



# Alternative Sensors for Retort Applications

*Electromagnetic Interference / Environmental Testing*

Jim Eldridge

Product Development Manager

[jeldridge@palmerwahl.com](mailto:jeldridge@palmerwahl.com)

*The World's Finest Manufacturers of  
Temperature, Pressure & Humidity,  
Test and Calibration Instruments*

# Alternative Sensors for Retort Applications

- Electromagnetic Interference (EMI)
- Environmental Testing

# Proposed Rule

- Proposed Rule states:
  - 113.40(a)(1)(i) “The design of the temperature-indicating device shall ensure that the accuracy of the device is not affected by electromagnetic and environmental conditions.”
  - Quantify by testing product to industry standards

# Why Standards?

- Standards provide definitive test methods
- Provide documented performance levels
- Allow for direct comparison of instruments

# Electromagnetic Interference Testing

- CE Standards
- Emissions
- Immunity
- ESD

# CE Standards

- **EN61326 – Parent Standard**
  - EN 55011 – Radiated and conducted emissions
  - EN 61000 – RF and ESD immunity

# Definitions

- **Emissions**

- Quantifies the amount of electromagnetic radiation emitted from the unit under test





# Definitions

- **Immunity (susceptibility)**
  - Verifies acceptable performance of the unit under test, while in the presence of electromagnetic radiation

# Definitions

- **Electro-Static Discharge (ESD)**
  - Verifies performance of the unit under test, while being subjected to high-voltage discharges

# Electromagnetic Interference

- Questions?

# Environmental Testing

- **IP Codes**
- **NEMA Ratings, Corrosion resistance**
- **Vibration testing**
- **Ambient temperature / coefficient**

# Ingress Protection / NEMA Ratings

- **IP Codes, 2 digit code**
  - 1<sup>st</sup> digit = Protection against Solid Bodies
  - 2<sup>nd</sup> digit = Protection Against Liquids

# Ingress Protection per EN 60529

1 <sup>st</sup> Number		2 <sup>nd</sup> Number	
0	No protection	0	No Protection
1	Objects > 50 mm	1	Vertically dripped water
2	Objects > 12 mm	2	75° to 90° dripped water
3	Objects > 2.5 mm	3	Sprayed water
4	Objects > 1 mm	4	Splashed water
5	Dust protected	5	Water Jets
6	Dust-tight	6	Heavy Seas
7	N/A	7	Effects of immersion (<1 m)
8	N/A	8	Indefinite immersion

