07-415-91

REFERENCES:

EE-3A	0007.222-001-010 (807E160TY SH6)
EE-3AG	0007.222-001-020 (15-484-0263-3)
EE-3AX	0007.222-001-021 (15-577-0729-3)
EE-3DU	0007.227-001-012 (944E995 SH11)
EE-3SD	0007.511-414-473 (3088-E1-1)
EE-3WA	0007.511-414-477 (3088-E5-1)
EE-11FG	0007.520-001-348 (793E765 SH9)
ESK-10SXS05	0007.520-001-355 (793E765 SH16)
FSK-6-1A	0007.520-001-394 (793E769 SH2)
PID-6A	0007.520-001-395 (793E769 SH3)
PID-6B	0007.520-001-396 (793E769 SH4)
PGCC 7.520-5008	0007.520-001-397 (793E769 SH5)
PGCC 7.520-5022	0007.520-001-398 (793E769 SH6)
0007.159-451-315 (PW-25-1)	0007.520-001-399 (793E769 SH7)
0007.159-451-710 (CD-25-101)	0007.520-001-400 (793E769 SH8)
0007.222-001-002 (732E120AF SH1)	0007.520-001-401 (793E769 SH9)
0007.222-001-003 (807E160TY SH1)	0007.520-001-408 (793E771 SH2)
0007.222-001-004 (807E160TY SH2)	0007.520-001-410 (793E771 SH4)
0007.222-001-005 (807E160TY SH3)	
0007.222-001-007 (807E160TY SH5)	

NOTES:

1. **PLANT IMPACT: LOSS OF CONTROL OF LV10A WHICH WILL CAUSE REACTOR WATER LEVEL TRANSIENTS.**

2. ALL INSTRUMENT AND EQUIPMENT NUMBERS ARE TO BE PREFIXED WITH '2FWS' EXCEPT WHERE A DIFFERENT PREFIX IS SHOWN.

3. LOOP ACTION: FY1633 (C33-K633-1) (TERM. 5) RECEIVES A ONE-ELEMENT OF THREE ELEMENT REACTOR VESSEL CONTROL SIGNAL (SEE TL2ISC-039) AND SUMS IT WITH A SETPOINT SIGNAL FROM:

   A) HIC1600 (C33-R600) (TERM. 7) VIA DL1653 (C33-K653) (TERM. 7) WHEN REACTOR WATER LEVEL '3' SETPOINT IS NOT ACTUATED. (SEE TL2ISC-039) OR,

   B) DL1653 (C33-K653) (TERM. 7) VIA (C33A-R1) AND (C33A-R2) WHEN REACTOR WATER LEVEL '3' SETPOINT IS ACTUATED (RELAY C33A-K10).

   C) DL1653 (C33-K653) PROVIDES FOR BUMPLESS TRANSFER BETWEEN THESE SETPOINT SIGNALS.

   FY1633 (C33-K633-1) (TERM. 9) PROVIDES AN ERROR SIGNAL TO LC1633 (C33-K633) (TERM. 5). LC1633 (C33-K633) (TERM. 8) PROVIDES A DYNAMICALLY COMPENSATED TOTAL FEEDWATER CONTROL SIGNAL TO:

   A) FYX1010A (C33-K625A) (TERM. 5).
   B) FYX1010B (C33-K625B) (TERM. 5) (SEE TL2FWS-088 FOR 2FWS-LV10B CONTROL LOOP CONTINUATION).
   C) FYX1010C (C33-K625C) (TERM. 5) (SEE TL2FWS-089 2FWS-LV10C CONTROL LOOP CONTINUATION).
   D) ENGINEERING TEST AND INFORMATION SYSTEM, CHANNEL 15-17.

   THIS OCCURS WHEN HIC1600 (C33-R600) VIA HC6341 (C33-K634-1) AND FY6342 (C33-K634-2) IS IN THE AUTO MODE. THE TOTAL FEEDWATER CONTROL SIGNAL IS MANUALLY CONTROLLED AT HIC1600 (C33-R600) VIA HC6341 (C33-K634-1) AND FY6342 (C33-K634-2) WHEN HIC1600 (C33-R600) IS IN THE MANUAL MODE. HC6341 (C33-K634-1) PROVIDES FOR BUMPLESS TRANSFER BETWEEN AUTO AND MANUAL MODES. LC1633 (C33-K633) (TERM. 13) ALSO PROVIDES AN INPUT ERROR SIGNAL AND AN OUTPUT SIGNAL TO HIC1600 (C33-R600) (TERM. 5) FOR INDICATION.

