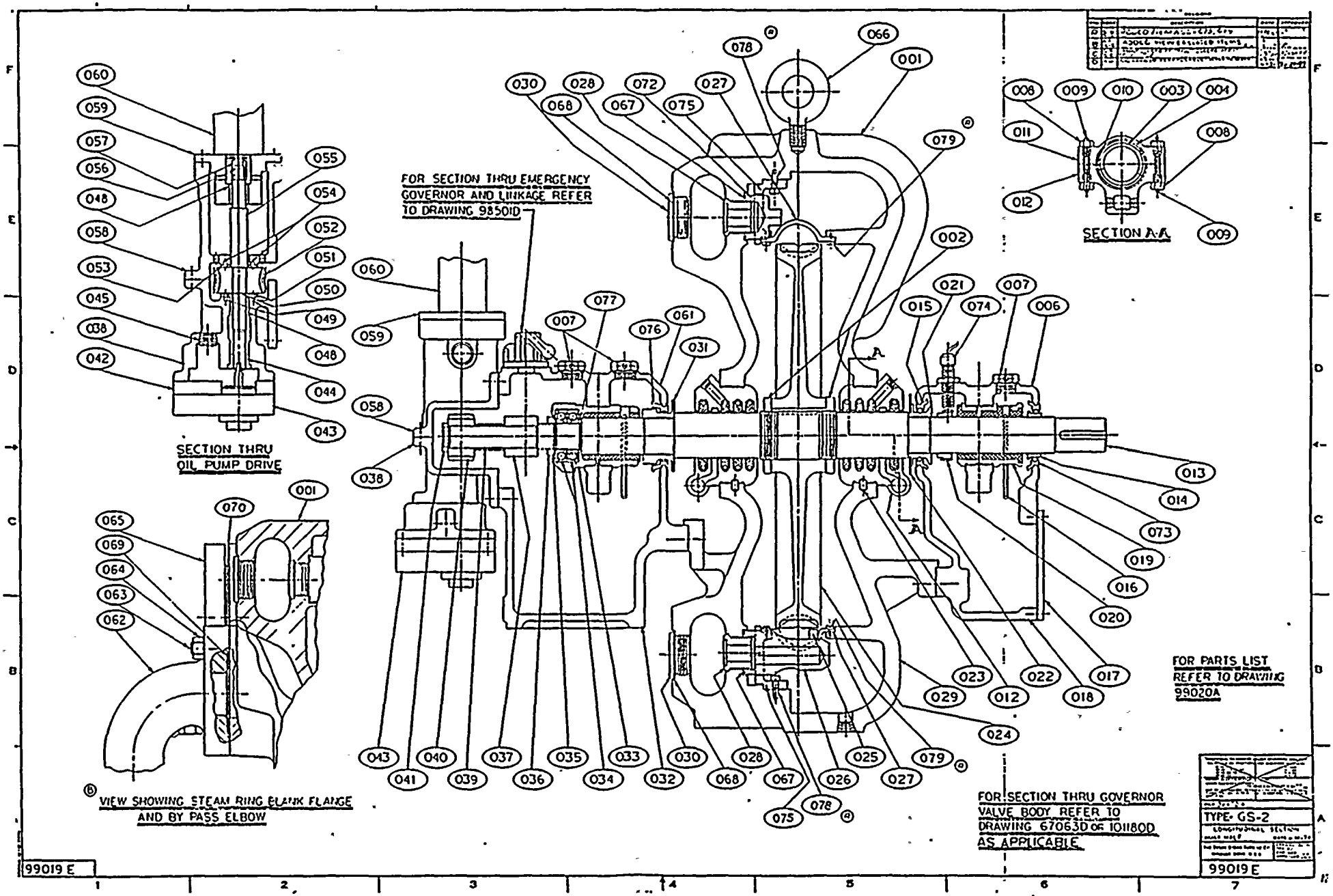
U-R SYSTEM: ICS	TEXT FIGURE 3	DATE 4-12-91
TITLE: ICS Turbine		



