NINE MILE POINT UNIT 2

DOCKET NO. 50-410

COMPARISON OF ELECTRICAL DESIGN OF THE WYE PATTERN GLOBE VALVE ACTUATOR WITH THE BALL VALVE, HANFORD 2 and RIVER BEND DESIGN

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I. SUMMARY

This report provides a description of the Nine Mile Point Unit 2 electrical portions of the Wye-Pattern Main Steam Isolation Valves (MSIVs). The electrical design of the system is essentially the standard General Electric design. The Protection System philosophy is unchanged.

Section II provides a comparison of the Wye-Pattern valves and the ball valves, while Section III provides a comparison of NMP2 and River Bend, and Section IV contains a comparison of NMP2 and Hanford (WPPSS Unit #2). Section V includes diagrams and a schematic to assist in the review of the proposed changes.

II. ELECTRICAL AND ACTUATOR COMPARISON OF WYE-PATTERN & BALL VALVE DESIGN

1. Initiation Signals and Power Supplies

a. The Protection System signals that provide the trips for the Wye-Pattern MSIVs are the same signals utilized in the ball valve design. The power supplies are the same non-Class 1E 120VAC supplied by UPS3A (Trip System A) and UPS3B (Trip System B). The design utilizes the same electrical protection assemblies (EPA), distribution panels and the same cables.

The fail safe de-energize to operate logic function, used for the ball valves, remains with the Wye-Pattern valves.

b. There has been no change in the routing of the field cables. Physical separation of the four channels of power supply remains the same. However, for the Wye-Pattern MSIV, the channel separation is maintained up to the junction box adjacent to the MSIV where the field cables end. This was addressed in the proposed changes to the Unit 2 FSAR Section 8.3.1 submitted on March 11, 1987.

c. Attached for your information are selected General Electric elementary wiring diagrams of the trip logic and a Stone and Webster One Line Diagram of the power distribution system.

2. Controls and Logic

a. Each Wye-Pattern MSIV contains two electrically operated solenoid valves, a three way pilot solenoid valve with two coils and a test solenoid valve. The two pilot solenoid coils on a MSIV is fed from a different trip system. Since the two (2) trip pilot solenoid coils are supplied power from two (2) different trip systems and both trip systems must de-energize to operate, a transfer and isolation scheme is not required on the Wye-Pattern valves. This change and the standard General Electric control scheme have reduced the number of field cables. See expanded description in Section IV, comparison of NMP2 and Hanford.

The original ball valve design had 5 solenoids (2-trip solenoids, 2-latch solenoid valves, 1-test solenoid) and pump motors for each MSIV as electrical load. Two trip solenoids and 2-latch solenoid valves were fed from two different channels of power supply (Class 1E). The test solenoid was fed from 120V Class 1E bus; the pump motor was fed from 600V non-Class 1E bus. The hydraulic MSIV ball valve equipment is being deleted along with the local relay control panel.

b. Each Wye-Pattern inboard and outboard MSIV is controlled by a three position maintained selector switch (close-auto-test) and a pushbutton switch for testing each valve. These switches are located on the operating benchboard in the PGCC similar to the ball valve design.

The following table provides a descriptive comparison of the MSIV operation:

	Wye-Pattern	Modified Ball
Opening		
	Opening the MSIV is accomplished by energizing either pilot solenoid coil A or B on the 3 way solenoid valve. This directs air to the 4 way control valve which directs the air to the cylinder piston to open the MSIV.	Opening the MSIV is accomplished by energizing both solenoid valves, and forcing the valve open using hydraulic fluid. Solenoid valves remain closed as long as MSIV is open. Hydraulic pressure is maintained by hydraulic pump and Jockey pump.
	a) One 3 way solenoid valve with dual coils (A & B) is needed to open an MSIV. Only one pilot solenoid coil is energized to open the MSIV.	a) Both solenoid valves needed to open MSIV. Solenoid valves are connected in parallel.
	b) One out of two taken twice NS4 trip inputs shall not be present to open MSIV (A or C + B or D)	b) Same
Closing		
	Closing the MSIV is accomplished by de-energized both coils A & B of the pilot solenoid valve.	Closing the MSIV is accomplished by de-energized any solenoid valve A or B, thus bleeding fluid from the piston and closing the MSIV.
	a) Both coils of solenoid valve must be de-energize to close MSIV.	a) One solenoid valve de-energization causes MSIV to close.
	b) One out of two taken twice NS4 inputs close MSIV. (A or C + B or D)	b) Same
	c) A single power failure of either UPS3A or UPS3B will not close the MSIV.	c) A single power failure will close the MSIV.

