

EVALUATION OF THE EFFECTS OF  
HIGH ENERGY LINE BREAKS ON  
CONTROL SYSTEMS

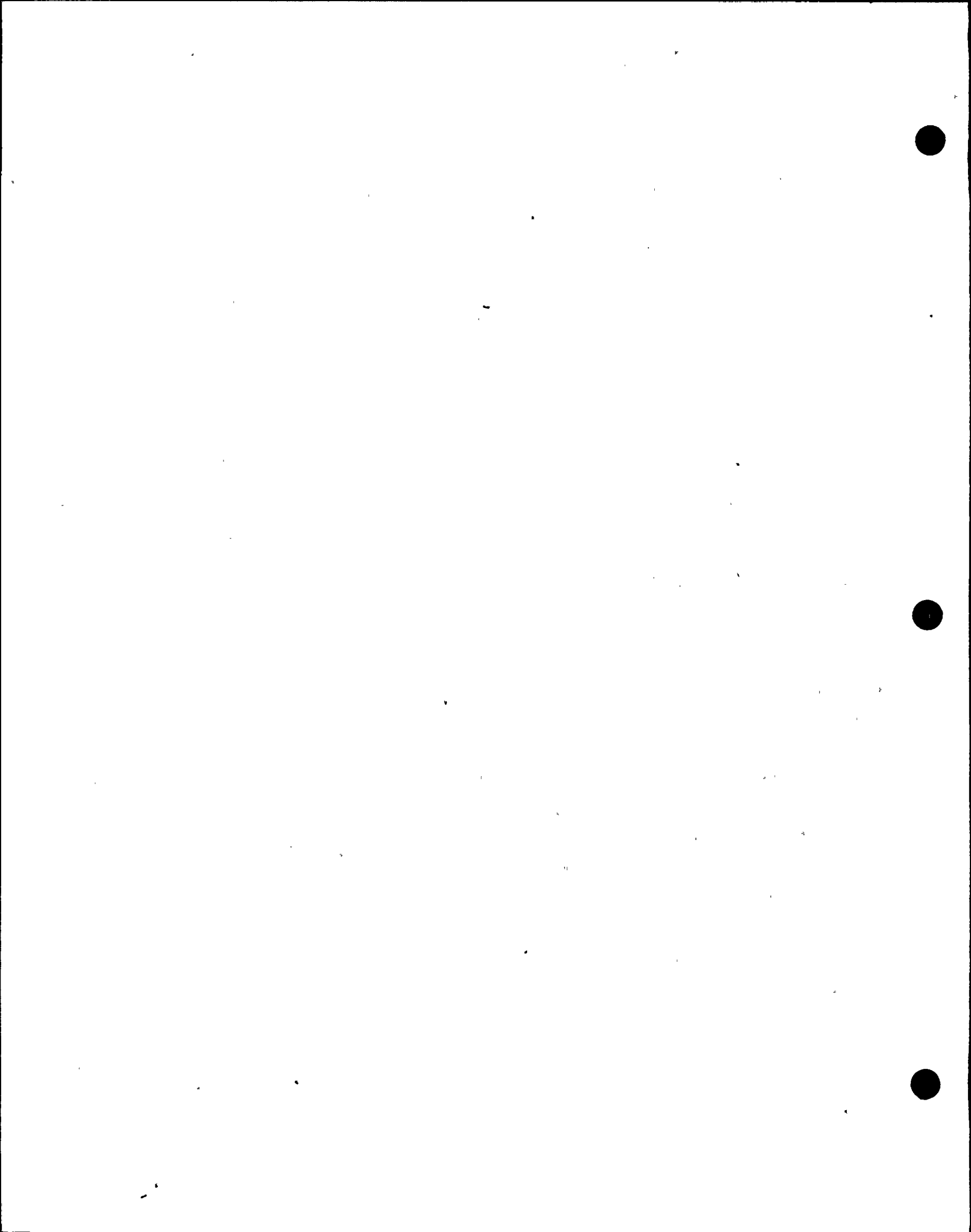
APPENDIX E

FAILURE MODES AND EFFECTS ANALYSIS

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Common High Energy Line Break: <u>4" Reactor Water Clean up Outside</u> <u>Containment 4" DBB-122, 4" EBC-101</u> <u>4" EBC-103, 4" EBC-104</u>		CSID: <u>0160-013-001</u>		Job No. <u>0160-013-1671</u>	Prepared by: <u>H. Byler</u>	Date: <u>6/6/83</u>	Rev. <u>0</u>
Control System Affected: <u>Reactor Water Clean Up Control System</u>		CD: <u>D-1</u>		Checked by: <u>[Signature]</u>	Date: <u>6/16/83</u>	Approved by: <u>[Signature]</u>	Date: <u>9/7/83</u>
Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance		
1. Filter demineralizer inlet temperature/TE-1N007	Off	Temperature signal to T1SH-1N008 disabled; failure to close RWCU outboard isolation valve on high temperature.	Containment isolation valves will be closed by the Leak Detection System.	NONE	None. Following this HELB, the RWCU containment isolation valves HV 1F001 and 1F004 are closed by the safety grade single failure proof Leak Detection System on high differential flow.		
2. Reactor water cleanup recirculation pump low flow/FDIS-1N025	Off	Pump suction pressure switch contacts remain open on low flow, failing to trip pumps.	Pumps will be tripped by signal from limit switches on containment isolation valves upon closure following a RWCU HELB.	Low pump suction pressure signal disabled.	Not required following a RWCU HELB.		
3. Flow control of HV-1F033/PSL-1N013 and PSH-1N014	Off	Failure of PSL-1N013 and PSH-1N014 causes HV-1F033 to fail as is.	HV-1F033 can be manually controlled.	Failure of auto control of RWCU flow to the liquid radwaste collection and surge tanks.	Not required following a RWCU HELB.		
4. Reactor bottom head flow/FT-1N037	Off	Loss of flow signal from pressure line below core plate.	NONE	NONE	Not required following a RWCU HELB.		
5. Pump cooling water high pump temperature shutoff/T1SH-1N002A, B	Closed	Contacts remain closed RWCU pumps cannot be tripped due to high cooling water temperature.	Pumps will trip on closure of RWCU containment isolation valves following the HELB.	NONE	Not required following a RWCU HELB.		



