



# The Monarch Cement Company

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## Certified Mill Test Report - Type I/II

Production Period: November 1 - November 30, 2017

Silo (Bin) No. 681

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	94.4	-	Air Content of Mortar (volume %)	8.2	<b>12.0 max</b>
Blaine fineness, specific surface			Autoclave Expansion (%)	-0.018	<b>0.80 max</b>
Air Permeability (cm <sup>2</sup> /g)	3790	<b>2600 min</b>	Compressive Strength (psi)		
Time of Setting, Gilmore test:			1 Day	2140	-
Initial (hrs:min)	2:35	<b>60 min</b>	3 Days	3450	<b>1740 min</b>
Final (hrs:min)	4:10	<b>600 max</b>	7 Days	4265	<b>2760 min</b>

### CHEMICAL

	Reported	Spec Limit		Reported	Spec Limit
SiO <sub>2</sub> - Silicon dioxide (%)	21.00	-	Loss on ignition (%)	1.66	<b>3.0 max</b>
Fe <sub>2</sub> O <sub>3</sub> - Ferric oxide (%)	2.94	<b>6.0 max</b>	Insoluble residue (%)	0.43	<b>1.50 max</b>
Al <sub>2</sub> O <sub>3</sub> - Aluminum oxide (%)	4.41	<b>6.0 max</b>	Free lime (%)	1.32	-
CaO - Calcium oxide (%)	65.23	-	Na <sub>2</sub> O - Sodium oxide (%)	0.19	-
MgO - Magnesium oxide (%)	1.33	<b>6.0 max</b>	K <sub>2</sub> O - Potassium oxide (%)	0.54	-
SO <sub>3</sub> - Sulphur trioxide (%)	2.8	<b>3.0 max</b>	Equivalent Alkalies (%)	0.55	<b>0.60 max</b>
			Inorganic Processing Addition (%)	2.10	<b>5.0 max</b>

### POTENTIAL CALCULATED COMPOUNDS

C <sub>3</sub> S - Tricalcium silicate (%)	64.2	-
C <sub>2</sub> S - Dicalcium silicate (%)	11.8	-
C <sub>3</sub> A - Tricalcium aluminate (%)	6.7	<b>8 max</b>
C <sub>4</sub> AF - Tetracalcium aluminoferrite (%)	8.9	-

### 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 and for Type II Portland Cement. Also as prescribed by the Highway Division of the Iowa DOT. All tests conform to 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: 12/22/2017

Sean D. Bowman  
 Quality Control Supervisor