



MITSUBISHI CEMENT CORPORATION

CERTIFICATE OF TEST

Source: Cushenbury Plant

Limestone Modified Portland Cement - Block

Date: 9/8/2016

| | |
|--|-------------------|
| ASTM designation: C 1157 – 11 for Type HE. | Production Period |
| UBC Standard: Section 21.303.1 Vol. 3 | From: 8/15/2016 |
| | To: 8/19/2016 |

Chemical Composition:

| | ASTM Limits | UBC Limits | Test Results |
|--|-------------|------------|--------------|
| Silicon Dioxide (SiO ₂), % | ---- | ---- | 18.8 |
| Aluminum Oxide (Al ₂ O ₃), % | ---- | ---- | 5.0 |
| Ferric Oxide (Fe ₂ O ₃), % | ---- | ---- | 1.1 |
| Calcium Oxide (CaO), % | ---- | ---- | 63.3 |
| Magnesium Oxide (MgO), % | ---- | ---- | 2.4 |
| Sulfur Trioxide (SO ₃), % | ---- | ---- | 3.0 |
| Loss on Ignition, % | ---- | 7.0 Max. | 5.6 |
| Insoluble Residue, % | ---- | 1.5 Max. | 0.8 |
| Total Alkali (%Na ₂ O + 0.658 * %K ₂ O), % | ---- | ---- | 0.33 |
| Tricalcium Silicate (C ₃ S), [b] % | ---- | ---- | 48 |
| Tricalcium Aluminate (C ₃ A), [b] % | ---- | ---- | 11 |
| CO ₂ , % | ---- | ---- | 5.0 |
| Limestone, % | 15 Max. | ---- | 12.5 |
| Limestone Purity, % | ---- | 85 Min. | 91 |
| Free Lime, % | ---- | ---- | 1.1 |

PHYSICAL RESULTS:

| | | | |
|--|----------------------|---------|-------|
| Blaine Fineness Average (m ² /kg) | ---- | ---- | 531 |
| 325 Mesh (% Passing) | ---- | ---- | 98.2 |
| Autoclave Expansion (%) | 0.80 Max. | ---- | 0.09 |
| Mortar Bar Expansion (%) July 2016 | 0.020 Max. | ---- | 0.006 |
| Time of Set Initial Vicat (minutes) | 45 / 420 Min. / Max. | ---- | 108 |
| Air Content (% by Volume) | 12 Max | 22 Max. | 6.6 |
| Heat of Hydration (kJ/kg) | (a) | ---- | 377 |
| Color (L value) | (a) | ---- | 77 |

Compressive Strength Test:

| | ASTM Limits | | MPA | PSI |
|------------------|-------------|------|------|-----------|
| | MPA | psi | | |
| 1 Day | 12.0 | 1740 | Min. | 20.3 2945 |
| 3 Day | 24.0 | 3480 | Min. | 31.4 4555 |
| 7 Day | ---- | ---- | | 34.4 4985 |
| 28 Day July 2016 | ---- | ---- | | 42.3 6128 |

This cement has been sampled and tested in accordance with ASTM standard methods and procedures. All tests results are certified to comply with the type specification designated above. No other warranty is made or implied. We are not responsible for improper use or workmanship. [a] For information only. [b] Adjusted per ASTM C150 A1.6

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Cushenbury plant



Tom Gepford
Quality Control Manager



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Additional Data

Limestone Addition

| | |
|------------------------------------|------|
| % Addition: | 12.5 |
| SiO ₂ (%) | 4.8 |
| Al ₂ O ₃ (%) | 1.2 |
| Fe ₂ O ₃ (%) | 0.6 |
| CaO (%) | 49.9 |
| SO ₃ (%) | 0.3 |

Base Cement Phase Composition

| | |
|-------------------|----|
| C ₃ S | 54 |
| C ₂ S | 18 |
| C ₃ A | 13 |
| C ₄ AF | 3 |

We certify that the above described data represents the material used in the cement manufactured during the production period indicated.

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