USN SYSTEM	TEXT	FIGURE	DATE
	ICS	4	4-12-91

TITLE: ICS Turbine

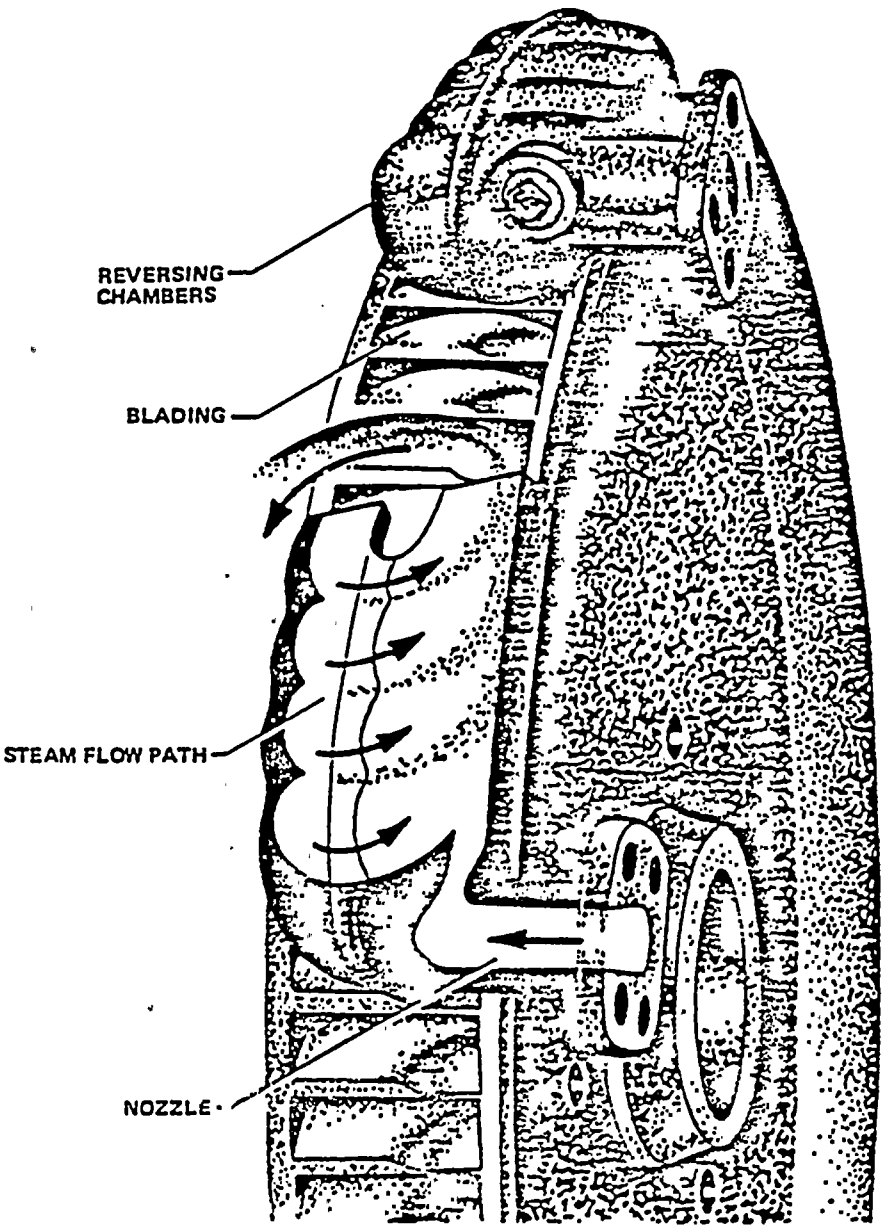




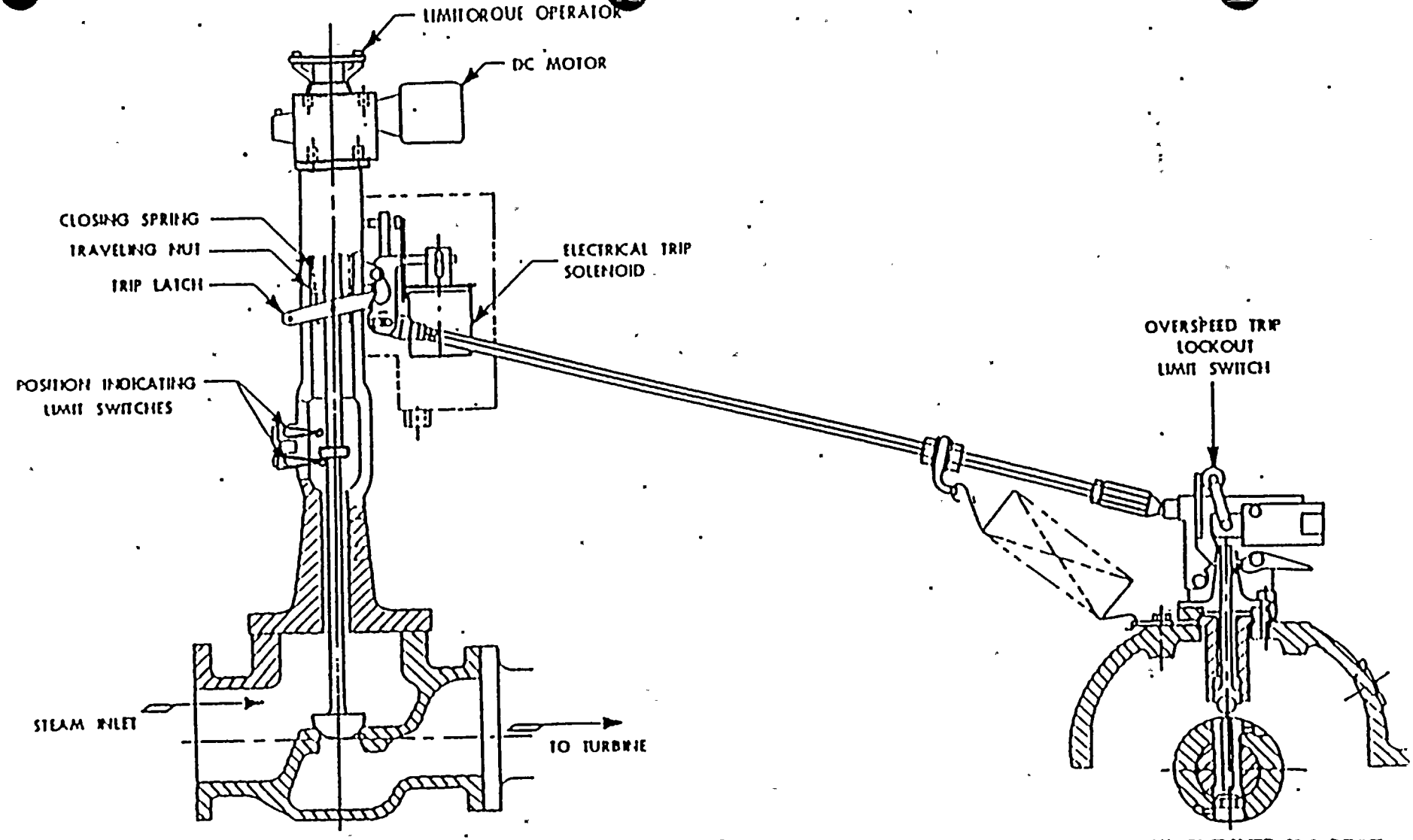
U-R	TEXT	FIGURE	DATE
