TOP END INSPECTION

ID rotating scan of the top ends for cracks and other signs of thermal fatigue

Reliable technique for scanning the upper tube top end areas

The historically accepted standard for examining in-service reformer tubes in steam methane reformers (SMRs) has been to inspect the heated length of the tube within the furnace. However, recent trends have changed that perspective, due to the discovery of internal defects and damage in these heretofore uninspected portions of the tube at the top ends in some plant designs. Defects have been found in two completely different design arrangements: a top-fired, down-flow design; and a bottom-fired, up-flow design. In both, a damage mechanism known as "thermal fatigue" was to blame.

The benefits

- Development of a **reliable inspection technique** with a specialized EC device
- **A purpose-built eddy current probe** for crack detection / thermal fatigue damage
- **Color coded C-Scan** clearly documents the findings and their locations
- **Timely identification of these flaws** contributes to the safe and dependable operation
- **Prevention of fires** that may result in significant losses of production

Importance of top end inspection

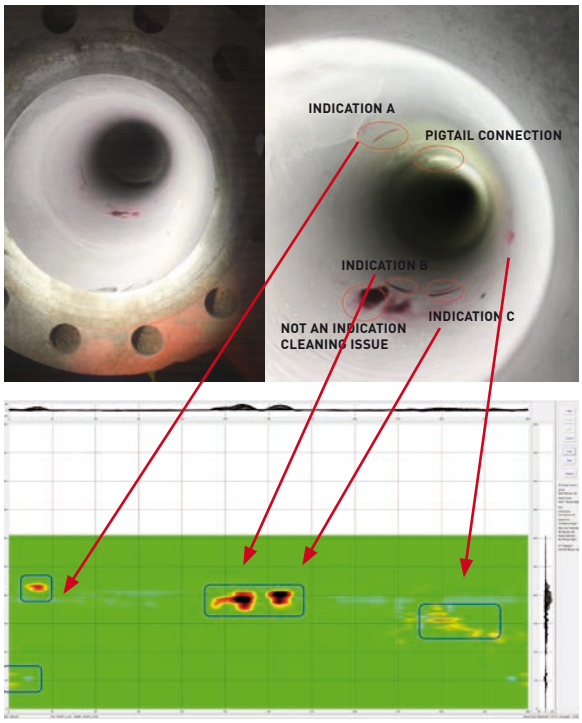
Top End failure mechanism

It is necessary to emphasize that these crack defects start on the inside and propagate towards the outside, offering no warning until an unexpected failure interrupts service. It is also important to know that these cracks typically show no measurable creep. Therefore, an effective inspection of the top ends must detect cracks rather than creep damage.

When failures of this type occur, they can cause catastrophic property damage, production outages and safety breaches. This is because a fire in the top ends of the reformer tubes, occurring in an area not frequently visited, can burn undiscovered for quite a while. Adjacent tube tops, inlet pigtails and structural steel can become overheated, setting off a cascade of further failures.

Clear C-scan representation of indications

The figure displays a typical scan of the top end of the reformer tube, showing cracks in the tube wall that radiate outward from the inside surface. The customer verified the cracks with penetrant testing (PT). Prompt detection of such defects can increase the reliability and protect the value of the asset while ensuring safety.



Printed in Germany ▪ Edition 01/2024 ▪ © Copyright Institut Dr.Foerster GmbH & Co.KG ▪ Subject to change ▪ Order No. 2298732

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