Testing

Testing of the MSIV is accomplished by energizing solenoid "C" (test solenoid) on the second 3 way solenoid valve. This solenoid valve directs control air to the pilot air operated control valve and shifts it to allow the air cylinder piston to exhaust at a controlled rate through an adjustable orifice. Both green/red lights of MSIV will light, thus indicating valve is in intermediate position.	Testing of MSIV is accomplished by de-energizing testing solenoid valve, which will initiate slow closing of MSIV by bleeding fluid. When MSIV is 90% open, the test circuit is automatically disconnected. Thus solenoid valve will energize and MSIV will open again. Test completed indication light will light when valve 90% open. Also both green/red lights of MSIV will light, thus indicating the valve is in intermediate position.
a) Test solenoid is normally de-energized. Energize to perform test.	a) Test solenoid normally energized, de-energize to perform test.
b) Test solenoid is Class 1E	b) Test solenoid is non-Class 1E
c) Operator action required to return MSIV to full open position of the test. Limit switches are not wired in the test circuit.	c) MSIV return to full open position of the test automatically. Limit switches wired in test circuit to automatically disconnect test circuit.

c. The trip logic for the Wye-Pattern valves remains the same as the ball valves, one out of two taken twice. Isolated interlocks between trip system logic have been maintained to meet the requirements of NUREG 0737, Section II.E.4.2, Position 4 (Containment Isolation Dependability) as it pertains to resetting containment isolation valves. The NUREG requirement is still maintained. All logic and controls are located in the control room.

d. With the Wye-Pattern valves, there are some minor hardware changes in the logic, as delineated in (c) above. The relays used by General Electric are qualified MDR (Potter & Brumfield) and Agastat. The ball valve, local J10 Gould relays are not being used and are being removed.

Ball valve reed switches that were used in the control circuits have been deleted from the Wye-Pattern valve circuitry.

3. MSIV Limit Switch Inputs to the Reactor Trip System

The MSIV limit switch inputs to the Reactor Trip System logic remains unchanged from the ball valve design. However, there are two changes associated with the MSIV limit switches.

a. The trip setpoint for the ball valves was 94% open, while the trip setpoint for the Wye-Pattern valves has been changed to 92% open. This change is reflected in the Technical Specifications.

b. White status lights have been added to the two (2) Reactor Trip System vertical panels to assist the operating staff during surveillance testing of the MSIVs. The white status lights will be extinguished when the MSIV limit switch reaches the trip setpoint during the performance of the test described in paragraph 2.B above.

4. Actuators

a. The design change to Wye-Pattern MSIVs necessitated the addition of an air supply system for operation of the Wye-Pattern valves. The air system includes the use of individual air accumulators of sufficient reserve to close each valve one time. The ball valve relied on stored spring force alone to close the valve.

The Wye-Pattern valves utilize a pneumatic cylinder to provide the necessary force to compress the MSIV springs. The hydraulic portion of the actuator consists of hydraulic cylinders and flow control valves. This system is the hydraulic speed control system. There are no electrical controls involved for the hydraulic speed control system.

The ball valves used a hydraulic actuator and opened the valve by hydraulic pressure. Solenoids and hydraulic pumps were used to maintain pressure against the piston to keep the MSIV open. When the fluid is bled from the piston, the valve closes.

Attached is a pneumatic and hydraulic control circuit schematic of the Wye-Pattern valves.

b. The four inboard MSIV pilot valves and MSIV actuator accumulators are supplied with nitrogen gas from the instrument nitrogen system (GSN). The four outboard MSIV pilot valves and MSIV actuator accumulators are supplied from the reactor building instrument air system (IAS).

5.. Monitoring

a. Red and green status lights located on the operating benchboard indicates that the valve is open or closed based on input from the MSIV limit switches. Additionally, white status lights for each MSIV solenoid valve energized are also located on the same benchboard. These monitoring lights remain the same as the ball valves. Monitoring lights have been deleted for associated ball valve specific controls that have been deleted.

b. MSIV limit switch inputs to the Emergency Response Facility (ERF) remains unchanged as are the limit switch inputs to the General Electric transient analysis recording computer (GETARS). Off normal status inputs also remain unchanged with the Wye-Pattern valves.

c. Process computer and annunciator inputs remain unchanged except for ball valve specific hydraulic controls that have been deleted.