SYSTEM	ICS	5	4-12-91

TITLE:
ICS Turbine (detail)

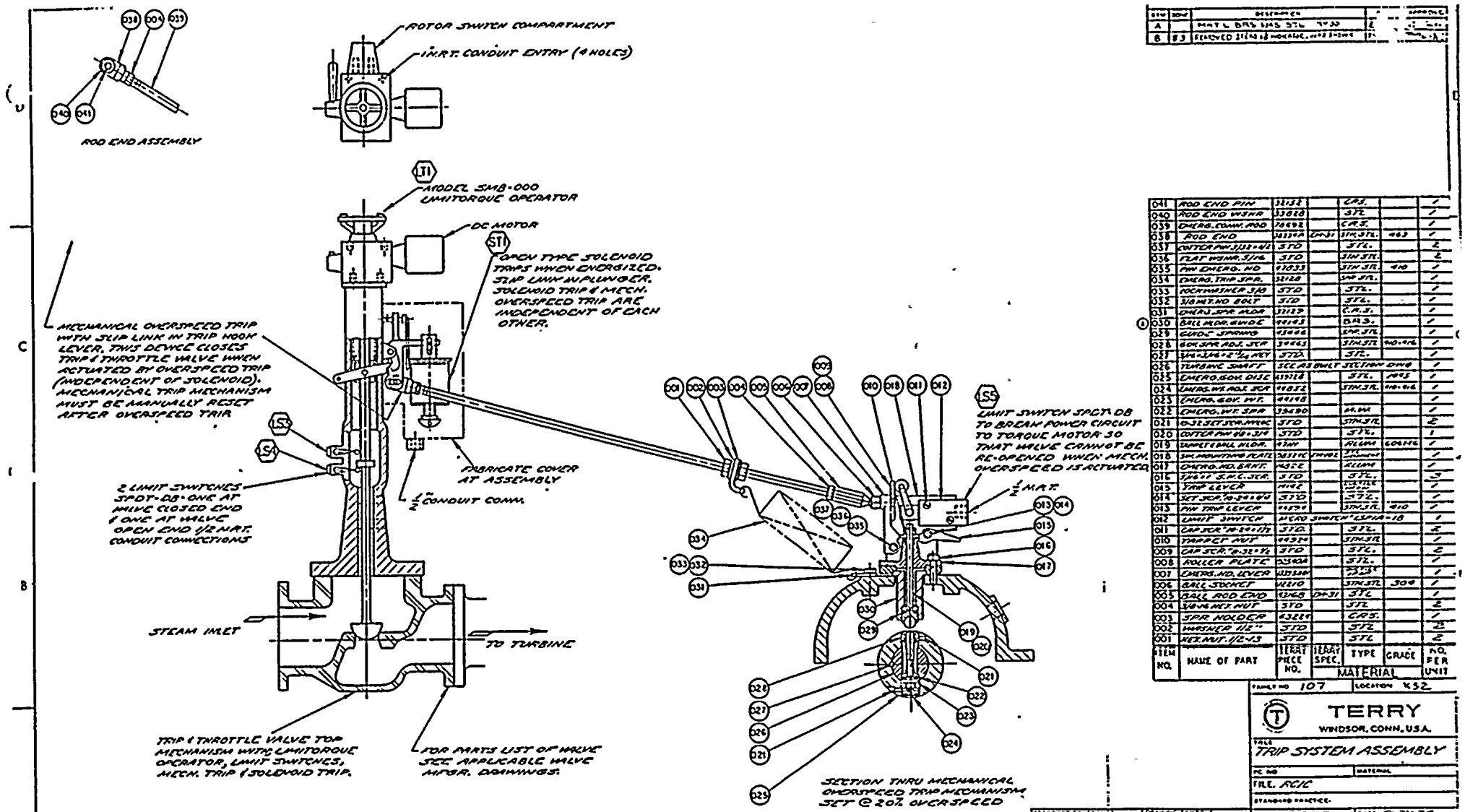
USE	TEXT	FIGURE	DATE
SYSTEM ICS		6	4-12-91
TITLE: Terry Wheel			



