



The Monarch Cement Company

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Certified Mill Test Report - Type III

Production Period: May 1, 2019 through May 31, 2019

The following is based on average test data during the production period. The data is typical of cement produced at The Monarch Cement Company, Humboldt, KS. Individual shipments may vary.

PHYSICAL

| | <u>Reported</u> | <u>Spec Limit</u> | | <u>Reported</u> | <u>Spec Limit</u> |
|---------------------------------------|-----------------|-------------------|----------------------------------|-----------------|-------------------|
| 325 Sieve, % Passing | 99.2 | - | Air Content of Mortar (volume %) | 8.9 | 12.0 max |
| Blaine fineness, specific surface | | | Autoclave Expansion (%) | -0.0045 | 0.80 max |
| Air Permeability (cm ² /g) | 5940 | - | | | |
| | | | Compressive Strength (psi) | | |
| Time of Setting, Gilmore test: | | | 1 Day | 4069 | 1740 min |
| Initial (hrs:min) | 2:00 | 60 min | 3 Days | 4926 | 3480 min |
| Final (hrs:min) | 2:45 | 600 max | 7 Days | 5915 | - |

CHEMICAL

| | <u>Reported</u> | <u>Spec Limit</u> | | <u>Reported</u> | <u>Spec Limit</u> |
|---|-----------------|-------------------|--|-----------------|-------------------|
| SiO ₂ - Silicon dioxide (%) | 21.15 | - | Loss on ignition (%) | 0.79 | 3.0 max |
| Fe ₂ O ₃ - Ferric oxide (%) | 2.82 | 6.0 max | Insoluble residue (%) | 1.31 | 1.50 max |
| Al ₂ O ₃ - Aluminum oxide (%) | 4.15 | 6.0 max | Free lime (%) | 0.70 | - |
| CaO - Calcium oxide (%) | 63.85 | - | Na ₂ O - Sodium oxide (%) | 0.19 | - |
| MgO - Magnesium oxide (%) | 1.43 | 6.0 max | K ₂ O - Potassium oxide (%) | 0.54 | - |
| SO ₃ - Sulphur trioxide (%) | 3.31 | 3.5 max | Equivalent Alkalies (%) | 0.55 | - |

POTENTIAL CALCULATED COMPOUNDS

| C ₃ S - Tricalcium silicate (%) | 57.8 | - |
|---|------|---------------|
| C ₂ S - Dicalcium silicate (%) | 17.0 | - |
| C ₃ A - Tricalcium aluminate (%) | 6.2 | 15 max |
| C ₄ AF - Tetracalcium aluminoferrite (%) | 8.6 | - |

The cement in this shipment meets standard requirements in the current specifications of the Federal Government and the American Society for Testing and Materials for Type III Portland Cement. All tests conform to AASHTO M-85 and ASTM Test Methods: Chemical C-114, Blaine C-204, Soundness C-151, Gillmore C-266, Compressive Strength C-109, Air Content C-185, and C-150.

Date: 8/19/2019

Sean D. Bowman
 Quality Control Supervisor