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Abstract

The daily check list, the startup procedure both for in-pool and in-air operation, and the normal shutdown procedure for the Tower Shielding Reactor-II are outlined. The sequence of events which leads to each annunciator warning and the automatic corrective action which is then initiated by the control circuits are described.

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STANDARD OPERATING PROCEDURE FOR TSR-II

Routine operation of the TSR-II will be similar, procedurally, to operation of the TSR-I¹ with the following notable added complexities in TSR-II operation:

1. A pressurized water coolant system and a water pumping system for control must be supervised.
2. The direction of the collimated beam from the reactor shield, when the reactor is at power, must be programmed so that tolerance levels at the perimeter and exclusion fences are not exceeded.

Routine Operating Procedure - Outline

- I. Examine previous run's operation log sheet. Any abnormalities and malfunctions must have been explained and corrected. If not, specific explanation and waiver must be entered on the new log sheet by the responsible reactor operator.
- II. Check weather. (Contact AEC Weather Bureau for weather report.)
  - A. Check daily weather report.
  - B. Read TSF weather instruments and enter on daily log sheet the wind velocity and direction and the air temperature at ground level.
  - C. Use weather radar to detect approaching thunderheads.
- III. Turn on TV cameras and receivers. Adjust cameras to bring reactor into view on receiver screens.
- IV. Check reactor controls and cooling system controls.
  - A. Turn on all circuit switches at the main power panel in cubicle. Push in "start" button of seat switch pump just over main power panel. Check water flow blockout switch for "off" position. Place TARDI selector switch in "inhibit" position. Annunciator XA1507, "TARDI ON", will light up. Acknowledge the annunciator.
  - B. Turn on all five reactor control recorders. Turn on all four water system control recorders.

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1. Watson, Clifford, Welch, Hull, Cain, "Manual of Routine and Emergency Operating Procedures for the Tower Shielding Facility," ORNL CF-57-11-39.

- C. Push in "Temp. Test" button TSX101, under "TR101" temperature recorder. Recorder should go full up scale and down again. Switch louver selector (HS117) switch to "auto." Check temperature selector on TR101 and controller position for automatic pitch control of blowers.
- D. Turn on pressure pump. Observe rise in pressure to at least 80 psi but normally to 100 psi at main pump inlet press gauge. This pressure is designated P_0 on the recorder operation log sheet.) Check emergency pump and demineralizer pump operation lights for "on" indication. (These pumps may be continuously running).
- E. Turn emergency pump bypass valve to fully closed position. (Amber light "on" indicates valve is closed.)
- F. Turn main pump bypass valve to fully opened position. (Amber light "on" indicates that bypass is open.)
- G. Move fission chamber to full-up position and determine the linear amplifier pulse height selector setting at which α background noise is counted on the scaler with scaler set in low range. Record this value on the log sheet. Reset pulse height selector to a level at which no noise counts are accepted by the scaler. (This should be near the level and at same gain determined in original fission chamber calibration.)
- H. Calibrate fission chamber log count rate meter at two positions, 60 cps input and 5×10^4 cps. Return selector to "operate" position.
- I. Run fission chamber down to obtain a counting rate of at least 2 cps. This may be done automatically (fission chamber position switch in "automatic" position) from an initial count rate below 2 cps.
- J. Calibrate the safety system's log N meter. This may be done at the control console as follows:
  - (a) Turn selector switch to "lo cal." The "pile power" pointer should now be aligned with "lo cal" mark at left side of the meter face. To correct pointer position turn adjusting screw marked "lo cal."

(b) Turn selector switch to "hi cal." The "pile power" pointer should now be aligned with "hi cal" mark at the right side of the meter face. To correct pointer position turn adjusting screw marked "hi cal."

(c) Return selector switch to "lo cal." The "pile power" pointer should still align with "lo cal" mark on meter face. If it does not, the calibration procedure must be repeated for both calibration positions.

(d) Return selector switch to "operate" position.

