

FINAL REPORT  
FAILURE OF EXPANSION JOINTS  
IN SAFETY RELATED PIPING SYSTEMS  
DURING STARTUP TESTING AT SAN ONOFRE NUCLEAR GENERATING STATION  
UNIT 2

INTRODUCTION

This report is submitted pursuant to 10CFR50.55(e)(3). It describes deficiencies related to pressure boundary failure of expansion joints within safety related Saltwater Cooling and Component Cooling Water Systems and includes analysis of the safety implications and a summary of the corrective action taken to date or planned.

BACKGROUND

During system startup testing of Unit 2 three ASME Section III, Code Class 3 expansion joints exhibited failure of the pressure boundary (hair-line cracks or pinhole leaks). These failures occurred while Saltwater Cooling pumps and Component Cooling Water pumps were operating at pump design pressure. Another similar expansion joint in the Saltwater Cooling System exhibited deformation of the convoluted section after being subjected to field hydrostatic pressure test. The pressure boundary was not breached.

All expansion joints in question were manufactured by Pathway Bellows, Inc. of El Cajon, California.

Description of Deficiency

ASME Section III, Subsection ND, Paragraph ND-3649.2 requires flow liners for expansion joints when flow rates exceed 10 feet per second. The purpose of these flow liners is to eliminate vibration which is induced when flow velocities exceed values prescribed by ASME Section III. Procurement specifications for these expansion joints did not specify flow liners.

The expansion joints which failed were subjected to flow rates in excess of 10 feet per second. Flow induced vibration caused excessive flexing to the joint, resulting in fatigue failure of the pressure boundary. Failure to specify flow liners is recognized as a significant deficiency in final design as approved and released for construction such that the design did not conform to the design criteria and bases.

The expansion joint which failed during hydrostatic test was tested in parallel with two other identical (redundant) expansion joints at the same elevation and gage pressure. These other units do not exhibit deformation.

### Analysis of Safety Implications

The Saltwater Cooling System (SWCS) provides cooling water to the low temperature side of the Component Cooling Water System (CCWS). The CCWS provides cooling water for safety related components during normal plant operation and during plant shutdown. Portions of the CCWS are required for heat removal during and after a design basis earthquake or loss of preferred source of electrical power. System redundancy is provided in the form of separate headers and redundant pumps and heat exchangers so that a single failure does not preclude the supply of sufficient cooling water to the engineered safety features systems required for safe shutdown. The design deficiency poses the possibility of loss of more than one of the redundant trains and, consequently, loss of system function.

### Corrective Action

Project data sheets for all expansion joints in the Saltwater Cooling System and Component Cooling Water System for San Onofre Units 2 and 3 were reviewed for correct flow rate specifications and whether or not flow liners were specified. As a result of this review data sheets have been revised and flow liners will be added to seven expansion joints in the SWCS and CCWS of each Unit.

The expansion joint which exhibited deformation under hydrostatic test will be removed and returned to the manufacturer for analysis. The disposition of that item will be applied to other expansion joints, as appropriate.

Data sheets and specifications for other in-line components of the Saltwater Cooling System and Component Cooling Water System will be checked for compatibility of process flow data with the component design. This review will be completed by July 20, 1980.

Assurance that the Systems will perform as intended in service will be provided by completion of the data sheet review, modification of expansion joints, as appropriate, and retesting to confirm flow stability and pressure capability.