

# HEAT FLUX CALIBRATION TASK GROUP

2013 March Materials Meeting  
Renton, WA

Michael Burns, FAA Tech Center

March, 2013



Federal Aviation  
Administration



# HEAT FLUX GAUGE PAINT

- Nextel Black Velvet Paint No Longer Available
- Replacement Product Nextel Black Suede
- Alternative High Emissivity HFG Surface Paints



# TEST CONFIGURATION

## 3 Heat Flux Gauges Used

<u>Manufact.</u>	<u>Gauge Type</u>	<u>Range (Approx.)</u>
Vatell	Schm.Boel	0-5 W/cm <sup>2</sup>
Vatell	Gardon	0-15 W/cm <sup>2</sup>
Medtherm	Gardon	0-15 W/cm <sup>2</sup>

## 10 Surface Conditions

5 Black Paints

4 Various Color Paints

1 No Paint



# TEST CONFIGURATION

- Reference Gauge:
  - Vatell, 0-5 W/cm<sup>2</sup>, Gardon, Nextel Black Velvet Coating
- NBS Smoke Density Chamber Furnace with Holding Fixture
- Heat Flux set @ Approximately 3 W/cm<sup>2</sup>
- Process
  - ✓ Paint Applied (24 hour cure time)
  - ✓ Thickness Measured
  - ✓ Calibration
  - ✓ Heat Flux Verification
  - ✓ Bake Time (5 hours)
  - ✓ Paint Removed













PREMIUM  
**RUST-OLEUM**  
  
**GLOSS PROTECTIVE ENAMEL**  
 SUPERIOR COVERAGE AND DURABILITY  
 DANGEROUSLY FLAMMABLE. VAPORS MAY CAUSE INSTANTANEOUSLY UNDER PRESSURE. See cautions on Back Panel.  
 ¡PELIGRO! LÍQUIDO Y GASES EXTREMAMENTE INFLAMABLES. PUEDEN CAUSAR UN INCENDIO REPENTINO. NO SOMETER A PRESIÓN. Observar otras precauciones al dorso.  
 NET WT. 12 OZ. 340 GRAMS



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TRUSTED QUALITY SINCE 1921  
**RUST-OLEUM**  
  
**GLOSS PROTECTIVE ENAMEL**  
 SUPERIOR COVERAGE AND DURABILITY  
 DANGEROUSLY FLAMMABLE. VAPORS MAY CAUSE INSTANTANEOUSLY UNDER PRESSURE. See other cautions on Back panel.  
 ¡PELIGRO! LÍQUIDO Y VAPORES EXTREMAMENTE INFLAMABLES. PUEDEN CAUSAR UN INCENDIO INSTANTANEO REPENTINO. NO SOMETER A PRESIÓN. Observar otras precauciones en el panel de atrás.  
 NET WT. 12 OZ. 340g



ZYNOLYTE  SINCE 1928  
**Hi-TEMP**  
 EXTREME HEAT ENAMEL  
  
 Heatproof to 1200°F  
 PROTECTS AGAINST RUST & CORROSION  
 Heavy Duty Finish Resists Blistering and Peeling  
 Metal Stoves • Boilers • Engines • Gas  
 DANGEROUSLY FLAMMABLE! HARMFUL OR FATAL IF INHALED. VAPOR HARMFUL. CONTENTS UNDER PRESSURE. See cautions on back panel.  
 ¡PELIGRO! EXTREMAMENTE INFLAMABLE. DAÑINO O FATAL SI SE INHALA. EL VAPORES ES DAÑINO O FATAL SI SE INHALA. CONTENIDOS BAJO PRESIÓN. Observar otras precauciones en el panel de atrás.  
 NET WEIGHT 11 OUNCES (312g)