III. ELECTRICAL COMPARISON OF NMP2 AND RIVER BEND STATION (RBS)

1. Initiation Signals and Power Supplies

a. The Protection System signals for NMP2 remain unchanged and are the standard General Electric design. The initiation signals are essentially the same as RBS.

b. The electrical power distribution system of NMP2 with Wye-Pattern MSIV is very similar to the power distribution system of RBS Wye-Pattern MSIV. The RBS M-G sets used to supply power to the MSIVs are non-Class 1E, and are normally fed from plant non-Class 1E buses. These are connectible to the emergency buses except during a LOCA. The NMP2 UPS used to supply power to the Wye-Pattern MSIVs are non-Class 1E AC and DC buses.

The alternate power supply at the output of the RBS M-G set is from the plant non-Class 1E bus through step down and regulating transformers. The alternate power supply at the output of the NMP2.UPS is also from the plant non-Class 1E buses through step down and regulating transformers which are connectible to the emergency buses, except during a LOCA.

RBS considers these power sources non essential because the system is of fail-safe design. NMP2 also considers these power sources non essential because the system is of fail safe design.

RBS uses two series electrical protection assemblies (EPA) to protect the logic circuits from overvoltage, undervoltage and under frequency conditions. The EPAs are Class 1E. NMP2 also uses two series Class 1E EPAs, and provides the same protective functions. Both RBS and NMP2 designs treat this distribution system beyond EPAs as Class 1E. Both designs have used 4 channels. The cables associated with each channel are uniquely identified in both designs. In both cases, the channel separation is maintained up to the junction box adjacent to the MSIVs. RBS uses two high integrity, alternating current motor-generator sets as the normal power source for the MSIV power supply. NMP2 uses two uninterruptible power supplies (UPS) as the normal power source for the Wye-Pattern MSIVs.

2. <u>Controls and Logic</u>

The control of the NMP2 MSIV Wye-Pattern valve is similar to the operation of the River Bend MSIV Wye-Pattern valves. Protection System logic for isolation are developed in the same fashion as to cause a trip of the MSIV valves. The manual, auto, and test hardware, operator control functions and monitoring devices located in PGCC are also similar. In both plants, each MSIV valve is operated by two normally energized solenoids to keep the MSIV valve open under normal plant operation. Failure of one channel will de-energize only one solenoid keeping the MSIV valve open, failure of two channels of power will de-energize both solenoids closing the MSIV valve. Both plants are also equipped with a MSIV test solenoid valve, which can be manually operated from the control room.

3. <u>Actuators</u>

The NMP2 MSIV is a 26" Rockwell valve while the River Bend MSIV is a 24" Atwood Morill Valve.

A comparison of the NMP2 Wye-Pattern valve and the River Bend Wye-Pattern valve reveals no functional differences. This is because both valves were designed to meet General Electric's specification requirements for MSIVs (i.e., closure times). Both valves utilize loaded springs and/or pneumatic pressure to close the valve. A comparison of air systems shows that both plants use an accumulator to supply the air quantity required for pneumatic closure of the valve if the normal air supply is unavailable. NMP2 and River Bend protect this air reserve with a check valve which isolates each accumulator from a loss of upstream pressure. NMP2 and River Bend use filters in the air piping to meet General Electric's air quality requirements. Both plants use stainless steel piping downstream of the air filters to maintain air quality to the MSIVs.

- The air supply systems to the MSIV actuator accumulators on NMP2 is similar to that found on the RBS with the following exceptions.

NMP2 supplies the four inboard MSIV pilot valves and MSIV actuator accumulators with nitrogen gas from the instrument nitrogen system (GSN). The four NMP2 outboard MSIV pilot valves and MSIV actuator accumulators are supplied with air from the reactor building instrument system (IAS). On River Bend both inboard and outboard main steam isolation valves and MSIV actuator accumulator are supplied from the instrument air system (IAS).

4. Monitoring

Monitoring for NMP2 was described in detail in Section II.5 above. NMP2 monitoring devices are essentially the same as RBS with the following exceptions.

- NMP2 has MSIV status inputs to the off normal status display, while RBS does not.
- NMP2 and RBS both have indicator lights to monitor both MSIV pilot solenoid valves energized.
- RBS utilizes ammeters to monitor pilot solenoid valve current, while NMP2 does not utilize this feature.

IV. ELECTRICAL COMPARISON OF NMP2 AND HANFORD (WPPSS UNIT #2)

a. General Description of Control Logic

The NMP2 Nuclear Steam Supply Shutoff System (NS4) functions are initiated when sensor signals, monitoring key parameters, exceed setpoints and de-energize relay control circuits, which initiate closure of the isolation valves. The control circuitry is arranged in dual systems so that a trip must occur in both trip systems to cause a closure of a main steam isolation valve. Each trip system contains two independent tripping sensors from each measured variable, only one of which is required to activate a trip system. The trip systems designated A and B are subdivided into logic channels A through D. MSIV logic channels A and C are in trip system A and logic channels B and D are in trip system B.

