

FEEDWATER HEATERS

CTI's sleeving of feedwater heater tubes is typically performed via "hybrid" expansion – hydraulic expansion for the full length of the Shields followed by mechanical expansions at each end.

This process will allow the feedwater heater to operate efficiently for years. The Shields will not only protect damaged tubes from future failure, but will also recover plugged tubes to active circulation.

A partial list of feedwater heater repairs to date:

Company Plant Date	Existing Tubes Problems	CTI Shields Quantity / Material Length
Colorado Springs *Martin Drake July 1997	70/30 CuNi tubes suffering SCC at inside face of 4½" tubesheet	464 Shields 70/30 CuNi 8" long
Florida Power & Light *Port Everglades March 1998	Monel tubes suffering SCC at inside face of 13" tubesheet	2,566 Shields 70/30 CuNi 18" long
Baltimore Gas & Electric C.P. Crane March 1998	304ss tubes suffering SCC up to the 77" depth from the outlet tube ends	718 Shields 316Lss 87" long
Tampa Electric *Big Bend April 1998	Fretting of 304ss tubes at baffles in the desuperheating zone due to vibration	238 Shields 316ss 43" / 74" lengths
Florida Power & Light *Sanford November 1998	Monel tubes suffering SCC near drains cooler end plate	500 Shields 70/30 CuNi 48" long
Pfizer, Inc Groton, CT March 1999	90/10 CuNi tubes damaged from vibration at 1 st support sheet, 31" from tubesheet face	322 Shields 70/30 CuNi 36" long
Tennessee Valley Authority *Allen September 1999	Monel tubes suffering SCC at inside face of 13" tubesheet	1,590 Shields 304ss 15" long
Southern Energy – California Contra Costa October 1999	304ss suffering failures in the desuperheating section, 96" from tubesheet face	927 Shields 316Lss 110" long
Keyspan Corp. Northport May 2001	Admiralty Brass tubes suffering wall loss in sub-cooling zone, 13½ Feet from tubesheet face	242 Shields 70/30 CuNi 14 feet long
Electrabel (Belgium) Doel Nuclear June 2001	Carbon steel suffering pitting and corrosion up to 8" depth from tubesheet face	3,944 Shields 316ss 12" long
*+South Texas Project Nuclear Wadsworth, TX October 2001	304ss suffering intergranular attack and SCC up to 20" depth from tubesheet face	1,950 Shields 316ss 22" / 13" lengths

Pacific Gas & Electric Humboldt Bay April 2002	Admiralty Brass tubes suffering from condensate corrosion	72 Shields 304ss 56" long
Reliant Energy Portland April 2002	304ss suffering SCC up to 5 feet from tubesheet face	396 Shields 316ss 72" long
*Enel (Italy) Bastardo July 2002	Preventative maintenance. To be installed in conjunction with OEM in Milan, Italy	370 Shields 316ss 6" long
Pennsylvania P+L Martins Creek October 2002	304ss suffering SCC up to 5 feet from tubesheet face	1,253 Shields 316ss 56" / 60" lengths
Con Edison Waterside November 2002	Monel tubes suffering from SCC in tubesheet area	500 Shields 90/10 CuNi 9" long
Reliant Energy/Texas Genco Webster January 2003	304ss suffering SCC at Inside face of 11 ³ / ₄ " tubesheet	1,333 Shields AL-6XNss 16" long
Enel (Italy) N/A July 2003	Preventative Maintenance To be installed in conjunction with OEM in Milan, Italy	4,680 Shields 321ss 6" long
*Mirant Contra Costa December 2004	304ss suffering from Chloride-induced SCC from tubesheet face	927 Shields 316ss 12 feet long
*Eskom (So. Africa) Camden September 2005	439ss suffering from pitting corrosion	1,088 Shields 316ss 14" long
Mirant Pittsburg December 2005	304ss suffering from Chloride Pitting	700 Shields 316Lss 8 feet long
Detroit Edison St. Clair September 2006	Cracking of 304 SS tubes throughout the 12 ft. desuperheating zone (LP)	894 Shields Alloy 800 13 feet long
Xcel Energy *Black Dog March 2007	Two (2) units with 304SS tubes suffering from Stress Corrosion Cracking	1,595 Shields 317 SS 67" long

Eskom (So. Africa) Komati March 2007	IBW related problems to ferritic SS tubes	6,000 Shields 316ss 28" long
TransCanada *Ravenswood December 2008	ECT revealed 304Nss tubes suffering defects in the desuperheating zone, up to 11 feet downstream	325 Shields 316Lss 11'6" long
Ameren Labadie May 2009	Admiralty Brass tubes suffering from erosion / failures up to the 4 th baffle plate	557 Shields 90/10 CuNi 12'6" long
Western Farmers Hugo May 2010	Admiralty Brass tubes suffering from erosion/ failures at various depths	250 Shields Admiralty Brass 6 ft. / 10 ft. long
NRG (Australia) Gladstone March 2011	OD corrosion / ammonia grooving of Admiralty Brass tubes	815 Shields 70/30 CuNi 13 feet long

* Denotes additional HP feedwater heaters were "Shielded" at a later date based on the success of the initial installation.

+ Denotes portion of these Shields installed "downstream".

NOTES:

- CTI's initial test installation, performed for Florida Power & Light in 1997 resulted in CTI winning FP & L's 1997 Presidents Cup award for "Best New Technology".
- In most cases, units with plugged tubes had existing plugs removed and Shields installed, resulting in tubes being returned to active circulation.
- Technical papers have been written by Con Edison, Florida Power & Light, Baltimore Gas & Electric, Colorado Springs, TVA, Detroit Edison and Ameren for presentations at various EPRI and FOMIS conferences nationwide.