SUMMARY REPORT

ON THE

DESIGN BASIS

OF THE

SHUTDOWN COOLING SYSTEM

RELIEF VALVES

FOR

CESSAR SYSTEM 80

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1.0 PURPOSE

The purpose of this report is to describe the design basis that is applied to the relief valves intended for use in the suction piping of the Shutdown Cooling System of C-E System 80 Units. The report will detail the sizing criteria and test specifications applied to these valves.

This report documents a C-E presentation which was delivered to the NRC Staff on November 9, 1984. The purpose of that meeting was to substantiate the operability of these valves.

NOTE: The figures used in this report represent slides which were used at that meeting.

2.0 SCOPE

This report is applicable to all C-E System 80 units. All the information contained in this report is directly referenceable to CESSAR. In keeping with the CESSAR format no valve manufacturer specific information is presented. CESSAR specifies the necessary valve criteria to meet the system's requirement which can be supplied by any manufacturer of pressure relief devices.

3.0 DESIGN BASIS

The following sections and figures describe the design basis, test specifications, and sizing criteria applied to the relief valves installed in the suction piping of the shutdown cooling system. As identified in CESSAR these are valves SI-179 and SI-189. They are shown on the system piping and instrumentation diagram in CESSAR Figure 6.3.2-18.

3.1 FUNCTION

CESSAR identifies these valves as providing a dual function. Their initial function was to protect the shutdown cooling system from overpressurization from any possible occurance. Their function was later expanded to provide low temperature overpressure protection (LTOP) for the RCS. For both functions the valves are designed to be redundant, in that one single valve is capable of handling any overpressurization event.

Figure 1 is a schematic of the SCS suction piping showing only the section in the region of the relief valves and the suction line isolation valves which isolate the low pressure SCS from RCS pressure. Also indicated are the safety grade interlocks and alarms associated with the isolation valves. The interlocks provide additional overpressure protection for the system. The alarms connected to the isolation valves annunciate overpressure transients which could challange the relief valves and annunciate that LTOP is inhibited by a closed isolation valve. Only train A of the two redundant suction lines is shown. The nomenclature in parentheses indicates Train B's identification.

3.2 REGULATORY REQUIREMENTS

Figure 2 presents the regulatory requirements which create the design bases for the SCS relief valves. Branch Technical Position, RSB 5-1 stipulates the basis for overpressure protection of the SCS and makes direct reference to the ASME Boiler and Pressure Vessel Code for relief capacity sizing. Branch Technical Position, RSB 5-2 creates the basis for the LTOP function of these valves.

3.3 SIZING CRITERIA

Figure 3 details the sizing criteria for these valve. This figure also highlights the history of the design of these valves in that they were initially designed for the SCS overpressure protection function.

The LTOP function was later added to these valves, (which necessitated evaluating LTOP events against the existing design). CESSAR sections 5.4.7.2.2 (4.a2) and 5.2.2.10.2.1 explain in detail the data used to determining the capacity and setpoint for these valves. A significant point about the capacity of these valves is that although the initial sizing criteria for the SCS function of these valves appears conservative the inclusion of the LTOP events to the valve requirements utilizes the full rated capacity.

3.4 TEST REQUIREMENTS

Figure 4 details the test requirements imposed on the valves at their purchase. The ASME code accepts capacity certification by calculation rather than full size testing. C-E imposes additional requirements. The seismic tests are necessary because these valves are rated for Seismic Class I operation. Prorated tests are acceptable for seismic operability testing. The standard production tests do not require full flow verfication only verification of setpoint and leakage.

CESSAR Technical Specification 4.4.8.3.2 requires that these valves be tested for setpoint drift once every 18 months.

4.0 SUMMARY

The shutdown cooling relief valves are designed to provide overpressure protection of the low pressure Shutdown Cooling System and LTOP protection of the Reactor Coolant System. They are specified to meet the applicable NRC and industry requirements. The valves' capacity and setpoint are chosen so as to be redundant. Each valve can individually provide system protection from any design basis overpressurization event.

5.0 REFERENCES

(A) Combustion Engineering Standard Safety Analysis Report (CESSAR), System 80, Nuclear Steam Supply System, FSAR.

(B) American Society of Mechanical Enginers, Boiler and Pressure Vessel Code, Section III Division 1, Subsection NC, "Class 2 Components."

(C) Nuclear Regulatory Commission, Branch Technical Position:

(C.1) RSB 5-1, "Design Requirements of the Residual Heat Removal System."

