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Attachment

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SYSTEM DESCRIPTION
SRV BLOWDOWN CONTROL SYSTEM
FOR
MONTICELLO NUCLEAR
GENERATING PLANT

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NOTICE

The design documentation associated with this System Description has not been approved in its entirety. This document is written in the present tense, awaiting Northern States Power Company approval of the preliminary design documentation.

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1.0 INTRODUCTION

The safety function of the SRV Blowdown Control System is to prevent an SRV actuation during the period of an elevated water leg in the respective discharge line, and to ensure manual SRV control capability as part of the fire protection alternate safe shutdown capability.

Of primary concern is the potential high thrust loads on the SRV discharge piping and elbows. This concern is a direct result of operating and accident transient events. A high water leg is formed in the SRV discharge line (SRVDL) immediately after an SRV closure. The water leg will return to its normal water level when the vacuum breakers on the discharge line equalize the pressure in the SRVDL and the drywell. If the SRV reopens before the water leg returns to the normal level, the water clearing thrust loads on the SRVDL may exceed their design limit.

The SRV Blowdown Control System is designed to preclude these excessive loads during the transfer of reactor decay heat to the suppression pool. The loads are minimized by ensuring a minimum water leg clearing time between SRV closure and subsequent actuation.

2.0 OBJECTIVE

The purpose of this document is to present the design bases and describe the resulting SRV Blowdown Control System design. This will be accomplished by identifying the major design bases and providing a description of the system configuration, identification of major components, and a summary of the systems' functional capabilities.

3.0 SYSTEM DESCRIPTION

3.1 Monticello is equipped with eight (8) Target Rock safety relief valves (SRV's). Three of these valves are the selected low-low set valves, and three are Automatic Depressurization System (ADS) valves. The Blowdown Control System is functionally independent of the ADS. All these valves can actuate either mechanically due to reactor pressure or electrically by means of a pilot solenoid valve. The mechanical setpoints for all the valves are essentially the same (1108 psig nominal).

The SRV Blowdown Control System ensures a minimum water leg clearing time between any SRV closure and subsequent actuation. This safety function is

accomplished by electrically actuating the low-low set valves. These are valves RV2-71E, RV2-71G, and RV2-71H.

The electrical open setpoint for the low-low set SRV's is lower than those of the spring-actuated mechanical setpoints. The blowdown window associated with the electrical actuation of the low-low set SRV's is greater than that associated with the mechanical setpoints. These setpoints are such that pressure-induced subsequent actuation of non-low-low set SRV's will not take place and that a minimum close-open duration of 5.75 seconds for the low-low set SRV's is ensured. Figure 3-1 depicts the mechanical and the other Blowdown Control Operating Setpoints and Design Limits.

The SRV low-low set function is interlocked with the Reactor Protection System. A "SCRAM" signal is required as a permissive. This interlock is necessary to prevent inadvertent SRV actuation while at power (i.e., the pressure range between the reactor high pressure scram limit and SRV mechanical setpoint limit is too small to establish and maintain low-low set SRV open setpoints) and to reduce SRV challenges.

The low-low set logic also prevents inadvertent subsequent actuation by the operator for those valves.

To meet the intent of 10CFR50 Appendix R, dual manual controls have been provided on four (4) SRV's. These include the three low-low set valves and RV2-71F (non-ADS valve). This feature ensures an alternate shutdown path in the event of a design bases fire defeating the RHR shutdown cooling function. The addition of this dual control capability provides adequate safe shutdown system capability.

3.2 System Configuration

Each SRV utilized in the Blowdown Control System has remote manual control capability in the main control room for the air actuated (via pilot solenoid) relief function. There are no operating bypasses at the system level such that the SRV Blowdown Control function is inhibited on all three low-low set valves.

Positive SRV actuation determination is based on monitoring the SRV discharge line pressure relative

to the primary containment pressure. This monitoring system indicates SRV actuation at a differential pressure of 50 psi and has a minimum range of 300 psid. The design limit for determining SRV actuation via the discharge line pressure is 150 psid maximum.

