



The Monarch Cement Company

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Certified Mill Test Report - Type I

Production Period: December 1, 2018 through December 31, 2018

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	91.5	-	Air Content of Mortar (volume %)	9.9	12.0 max
Blaine fineness, specific surface			Autoclave Expansion (%)	-0.001	0.80 max
Air Permeability (cm ² /g)	3740	2600 min	Compressive Strength (psi)		
Time of Setting, Gilmore test:			1 Day	2058	-
Initial (hrs:min)	2:50	60 min	3 Days	3301	1740 min
Final (hrs:min)	3:50	600 max	7 Days	4228	2760 min
Specific Gravity	3.13				

CHEMICAL

	<u>Reported</u>	<u>Spec Limit</u>		<u>Reported</u>	<u>Spec Limit</u>
SiO ₂ - Silicon dioxide (%)	21.21	-	Loss on ignition (%)	1.58	3.0 max
Fe ₂ O ₃ - Ferric oxide (%)	2.77	6.0 max	Insoluble residue (%)	0.26	1.50 max
Al ₂ O ₃ - Aluminum oxide (%)	4.16	6.0 max	Free lime (%)	1.12	-
CaO - Calcium oxide (%)	64.73	-	Na ₂ O - Sodium oxide (%)	0.20	-
MgO - Magnesium oxide (%)	1.63	6.0 max	K ₂ O - Potassium oxide (%)	0.51	-
SO ₃ - Sulphur trioxide (%)	2.70	3.0 max	Equivalent Alkalies (%)	0.54	0.60 max
			Inorganic Processing Addition (%)	2.10	5.0 max

POTENTIAL CALCULATED COMPOUNDS

C ₃ S - Tricalcium silicate (%)	62.7	-
C ₂ S - Dicalcium silicate (%)	13.6	-
C ₃ A - Tricalcium aluminate (%)	6.3	8 max
C ₄ AF - Tetracalcium aluminoferrite (%)	8.4	-

INORGANIC PROCESS ADDITON (C150)

Process Dust (%)	2.10
SiO ₂ - Silicon dioxide (%)	12.2
Fe ₂ O ₃ - Ferric oxide (%)	3.39
Al ₂ O ₃ - Aluminum oxide (%)	4.17
CaO - Calcium oxide (%)	58.7
SO ₃ - Sulphur trioxide (%)	0.28

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 I 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, C-465 and C-150.

Date: 1/17/2019

Sean D. Bowman
 Quality Control Supervisor