   FYX1010A (C33-625A) PROVIDES A DYNAMICALLY COMPENSATED VALVE 'A' CONTROL SIGNAL TO:

   A) HIC1010A (C33-R601A) FOR INPUT INDICATION.
   B) HIC1010A (C33-R601A) (TERM. 12) VIA DL1010A (C33-K637A) (TERM. 11) FOR OUTPUT INDICATION.
   C) MOD-100 (LV10A CONTROLLER) VIA MV/I1639A (C33-K639A) (TERMS. 6 AND 7), VOLTAGE DIVIDER (C33A-R15A), LIM1661A (C33-K661A) (INPUT TERM. 5, OUTPUT TERM. 9), AND DL1010A (C33-K637A) (TERM. 8) TO MODULATE LV10A.
   D) DL1010A (C33-K637A) (TERM. 11) FOR TRACKING ITSELF.

   THIS OCCURS WHEN:

   A) HIC1010A (C33-R601A) IS IN THE AUTO MODE.
   B) THE CAVITATION INTERLOCK FLOW LIMITER LOGIC IS NOT ACTUATED (LIM1640A (C33-K640A) AND RELAY C33-K31A).
   C) THE VALVE 'A' CONTROL SIGNAL FAILURE LOGIC IS NOT ACTUATED (RELAY LOS) (SEE SHEET 2).
   D) THE RRCS FEEDWATER RUN BACK LOGIC IS NOT ACTUATED (RELAYS C33A-K21, C33A-K28 AND C33-K31A).

   THE VALVE 'A' CONTROL SIGNAL IS LIMITED BY HIGH LIMITER LIM1640A (C33-K640A) (OUTPUT TERM. 9 AND INPUT TERM. 5) WHEN THE CAVITATION INTERLOCK FLOW LIMITER LOGIC IS INITIATED (RELAY C33-K31A, CONTACTS T2 AND M2).

   HIC1010A (C33-R601A) PROVIDES AN ADJUSTABLE BIAS SIGNAL (TERM. 7) WHICH IS INTEGRATED WITH THE VALVE 'A' CONTROL SIGNAL AT DL1010A (C33-K637A).

   THE VALVE 'A' CONTROL SIGNAL IS LIMITED BY LOW LIMITER LIM1661A (C33-K661A) (OUTPUT TERM. 9 AND INPUT TERM. 5)

   THE VALVE 'A' CONTROL SIGNAL IS MANUALLY CONTROLLED AT HIC1010A (C33-R601A) (TERMS. 8, 9, AND 10) VIA HC1010A (C33-K638A) (TERMS. 5, 6, AND 12), AND FYY1010A (C33-K638A-1) WHEN HIC1010A (C33-R601A) IS IN THE MANUAL MODE.

   HC1010A (C33-K638A) AND DL1010A (C33-K637A) PROVIDE FOR A BUMPLESS TRANSFER BETWEEN AUTO AND MANUAL MODES.

   THE VALVE 'A' CONTROL CIRCUIT IS AUTOMATICALLY TRANSFERRED TO MANUAL AND LV10A DRIVEN CLOSED VIA FYY1010A (C33-K638A1), DL1010A (C33-K637A), AND HC1010A (C33-K638A) WHEN THE RRCS FEEDWATER RUN BACK LOGIC IS INITIATED (RELAYS C33A-K23), C33A-K28, AND C33-K31A).

   THE RVDT MONITORS LV10A POSITION AND VIA THE RVDT AMPLIFIER, ISOLATOR 12, AND I/E10A PROVIDES POSITION SIGNALS TO Z110A AND THE TRANSIENT ANALYSIS RECORDING SYSTEM.

