



Cement Mill Test Report

Date of Issue: January 12, 2022

Plant: Exshaw AB
 Product: Portland Cement Type I/II/V
 Mill Test Report Number: MTR-I/II/V-2021-12
 Manufactured: December 1-31, 2021

ASTM C 150-20 and AASHTO M 85-18 Standard Requirements

| CHEMICAL ANALYSIS | | | PHYSICAL ANALYSIS | | |
|--|------------|-------------|---|-----------------|-------------|
| Item | Spec limit | Test Result | Item | Spec limit | Test Result |
| Rapid Method, X-Ray (C114) | | | Air content of mortar (%) (C185) | 12 max | 4 |
| SiO ₂ (%) | --- | 19.7 | Blaine Fineness (m ² /kg) (C204) | 260 min | 428 |
| Al ₂ O ₃ (%) | 6.0 max | 4.0 | Passing 45 μm (%) (C430) | --- | 99.0 |
| Fe ₂ O ₃ (%) | 6.0 max | 3.7 | Autoclave Expansion (%) (C151)** | 0.80 max | 0.10 |
| CaO (%) | --- | 62.4 | Compressive strength (MPa, [psi]) (C 109) | | |
| MgO (%) | 6.0 max | 4.4 | 3 days | 12.0 [1740] min | 33.0 [4790] |
| SO ₃ (%) | 2.3 max * | 2.8 | 7 days | 19.0 [2760] min | 37.7 [5460] |
| Loss on Ignition (%) | 3.5 max | 2.5 | 28 days (Reflects previous month's data) | | 43.1 [6240] |
| Insoluble Residue (%) | 1.5 max | 0.33 | Time of setting (minutes) | | |
| CO ₂ (%) | --- | 1.9 | Vicat Initial (C191) | 45 - 375 | 115 |
| Limestone (%) | 5.0 max | 4.6 | Sulfate Resistance (%) (C452) | 0.040 max | 0.033 |
| CaCO ₃ in Limestone (%) | 70 min | 94 | Mortar Bar Expansion (%) (C1038) | 0.020 max | 0.008 |
| Inorganic Process Addition (Lafarge Cement Kiln Dust) | 5.0 max | - | | | |
| Adjusted Potential Phase Composition (C 50) | | | | | |
| C ₃ S (%) | --- | 55 | | | |
| C ₂ S (%) | --- | 15 | | | |
| C ₃ A (%) | 5 max | 4 | | | |
| C ₄ AF (%) | --- | 11 | | | |
| C ₄ AF + 2(C ₃ A) | 25 max | 19 | | | |
| C ₃ S+4.75*C ₃ A (%) | 100 max | 74 | | | |
| ASTM C 150-17 and AASHTO M 85-17 Optional Requirements: | | | | | |
| NaEq (%) | 0.60 max | 0.55 | False set (%) (C451) | 50 min | 72 |

* May exceed the SO₃ maximum based on C 1038 results of <0.020% expansion at 14 days.

** Current Production run not available - most recent provided

We certify that the above described cement, at the time of shipment, meets the chemical and physical requirements of ASTM C 150-20 & AASHTO M 85-18 STANDARD SPECIFICATIONS FOR TYPES I, II & V CEMENTS; and ASTM C 150-20 & AASHTO M 85-18 OPTIONAL CHEMICAL REQUIREMENTS FOR TYPES I, II & V LOW ALKALI CEMENT.

Certified By:

Lorraine Richards

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 Quality Control Coordinator

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Additional Data

| Item | Test Result | |
|------------------------------------|-------------|--|
| | Limestone | Inorganic Process Addition Lafarge Cement Kiln Dust |
| Amount (%) | 4.6 | - |
| SiO ₂ (%) | 0.8 | n/a |
| Al ₂ O ₃ (%) | 0.7 | n/a |
| Fe ₂ O ₃ (%) | 0.2 | n/a |
| CaO (%) | 52.1 | n/a |
| SO ₃ (%) | 0.1 | n/a |
| CO ₂ (%) | 41.5 | n/a |

Base Cement Phase Composition

| Item | Test Result |
|-----------------------|-------------|
| C ₃ S (%) | 58 |
| C ₂ S (%) | 16 |
| C ₃ A (%) | 4 |
| C ₄ AF (%) | 12 |

We certify that the data above reflects the materials used in cement manufacture during the production period indicated.

Note: Specific Gravity for Portland Cements is 3.14

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