

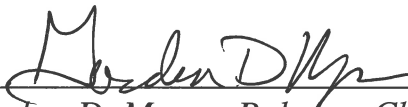


ATS JOB # C200410 Rev. 1

PURCHASE ORDER # CC

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## CHEMICAL TEST REPORT

Ref. C200410 Rev. 1\*

Date: July 29, 2013

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Purchase Order # CC

### Subject

Determine Coefficient of Thermal Expansion (CLTE) by Thermomechanical Analysis (TMA) for Precast Architectural Cement Stone.

### Material

Limestone based concrete

### Background and Objective

Determine Coefficient of Thermal Expansion.

### Test Procedure

ASTM E794-06: ASTM E831-06: *Standard Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis*

### Discussion and Results

Samples of the prepared precast architectural cement stone were saturated by holding them in de-ionized water for 24 hours. The cubic samples were placed into the TMA and the temperature was equilibrated at -25 °C , The samples were heated @ 5°C/min from -25°C to 100°C with an applied static force of 0.10N utilizing an expansion probe. The Coefficient of Thermal Expansion (CLTE) observed experimentally was calculated from 10°C to 50°C

### Conclusion

Three replicates were analyzed and found to have an average CLTE of 5.697  $\mu\text{m}/(\text{m}\cdot^{\circ}\text{C})$ . This converts to English units as  $3.165 \times 10^{-6}$  in/in°F (see Figure 1).



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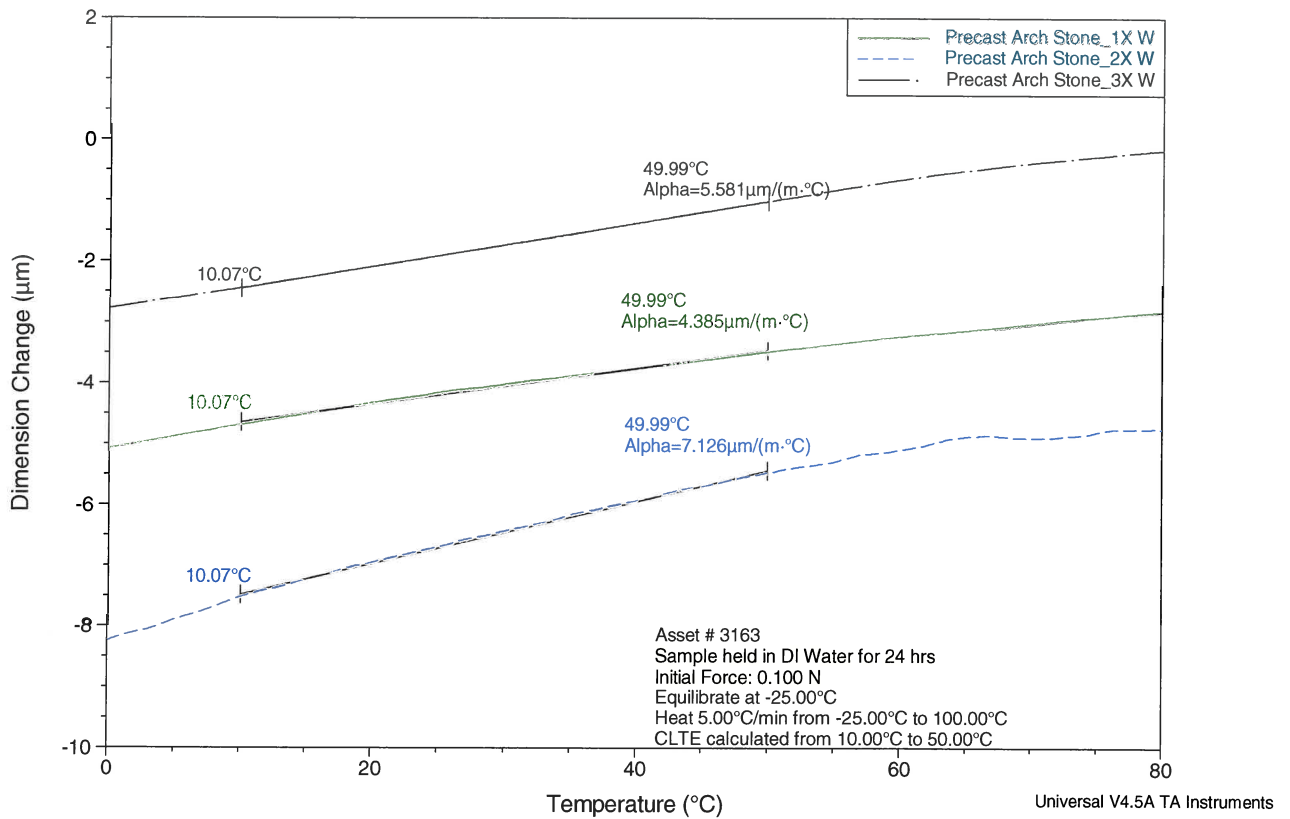


Figure 1. Curve Overlay of TMA Thermograms for the three replicates.