Field Diagnostics

RTU FDD System

York Predator
3 to 12.5 ton

YORK®
Heating and Air Conditioning
TECHNICAL GUIDE
R-410A
ZH/ZJ/ZR SERIES
3 - 12-1/2 TON
60 Hertz

ZH/ZJ/ZR 3 THROUGH 10 TON

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Field Diagnostics

Objective and Scope

- Refrigeration cycle diagnostics
- Equipment Scope
  - Unitary package units
  - Simple - small to medium size
  - York Predator line, 3 to 12.5 tons
  - Multistage, no circuit unloading
- Other diagnostics (e.g. economizer) are included, but supported by a separate imitative

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Diagnostic Outcomes

- Numerous communication error scenarios
- Numerous sensor error scenarios
- Unit is off
- Detection of numerous non-physical sensor value combinations (e.g. LT<OAT)
- Extreme conditions – beyond valid range for diagnostics
- Refrigeration cycle diagnostics

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Refrigeration Cycle Faults

- High and low side heat transfer
  - High-side heat transfer problem
  - Low-side heat transfer problem
  - Reduce evaporator airflow
- Compressor efficiency and flow restrictions
  - Inefficient compressor
  - Insufficient refrigerant flow through the metering device
  - Excessive refrigerant flow through the metering device
- Refrigerant charge
  - Add charge
  - Recover charge
- Efficiency and capacity assessments
  - Low capacity
  - Low efficiency
- Safe and reasonable performance

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Sensor data + Performance Metrics

- Driving conditions
  - Outdoor dry bulb temperature (OAT)
  - Return wet bulb or dry bulb/relative humidity (RWB, RAT/RRH)
- Performance dependent values
  - Suction pressure (SP)
  - Liquid or discharge pressure (LP, DP)
  - Suction temperature (ST)
  - Liquid temperature (LT)
- Calculated performance metrics
  - Superheat (SH)
  - Subcooling (SC)
  - Evaporating temperature (ET)
  - Condensing temperature over outdoor ambient temperature (COA)

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UI and FDD Experience

- User interfaces
  - Networked BACnet interface
  - Standalone (non-networked) solution
- Testing included an automated test rig install in a typical unit and deployed in psychometric chambers. Testing included:
  - Different indoor and outdoor driving conditions
  - All single fault scenarios at multiple levels
  - Multiple simultaneous fault scenarios
- Initial release field scenarios
  - Example: Overcharge fault preceded by ultimate high pressure cut-off
- Product release expected before end of 2014

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Next steps - Future

- Field Diagnostics is working with national accounts and utilities to integrate embedded FDD solutions into maintenance and service workflows
  - Figure out how the technology fits into a complete customer solution
    - Building closer to condition-based maintenance
    - Tackle workflow and business process changes
  - Prove the benefits / business case
  - Help structure applicable utility incentives to help drive adoption
- PG&E has an Emerging Technology (ET) program (via Field Diagnostics) to demonstrate the performance and benefits of integrated FDD in 15 units at 5 sites (nominal)

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Field Diagnostics Perspective

- OEM based FDD solutions are driven by:
  - Competitive pressures
  - Regulation (e.g. Title 24)
  - Business opportunities
- Reasons #1 and #2 are the strongest drivers in the current early stage market
- The real money is in putting the systems in place to drive significant business opportunities and develop the market for this type of technology
- Field Diagnostics is integrating these types of OEM embedded diagnostic systems into its solution to help make a stronger connection to revenue sources:
  - End user facility customers
  - Electric utilities – incentives for adoption and use