



# The Monarch Cement Company

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## Certified Mill Test Report - Type I

Production Period: October 1- October 31, 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

	Reported	Spec Limit		Reported	Spec Limit
325 Sieve, % Passing	93.5	-	Air Content of Mortar (volume %)	7.9	12.0 max
Blaine fineness, specific surface			Autoclave Expansion (%)	-0.018	0.80 max
Air Permeability (cm <sup>2</sup> /g)	3720	2600 min	Compressive Strength (psi)		
Time of Setting, Gilmore test:			1 Day	1900	-
Initial (hrs:min)	2:20	60 min	3 Days	3260	1740 min
Final (hrs:min)	4:00	600 max	7 Days	4360	2760 min

### CHEMICAL

	Reported	Spec Limit		Reported	Spec Limit
SiO <sub>2</sub> - Silicon dioxide (%)	21.20	-	Loss on ignition (%)	2.27	3.0 max
Fe <sub>2</sub> O <sub>3</sub> - Ferric oxide (%)	2.95	6.0 max	Insoluble residue (%)	0.37	1.50 max
Al <sub>2</sub> O <sub>3</sub> - Aluminum oxide (%)	4.34	6.0 max	Free lime (%)	1.08	-
CaO - Calcium oxide (%)	64.75	-	Na <sub>2</sub> O - Sodium oxide (%)	0.19	-
MgO - Magnesium oxide (%)	1.38	6.0 max	K <sub>2</sub> O - Potassium oxide (%)	0.52	-
SO <sub>3</sub> - Sulphur trioxide (%)	2.77	3.0 max	Equivalent Alkalies (%)	0.53	0.60 max
			Inorganic Processing Addition (%)	2.10	5.0 max

### POTENTIAL CALCULATED COMPOUNDS

C <sub>3</sub> S - Tricalcium silicate (%)	61.2	-
C <sub>2</sub> S - Dicalcium silicate (%)	14.6	-
C <sub>3</sub> A - Tricalcium aluminate (%)	6.5	8 max
C <sub>4</sub> AF - Tetracalcium aluminoferrite (%)	9.0	-

### INORGANIC PROCESS ADDITON (C150)

Process Dust (%)	2.10
SiO <sub>2</sub> - Silicon dioxide (%)	10.3
Fe <sub>2</sub> O <sub>3</sub> - Ferric oxide (%)	2.16
Al <sub>2</sub> O <sub>3</sub> - Aluminum oxide (%)	4.23
CaO - Calcium oxide (%)	43.8
SO <sub>3</sub> - Sulphur trioxide (%)	0.46

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: 11/22/2017

Sean D. Bowman  
 Quality Control Supervisor