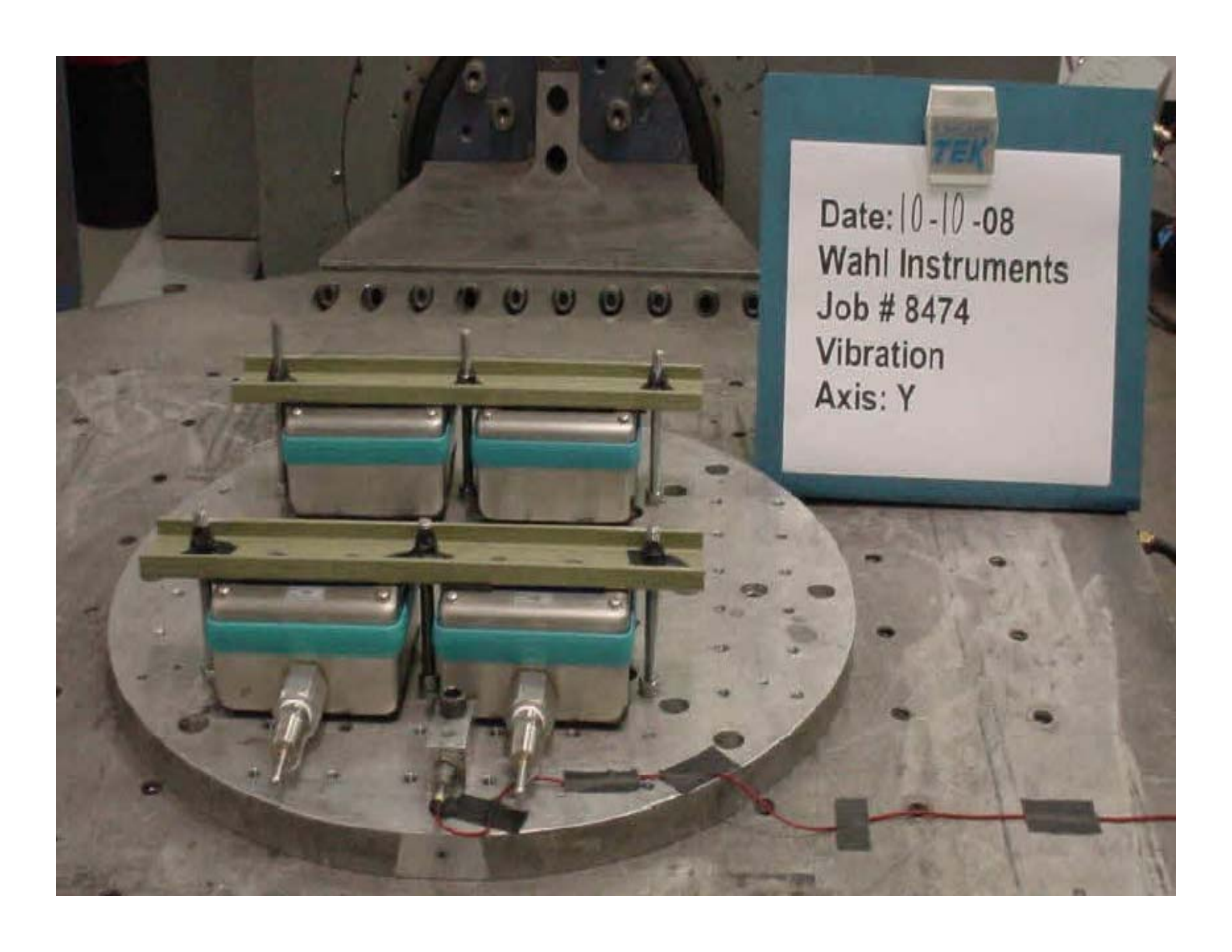
# NEMA Approximate Equivalents

- NEMA 4 – IP55
  - NEMA 6 – IP67
  - NEMA 3S – IP54
  - NEMA 12 – IP52
- 
- “X” suffix on NEMA code indicates corrosion resistance

# Vibration Testing

- **Numerous standards for Vibration testing**
  - Most for transportation and shipping
  - MIL-STD-202G – Test Method Standard for Electronic and Electrical Component Parts



A photograph of a vibration test setup. In the foreground, a circular metal plate is mounted on a larger metal structure. Four sensors are arranged in a 2x2 grid on the plate. Each sensor consists of a cylindrical metal base with a teal-colored top section and a silver-colored bottom section. The sensors are held in place by two horizontal green metal bars. A red wire is connected to the bottom of the sensors. To the right, a blue clipboard holds a white piece of paper with handwritten text. A small white tag with the word 'TEK' in blue is attached to the top of the paper. The background shows a grey metal structure with several circular holes.

Date: 10-10-08  
Wahl Instruments  
Job # 8474  
Vibration  
Axis: Y

# Ambient Temperature Coefficient

- **Quantifies the effects of ambient temperature change on the measurement being taken**
- **Expressed as worst case specification**
  - Examples of specification:
    - $0.003^{\circ}\text{C}/^{\circ}\text{C}$  (ex. =  $0.03^{\circ}\text{C}$  change in reading with  $10^{\circ}\text{C}$  ambient change)
    - Better than  $0.03^{\circ}\text{C}$  per  $10^{\circ}\text{C}$  ambient change

# Ambient Temperature Coefficient Calculation

- Specified Ambient Temperature Coefficient =  $.02^{\circ}/^{\circ}\text{C}$   
Calibrated at  $23^{\circ}\text{C}$  ( $73.4^{\circ}\text{F}$ )  
Operated at  $38^{\circ}\text{C}$  ( $100.4^{\circ}\text{F}$ )  
 $= (38-23) * .02 = .3^{\circ}\text{C}$  ( $.54^{\circ}\text{F}$ ) potential error



# Environmental Testing



**Questions?**

Thank you