

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



ISO 9001:2008 CERTIFIED
QUALITY ASSURANCE

Since 1973
**Global Headquarters &
Manufacturing in Houston, TX**

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



Temperature Measurement Solutions

DAILY THERMETRICS

UPGRADE & REVAMP SOLUTIONS

REACTOR THERMOMETRY



HEATERS & FURNACES



Technical Services



Design & Field Engineering

Thermowells & Sensors



VESSEL SURFACES

Vessel Skin Sensors™

Temperature Measurement Solutions



AGENDA

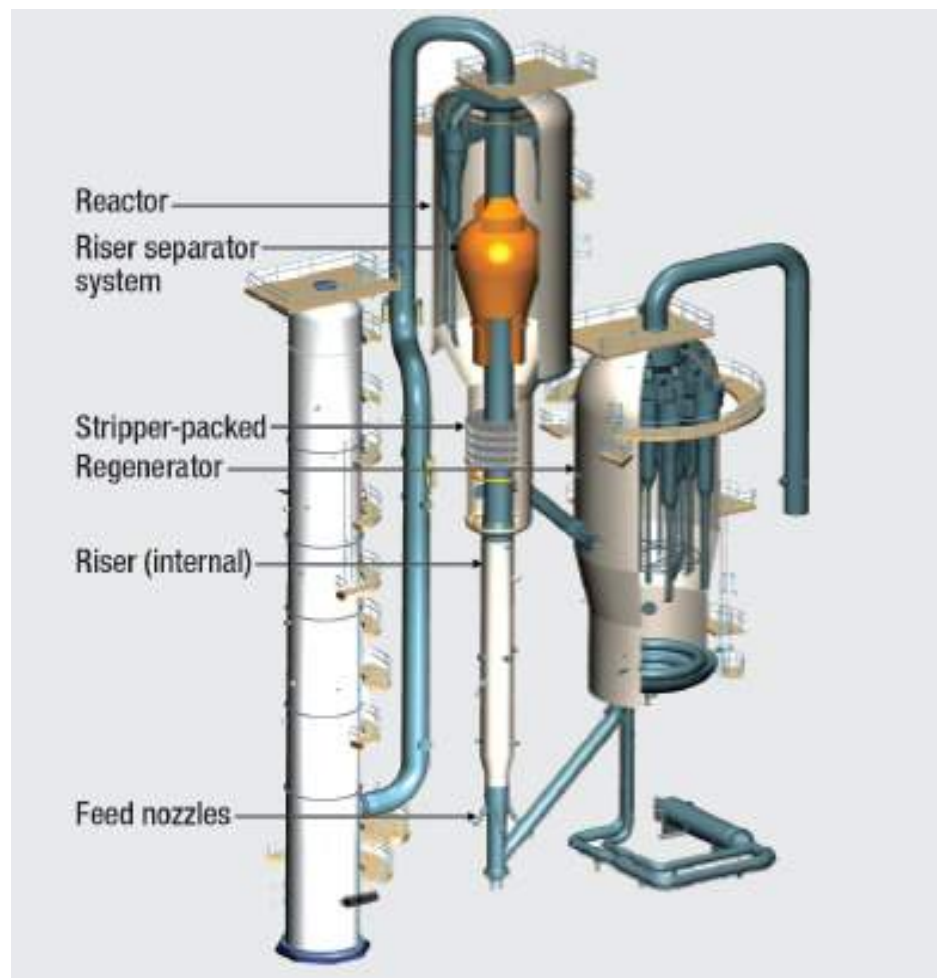
- I. Intro to Daily Thermetrics
- II. FCC Applications
 - I. Feed Hydrotreater/Pre-Treater
 - II. Reactor
 - III. Reactor Stripper
 - IV. Regenerator
 - V. Fractionator



FCC Unit Components

Fluidized Catalytic Cracking

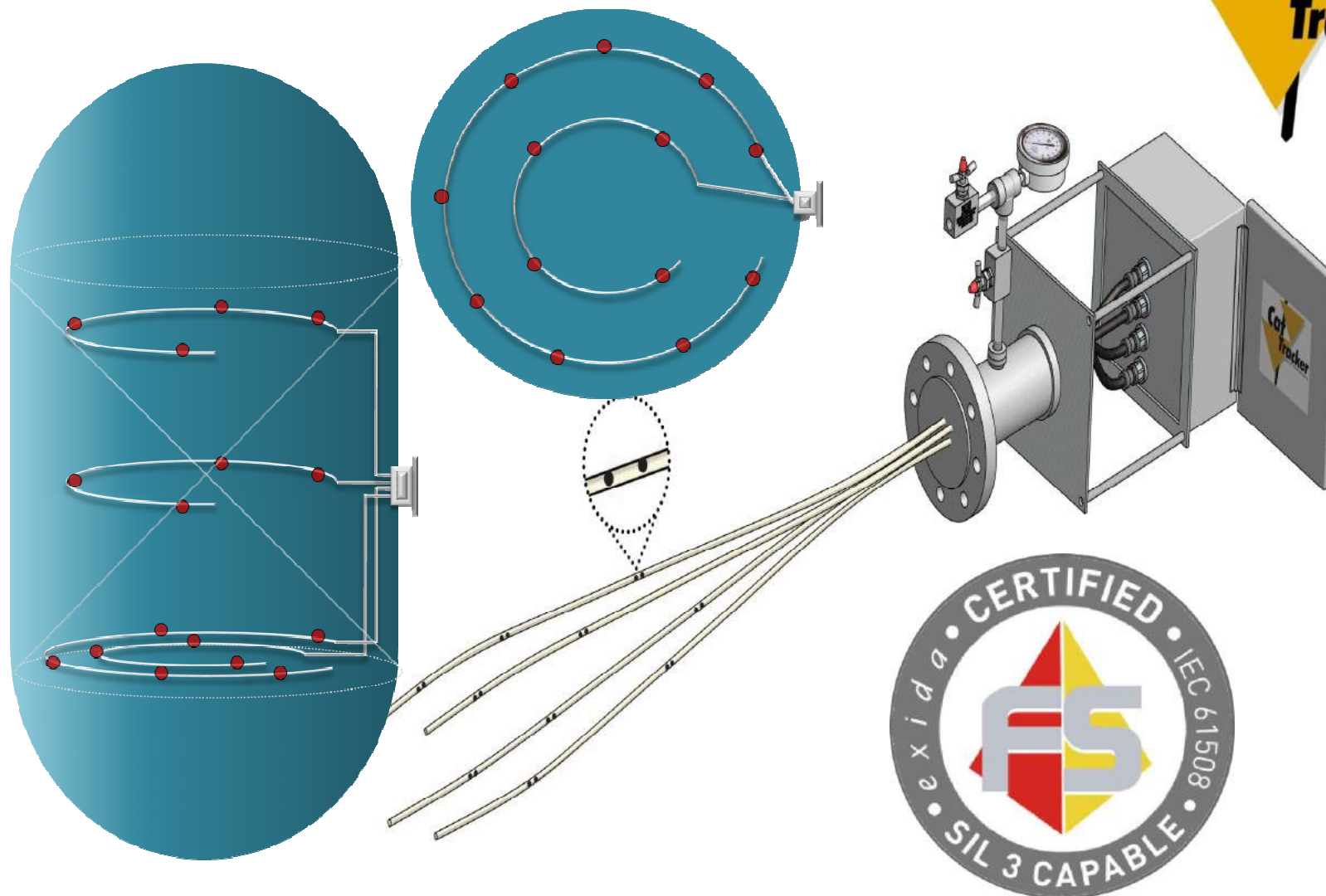
- **Direct Components**
 - Reactor
 - Regenerator
 - Fractionator
- **Indirect Components**
 - Feed Hydrotreater (Pretreater)
 - Feed Heater
 - CO Boiler