- K. Clear the annunciator board by pushing "acknowledge" and "reset" buttons. Both colored and white annunciator lights should go out except for "TARDI ON" annunciator. If other annunciators remain on, the reason must be understood and noted on log sheet. (See discussion of annunciator indications.)
- L. Check seat switch lights. All lights should be on, indicating that all five shim rods are seated.
- M. Check servo selector for "off" position. Operate the shim-rod drive motor and check upper and lower limits and limit lights. Leave drive at approximately mid-travel position.
- N. Operate regulating rod drive and check upper and lower limits. Leave regulating rod at fully withdrawn position.
- O. Set micromicroammeter to most sensitive range, 1×10^{-11} amperes full scale. Set demand helipot of the servo system amplifier to desired scale reading on the demand meter. (See calibration of demand settings vs. power levels). Turn on servo. Annunciator XA1502, "Regulating Rod at Upper Limit" will light up. Acknowledge annunciator.
- P. Visually check four sigma amplifier level indicators for pointers at "zero."
- Q. Turn TARDI selector switch in cubicle to "normal" position.
(Shim drive will automatically run down to first limit switch.)
- V. The reactor should now be positioned, if necessary. If collimator is used on the reactor shield, its direction must be recorded in the daily log.

VI. Make personnel safety precautions.

For in-pool operation:

- A. When safety range is 0-100 kw and level scram is 150 kw:
  1. Clear personnel from a 40-ft radius area around pool.
  2. Put up 40-ft radius barrier with radiation hazard signs around pool and close gate on road leading from rear door to reactor area.
  3. Announce imminent in-pool operation over inside and outside loudspeakers.
  4. Instruct guard to restrict entry to the area except by permission of the reactor operator.
- B. When safety range is over 100 kw and level scram is $1\frac{1}{2} N_f$:
  1. Use in-air operating procedure.

For in-air operation:

- A. Confirm number of persons in area with guard.
- B. Check personnel within building.
- C. Notify guard to move to 3000-ft fence.
- D. Receive telephone call from guard at 3000-ft fence.
- E. Announce imminent operation of reactor over PA system.

VII. Start Reactor.

- A. Turn on main pump. Close main pump bypass valve (green light "on" indicates that bypass is closed). Enter pressure and flow rate readings on log sheet.
- B. Turn on key switch. (Push in back door interlock bypass removal request button to make sure no bypass exists.) Wait for 3-min delay period to end. Push scram reset button.
- C. Turn on blowers during 3-min delay period.
- D. Record magnet current as shown on magnet amplifier ammeters.
- E. Run shim rod mechanism to insert the clutches. (Beyond first insert limit, shim rods will insert only at slow speed.) Observe rise in clutch pressures as indicated by five ammeters. Clutch lights will go off as clutch pressure builds up. Note a drop-off in ammeter readings indicating that clutch servo action is in order. This should just precede lighting of shim rod second insert limit light. Caution: Do not depend on limit switch to stop shim-rod insertion.
- F. Withdraw shim rods until seat switch lights go out indicating that shim rods are out of fully inserted position.

G. Test scram circuits.

- (a) Actuate the manual scram lever on the reactor control panel. All five rods should drop. Seat lights should come on, clutch lights should come on and the clutch ammeters show low current. Push acknowledge and reset annunciators.
- (b) Again withdraw shim rods until seat lights go out. Push scram button on composite amplifier. The period amplifier section of the composite amplifier should produce a scram with all previously mentioned indications on reactor control panel.
- (c) Check reactor log for previous day's testing. If sigma amplifiers have been scram tested consecutively over the previous three days, only one sigma amplifier need be tested, provided no sigma amplifier abnormalities were noted on previous day's operation. Withdraw shim rods again until seat lights go out. Check the next consecutive sigma amplifier for scram by inserting a small probe into the hole marked "scram" on the face of the amplifier. Note number of amplifier tested in reactor log.
- (d) Reset scram circuit and clear annunciator board. If any annunciators do not clear, exact cause of the abnormalities must be known and noted in reactor log.

H. Announce over PA system that reactor is being taken critical.

- I. Withdraw shim rods at fast rate while observing the fission chamber's count-rate meter period recorder and listening to audible scaler signals. Also scan log N period meter and rod position indicator. When the count-rate meter period recorder begins to indicate a steady positive period stop shim rod withdrawal. In any case the shim rods should never be withdrawn beyond the position where normally a steady positive period is obtained without definite recorded explanation for any change in critical position of the rods.
- J. Withdraw shim rods as necessary to maintain a reasonable period as observed by the count-rate channel, until the log N period recorder begins to show a positive period and the log N level recorder begins to show a positive reading. The micromicroammeter should at this point also indicate a power level.
- K. During the preceding period, switching of scales on the fission chamber scaler will be necessary. When the log N level reading

and the micromicroammeter recorder is steady and up scale one decade the fission chamber may be withdrawn automatically when counting rate has reached 10^5 cps. Stop rod withdrawal unless log N level and micromicroammeter level are up-scale at least one decade.