TERRY WHEEL



U-2 TEXT SYSTEM ICS	FIGURE 7	DATE 4-12-91
TITLE: ICS Turbine Trip and Throttle Valve		



ITEM NO.	NAME OF PART	TERRY PIECE NO.	MATERIAL SPEC.	TYPE	GRADE	NO. PER UNIT
041	ROD END PIN	31153		CRS.		1
040	ROD END WSHR	33818		STL.		1
039	CHEMG. CONN. ROD	10692		CRS.		1
038	ROD END	31339A	CM-31	STN. STL.	463	1
037	CUTTER PIN 3/32 x 1/2	STD		STL.		2
036	FLAT WASH. 5/16	STD		STN STL.		2
035	PIN CHEMG. NO	11039		STN STL.	410	1
034	CHEMG. TRIP SPR.	31128		SWG STL.		1
033	ROCHESTER 3/8	STD		STL.		1
032	3/8 HEX. HD BOLT	STD		STL.		1
031	CHEMG. SPR. ROD	31133		CRS.		1
030	BALL MOD. SHOE	41103		CRS.		1
029	GUIDE SPRING	41006		EXP. STL		1
028	GOV. SPR. ADJ. SCR	30663		STN STL	410-416	1
027	1/4-32 x 2 1/2 KEY	STD		STL.		1
026	TURBINE SHAFT	SEE AS BUILT SECTION DWG				1
025	CHEMG. GOV. DISC	41316		STL.	1095	1
024	CHEMG. WT. ADJ. SCR	41054		STN. STL.	410-416	1
023	CHEMG. GOV. WT.	41118				1
022	CHEMG. WT. SPR	31490		MUSIC WIRE		1
021	6-32 SET SCR. HEX SOC	STD		STN STL		2
020	CUTTER PIN 3/8 x 3/4	STD		STL.		1
019	THRUST BALL BEAR.	41141		ALUM	LOAHG	1
018	SW. MOUNTING PLATE	31316	PM-31	STL		1
017	CHEMG. NO. BRKT.	41032		ALUM		1
016	1/4-27 S.H.C. SCR.	STD		STL.		3
015	TRIP LEVER	41182		STEEL		1
014	SET SCR. 10-32 x 3/8	STD		STL.		1
013	PIN TRIP LEVER	41184		STN ST.	410	1
012	LIMIT SWITCH	MICRO SWITCH BZE1A-18				1
011	CAP SCR. 10-32 x 1/2	STD		STL.		2
010	TRIPPET NUT	41034		STN ST		1
009	CAP SCR. 6-32 x 3/4	STD		STL.		2
008	ROLLER PLATE	33908		STL.		1
007	CHEMG. NO. LEVER	41038M		STEEL		1
006	BALL SOCKET	41110		STN. STL.	304	1
005	BALL ROD END	10468	CM-31	STL		1
004	1/2-13 HEX NUT	STD		STL		2
003	SPR. HOLDER	43229		CRS.		1
002	WASHER 1/2"	STD		STL		2
001	HEX. NUT 1/2-13	STD		STL		2

PAGE NO 107 LOCATION K52

TERRY
WINDSOR, CONN. U.S.A.