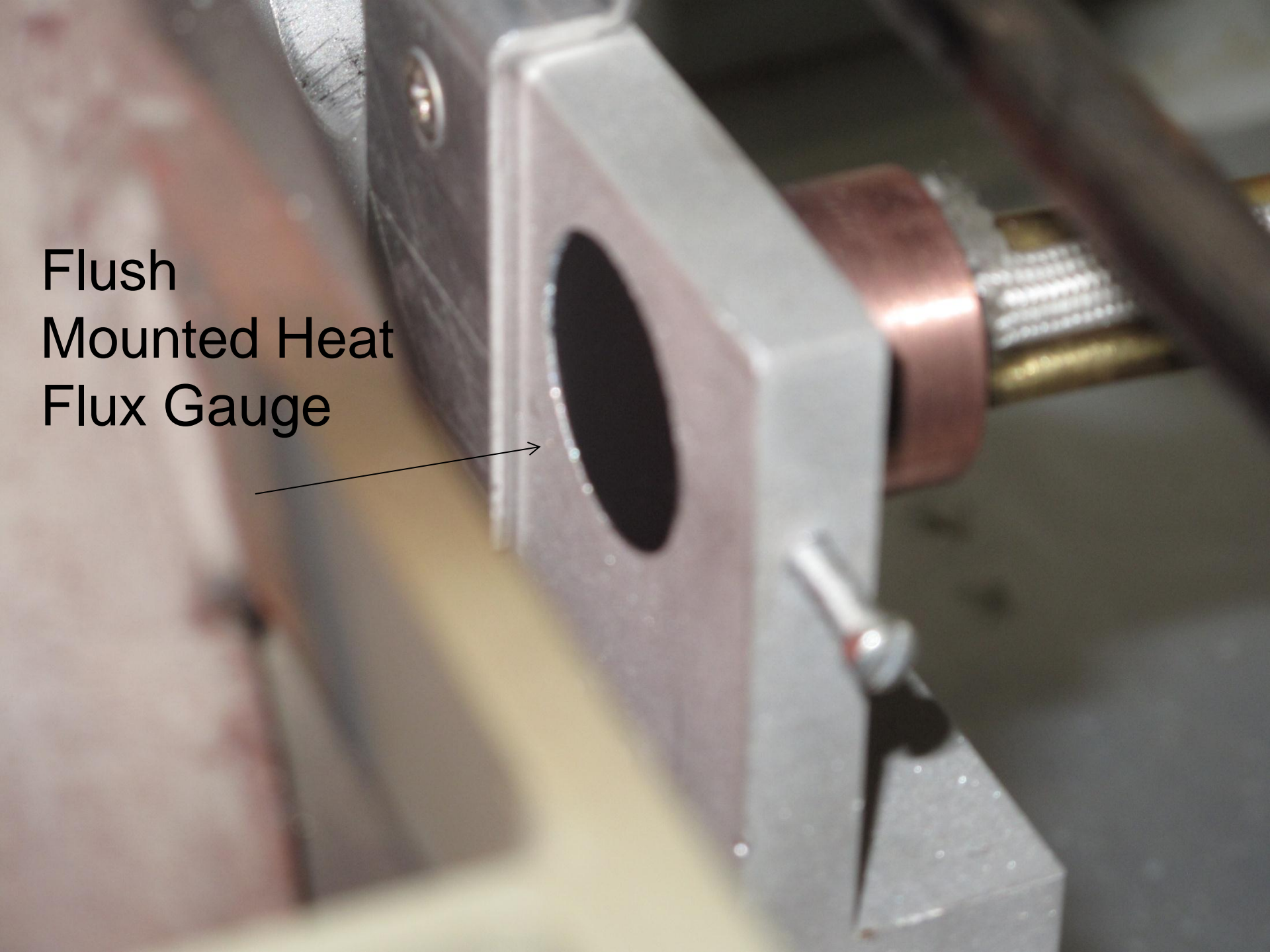


Furnace

Holding  
Fixture



Flush  
Mounted Heat  
Flux Gauge



