



| CONFORMITY CERTIFICATE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Ground Granulated Blastfurnace Slag Produced at | | Aboño | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sample Period | | January 2020 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Certificate of Conformity of GGBS to EN 15167-1:2006 | | Certificate of Conformity of Combinations of GGBS and CEM I Portland Cement to Annex A of BS 8500-2:2015 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Spot samples of GGBS were taken and tested to determine conformity to the autocontrol requirements of EN 15167-1:2006 "Ground granulated blastfurnace slag for use in concrete, mortar and grout" following the methods given in that standard. The values reported are mean values for the monthly production period. | | Portland Cement Source: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aboño GGBS Only | | Secil | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| For combinations of GGBS supplied from the above works with the above CEM I Portland cement the permitted proportions conforming to the requirements given in annex A of BS 8500-2:2015 are: | | <table border="1"> <thead> <tr> <th>Strength Class</th> <th>Not Less Than**</th> <th>Not More Than**</th> </tr> </thead> <tbody> <tr> <td>52.5L</td> <td>6</td> <td>37</td> </tr> <tr> <td>42.5L</td> <td>6</td> <td>66</td> </tr> <tr> <td>32.5L</td> <td>55</td> <td>80</td> </tr> <tr> <td>Conformity Evaluation Period (if less than 6 months)</td> <td>N/A</td> <td>month(s)</td> </tr> <tr> <td>Combination Designation (Table 1 BS 8500-2:2015)</td> <td colspan="2"></td> </tr> <tr> <td>CIIA-S</td> <td>6</td> <td>20</td> </tr> <tr> <td>CIIB-S</td> <td>21</td> <td>35</td> </tr> <tr> <td>CIIIA</td> <td>36</td> <td>65</td> </tr> <tr> <td>CIIBB</td> <td>66</td> <td>80</td> </tr> <tr> <td colspan="3" style="text-align: right;">** % GGBS</td> </tr> </tbody> </table> | | Strength Class | Not Less Than** | Not More Than** | 52.5L | 6 | 37 | 42.5L | 6 | 66 | 32.5L | 55 | 80 | Conformity Evaluation Period (if less than 6 months) | N/A | month(s) | Combination Designation (Table 1 BS 8500-2:2015) | | | CIIA-S | 6 | 20 | CIIB-S | 21 | 35 | CIIIA | 36 | 65 | CIIBB | 66 | 80 | ** % GGBS | | |
| Strength Class | Not Less Than** | Not More Than** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 52.5L | 6 | 37 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 42.5L | 6 | 66 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 32.5L | 55 | 80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Conformity Evaluation Period (if less than 6 months) | N/A | month(s) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Combination Designation (Table 1 BS 8500-2:2015) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CIIA-S | 6 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CIIB-S | 21 | 35 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CIIIA | 36 | 65 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CIIBB | 66 | 80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ** % GGBS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th>Results</th> <th>Product</th> <th>EN Limit</th> </tr> </thead> <tbody> <tr> <td>Fineness m²/kg</td> <td>499</td> <td>min. 275</td> </tr> <tr> <td>Magnesium Oxide MgO %</td> <td>8</td> <td>max. 18</td> </tr> <tr> <td>Sulfate SO₃ %</td> <td>0.1</td> <td>max. 2.5</td> </tr> <tr> <td>Sulfide S²⁻ %</td> <td>0.6</td> <td>max. 2.0</td> </tr> <tr> <td>Chloride Content Cl⁻ %</td> <td>0.03</td> <td>max. 0.10</td> </tr> <tr> <td>Moisture Content %</td> <td>0.0</td> <td>max. 1.0</td> </tr> <tr> <td>Corrected Loss on Ignition %</td> <td>1.2</td> <td>max. 3.0</td> </tr> <tr> <td>Aluminium Oxide Al₂O₃ %</td> <td>11.4</td> <td>to 1 d.p.</td> </tr> </tbody> </table> | | Results | Product | EN Limit | Fineness m ² /kg | 499 | min. 275 | Magnesium Oxide MgO % | 8 | max. 18 | Sulfate SO ₃ % | 0.1 | max. 2.5 | Sulfide S ²⁻ % | 0.6 | max. 2.0 | Chloride Content Cl ⁻ % | 0.03 | max. 0.10 | Moisture Content % | 0.0 | max. 1.0 | Corrected Loss on Ignition % | 1.2 | max. 3.0 | Aluminium Oxide Al ₂ O ₃ % | 11.4 | to 1 d.p. | Results of tests in accordance with BS EN 196-1 for 50% GGBS in combination with 50% CEM I Portland cement shown above | | | | | | | |
