FCCU Process Optimization
with High-Performance Temperature Instrumentation

Taylor Fama

Regional Technology Manager

Daily Thermetrics

a division of Daily Instruments Corp.
AGENDA

I. Intro to Daily Thermetrics

II. FCC Applications
   I. Feed Hydrotreater/Pre-Treater
   II. Reactor
   III. Reactor Stripper
   IV. Regenerator
   V. Fractionator
Daily Thermetrics

Since 1973
Global Headquarters & Manufacturing in Houston, TX

© Daily Instruments Corporation. All Rights Reserved. Any unauthorized distribution or disclosure is prohibited.
AGENDA

I. Intro to Daily Thermetrics

II. FCC Applications
   I. Feed Hydrotreater/Pre-Treater
   II. Reactor
   III. Reactor Stripper
   IV. Regenerator
   V. Fractionator
FCC Unit Components

Fluidized Catalytic Cracking

• **Direct Components**
  – Reactor
  – Regenerator
  – Fractionator

• **Indirect Components**
  – Feed Hydrotreater (Pretreater)
  – Feed Heater
  – CO Boiler

*Typical Side-by-Side Configuration*
CatTracker® Reactor TI: FCC Pretreater

Patented Reactor Profiling Technology

PATENT # US 6,550,963 & 6,599,011 / CANADA 2,449,074 / EU PATENT PENDING

© Daily Instruments Corporation. All Rights Reserved. Any unauthorized distribution or disclosure is prohibited.
High Hardness TWs: Erosive Catalyst

High Hardness Coatings

Do you have issues like this?

Example of failed TW from FCC service
High Hardness TWs: Erosive Catalyst

High Hardness Coatings

Do you have issues like this?

Example of failed TW from FCC service
High Hardness TWs: Options

Coating Methods & Solid Tip

• **Spray and Fuse**
• **Welded Overlay**
  • *Tungsten Inert Gas (TIG)*
  • *Plasma Transfer Arc (PTA)*
  • *Laser Cladding*
• **Solid Barstock**
High Hardness TWs: Welded Overlay
Coating Methods

Daily Thermetrics is CERTIFIED to directly manufacture
Stellite® TIG weld overlay and solid tip types

Example of Stellite® TIG weld overlay

Stellite® is a registered trademark of Kennametal Stellite Group
© Daily Instruments Corporation. All Rights Reserved. Any unauthorized distribution or disclosure is prohibited.
High Hardness TWs: Welded Overlay

Coating Methods

Example of Stellite® TIG weld overlay TW during fabrication

Stellite® is a registered trademark of Kennametal Stellite Group

© Daily Instruments Corporation. All Rights Reserved. Any unauthorized distribution or disclosure is prohibited.
High Hardness TWs: Assembly

Complete Assembly

Example of weld overlay coating TW with Shear Valve
FCCU Reactor – Riser Section

High Hardness Coating TW

Shield is first defense in addition to overlay coated TW in this case.

© Daily Instruments Corporation. All Rights Reserved. Any unauthorized distribution or disclosure is prohibited.
CatTracker®: FCC Riser

More Robust CatTracker® in Stellite® TW

3/8” OD TC
Heavy Wall 0.07”

1/8” Stellite #6

SHED OUTSIDE LD2
SEE DETAIL 6

1” THK REF INSIDE GAS OUTLET TUBE

NEW STELLITE COATED
THERMOWELL (SEE DETAIL 3)
(SHED INSIDE GAS OUTLET)
(TUBE NOT SHOWN FOR
CLARITY, DETAIL 2)

FIELD BENT
THERMOCOUPLE

SHEAR VALVE THERMOCOUPLE
ASSEMBLY

REACTOR SHELL

THERMOCOUPLE 3/8” OD

EXISTING 1” 6000 PSI
STEEL LINE
Critical Monitoring of Start-up Fouling

During start-up, moisture buildup within the mechanical components of the FCC can affect proper flow of catalyst between the reactor and the regenerator. Such moisture can eventually create a bridging effect that may develop into a blockage or plugging of critical catalyst pathways. More severe fouling may cause productivity limitations and environmental issues if not caught quickly enough.

