APPLICATION NOTE

ARE YOU MONITORING YOUR OIL & GAS WELL HEAD TEMPERATURE?

Temperature measurement at oil and gas wellheads is essential for optimizing operations, ensuring safety, and enhancing production efficiency. By monitoring temperature, operators can gain valuable insights into well conditions and implement effective strategies to address potential challenges. These challenges include:

Operational Monitoring and Control

- **Indicator of Flow Conditions:** Temperature variations can reveal changes in flow conditions within the well. For instance, significant temperature fluctuations may indicate alterations in production rates or blockages in the flowlines.

- **Reservoir Diagnostics:** Temperature readings help identify contributions from different production zones, as each zone may have a unique temperature profiles.

- **Early Detection of Well Behavior:** Monitoring temperature changes can signal shifts in reservoir dynamics, such as gas or water breakthrough, enabling proactive management.

Safety Assurance

- **Prevention of Hydrate Formation:** Accurate temperature measurements allow operators to maintain wellhead conditions above the hydrate formation temperature, reducing the risk of blockages.

Equipment Longevity and Maintenance

- **Corrosion Monitoring:** Elevated or fluctuating temperatures combined with high moisture content can accelerate corrosion. Temperature data, when combined with pressure and chemical analysis, allows for better material maintenance planning.

Production Optimization

- **Enhanced Recovery Techniques:** Temperature monitoring aids in evaluating the effectiveness of enhanced oil recovery (EOR) techniques, such as steam injection or thermal flooding.

Environmental and Regulatory Compliance

- **Spill Prevention:** Temperature trends can reveal unexpected pressure-temperature relationships that indicate leaks, aiding in containment and spill prevention.

Real-Time Data Integration and Analytics

- **Automation and Remote Monitoring:** Coupling temperature sensors with IoT systems allows real-time remote monitoring, reducing the need for manual inspections and improving overall response times.
- **Enhanced Decision-Making:** Integrating temperature data with machine learning models enables predictive analysis of well behavior and equipment performance.
- **Data Correlation:** Temperature readings can be correlated with other parameters (e.g., pressure, flow rate, and chemical composition) for a comprehensive understanding of wellhead dynamics.

Temperature measurement at wellheads is a cornerstone of effective oil and gas operations, providing critical data that enhances safety, optimizes production, and ensures environmental compliance.

— 01 NINVA monitors temperature of “christmas trees” to ensure equipment performance within limits and maintain safe operations.

Traditional measurement approaches come with a host of problems:

- Oil and gas operators often hesitate to install temperature measurement points at wellheads due to several challenges.
- The harsh environmental conditions at wellheads, including extreme temperatures, high pressures, and corrosive substances, can compromise the accuracy and longevity of temperature sensors.
- Additionally, the installation process can be complex and costly, potentially requiring modifications to existing infrastructure and leading to operational downtime.
- Maintenance of these sensors becomes hazardous as thermowell may be compromised without any external indication of failure. An intervention can therefore be extremely dangerous. The inspection cost therefore increases as well.

These factors contribute to the reluctance of operators to implement temperature measurement points at wellheads.

