MBW calibration

EMPIR HIT Workshop

Need for reliable humidity measurements in harsh conditions

EMPIR EURAMET
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Humidity Measurement in Harsh Conditions

- Common Objectives
- Common Requirements
- Example Applications

Common Objectives

- Improve product quality
  - Production consistency
  - Less defects
- Increase yield
  - Less waste of raw materials
- Optimised processes
  - Time
- Improving efficiency
  - Energy and emissions

Common Requirements

- Improved measurement performance

  - Performance at working condition
    - Unknown specification at elevated temperatures
  - Calibration at elevated temperatures
    - Adjustment/calibration typically at room temperature
    - Limited availability above 70 °C
    - High cost
    - Rarely applied
  - Speed of response
    - Thermal characteristics
    - Sampling system effects
    - Recovery from condensation events

Common Requirements

- Lower cost of measurement

  - Precise solutions exist (e.g. Dew Point Mirrors)
    - High capital cost
    - Operational practicalities

  - Correct instrument selection
    - Do users really assess all the options?
    - Where to go for independent advice?

Common Requirements

- Reduced Maintenance
  - Minimising application related effects
    - Contamination
      - Particulate
      - Chemical
  - Calibration
    - Impractical at most installation sites
    - Expectation is to ‘fit and forget’

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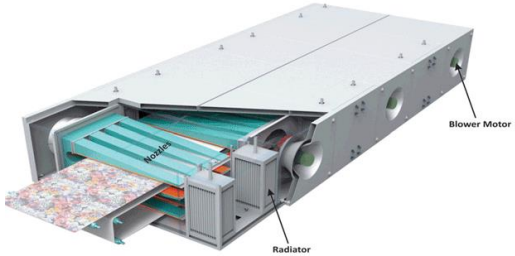
Example Applications

Pasta Drying

- Bulk production on a large scale
- HT and VHT processes
- 60…120°C, 10..20 %rh

Textile Drying

- Production dryers
- Large commercial laundry dryers
- 80…130 °C, 95…5 %rh



- Imagine the saving if the efficiency every textile dryer was improved?

Ceramic Drying

- Reduction of water content prior to firing
- Generally a batch process
- Usually temperature and time controlled
- Humidity measurement and control improves product consistency

Brick Drying

- Batch or tunnel dryer
- Reduce water content of clay prior to kiln firing
- Poor control can lead to water pockets
- Expansion in the kiln cause mechanical failure of bricks
- 80…130 °C, 85...5 %rh
- Contaminated air
- Sulphur from some clay
- Acidic degradation of sensors

Bakery

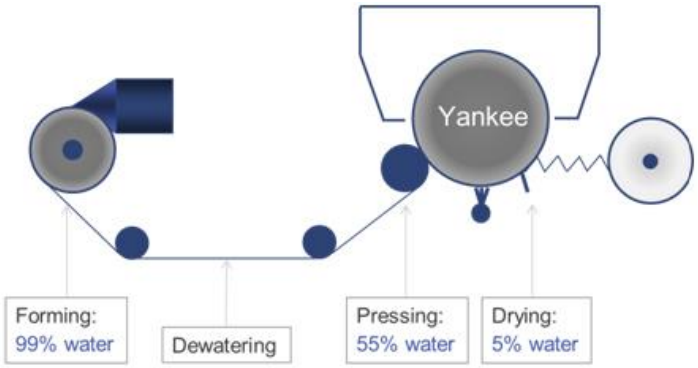
- Baking ovens
  - 150…220 °C
  - Humidity control for crust thickness and different finishes
  - Lower humidity produces a thicker crust
- Provers
  - 35…45 °C, 65…90 %rh
  - Contamination effects
  - Measurement performance

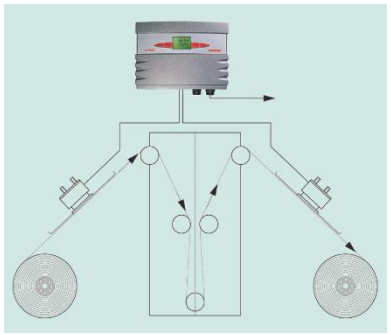
Wood Dryers

- Kiln drying
- 50…100 °C
- Contaminated exhaust air
- High maintenance requirement

Drying Paper

- High energy consumption
- Fast process
- Slow measurement
- Difficult to control





Electronic Product Environmental Test

- Test conditions:
  - -40…180 °C
  - 85 °C / 85 %rh
  - Salt fog
  - 100 °C, condensing
  - Transient conditions

- Standards
  - IEC 60068-2
    - Environmental Testing
  - Accelerated Stress Tests (AST)
    - HALT – Highly Accelerated Life Test
    - HASS(T) – Highly Accelerated Stress Screening (Testing)
  - MIL-STD-202 and 810
    - US Department of Defence
    - Electronic & Electrical Component Testing Standards

Pharmaceutical Development

- ASAP – Accelerated Stability Assessment Programme

  - Developing application
  - Early stage drug formulation studies
  - 60…90 °C, 10…75 %rh
  - Current challenge is the validation of performance at working conditions….

Conditions		Time points
T (°C)	%RH	days
50	75	3-7-14
60	50	3-7-14
70	10	3-7-14
70	75	1-3-7-14
80	50	1-3-7-14

On Line aW(ERH) Measurement

- Potential Applications
  - Paper
  - Textiles
  - Carpets
  - Pharmaceuticals
  - Animal feeds
- Issues
  - Speed of response
  - Temperature effects
  - Contamination of measurement device

Motivation for Measurement Implementation

- For
  - Product quality
  - Energy saving
  - Improved quality
  - Process times
- Against
  - Energy costs too low!
  - Implementation complexity
  - Maintenance
  - Understanding of humidity/moisture