Typical Side-by-Side Configuration

CatTracker® Reactor TI: FCC Pretreater

Patented Reactor Profiling Technology



Temperature Measurement Solutions



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

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

Temperature Measurement Solutions



High Hardness TWs: Erosive Catalyst

High Hardness Coatings

Do you have issues like this?

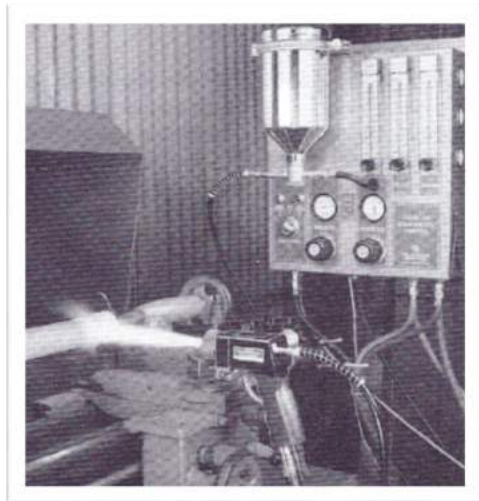


Example of failed TW from FCC service

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



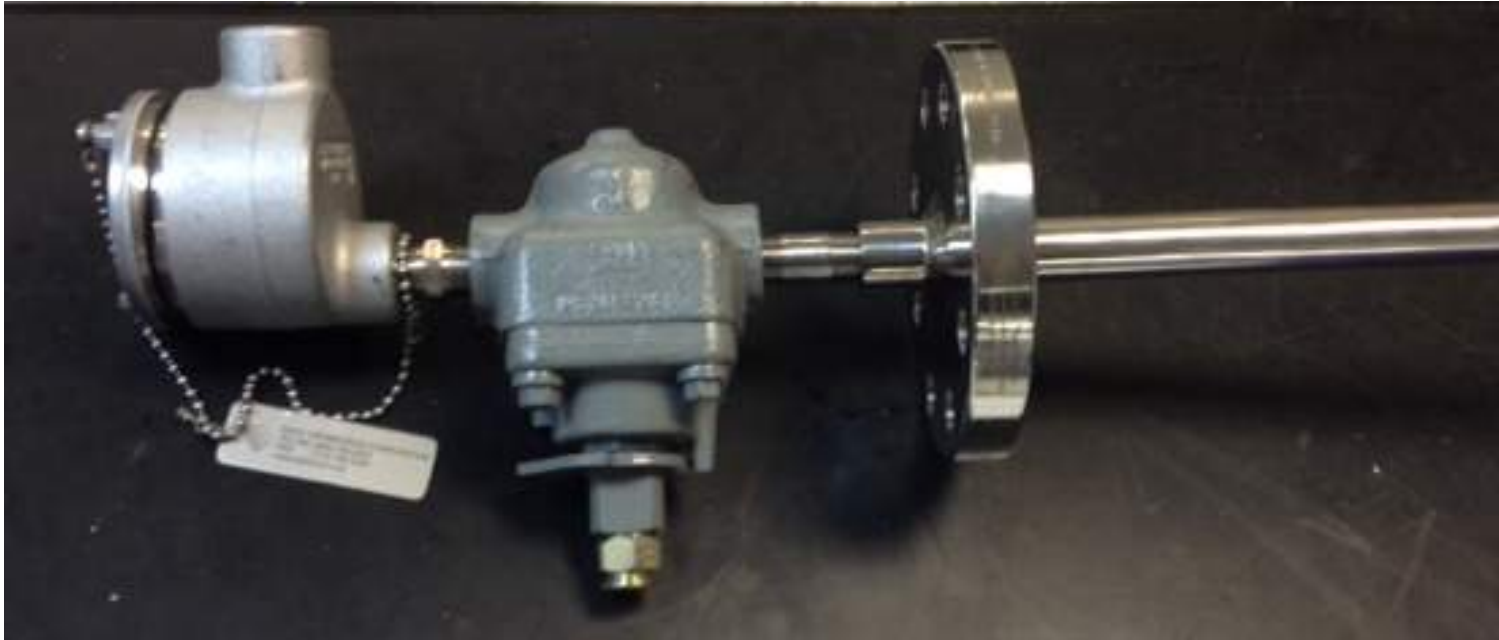
Example of Stellite® TIG weld overlay TW during fabrication

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.

