

INTEGRATION OF NDT FOR WATER TUBE BOILER

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Abstract □ Non-Destructive Testing (NDT) has been confirmed to be the most effective technology for supervising health condition of water tube boiler. Most of the fault symptoms, such as overheat, corrosion, erosion, crack of boiler tube, root crack of turbine blades, wear or pinhole of condenser tube, can be effectively identified in an early stage.

Thanks to up- to-date hardware and software, we use NDT can easily recognize any abnormal condition and avoid costly damage and accidental shut down during normal operation.

Introduction □ Due to the type of boiler is different. The entire boiler system has the possible module and the components include: pump, the heater, the pre-heater, the steam separator, the superheater, the economizer, the tube, and the valve.... Each boiler has the characteristic which it operates, but in short annual repairs period, using Non-Destructive Testing discovers the weakness and performs to renew or to make up strongly, in order to help its may lengthen the service life to the next maintenance point. Therefore NDT becomes the indispensable sharp weapon and acting for important role. This article is applies by NDT to my company and the domestic correlation field boiler, based on carries out the result to be good also deeply to attain the high praise, after reorganizes its examination items, the method, the position and so on makes the introduction.

Results □ 1. pre-preparation □ To collecting and studying the follows data for pre-testing:

- a. The layout (original design) of tube row of boiler. such as □ the panel of water tube, superheater, economizer, etc.
- b. The type of material and thickness of water tube.
- c. To check the tube records of formerly damaged. (Aim at formerly time of breaks and the position) in order to understood its following was possible to deteriorate mechanism and the position for doing the reference position of the plans as the examination.
- d. The layout of condenser's cross-section.
- e. The type of material, outer diameter, and thickness of condenser's tube.
- f. Unit serial number, use fuel, and estimate annual repairs period.

2. Testing items, methods and positions □

- a. Testing of furnace tube by Ultrasonic Testing for checking the area of less strength

For Examples □

Position □ Burner Side

Height □ 14.5m, 16.5m, 17.7m

Attenuation Factor □ 1.2

Attenuation Factor □ 1.0

Position □ Burner's Opposite Side

Height □ 14.5m, 16.5m, 17.7m

Attenuation Factor □ 1.2

Attenuation Factor □ 1.0

Position □ Burner's Right Side

Height □ 14.5m, 16.5m, 17.7m

Attenuation Factor □ 1.2

Attenuation Factor □ 1.0

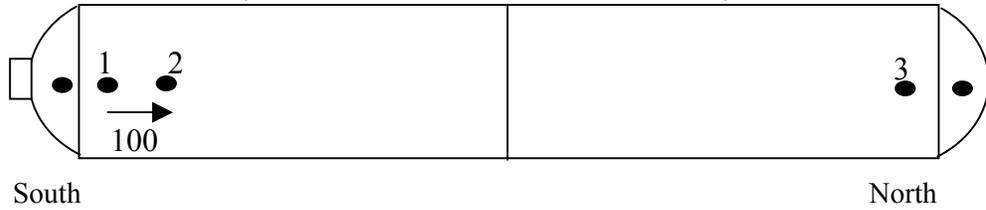
Position □ Burner's Left Side

Height □ 14.4m, 16.5m, 17.7m

Attenuation Factor □ 1.2

Attenuation Factor □ 1.0

Position □ Blow Tube
 Height □ 10.7m, 19.35m, 23m Attenuation Factor □ 1.2 Attenuation Factor □ 1.0
 b. The testing of pressure vessel /steam drum, water-drum by UT and Magnetic Particles Testing
 The record of thickness by UT measured and the weld examined by MPT



UT Thickness Measurement

Unit □ mm

	South	1	2	3	North
East	21.6	31.7	31.9	32.0	21.8
West	21.3	31.8	31.8	32.1	22.8
Upper	21.2	31.9	31.9	32.1	22.1
Down	21.1	31.8	31.8	32.1	21.2

MPT :
1.The

circumferential weld bead of south, north, and middle shell examined the result to be qualified.
 2.The longitudinal weld bead of south, north, and included the extend 50 mm between the two sides of longitudinal weld to examine the result to be qualified.