# Gardon Guages

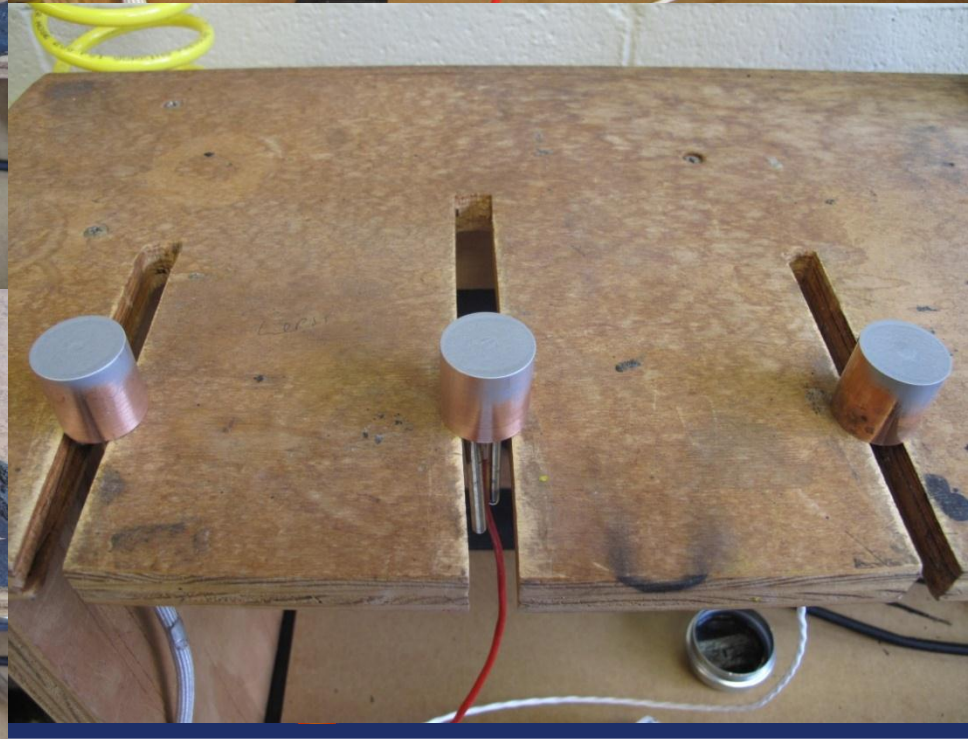
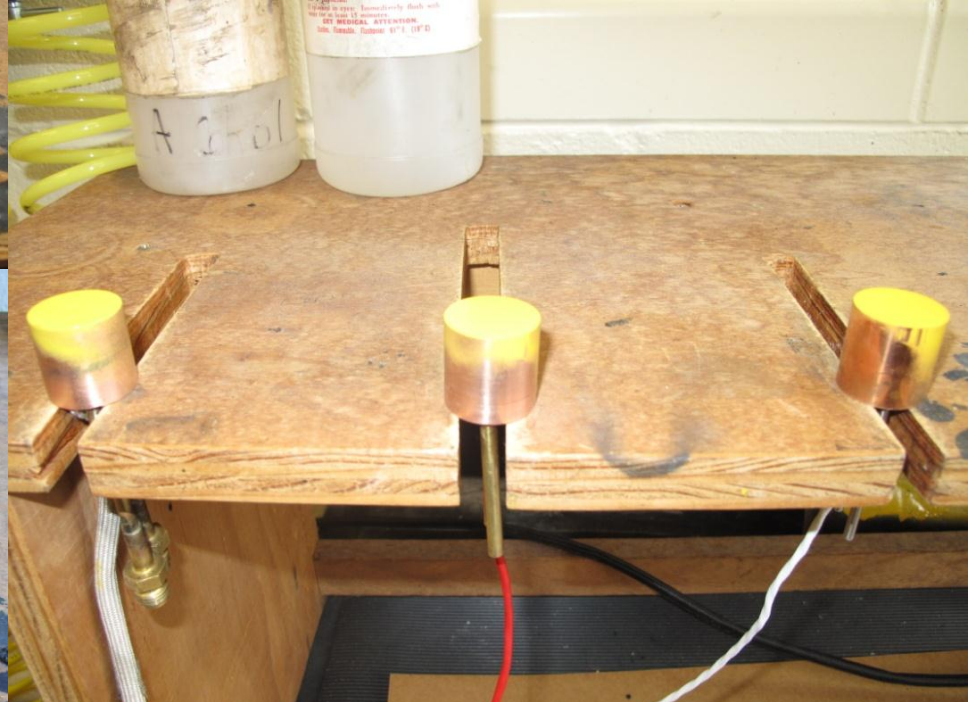