For MSIVs, a tripped sensor provides open inputs to a logic function which causes the sensor relay in the associated trip channel to de-energize. The open contacts from the de-energized sensor relay are connected in logic functions which cause a trip relay to de-energize. Output from the de-energized trip relays are combined in one-out-of-two-twice logic which generates closure signals for the main steam isolation valves. The Hanford MSIV trip logic functions the same as the NMP2 logic described above.

Outputs from the main steam isolation valve limit switches are connected into the Reactor Protection System (RPS) circuits for both Hanford and NMP2, which is the standard General Electric design.

b. MSIV Trip Variables

There are seven monitored parameters that make up a trip logic channel for MSIV isolation. A comparison of these for NMP2 and Hanford follows:

	NMP2	HANFORD
Reactor Low-Low Wtr Lvl		
Instrument make -	Rosemount XMTR & Trip	Barton XMTR/Switch
Setpoint -	17.8" (-5 to 205 scale) (Level 1)	-50" (-150 to 60 scale (Level 2)
STM Ln HI Flow		
Instrument make -	Rosemount XMTR & Trip	Barton Press Switch
Setpoint -	103 psid (prelim)	105.5 psid (prelim)
Main STM Line Low Press		
Instrument make -	Rosemount XMTR & Trip	Barksdale Press Switch
Setpoint -	766 psig	831 psig
Main STM Line HI Rad		
Instrument make -	GE	GE
Setpoint -	118%	118%
Main Cond. Low Vac		
Instrument make -	Rosemount XMTR & Trip	Supplied by AE
Setpoint -	8.5" vac.	By AE
Turbine Bldg HI Temp		
Instrument make -	Riley (part of main stm line area HI temp)	Riley
Main Stm Ln Area HI Temp		
Instrument make -	Riley	Riley

c. Reset Function

To reset the relay circuits and re-energize the pilot solenoids following a main steam line isolation (i.e., a trip in both trip system A and B which is subsequently cleared), the manual switches for all of the main steam line isolation valves must be operated to the closed position. The switches in the reset circuit which energize relays whose contacts are in parallel with the seal-in contacts of the trip relays are then actuated. To reset the relay circuits following a spurious trip of either system A or system B (not both) after the sensor(s) is reset, only the isolation reset switches must be actuated. This reset operation is the same for both NMP2 and Hanford.

d. Test Function

Manual switches for the MSIVs are located on panel H13-P602. There are two switches associated with each valve. One is a 3 position maintained-contact switch for valve control and one momentary switch for testing the valve. After the main control switches are placed in the closed position and the trip logic reset the valves may be opened by placing the control switch in auto. To test the valve, assume the valve is open. The control switch is then placed in the test position. This provides a permissive for the momentary test switch to energize the test solenoid. Pushing the test switch and holding it, energizes the test solenoid and the valve proceeds to close. When the test switch is released the valve reopens. This operation is the same for both NMP2 and Hanford. Hanford differs only in that the main control switch is a different type GE 3 position maintained-contact switch mounted on panel H13-P601 and the test switch is a different type pushbutton switch also mounted on panel H13-P601.

e. Monitoring and Annunciation

NMP2 has two white indicating lights for each valve (one on each pilot solenoid) to indicate solenoid energized. These lights are mounted on panel H13-P602. Also mounted on panel H13-P602 is a red and green indicating light to indicate valve open or closed. Hanford has the same light configuration except the red and green lights are mounted on panel H13-P601 and the white lights are mounted on backrow panels H13-P622 and H13-P623.

NMP2 monitors valve-open, valve-closed and valve initiation (valve solenoid A energization) by the GETARS system whereas Hanford monitors control switch in auto position by their TDAS system and "logic ready for valve opening" (both pilot solenoids inboard and outboard valves) to an isolation valve status and display system.

Both NMP2 and Hanford annunciate the following parameters: Reactor vessel low water level, main condenser low vacuum bypass, main steam line high flow, main steam line low pressure, main condenser low vacuum. Also, main steam line high flow is sent to the computer for both plants.

NMP2 annunciates main steam line isolation system-out-of-service by monitoring the Rosemount trip units while Hanford monitors MSIV Div. 1 and Div. 2 trip channel de-energization.

NMP2 monitors trip unit in CAL or gross failure with status lights that have an integral test switch. Hanford does not have trip units and therefore does not monitor this parameter.

NMP2 annunciates inboard and outboard reactor isolation system-out-of-service whereas Hanford annunciates NSSS Div. 1 and Div. 2 out-of-service.

