THIELSCH ENGINEERING, INC. • 195 FRANCES AVENUE • CRANSTON, RHODE ISLAND 02910
TEL. 401-467-6454 • FAX. 401-461-6006 • WWW..THIELSCH.COM

TECHNICAL BULLETIN

SUBJECT: Failures Associated with HRSG Bypass Desuperheaters

Dear Sir/Madam:

Over the last few years, Thielsch Engineering has been involved in the inspection, evaluation, and repair of multiple through-wall failures in Bypass Desuperheaters used in combined cycle power plants. The Desuperheater components are designed to operate for short periods of time during start-up to reduce the temperature of steam entering the condenser or to maintain low-temperature steam flow through the HRSG until adequate steam flow and temperature are achieved for steam turbine operation.

These components operate in a manner similar to that of standard Desuperheaters used in conventional power plants for the past 40 years. High-pressure feedwater is extracted from the feedwater discharge line and directed to a valve control station, which regulates feedwater sprayed directly into path of the high-temperature steam.

This process reduces the temperature and pressure of the primary steam systems so that it can be recaptured without doing harm to the downstream components. In most combined-cycle designs however, the in-line piping associated with the Desuperheaters does not include an internal liner commonly found in conventional power plants. This results in spray water coming in direct contact with the pressure boundary piping. It is the direct contact that has produced very high thermal and mechanical stresses that have resulted in through-wall failures and has resulted in numerous failures over a very short period of time.

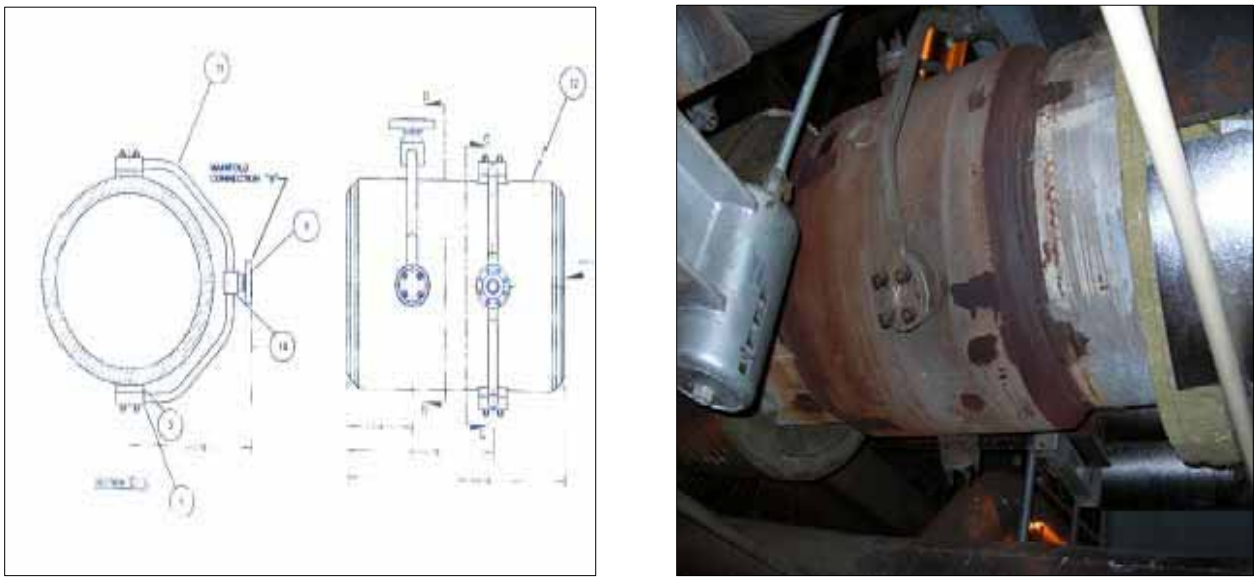

Fig. 1.

In particular, the design that has shown the greatest propensity for failure involves a heavy-walled desuperheater fitting with multiple spray nozzles around the circumference. The sketch and photograph provided in Fig 1 detail this arrangement. These failures are occurring on the downstream side of the Desuperheater at the circumferential weld joining the thin walled down-stream piping.

Views of inside diameter initiated cracking at the circumferential weld between the Desuper-heater fitting and the bypass piping system is shown in the photographs provided in Fig. 2.

Fig. 2.

This next set of photographs details an instance where thermal gradients created during Desuperheater operation resulted in applied bending stress to the piping system. This caused the cracking to initiate on the outside diameter surface as shown in Fig 3.

Fig. 3.

This specific case was modeled for a finite element analysis to demonstrate the magnitude of the thermally-induced bending stresses on the Desuperheater joint. The magnitude of the loads show that crack initiation could occur in less than 100 cycles of operation as shown in Fig 4.

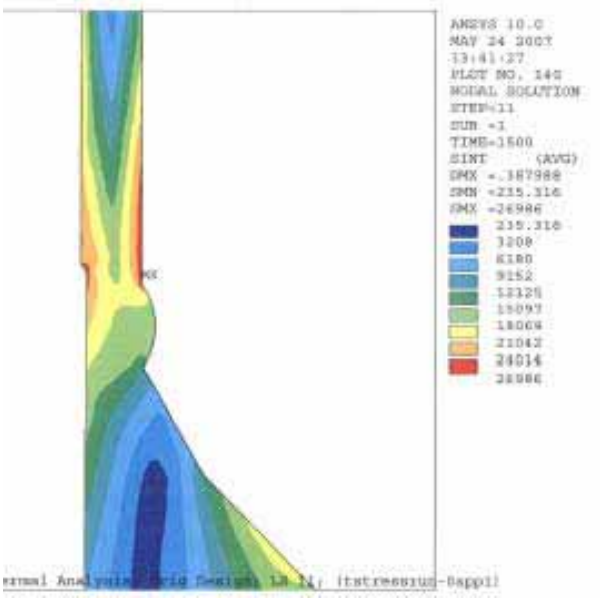

Fig. 4.

This last set of photographs shows a condition where the Desuperheater fitting has been removed and the damage to the internal diffuser can be seen. Again, this condition is related to thermal gradients from the relatively cold spray water thermally shocking the hot internal components.

If you would like more information on failures associated with HRSG Bypass Desuperheaters or would like Thielsch Engineering to develop a scope of work for an engineering inspection and evaluation, please call 401-467-6454 or you can e-mail me at Pkennefick@thielsch.com.

Very truly yours,

THIELSCH ENGINEERING, INC.

Peter R. Kennefick, Vice President
Field Engineering Services

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