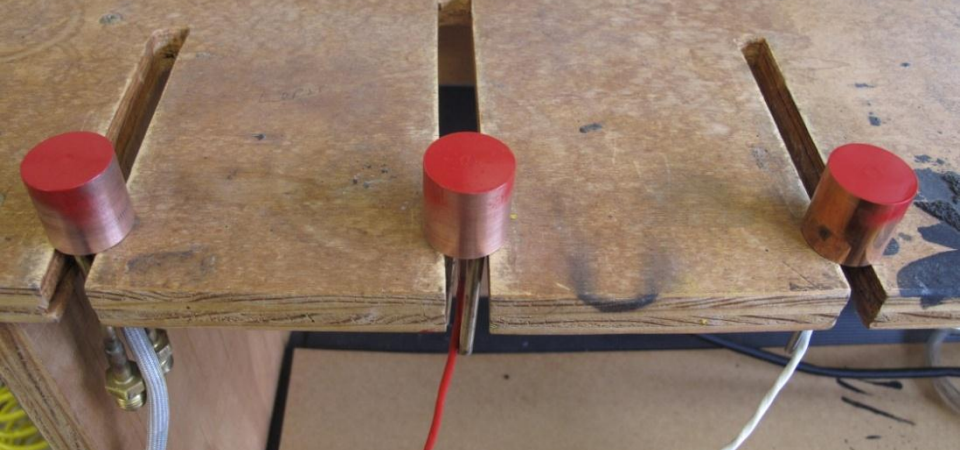
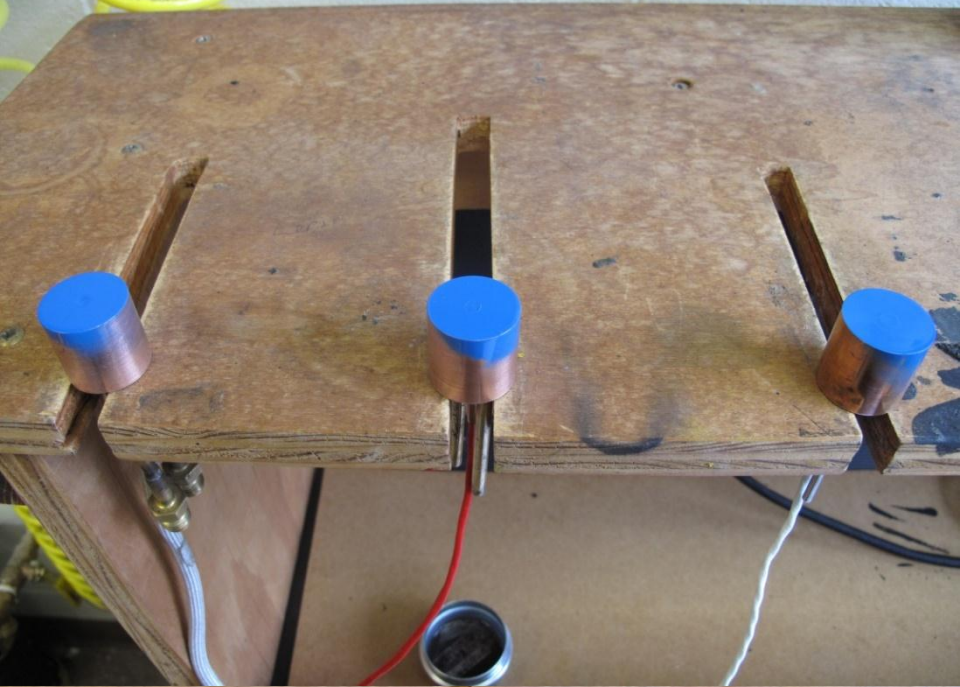
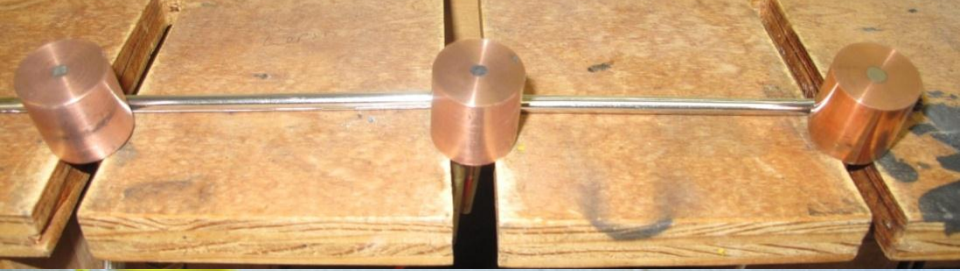