V. <u>ATTACHMENTS</u>

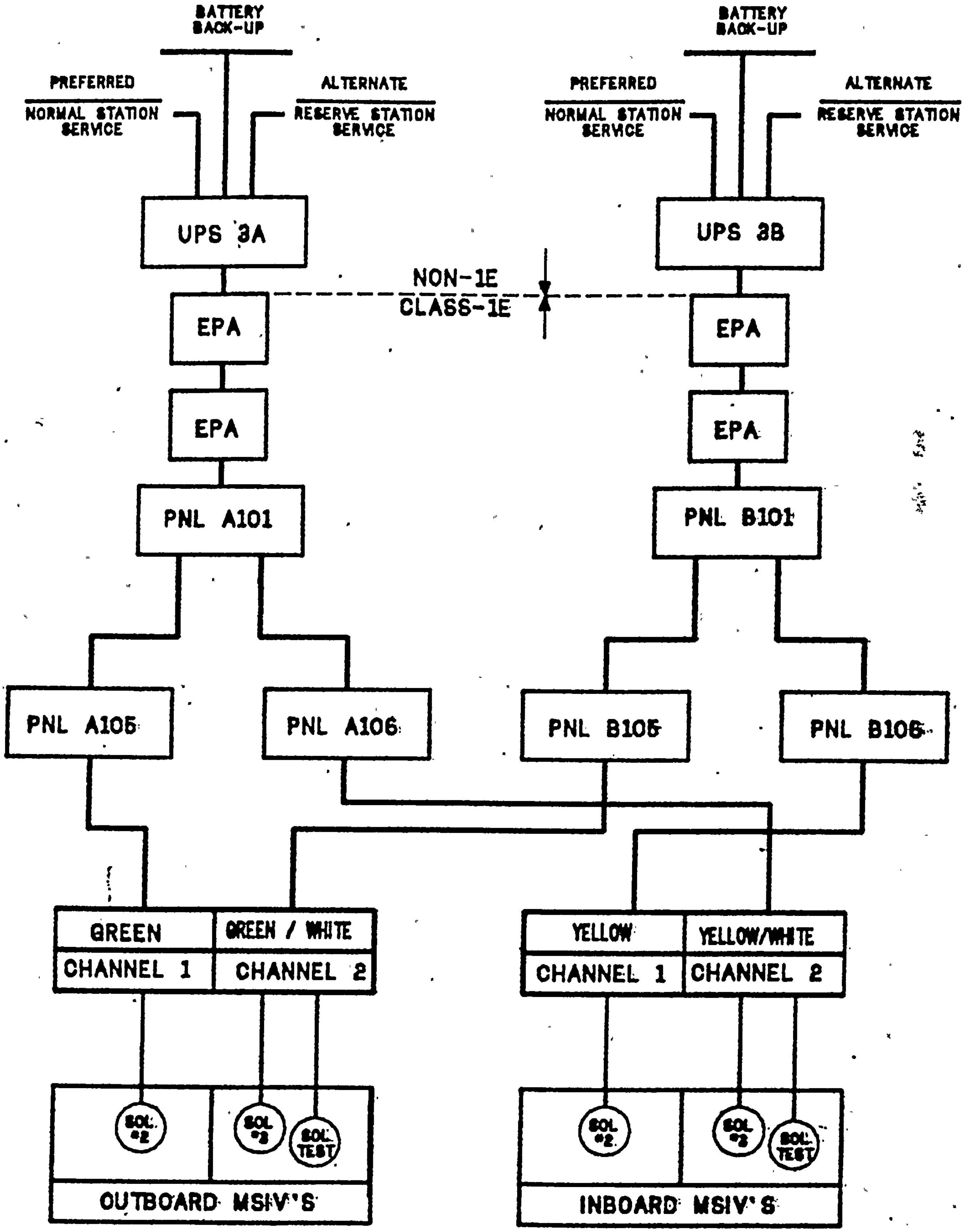
a. NMP2 One Line Diagram Normal 600V and 120VAC EE-M01D-6

b. Pneumatic Control Circuits Schematic of MSIV Actuator

c. Proposed NMP2 Nuclear Steam Supply Shutoff System (NS4) Elementary Wiring Diagrams of Logic and Controls (four diagrams)

