

# JM

# Reformer applications

CatTracker<sup>®</sup> catalyst temperature system

**Johnson Matthey**  
Inspiring science, enhancing life



# CatTracker<sup>®</sup>: multipoint catalyst temperature tracking system

## The most advanced temperature tracking technology

The CatTracker<sup>®</sup> catalyst temperature tracking system, patented by Daily Thermetrics and first introduced commercially in 2001, is a proven technology with superior operational service over five continents profiling hundreds of vessels.

The CatTracker<sup>®</sup>, employing patented aerospace thermocouple technology, offers the process industry the most rugged yet flexible temperature probes designed to be in direct contact with the process. CatTracker<sup>®</sup> temperature sensors are engineered to withstand the harshest environments and the most strenuous temperature demands.

Each CatTracker<sup>®</sup> probe consists of a minerally insulated cable which can sense temperature along its length at various predetermined locations. The CatTracker's multiple temperature sensing points are independent and isolated from one another, while at the same time ungrounded from the sheath. The CatTracker's patented design eliminates any possibility of signal interference (due to the fact that there is no common leg) and provides unsurpassed reliability for the most demanding applications.

In order to optimise plant performance, it is important to accurately monitor catalyst utilisation and condition. Reliance on inadequate or poor temperature instrumentation can have a severe adverse effect on the bottom line. Today's high activity catalysts can require temperature operating tolerances that simply cannot be met with outdated reactor profiling systems. Only with the most advanced, up-to-date equipment can a plant operator expect to get the most from the processing unit. Employing advanced techniques and technologies, such as CatTracker<sup>®</sup> gives the modern operator an edge on productivity as margins become an increasing concern.

## Reformer tube process temperature measurement

The CatTracker<sup>®</sup> has now been optimised for use in steam reformer tubes, providing customers with a unique insight into the process conditions in their reformer. Available exclusively from Johnson Matthey (JM), each CatTracker<sup>®</sup> probe is inserted into the centre of a reformer tube using a JM patented loading technique.

The CatTracker<sup>®</sup> requires no external sheath, and is approximately 6mm (0.24") in diameter. The small diameter and loading technique ensure that there is no impact on the reformer operation or on the gas flow distribution through the catalyst filled reformer tube.

Multiple sensors give temperature readings at different points in the reformer tube; the location of these sensors in the tube is determined by JM using their REFORM modelling program, indicating the best position in the tube for a given reformer. The hermetically sealed individual probes are fed to a common junction box, which can be appropriately located on the reformer.

CatTracker<sup>®</sup> offers many potential benefits including:

- Continuous on-line monitoring of the tube temperature profile, with the profile available in real time through the plant DCS system.
- Installation of trips based on reformer process gas temperatures, preventing costly reformer damage.
- Determination of the tube temperature profile leads to more accurate prediction of operating proximity to the carbon formation zone, and hence the ability to avoid catalyst steam-outs as a result of carbon formation.



# An overview of CatTracker



KATALCO QUADRALOBE™ steam reforming catalysts



CatTracker installed in a reformer tube

## Proprietary technologies designed into each CatTracker sensor

- **Ultra High Precision Technology**  
Every CatTracker temperature sensor is engineered and manufactured such that the temperature readings are within 1°C (2°F) at 427°C (800°F).
- **Drift Detection Technology**  
The CatTracker system is designed to identify temperature trends unrelated to actual operational trends of the processing unit.

## External weld beads

Purpose: to provide permanent visual and tactile identification of CatTracker® temperature sensor location