TITLE: TRIP SYSTEM ASSEMBLY

FILE: ACIC

SCALE: NONE DATE: 5-31-79

ENGINEERING APPROVAL DATE

MANUFACTURING APPROVAL DATE

TYPE: GS GSG45C

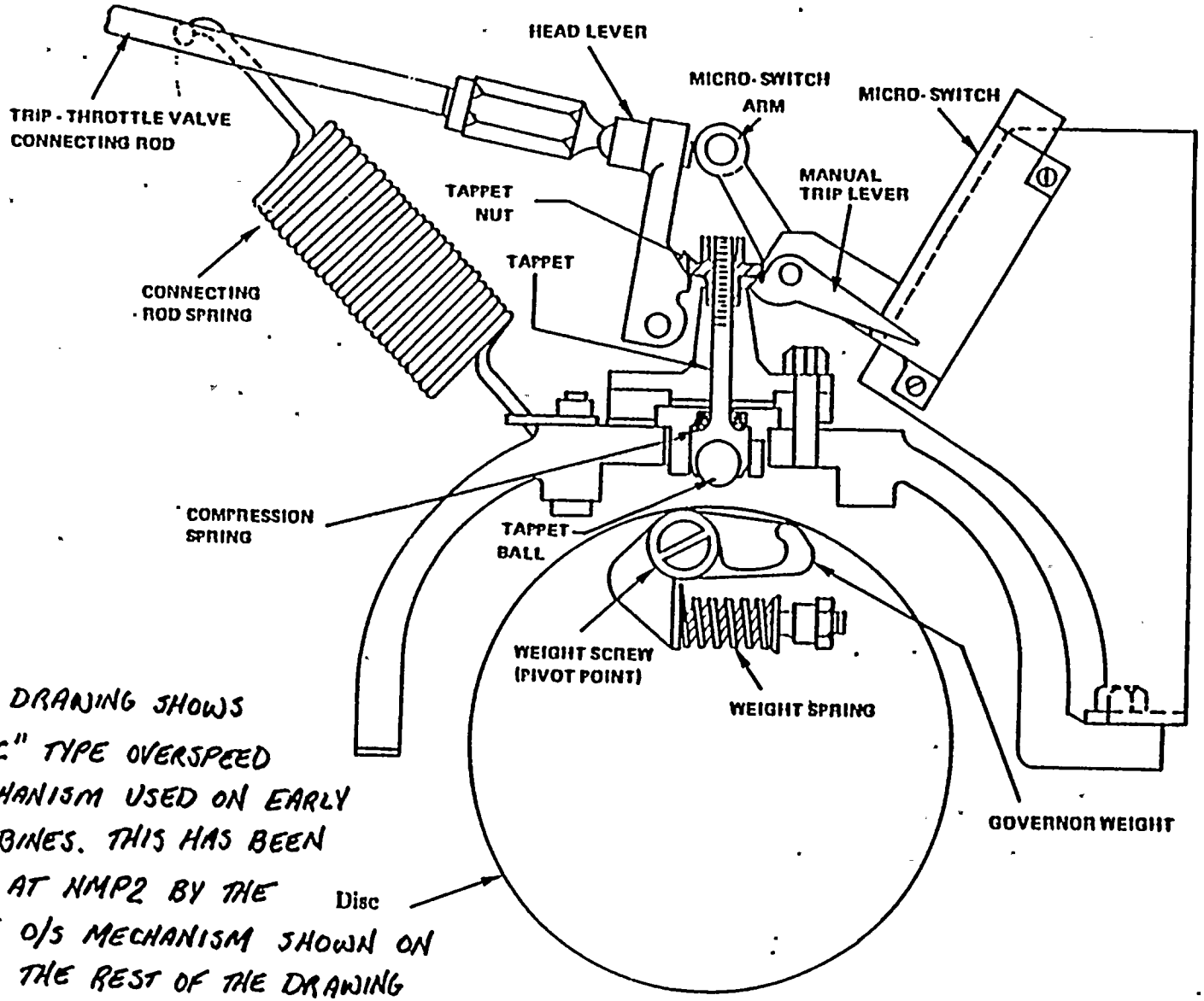
DRAWING NO: 98501D

NOTES:
1) SEE 38433D FOR WIRING OF ELECTRICAL DEVICES EXCEPT LIMITORQUE OPERATOR (LTI)
2) SEE 38438C FOR WIRING OF LIMITORQUE OPERATOR (LTI)
3) SEE A8130 FOR ADJUSTMENTS OF EMERGENCY GOV. DISC ASSEMBLY.

98501D

U-2 SYSTEM	TEXT ICS	FIGURE 8	DATE 4-12-91

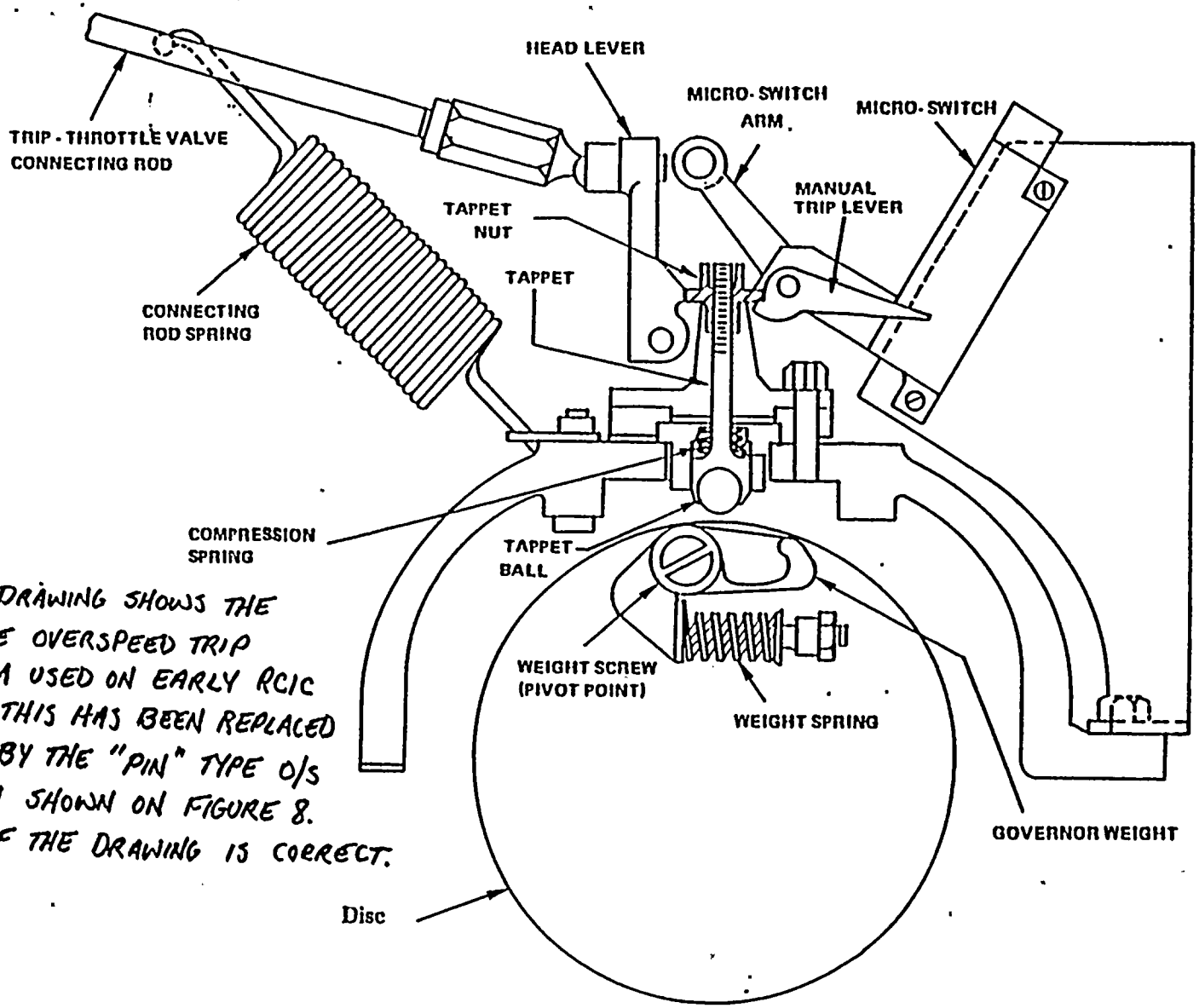
TITLE: Trip System Assembly (detail)