- L. Continue to increase power level until it approaches the demand setting on the servo system. Switch scales on micromicroammeter by factors of 10 to keep demand higher than actual power level. When desired power level is reached, the servo system will drive the regulating rod in. Stop shim-rod motion until regulating rod has come to rest in one position. Trim shim-rod position so that regulating rod comes to rest at approximately the mid-point of its travel. The power level called for on the servo system demand has now been reached.
  - M. If a change in power level is required during operation, turn off servo, by pushing "servo off" button on reactor control panel. Reset micromicroammeter range to desired level and withdraw the regulating rod to obtain a positive period if power level increase is required or insert the regulating rod if power level decrease is required. Provided the change in power level can not be accomplished by means of regulating rod only, move shim rods in required direction. As the power level approaches the desired value turn servo on and stabilize system with regulating rod at approximately mid-travel position as before.
  - N. After reaching any desired power level, record the following:
    - (a) Power level
    - (b) Time of day
    - (c) On recorder strip chart mark run number, power level, time of day, and date.
    - (d) Complete the daily log form.
- VIII. To shut down reactor, actuate manual scram. Check fission chamber motion selector for "automatic" position.

Tower Shielding Facility
Reactor Operation Log Sheet

Date _____ Run No. _____ Operator _____ Page No. _____
Experiment No. _____ Description _____

Weather

Time _____
Wind Velocity and Direction _____
Air Temperature at Gnd. Level _____
Radar check _____
AEC Weather Bureau (4301) _____

Reactor Configuration

Core _____
Spherical Shield A _____; E _____; Normal _____; Other _____
Beam Hole Direction _____
Other Shield _____
Altitude _____

Water System

Emerg. Pump _____ Bypass Closed _____ Demin. Pump _____ Press Pump _____ Po _____
Reactor AP _____ Seat Sv. Pump _____ Lights _____ Main Pump _____ GPM _____ Po _____
Reactor AP _____ Fission Break Monitor _____

Fission Chamber

Withdrawn _____ Amp. Gain _____ PHS Noise _____ PHS Normal _____
Log CRM Calib. _____ Operate _____ Inserted _____ CR _____ Remarks _____

Safety System

Log N Calib. _____ Σ_1 _____ Σ_2 _____ Σ_3 _____ Σ_4 (Comp. Amp.) _____
Operate _____

Annunciators

Cleared and Reset _____ Remarks _____
Shim Drive Limits _____; Reg. Rod Limits _____ No. of Badges _____
Shim pump on _____ Magnet I_1 _____ I_2 _____ I_3 _____ I_4 _____ I_5 _____

Scram Tests

Manual _____ Comp. Amp. _____ Σ amp _____

Badge Nos. _____

Weather Report _____

Reactor Notes _____

ANNUNCIATORS

There are 32 annunciators to indicate the location of malfunctions or abnormal conditions in the reactor system. Sixteen annunciators refer, in general, to the reactor control system and nuclear instrumentation while 16 others refer to the reactor cooling system.

In the following section the arrangements of the two groups of annunciators is shown and a brief description of the meaning of each annunciator is given. If a reactor scram or a shim rod reverse (insertion) occurs automatically, this is indicated in the first sentence of the annunciator description. If the annunciator only warns of an abnormal condition, the sentence "annunciator warns only" is used.

In accordance with Instrumentation and Controls Division standards¹ the following designations for components are used in the descriptions:

K	-	Relay	
LS	-	Level switch	
T	-	Timer	
TS	-	Temperature switch	
T _d S	-	Temperature difference switch	
T _d M	-	Temperature difference modifier (transducer)	
PS	-	Pressure switch	P - Reactor power level
P _d S	-	Pressure difference switch	
A _c S	-	Conductivity analysis switch	
RS	-	Radiation switch	RT - Radiation transmitter
HS	-	Manual switch	
ZS	-	Position switch (limit switch)	
XS	-	Special switch (in the TSR-II system this refers to contacts within the monitron monitor.	
FS	-	Flow switch	
XSS	-	Special safety switch (in the TSR-II system this barrier interlock switches)	
HCV	-	Manually operated but remotely located valve.	
FCV	-	Remotely controlled flow valve.	
FT	-	Flow transmitter	
FC	-	Flow control component	
TE	-	Temperature element (sensor)	TM - Temperature modifier (transducer)