Common High Energy Line Break:	<u>4" Reactor Water Clean up Outside Containment 4" DBB-122, 4" EBC-101</u> <u>4" EBC-103, 4" EBC-104</u>	CSID: <u>0160-013-001</u>	Job No. <u>0160-013-1671</u>
Control System Affected:	<u>Traversing Incore Probe</u>	CD: <u>D-1</u>	Prepared by: <u>R. Ghahshvar</u>
			Date: <u>6/6/83</u>
			Checked by: <u>M. Bellard</u>
			Approved by: <u>WKL</u>
			Rev. <u>0</u>
			Date: <u>6/6/83</u>
			Date: <u>6/2/83</u>

Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
1. Guide tube valve assembly/ J004A J004B J004C J004D J004E	As is	Shear valve is inoperative. Ball valve is de-energized.	Due to the action of the fail safe spring, the ball valve will tend to close.	Operator will retract the TIP detector from it's core position to the normal chamber shield position, the ball valve automatically closes and maintains primary containment integrity.  Unable to perform TIP operation.  Unable to obtain core flux readings through TIP probe.	None. TIP is not required after RWCU HELB.
2. Purge Valve/J009	Closed	Inability to control purge valve.	Dry air & N <sub>2</sub> piping is such that a mixture of dry air & N <sub>2</sub> can still be supplied to the drive and indexing mechanisms.	A mixture of dry air and nitrogen will be supplied and safety-relief valves will actuate to reduce over-pressurization.	None. TIP is not required after RWCU HELB.

Common High Energy Line Break: LOCA or Main Steam Line Break  
Inside Containment

Control System Affected: Recirculation Flow Control System

Job No. 0160-013-1671  
 Prepared by: H. A. Jones  
 Date: 6/6/83  
 Checked by: M. Belland  
 Approved by: W. J. L.

CSID: 0160-013-001  
 CD: D-2

Rev. 2  
 Date: 6/6/83  
 Date: 6/7/83

Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
1. Recirculation pump A, B suction valve position Switch/ZS-14323 A, B	OPENED	The valve open control circuit remains energized.	NONE	Pump suction valve remains open.	NONE:
2. Recirculation pump A, B discharge valve position switch/ZS-14331A, B	OPENED	The valve open control circuits remains energized.	NONE	Pump Discharge Valve remains open.	Any HELB inside containment will result in a turbine trip, which in turn causes main power to be disconnected from both recirculation pumps.
3. Recirculation loop A, B discharge bypass valve position switch/ZS-14332A, B	CLOSED	The valve close circuit remains energized.	NONE	Bypass valves remain closed.	Also the RPT breakers, which are between the variable frequency Generator and the Recirculation Pump motor will trip when reactor low water level or high vessel pressure is sensed.

Common High Energy Line Break: <u>LOCA or Main Steam Line Break</u> <u>Inside Containment</u>		CSID: <u>0160-013-001</u>	Job No. <u>0160-013-1671</u>	Prepared by: <u>M. Bell</u>	Rev. <u>0</u>
Control System Affected: <u>Reactor Feedwater Control System</u>		CD: <u>D-2</u>	Date: <u>6/6/83</u>	Checked by: <u>H. [Signature]</u>	Date: <u>6/6/83</u>
Approved by: <u>[Signature]</u>			Date: <u>6/2/83</u>		
Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
1. Main Steam Line A, B, C, & D Flow/PT-1N003A, B, C, D	Off	Loss of MS Flow caused by instrument line break as a result of a 12" recirculation line break inside containment.	NONE	3-element feedwater control disabled. Manual control is available if needed.	None. Feedwater system is not required following a LOCA inside containment. The Feedwater system operation is terminated following MSIV closure on low reactor level or high RV pressure.
2. Reactor Vessel Water Level/PDT-1N004A, B, C	Off	Loss of A & C or B RV level caused by instrument line break as a result of a 12" core spray or feedwater line break.	A & C are on one common instrument line, B is on a separate line. Failure of only one of the two instrument lines is possible from one HELB.	1-element and 3-element feedwater control disabled. Manual FW control is possible if needed.	None. Feedwater system is not required following a LOCA inside containment. The Feedwater system operation is terminated following MSIV closure on low reactor level or high RV pressure.
3. Reactor Vessel pressure/PT-1N005	Off	Loss pressure indication due to instrument line break resulting from a 12" core spray line break.	NONE	Loss pressure signal to display computer, performance monitoring computer and high pressure alarm.	NONE

Common High Energy Line Break: <u>LOCA or Main Steam Line Break</u> <u>Inside Containment</u>		CSID: <u>0160-013-001</u>	Job No. <u>0160-013-1671</u>	Prepared by: <u>R. Shahbraz</u>	Rev. <u>0</u>
Control System Affected: <u>Traversing Incore Probe</u>		CD: <u>D-2</u>	Date: <u>6-6-83</u>	Checked by: <u>M. Bellard</u>	Date: <u>6/6/83</u>
Date: <u>6/7/83</u>		Approved by: <u>[Signature]</u>	Date: <u>6/7/83</u>		
Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
1. Indexing Mechanisms J002A J002B J002C J002D J002E	As Is	Control circuit for processing signal to the indexing mechanisms is de-energized.	NONE	Loss of Control Capability to successfully process signals to the indexing mechanisms.  TIP probe can still be retracted to it's normal chamber shield position and containment integrity maintained.  Unable to perform proper TIP operation except for 5 tube positions selected prior to HELB.  Unable to obtain core flux readings through TIP probe except for 5 tube positions selected prior to HELB.	None. Not required following a HELB inside containment.