c. Field Metal photography □ this examination is in view of the high temperature area examined whether the furnace tube surface does decarbonise unusually, takes 2pieces.

d. Eddy Current Testing

For Examples :

1. Condenser's Tubes : 5844pcs, 100% Inspected.
2. Air cooler's Tubes : 308pcs, 100% Inspected.
3. Oil cooler : 648pcs, 100% Inspected.
4. Gland CDS : 158pcs, 100% Inspected (OD 16mm X t 1.2mm).
5. Air In-Jet CDS : 100pcs, 100% Inspected (OD 16mm X t 1.0mm).

The result of eddy current testing includes:

The unit's computer chart files, Signal picks up and the analysis, Tube plate visual examination, Flaw distribution map plan, the analysis of damages and reasons.

6. Testing Process of Low Pressure Heater

Jobsite testing process generally divides into three steps □ pushes probe into the tubes, picks up signal and the signal analysis to get results, as shown in figure 1~ 4.



Figure 1
Pushes Probe

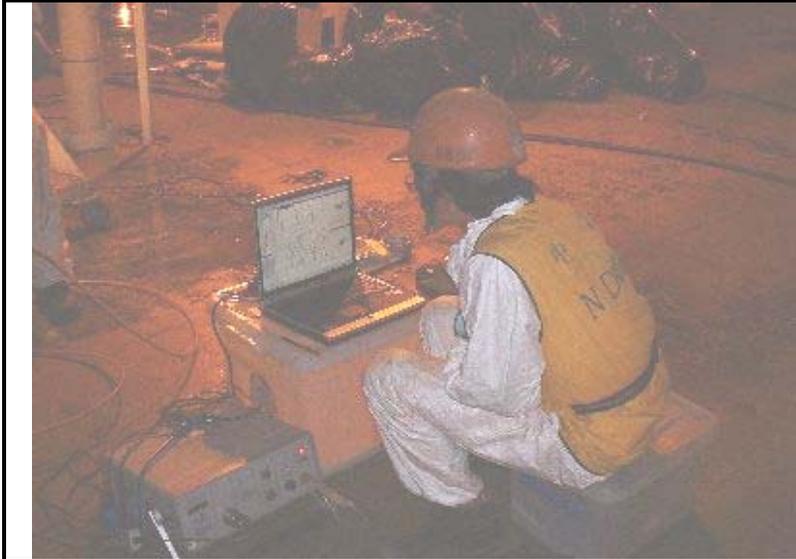


Figure 2
Pick up Signal

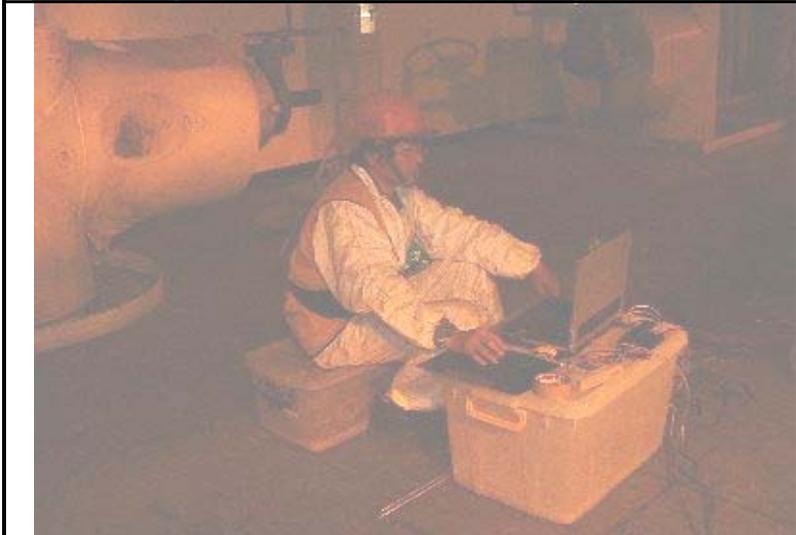


Figure 3
Signal Analysis

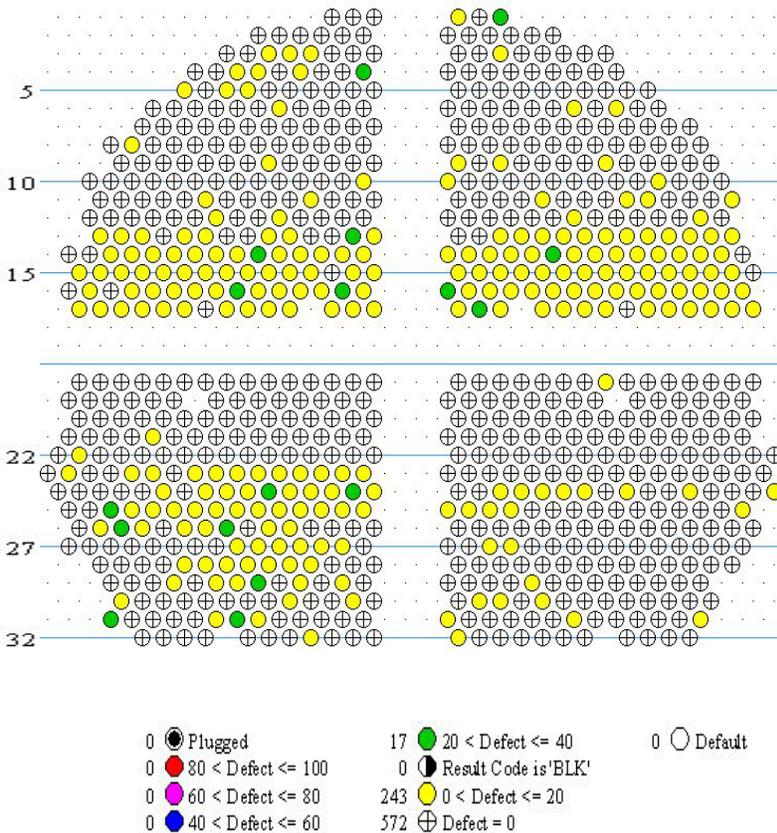


Figure 4 Cross Section of Tube sheet of Flaw Distribution

7. The results of ET : The slight defect is lower than 40%, the condition is good, still did not have to plug the tube . The suggestion monitoring contains O2 and the CO2 quantity for the feeder water.
 e. MPT for Turbine Blades, UT for Turbine Shaft and Bolts.

- Discussion**
1. The work is high above the ground for to guarantee the examination quality to be correct and the operating personnel safety, must be in good scaffolding.
