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drilling foundations

#THE.COVER

A top-notch
machine
for a first-rate
business

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EVERYTHING WORTH KNOWING ABOUT DRILLING, SPECIAL FOUNDATIONS AND NO-DIG

A top-notch machine for a first-rate business

Once again, with a view to obtaining maximum output, Keller has chosen an **Enteco** drilling rig (an **E9080** employing Soil Displacement technology) for an important construction site. The **Italian** manufacturer's **machine** has been used for the foundations of the Merlin Northern Lisbon Logistics Platform: **2,200 piles** at a maximum **depth of 32 m**, installed at breathtaking speed, up to 1,200 m per day.

 CRISTIANO PINOTTI  KELLER E ENTECO



Inspired by a great nineteenth-century novel by Goethe, one of the giants of world literature, the relationship between Enteco and Keller can be defined quite readily as an elective affinity. For many years, the two companies, an Italian manufacturer famous around the globe as the leading exponent of Soil Displacement technology and a giant enterprise established in more than 40 countries, boasting 22 business units and more than 10,000 employees, have enjoyed a genuine partnership bolstered by a host of successful construction sites. A partnership we can deem veritable technological affinity. Indeed, whilst Enteco's innovative patents, thirty plus years' experience and strong commitment to Research and Development mean that it is universally acknowledged as a prominent player in the Soil Displacement sector, Keller is not just a "simple business", but a true special foundations giant, capable of setting up construction sites around the world also thanks to patented technology such as the CMM used in Portugal. Once again, this lingua franca has resulted in an exceptional construction site marked by highly respectable figures.

The Castanheira do Ribatejo construction site

Indeed, 2020 has witnessed the opening of an important construction site in Portugal. We are talking about the construction of the first warehouse of the Merlin Northern Lisbon Logistics Platform in Castanheira do Ribatejo, north of Lisbon, which is discussed in detail here below.

This extraordinary Portuguese logistics project has entrusted Keller with the special-foundation work. The company has assigned part of this commission to Enteco, a genuine Soil Displacement specialist, and the contractor Locafond from Treviso: the results demonstrate the wisdom of the choice made. Indeed, the site has achieved some highly impressive figures: more than 2,200 piles of up to 32 m in length installed at an incredible rate. Records indicate about 1,200 linear metres in a single day. Results obtained by pairing two winning technologies: Enteco SP and Keller CMM that have produced a displacement pile with concrete pumped up to around 2.0 m from the top of

→ SP technology

Soil Displacement (SP) is a method of foundation pile installation without soil removal and must therefore be considered an interesting alternative to driven, vibrated or bored piles. Basically, the soil is compacted by a special tool having various diameters. The tool is sealed off at the bottom and exerts considerable lateral compression that increases the soil's natural density. Clearly, rotation and penetration speed will vary according to soil characteristics, whilst in most cases the water table does not affect operations. Having reached the desired depth, the concrete is cast in place and, where necessary, reinforced. This system offers several advantages. Firstly, it greatly reduces the amount of debris **produced with notable savings as regards transport and landfill disposal; pile capacity is increased (with the same diameter, Enteco engineers estimate it is between 25 and 40% greater than in the case of a CFA pile); there is minimal concrete overconsumption.**



THE ENTECO-KELLER PARTNERSHIP HAS FORMED THE PERFECT COMBINATION OF TWO WINNING TECHNOLOGIES: ENTECO SP AND KELLER'S EXCEPTIONAL CMM. COMBINING SP AND CMM HAS PRODUCED A DISPLACEMENT PILE WITH CONCRETE PUMPED UP TO AROUND 2.0M FROM THE TOP OF THE PILE. IT IS THEN FORMED A VIBRO COMPACTED STONE COLUMN THANKS TO KELLER'S SPECIAL CMM METHOD, GLOBALLY APPROVED AND UTILISED IN THE MOST IMPORTANT INTERNATIONAL CONSTRUCTION SITES BY ALL GROUP MEMBERS.



#The construction site

The Enteco E9080 drilling rig is part of a Merlin Properties project worth 147 million euro. The leader, Magna General Contractors, has commissioned Keller to build the foundations

Early in 2020, Merlin Properties, recently listed on the Lisbon Stock Exchange, began **construction of the first** warehouse of the Merlin Northern Lisbon Logistics Platform, with a lettable area of around 45,000 m². The entire project covers a total area of 225,000 m² and is valued at around 147 million euro. As one might readily assume, this is an unprecedented deal for

the Portuguese market offering the chance to create "turnkey" projects for leading e-commerce companies and a host of domestic and international **players. The first warehouse** in Castanheira do Ribatejo is scheduled for completion by **first quarter 2021 and in this** regard Merlin Properties has chosen Savills and CBRE to handle the sale. One of the most

important on the continent, the new logistics hub also provides for green spaces to provide mellow surroundings. As stated, the project leader, Magna General Contractors, has commissioned the foundation work to Keller, a veritable giant in this sector. For this commission, Keller has installed around 1,400 piles for the structure's **foundations and floor slabs,**

whilst for the external areas, ground improvement has been achieved by installing 2,200 CMM hybrid columns. And it is in performing this task that the Enteco machine really shines. The men and machines engaged in this task have worked around the clock with extended daily shifts in order to meet the strict deadlines set for this prestigious project.

the pile that is then covered with vibro compacted stone columns thanks to Keller's special CMM method, globally approved and utilised in the most important international construction sites by all Group members.

