# DSR Thermometer Validation Study

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Presented at the Asphalt Binder ETG
Fall River, Massachusetts
September 12-13, 2016

# Introduction

- At the April 2016 Asphalt Binder ETG Meeting it was claimed that AMRL has been requiring that the Canon wafer be certified certified annually
  - ✓ Karl Zipf – Delaware DOT
  - ✓ John Casola – Malvern
- Questions?
  1. Is it required by AASHTO D 315?
  2. Is this a change in AMRL practice?
  3. Is this necessary?

# Past and Current Practice

- Long-standing common practice –
  - ✓ Reference thermometer is calibrated annually.
  - ✓ Reference thermometer or Outside Agency is used to standardize the portable thermometer (Cannon wafer + CPU as a unit) every six months
  - ✓ Canon wafer used to verify DSR thermometer every six months
    - Canon wafer including circuitry

# Past and Current Practice

- Alternative allows laboratory reference thermometer to be used to verify DSR thermometer
  - ✓ Not recommended
- Intent was to avoid excessive number of calibrated thermometers
  - ✓ Consistent with BBR practice
  - ✓ Reference thermometer should be used as a reference not as an every day working thermometer

# TAI MS-25
# Portable Thermometer Standardization

Specific instructions for standardizing working thermometer (silicone wafer) along with the following cautions:

- Battery charge
- Heat transfer medium
- Equilibrium time
- Probe contact

Many of these are not given sufficient attention!

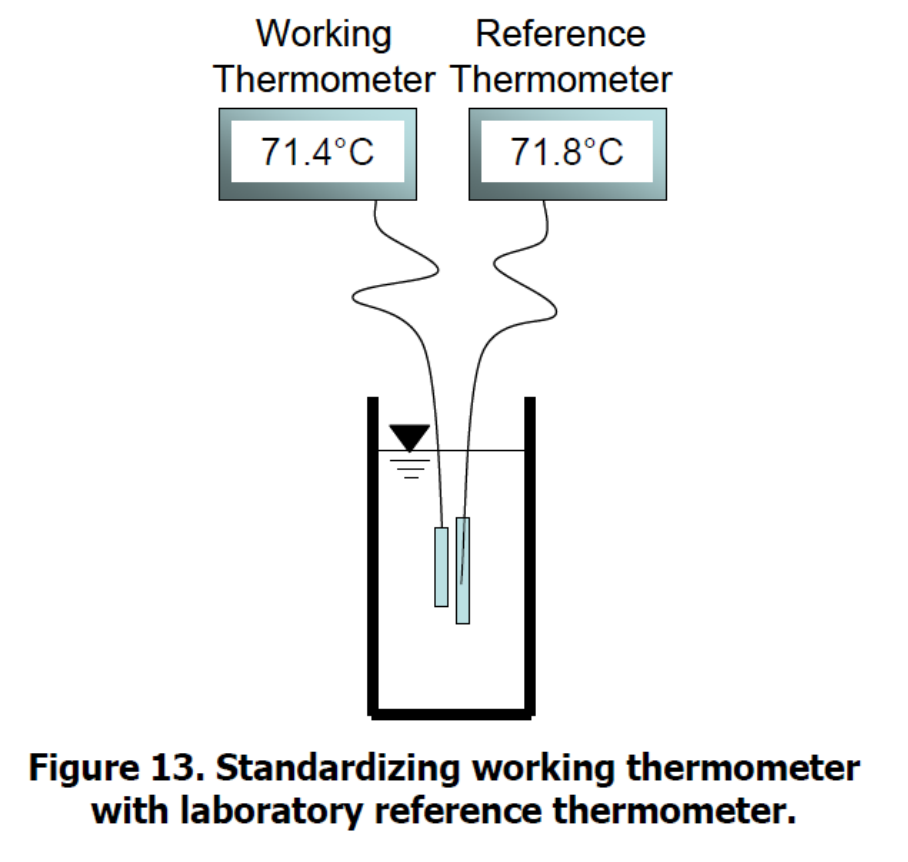


**Figure 13. Standardizing working thermometer with laboratory reference thermometer.**

# What is wording in AASHTO T315 regarding reference thermometer?

6.12.1.6.10.1. Reference Thermometer—Either NIST-traceable liquid-in-glass thermometer(s) or NIST–traceable electronic thermometric device(s). This temperature standard shall be used to standardize the portable thermometer (Section 9.3).

- Clearly a reference thermometer is required
  - ✓ Must be certified and NIST-traceable
  - ✓ Accompanied by statement of uncertainty
- Wording regarding portable thermometer not so clear
- Indicates reference thermometer and portable thermometer may be same

# Why reference thermometer

- Rationale is that this thermometer can be used for a number of test methods – NOT simply DSR
- Availability of cost-effective Pt100 based thermometers make this very practical
  - ✓ Typically less than $700 - $1,000
  - ✓ Make sense as replacement for liquid-in glass thermometers
  - ✓ Martel (Fluke Subsidiary) makes lower cost version

# Example – Fluke 1551 Ex Stix

# Fluke 1551 Ex Stix
# Also Martel (Fluke Subsidiary)

- **Features at a glance:**
  - ✓ Accuracy of ±0.05°C (±0.09°F) over full range
  - ✓ Intrinsically safe (ATEX and IECEx compliant)
  - ✓ Two models to choose from (-50°C to 160°C or -80°C to 300°C)
  - ✓ User-configurable temperature Trend/Stability indicator
  - ✓ Display temperature in °C or °F
  - ✓ Optional data logging to internal memory
  - ✓ 300-hour battery life
  - ✓ Percent battery-life and low-battery indicator
  - ✓ NVLAP-accredited, NIST-traceable calibration included

# AASHTO T315 on portable thermometer

Portable Thermometer—A standardized portable thermometer consisting of a resistive detector, associated electronic circuitry, and digital readout. The thickness of the detector shall be no greater than 2.0 mm such that it can be inserted between the test plates. The reference thermometer (see Section 6.6) may be used for this purpose if its detector fits within the dummy specimen as required by Section 9.4.1 or 9.4.2.

- Allows reference thermometer to be used as the portable thermometer
- When this is done the portable thermometer must be calibrated but otherwise it must be standardized

# Thermometer requirements - Future

*7.4.3.1 Platinum Resistive Thermometer (PRT)—A thermometer and its electrical components with a* probe which conforms to the requirements of E1137. The PRT shall have a 3- or 4-wire configuration and the overall sheath length shall be at least 2 in. (50.8 mm) greater than the immersion depth. The PRT system (probe and readout) shall be standardized as a unit in accordance with E644.

7.4.3 *Thermometer (Thermistor-based)*—A metal-sheathed thermistor with its electrical components and a sensor substantially similar in construction to the PRT probe described in 7.4.3.1. The thermistor system (sensor and readout) shall be standardized in accordance with E644. Corrections shall be applied to ensure measurements within 0.1°C.

# Why the apparent change in AASHTO Resource interpretation?

- Change is a matter of interpretation of poorly worded test methods – both AASHTO and ASTM!
  - ✓ Caused misunderstanding among inspectors
  - ✓ This will be corrected by Maria Knake
- Use of Canon wafer and reference thermometer **WILL** be allowed in future
  - ✓ Consistent with past practice
- If Canon wafer is used as reference thermometer then it must be calibrated with a certificate of uncertainty

# Action items

- AASHTO Resource will verify policy in communication to inspectors
  - ✓ Laboratories should no longer be dinged if use reference thermometer to the verify DSR thermometer
- Recommendation for updating test methods will be forthcoming from task group

**End of Story**