d. Simplified MSIV Power Supply One Line Diagram

MSIV POWER SUPPLY



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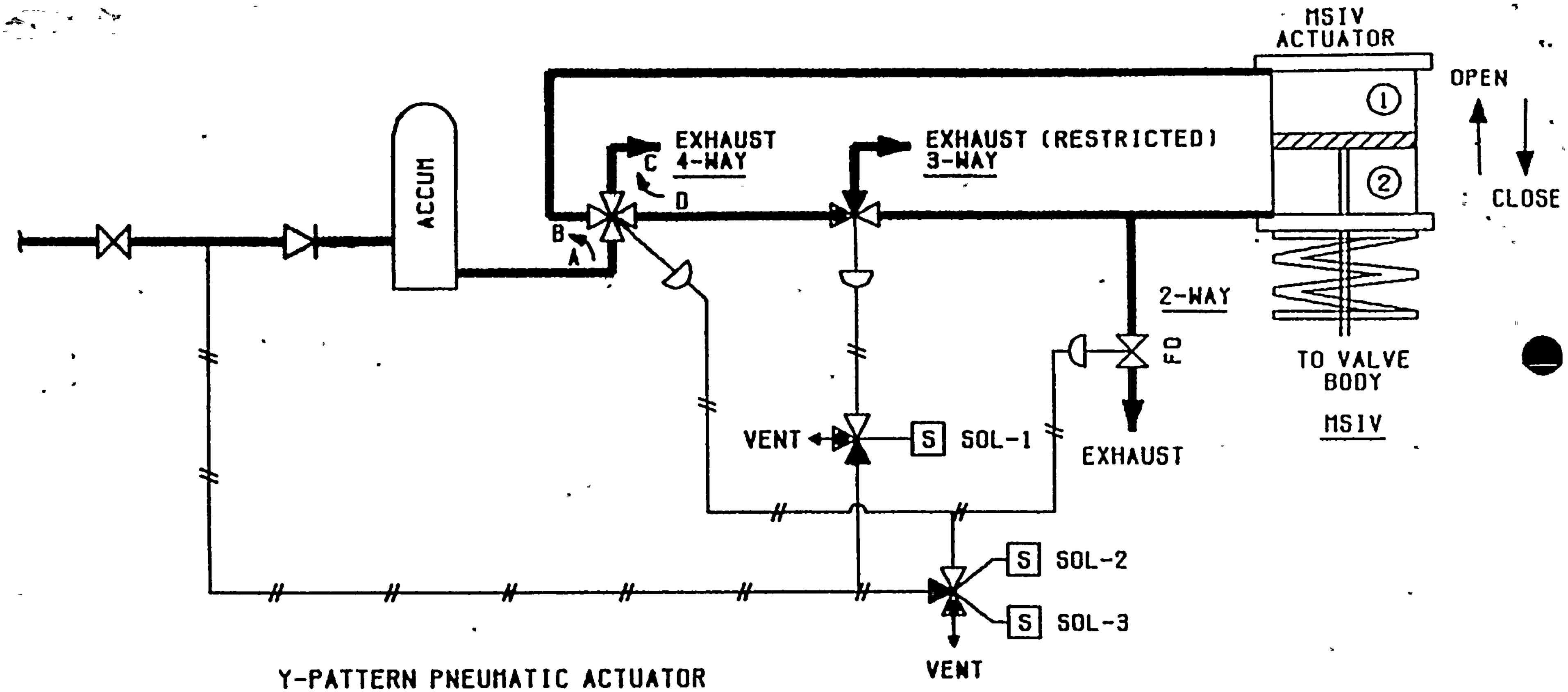


Y-PATTERN PNEUMATIC ACTUATOR
(SHOWN IN DE-ENERGIZED/CLOSED CONDITION)

TABLE OF OPERATIONS

MSIV OPEN

(A) SOL-1 IS DE-ENERGIZED-
3-WAY VLV ACTUATED

(B) SOL-2 OR SOL-3 ENERGIZED

a) 2-WAY VLV CLOSES
b) 4-WAY VLV ACTUATED & AIRFLOW REDIRECTED (A→D/B→C) WHICH ALLOWS VOLUME (1) TO EXHAUST VIA B-C & VOLUME (2) TO PRESSURE VIA A-D & 3-WAY VLV.;MSIV OPENS.

RPS TEST

(A) MSIV IS OPEN

(B) SOL-1 IS ENERGIZED

(C) 3-WAY VLV GOES TO EXHAUST POSITION & ALLOWS VOLUME (2) TO VENT THROUGH RESTRICTED EXHAUST.

(D) MSIV SLOW CLOSES UNTIL OPERATORS DE-ENERGIZE SOL-1. AFTER WHICH MSIV RETURNS TO FULL OPEN.

