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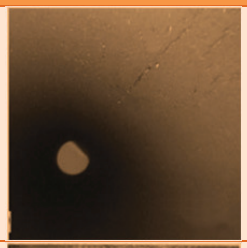
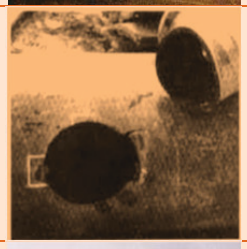
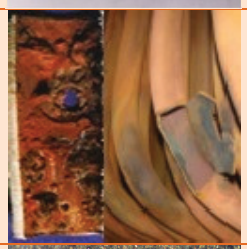
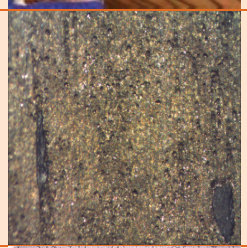
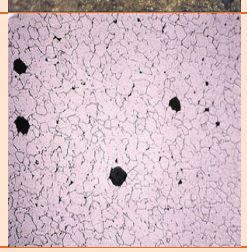
Boiler inspection

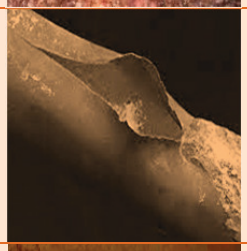
| Visual inspection | MPT | PT | ACPT | Ultrasonic thickness measurement | Internal oxide scale |

| TOFD | Phased Array | UFD | Videoscopy | AUBT | LFET | APR | Radiography | Replica | Hardness |

Damage mechanisms, locations and techniques

Damage mechanism	Damage sites	Inspection locations	Inspection technique
	**Corrosion fatigue**		
	Economizer, tubes with condensate during operational changes, Weld joints and bends exposed to high thermally induced forces and bending moments, sites with thickness variation	Tube to headers joints Riser tubes Down- comer tubes Scallop bar of water wall	Visual inspection (Videoscopy) Digital radiography Quantifying by tube sampling
	**Thermal/thermo-mechanical fatigue**		
	Thermal fatigue at high heat fluxes/flame impingement, wherein cyclic thermal stresses are sufficiently high. Thermo-mechanical fatigue is observed at weld joints, Sites with thickness changes	Thermal fatigue- at fire side of water wall tubes. Tube to headers joints – ligaments. Tube bends near header joint slope region near ash collector	Visual testing WFMPI Quantify the crack with potential drop technique
	**Creep fatigue**		
	Pressure parts in creep range, superheater and reheater	Tube to header connections, Header bore holes	VT, WFMPI/PT, replication, potential drop technique
	**Flow induced vibration fatigue**		
	Welded connections, bends and attachments at all pendants mostly at reheater and superheater	Screen tubes /superheater tubes/ reheater tubes	VT, WFMPI/PT, replication, potential drop technique
	**Flow accelerated corrosion**		
	High pressure portions of the feed water system, water touch pressure parts in range of 280 ^{0}C to 300 ^{0}C	Stub tubes of economizer inlet header	Visual inspection (Videoscopy) Digital radiography Quantifying by tube sampling
	**Acid phosphate corrosion, caustic gauging, hydrogen damage**		
	Sites where the water flow adjacent to the tube wall is disrupted Sites with internal deposits, high heat flux zones	Water wall tubes	LFET, AUBT scanning of water wall tubes Thickness survey
	**Oxygen pitting**		
	wet internal and non-drainable surfaces, due to improper chemical cleaning, sites where condensates form and remain as liquid during shut down periods	Bottoms of pendant tubes, horizontal economizer tubes, bank tubes	Videoscopy, tube sampling
	**Graphitization**		
	Occurs in carbon steel and C– Mo tubes due to prolonged exposure to temperature 450 ^{0}C to 500 ^{0}C	Primary superheater tubes	In-situ metallography, sampling testing
	**Coal particle erosion**		
	Fire side of water wall tube	Water wall near burner	Visual inspection and Ultrasonic thickness to quantify

Damage mechanisms, locations and techniques

Damage mechanism	Damage sites	Inspection locations	Inspection technique
	**Acid dew point corrosion**		
	At sites along the flue-gas path where the metal temp. are below the acid dew point, from combustion in the furnace to the top of the chimney.	Tubes, casing, ducts and stacks	Visual inspection Ultrasonic thickness gauge
	**Short term overheating**		
	Sites having tendency of over-heating due to partial or complete blockage of tubes	Blockage due to debris, oxide or condensate at bends, bends of bank tubes, bottom bends in SH tubes	VT – Videoscopy Acoustic pulse reflectometry - APR
	**Stress corrosion cracking**		
	Sites with highest potential of stress and contaminants	Condensate collection points, bends, welds, attachment supports	Visual, WFMPI, PT, quantifying with potential drop/ stepwise grinding
	**Long term overheating**		
	Sites where overheating is likely, near material changes, variation in flue gas exposure for same material	Final tubes just before outlet header. Lowest tube in horizontal platen or leading tube of pendant	Visual inspection, OD and internal oxide scale measurement, in-situ metallography and quantify remaining life of tube, destructive testing
	**Low temperature creep cracking**		
	High stress areas including residual stresses from fabrication	Weld connections and header bore holes	WFMPI, quantify with potential drop technique, in -situ metallography
	**Fly ash erosion**		
	Locations wherein non-uniform high gas flows develop locally	Water wall tubes, inlet sections of reheater tubes	Visual inspection Ultrasonic thickness gauge
	**Fire side corrosion**		
	Sites wherein metal temperature exceeds 600^{0}C like water wall tubes facing flame, superheater and reheater tubes	Water wall tubes, leading sides of pendants, tubes out of alignment, spacers and uncooled hangers	VT for signs of corrosion, loss in thickness etc, UT survey for quantifying thickness loss.
	**Soot blower erosion**		
	Water wall tubes, superheater and reheater tubes	Circular pattern around wall blowers Direct path of retractable blowers for SH/RH	VT for signs of corrosion, loss in thickness etc, Ultrasonic thickness survey for quantifying thickness loss.

