After competing with some of the world’s largest engineering companies, Cemengal was awarded the engineering, procurement and construction (EPC) contract to build the state-of-the-art grinding plant. The company’s scope of supply for the 140tph unit included:

- 150,000t raw material storage
- raw material transport and handling
- Cemengal 4350kW ball mill (£4.8m x 18m) with drying chamber
- two Redecam process filters (mill and separator)
- type SD Magotteaux separator
- six cement silos with individual capacities of 3000t
- bulk loading facilities
- palletising, bag loading and storage hall
- control building and electric room.

As the project’s EPC contractor, Cemengal supplied all mechanical, electrical, structural and civil engineering as well as supply and erect all electrical and mechanical equipment and the plant’s steel structure. The company also supervised the civil works, commissioning and training of personnel. The project deadline was 20 months to the first approved cement, in February 2012.

**Project overview**

Cemengal’s Technical Department decided to install six 3000t steel silos rather than one 18,000t concrete silo on the basis of cost advantages and a shorter turnaround time. Moreover, having six silos allows greater flexibility to produce different cement types – a configuration also offered to other clients in Europe and contributing to the client’s confidence in the solution.

The silos were built in a workshop less than 70km away from the erection site and transported by vessel to a harbour 2km away from the Espabel plant.

Cemengal transported the silos in two pieces – cone and cylinder. Start-to-finish the process took only one working day.

The transport of the 4350kW ball mill followed a similar process. It was transported by vessel to the jetty close to the plant and later transferred by a special truck.

**Espabel’s new plant**

by Moisés R Núñez, Cemengal, Spain

In 2010, the Belgian-Spanish company Espabel decided to introduce itself in the northern European continent as a cement producer. As a base for its grinding plant, Espabel chose the beautiful and historic city of Ghent. Situated right on the river Leie, the location offers the company enormous logistical advantages for clinker import as well as being near its key markets of The Netherlands and France. The turnkey contract for the grinding unit was awarded to Cemengal.
The 150,000t storage unit for clinker and other raw materials was engineered in-house according to the latest engineering practices, based on years of experience. Cemengal used the X-light system, similar to that used to build Europe’s gothic cathedrals. High ceilings and light structures offer plenty of space and are less concrete intensive. The system means that only parts of the building would need repair and the entire structure would not be affected.

**Cement mill**
Cemengal delivered a horizontal three-chamber ball mill with shoe-pad bearings with the main characteristics as shown in Table 1.

**Mill shell**
The 50mm-thick mill shell is made of S275J2G3 EN10025-standard steel plates, which after welding are subjected to distention thermal treatment.

The crown end flange is welded onto the shell and the shell area leaning on the shoe-bearing units consists of 85mm-thick steel.

Two manholes with related locking covers – one for each chamber – are also included. The holes for liners are manufactured in accordance with the appropriate DIN standard.

As part of the company’s quality control process, welds are checked before heat treatment (100 per cent ultrasounds on all welds) and after heat treatment (MT at 100 per cent on all welds and UT at 100 per cent on welds around the manholes).

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**Internal end flanges**
Two inside end rings, manufactured from S275J0 EN 10025 steel, are welded on the shell. One is needed to fix the head internal lining and the other to apply the discharge diaphragm.

**Shoe-bearings and supports**
The mill is supported by two shoe-bearing units, which are fitted with an alignment system and have a white antifriction steel coating. Two thrust bearing units are incorporated on the mill discharge end.

The shoe-bearings are located in supports anchored in foundations and protected with a cover and manholes.

In addition, units are further provided with pumps suited to high and low.

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**Table 1: cement mill specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal diameter (m)</td>
<td>4.4</td>
</tr>
<tr>
<td>Total internal length (m)</td>
<td>18</td>
</tr>
<tr>
<td>Mill output</td>
<td>140tph OPC or 90tph – CEM III/A 42.5R at 4200Blaine</td>
</tr>
<tr>
<td>Estimated output after raw material analysis is 85-90tph CEM III/A 42.5R at 4200Blaine – 140tph OPC</td>
<td></td>
</tr>
<tr>
<td>Power consumption in mill shaft (kWh/t)</td>
<td>51 (value to be confirmed with raw material analysis)</td>
</tr>
<tr>
<td>Transmission system</td>
<td>pinion/crown</td>
</tr>
<tr>
<td>Speed</td>
<td>15.2 (75.38% of critical speed)</td>
</tr>
<tr>
<td>Motor (kW)</td>
<td>4200</td>
</tr>
<tr>
<td>Gear box</td>
<td>included</td>
</tr>
<tr>
<td>Lubrication system</td>
<td>included</td>
</tr>
<tr>
<td>First- and second chamber filling level (%)</td>
<td>30</td>
</tr>
<tr>
<td>Auxiliary drive</td>
<td>included</td>
</tr>
<tr>
<td>Intermediate and end walls</td>
<td>included</td>
</tr>
</tbody>
</table>
pressures – one for the load end and one at the discharge.

Temperature detection is carried out with thermocouples and cooling takes place by means of a water coil.