FAST CLOSE (EMERGENCY)

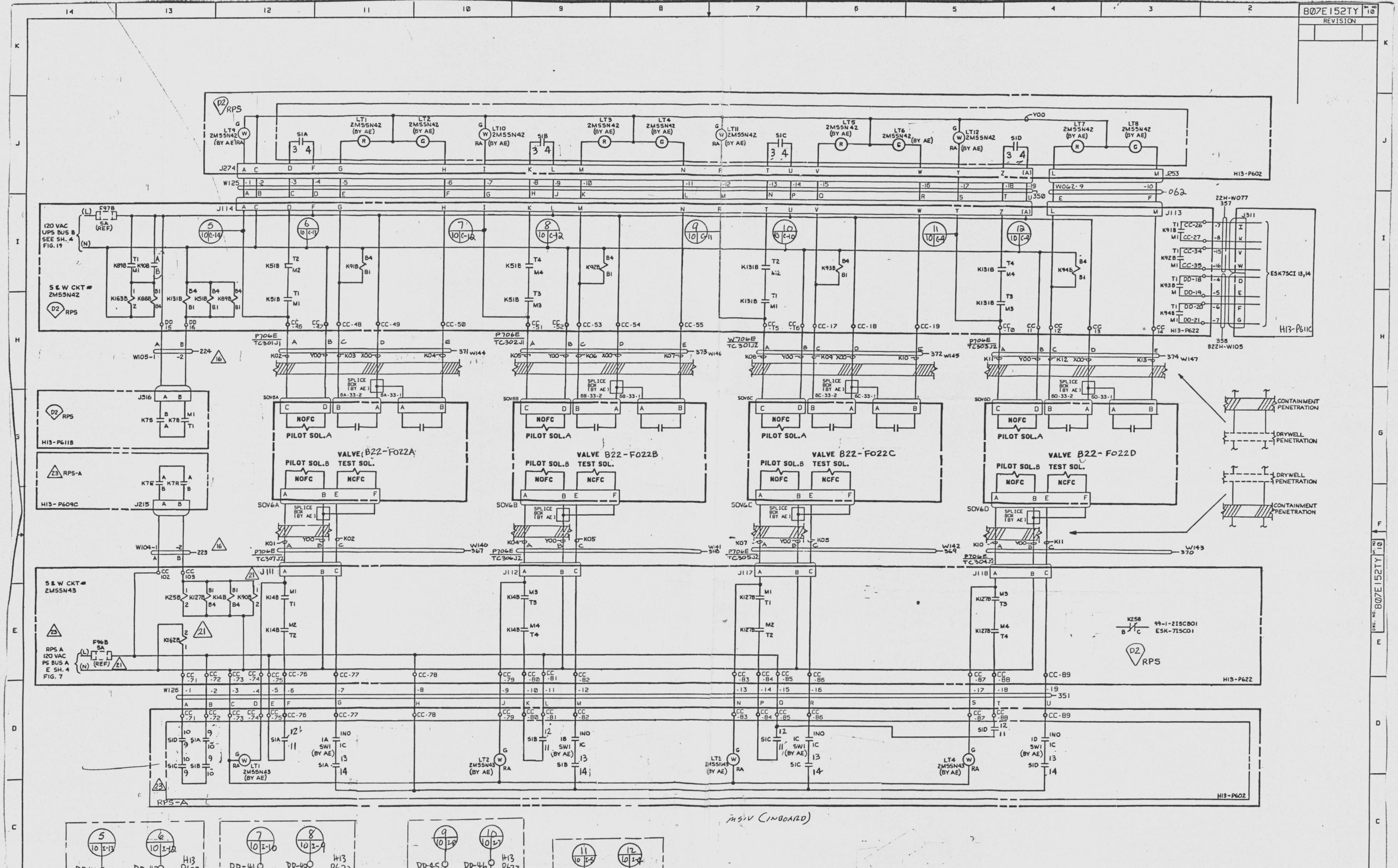
(A) SOL-2 & 3 ARE DE-ENERGIZED.

(B) 4-WAY VLV GOES TO NORMAL. (AIRFLOW IS A - B/D - C)

(C) 2-WAY VLV OPENS.

(D) VOLUME (2) VENTS THROUGH 2-WAY VALVE & 4-WAY VLV (D-C).

(E) VOLUME (1) IS PRESSURIZED VIA 4-WAY VLV (A-B) WHICH FORCES MSIV CLOSED ALONG WITH ACTUATOR SPRING'S.