Common High Energy Line Break: Main Steam Line Break or Feedwater Line Break in Turbine Building CSID: 0160-013-001

Control System Affected: Reactor Feedwater Control System CD: D-3

Job No. 0160-013-1671  
 Prepared by: R. Shahbaban  
 Date: 6-6-83 Rev. 0  
 Checked by: M. Bellard Date: 6/6/83  
 Approved by: W.R.C. Date: 6/7/83

Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
1. Feedwater flow transmitters/ FT-1N002A, B, C	Off	Loss of input signals to square rooters K606A, B, C  Loss of process computer input signals 18CA1, A2, A3	One element mode of control (based on water level) is still available for level monitoring.	Loss of 3 element error signal to accurately monitor amount of feedwater pumped into the reactor.  Turbine driven reactor feed pumps (TDRFP) stopped (no steam supply to the turbines after MSIV closure).	Following a Main steam or feedwater line break in the turbine building, the MSIV's close (on high steam flow for MSLB and low RPV level for a FLB). This terminates steam flow to the feed pump turbines stopping feedwater flow into the reactor. Therefore, the failure of the Feedwater Control System is acceptable. The normal sequence of events as described in FSAR Tables 15.6-6 and 15.6-23 for a FLB and MSLB can be accomplished.
2. Pressure transmitter/ PT-1N007	Off	Loss of main turbine steam flow recording.  Loss of computer input signal 20BA (turbine steam flow signal).	NONE	NONE	NONE
3. Reactor Feedwater Pump Turbine (RFPT) Hand Switches (cable)/ HS-12772A, B, C	Off	Loss of manual speed control switch.	NONE	Loss of RFPT hand jack operation.	NONE

Common High Energy Line Break: Main Steam Line Break or Feedwater  
Line Break in Turbine BuildingCSID: 0160-013-001Job No. 0160-013-1671Prepared by: R. ShalabhanDate: 6-6-85 Rev. 0Checked by: M. Belland Date: 6/6/85Approved by: W. J. [Signature] Date: 6/7/85Control System Affected: Reactor Feedwater Control SystemCD: D-3

Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
4. RFPT Hand Switches (cable)/ HS-12730A1, B1, C1	Off	Loss of motor speed changer (power speed)	NONE	Inability to reduce turbine speed manually (see also Item 8)	NONE
5. RFPT Hand Switches (cable)/ HS-12730A2, B2, C2	Off	Loss of motor speed changer (raised speed)	NONE	Inability to increase turbine speed manually (see also Item 8).	NONE
6. RFPT Solenoid Valves/ SV-12772A, B, C	Off	Loss of hydraulic (hand) jack operation.	NONE	NONE	NONE
7. RFPT Electric Automatic Positioner/LZ-12730A, B, C	Off	Loss of electric automatic positioner.	Note that speed regulating hand-switches are also lost (Item 4 & 5)	Inability to automatically control TDRFP's speeds.  TDRFP's speed locks as is. (See Item 8)	NONE
8. RFPT Solenoid Valves/ SV-12746 A, B, C	Off	Turbine trip capability is lost.	NONE	TDRFP will stop because steam cannot be supplied to the turbine.	NONE
9. RFPT Motor speed changer/ HZ-12730A, B, C	Off	Loss of motor speed changer	NONE	Unable to reduce or increase TDRFP's speed. (See Item 8)	NONE
10. Feedwater flow control/ LY-10641	Close	Loss of start-up control valve.	NONE	Unable to control low feedwater flow through the start-up control valve  Unable to use "one- element" control through TDRFP's because TDRFP's are stopped (Item 8) due to MSIV closure.	NONE



Common High Energy Line Break: Main Steam Line Break or Feedwater Line Break in Turbine BuildingCSID: 0160-013-001Job No. 0160-013-1671Prepared by: M. BallouDate: 6/6/83Rev. 0Checked by: Matthew Parkhurst Date: 6/6/83Approved by: W. K. Date: 6/7/83Control System Affected: T/G Control SystemCD: D-3

Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
1. Intermediate steam pressure sensor/PT-10107	Off	Loss of intermediate steam pressure signal (power-level signal) which is normally compared to the generator load to provide turbine over-speed protection.	Mechanical over-speed trip device acts as a backup based on power/load imbalance.	Loss of the electrical over-speed trip.	None, mechanical over-speed system will function if a turbine overspeed condition is produced.
2. Main steam sensor/PT-10101 A, B	Off	Loss of main steam pressure signals.	NONE	Not required for turbine trip.	NONE
3. Electronic pressure transmitter in steam chest/PT-10102	Off	Loss of steam chest pressure signal.	NONE	Not required for turbine trip.	NONE
4. Generator stator cooling water common header pump discharge/PSL-10183B1	Fails High (Closed)	Loss of generator stator cooling water pump control.	Turbine trip signal would be generated on low stator coolant pressure/PSL-10187	Not required for turbine trip.	NONE
5. Condensor vacuum pressure switch/PSH-10502 A1, B1, C1 A2, B2, C2	Fails Low (Closed)	Low-vacuum pressure trip signal disabled.	NONE	Loss of turbine trip signal.	None. The turbine is effectively tripped when the Main Steam isolation valves are automatically closed following this HELB.
6. Bypass valve low vacuum pressure trip/PSH-10504A-C	Off	A loss of vacuum cannot initiate a T/G trip.	NONE	Inactivation of low vacuum pressure trip.	None. The turbine is effectively tripped when the Main Steam isolation valves are automatically closed following this HELB.
7. Trip system pressure switch/PSL-10126A, B	Fail High	Low system pressure trip signal disabled	NONE	Loss of low pressure turbine trip signal.	None. The turbine is effectively tripped when the Main Steam isolation valves are automatically closed following this HELB.

