



The Monarch Cement Company

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Certified Mill Test Report - Type III

Production Period: September 1 - September 30, 2017

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	99.7	-	Air Content of Mortar (volume %)	6.9	12.0 max
Blaine fineness, specific surface			Autoclave Expansion (%)	-0.026	0.80 max
Air Permeability (cm ² /g)	5700	-			
			Compressive Strength (psi)		
Time of Setting, Gilmore test:			1 Day	3200	1740 min
Initial (hrs:min)	1:35	60 min	3 Days	4580	3480 min
Final (hrs:min)	2:15	600 max	7 Days	5260	-

CHEMICAL

	<u>Reported</u>	<u>Spec Limit</u>		<u>Reported</u>	<u>Spec Limit</u>
SiO ₂ - Silicon dioxide (%)	21.22	-	Loss on ignition (%)	1.50	3.0 max
Fe ₂ O ₃ - Ferric oxide (%)	2.92	6.0 max	Insoluble residue (%)	0.12	1.50 max
Al ₂ O ₃ - Aluminum oxide (%)	4.40	6.0 max	Free lime (%)	1.04	-
CaO - Calcium oxide (%)	64.43	-	Na ₂ O - Sodium oxide (%)	0.20	-
MgO - Magnesium oxide (%)	1.37	6.0 max	K ₂ O - Potassium oxide (%)	0.55	-
SO ₃ - Sulphur trioxide (%)	3.1	3.5 max	Equivalent Alkalies (%)	0.56	0.60 max

POTENTIAL CALCULATED COMPOUNDS

C ₃ S - Tricalcium silicate (%)	58.4	-
C ₂ S - Dicalcium silicate (%)	16.8	-
C ₃ A - Tricalcium aluminate (%)	6.7	15 max
C ₄ AF - Tetracalcium aluminoferrite (%)	8.9	-

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: 12/22/2017

Sean D. Bowman
Quality Control Supervisor