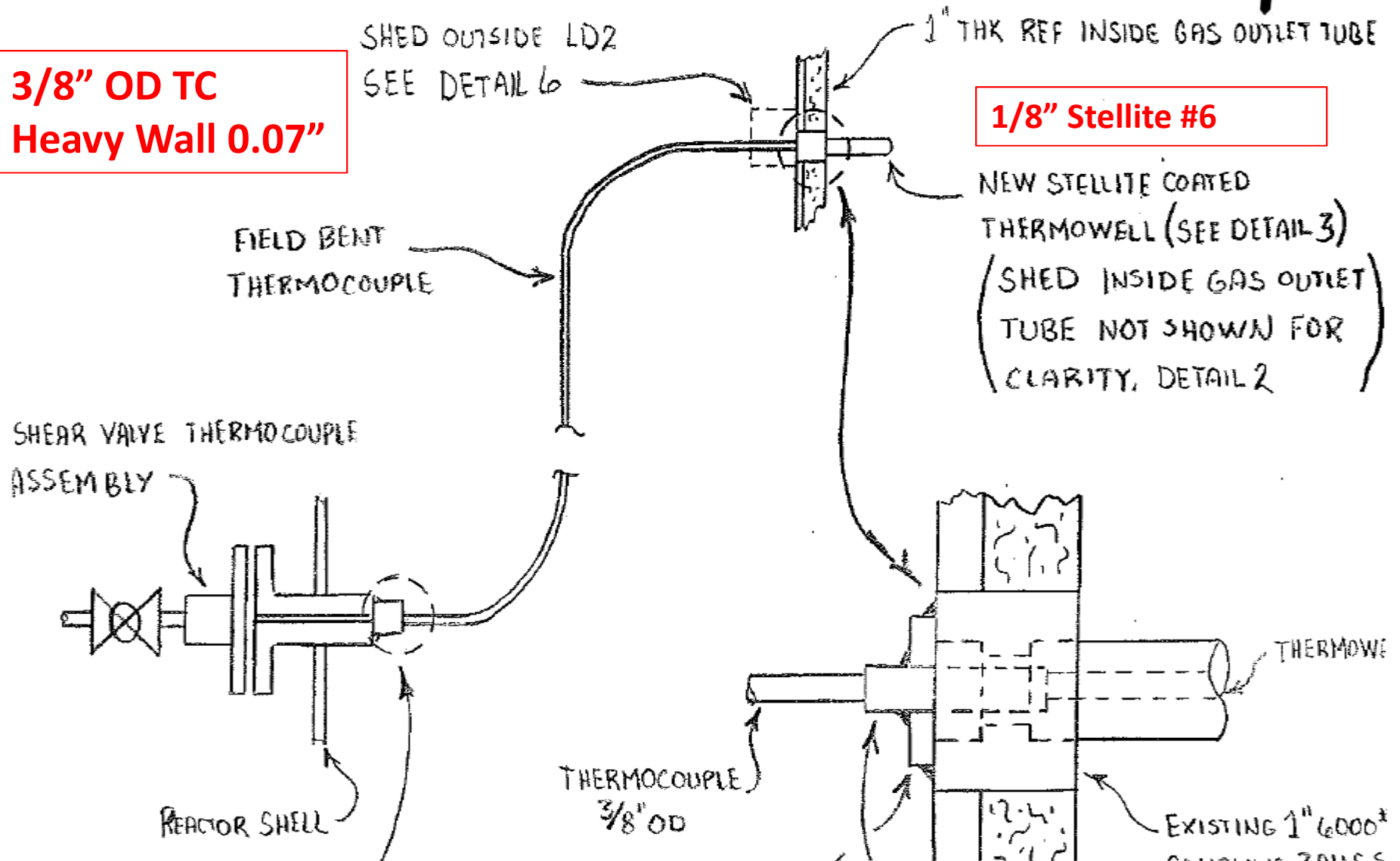
CatTracker®: FCC Riser

More Robust CatTracker® in Stellite® TW



**3/8" OD TC
Heavy Wall 0.07"**

1/8" Stellite #6



Skin TI: Reactor Cyclone Dip Legs

Skin Thermometry – Cyclone Dip/Exit Legs

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.