NOTE: THIS DRAWING SHOWS THE "DISC" TYPE OVERSPEED TRIP MECHANISM USED ON EARLY RCIC TURBINES. THIS HAS BEEN REPLACED AT NMP2 BY THE "PIN" TYPE O/S MECHANISM SHOWN ON FIGURE 8. THE REST OF THE DRAWING IS CORRECT.

SIMPLIFIED DIAGRAM OF RCIC TURBINE
MECHANICAL OVERSPEED TRIP UNIT (TRIPPED)

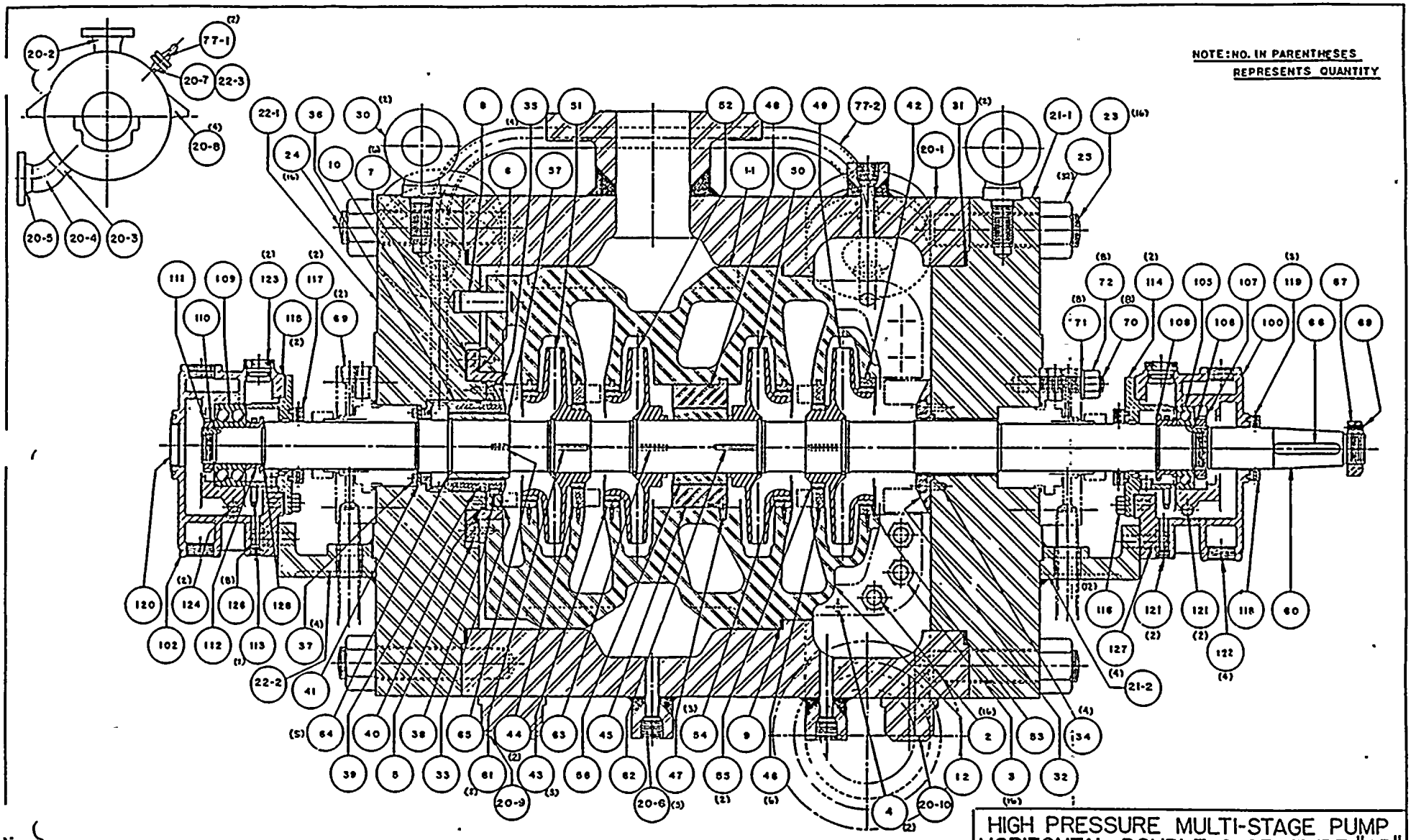
U-2 TEXT SYSTEM ICS	FIGURE 9	DATE 4-12-91
TITLE: Overspeed Trip Unit (tripped)		