**Pinion and crown**
The gear crown is welded, with a full weld between the S275JR steel core and the 30 CR Mo 4 external ring. The crown has a straight-tooth, 30 module and surface hardness of HB 250.

The crown has the following controls:
- UT in core, in laminated ring and in welds before the heat treatment
- MT 50 per cent after heat treatment
- geometrical and dimensional control before and after gear cutting.

The pinion is self aligned with internal lubrication and manufactured in hardened, carbonised and rectified 18 Ni Cr Mo 5 steel, straight-tooth, 30 module and pressure angle 25°. The support shaft for the tooth pinion is made from hardened and tempered 39 Ni Cr Mo 3 steel.

A segmental protection crankcase in S275JO is positioned on the rotation unit, complete with inspection and maintenance doors and integrated with a lubrication device for the crown-pinion unit.

**Main motor**
The specification of the mill's main motor is shown in Table 2.

Corrosion painting and protection is carried out as superficial treatment C3 according to ISO 12944 standards.

**Accessories specifications include:**
- minimum ambient design of 0 to -20°C
- standard vibration according to IEC 60034-14 Grade A
- IP55
- insulated antifriction bearing construction, NDE
- RTD’s (Pt-100) in stair windings, six pieces, three-wire, unshielded, safe and hazardous areas
- space heater for stator winding, 1ph
- separate auxiliary terminal box for space heater
- space heater for slip ring device, 1ph in a dedicated auxiliary terminal box
- SPM nipples for shock pulse measurement
- differential pressure switch for condition monitoring of air filters, wired into an auxiliary terminal box
- electric light installed in slip-ring compartment, wired to heaters of the auxiliary terminal box
- auxiliary terminal box
- holding down bolts, jacking screws and stainless steel shims for horizontal mounting only
- balancing with half-key
- English-language labels.

**Mill drive**
The mill drive consists of a Flender Combiflex DMG22 gear box (see also Table 3) and is fitted with an oleo-dynamic
lubricating system with a double pump and oil/air heat exchanger (3x). The oil flows at 430 l/min. The cooling power is 130 kW at maximum ambient temperature of 35˚C and the oil temperature at inlet is 60˚C. The drive’s auxiliary reduce is equipped with a stop brake, manual coupling and a 30W motor. A motor coupling joint is also included with plates and screws for foundations.

**Load and discharge systems**
The mill inlet device is manufactured in welded S275JR steel with a support saddle, complete with wearproof plates. The mill outlet is made from welded S275JR steel.

**Anchorage plates**
Anchorage plates are included for the mill support, control unit and load and discharge unit. They are electro-welded with MT heat treatment and mechanised.

**Other key equipment**
Other key equipment delivered by Cemengal includes:
- Magotteaux inlet trunion head liners, in casting material with resistance to wear FMU-12, with anchorage screws and special rubber for plate accommodation
- Slegten outlet wall, Optimex design, or similar
- Electric ear, complete with microphone and amplifier.

**Health and safety**
Cemengal had to prove its knowhow in health and safety issues and the trust put in the company by not only big players but also by independent cement companies.

Bearing in mind that prevention is better than the cure, Cemengal and its partners applied preventive safety principles during the design stage, implementing improvements to equipment to avoid any possible risk. Potential risks were evaluated and action to eliminate or at least minimise them was taken at source. In addition to ergonomic principles in building, passage and maintenance design, all essential safety and EMC requirements for machinery were taken into consideration, aiming for a zero accident rate.

While Cemengal considered this an excellent baseline, the company was keen to go a step further and aim for excellence. It is proud of the way tidiness and cleanliness are constants during the execution of the work and follows very strict rules to control higher-risk tasks, coordinate different work teams and periodically carry out audits.

**The team**
The success of the project and one of Cemengal’s key strengths are its staff, particularly its site managers. They are crucial in reaching the company’s objectives and solving the day-to-day issues that inevitably arise. Thanks go to the team led by project manager Eng Alfredo Camporro and assistant Eng Valentina Parra.

Meanwhile, the combination of Cemengal’s technology and the strategic location of the facilities will enable the Espabel plant to become a cement production reference in northern Europe.

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**Table 3: gear box specification**

<table>
<thead>
<tr>
<th>Make and type</th>
<th>Flender Combilift DMG22 gear box</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>22</td>
</tr>
<tr>
<td>Oil system size</td>
<td>10</td>
</tr>
<tr>
<td>Oil flow (l/min)</td>
<td>280</td>
</tr>
<tr>
<td>Cooling water flow (l/min)</td>
<td>367</td>
</tr>
<tr>
<td>Required oil quantity (l)</td>
<td>2250</td>
</tr>
<tr>
<td>Weight (t)</td>
<td>2</td>
</tr>
<tr>
<td>Approximate dimensions (mm)</td>
<td>2850 x 1900 x 1850</td>
</tr>
</tbody>
</table>

Its strategic location near the river Leie combined with Cemengal’s state-of-the-art technology will enable Espabel’s grinding unit to serve as a reference point for cement production in Europe.