Essence of Castable
Chemical composition (%)

<table>
<thead>
<tr>
<th>Al₂O₃</th>
<th>CaO</th>
<th>SiO₂</th>
<th>Fe₂O₃</th>
<th>MgO</th>
<th>TiO₂</th>
<th>Soluble K₂O+Na₂O</th>
<th>SO₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>79.5 - 82.5</td>
<td>16.2 - 17.8</td>
<td>&lt; 0.35</td>
<td>&lt; 0.2</td>
<td>&lt; 0.5</td>
<td>&lt; 0.3</td>
<td>&lt; 0.7</td>
<td>&lt; 0.3</td>
</tr>
</tbody>
</table>

Test method according to BS EN 196-2: Methods of testing cement; Chemical Analysis of Cement. Soluble K₂O and Na₂O determined by the standard ASTM C114.

Fineness

<table>
<thead>
<tr>
<th>Blaine specific surface (cm²/g)</th>
<th>Residue at 90 μm (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 8,000</td>
<td>&lt; 3</td>
</tr>
</tbody>
</table>

Test method according to EN-196-6: Method of testing cement; Fineness Determination.

Workability (%)

<table>
<thead>
<tr>
<th>Flow after 60 min.</th>
<th>Flow after 90 min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>60-80</td>
<td>50-70</td>
</tr>
</tbody>
</table>

Test method according to the ASTM C230 flow table using a standard siliceous sand mortar. Composition of the sand mortar: cement 500g, sand 1,350g, water 160g (W/C=0.32) prepared according to EN 196-1.

Setting time

<table>
<thead>
<tr>
<th>Initial set (min.)</th>
<th>Final set (min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>160-230</td>
<td>180-260</td>
</tr>
</tbody>
</table>

Composition of the mortar: cement 500g, sand 1,350g, water 160g (W/C=0.32) prepared according to EN 196-1. Setting time measurement according to NF P15-431: Vicat apparatus standard EN 196-3 but using a 1,000g test weight; temperature 20°C, 70% relative humidity.

Green strength

<table>
<thead>
<tr>
<th>Age</th>
<th>Compressive strength (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 h</td>
<td>18-24</td>
</tr>
</tbody>
</table>

Test conditions according to EN 196-1. Composition of the sand mortar: cement 500g, sand 1,350g, water 160g (W/C=0.32) prepared according to EN 196-1.

Mineralogical composition

Principal phases*: CA, CA₂, Aα.
Secondary phases*: C₁₂₂₇

*CaO, 2Al₂O₃

Other physical characteristics

Bulk Density: 700-800 kg/m³
Specific Gravity: 3.2 - 3.3 g/cm³
P.C.E.: 1,770-1,810°C

This information is given for guidance only.
SECAR Plenium® is an innovative engineered binder with built-in advanced formulation technology developed by Kerneos.

SECAR Plenium® extends the SECAR® range of refractory cements and brings new dimensions to castable formulation and manufacture:

- **SECAR Plenium®** will enable refractory producers to meet the latest challenges presented by increasingly demanding refractory formulation constraints.
- **SECAR Plenium®** is the key to integrating high final performance with ease of use that allows the Refractory Manufacturer to:
  - simplify the development process,
  - optimise formulations with fewer additives,
  - reduce production complexity with fewer components,
  - improve placing properties.

**Simplicity and flexibility of castable design**

SECAR Plenium® is designed for the formulation of dense castables where a reduced lime content is desirable. Placing can be either by vibration or self-flow techniques. Recommended castable systems include:

- High Purity Alumina,
- Alumina Spinel,
- Alumina Magnesia,
- Low Cement systems containing Fume Silica or Alumina.

SECAR Plenium® enables the manufacture of low cement castables with normal placing characteristics without the addition of additives:

- **SECAR Plenium®** is completely compatible with all types of refractory fillers,
- **SECAR Plenium®** offers a high degree of compatibility with a wide range of additives.

**Choice of additives in recommended systems**

<table>
<thead>
<tr>
<th>ADDITIVES</th>
<th>High Purity Alumina</th>
<th>Alumina-Spinel</th>
<th>LCC Alumina-Alumina</th>
<th>LCC Fume Silica</th>
<th>Alumina-Magnesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLUXIFIERS</td>
<td>not needed</td>
<td>only for high flow</td>
<td>not needed</td>
<td>only for high flow</td>
<td></td>
</tr>
<tr>
<td>Phosphates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polycarbonates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polyacrylates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Naphthalenes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulphonates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SET MODIFIERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>all types can be used</td>
</tr>
<tr>
<td>Accelerators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- lithium salts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- sodium aluminates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- nitrates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retarders</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- citrates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- borates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- carbonates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Successful installation is a vital factor in achieving required refractory performance. **SECAR Plenium®** is the key to ease of placing in a wide range of environmental conditions:

- **High fluidity with reduced water demand**  
  Whatever the castable system, **SECAR Plenium®** reduces water demand and confers high fluidity, without affecting the safety of de-watering during initial heating.

- **Good workability**  
  **SECAR Plenium®** provides stable flow and sufficient working time in critical installation conditions such as with the placing of alumina magnesia castables.

- **High reliability in installation**  
  **SECAR Plenium®** brings high reliability in installation due to its tolerance to a wide range of working temperatures and varying water contents.

**Flow profiles for various castables containing **SECAR Plenium®***
The performance of SECAR Plenium® meets the demanding requirements of critical monolithic refractory applications thanks to its powerful combination of attributes:

- rapid hardening,
- consistently predictable demoulding time,
- fast mechanical strength development,
- excellent thermo-mechanical properties,
- volume stability.

The stable and predictable behavior of SECAR Plenium® is an additional success factor in critical applications. It is achieved through the inherent design features of the product and the performance of the newly engineered production line, a testament to Kerneos commitment to product quality excellence.

**SECAR Plenium® competitive performance**

*with a reference cement in each system*

<table>
<thead>
<tr>
<th>Properties</th>
<th>High Purity Alumina</th>
<th>Alumina-Spinel</th>
<th>Alumina-Magnesia</th>
<th>LCC Alumina-Alumina or Fume Silica</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardening</td>
<td>![As good]</td>
<td>![Better]</td>
<td>![Much better]</td>
<td>![As good]</td>
</tr>
<tr>
<td>Mechanical Strength Development</td>
<td>![As good]</td>
<td>![Better]</td>
<td>![Much better]</td>
<td>![As good]</td>
</tr>
<tr>
<td>Thermo-mechanical Properties</td>
<td>![As good]</td>
<td>![Better]</td>
<td>![Much better]</td>
<td>![As good]</td>
</tr>
<tr>
<td>Volume Stability</td>
<td>![As good]</td>
<td>![Better]</td>
<td>![Much better]</td>
<td>![As good]</td>
</tr>
</tbody>
</table>
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