NOTE: THIS DRAWING SHOWS THE "DISC" TYPE OVERSPEED TRIP MECHANISM USED ON EARLY RCIC TURBINES. THIS HAS BEEN REPLACED AT NMP2 BY THE "PIN" TYPE O/S MECHANISM SHOWN ON FIGURE 8. THE REST OF THE DRAWING IS CORRECT.

SIMPLIFIED DIAGRAM OF RCIC TURBINE MECHANICAL OVERSPEED TRIP UNIT (RESET)

U-E TEXT SYSTEM ICS	FIGURE 10	DATE 4-12-91
TITLE: Overspeed Trip Unit (reset)		



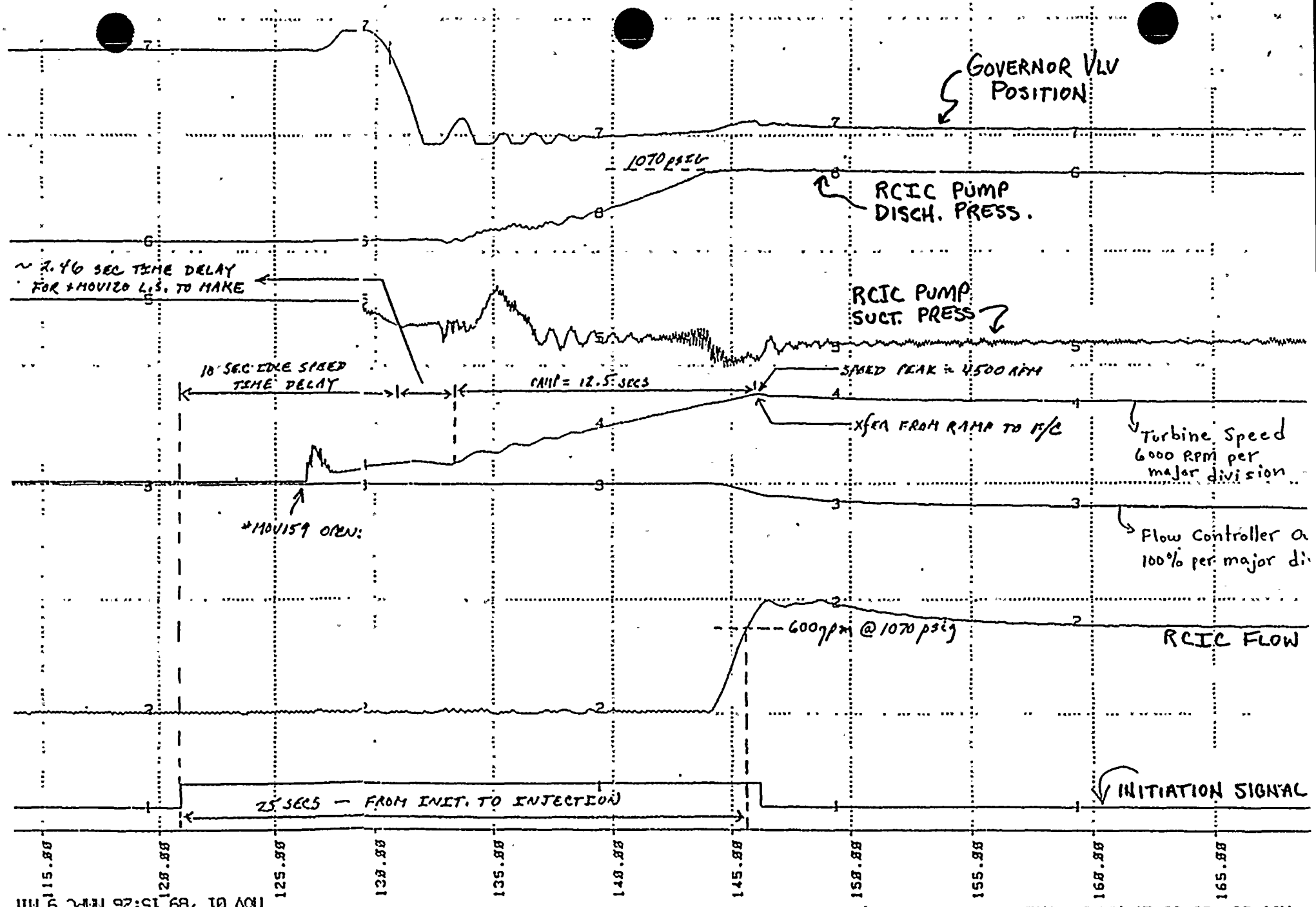
HIGH PRESSURE MULTI-STAGE PUMP HORIZONTAL DOUBLE CASE—TYPE "CP"

BINGHAM-WILLAMETTE CO.
PORTLAND, OREGON — SHREVEPORT, LOUISIANA.
BINGHAM PUMP CO. LTD. BURNABY, B.C. CANADA.