1. ORNL CF-57-2-1 "Instrumentation Flow Plan Symbols and Recommended Drawings."

XA1101	XA1103	XA1105	XA1107
LEVEL TANK HIGH WATER	REACTOR WATER FLOW <200 gpm	REACTOR OUTLET T ABOVE 180°F	REACTOR WATER Δ T ABOVE 35°F

XA1102	XA1104	XA1106	XA1108
LEVEL TANK LOW WATER	EMERGENCY PUMP FLOW <10 gpm	REACTOR INLET TEMP OUT OF RANGE	MAIN PUMP SUCTION < 80 psi

XA 1201	XA 1203	XA 1205	XA 1207
INSTR. AIR PRESSURE < 60 psi	WATER ACTIVITY HIGH	PNEUMATIC CONTROL NOT AT CONSOLE	LOUVERS NOT OPEN

XA 1202	XA 1204	XA 1206	XA 1208
WATER RESISTIVITY LOW	TEST BLOCK REMOVED	DEMINERALIZER PUMP SUCTION BELOW ATM. PRES.	MAIN PUMP SUCTION < 90 psi

XA1301

XA1303

XA1305

XA1307

LOG N PERIOD < 5 sec	FAST SCRAM	SHIM DRIVE REVERSED	STOP

XA1302

XA1304

XA1306

XA1308

FISSION CHAMBER PERIOD < 5 sec	POWER LEVEL ABOVE 1.2 N_f	SAFETY TROUBLE	DOOR OR HOIST SEAL BROKEN

XA1501

XA1503

XA1505

XA1507

FISSION CHAMBER ABOVE 10^5 cps	ONE MONITRON OUT OF SERVICE	MONITRON SCRAM 10 mr/hr	TARDI ON

XA1502

XA1504

XA1506

XA1508

REGULATING ROD AT UPPER LIMIT	MONITRON WARNING 10 mr/hr	HOIST POWER OFF	WATER FLOW BLOCKOUT

COOLING SYSTEM ANNUNCIATORS

- XA-1101 LEVEL TANK HIGH WATER: Annunciator warns only.
 "LS 110-1" liquid level switch on level tank in pump house, opens to actuate annunciator. Overflow of tank is imminent.
- XA-1102 LEVEL TANK LOW WATER: Annunciator warns only.
 "LS 110-4" liquid level switch on level tank in pump house, opens to actuate annunciator. Starvation of fill and pressure pump may be imminent.
- XA-1103 REACTOR WATER FLOW < 200 GPM: Reactor scrammed or annunciator warns only. "FS 102" flow switch in control cubicle opens when water flow in main supply line at "FE 102" drops below 200 GPM. This de-energizes relay K42. Contact K42A actuates annunciator. Contact K42C initiates a slow scram unless "HS26" (water flow blackout switch) is in "blockout" position; and contact K42B simultaneously opens "withdraw shim rod" circuit, but is bypassed by HS26H if water flow blackout switch is in blackout position.
- XA-1104 EMERGENCY PUMP FLOW < 10 GPM: Annunciator warns only or shim drive reversed (inserting).
 "FS 103" flow switch in control cubicle opens when water flow in emergency pump line at "FT 103" drops below 10 GPM. This de-energizes relay K41. Contact K41A actuates annunciator. Contact K41B closes completing circuit to the "reverse" relay when water flow blackout switch is in "normal" position only. No reverse takes place if HS26, water-flow blackout switch, is in blackout position.
- XA-1105 REACTOR OUTLET T. ABOVE 180°F: Shim drive reversed (inserting).
 "TS 111" temperature switch closes on signal from "TE 111" in reactor outlet water line, through TM 111, energizing K43 relay. K43A actuates the annunciator. K43B closes, completing circuit to the "reverse" relay, K56.
- XA-1106 REACTOR INLET TEMPERATURE OUT OF RANGE: Annunciator warns only.
 TS 108A opens when water temperature entering reactor exceeds 128°F. TS 108B acts as a check on accuracy of TS108A.