| Results | Product | EN Limit | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Fineness m ² /kg | 499 | min. 275 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Magnesium Oxide MgO % | 8 | max. 18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sulfate SO ₃ % | 0.1 | max. 2.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sulfide S ²⁻ % | 0.6 | max. 2.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Chloride Content Cl ⁻ % | 0.03 | max. 0.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Moisture Content % | 0.0 | max. 1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Corrected Loss on Ignition % | 1.2 | max. 3.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Aluminium Oxide Al ₂ O ₃ % | 11.4 | to 1 d.p. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Note: If the value of Al ₂ O ₃ is ≥ 14.5% the '+SR' restriction will be exceeded if the C ₃ A of the CEM I is >10%. | | <table border="1"> <thead> <tr> <th>Age</th> <th>7 Days</th> <th>28 Days</th> </tr> </thead> <tbody> <tr> <td>Compressive Strength N/mm²</td> <td>29.3</td> <td>50.5</td> </tr> </tbody> </table> | | Age | 7 Days | 28 Days | Compressive Strength N/mm ² | 29.3 | 50.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Age | 7 Days | 28 Days | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Compressive Strength N/mm ² | 29.3 | 50.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alkalis as Na ₂ O equ. (acid soluble) | | <i>The samples of LKAB Minerals GGBS and the CEM I Portland cement were bulk average monthly samples for the works specified</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <tbody> <tr> <td>Guaranteed Alkali limit %</td> <td>≤ 1.0</td> <td></td> </tr> <tr> <td>Certified Average Alkali (Last 25) %</td> <td>0.57</td> <td></td> </tr> <tr> <td>Declared Mean : Mean last 25 + (SD last 25 x 1.64) %</td> <td>0.58</td> <td></td> </tr> </tbody> </table> | | Guaranteed Alkali limit % | ≤ 1.0 | | Certified Average Alkali (Last 25) % | 0.57 | | Declared Mean : Mean last 25 + (SD last 25 x 1.64) % | 0.58 | | CE | | | | | | | | | | | | | | | | | | | | | | | | | |
| Guaranteed Alkali limit % | ≤ 1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Certified Average Alkali (Last 25) % | 0.57 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Declared Mean : Mean last 25 + (SD last 25 x 1.64) % | 0.58 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| COMBINATION OF 50% LABORATORY STOCK CEM I PORTLAND CEMENT AND 50% GGBS | | 0099/CPR/B34/0001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <tbody> <tr> <td>Initial Setting Time min</td> <td>215</td> <td>not > than 2 x PC</td> </tr> <tr> <td rowspan="2">Activity Index %</td> <td>7 days</td> <td>62</td> </tr> <tr> <td>28 days</td> <td>94</td> </tr> </tbody> </table> | | Initial Setting Time min | 215 | not > than 2 x PC | Activity Index % | 7 days | 62 | 28 days | 94 | <i>The stock CEM I Portland cement used in these tests was supplied by CEMENTOS TUDELA VEGUIN, S.A and the following results were obtained from that sample</i> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Initial Setting Time min | 215 | not > than 2 x PC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Activity Index % | 7 days | 62 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 28 days | 94 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LABORATORY STOCK CEM I PORTLAND CEMENT ONLY | | <table border="1"> <tbody> <tr> <td>Initial Setting Time min</td> <td>180</td> <td></td> </tr> <tr> <td rowspan="2">Compressive Strength N/mm²</td> <td>7 days</td> <td>48.8</td> </tr> <tr> <td>28 days</td> <td>55.7</td> </tr> </tbody> </table> | | Initial Setting Time min | 180 | | Compressive Strength N/mm ² | 7 days | 48.8 | 28 days | 55.7 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Initial Setting Time min | 180 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Compressive Strength N/mm ² | 7 days | 48.8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 28 days | 55.7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| The GGBS contained no additional materials other than those permitted. The above results and other tests demonstrate the conformity of the material sold during the month to the requirements of EN 15167-1:2006. | | LKAB Minerals Ltd are acting as a dispatching centre in the distribution of the above GGBS and further details and certification are available on request. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Signed:

L Bontoft - Technical Manager GGBS