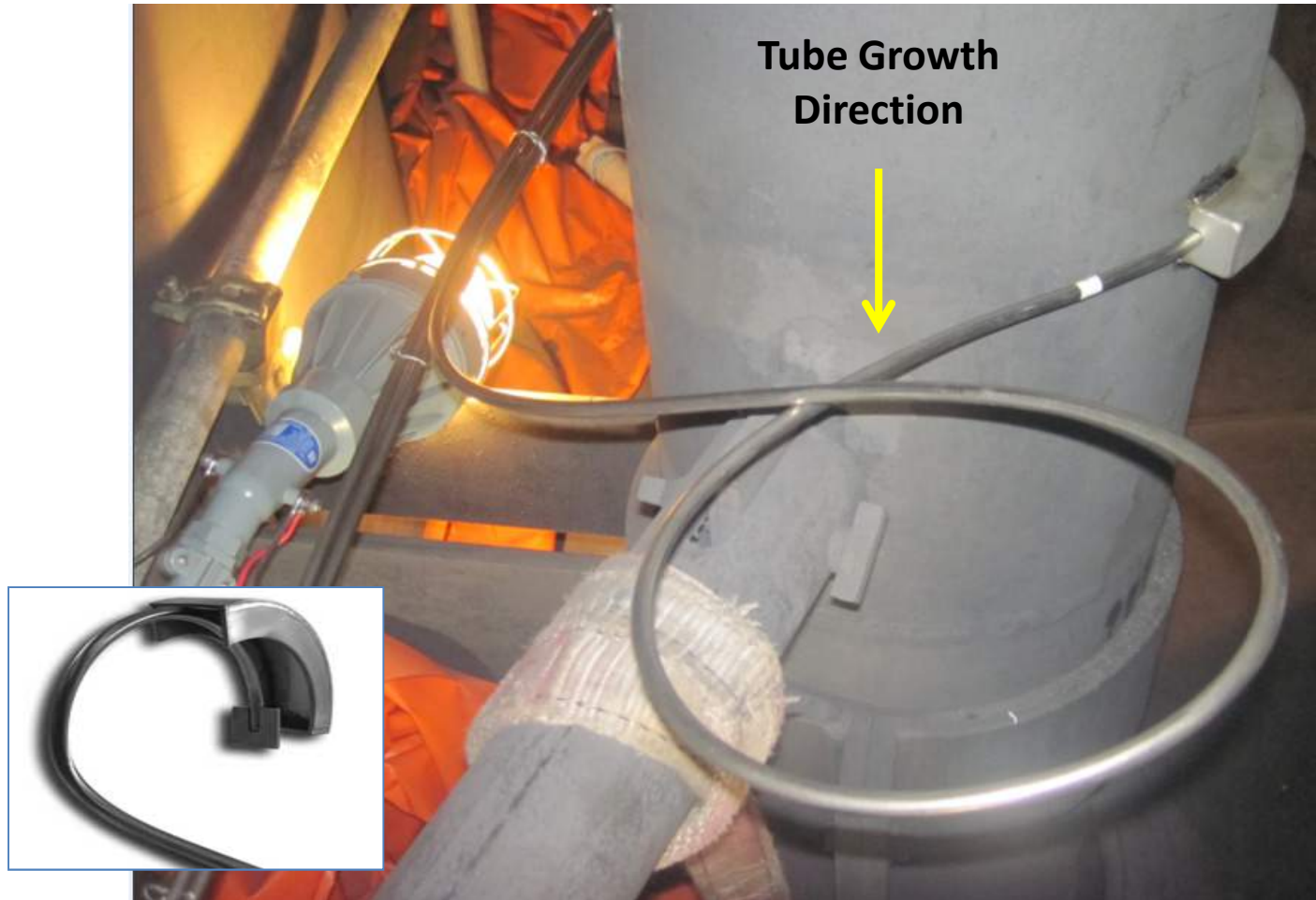
Daily Thermetrics manufactures a temperature monitoring solution to eliminate premature catalyst injection with respect to moisture buildup within the cyclone's 'catalyst exit tubes'. The routing and appropriate attachment location of the temperature sensor directly to each of the catalyst exit tubes 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.



FIGURE 1:
FCC Cyclones &
Cyclone Exit Legs

DAILY THERMETRICS

FCCU Reactor - Cyclone Dip Leg Section

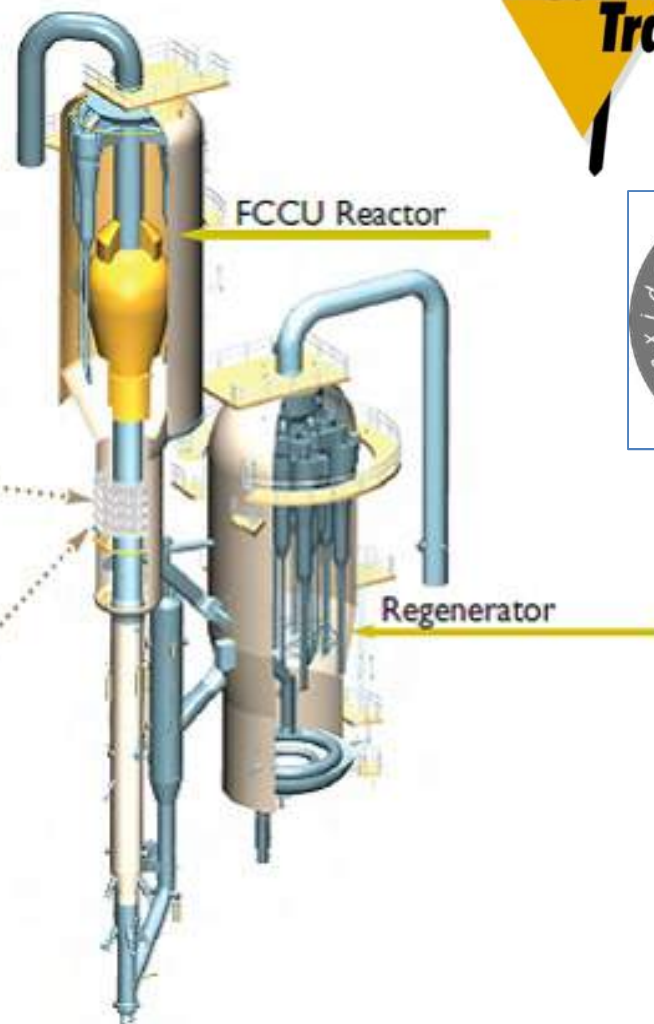
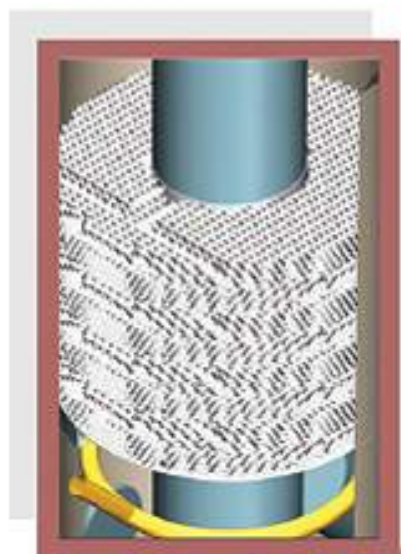


Multipoint Weld Pad Skin Thermocouple Assembly

FCC Reactor: Stripper Section

CatTracker® Multipoint Technology

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.