SWITCH NO.	CONN. PIN NO. FROM	TO	% VLV OPEN (0 10 90 92 100)	USE INBOARD	USE OUTBOARD
33-1				----	----
	B	A		VLV CLOSED IND	VLV CLOSED IND
33-1	H	G		ESK 10SX507	ESK 10SX506
				----	----
33-5				----	----
	C	D		RPS REF 6	RPS REF 6
33-6				----	----
	C	D		RPS REF 6	RPS REF 6
33-3	D	C		----	----
				----	----
33-3				----	----
	F	E		ESK 7SCI 13, 14	ESK 7SCI 02, 03
33-2	D	C		ESK-7MS523	ESK-7MS522
	B	A		VLV OPEN IND	VLV OPEN IND
33-2	H	G		ESK 10SX507	ESK 10SX506
				----	----
33-7	C	D		MSIV LEAK. REF 28	----
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SIGNATURES | DWG NO. 807E152TY | GENERAL ELECTRIC | C-190-DP

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LTR 4/7/87
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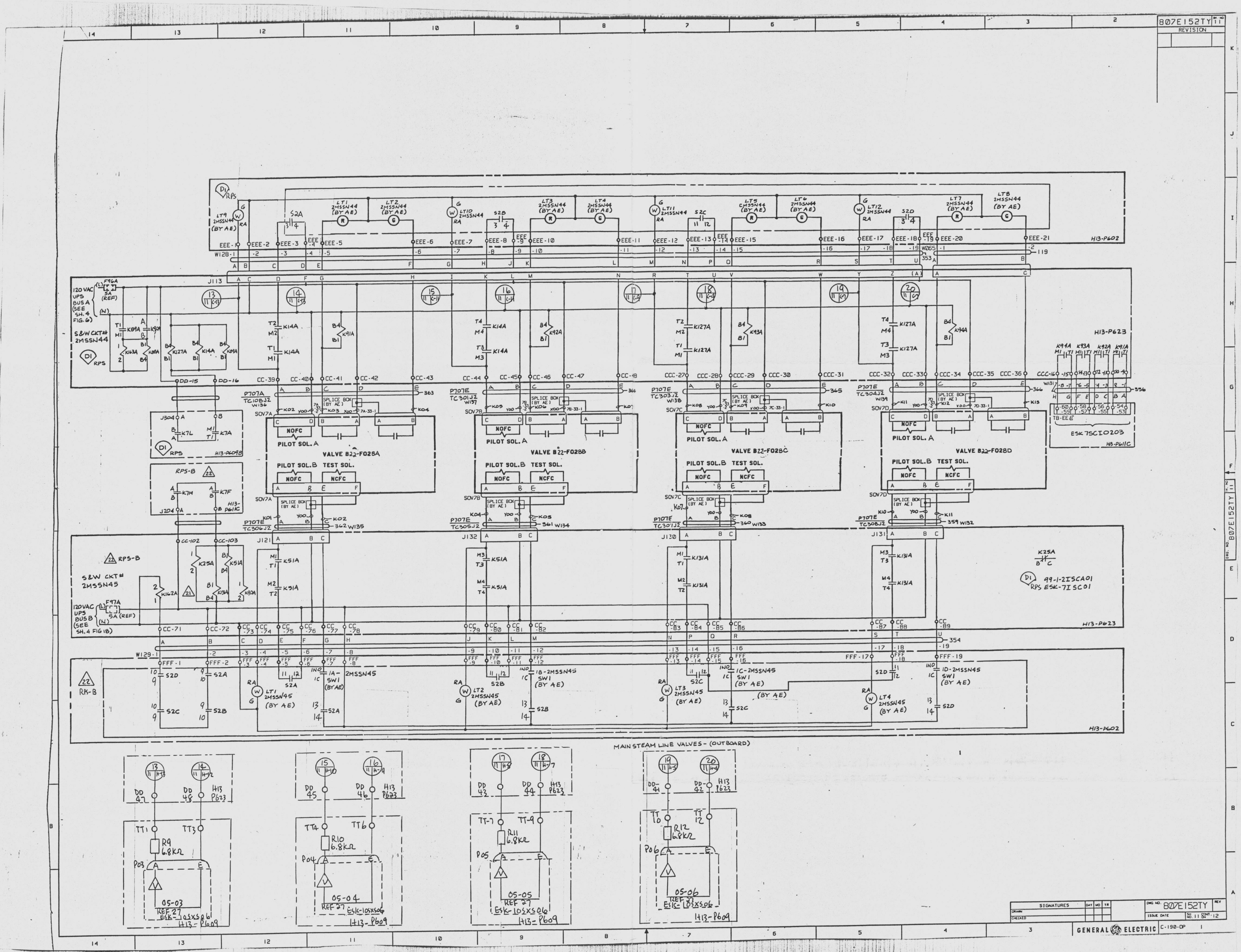

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