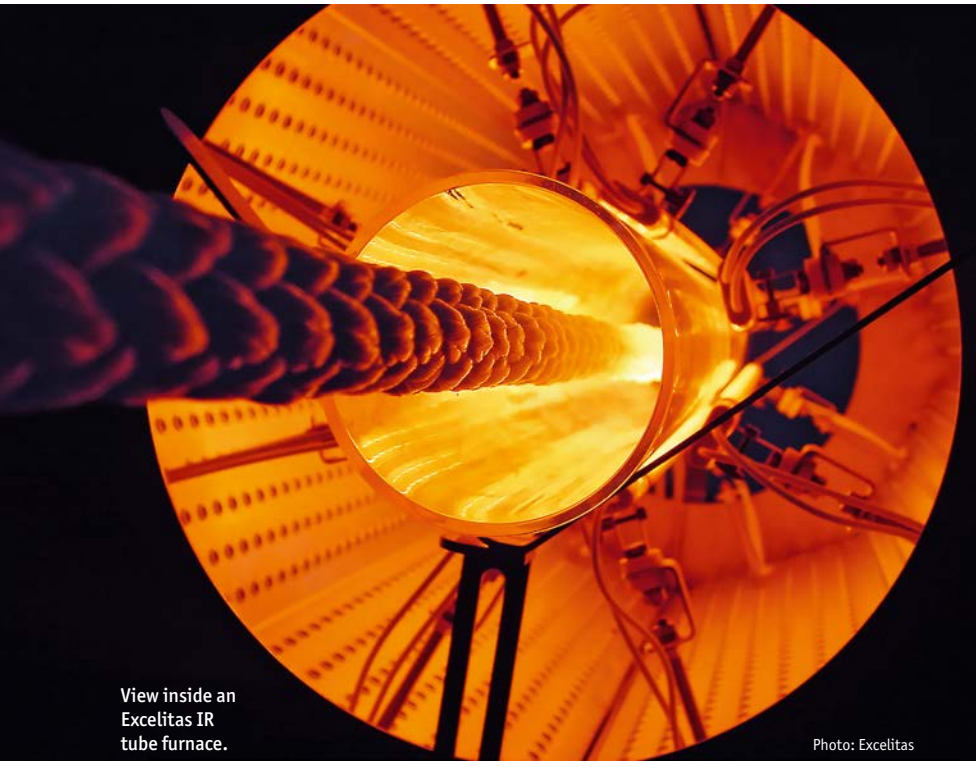


View inside an Excelitas IR tube furnace.

Photo: Excelitas

Plastic sheathing for extreme conditions

How SLB protects kilometres of cable used in oil production in aggressive environments

Cables are an indispensable part of oil production. The demands placed on them are high, as they must withstand extreme environmental influences such as cold, heat, salt water and storms. In addition to the harsh environmental conditions, they must also withstand heavy loads. They are typically exposed to temperatures of over 150 °C, very high pressures of more than 690 bar and repeated stress cycles, as is typical when lowering equipment weighing up to several tonnes into oil wells. Substances such as hydrogen sulphide are highly corrosive and also attack the cables. The manufacture of the cables is correspondingly complex. At its plant in Abbeville in northern France, SLB employs around 200 people to manufacture precisely this type of cable.

Text: Dipl.-Ing. Gabriele Rzepka, Editor K-PROFI

Today, SLB N.V. is the largest oil exploration and oilfield services company, headquartered in Willemstad on the Dutch island of Curaçao and with operational headquarters in Paris, Houston, The Hague and London. The success story began in Paris in 1926, when brothers Conrad and Marcel Schlumberger founded their company Société de Prospection Électrique. Their business model was based on a geophysical survey method they had developed that measures the electrical resistance and conductivity of soils – electrical prospecting. The Schlumberger brothers expanded this method to locate oil deposits. The company thus evolved from a former geoelectric surveying business into a global oilfield services provider. Today, the global corporation employs around 100,000 people worldwide and generated sales of just under EUR 33 billion in the 2024 financial year.

