

JM

Reformer surveys

Optimising your reformer performance



Johnson Matthey
Inspiring science, enhancing life

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Unrivalled reforming expertise and know-how

Achieving the best performance from your steam reformer is key to your plant operation. The optimum operating temperature is a balance between maximising the reaction conversion without compromising the lifespan of the equipment.

By choosing **KATALCO™** high activity reforming catalysts and combining this with a range of **KATALCO PERFORMANCE** services, the efficiency of the plant can be optimised.

Reformer surveys

Johnson Matthey (JM) offers a reformer survey service to enhance the performance of your reformer unit. With extensive experience, having carried out over 350 reformer surveys to date, our engineers know how to get the best from your reformer.

The survey provides reliable tube wall temperature (TWT) measurements by using the latest measurement techniques. This data, used in conjunction with detailed kinetic modelling of the reformer catalyst, enables verification of current performance and accurate future performance predictions.

By selecting a **KATALCO PERFORMANCE** reformer survey you can achieve the following benefits:

- Minimise tube wall temperature spread allowing:
 - Safe operation
 - Increased fuel efficiency
 - Increased methane conversion
 - Increased tube life
 - Increased catalyst life
 - Reduced downtime
- Identify improvement opportunities within your reformer.
- Understand and prevent any issues inside the tubes.
- Collect baseline information.

Service levels

Johnson Matthey offers four service levels of its **KATALCO PERFORMANCE** reformer survey to ensure there is one to fit your requirements.

Diamond	Our premium survey for operators which strive to continuously improve their reformer performance. A tailor-made approach in troubleshooting problematic reformers.
Gold	An intense check of the tube wall temperatures plus detailed modelling of the reformer catalyst. A complete view of the physical and process performance of the reformer and its catalyst. More advanced diagnostics will be offered based on the output of the survey.
Silver	A detailed health check with corrected tube wall temperatures and an overall view of temperature distribution across the reformer, highlighting problem areas.
Bronze	A general health check of the tube wall temperatures using either a pyrometer or reformer imager.

The table on page 5 summarises the specific services attributed to each of the above options.

Reformer survey service levels in detail

		Diamond	Gold	Silver	Bronze
Equipment	Reformer imager	○	○	○	○
	Gold cup	○	○		
	Pyrometer	○	○	○	○
On-site	Task specific risk assessment	✓	✓	✓	✓
	Reformer tube visual health check	✓	✓	✓	✓
	Visual check on reformer firing condition	✓	✓	✓	
	Collect plant design and operating data	✓	✓	✓	
	Internal and external visual inspection of the reformer	✓	✓		
	Preliminary results presentation	✓	✓		
Support output	Full raw TWT data in table and map	✓	✓	✓	✓
	Reformer performance summary	✓	✓	✓	
	Technical explanation on method and equipment used	✓	✓	✓	
	Corrected TWT analysis	✓	✓	✓	
	Reformer problems identification	✓	✓	✓	
	Full report	✓	✓	✓	
	Typical final report delivery time (weeks)	4 - 6	5 - 7	6 - 8	
	Detailed TWT statistical and graphical analysis	✓	✓		
	Recommendations on areas of improvement	✓	✓		
	Reformer benchmark to industrial standard	✓	✓		
	TWT spread / margin / max operating TWT analysis	✓	✓		
	Thermal images of reformer interior highlighting areas of concern	✓	○		
	Raw thermal images of each row of the reformer	✓	○		
Plant data reconciliation	✓	○			
Detailed reformer performance (PRIMARY) tailored to plant ¹	✓	○			
Further support	Advice on reformer problems	✓	○		
	General advice on reformer balancing techniques	✓	○		
	Future projections of catalyst performance ¹	○			
	Sensitivity analysis	○			
	Follow up report discussion	○			
Hands-on equipment training for operators ²	○				

¹ Applies to Johnson Matthey catalyst

² If the customer has their own measuring equipment (pyrometer/ reformer imager)

TWT = Tube wall temperature

○ = Optional, additional charges may apply

Reformer imager

Unsurpassed insight with reformer imaging

The reformer imager uses near infra-red temperature measurement technology with a short wavelength to minimise errors associated with varying emissivity.

Combined with high definition images, no other reformer survey offers the same level of detail.

The reformer imager provides a high level of repeatability compared to hand held pyrometers allowing continuous reformer performance improvement over multiple surveys.

Combining the reformer imager with our reformer model, engineering know-how and modelling capability, can significantly improve the performance of your reformer.

Available in all service levels.



Above: Thermal footage is recorded at every peephole.



Above: Live thermal footage of the reformer internal is reviewed by our reformer engineer to ensure good quality data is collected on-site.