Temperature Measurement Solutions



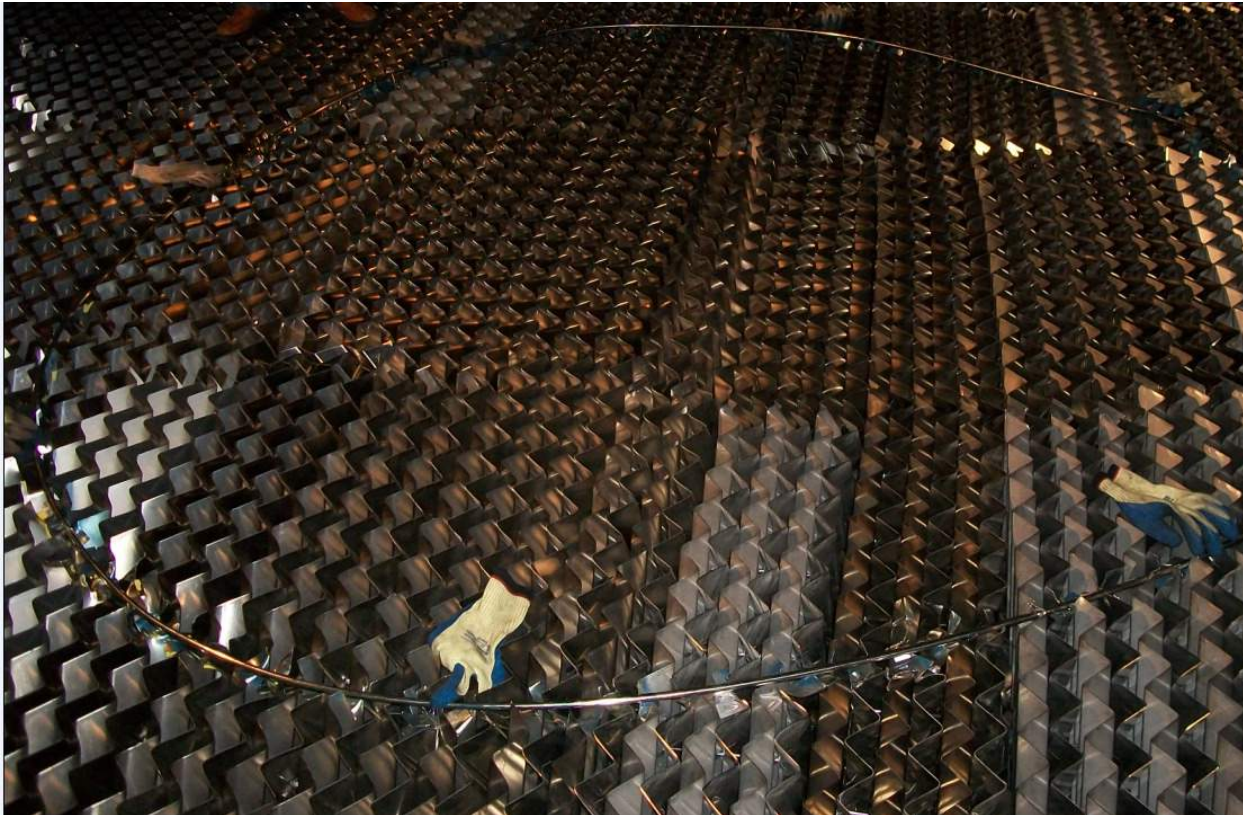
DAILY
THERMETRICS

Image courtesy of Koch-Glitsch: <http://www.koch-glitsch.com/Document%20Library/KGSS.pdf>

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

FCC Reactor: Stripper Section

CatTracker® Multipoint Technology



Temperature Measurement Solutions



DAILY
THERMETRICS

High Hardness TWs: Welded Overlay

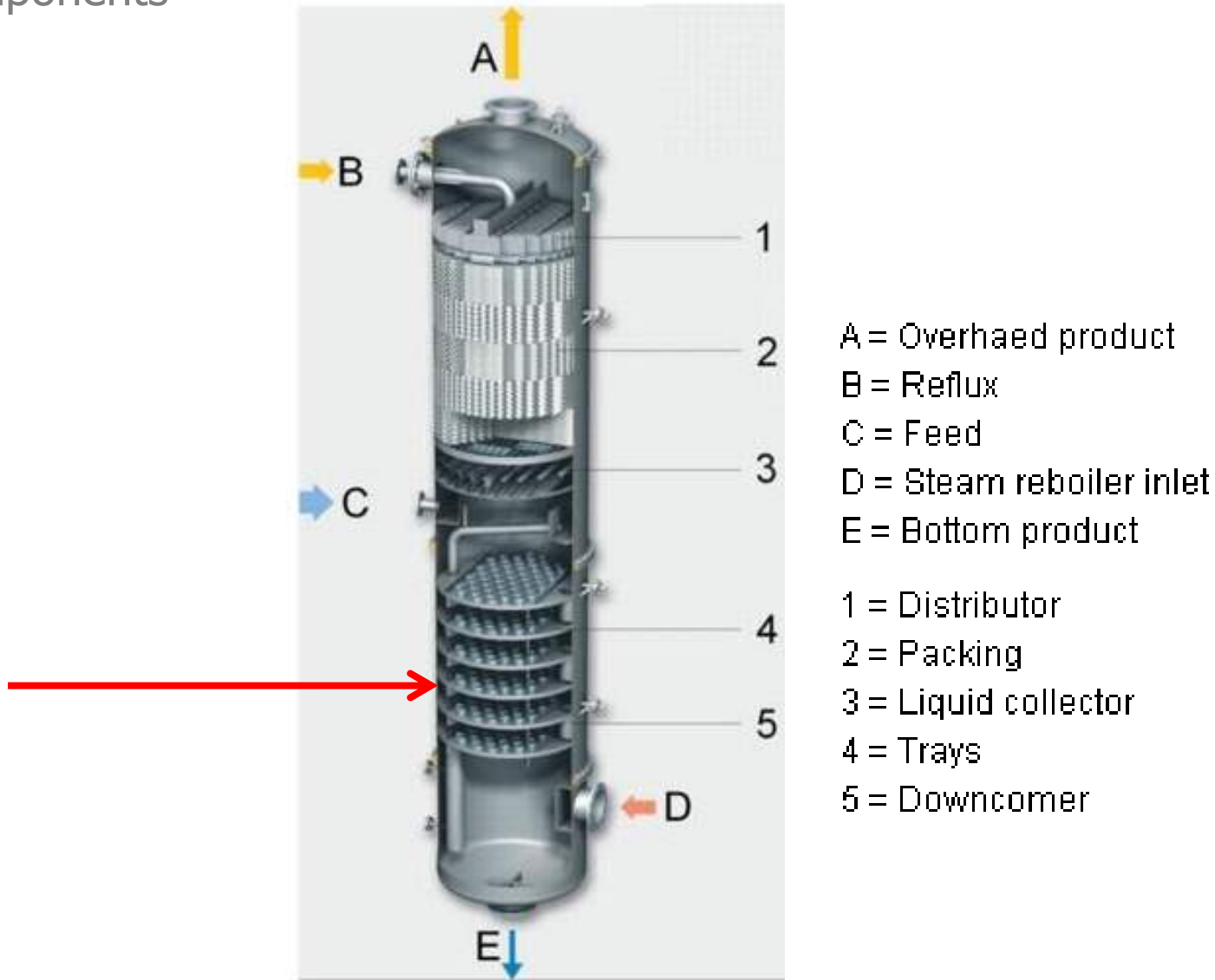
Regenerator Long Pipewells with Sensitive Tip