The main machine

The real star of this Portuguese venture has been the Enteco E9080, flagship of the E9000 series that includes models ranging from 75 to 200 tons. This is a multipurpose rig capable of performing various techniques starting with a standard configuration that does not require modification before passing from one drilling technique to another. Indeed, the switch can be performed directly at the construction site, offering clear savings in terms of time and costs. More specifically, the E9080 is designed to offer bored piles, cased piles, CFA piles, SP piles, large diameter DTH piles, diaphragm walls, soil mixing, driven piles and many other exclusive Enteco techniques such as SP-HG and DTHR (DTH piles with a special rotary head with 93° tilting device). Like other drilling rigs of the E9000 series, the E9080 is also supplied as standard with the exclusive, patented Enteco mast support system (E9000 Mast Support System) that provides the mast with much greater rigidity than a conventional pantograph system and high torque along the entire length in order to ensure optimum performance and maximum stability.

#Technical specifications

<i>Model</i>	Enteco E9080 SP300	
<i>Diameter (Soil displacement)</i>	320-800 mm	
<i>Maximum depth (Soil displacement)</i>	40 m	
<i>Rotary stroke</i>	24,000 mm	
<i>Crowd force</i>	330 kN	
<i>Extraction force</i>	870 kN	
<i>Rotary</i>	Enteco RH51/2	
<i>Maximum torque</i>	320 kNm	
<i>Drilling speed</i>	33 RPM	
<i>Kelly extension</i>	6, 9, 12, 17 m	
<i>Engine</i>	Caterpillar C13B StageV	Caterpillar C18 StageV
<i>Rated power</i>	400 kW (536 HP)	563 kW (755 HP)
<i>Undercarriage</i>	extendable (3,000-4,500 mm)	
<i>Main winch</i>	270 kN	
<i>Auxiliary winch</i>	150 kN	
<i>Operating weight</i>	exceeding 90 tons	

The Mast Support System represents an extremely innovative concept whose new design integrates the standard machine frame with the mast support itself. This produces several unusual features. These include the low frame/mast attachment point and high attachment point of the two back struts: the large triangle conformation guarantees an extremely rigid system. The absence of rear cylinders to support the mast should be noted, these being replaced by two back struts formed by extremely stiff steel hollow section to provide greater overall stability. The mast also has vertical translation provided by two cylinders and two guides. The mast can therefore be lowered and touch the ground. With this exclusive design, the mast can be lowered backwards to facilitate transport. Finally, the configuration of the standard machine frame and mast



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↑ Keller CMM

Keller's exclusive CMM technology is a sustainable ground improvement method using high deformation modulus columns constructed through compressible soils to reduce settlement and increase bearing capacity. CMM is the combination of a rigid inclusion for its lower part with a 'supple' inclusion in compacted gravel or crushed stone for the upper part. Having penetrated down to the designated depth, concrete is pumped as the tool is pulled upwards. Once the rigid inclusion is installed up to the designated level, a vibro compacted stone column is placed on top whose length is adapted to the characteristics of the project. Typically, the column is between 2.0 m and 3.0 m, although the possibility of deeper installation exists.

support system means that the main winch can be fitted right next to the cabin in full view of the operator.

Detailed description

More specifically, the Enteco E9080 has an internally-reinforced high-strength-steel mast whose guides are made from Hardox (wear-resistant steel that certainly has no need for introductions), welded to the mast and machine-tooled along the entire length. This provides an extremely solid structure with wear-resistant guides. Furthermore, the Mast Support System allows extremely high torque to be applied along the entire length of the mast, thus providing more powerful and efficient rotary heads. The sturdy rotary heads are covered by Enteco patents and have a duty cycle exceeding 30,000 hours, an extraordinary achievement, particularly in Soil Displacement technology. Machine maintenance is very simple with side-doors on both sides for easy access. The same applies to the longitudinal engine mounted behind the cabin and always accessible from both sides. Finally, with its rational arrangement of components, Enteco has created space for a corridor in the center of the base frame with a convenient access door for easy inspection of all main drilling parts and

components. As is customary for Enteco, the E9080 also monitors soil pressure and stability, whilst rear outriggers are another notable feature. Mechanical components such as patented high-strength rods and joints and tools for every soil type, designed, developed and patented by Enteco, combine with first rate electronics. The EIAS (Enteco Interactive Automation System) handles automation and monitoring of all machine operations, from transportation to the work itself. This is of great support to the operator, but also for servicing that is simplified and accelerated by remote assistance. And to the technology we have observed on the Keller-Enteco construction site we can add special configurations of SP Enteco (Soil Displacement) technology such as the innovative SP-TT (Soil Displacement-Twin Tool), SP-Jet (Soil Displacement+Injection) or SP-CS (Soil Displacement-Casing System) patents. SP-TT is designed to tackle the most difficult soil conditions by combining two methods, pre-drilling and subsequent reaming. And for this it uses a special concentric tool that allows initial boring of a hole of smaller diameter, followed by widening of this hole to the required diameter. On the other hand, SP-Jet is designed to improve the tool's penetration in especially problematic soil with high-pressure injection of biodegradable foams or liquids. Finally, SP-CS uses a tool with a very long centre body (whose diameter equals that of the pile) that prevents interconnection of water bearing layers at different levels and makes the pile straighter.