Common High Energy Line Break: <u>Main Steam Line Break or Feedwater Line Break in Turbine Building</u>	CSID: <u>0160-013-001</u>	Job No. <u>0160-013-1671</u> Prepared by: <u>M. Baker</u> Date: <u>6/6/93</u> Rev. <u>0</u> Checked by: <u>M. Baker</u> Date: <u>6/6/93</u> Approved by: <u>M. Baker</u> Date: <u>6/7/93</u>
Control System Affected: <u>T/G Control System</u>	CD: <u>D-3</u>	

Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
8. Thrust bearing wear detector and low bearing oil pressure/PSL-11981 A1, A2, A3, B1, B2, B3	Fail High	Coil does not energize and fails to change state of contacts in EHC logic circuit. Thrust bearing wear and low bearing oil pressure trip disabled.	Logic arrangement (2/3) however, all 3 trains are lost.	Loss of thrust bearing wear and low bearing oil, pressure turbine trip.	None. The turbine is effectively tripped when the Main Steam isolation valves are automatically closed following this HELB.
9. Shaft pump discharge low pressure trip/PSL-11932A-C	Off	Low pressure trip disabled.	NONE	Loss of shaft pump discharge low pressure trip.	None. The turbine is effectively tripped when the Main Steam isolation valves are automatically closed following this HELB.
10. Hydraulic fluid low pressure trip/PSL-10180A-C	Off	Low pressure trip disabled.	NONE	Loss of low pressure turbine trip.	None. The turbine is effectively tripped when the Main Steam isolation valves are automatically closed following this HELB.
11. Main Turbine Vibration detectors/VE-10106A-M	Off	Turbine Supervisory Instrumentation high vibration trip disabled.	NONE	Loss of high turbine vibration trip and recording at VRSH-10106	None. The turbine is effectively tripped when the Main Steam isolation valves are automatically closed following this HELB.
12. Shell expansion detector/XE-10112	Off	Loss of HP shell expansion indication through turbine supervisory instrumentation.	NONE	Not required for turbine trip.	NONE
13. Differential expansion detector/XE-10110	Off	Loss of HP shell differential expansion indication through the turbine supervisory instrumentation.	NONE	Not required for turbine trip.	NONE

Common High Energy Line Break: Main Steam Line Break or Feedwater Line Break in Turbine Building CSID: 0160-013-001 Job No. 0160-013-1671  
 Control System Affected: T/G Control System CD: D-3 Prepared by: M. Ballant  
 Date: 6/6/83 Rev. 9  
 Checked by: Helmut R. Dreyer Date: 6/6/83  
 Approved by: W. J. Date: 6/7/83

Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
14. Eccentricity detector/XE-10116	Off	Loss of indication of vibration or eccentricity of the center of the HP turbine shaft through turbine supervisory instrumentation.	NONE	Not required for turbine trip.	NONE
15. Rotor expansion detector/XE-10114	Off	Loss of LP rotor expansion indication through turbine supervisory instrumentation.	NONE	Not required for turbine trip.	NONE
16. Vibration Phase angle reference detector/XE-10106	Off	Loss of phase angle and amplitude of vibration monitoring through turbine supervisory instrumentation.	NONE	Not required for turbine trip.	NONE
17. Steam Chest Inner Metal Temperature/TE-10102A, B	Off	Loss of signal to computer IZ-638 and turbine metal temperature expansion recorder XRSR-10110.	NONE	Not required for turbine trip.	NONE
18. Cooling Water To/From Generator Windings temperature/TE-10183 A1, B1	Off	Loss of signal to T1SH-10183A, B	NONE	Loss of alarm on high temperature.	NONE
19. LP Turbine A, B, C exhaust hood high temperature generator end trip/TSHH-10119A1, A2, A3, B1, B2, B3, C1, C2, C3	Off	Exhaust hood, high temperature trip disabled.	NONE	Loss of exhaust hood high temperature generator end trip.	None. The turbine is effectively tripped when the Main Steam isolation valves are automatically closed following this HELB.