B-29968

REV. 2 | 6-3-75

U-2 SYSTEM ICS	TEXT	FIGURE 11	DATE 4-12-91
TITLE: ICS Pump (detail)			

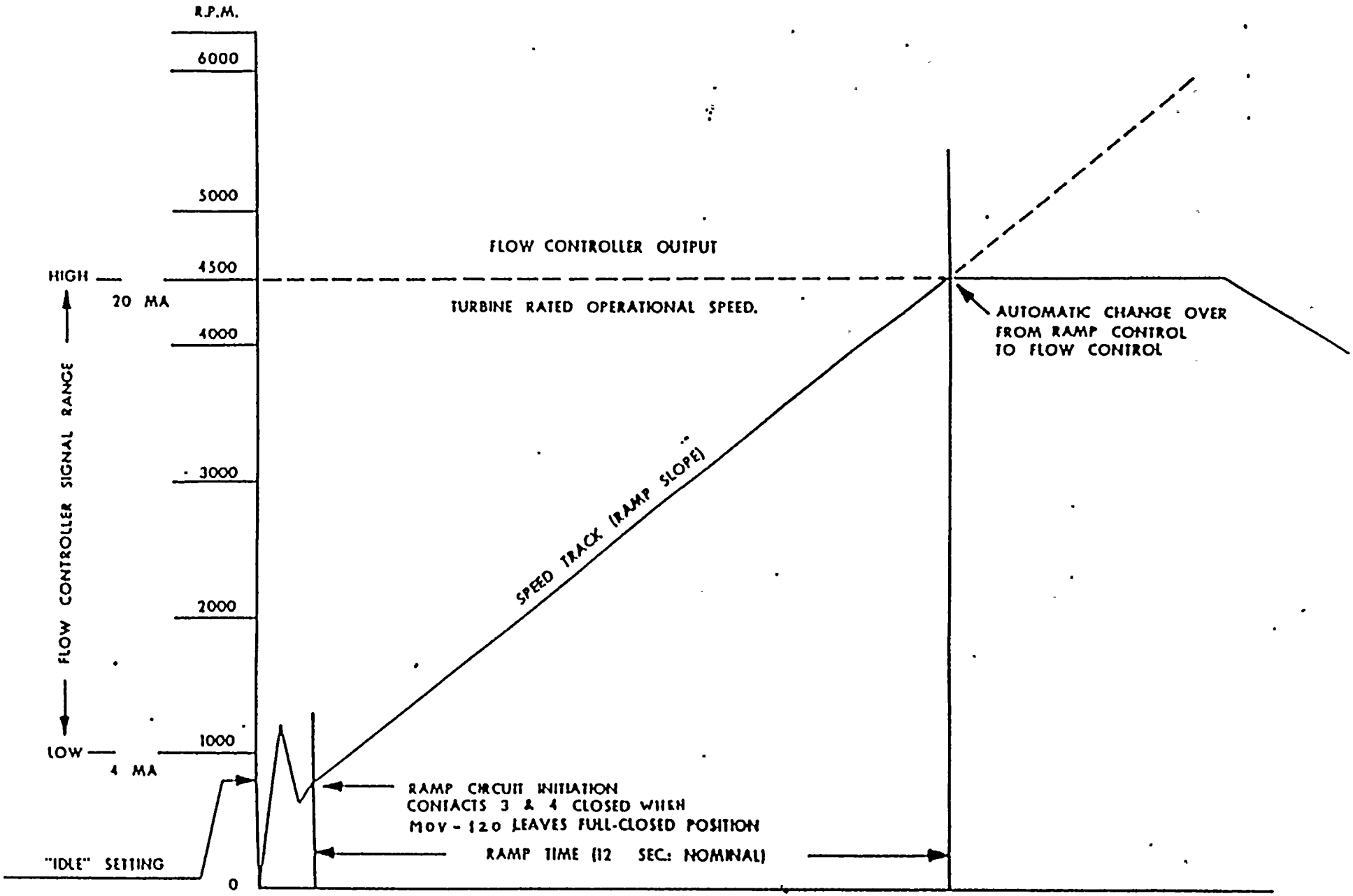


NOV 01 '89 15:26 MPC 9 MILE

P.4

NOV 01 '89 15:27 MPC 9 MILE #2

U-2 SYSTEM	TEXT ICS	FIGURE 12	DATE 4-12-91
TITLE: ICS Initiation Trace			



U-E , TEXT	FIGURE	DATE
SYSTEM: ICS	13	4-12-91

TITLE:
ICS Turbine Governor
Startup Characteristics