DCU Process Control

Protecting Critical Investments & Optimizing Process Control with Advanced Temperature Measurement Systems

Walter Tijmes
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a division of Daily Instruments Corp.

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AGENDA

I. Introduction to Daily Thermetrics

II. DCU Applications
   I. Thermowells
   II. Coke Drum Skin Temperature
   III. DCU Furnace Tubes
   IV. Advanced Fractionator Profiling

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DAILY THERMERTICS

Since 1973
Global Headquarters & Manufacturing in Houston, TX

ISO 9001:2008 CERTIFIED QUALITY ASSURANCE

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3 Critical Criteria for HIGH PERFORMANCE Thermometry

**SENSOR AVAILABILITY**
Is there sufficient quantity of sensors to properly troubleshoot, plan, and justify future investment?

**SENSOR ACCURACY**
Does the sensor provide the highest level of confidence of the actual reaction temperature?

**SENSOR RELIABILITY**
Does the sensor’s life represent a maintenance cost or a long term investment?
Thermowell Challenges
Coke Build-Up & High Polish

Machine Finish
32-84 RMS

Polished Finish
4-8 RMS

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High Hardness TWs: Erosive Conditions

Feed Lines

- Coke fines and particulate promote an erosive environment, creating accelerated wear on internal components, specifically thermowells
  - Reduced temperature visibility
  - Safety concerns when primary seal is breached
- Proper metallurgical selections can mitigate this degradation process to extend the working life of thermowells and temperature sensors through extended runs
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
# Importance of Temperature

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WELD & BOLT Surface Sensor Pads

Conventional Designs for Coke Drum Monitoring

Vessel Skin Sensors Designed for Maximum Acquisition Savings

Requires Successive Welding Each Time Sensor Fails
**VSS™ Weld Once: Interchangeable**

Engineered Solutions for Vessel Skin Surfaces

**WELD PAD:** Welded during vessel fabrication.

**INSULATION INSERT:** Designed to extend to the exterior of insulation.

**SPRING COMPONENT**

**THERMOCOUPLE**
VSS™ MAGNETIC: NO WELD Sensor

DCU: Coke Drum Monitoring

Spring Loaded
Easily Replaceable TC

Remote Mount Head Only
(not shown)

Patent-Pending

Specially Engineered Magnet
Rated to 1004°F
Continuous Operation!
VSS™ MAGNETIC: NO WELD Sensor

DCU: Coke Drum Monitoring
VSS – Banded Ski Slope:
Coke Drum Inlet Monitoring
Surface Temperature Measurement

- Process Pipelines
  - In a further effort to proactively detect early coking, pipeclamps with multiple concentric sensing locations can help detect coking on the coker inlet pipe
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DCU: Furnace Tube Skin TI

Engineered Solutions

KNIFE-EDGE™ TIP with optional Heat Shield

SLOTTED SQUARE PAD with optional Heat Shield

TUBE SKIN ENGINEERING

A DIVISION OF DAILY THERMETERS

EZ-PAD™ REPLACEABLE with optional Heat Shield

"EXTRACTABLE PROBE" PAD with optional Heat Shield

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DCU: Furnace Tube Skin TI

Engineered Solutions

- SENSOR TYPE
- SHEATH OUTSIDE DIAMETER
- SENSOR TIP SELECTION
- SENSOR WIRE TRANSITION DESIGN
- HEAT SHIELD
- SENSOR ENTRY LOCATION
- PROCESS TUBE THERMAL COOLING

- PROCESS TUBE SCALING
- FLUE GAS COMPOSITION
- SENSOR CONDUCTOR WIRE DIAMETER
- POSITIVE CONTACT WITH PROCESS TUBE
- ROUTING OF SHEATH
- SHEATH MATERIAL
- JUNCTION TYPE
- SHEATH WALL THICKNESS
- THERMAL EXPANSION
- SHEATH ROUTING CLIPS
TUBE SKIN THERMOCOUPLE FAILURES

Improper Design
TUBE SKIN THERMOCOUPLE FAILURES

Lack of Professional Installation

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Routing – Bottom Side Entry
DCU: Furnace Tube Skin TI
Engineered Solutions

Routing – Bottom Direct Entry
Routing – Side Entry
DCU: Furnace Tube Skin TI

Expansion Bends
TUBE SKIN THERMOCOUPLE APPROACH
Engineered Solutions for Heaters, Furnaces, & Boilers

APPLICATION Based Approach

1. Identify Heater process type and design
2. Gather Data, Run Diagnostics and Analyze Temperature Trends
3. Design/Re-Design based on accumulated Data
4. Supervise Installation by experienced Heater Specialists

4-Step Approach
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Coker Fractionator: Example
Coker Fractionator: Example

CatTracker® Thermometry Systems
DCU Fractionator: Downcomer Section

CatTracker® Multipoint Technology

Snug/Not fixed fitting

Plunger & Packing protect process bypass
DCU Fractionator: Example

Components
DCU Fractionator: Structured Packing

CatTracker® Multipoint Technology
TI can profile *under* distributor head

TI can profile *under* or *in* the wash bed
Delayed Coking Unit
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