## CatTracker® probe/ sheath

Purpose: enclose and protect temperature sensors

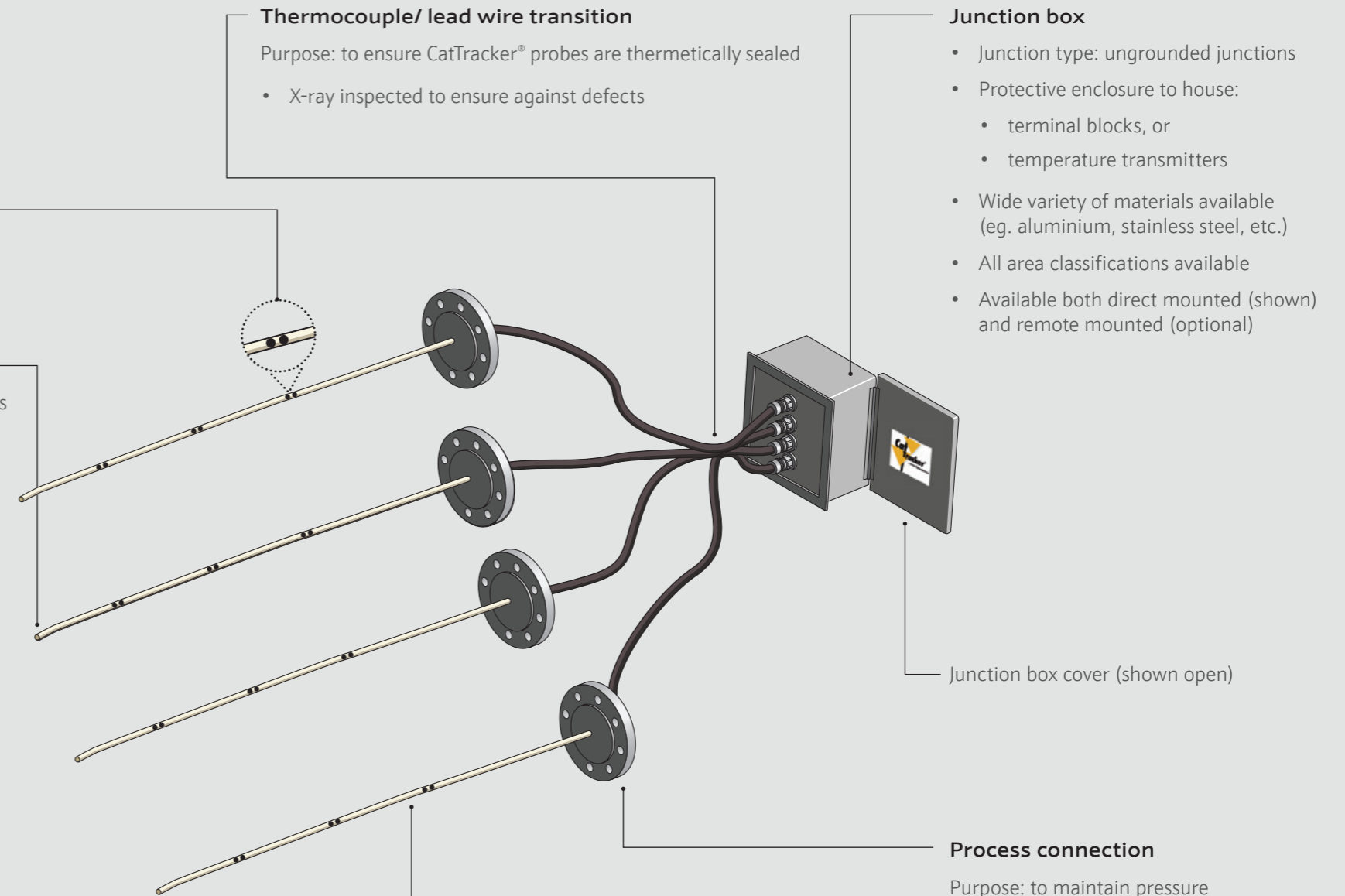
- Typical material to be matched to or complement the vessel internals
- Wide variety of materials available (eg. 316, 347, 310, stainless steel, etc.)
- Thermocouple sheath length determined by JM such that temperature profile is accurately measured

## Specifications for CatTracker® probes

- Up to eleven (11) sensing points per probe
  - sensing points: isolated, independent
  - junction type: ungrounded junctions
  - sheath diameter: = 6.35mm (0.250") OD
  - wall thickness: standard 0.508mm (0.02") minimum