The design limit range for the mechanical spring-actuated opening of all SRV's is from 1086 psig to 1119 psig. This allows a calibration range of 1097-1108 psig with a $\pm 1\%$ drift allowance.

The design limits for the low-low set control logic utilized for Blowdown Control are:

DESIGN LIMITS

SRV	Open	Close	Blowdown Range	
	Max	Min	Min	Max
E	1080	920	60	100
G	1080	920	60	100
H	1080	920	60	100

The nominal setpoints for the low-low set control logic are:

NOMINAL LIMITS

SRV	Open	Close	Nominal Blowdown
E	1060	980	80
G	1050	970	80
H	1040	960	80

All of the above valves are in psig.

These setpoints have been selected to minimize SRV actuation and reduce unnecessary loads on the suppression pool and related equipment. These new setpoints do not affect existing Technical Specification limits.

Manual control of the Blowdown Control low-low set SRV's should be in accordance with existing plant procedures with respect to Emergency Core Cooling System operation and SRV testing.

Two (2) SRV's are required to perform the low-low set function. The safety function is assured by providing low-low set for three (3) SRV's. Each of the low-low set SRV's is controlled by two (2) independent logic divisions with two (2) channels per division. The logic energizes to perform the safety function and shall be arranged in a 2-out-of-2-once scheme.

The safety function of the low-low set feature of the Blowdown Control System is complete when the Reactor Coolant System (RCS) pressure is stabilized below the opening setpoint of the low-low set SRV's. Similarly, the safety function of the fire protection safe shutdown feature is complete when alternate means of maintaining cold shutdown have been repaired and placed into operation.

The Blowdown Control System is functionally independent of the Automatic Depressurization and Anticipated Transient Without Scram Systems.

The control logic for SRV's E, F, G, and H is illustrated in Figure 3-2.

4.0 DESCRIPTION OF MAJOR COMPONENTS

4.1 Racks C290A & B (Reactor Building)

These racks contain all the differential pressure transmitters to monitor SRV position.

DIVISION I - C290A

- dPT 4061A&C RV2-71G
- dPT 4068A RV2-71B
- dPT 4062A&C RV2-71E
- dPT 4069A RV2-71A
- dPT 4063A&C RV2-71H
- dPT 4070A RV2-71C
- dPT 4071A RV2-71D
- dPT 4060A RV2-71F

DIVISION II - C290B

- dPT 4061B&D RV2-71G
- dPT 4062B&D RV2-71E
- dPT 4063B&D RV2-71H

4.2 Low-Low Set Logic Panels -

C253A (Cable Spreading Room)
C253B (Emergency Filtration Treatment Building)

These panels contain all the logic associated with electrically actuating the low-low set relief valves and SRV F. The reactor pressure, safety relief valve discharge line differential pressure switches, time delay relays, and system malfunction annunciator signals are located in these panels. Additionally, panel C253A contains the position detection instrumentation for SRV's A, B, C, D, and F. The position indication for SRV's E, G, and H is included as part of the C253A low-low-set logic.

4.3 Control Panel - C03 (Control Room) and C253C (Control room)

To insure compliance with fire separation criteria, controls for the Blowdown Control System may be activated from either the main control room panel C03 for Division I, or panel C253C for Division II. This applies to valves RV2-71 E, F, G, and H.

4.4 Reactor Protection System (RPS) Panel - C15 & C17

Scram interlock signals for the Blowdown Control System are obtained from these existing control room panels.

4.5 Jet Pump Instrumentation Rack - C121 & C122

Reactor pressure transmitters for the Blowdown Control System have been added to these existing panels located in the Reactor Building. The pressure transmitters control the operation of low-low set valves when the reactor is in the scram mode.

DIVISION I - C122

- PT 4067 A & C

DIVISION II - C121

- PT 4067 B & D

4.6 Pilot Solenoids

A second pilot solenoid has been added to SRV's E, F, G, and H. Previously, these valves had only one pilot solenoid.

5.0 INSTRUMENTATION AND CONTROL DESCRIPTION

5.1 Control Room

The SRV controls are located in the control room for valves E, F, G, and H. The valves that are equipped with the inhibit logic will be separated or grouped with demarcation lines to separate them from the ADS valves. SRV F will also be distinguished by demarcation lines.



