APH - Air Preheater TUBE FAILURES in BOILER

Root Cause Analysis of APH Tubes w.r.t Design & Operation

In Tubular type APH, Most of the APH tube failures take place at cold air entry side. Normally, Root Cause Analysis (RCA) indicate failures due to Dew Point Corrosion / Cold End Corrosion.

We rarely hear about a root cause of APH tube failure as Design Fault, while APH design is a major contributor. Life Span of tubes achieved is around 1.5 to 2.5 years with 2.0 / 2.3 mm thick APH tube.

Main reasons for APH tube failures are Erosion, High Localised Air velocity, High Localised Flue Gas velocity, Unbalance Air / Gas flow distribution at tube sheet entry, Expansion restriction, Bulging of Tube sheet & Ash deposition. According to my analysis & experience, Corrosion failure is least responsible reason for tube failures in Air Preheater.

Lets began our analysis in a broader way with few photos shown below for better understanding of the tube failure patterns.

CFBC Boiler - No sleeve, No Tube Expanding, Tube Thickness of 2.3 - 2.9 mm, Least tube failures recorded, while Fuel-Coal & Oil is used with %of Sulphur, High back end temperature required to avoid dew point corrosion

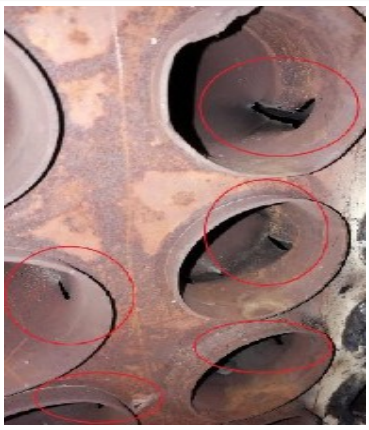
TG, AFBC & Other Boiler - Sleeve, Tube Expanding, Tube Thickness of 2.0 - 2.3 mm, Major tube failures recorded, while Fuel-Bagasse is used, Low back end temperature required to avoid dew point corrosion.

Main Observations of APH Tube Failures

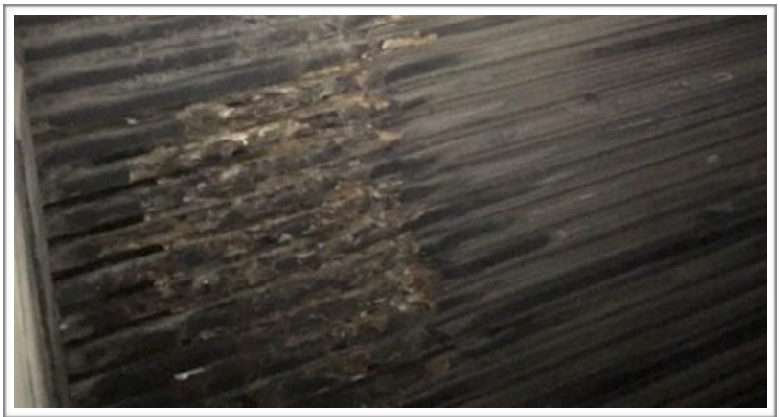
1. One individual APH tube at cold air entry fails partially but not complete tube length, while tube material, parameters is common.
2. Sometimes we observe that few APH tubes are not failed at cold air entry side.
3. All tube failures start from the end point of tube sheet i.e. tube expansion area.
4. All tube failures start from end point of sleeves, normally provided.
5. Corten Steel (SA 423 Gr1) tube failed but Carbon steel (BS 6323, Part-V) survives in APH, while all start / stop of boiler is faced by all APH tubes.
6. **In APH blocks, tube failure location is specific i.e. End point of tube sheet & sleeve, Expansion restriction points, Air / Gas distribution in tube sheet's air entry area, High Air / Gas velocity inside tube, except few specific case.**
7. Horizontal Tube APH (Air through tube) design as well as Vertical Tube APH (Gas through tube) both are prone to fail due to above cause.