 2. The steam drum long-term withstanding high temperature and the high pressure are easy in the welds and the heat affect zone area to have a fatigue crack use wet type fluorescence MT to be possible to examine.
 3. By using hardness tester check the Superheater Tubes (material type SA213-T91): The hardness test is based on the ASME standard limit in view of the T91 material's highest hardness value confirmed whether hardness value does surpass stipulation the standard.

Conclusions

1. The acceptance level of UT attenuation value for water tube are as following :
 - a. UT attenuation value \square 1.2 must cut-off
 - b. UT attenuation value \square 1.0 recommend cut-off
 - c. UT attenuation value \square 0.8 recommend cut-off or next time will expand tracing area
2. China Steel Corporation accumulates nearly 30 years boiler NDT examination experience, and establish the technical promotion apply to domestically, at present every year accepts the boiler examination service to surpass 50 sets. Because the boiler is the factory important equipment, cannot non- forewarn shutdown otherwise to be able to cause the heavy losses. Using NDT carries on the comprehensive inspection in the

Annual repairs opportunity, renews some not good and partial excision, will enable its to continue to operate till the next planned maintenance point. Therefore NDT to the boiler annual repairs already was the indispensable sharp weapon.

- References** □ 1. 2003 Annual Maintenance Report of Low Pressure Heater of MP-2.
2. 2003 Annual Maintenance Report of Ta-Yuan Cogeneration Co.