The following control switch positions and indications are available to the operator.

DIV. I (CO3)

The following indication is available for all SRV's:

White - Test
Green - No Electrical Demand
Amber - SRV Open
Red - Electrical Demand

The valves E, G, and H have the following switch positions:

CLOSE - AUTO - OPEN

Valve F will have the following switch positions:

CLOSE - OPEN

DIV. II C253C

The following indication is available for valves E, F, G, and H:

Green - No Electrical Demand
Red - Electrical Demand

The valves E, G, and H have the following switch positions:

CLOSE - AUTO - OPEN

Valve F has the following switch positions:

CLOSE - OPEN



5.2 Blowdown Control System Annunciators (C05)

System status indication is also provided by means of annunciator alarms located on panel C05 in the control room.

- Blowdown Control SRV Not in Auto
- SRV Blowdown Control Trouble
- SRV Open

5.3 Logic Panel

C253A (Cable Spreading Room)

C253B (Emergency Filtration Treatment Building)

These panels have the following indication presented to the operator or technician:

- Reactor pressure indication (0-1200 psig)
- SRV discharge line pressure (0-300 psid)
- White indicating test light to assist technicians in calibration
- Trip unit indicator lights for trip and gross failure conditions

Control features:

- Trip unit set point adjustment

Inside panel:

- Time delay relay adjustment

6.0 OPERATIONAL SUMMARY

The Blowdown Control System ensures that reopening of an SRV does not occur prior to the water level in the associated SRV discharge piping returning to normal in order to prevent excessive water thrust loads.

The low-low set function is fully automatic. No operator action is required.

Manual operation of SRV's E, F, G, and H for the purpose of establishing an alternate shutdown path is in accordance with the plant integrated fire protection plan.

7.0 RELATIONSHIP TO OTHER SYSTEMS

Power Distribution

Blowdown Control instrumentation channels A&C and B&D will be provided by Division I and Division II 125 VDC power supplies respectively. Load additions are compatible with power supply capabilities.

Each Blowdown Control SRV actuation solenoid is powered by the 125 VDC division associated with the actuation logic signal.