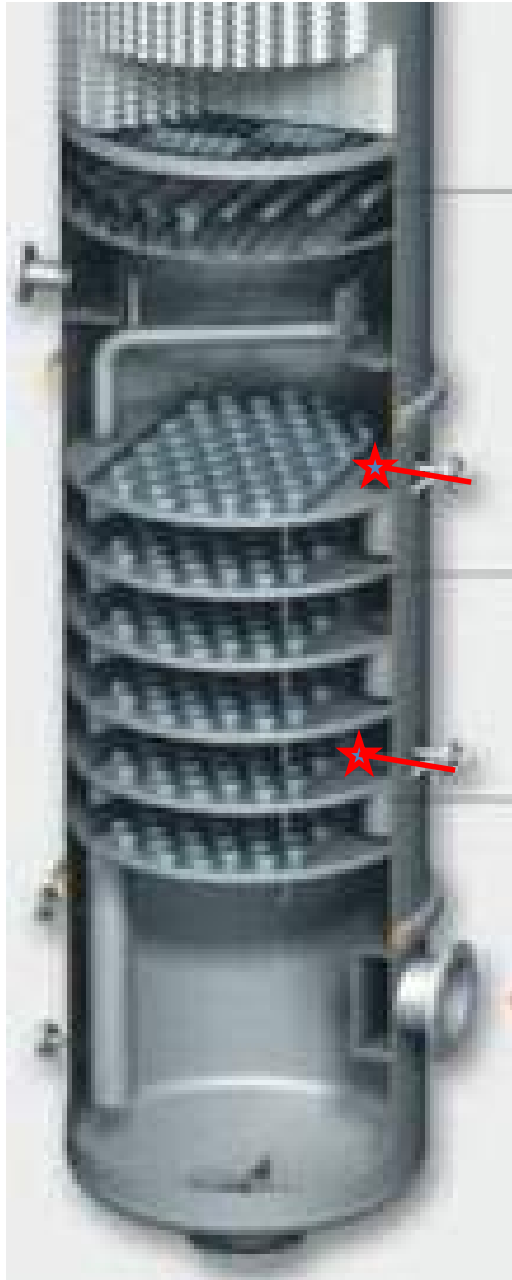


Example of coating weld overlay sensitive tip pipewell

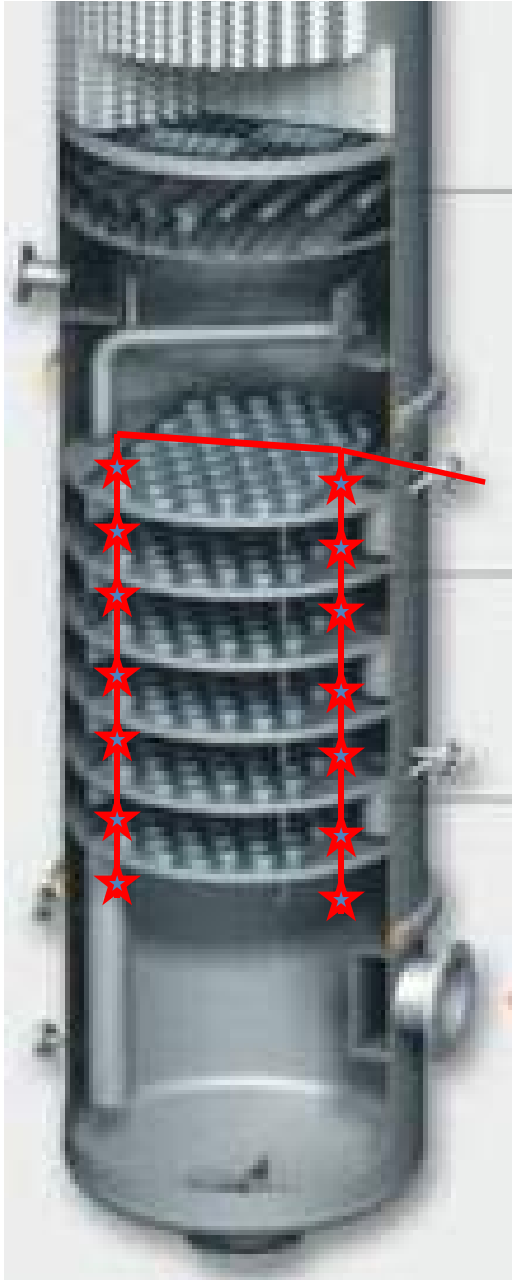
FCC Fractionator: Example

Components





Existing TE/TW's



Improved TI Profile with
CatTracker® technology



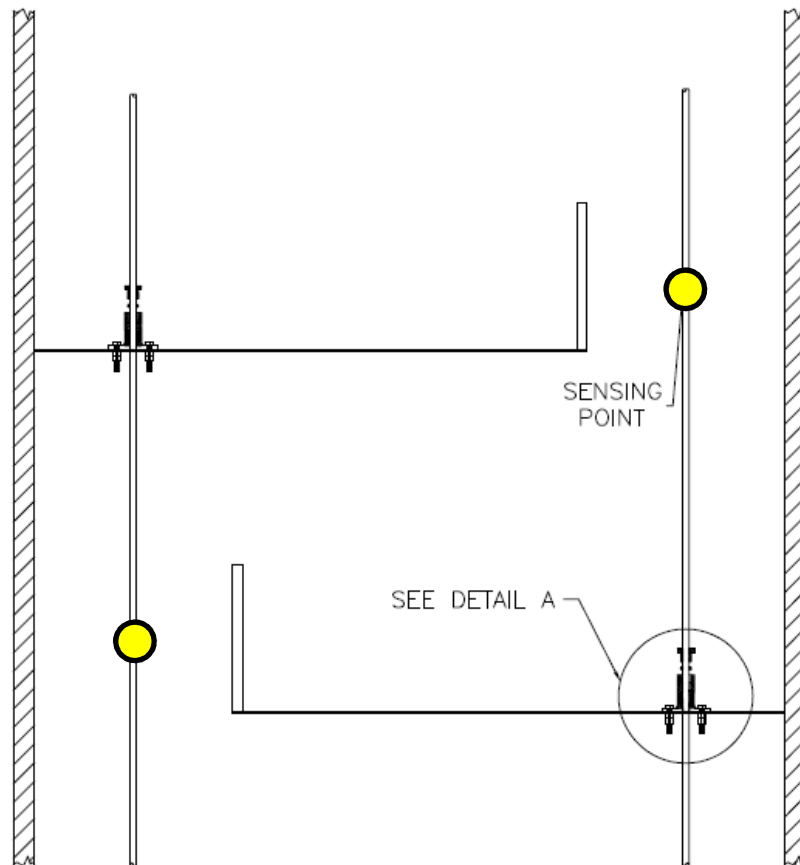
Temperature Measurement Solutions



DAILY
THERMETRICS

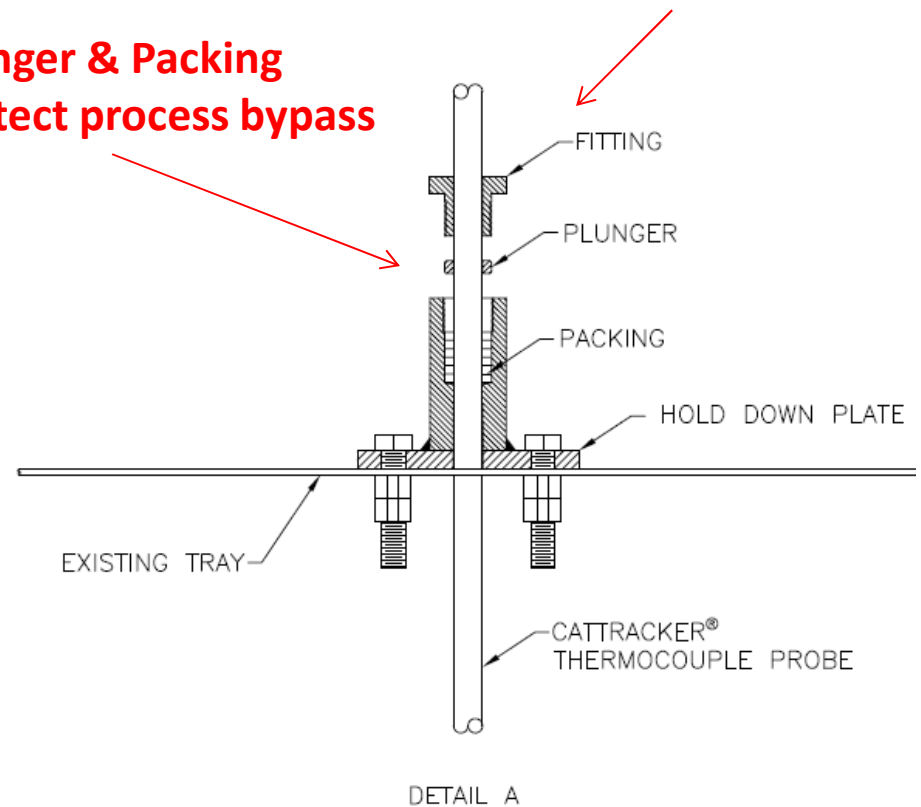
Fractionator: Downcomer Section

CatTracker® Multipoint Technology



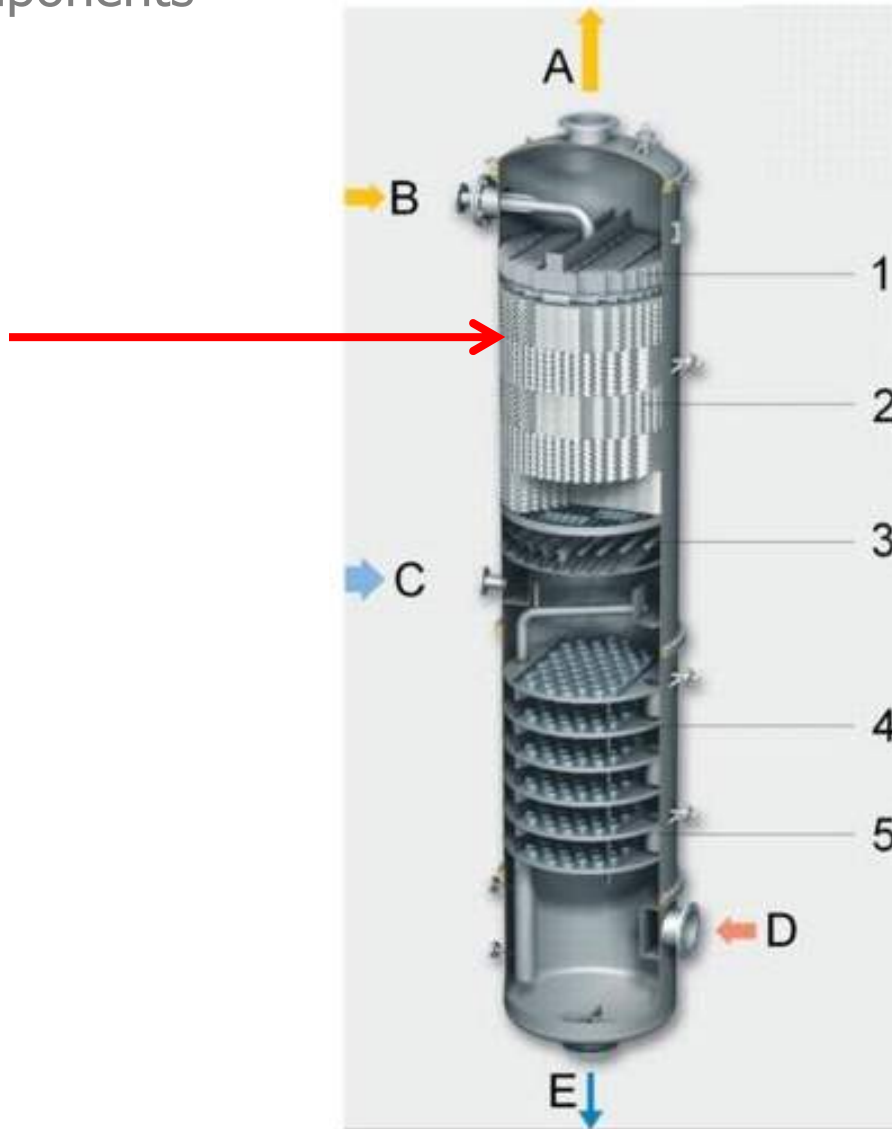
**Plunger & Packing
protect process bypass**

Snug/Not fixed fitting