Nextel Suede



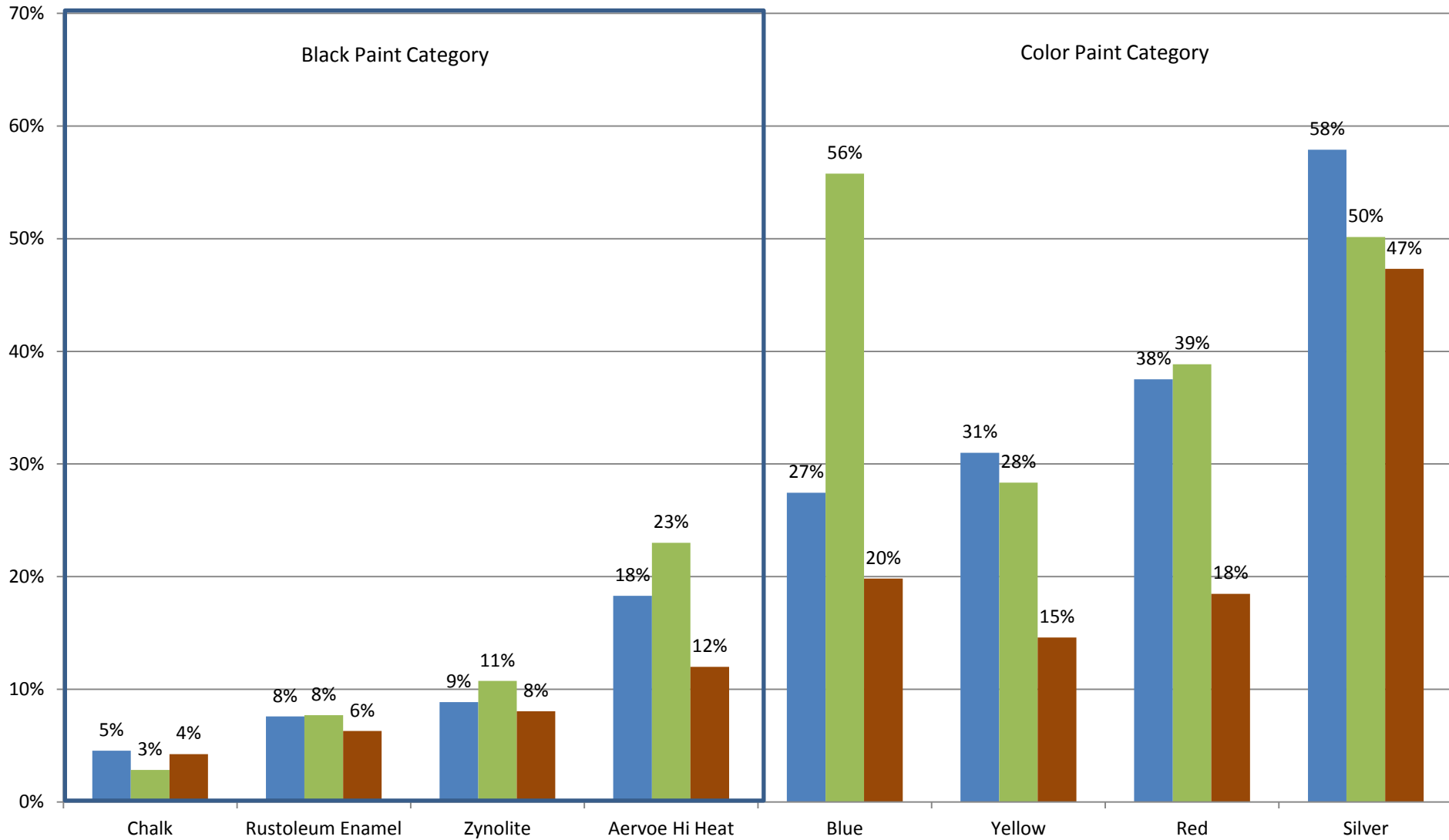
Zynolyte





