



The Monarch Cement Company

449 1200 Street · PO Box 1000 · Humboldt, KS 66748

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Certified Mill Test Report - Type IL (12)(MS)(HS)

Production Period: **March 2022**

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	97.4	-	Air Content of Mortar (volume %)	7.5	12.0 max
Blaine fineness, specific surface			Autoclave Expansion (%)	0.01	0.80 max
Air Permeability (cm ² /g)	4454	-	Compressive Strength (psi)		
Time of Setting, Vicat test:			1 Day	2746	-
Initial (minutes)	110	45 min	3 Days	4245	1890 min
Final (minutes)	180	420 max	7 Days	5302	2900 min
			28 Days	6567	3620 min
Specific Gravity	3.08		Sulfate Resistance (%)	0.012	< 0.10¹

CHEMICAL

	<u>Reported</u>	<u>Spec Limit</u>		<u>Reported</u>	<u>Spec Limit</u>
SiO ₂ - Silicon dioxide (%)	19.31	-	Loss on ignition (%)	4.73	10.0 max
Fe ₂ O ₃ - Ferric oxide (%)	2.89	6.0 max	Insoluble residue (%)	0.98	-
Al ₂ O ₃ - Aluminum oxide (%)	3.96	6.0 max	Free lime (%)	1.03	-
CaO - Calcium oxide (%)	63.33	-	Na ₂ O - Sodium oxide (%)	0.17	-
MgO - Magnesium oxide (%)	1.42	6.0 max	K ₂ O - Potassium oxide (%)	0.55	-
SO ₃ - Sulphur trioxide (%)	2.83	3.0 max	Equivalent Alkalies (%)	0.54	-
Limestone (%)	11.60	15.0 max	Inorganic Processing Addition (%)	2.50	-
CaCO ₃ content of Limestone (%)	90.28	70.0 min			

POTENTIAL CALCULATED COMPOUNDS

C ₃ S - Tricalcium silicate (%)	64.5	-
C ₂ S - Dicalcium silicate (%)	11.0	-
C ₃ A - Tricalcium aluminate (%)	5.0	-
C ₄ AF - Tetracalcium aluminoferrite (%)	7.8	-

Inorganic Process Addition

SiO ₂ - Silicon dioxide (%)	11.2
Fe ₂ O ₃ - Ferric oxide (%)	3.21
Al ₂ O ₃ - Aluminum oxide (%)	3.78
CaO - Calcium oxide (%)	59.0
SO ₃ - Sulphur trioxide (%)	0.52

1. Exhibits Special Properties for Moderate Sulfate Resistance (MS) and High Sulfate Resistance (HS) as demonstrated by ASTM C-1012.

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 IL Blended Hydraulic Cement. All tests conform to AASHTO M-240 and ASTM Test Methods: Compressive Strength C-109, Chemical C-114, Soundness C-151, Air Content C-185, Normal Consistency C-187, Time of Set C-188, Vicat C-191, Blaine C-204, Gillmore C-266, 325 Sieve C-430, Processing Additions C-465, Sulfate Resistance C-1012, and C-595 Specification for Blended Hydraulic Cements.

Date: 4/20/2022

Mitchell R. King
Quality Control Supervisor