   ISOLATOR 13 RECEIVES A 4 TO 20mA SIGNAL (POSITION COMMAND SIGNAL) FROM MV/I1639A (C33-K639A) VIA CABLE CNX007, AND IF SWITCH S4 IS IN THE 'REMOTE' POSITION, PROVIDES AN INPUT TO POSITION COMMAND METER M2 AND TERMINAL 7 OF THE MOD-100. THE MOD-100 COMPARES THIS SIGNAL TO THE POSTION FEEDBACK SIGNAL AT TERMINAL 1 FROM THE RVDT AND RVDT AMPLIFIER VIA THE POSITION FEEDBACK METER M3. THE MOD-100 SENDS DIRECTION AND SPEED SIGNALS VIA ISOLATOR I1, WHICH CONVERTS THE 4 TO 20 mA SIGNAL TO A 0 TO 10V SIGNAL, TO THE VARIABLE FREQUENCY CONTROLLER AND THE FREQUENCY COMMAND METER M1. IF SWITCH S1 IS IN THE 'AUTO' POSITION. THE VARIABLE FREQUENCY CONTROLLER PROVIDES AN OUTPUT PROPORTIONAL TO THE INPUT FREQUENCY COMMAND SIGNAL, AND THE RESULTING OUTPUT VOLTAGE IS CHANGED SO THAT THE VOLTAGE AND FREQUENCY FOLLOW THE V/HZ CURVE SET UP IN THE CONTROLLER'S SOFTWARE.

   DURING LOCAL OPERATION, THE INPUT IS VIA JACKS J1 AND J2. VALVE SPEED CAN ALSO BE CONTROLLED IN MANUAL OPERATION BY R10, SPEED CONTROL POTENTIOMETER.

4. ONE ELEMENT OR THREE ELEMENT REACTOR VESSEL LEVEL CONTROL SUMMED STEAM FLOW, FEEDWATER FLOW AND WATER SIGNAL (SEE TL2ISC-039).

5. (C33A-K10) ENERGIZES WHEN 2ISC-LSX-1626 (SEE TL2ISC-039) ACTUATES ON REACTOR LOW LEVEL 3 TO:

   A) CLOSE CONTACT 1B1-1B2 INSTANTANEOUSLY TO APPLY A NEW SETPOINT SIGNAL TO DL1653 (C33-K653).

   B) CLOSE CONTACT 1AT1-1AT2 AFTER A MINIMUM TIME DELAY TO APPLY A NEW REFERENCE SIGNAL TO DL1635 (C33-K653).

   C) OPEN CONTACT 1BT1-1BT2 AFTER A MINIMUM TIME DELAY TO DISABLE THE SETPOINT SIGNAL FROM HIC1600 (C33-R600) TO DL1653 (C33-K653).

6. CONTACT CLOSES (C33A-K21 DE-ENERGIZED) WHEN RRCS FEEDWATER RUN BACK LOGIC IS NOT INITITATED TO ENABLE THE AUTOMATIC CONTROL SIGNAL FROM HIC1010A (C33-R601A) TO BE PROVIDED TO FYY1010A (C33-K638A1), HC1010A (C33-K638A), AND DL1010A (C33-K637A).

7. CONTACT OPENS (C33A-K28 ENERGIZED) WHEN RRCS FEEDWATER RUN BACK LOGIC HAS BEEN INITIATED FOR A MINIMUM PERIOD OF TIME TO TRANSFER FYY1010A (C33-K638A1) TO MANUAL MODE.

8. (C33A-K23) ENERGIZES WHEN RRCS FEEDWATER RUN BACK LOGIC HAS BEEN INITIATED FOR A MINIMUM PERIOD OF TIME TO:

   A) OPEN CONTACT M2, R2 TO DISABLE MANUAL OPEN SIGNAL FROM HIC1010A (C33-R601A) TO HC1010A (C33-K638A) TO PREVENT MANUALLY OPENING LV10A.

   B) CLOSE CONTACT M1, T1 TO DECREASE HC1010A (C33-K638A) OUTPUT TO CLOSE LV10A.