Common High Energy Line Break: Main Steam Line Break or Feedwater Line Break in Turbine Building CSID: 0160-013-001

Control System Affected: T/G Control System CD: D-3

Job No. 0160-013-1671  
 Prepared by: M. Bell  
 Date: 6/6/83 Rev. D  
 Checked by: W. J. ... Date: 6/6/83  
 Approved by: W. J. ... Date: 6/7/83

Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
20. Moisture separator reheater drain tank high water level/LSH-10127A, B, LSH-10128A, B, LSH-10129A, B	Fail Low	LSH-10127A, B; LSH-10128A, B; and LSH-10129A, B will not energize: - Contacts remain unchanged in logic circuit. Moisture separator high level trip disabled.	NONE	Loss of high moisture separator level trip.	None. The turbine is effectively tripped when the Main Steam isolation valves are automatically closed following this HELB.
21. Generator inlet and outlet conductivity cell/CE-10183A, B	Off	Loss of signal to CIT-10183A, B; loss of indication and alarm to operator.	NONE	Operator would not be able to manually trip the turbine on high conductivity.	NONE
22. T/G shaft speed detector/ES-10120A, B, C	Off	Loss of speed signal feedback trip disabled.	NONE	Loss of speed signal feedback trip.	None. The turbine is effectively tripped when the Main Steam isolation valves are automatically closed following this HELB.
23. Permanent Magnet Generator speed measuring unit/ES-10120	Off	Loss of speed signal to recorder and computer.	NONE	Not required for turbine trip.	NONE
24. Main stop valve position transducer/ZT-10141 A-D	Off	Loss of position feedback to the unit in flow control.	NONE	Not Required.	NONE
25. Control Valve position transducer/ZT-10150 A-D	Off	Loss of position feedback to the unit in flow control.	NONE	Not Required.	NONE
26. Position transducer - intercept valves/ZT-10160A1 - E1	Off	Loss of position feedback to the unit in flow control.	NONE	Not Required.	NONE

Common High Energy Line Break: Main Steam Line Break or Feedwater Line Break in Turbine Building CSID: 0160-013-001

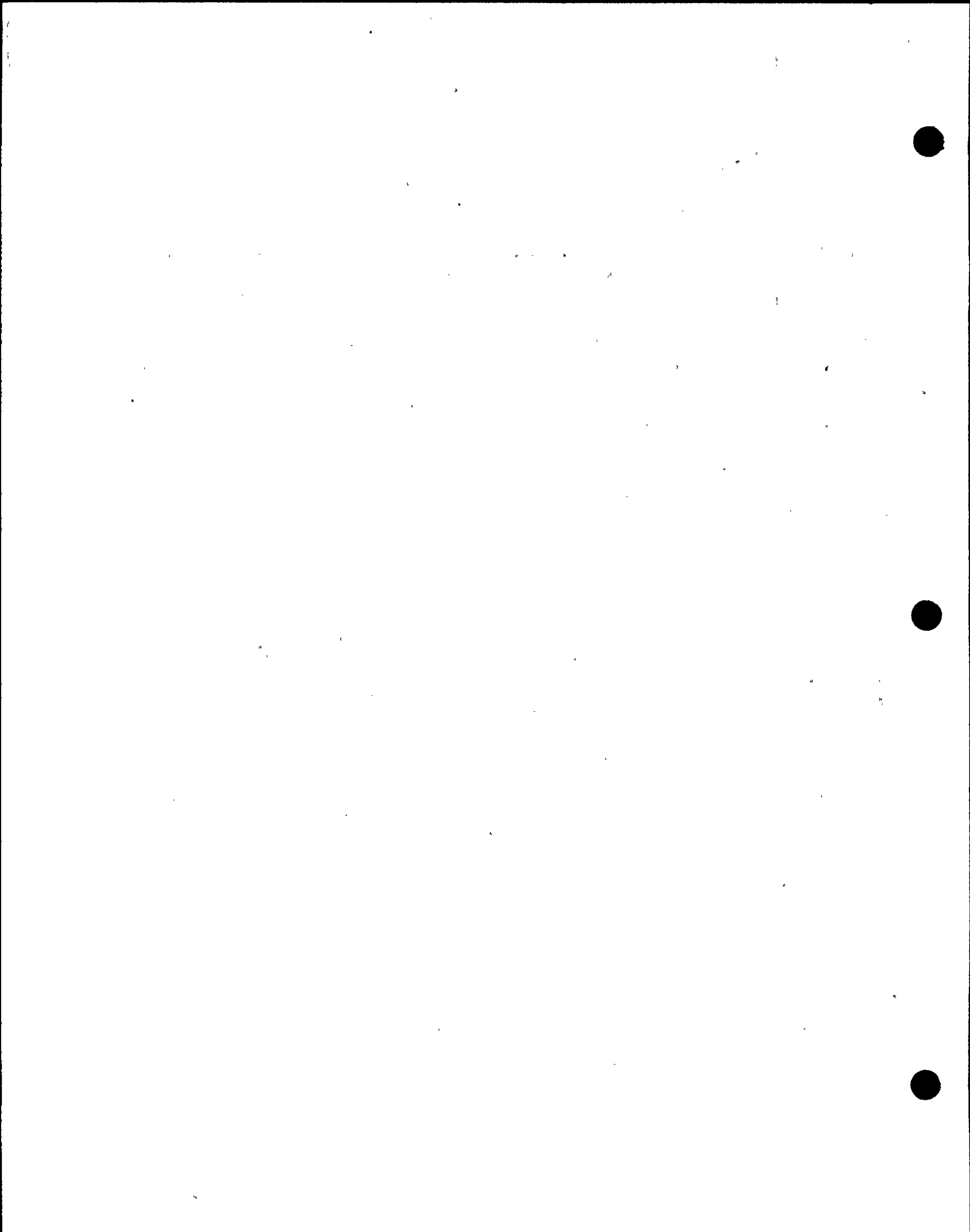
Control System Affected: T/G Control System CD: D-3

Job No. 0160-013-1671  
 Prepared by: M. Ballard  
 Date: 6/6/83  
 Checked by: Supriya S. Saha, Bob  
 Approved by: D. K.  
 Rev. 9  
 Date: 6/8/83  
 Date: 6/7/83

Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
27. Position transducer - intermediate stop valve/ZT-10160A2 - F2	Off	Loss of position feedback to the unit in flow control.	NONE	Not Required.	NONE
28. Bypass valve position transducer/ZT-10140 A-E	Off	Loss of position feedback to the unit in flow control.	NONE	Not Required.	NONE
29. Main Stop Valve opened and closed position switches/ZS-10141 A1-D1 and A2-D2 Load limit switch (load unit)/ZS-10141 A4-D4	Fail Off	All contacts must close to complete the sequential trip.	All valves that are operated by position are disabled.	All feedback from position switches is unavailable and results in the loss of automatic flow control.	NONE
30. Intermediate stop valve open switches/ZS-10160 A1, A4, A7, B1, B4, C1, C4, C7, D1, D4, E1, E4, E7	Fail Off	All switches disabled. Switches disable, valves cannot be positioned.	All valves that are operated by position switches are disabled.	All feedback from position switches is unavailable and results in the loss of automatic flow control.	NONE
31. Bypass valve position switches/ZS-10140A1-E1, A2-E2	Off	All position switches on bypass valves are disabled - Bypass valve cannot be positioned	All valves that are operated by position are disabled.	Not required.	NONE
32. Mechanical trip interlock switch, overspeed trip switch, mechanical trip valve switch/ZS-10125A, B, C	Off	Loss of position indication signal.	NONE	Loss of mechanical trip signal to operator.	NONE
33. Fast-acting solenoid valve - intermediate valve/SV-10160A1, B1, A2-F2 Closing solenoid valve intercept valve/SV-10160 C1-F1	As Is	Intermediate valve fails "As Is"	NONE	None. Turbine is tripped by auto MSIV closure.	NONE