SRV Pneumatic Air Supply

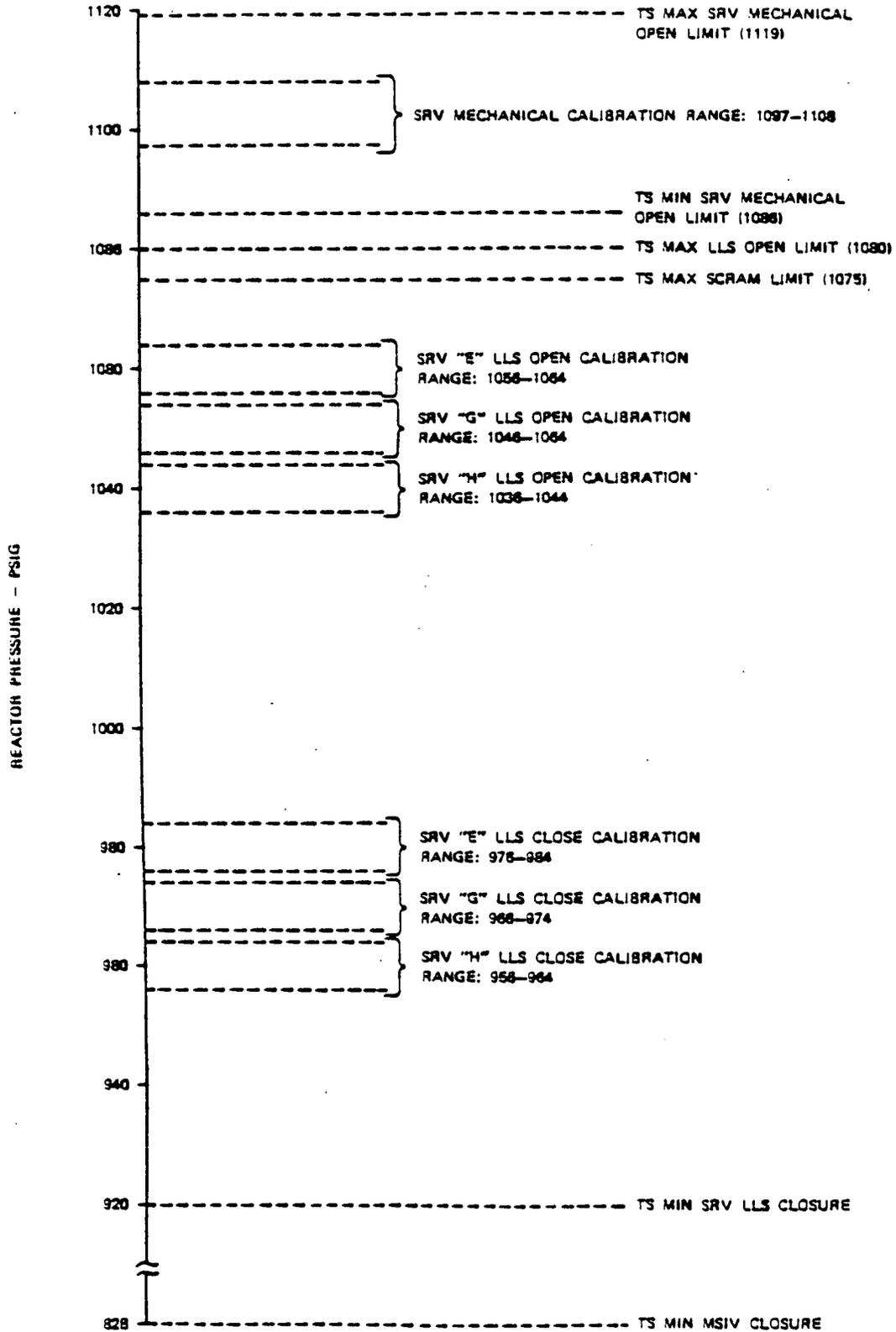
The design and changes to the SRV Pneumatic Air Supply System are not within the work scope of this project.

Process Computer

The SRVDL pressure monitoring instrumentation provides the plant process computer with position input for all eight Target Rock valves.

