



The Monarch Cement Company

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Certified Mill Test Report - Type V

Production Period: September 1, 2019 through September 30, 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	96.6	-	Air Content of Mortar (volume %)	7.4	12.0 max
Blaine fineness, specific surface			Autoclave Expansion (%)	-0.004	0.80 max
Air Permeability (cm ² /g)	3820	2600 min	Compressive Strength (psi)		
Time of Setting, Gilmore test:			1 Day	2426	-
Initial (hrs:min)	2:05	60 min	3 Days	3603	1160 min
Final (hrs:min)	3:00	600 max	7 Days	4439	2180 min
Specific Gravity	3.13		Sulfate Resistance (%)	0.012	< 0.040
			Mortar Bar Expansion at 14 days (%)	0.005	< 0.020

CHEMICAL

	<u>Reported</u>	<u>Spec Limit</u>		<u>Reported</u>	<u>Spec Limit</u>
SiO ₂ - Silicon dioxide (%)	21.52	-	Loss on ignition (%)	0.91	3.0 max
Fe ₂ O ₃ - Ferric oxide (%)	2.68	6.0 max	Insoluble residue (%)	0.15	1.50 max
Al ₂ O ₃ - Aluminum oxide (%)	4.00	6.0 max	Free lime (%)	1.48	-
CaO - Calcium oxide (%)	63.86	-	Na ₂ O - Sodium oxide (%)	0.22	-
MgO - Magnesium oxide (%)	1.67	6.0 max	K ₂ O - Potassium oxide (%)	0.51	-
SO ₃ - Sulphur trioxide (%)	2.82	2.3 max¹	Equivalent Alkalies (%)	0.55	-
			Inorganic Processing Addition (%)	2.10	5.0 max

POTENTIAL CALCULATED COMPOUNDS

C ₃ S - Tricalcium silicate (%)	57.7	-
C ₂ S - Dicalcium silicate (%)	18.2	-
C ₃ A - Tricalcium aluminate (%)	6.1	5 max²
C ₄ AF - Tetracalcium aluminoferrite (%)	8.2	-

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

1. May exceed 2.3% maximum based on C 1038 results of <0.020% expansion at 14 days.
2. May exceed limits when Sulfate Resistance (C 452) is <0.040% at 14 days.

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 V 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, C-150, C-1038, and C-452.

We certify that the above described cement meets the chemical and physical requirements for Type V per ASTM C-150.

Date: 10/21/2019

Sean D. Bowman
Quality Control Supervisor