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



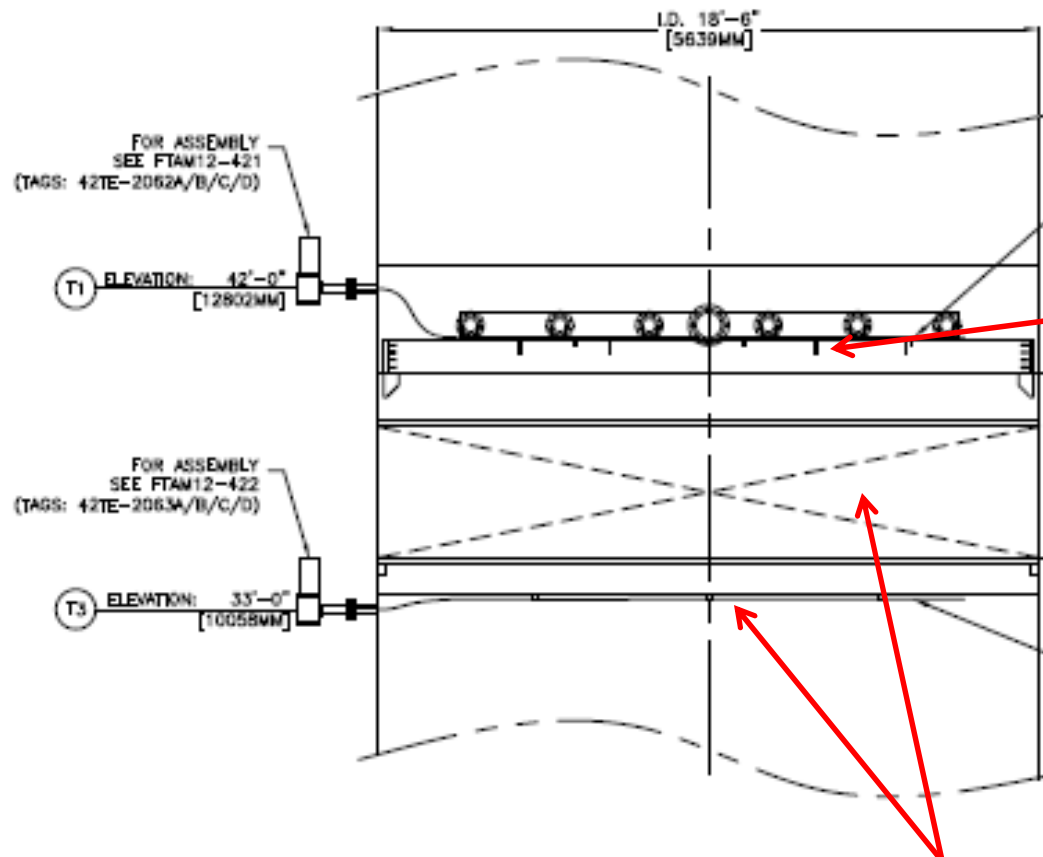
Temperature Measurement Solutions



DAILY
THERMETRICS

FCC Fractionator: Wash Bed Section

CatTracker® Multipoint Technology



TI can profile *under* distributor head

TI can profile *under* or *in* the wash bed

Temperature Measurement Solutions



Importance of Temperature

Location	Temperature Instrument	Operational Value
Feed Hydrotreater - Fixed Catalyst Bed	-CatTracker® Multipoint	-Optimize Catalyst Performance -Maximize Catalyst Life
Reactor -Reactor -Riser -Stripper	-Erosive Service TWs -Cyclone Dip/Exit Legs -CatTracker® Multipoint	-High-Hardness TWs to last unit run -Proper Start-Up Temperature; Reduce catalyst clogging -Optimize Catalyst Hydrocarbon Removal
Regenerator -Regenerator	-Erosive Service TWs/Pipewells	-High-Hardness TWs/Pipewells to last unit run
Main Fractionation Tower -Downcomers/Trays -Distributor Header/Packing	-CatTracker® Multipoint	-Tight control on cuts -Prevent Liquid Bottoms fouling downstream heat exchanger





**What can we do to improve
your FCCU profitability and
safety?**

Temperature Measurement Solutions