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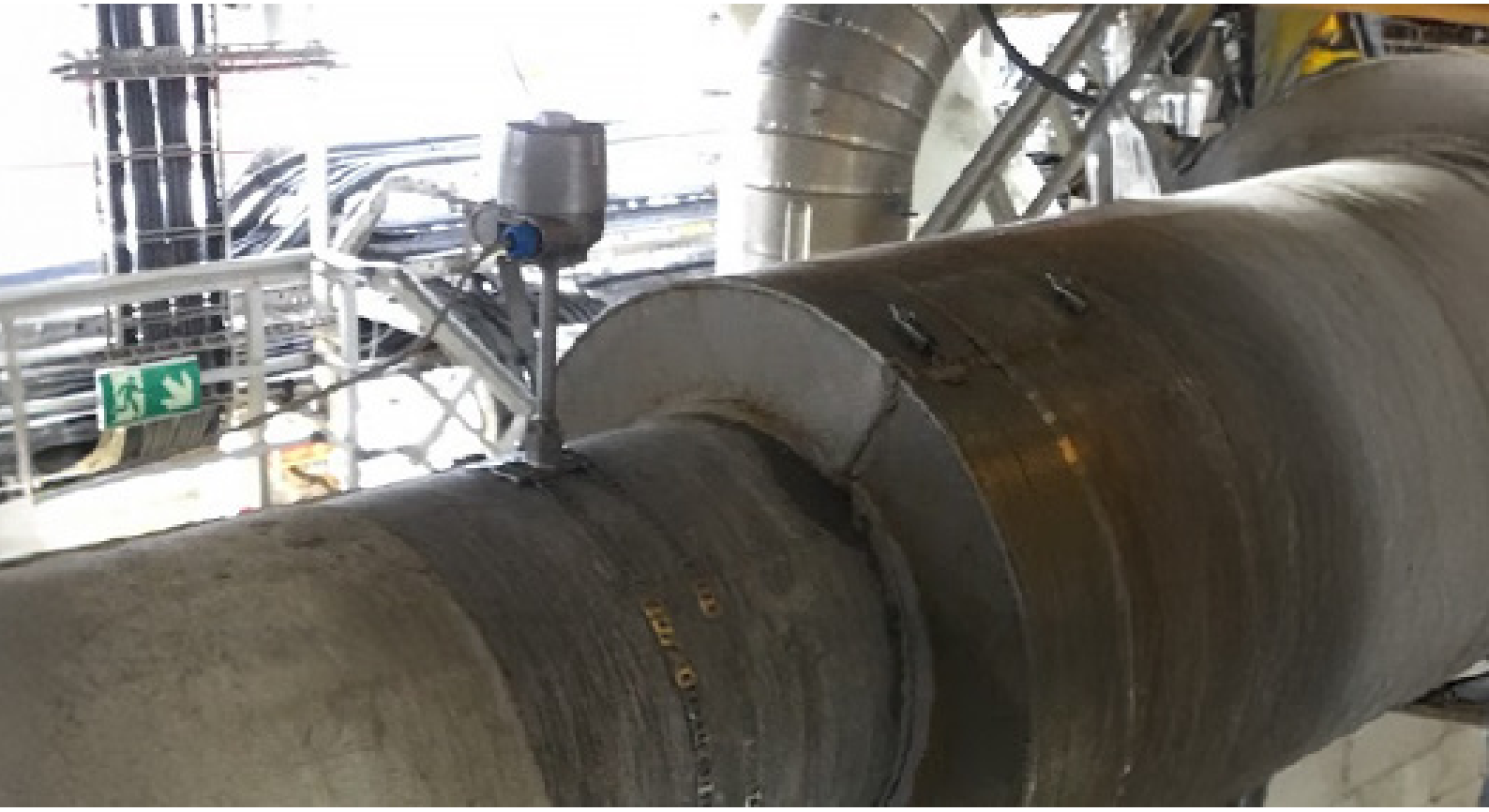
02 Equinor's NINVA case highlights accurate well head flow line measurement in offshore conditions. Such results have underscored the wider acceptance of proven surface temperature measurement approaches in industry standards like JIP33 and NORSOK.

ABB's NINVA eliminates these operational challenges of re-establishing a vital measurement
Non-invasive temperature measurement technologies, such as ABB's NINVA™ TSP341-N, address the challenges traditionally associated with invasive methods. By utilizing a clamp-on design, NINVA™ eliminates the need for shutdowns, drilling, or thermowell installation, thereby reducing operational downtime and associated costs. This approach enhances safety by eliminating potential leaks and minimizing the risk of contamination. Additionally, NINVA™ offers accurate physically based measurements and predictable response times comparable to traditional invasive sensors, ensuring reliable process monitoring and even control. Its SIL2 certification further underlines its suitability for safety critical applications. Its proven performance and simplicity are driving the wider adoption of non-invasive temperature measurement as a vital control and monitoring parameter on present and future wellheads.



