

Quality Certificate  
of Portland Cement Clinker  
Chemical and Mineralogical Requirements:

| Clinker                        |             | Modifier                       |             | total                          |             |
|--------------------------------|-------------|--------------------------------|-------------|--------------------------------|-------------|
| SiO <sub>2</sub>               | 21.5 ± 0.5% | SiO <sub>2</sub>               | 54.0 ± 5%   | SiO <sub>2</sub>               | 22.7 ± 1.0% |
| Al <sub>2</sub> O <sub>3</sub> | 5.2 ± 0.5%  | Al <sub>2</sub> O <sub>3</sub> | 14.0 ± 3.0% | Al <sub>2</sub> O <sub>3</sub> | 5.5 ± 0.5%  |
| Fe <sub>2</sub> O <sub>3</sub> | 3.7 ± 0.5%  | Fe <sub>2</sub> O <sub>3</sub> | 4.0 ± 2.0%  | Fe <sub>2</sub> O <sub>3</sub> | 3.78 ± 0.5% |
| CaO                            | 66.5 ± 0.5% | CaO                            | 9.0 ± 5.0%  | CaO                            | 64.5 ± 0.5% |
| MgO                            | 1.0 ± 0.3%  | MgO                            | 2.5 ± 1.5%  | MgO                            | 1.20 ± 0.2% |
| SO <sub>3</sub>                | 0.40 ± 0.3% | SO <sub>3</sub>                | 0.7 ± 0.5%  | SO <sub>3</sub>                | 0.60 ± 0.3% |
| R <sub>2</sub> O <sub>3</sub>  | ≤ 0.9%      |                                |             |                                |             |
| CaO (free)                     | ≤ 1.8%      |                                |             |                                |             |
| LSF                            | 97 ± 2%     |                                |             |                                |             |
| SR                             | 2.5 ± 0.2%  |                                |             |                                |             |
| ALM                            | 1.5 ± 0.2%  |                                |             |                                |             |
| LOI (loss of ignition)         |             |                                |             |                                |             |
| 0.35 ± 0.1%                    |             |                                |             |                                |             |
| C <sub>3</sub> S               | 62 ± 2%     |                                |             |                                |             |
| C <sub>2</sub> S               | 15 ± 3%     |                                |             |                                |             |
| C <sub>3</sub> A               | 8 ± 2%      |                                |             |                                |             |
| C <sub>4</sub> AF              | 11 ± 2%     |                                |             |                                |             |

Physical Parameters

|                                                                                   |             |
|-----------------------------------------------------------------------------------|-------------|
| Compressive Strength                                                              |             |
| 2 days -                                                                          | 25 - 29 MPa |
| 28 days -                                                                         | 50 - 54 MPa |
| (note: specific surface 4200cm <sup>2</sup> /gr or max. sieve residue (008) 4-5%) |             |

Technical Director:

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