- XA-1107 REACTOR WATER AT ABOVE 35°F: Annunciator warns only.
T_dS 102 in control room cubicle, opens when signal from T_dM 102 in control room cubicle indicates a water temperature rise through the reactor of over 35°F.
- XA-1108 MAIN PUMP SUCTION < 80 PSI: Reactor scrammed or annunciator warns only.
KI38C opens to actuate annunciator. KI39B opens to produce a slow ~~scram~~ unless water flow blackout switch "HS26" is in blackout position. KI38A closes to energize PEV-107 in control cubicle which signals HCV 107 to fully close emergency pump bypass valve. All action is in response to "PS 107" signal which de-energizes KI38 when main pump inlet pressure drops below 80 psi and re-energizes KI38 when pressure has reached 100 psi.
- XA-1201 INSTRUMENT AIR PRESSURE < 60 PSI: Annunciator warns only.
"PS 112" in pump house opens to actuate annunciator when instrument air pressure drops below 50 psig.
- XA-1202 WATER RESISTIVITY LOW: Annunciator warns only.
"A_cS-128" in pump house opens to actuate annunciator. TB4-C in pump house, removed, would also produce this annunciator warning.
- XA-1203 WATER ACTIVITY HIGH: Annunciator warns only.
"RS-129" in control cubicle opens to actuate annunciator. Iodine 135 gamma ray count rate has exceeded the limit indicating fission product release to the coolant.
- XA-1204 TEST BLOCK REMOVED: Annunciator warns only.
One or more of 11 test blocks in control cubicle when removed break circuit to actuate annunciator.
- XA-1205 PNEUMATIC CONTROL NOT AT CONSOLE: Annunciator warns only.
"HS-101" or "HS-102" on control console, when switched to "Pump H" position, actuate annunciator. "HS 101" selects control over louver opening while "HS 102" selects control over main pump bypass.

- XA-1206   DEMINERALIZER PUMP SUCTION BELOW ATMOSPHERIC PRESSURE: Annunciator warns only.
"PS 127" in pump house opens to actuate annunciator.
TE⁴-C in pump house, removed, would also produce this annunciator warning.
- XA-1207   LOUVERS NOT OPEN: Annunciator warns only.
"2S-117A" at louvers opens when heat exchanger louvers move out of full open position. Annunciator is actuated and position indicator light "full open" goes out.
- XA-1208   MAIN PUMP SUCTION < 90 PSI: Annunciator warns only.
"PS 109" in pump house opens when main pump inlet pressure drops below 90 psi.

NUCLEAR AND REACTOR CONTROL ANNUNCIATORS

- XA-1301 LOG N PERIOD: Shim drive reversed (inserting).
Relay K39 energized by RS-4BA on Log N period recorder. K39B closes to insert shim rods.
- XA-1302 FISSION CHAMBER PERIOD < 5 SEC: Shim drive reversed (inserting).
Relay K38 energized by RS-12BA on fission chamber count rate period recorder. K38B closes to insert shim rods.
- XA-1303 FAST SCRAM: Reactor scrambled.
Relay RT6 in safety trouble monitor drops out when $\tau = 3$ sec or $P > 1.5 N_p$ on signal from sigma amplifier. Sigma bus signal has turned off magnet current inside magnet amplifiers.
- XA-1304 POWER LEVEL ABOVE $1.2 N_p$: Shim drive reversed (inserting).
Relay RT14 in safety trouble monitor drops out when $P > 1.2 N_p$, energizing annunciator. RT12 relay in safety trouble monitor should be energized to reverse shim rod motor.
- XA-1305 SHIM DRIVE REVERSED: Shim drive reversed (inserting).
Relay K56 is energized opening K56-D which actuates annunciator. Insertion occurs at fast insert rate when K47B closes. One of eight conditions must be responsible, as follows:
- (1) Log N, $\tau \leq 5$ sec. Relay K39 energized by RS4BA on Log N period recorder. K39B closes, energizing K56. K56B energizes K47.
  - (2) Fission chamber count-rate period ≤ 5 sec. Relay K38 energized by RS12BA on recorder. K38B closes; energizing K56.
  - (3) Recorder water outlet $T \geq 180^\circ\text{F}$. Relay K43 energized by TS111 on pneumatic switch panel. K43B closes, energizing K56.
  - (4) Two or more safety channels inoperative. RT11-1 contacts in safety trouble monitor close. XS11A closes, energizing K56.
  - (5) Power level $> 1.2 N_p$. RT12-3 contacts in ST monitor close. XS11D closes, energizing K56.