Using the reformer imager provides the following advantages over other techniques:

- The wide field of view, gives clear images of the whole reformer lane.
- The ability to measure areas of tube hidden from pyrometer or gold cup techniques.
- Recorded images give instant analysis.
- Spot temperature measurements from anywhere in the image.
- Highlights details the human eye cannot detect.
- Allows for fast data collection.
- Recorded footage is available for future reference.
- The ability to identify:
 - Hot tubes, spots or bands.
 - Flame impingement on tubes or refractory walls.
 - Damage to refractory wall, roof or tunnels (Figure 1).
- Easy profiling of tube wall temperature (Figure 2).

Where concerns are identified, the reformer imager allows identification of location specific temperatures.

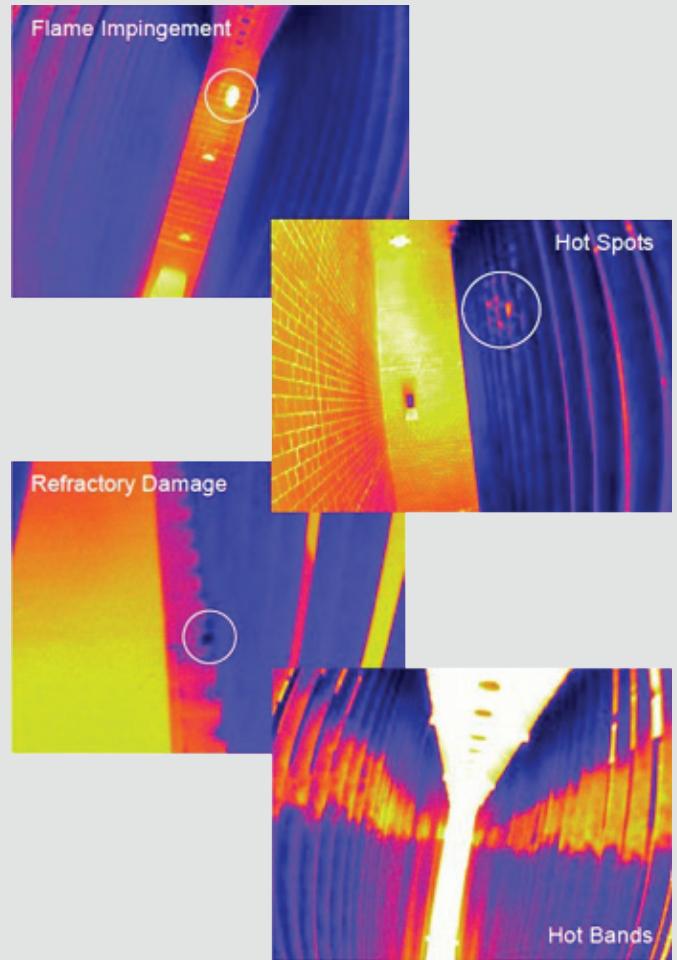


Figure 1: Problems identified from reformer imager surveys

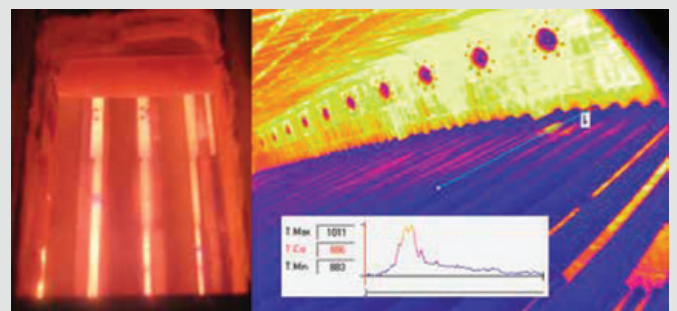
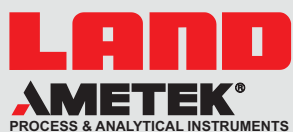


Figure 2: Above left: Limited pyrometer view from peephole
Above right: Wide angle view from same peephole allows viewing of the roof and tube top

The reformer imager is offered under an exclusive relationship with AMETEK Land. AMETEK Land's expertise in temperature measurement, coupled with Johnson Matthey's reformer experience enables you to optimise the operation of your reformer.

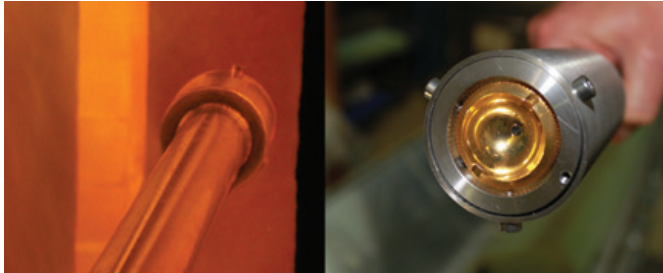




Gold cup

Gold and Diamond service levels only

Over 40 years' continuous development of our pioneering gold cup temperature measurement has helped customers around the world achieve accurate tube wall measurement without the effect of background radiation.