Figure 3-1

BLOWDOWN CONTROL OPERATING SETPOINTS AND DESIGN LIMITS



ABBREVIATIONS

TS - TECHNICAL SPECIFICATION
LLS - LOW - LOW SET

Figure 3-2

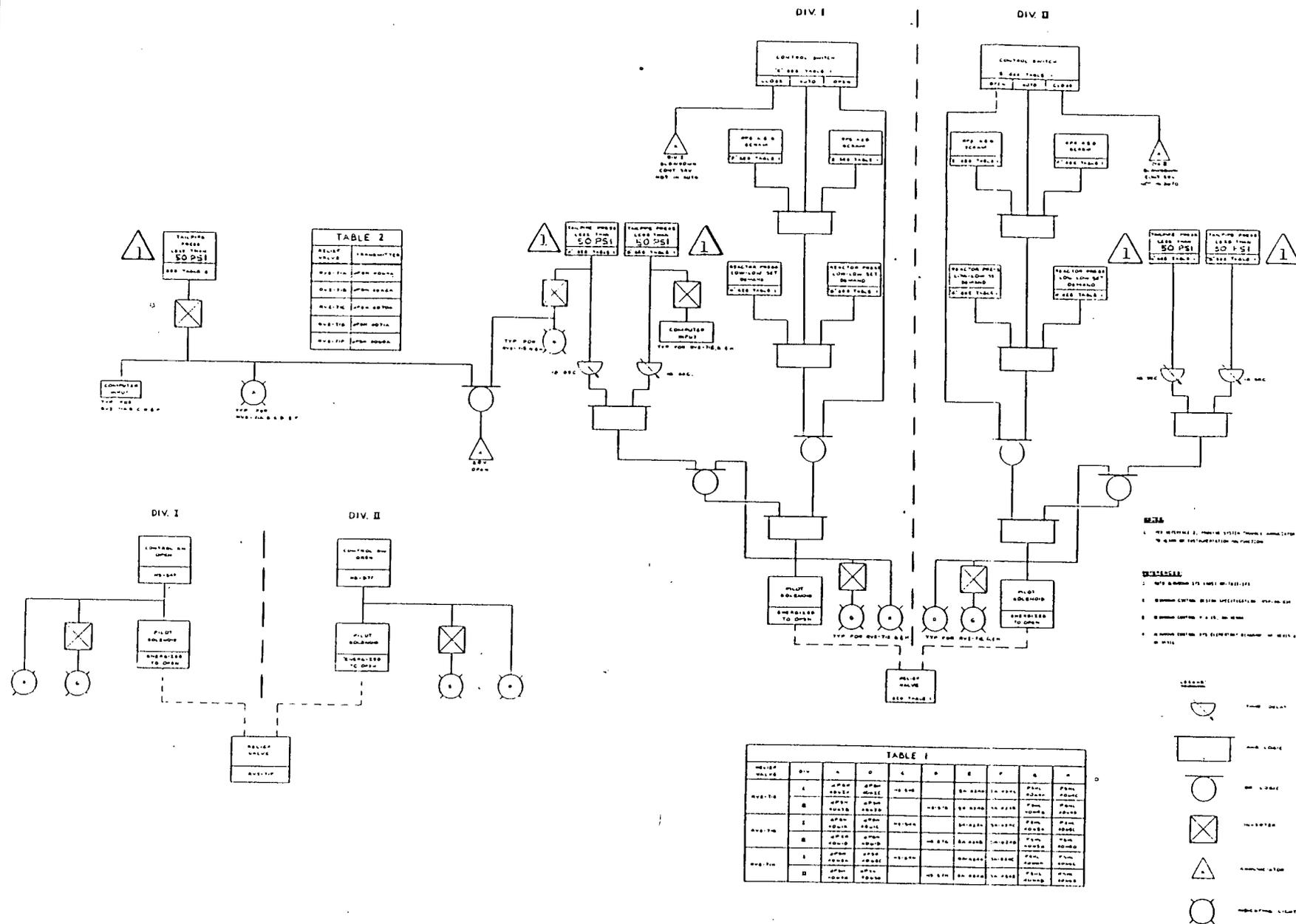


TABLE 2

RELIEF VALVE	TRANSMITTER
REL-714	SRV-700A
REL-715	SRV-700B
REL-716	SRV-700C
REL-717	SRV-700D
REL-718	SRV-700E
REL-719	SRV-700F

TABLE I

RELIEF VALVE	DIV	A	B	C	D	E	F	G	H
REL-714	I	SRV-700A	SRV-700B	SRV-700C	SRV-700D	SRV-700E	SRV-700F	SRV-700G	SRV-700H
REL-715	II	SRV-700A	SRV-700B	SRV-700C	SRV-700D	SRV-700E	SRV-700F	SRV-700G	SRV-700H
REL-716	I	SRV-700A	SRV-700B	SRV-700C	SRV-700D	SRV-700E	SRV-700F	SRV-700G	SRV-700H
REL-717	II	SRV-700A	SRV-700B	SRV-700C	SRV-700D	SRV-700E	SRV-700F	SRV-700G	SRV-700H
REL-718	I	SRV-700A	SRV-700B	SRV-700C	SRV-700D	SRV-700E	SRV-700F	SRV-700G	SRV-700H
REL-719	II	SRV-700A	SRV-700B	SRV-700C	SRV-700D	SRV-700E	SRV-700F	SRV-700G	SRV-700H

- NOTES**
1. SEE DRAWING 3, PRESSURE SYSTEM TRANSMITTERS FOR THE LOCATION OF THE TRANSMITTERS.
 2. SEE DRAWING 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.
 3. SEE DRAWING 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.
 4. SEE DRAWING 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

- LEGEND**
- TIME DELAY
 - AND LOGIC
 - OR LOGIC
 - INVERTER
 - INTERLOCK SYSTEM
 - OPERATING LIGHT

REFERENCE: DWG. NF-95918

SRV Blowdown Control System Logic Diagram