## Non destructive testing (NDT) carried out on each CatTracker® assembly

- Thermocouple calibration test
- Thermocouple insulation resistance test
- Thermocouple continuity test
- Thermocouple compaction density test
- Dye penetrant test
- Ultrasonic testing
- Positive material identification:
- Hydrostatic pressure test
- Radiographic examination
- Helium leak test



## Thermocouple/ lead wire transition

Purpose: to ensure CatTracker® probes are thermetically sealed

- X-ray inspected to ensure against defects

## Junction box

- Junction type: ungrounded junctions
- Protective enclosure to house:
  - terminal blocks, or
  - temperature transmitters
- Wide variety of materials available (eg. aluminium, stainless steel, etc.)
- All area classifications available
- Available both direct mounted (shown) and remote mounted (optional)

Junction box cover (shown open)

## CatTracker® temperature sensor

Specifications for CatTracker® temperature sensors

- Thermocouple (T/C) ISA Type: Customer to specify. (e.g., type K, type J, etc.)
- T/C accuracy: premium grade, special limits of error (per ANSI MC96.1) or Class I, premium (per IEC EN 60584-2; JIS C 1602)
- T/C compaction density: 84% minimum compaction density (versus industry standard 70%)
- T/C lead wire: 20 AWG

## Process connection

Purpose: to maintain pressure boundary at flange face

- All pressure flange ratings and specification available (150lbs - 2500lbs, 68kg - 134kg)
- Wide variety of flange materials available
- Typically RTJ or RF (shown) flange used
- Other process connection types available



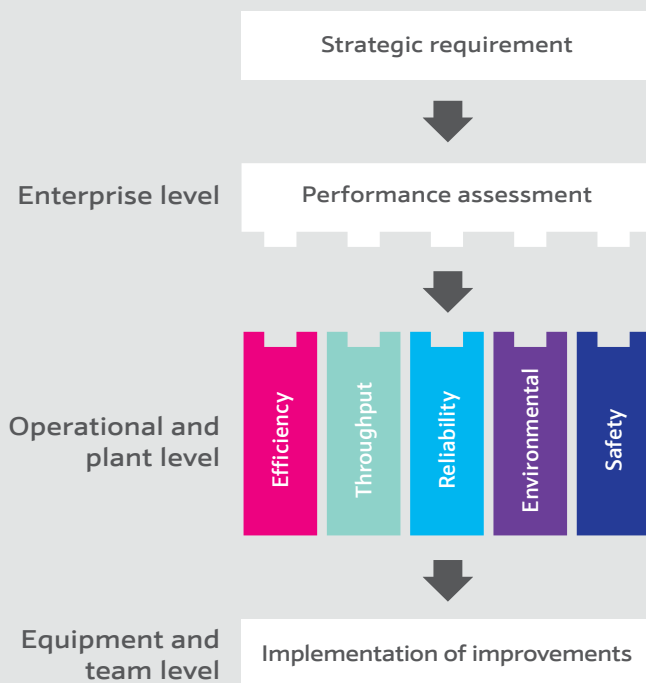


## KATALCO PERFORMANCE

At Johnson Matthey (JM), our customers have often told us that catalysts alone are not sufficient to ensure the best possible performance from a synthesis gas (syngas) plant. As a business with an operating heritage in the industry and people on our team who have designed, built, operated, monitored and maintained syngas plants over a period of more than 30 years, we know this to be true.

The right loading techniques, operation and process optimisation of catalysts can give world-beating performance. However, there are many areas other than catalysts that affect the plant performance. Through a combination of working closely with our customers, strategic partnerships and our background in the industry, we are able to offer advice and solutions that are a direct benefit to our customers. This is the essence of **KATALCO™ PERFORMANCE**.

**KATALCO PERFORMANCE** concentrates on issues that are important to our customers with the aim of improving your plant performance and profitability. It focuses this experience and knowledge in the five key areas; Efficiency, Throughput, Reliability, Environment and Safety. This range of services and know-how allows our customers to make more product, at higher rates, to tighter specifications, at reduced cost, while improving safety and reducing environmental impact.



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