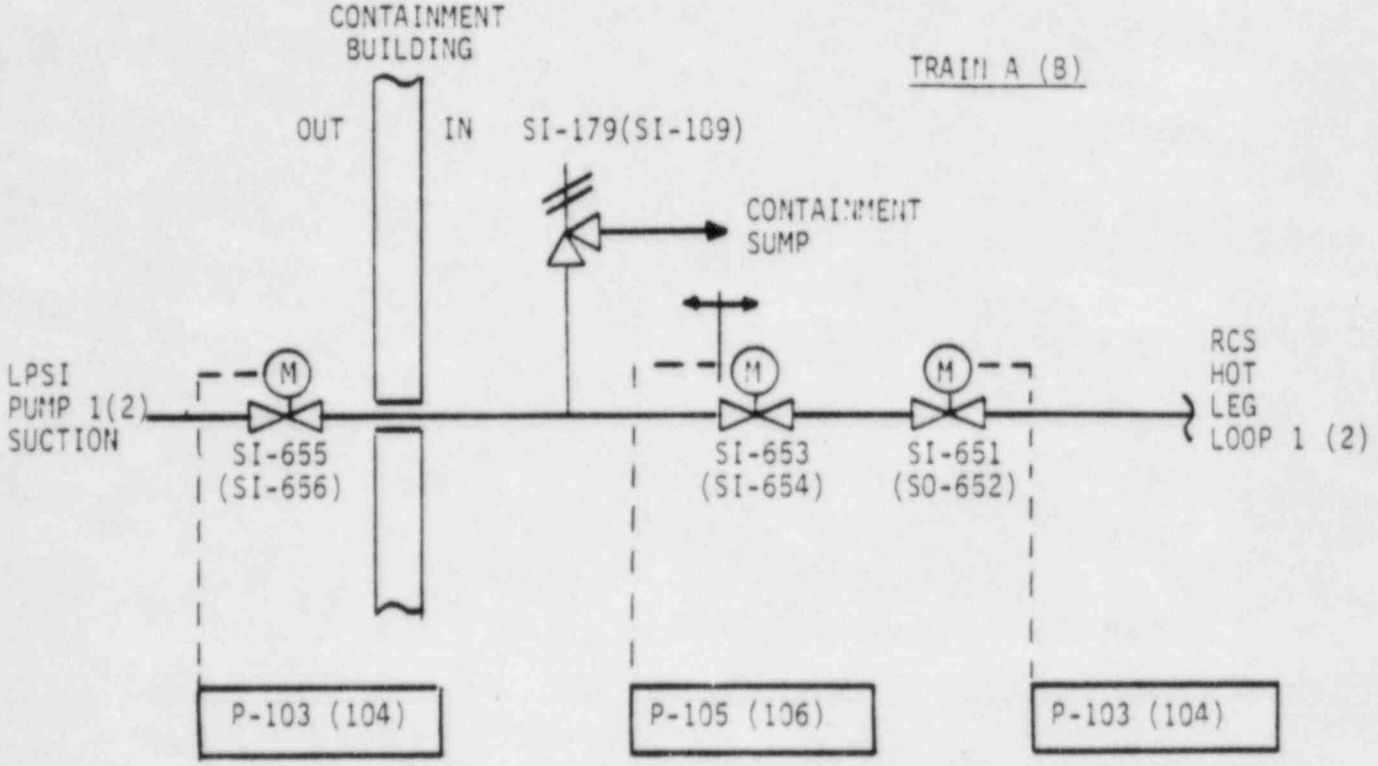
(C.2) RSB 5-2, "Overpressurization Protection of Pressurized Water Reactors While Operating at Low Temperatures."

FIGURE 1

SYSTEM CONFIGURATION

SHUTDOWN COOLING SYSTEM

SUCTION LINE RELIEF AND ISOLATION VALVES



AUTO CLOSURE
SETPOINT: 500 PSIA

OPEN PERMISSIVE
SETPOINT: 400 PSIA

SETPOINT: 700 PSIA

SETPOINT: 400 PSIA

LTOP ALARMS:

RCS PRESS > 400 PSIA
VALVE NOT CLOSED

RCS TEMP < 260°F
VALVE CLOSED

SETPOINT: 700 PSIA

SETPOINT; 400 PSIA

LTOP ALARMS:

RCS PRESS > 400 PSIA
VALVE NOT CLOSED

RCS TEMP < 260°F
VALVE CLOSED

SOURCE: CESSAR FIGURE 6.3.2-1B
CESSAR TABLE 7.6-1

FIGURE 2

DESIGN BASIS

DESIGN REQUIREMENTS OF RESIDUAL HEAT REMOVAL SYSTEM:

BRANCH TECHNICAL POSITION, RSB 5-1
(ASME B&PVC SEC III, NC-7000)

OVERPRESSURE PROTECTION OF PWR WHILE OPERATING AT LOW TEMPERATURE:

BRANCH TECHNICAL POSITION, RSB 5-2

FIGURE 3

SIZING CRITERIA

ORIGINAL FUNCTION: SDC OVERPRESSURE PROTECTION

CESSAR SECTION 5.4.7.2.2.(4.A2)

- EACH VALVE; RELIEF OF COINCIDENT OCCURENCE OF:

  2 HPSI PUMPS (RUNOUT)
  3 CHARGING PUMPS
  ENERGIZATION OF PRESSURIZER HEATERS

ADDITIONAL FUNCTION: LTOP

CESSAR SECTION 5.2.2.10.2.1

- EVALUATED WITH AS PURCHASED EQUIPMENT
- LIMITING EVALUATIONS:

  MASS ADDITION: INADVERTANT SAFETY INJECTION ACTUATION

  ENERGY ADDITION: RCP START WITH POSITIVE S.G. TO RCS $\triangle T$.

FIGURE 4

SYSTEM 80 SCS RELIEF VALVES

PURCHASED TO 1974 ASME SECTION III, SUBSECTION NC

- o ASME CODE REQUIREMENTS
  - CAPACITY CERTIFICATION BY CALCULATIONS OR FLOW TEST
  - FULL SCALE TESTING WAS NOT REQUIRED
  - HYDROSTATIC TESTS
- o C-E SPECIFICATION REQUIREMENTS
  - SEISMIC OPERABILITY TO BE DEMONSTRATED BY TEST AND/OR ANALYSIS
  - LOADS TO BE CONSIDERED IN THE VALVE DESIGN
    - SEISMIC LOADS
    - SYSTEM PRESSURE
    - LOADS DUE TO VALVE OPERATION
  - STANDARD PRODUCTION TESTS
    - VERIFY SET PRESSURE
    - SEAT LEAKAGE TEST AT 90% OF SET PRESSURE