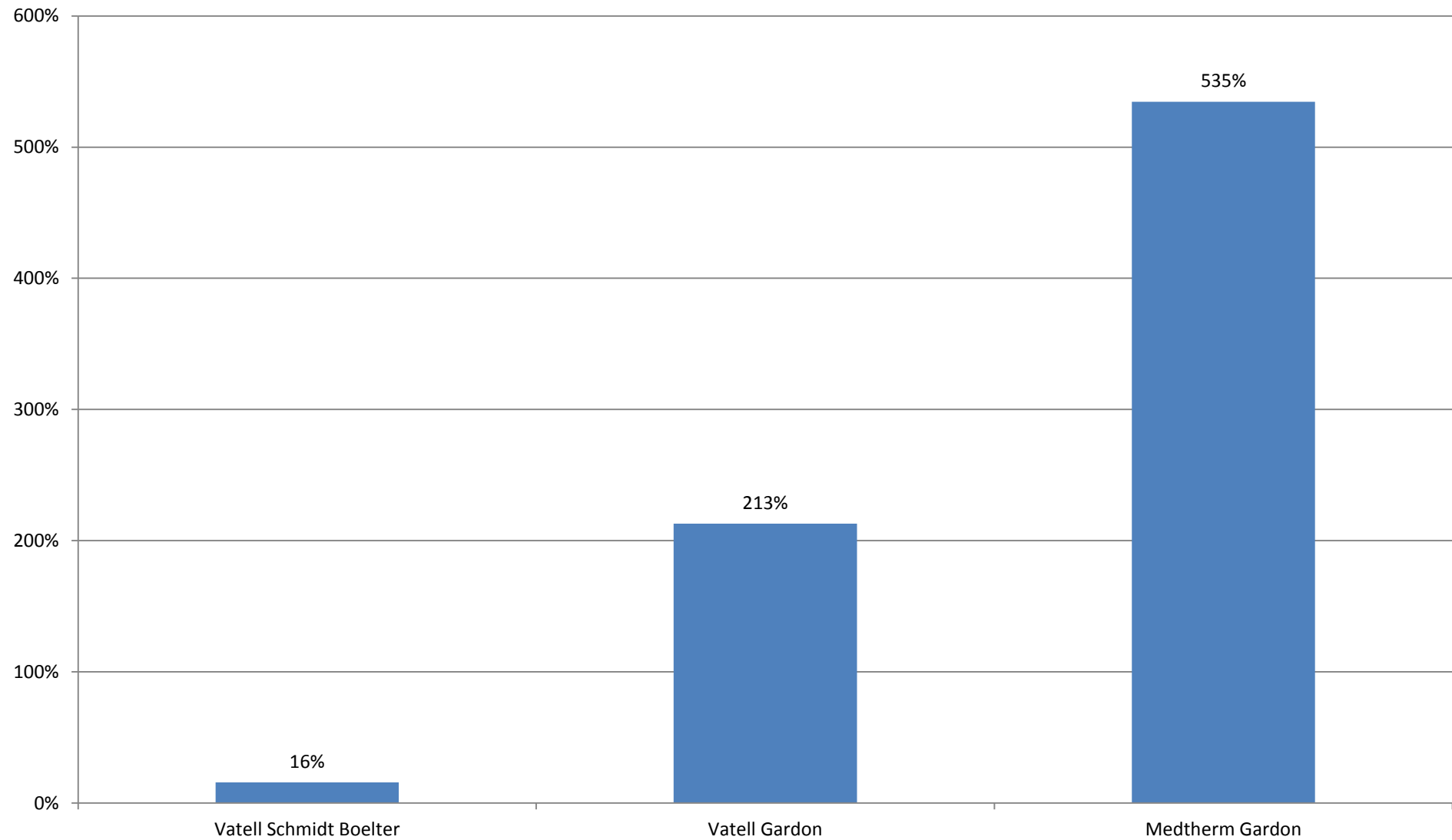
# % Difference in Calibration Factor Relative to Nextel Paint