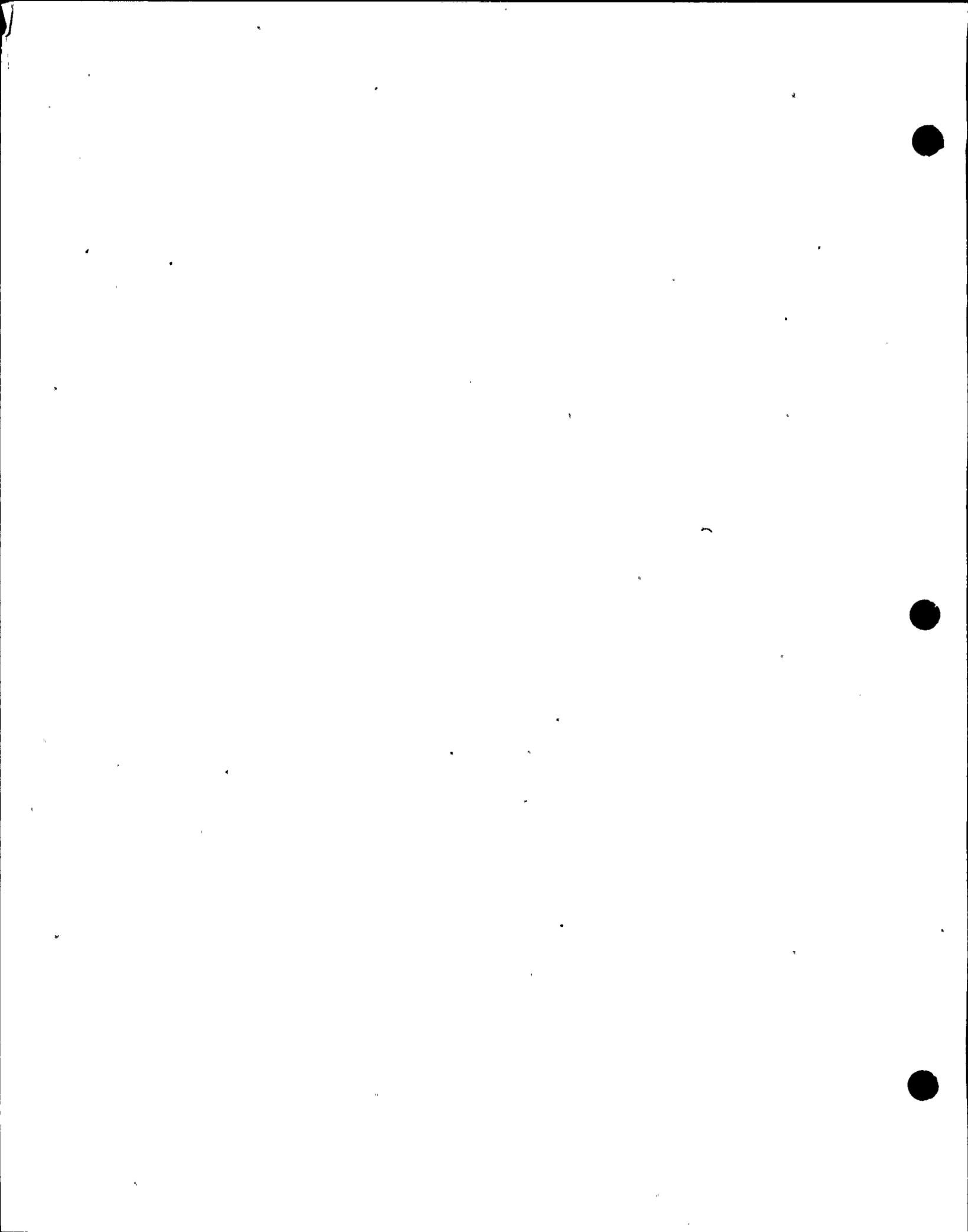


Common High Energy Line Break: <u>Main Steam Line Break or Feedwater Line Break in Turbine Building</u>		CSID: <u>0160-013-001</u>	Job No. <u>0160-013-1671</u>	Prepared by: <u>M. Ballard</u>	Date: <u>6/6/83</u>	Rev. <u>9</u>
Control System Affected: <u>T/G Control System</u>		CD: <u>D-3</u>	Checked by: <u>[Signature]</u>	Date: <u>6/6/83</u>	Approved by: <u>[Signature]</u>	Date: <u>6/7/83</u>
Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance	
34. Solenoid valve - bypass valve/SV-10140A-E	Closed	Bypass valves will fail closed - the bypass system is disabled.	NONE	NONE	NONE	
35. Reset oil valve solenoid/SV-10123	Off	Cannot be energized to reset mechanical trip valve.	NONE	NONE	NONE	
36. Lockout valve solenoid/SV-10124	Off	Prevents lockout valve from bypassing mechanical trip valve, whereby the mechanical trip valve remains effective.	NONE	NONE	NONE	
37. Oil trip valve solenoid/SV-10122	Off	Valve closes and prevents acceptable hydraulic pressure by closing mechanical trip valve.	NONE	NONE	NONE	
38. Closing solenoid - control valve/SV-10150A - D	As Is	The control valves will fail "As Is"	NONE	NONE	NONE	
39. Fast-acting solenoid valve - stop valve/SV-10141A - D	As Is	Stop valve fails "As Is"	NONE	NONE	NONE	
40. Mechanical trip solenoid/SV-10125	As Is	Normally de-energized will not energize on overspeed trip signal.	Mechanical overspeed trip provides redundancy.	Electrical overspeed trip disabled.	NONE	
41. Master trip solenoid valve/SV-10126	As Is	Normally energized, will not de-energize as required on overspeed trip signal.	Mechanical overspeed trip provides redundancy.	Electrical overspeed trip disabled.	NONE	
42. Servo valve - control valve/XV-10148A - D	Off	Loss of control valve positioning.	NONE	Not required following MSIV auto closure.	NONE	
43. Servo valve - control valve/XV-10150 A - D	Off	Loss of control valve position.	NONE	Not required following MSIV auto closure.	NONE	



Common High Energy Line Break: Main Steam Line Break or Feedwater Line Break in Turbine Building CSID: 0160-013-001 Job No. 0160-013-1671  
 Control System Affected: T/G Control System CD: D-3 Prepared by: M. B. [Signature]  
 Date: 6/6/83 Rev. 9  
 Checked by: [Signature] Date: 6/6/83  
 Approved by: [Signature] Date: 6/7/83

Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
44. Combined intercept valve/XV-10160A - F	Off	Loss of intercept valve positioning.	NONE	Not required following MSIV auto closure.	NONE
45. Servo valve - main stop valve/XV-10141 A - D	Off	Loss of stop valve positioning for chest/shell warming.	NONE	Not required following MSIV auto closure.	NONE
46. Servo valve - intercept valve/XV-10161A, C, E	Off	Loss of intercept valve positioning.	NONE	Not required following MSIV auto closure.	NONE
47. Servo Valve - bypass valve/XV-10139A - E	Off	Loss of bypass valve positioning.	NONE	Not required following MSIV auto closure.	NONE
48. Stator coolant low inlet pressure switch/PSSL-10187	High	Low-Low signal initiates a turbine trip, trip signal is disabled.	NONE	Loss of turbine trip signal.	None. The turbine is effectively tripped when the Main Steam isolation valves are automatically closed following this HELB.



Common High Energy Line Break: Main Steam Line Break or Feedwater Line Break in the Turbine Building CSID: 0160-013-001 Job No. 0160-013-1671  
 Control System Affected: Reactor Manual Control System CD: D-3 Prepared by: [Signature] Date: 6/6/83 Rev. 0  
 Checked by: [Signature] Date: 6/6/83  
 Approved by: [Signature] Date: 6/7/83

Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
1. First Stage Turbine Pressure Transmitters/ PT-1N054 A, B	Off	Signal from transmitters are not processed.	NONE	Bypass signal to Rod Sequence Control System when plant is operating above 20% power is cutoff. The movement of out-of-sequence rods is prevented and that of in-sequence rods is limited to predetermined increments at all power levels.	Rods cannot be moved as required to reach full power operations. Does not affect reactor scram operations. Therefore, the reactor will be scrammed automatically following this HELB (on Nuclear System high pressure or MSIV closure for a MSLB and RV low water level or MSIV closure for a FLB)

Common High Energy Line Break: <u>Main Steam Line Break or Feedwater Line Break in Turbine Building</u>	CSID: <u>0160-013-001</u>	Job No. <u>0160-013-1671</u> Prepared by: <u>[Signature]</u> Date: <u>6/6/83</u> Rev. <u>0</u> Checked by: <u>[Signature]</u> Date: <u>6/6/83</u> Approved by: <u>[Signature]</u> Date: <u>6/7/83</u>
Control System Affected: <u>Recirculation Flow Control System</u>	CD: <u>D-3</u>	

Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
1. Temperature switch high-high, MG set fluid drive oil/TSHH-14021 A2, B2	Off	On high temperature in lube oil sump, sends trip signal to MG motor.	None required.	Loss of ability to trip MG motor on high temperature.	No affect.
2. Level switch high-high, feedwater heater train isolation 2-A, B, C/LSHH-10317 A2, B2, C2	Off	Loss of ability to transmit high level condition for feedwater heater as part of recirculation runback circuitry.	For HELB event considered, recirculation pump is automatically tripped.	Runback circuitry will be partially armed.	Recirculation pump trip is overriding result.
3. Level switch high-high, feedwater heater train isolation 1-A, B, C/LSHH-10305 A2, B2, C2	Off	Loss of ability to transmit high level condition for feedwater heater as part of recirculation runback circuitry.	For HELB event considered, recirculation pump is automatically tripped.	Runback circuitry will be partially armed.	Recirculation pump trip is overriding result.
4. Pressure switch low, condensate pump discharge/PSL-10507 A, B, C, D	Off	Loss of ability to transmit low pressure condition on condensate system as part of recirculation runback circuitry.	For HELB event considered, recirculation pump is automatically tripped.	Runback circuitry will be partially armed.	Recirculation pump trip is overriding result.
5. Flow transmitter, reactor feed pump discharge/FT-10604 A1, B1, C1	Off	Low flow signal transmitted from feedwater system control of reactor recirculation system runback circuitry to auxiliary circuits A and B.	To get recirculation runback, input still required from: - low flow input from feedwater system alarm relay - circulation water pump tripped - low NPSH input from feedwater system	Reactor recirculation runback circuitry is partially armed.	No affect. Recirculation flow is identical to the flow prior to the loss of the component.
6. Pressure switch low, MG set lube pump start/PSL-14030 A1, A2, B1, B2	Off	Trips lube oil pump on low lube oil pressure (sump).	None required.	Loss of lube oil pump protection only.	No affect.

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Control System Affected:	<u>Recirculation Flow Control System</u>	CD: <u>D-3</u>	Prepared by: <u>Notes on task sheet</u>
			Date: <u>6/6/83</u>
			Checked by: <u>M. Ballard</u>
			Approved by: <u>W. H.</u>
			Rev. <u>0</u>
			Date: <u>6/6/83</u>
			Date: <u>6/10</u>

Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance
7. Pressure switch low, MG set lube oil pump/PSL-14031 A, B	Off	Trips lube oil pump on low lube oil pressure (sump).	None required.	Loss of auxiliary lube oil pump protection only.	No affect.
8. Pressure switch high, MG set lube oil pump permissive/PSH-14030 A, B	Off	Prevent startup of MG set unless lube oil pressure.	None required.	MG cannot be started unless lube oil system providing main lube oil pressure.	No affect.
9. Temperature switch high, MG set motor cooling air out/TSH-14001 A, B	Off	Loss of temperature alarm function on main outlet to motor.	None required.	Loss of alarm condition monitoring only.	No affect.
10. Temperature switch high, MG set generator cooling air out/TSH-14025A, B	Off	Loss of temperature alarms on air outlet to generator.	None required.	Loss of alarm condition monitoring only.	No affect.
11. Flow switch low, (cable) reactor feed pump discharge runback/PSL-10604 A1, B1, C1	Off	Low flow signal transmitted from feedwater system control of reactor recirculation system runback circuitry to auxiliary circuits A and B.	To get recirculation runback, input still required from: - low flow input from feedwater system alarm relay - circulation water pump tripped - low NPSH input from feedwater system	Reactor recirculation runback circuitry is partially armed.	No affect. Recirculation flow is identical to the flow prior to the loss of the component.
12. Position switch (cable), recirculation pump A suction/ZS-14323A	Off	Unable to trip MG set on suction valve closure indication (A loop).	Other MG set trip functions (non-valve related) still available.	Loss of one of the normal MG set trip functions.	No affect. Pump protection due to valve closure is lost.
13. Position switch (cable), recirculation pump A discharge/ZS-14331A	Off	Unable to trip MG set on suction valve closure indication (A loop).	Other MG set trip functions (non-valve related) still available.	Loss of one of the normal MG set trip functions.	No affect. Pump protection due to valve closure is lost.

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Control System Affected: <u>Recirculation Flow Control</u>		CD: <u>D-3</u>	Checked by: <u>M. ...</u>	Date: <u>6/6/83</u>	Approved by: <u>W. J. ...</u>	Date: <u>6/6/83</u>
Component Name and Number	Failure Mode	Symptoms and Local Effects Including Dependent Failures	System Inherent Compensating Provision	Summary: Effect Upon Control System	Summary: Effect Upon Plant Performance	
14. Position switch (cable), recirculation loop A (bypass)/ZS-14332A	Off	Loss of MG set breaker permissive on startup. Bypass valve cannot indicate closed during MG set startup.	MG set cannot be started up without closed permissive from bypass valve. Not required after startup.	Cannot startup MG set.	No affect.	
15. Position switch (cable), recirculation pump B suction/ZS-14323B	Off	Unable to trip MG set on suction valve closure indication (B loop).	Other MG set trip functions (non-valve related) still available.	Loss of one of the normal MG Set Trip Function.	No affect. Pump protection due to valve closure is lost.	
16. Position switch (cable), recirculation pump B discharge/ZS-14331B	Off	Unable to trip MG set on discharge valve closure indication (B loop).	Other MG set trip functions (non-valve related) still available.	Loss of one of the normal MG Set Trip Function.	No affect. Pump protection due to valve closure is lost.	
17. Position switch (cable), recirculation loop B (bypass)/ZS-14332B	Off	Loss of MG set breaker permissive on startup. Bypass valve must indicate closed during MG set startup.	MG set cannot be started up without closed permissive from bypass valve.	Cannot startup MG set.	No affect.	
18. Interlock from reactor runback signal (cable)	Off	Loss of runback signal	To get recirculation runback, input still required from: - low flow input from feedwater system alarm relay - circulation water pump tripped - low NPSH input from feedwater system	Reactor recirculation runback circuitry is partially armed.	No affect. Recirculation flow is identical to the flow prior to the loss of the component.	