9. TO FYX1010B (C33-K6257B) (SEE TL2FWS-088) AND FYX1010C (C33-K637C) (SEE TL2FWS-089) FOR LOOP CONTINUATION.

10. CONTACTS T2, M2 CLOSE AND M2, R2 OPEN (C33A-K31A ENERGIZED) WHEN FEEDWATER PUMP 'A' SUCTION PRESSURE IS LOW AND THE TURBINE IS TRIPPED TO INITIATE THE CAVITATION INTERLOCK FLOW LIMITER LOGIC. (SEE TL2CNM-099).

11. 120VAC FROM 2VBS-PNLB101 CKT. #15.

12. POWER FROM 2NHS-MCC003 CUB. 7C VIA TRANSFORMER XD-10A.

13. VENDOR IDENTIFICATIONS ARE SHOWN IN PARENTHESIS.

14. MOD-100, TERMINAL 5, IS THE 'CLOSE' ENABLE OUTPUT WHICH ENERGIZES RELAY CRC IF SWITCH S1 IS IN THE 'AUTO' POSITION, AND EITHER LIMIT SWITCH 1 OR TORQUE SWITCH 17 IS CLOSED. THE CRC RELAY ENABLES VALVE MOVEMENT VIA THE VARIABLE FREQUENCY CONTROLLER.

15. MOD-100, TERMINAL F, IS THE 'OPEN' ENABLE OUTPUT WHICH ENERGIZES RELAY CRO IF SWITCH S1 IS IN THE 'AUTO' POSITION, AND EITHER LIMIT SWITCH 5 OR TORQUE SWITCH 18 IS CLOSED. THE CRO RELAY ENABLES VALVE MOVEMENT VIA THE VARIABLE FREQUENCY CONTROLLER.

16. MOD-100, TERMINAL 6, IS THE LOSS OF SIGNAL OUPUT WHICH DE-ENERGIZES RELAY LOS. UPON LOSS OF SIGNAL THE MOD-100 'LOCKS-UP' AND THE VARIABLE FREQUENCY CONTROLLER ALSO 'LOCKS-UP' HOLDING THE VALVE IN THE PRESENT POSITION. ANNUNCIATOR 603142 AND AN AMBER LIGHT ARE ENERGIZED IN THE MAIN CONTROL ROOM TO ALARM THAT THERE IS A 'FEEDWATER SYSTEM CONTROL SIGNAL FAILURE'.

17. MOD-100, TERMINAL E, IS THE TRIP OUTPUT WHICH DE-ENERGIZES RELAY TRIP-B WHEN THE MOD-100 SENSES THAT THE COMMAND AND FEEDBACK SIGNAL IS OUT OF THE DEAD BAND FOR LONGER THAN 5 SECONDS. THE 5 SECONDS IS SOFTWARE CONTHOLLED. TIME DELAY RELAY 'TD' IS DE-ENERGIZED, AND IF THE SIGNAL IS OUT OF NULL LONGER THAN 45 SECONDS, ANNUNCIATOR 603143 'FD WTR CONT V 10A/10B/10C ACTUATOR TROUBLE' WILL ALARM.

18. ACTUATOR MOTOR THERMAL OVERLOAD. VALVE 'LOCKS-UP' WHEN CONTACT OPENS.

19. CONTACT CLOSED WHEN VALVE IS CLOSED, TO BYPASS THE 'TD' CONTACTS WHEN COMMAND AND FEEDBACK SIGNAL ARE OUT OF NULL.

20. SWITCH S1 SHOWN IN AUTO.

21. SWITCH S4 SHOWN IN REMOTE.

PLANT USE ONLY-
PRINT APPROVAL

I&C	SSS	CSO
APPR. / DATE	APPR. / DATE	APPR. / DATE

NUCLEAR NON-SAFETY RELATED

MK	DATE	BY	MF	DESCRIPTION	CK	APP
1	3-13-91	CEM	M	ORIGINAL ISSUE		

NIAGARA MOHAWK
NINE MILE POINT
NUCLEAR STATION - UNIT 2
SCRIBA, N.Y.

TEST LOOP DIAGRAM
MAIN FEEDWATER CONTROL VALVE
2FWS-LV10A

SCALE: NONE
DRAWING NO: TL2FWS-087 SH.1 OF 5