

APPENDIX 5.2B

LOW TEMPERATURE OVERPRESSURE PROTECTION
DURING HEATUP COOLDOWN AND COLD SHUTDOWN

LOW TEMPERATURE OVERPRESSURE PROTECTION
DURING
HEATUP, COOLDOWN, AND COLD SHUTDOWN

5.2B.1 SYSTEM DESCRIPTION

Overpressure protection of the Reactor Coolant System (RCS) during low temperature conditions is provided by relief valves SI-486 (2SI-R339A) and SI-487 (2SI-R340B) located in the Shutdown Cooling System (SDCS) suction line. The SDCS relief valves are shown on the piping and instrumentation diagram of Figure 6.3-1 (for Figure 6.3-1, Sheet 1, refer to Drawing G167, Sheet 1) and described in Subsection 9.3.6.2. This protection precludes any overpressurizing transient from exceeding the pressure-temperature (P-T) operating limits provided in the Technical Specifications.

→(DRN 03-2059, R14)

The protection provided by these relief valves is required during heat up and cooldown and during extended periods of cold shutdowns. Administrative controls and procedures are provided to ensure proper alignment of the system. To maintain RCS overpressure protection, the relief valves are aligned at all temperatures below the P-T curve limits corresponding to the pressurizer safety valve setpoint of 2500 psia. For temperatures above the P-T limits which correspond to the pressurizer safety valve setpoint, overpressure protection is provided by the pressurizer safety valves as described in Subsection 5.2.2 and Appendix 5.2A.

←(DRN 03-2059, R14)

5.2B.2 DESIGN CRITERIA

a) Credit for Operator Action

No credit is taken for operator action until 10 minutes after the operator is made aware that a transient is in progress.

b) Single Failure

The SDCS relief valve is designed to protect the reactor vessel given any event initiating a pressure transient as a result of an operator error or equipment malfunction. The redundant SDCS suction line trains meet the single failure criteria as described in Subsection 9.3.6.2. No single failure of an isolation valve will prevent the relief valves from performing their intended function.

c) Testability

Periodic testing of the SDCS suction isolation valves is defined in the Technical Specifications and Section XI of the ASME code.

d) Seismic Design and IEEE 279 Criteria

The SDCS suction line relief valves, isolation valves, associated interlocks and instrumentation are designed to safety class 2 seismic Category I requirements. The interlocks and instrumentation associated with the SDCS suction isolation valves satisfy the appropriate portions of IEEE 279-71 as discussed in Subsection 7.6.1.1.2.

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e) Reliability

The use of the SDCS suction line relief valves for RCS overpressure protection does not reduce the reliability of the ECCS or SDCS.

5.2B.3 DESIGN AND ANALYSIS

To demonstrate that the SDCS overpressure protection meets the LTOP criteria listed in Subsection 5.2B.2, the following information is provided.

a) Limiting Transients

→(DRN 03-2059, R14)

←(DRN 03-2059, R14)

The most limiting transients initiated by a single operator error or equipment failure are:

1. An inadvertent safety injection actuation (mass input).
2. A reactor coolant pump start when a positive steam generator to reactor vessel ΔT exists (energy input).

The transients were determined as most limiting by conservative analyses which maximize mass and energy additions to a water-solid RCS as a function of time.

→(DRN 03-2059, R14)

The results of the analyses demonstrate that the use of the SDCS suction line relief valves provide sufficient pressure relief capacity to mitigate the most limiting events.

b) Provision for Overpressure Protection

Above the P-T operating curve temperature corresponding to the LTOP enable temperature, RCS overpressure protection is provided by the pressurizer safety valves. Below this temperature, overpressure protection is provided by the SDCS relief valves.

→(EC-8458, R307)

An inadvertent pressure transient that increases RCS pressure is terminated by the SDCS relief valve with a conservative pressure margin below the Appendix G P-T limits and the SDCS design pressure. Current Appendix G P-T limits as described in Subsection 5.3.2 are bounded by the maximum allowable SDCS pressure. For the limiting transient (energy addition), the peak pressure translated to the most limiting location is 491 psia, which is less than 110% of the limiting component design pressure (493.2 psia)."

←(DRN 03-2059, R14; EC-8458, R307)

c) Equipment Parameters

The SDCS relief valve is a spring-loaded (bellows) liquid relief valve with sufficient capacity to mitigate the most limiting overpressurization event. Pertinent valve parameters and assumptions used in the analyses are as follows:

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<u>Parameters</u>	<u>Assumption</u>
Setpoint 430 psia	430 psia
Accumulation 10%	10%
Blowdown 10%	0%
→ (DRN 01-368; 03-2059, R14)	
← (DRN 01-368; 03-2059, R14)	
Capacity (@ 10% acc) 3345 gal/min	3089 gal/min (@ 10% acc)

d) Administrative Controls

Administrative controls necessary to provide LTOP are limited to those controls that open the SDCS isolation valves. Before entering the low temperature region for which overpressure protection is necessary, RCS pressure is decreased to below the maximum pressure required for SDCS operation. Once the SDCS is aligned, no further specific administrative or procedural controls are needed to ensure proper overpressure protection. The SDCS will remain aligned whenever the RCS is at low temperatures and the reactor vessel head is secured. As shown on Figure 6.3-1 (for Figure 6.3-1, Sheet 1, refer to Drawing G167, Sheet 1) and in Tables 6.3-3 and 7.5-1, indication of SDCS isolation valve position is provided to enable the operator to determine that LTOP is operable.