



**MATERIAL CERTIFICATION REPORT**

**Plant:** Trident  
**Address:** 4070 Trident Road  
 Three Forks, MT 59752  
**Contact:** Zach Gill  
**Phone:** (406)285-3988

**Cement Type:** V, Low Alkali, HS  
**Date Issued:** 12-Oct-18  
**Production Period:** 1-Sep-18  
**To:** 30-Sep-18

**STANDARD REQUIREMENTS ASTM C150/ASTM C1157/CSA A3001-13**  
 Trident Plant is an ISO 9001:2015 Certified Facility

| CHEMICAL                                   |                  |                       |             |
|--|------------------|-----------------------|-------------|
| Item                                       | ASTM Test Method | ASTM C150 Spec. Limit | Test Result |
| SiO <sub>2</sub> (%)                       | C114             | -                     | 20.5        |
| Al <sub>2</sub> O <sub>3</sub> (%)         | C114             | 6.0 max               | 3.9         |
| Fe <sub>2</sub> O <sub>3</sub> (%)         | C114             | 6.0 max               | 3.1         |
| CaO (%)                                    | C114             | -                     | 65.0        |
| MgO (%)                                    | C114             | 6.0 max               | 2.0         |
| SO <sub>3</sub> (%)                        | C114             | 2.3 max <sup>A</sup>  | 3.0         |
| Loss On Ignition (%)                       | C114             | 3.5 max <sup>B</sup>  | 2.8         |
| Na <sub>2</sub> O (%)                      | C114             | -                     | 0.00        |
| K <sub>2</sub> O (%)                       | C114             | -                     | 0.00        |
| Insoluble Residue (%)                      | C114             | 1.5 max               | 0.3         |
| CO <sub>2</sub> (%)                        | C114             | -                     | -           |
| Limestone (%)                              | C150             | 5.0 max               | 4.0         |
| CaCO <sub>3</sub> in Limestone (%)         | C150             | 70 min                | 99          |
| Inorganic Processing Addition              | C150             | 5.0 max               | -           |
| Potential Phase Composition                |                  |                       |             |
| C <sub>3</sub> S (%)                       | C150             | -                     | 60          |
| C <sub>2</sub> S (%)                       | C150             | -                     | 13          |
| C <sub>3</sub> A (%)                       | C150             | 5 max                 | 5           |
| C <sub>4</sub> AF (%)                      | C150             | -                     | 9           |
| C <sub>4</sub> AF + 2 C <sub>3</sub> A (%) | C150             | 25 max                | 19          |

| PHYSICAL                              |                  |                       |                        |             |
|---------------------------------------|------------------|-----------------------|------------------------|-------------|
| Item                                  | ASTM Test Method | ASTM C150 Spec. Limit | ASTM C1157 Spec. Limit | Test Result |
| Air Content (%)                       | C185             | 12 max                | 12 max                 | 6           |
| Blaine Fineness (%)                   | C204             | 260 min / 430 max     | -                      | 403         |
| Residue 45 µm (No.325) Sieve (%)      | C430             | -                     | -                      | 100.0       |
| Autoclave Expansion (%) CSA A3004-B4  | C151             | 0.80 max              | 0.80 max               | -0.01       |
| Compressive Strength                  |                  |                       |                        |             |
| 3 days, MPa (psi)                     | C109             | 12.0 (1740) min       | 13.0 (1890) min        | 32.2 (4140) |
| 7 days, MPa (psi)                     | C109             | 19.0 (2760) min       | 20.0 (2900) min        | 36.9 (5350) |
| 28 days, MPa (psi) <sup>C</sup>       | C109             | 28.0 (4060) min       | 28.0 (4060) min        | 46.1 (6690) |
| Time of Setting, Initial Vicat (min)  | C191             | 45 min / 375 max      | 45 min / 420 max       | 142         |
| Mortar Bar Expansion (%) CSA A3004-C5 | C1038            | 0.020 max             | 0.020 max              | -0.003      |
| Sulfate Resistance (%) CSA A3004-C6   | C452             | 0.050 max             | 0.040 max              | 0.025       |

| ADDITIONAL DATA                    |           |             |                        |                  |             |
|------------------------------------|-----------|-------------|------------------------|------------------|-------------|
| Type                               | Limestone | Test Method | Base Phase Composition | ASTM Test Method | Test Result |
| SiO <sub>2</sub> (%)               | 0.7       | Internal    | C <sub>3</sub> S (%)   | C150             | 63          |
| Al <sub>2</sub> O <sub>3</sub> (%) | 0.1       | Internal    | C <sub>2</sub> S (%)   | C150             | 14          |
| Fe <sub>2</sub> O <sub>3</sub> (%) | 0.2       | Internal    | C <sub>3</sub> A (%)   | C150             | 5           |
| CaO (%)                            | 59.8      | Internal    | C <sub>4</sub> AF (%)  | C150             | 10          |
| SO <sub>3</sub> (%)                | 0.3       | Internal    |                        |                  |             |

**OPTIONAL REQUIREMENTS ASTM C150/ASTM C1157**

| CHEMICAL                |                  |                       |             |
|-------------------------|------------------|-----------------------|-------------|
| Item                    | ASTM Test Method | ASTM C150 Spec. Limit | Test Result |
| Equivalent Alkalies (%) | C114             | 0.60 max              | 0.36        |

| PHYSICAL      |                  |                       |                        |             |
|---------------|------------------|-----------------------|------------------------|-------------|
| Item          | ASTM Test Method | ASTM C150 Spec. Limit | ASTM C1157 Spec. Limit | Test Result |
| False Set (%) | C451             | 50 min                | 50 min                 | --          |

<sup>A</sup> It is permissible to exceed the specification limit provided that ASTM C1038 Mortar Bar Expansion does not exceed 0.020 % at 14 days.  
<sup>B</sup> Loss on ignition, max: 3.0 % when limestone is not an ingredient; Loss on ignition, max: 3.5 % when limestone is an ingredient  
<sup>C</sup> Test result of prior month

GCC of America Cement is warranted to conform at the time of shipment with current ASTM C150/ASTM C1157. No other warranty is made or implied. Having no control over the use of its cements, GCC of America does not guarantee finished work.