NINVA on well head flow line measurement in offshore environmental conditions providing an accurate correlation to flow temperature. Such results have underlined the wider acceptance of proven surface temperature measurement approaches in industry standards such as JIP33 and NORSOK.

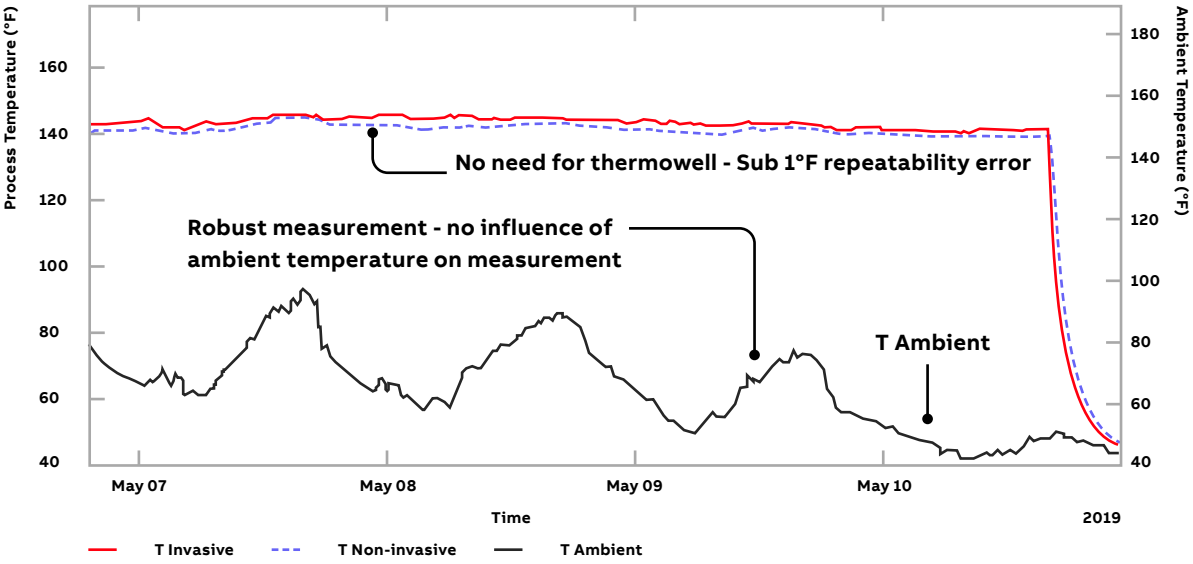
Use Case: Abrasive media
High-velocity multiphase flow in wellhead temperature measurement, a global oil producer in North America

03 NINVA used for flow line temperature monitoring in shale oil and gas fields. Ensuring piping integrity and tracking well evolution in high velocity, high abrasion flow (sand, oil, water and gas). The graph shows the performance and the trend between invasive and NINVA when the well was shut in.

Robust temperature measurement – thermowells eroded in weeks

Retrofitting – Eliminate a need for shutdowns to reinstrument well

Performance under harsh environmental conditions



Difference (Non-Invasive – Invasive): With minimal insulation,
Accuracy (Mean) = -1,7°F (-1°F with paint compensation) ,
Repeatability (Stdev) = 0,63°F (>3 months testing),
Pipe: 2" OD (8-10mm wall thickness), Steel, Process: 3 Phase oil/water, gas, sand flow, Thermowell: 316SS tapered, 6mm tip thickness.

ABB Measurement & Analytics
For your local ABB contact, visit:
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AN/NINVA/WELL_CONTROL/101- EN REV.A 02.2025