Daily Thermetrics manufactures a temperature monitoring solution to eliminate premature catalyst injection with respect to moisture buildup within the cyclone’s ‘catalyst exit tubes’. The routing and appropriate attachment location of the temperature sensor directly to each of the catalyst exit tubes is critical and Daily Thermetrics’ experience assures accurate and reliable temperature measurement in locations where moisture is known to collect during start-up of the FCC.
FCCU Reactor - Cyclone Dip Leg Section

Multipoint Weld Pad Skin Thermocouple Assembly

Tube Growth Direction
Monitoring of structured packing in FCC Spent Catalyst Strippers: Removal of hydrocarbons from the catalyst before it enters the regenerator can significantly improve over-all performance and hence profitability of the FCC unit.


© Daily Instruments Corporation. All Rights Reserved. Any unauthorized distribution or disclosure is prohibited.
High Hardness TWs: Welded Overlay

Regenerator Long Pipewells with Sensitive Tip

Example of coating weld overlay sensitive tip pipewell
FCC Fractionator: Example

Components

A = Overhead product
B = Reflux
C = Feed
D = Steam reboiler inlet
E = Bottom product

1 = Distributor
2 = Packing
3 = Liquid collector
4 = Trays
5 = Downcomer
Existing TE/TW’s
Improved TI Profile with CatTracker® technology
Fractionator: Downcomer Section
CatTracker® Multipoint Technology

- Snug/Not fixed fitting
- Plunger & Packing protect process bypass
FCC Fractionator: Example

Components

A = Overhead product
B = Reflux
C = Feed
D = Steam reboiler inlet
E = Bottom product

1 = Distributor
2 = Packing
3 = Liquid collector
4 = Trays
5 = Downcomer
FCC Fractionator: Structured Packing

CatTracker® Multipoint Technology
FCC Fractionator: Wash Bed Section

CatTracker® Multipoint Technology

TI can profile under or in the wash bed

TI can profile under distributor head
# Importance of Temperature

<table>
<thead>
<tr>
<th>Location</th>
<th>Temperature Instrument</th>
<th>Operational Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Hydrotreater</td>
<td>CatTracker® Multipoint</td>
<td>- Optimize Catalyst Performance</td>
</tr>
<tr>
<td>- Fixed Catalyst Bed</td>
<td></td>
<td>- Maximize Catalyst Life</td>
</tr>
<tr>
<td>Reactor</td>
<td>Erosive Service TWs</td>
<td>- High-Hardness TWs to last unit run</td>
</tr>
<tr>
<td>- Reactor</td>
<td></td>
<td>- Proper Start-Up Temperature; Reduce catalyst clogging</td>
</tr>
<tr>
<td>- Riser</td>
<td>Cyclone Dip/Exit Legs</td>
<td>- Optimize Catalyst Hydrocarbon Removal</td>
</tr>
<tr>
<td>- Stripper</td>
<td>CatTracker® Multipoint</td>
<td></td>
</tr>
<tr>
<td>Regenerator</td>
<td>Erosive Service TWs</td>
<td>- High-Hardness TWs/Pipewells to last unit run</td>
</tr>
<tr>
<td>- Regenerator</td>
<td>Pipewells</td>
<td></td>
</tr>
<tr>
<td>Main Fractionation Tower</td>
<td>CatTracker® Multipoint</td>
<td>- Tight control on cuts</td>
</tr>
<tr>
<td>- Downcomers/Trays</td>
<td></td>
<td>- Prevent Liquid Bottoms fouling downstream heat exchanger</td>
</tr>
<tr>
<td>- Distributor Header/Packing</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What can we do to improve your FCCU profitability and safety?