(6) Log N negative period slower than - 100 sec and Log N level 10x servo demand. Relay K83 energized by Log N period recorder switch, RS4BD, and Log N level switch. K83B energizes K56.

(7) Emergency pump flow less than 10 gpm and HS26 (water-flow blockout) in "normal." K41B and HS26 F, both closed, energize K56.

(8) Log N level $> 10^{-4} N_f$ and backdoor interlock bypass permit "on" or HS26 (water-flow blockout) in "blockout." K40B and either K56 or HS26E close to energize K56.

XA-1306

SAFETY TROUBLE: Annunciator warns only.

Relay RT5 in safety trouble monitor drops out when abnormal condition occurs in safety trouble monitor. Does not affect reactor operation.

XA-1307

STOP: Reactor scrammed.

HS-28C (ramp) or HS-28B (pool) or HS-28A (gate) have been actuated or HS-22A has not been in "reset" position.

XA-1308

DOOR OR HOIST SEAL BROKEN: Reactor scrammed.

K11 relay re-energized by back door opened XSS22C switch or ramp door opened XSS22C switch or ramp chain removed XSS22B switch unless reactor is in pool in which case all three are bypassed. Relay also is de-energized if HS22A has not been reset or if pool hoist HS24A or ramp hoist HS24B key switch is turned on. (Relay K137 and K105 are de-energized by XSS2B and HS24A and B respectively.)

XA-1501

FISSION CHAMBER ABOVE 10^5 CPS: Annunciator warns only.

Relay K37 is energized and contact K37A is broken to actuate annunciator when fission chamber count rate reaches 10^5 cps and fission chamber is not in "auto" mode. RS12AC on Log CR meter recorder closes to energize K37. Annunciator warns only. Does not affect reactor operation.

XA-1502

REGULATING ROD AT UPPER LIMIT: Annunciator warns only.

Servo is on (K68 relay energized) and regulating rod is in upper limit. K73 relay drops out when ZS13A limit switch on regulating rod drive opens on upper limit.

- XA-1503 ONE MONITRON OUT OF SERVICE: Annunciator warns only.
One room monitron out of service. XS21E contacts in monitron monitor open.
- XA-1504 MONITRON WARNING 10 mr/hr: Annunciator warns only.
One monitron dose rate greater than 10 mr/hr. XS21F contacts in monitron monitor open.
- XA-1505 MONITRON SCRAM 10 mr/hr: Reactor scrambled.
Rear door and front door monitron dose rates greater than 10 mr/hr each. XS21D contacts in monitron monitor open. XS21C contacts in monitron, monitron open to de-energize the slow scram relay K139.
- XA-1506 HOIST POWER OFF: Annunciator warns only.
Hoist power not available for changeover. K109 relay de-energized. This power may be connected or disconnected by switches at the pool hoist control station and in the switch room of Bldg. 7702
- XA-1507 TARDI ON: Reactor scrambled.
K46C opens to actuate annunciator. If reactor has been operating, K46D opens to de-energize K139 (scram) relay. K46 relay is energized when HS23 (TARDI) switch is placed in "inhibit" Shim drive will not run down automatically (K46 open). Shim drive may be withdrawn (K46B closes) so long as all seats are made (K82B closed) and key switch (HS22A) is in "off" position.
- XA-1508 WATER FLOW BLOCKOUT: Annunciator warns only.
HS26, water flow blockout switch is in "blockout" position. HS26D opens to actuate annunciator. HS26A closes to energize "run permit" relay (K22) even when main pump is not on. HS26K opens to stop main pump, but only if power level is below approximately 500 v. ($\log N \text{ level} < 10^{-4} N_p$). HS26J opens to make restart of main pump impossible so long as any shim rod is out of its seat. HS26E closes

to energize shim rod reverse relay (K56) is log N level is above $10^{-4} N_f$. HS26F opens to de-energize shim rod reverse relay if emergency pump flow is below 10 gpm. (If flow is above 10 gpm, these contacts have no effect since K41B has already opened this circuit.) HS26G closes to keep K139 energized and prevent a slow scram from occurring even though main pump flow is below 200 gpm.

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