Vatell Gardon Medtherm Gardon Vatell Schmidt Boelter





# % Difference in Calibration Factor Relative to Nextel Paint - No Paint -





Schmidt Boelter

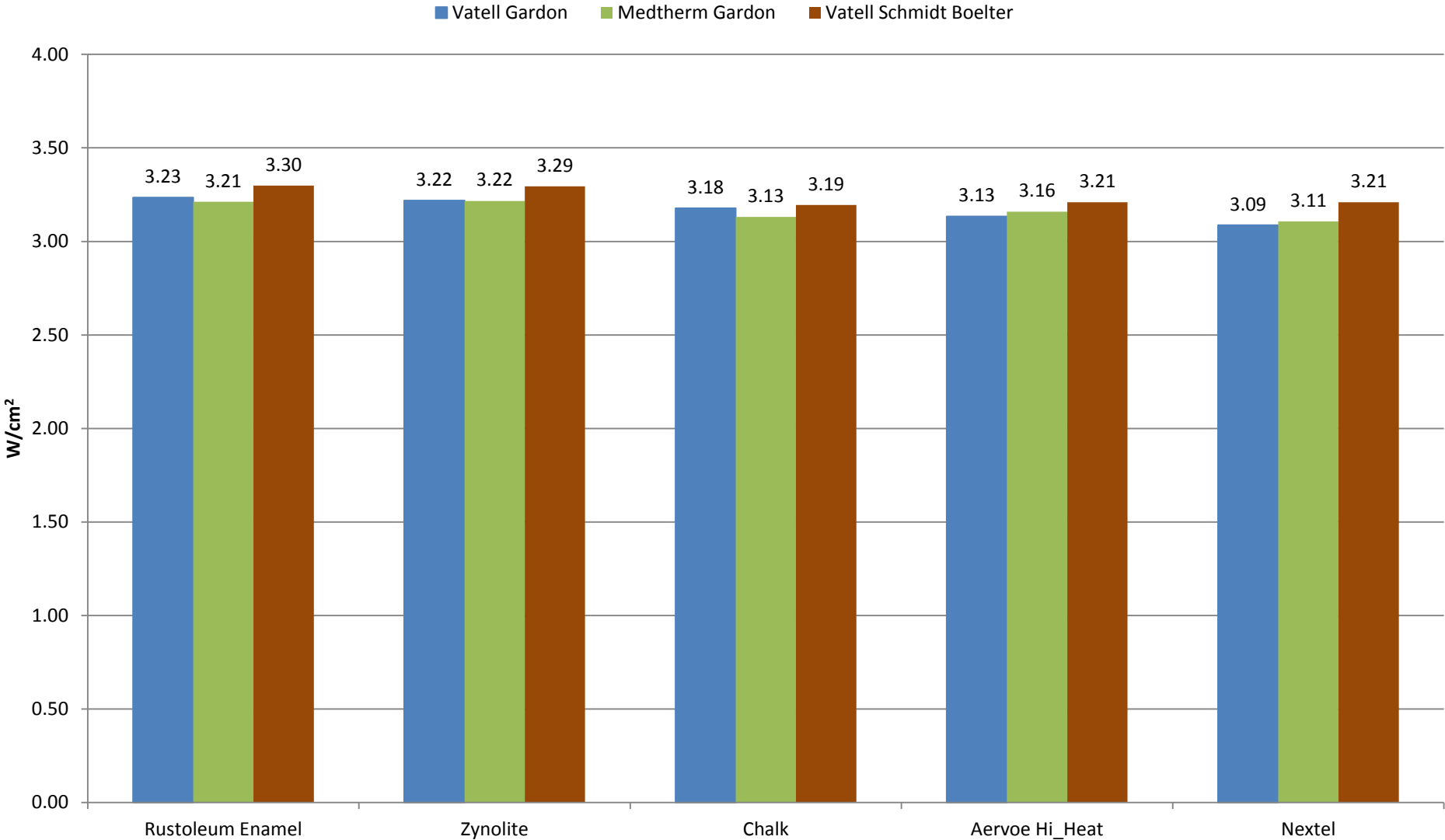


Gardon



# HEAT FLUX GAUGE PAINT COMPARISON

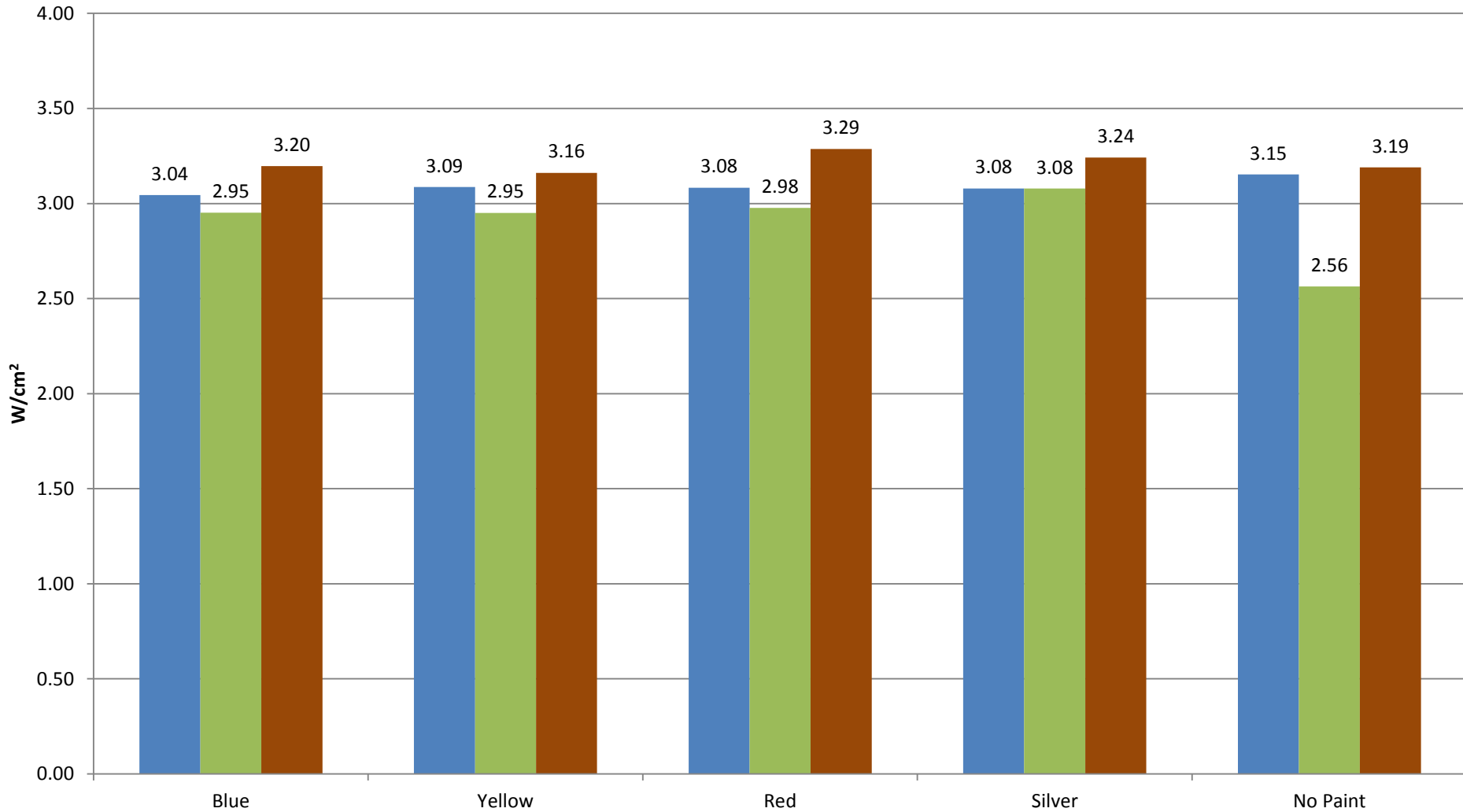
## AVG. = 3.19 W/cm<sup>2</sup> ; 1.9% STDEV



# HEAT FLUX GAUGE PAINT COMPARISON

AVG. = 3.13 W/cm<sup>2</sup> ; 4.5% Stdev

Vatell Gardon   Medtherm Gardon   Vatell Schmidt Boelter



# SUMMARY / CONCLUSION

- Each Gauge Average Dry Paint Thickness Was Within The Range Of 1.0 +/- 0.3 mils
  - \* Dry Thickness Gauge PosiTest DFT
- All Paints Were Easily Removed Using Acetone (even after 5 hour bake time)
- Nextel Suede Replacement Product Provided The Highest Signal Gain (lowest Cal. Factor) For Each Sensor
- All Black Paints Had Good Repeatability (< 2%Stdev)
- Data Shows The Importance Of Maintaining The Dark Coating In “As Received” Condition Once Calibrated





# TASK GROUP DISCUSSION

Develop Two Part Conformity Check List to Support New Chapter HF

Assist Calibration Entities / Certification Officials Validate Conformance To The Document.

## PART I

Equipment / Specifications / Dimensions

## PART II

Data Acquisition / Operation / Paint Application / Misc.

NIST Calibration Discussion (minimum # of data points?)



# Brain Teaser

Name the only vegetable or fruit that is never sold frozen, canned, processed, cooked, or in any other form except fresh.

Answer: Lettuce