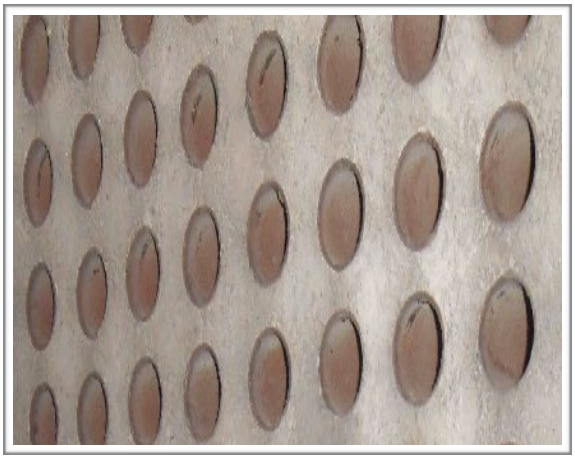
Discussion on APH Tube Failure

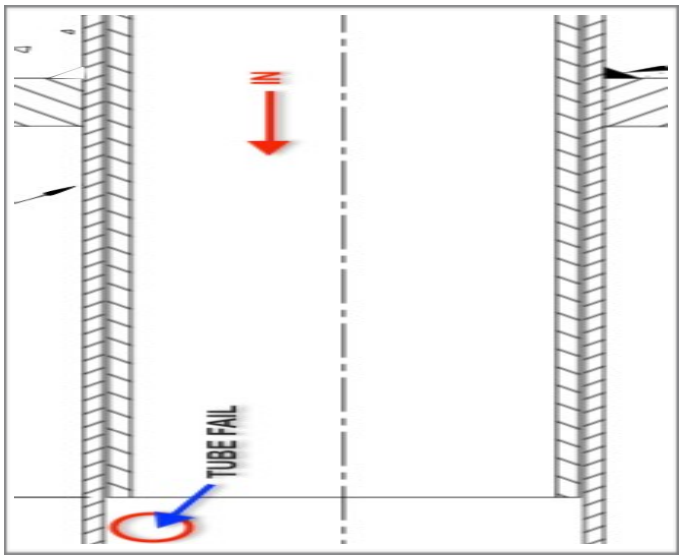
Photos showing Failure due to Expanding, Erosion, High Velocity

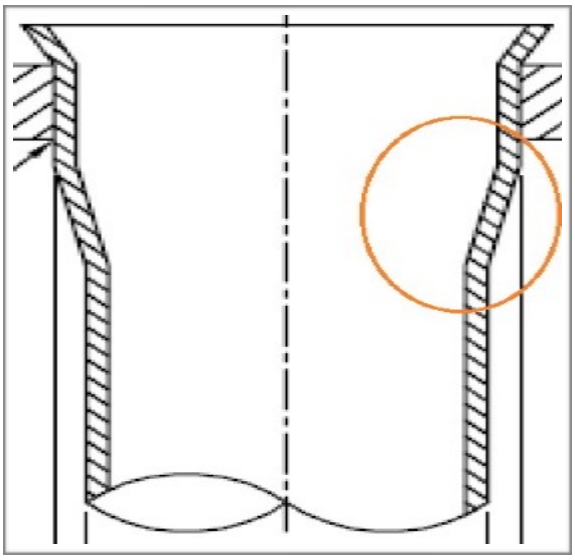











Root Cause Analysis & Reasons of APH Tube Failures

1. **Tube Expanding in tube sheet (Thickness reduction to tube failure)**
2. **Air Turbulence due to Sleeve (Erosion from tube inside)**
3. **Tube sheet, APH casing expansion restriction (Cracks in tube at end)**
4. **Damage started in most of the tubes from inside not outside.**
5. **High Air velocity / gas velocity in tubes (Erosion in tube)**
6. **Unbalance Air Flow at tube sheet entry (Localise high air velocity)**
7. **Unbalance Gas Flow at tube sheet entry (Localise high gas velocity)**

Unite Energy Corporation LLP, Ghaziabad, UP is assuring customers that this article shall help them to get best results from Slop fired boiler. Our mission of **"ENERGY CONSERVATION & TROUBLE FREE WORK ENVIRONMENT"** with an idea to reduce plant's cost & maintenance.

Unite Energy Corporation LLP is keen to provide best support to you to mitigate the irregularities in the plant, best technical services to mitigate breakdown, minimize downtime, improvise design and system performance, operational recommendations, genuine analysis, training and skill enhancement etc, to improve the overall plant's health and performance.

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