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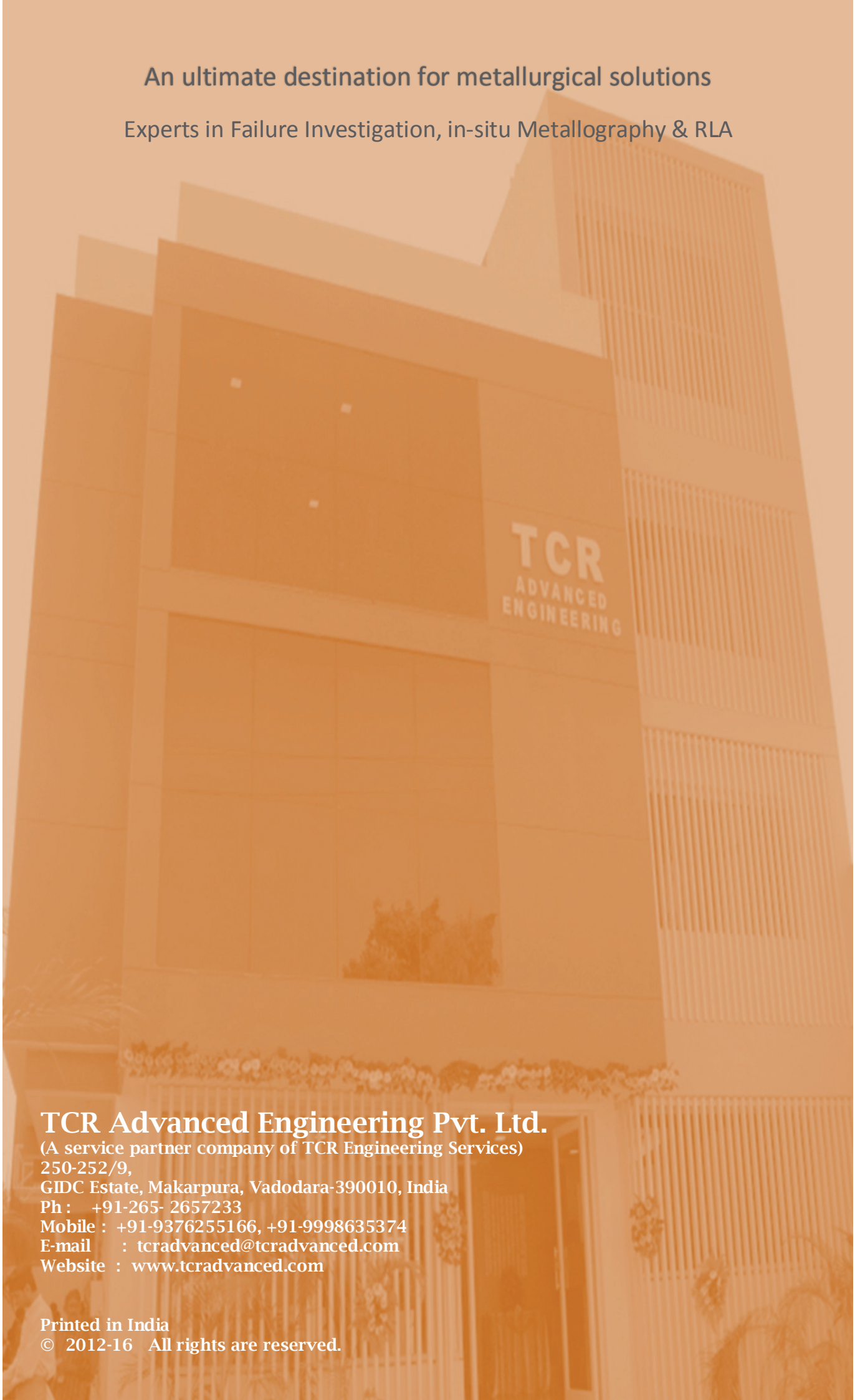

TCR Advanced Engineering Pvt. Ltd.
(A service partner company of TCR Engineering Services)
250-252/9,
GIDC Estate, Makarpura, Vadodara-390010, India
Ph : +91-265- 2657233
Mobile : +91-9376255166, +91-9998635374
E-mail : tcradvanced@tcradvanced.com
Website : www.tcradvanced.com

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