Above left: Tube contact using gold cup
Above right: Gold cup

Using direct tube contact the gold cup creates a seal between the tube surface and the instrument, shielding the thermocouple from additional radiation around the tube.

Temperature readings obtained from the gold cup do not require background radiation correction.

Advantages

- Accurate measurement of real tube wall temperature.
- No temperature correction required.
- Not affected by flame pattern or box condition.
- Allows validation of pyrometer offset.

PRIMARY modelling

Gold and Diamond service levels only

A reformer survey is not just measuring temperatures. Without detailed modelling of the reformer on both the furnace and process side it is difficult to make informed and targeted performance improvements.

Our PRIMARY modelling software, can evaluate:

- Process side performance
- Catalyst life
- Furnace performance
- Opportunities for improvement
- Projection of future performance

An example of plot comparing PRIMARY modelled and measured values is shown in Figure 3.

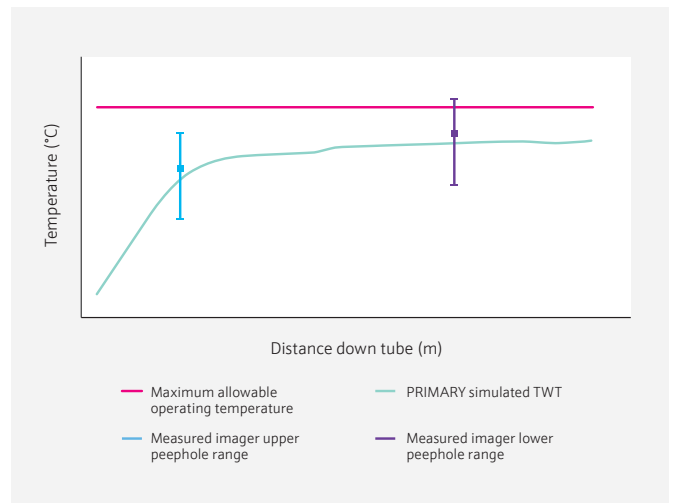


Figure 3: Comparison of modelled and measured reformer data

Detailed TWT analysis

Gold and Diamond service levels only

JM provides a thorough assessment of the reformer, focusing on more than just the furnace box.

The includes detailed reformer modelling and catalyst performance evaluation for JM installed catalyst.

Full plant data is collected, reconciled and used to characterise the catalyst performance using our modelling software.

Tube wall temperature data is corrected for background interference. The results are presented as surface plots with key information (Figure 4).

The combination of reformer imager, gold cup or pyrometer measurements with our modelling software allows improvements to be identified, potentially avoiding tube failure and poor catalyst performance over the life of your reformer.

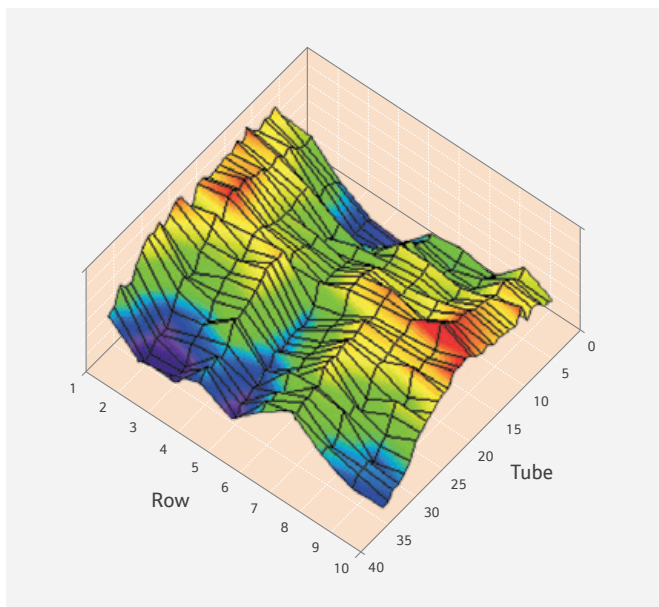


Figure 4: Three dimensional model of corrected reformer tube temperatures

KATALCO PERFORMANCE

additional services

When a reformer survey highlights a more detailed investigation is required, JM is able to help. A combination of additional services can be tailored to your specific issues to ensure a targeted approach to solving your problems. Some of these options are listed below. Contact your JM representative to discuss your requirements.

 Plant revamps	 Pressure surveys
 Sensitivity analysis	 Heat loss survey
 Remnant tube life calculations	 Design philosophy review
 Computational fluid dynamics	 Corrosion investigations and analysis
 Tube failure analysis	 Maldistribution checks
 CatTracker™ in-tube temperature measurements	 Assessment of burners
 Combustion air survey	 Process simulation
 Reformer benchmarking	 Start-up procedure review

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