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CEMENT TEST REPORT

Cement: Permanente Type II/V, Low Alkali; ASTM C 150-16

Production Period: Permanente October 2016

Report Date: 11/8/2016

STANDARD CHEMICAL REQUIREMENTS ASTM C 114	TEST RESULTS	ASTM C 150-16 SPECIFICATIONS	
		TYPE II	TYPE V
Silicon Dioxide (SiO ₂), %	21.4	----	----
Aluminum Oxide (Al ₂ O ₃), %	4.0	6.0 Max	----
Ferric Oxide (Fe ₂ O ₃), %	3.9	6.0 Max	----
Calcium Oxide (CaO), %	65.2	----	----
Magnesium Oxide (MgO), %	1.2	6.0 Max	6.0 Max
Sulfur Trioxide (SO ₃), % ^{Note B}	3.4	3.0 Max	2.3 Max
Loss on Ignition (LOI), %	2.0	3.5 Max	3.5 Max
Insoluble Residue, %	0.61	1.5 Max	1.5 Max
Alkalies (Na ₂ O equivalent), %	0.30	0.60 Max	0.60 Max
Tricalcium Silicate (C ₃ S), % ^a	58	----	----
Dicalcium Silicate (C ₂ S), % ^a	16	----	----
Tricalcium Aluminate (C ₃ A), % ^a	4	8 Max	5 Max
Tetracalcium Aluminoferrite (C ₄ AF), % ^a	11	----	----
2 (C ₃ A) + C ₄ AF, %	19	----	25 Max
PHYSICAL REQUIREMENTS			
(ASTM C 1038) Expansion @ 14 days, %	0.005	0.020 Max	0.020 Max
(ASTM C 452) Expansion @ 14 days, %	0.027	----	0.04 Max
(ASTM C 430) -325 Mesh, %	98.4	----	----
(ASTM C 204) Blaine, m ² /kg	366	280 Min	280 Min
(ASTM C114) Limestone, max, % ^{Note C}	2.9	5 Max	5 Max
(ASTM C114) Limestone, %CaCO ₃	74.5	----	----
(ASTM C114) Cement, %CO ₂	0.94	----	----
(ASTM C 191) Time of Setting - Initial (Vicat)	130	45 Min	45 Min
(ASTM C 191) Time of Setting - Final (Vicat)	244	375 Max	375 Max
(ASTM C 451) False Set, %	87	50 Min	50 Min
(ASTM C 185) Air Content, %	6.4	12 Max	12 Max
(ASTM C 151) Autoclave Expansion, %	-0.01	0.80 Max	0.80 Max
(ASTM C 187) Normal Consistency, %	25.5	----	----
(ASTM C 109) Compressive Strength, psi (MPa)			
1 Day	1718	----	----
3 Day	3194	1450 (10.0) Min	1160 (8.0) Min
7 Day	4223	2470 (17.0) Min	2180 (15.0) Min
28 Day (previous month)	6573	----	3050 (21.0) Min

This cement meets the requirements of specification:

ASTM C150-16 Type II/V, Low Alkali
^a Adjusted per ASTM C-150-16 Section A1.6
 Caltrans Section 90-2.01 - Type II/V Modified
 ASTM C 1157 Portland Cement Type HS
 AASHTO Practice R18 accredited laboratory
 Certified in accordance with Lehigh's Quality Assurance Program effective June 12, 2013

Anna Castillo, Quality Control Manager

Applicable ASTM C 150 Notes:

Note B: There are cases where the optimum SO₃ for a particular cement is close to or in excess of the limit in this specification. In such cases where properties of a cement can be improved by exceeding the SO₃ limit stated in this table it is permissible to exceed the values in the table, provided it has been demonstrated by Test Method C1038 that the cement with the increased SO₃ will not develop expansion in water exceeding 0.020% at 14 days. When the manufacturer supplies cement under this provision, he shall, upon request, supply supporting data to the purchaser.

Note C: Limestone addition as per C 150-16 Item 5.1.3