Shrink-fitting in the IR oven

Gabriel Cuvelier, an engineer at the Abbeville plant, describes how the company meets the challenges that the cables have to withstand: ‘We use special polymers to protect our cables from the harsh environmental conditions in oil wells. We sell the cables worldwide for use in oil and gas wells for various tasks. Due to the acidic atmosphere and high corrosion load, we have to ensure complete protection for our cables.’ The cables can be up to 10 km long and weigh several tonnes, depending on their diameter and the material used. But no matter how long or thick a cable is, it is always protected by a plastic sheath. ‘The thickness of the plastic sheath varies from just under 10 mm to less than a tenth of a millimetre. So it is thin compared to the overall diameter, but it fulfils its purpose completely,’ Cuvelier explains.

The cable cores are usually made of copper and insulating materials. The company shrinks the plastic sheath onto the cables in a Noblelight infrared oven from Excelitas. Heating it close to its melting point under tension causes the plastic sheath to adapt to the cavities on the outer surface of the cable and form a homogeneous protective layer. The heat input must be precisely correct. If the cable is heated just a few degrees too much or remains in the IR oven for just a second too long, it can ruin the entire product. Cuvelier explains why: ‘If the insulation of the core conductor inside the cable begins to melt due to prolonged exposure to IR heating, this means that the current flow and electrical connection in the cable are interrupted. Therefore, the customised integration of the IR oven into the production line was absolutely essential. As a team, we are proud to have successfully mastered this challenge.’

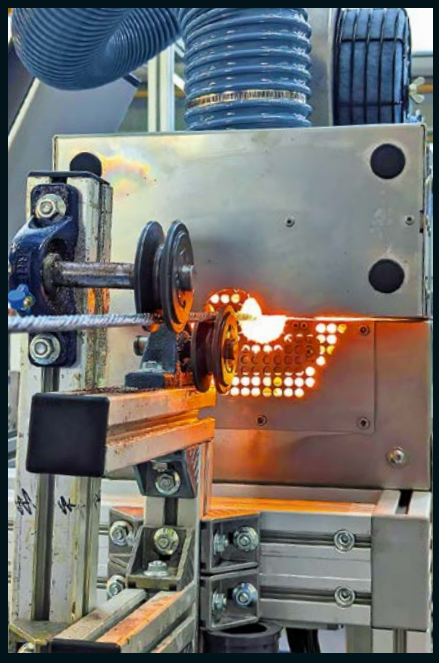


Photo: SLB

The plastic sheath is shrunk onto the copper cable core and insulating material in the IR furnace.

Photo: SLB

The temperature and throughput speed of the cable through the IR oven are constantly monitored.

Cuvelier's team carried out numerous measurements to determine the optimum heat input from the infrared radiation. To do this, the experts launched a measurement campaign with sophisticated measurement series to determine the effects of IR heating on the cables and the optimum process and oven settings. 'We saw that a deviation of 5 °C already leads to significant differences in cable quality,' explains Cuvelier.

Integration into production line

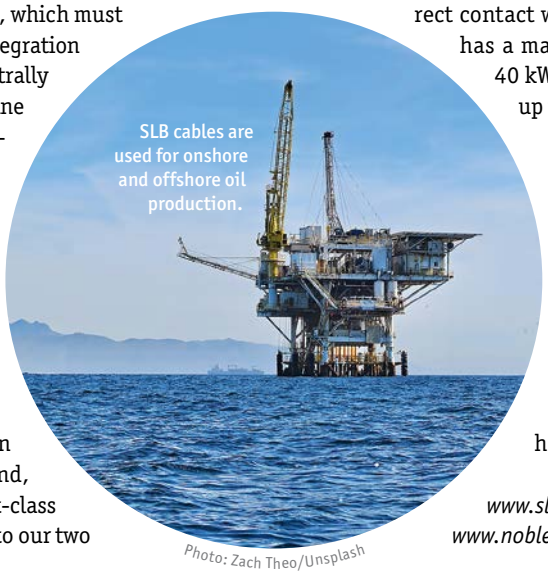
The IR furnace is now fully integrated into the production line. The cables pass through the oven at a speed defined in advance by measurements and remain there for only a few seconds so that the surface temperature rises to the predetermined values. This type of heating ensures that only the surfaces of the cables are heated and not the underlying layers or conductors, which must be protected from high temperatures. Integration into the line enables SLB to log and centrally document all data relating to the entire line operation. The biggest challenge in integration is establishing communication between the production line and the IR oven. Both must stop simultaneously when necessary to prevent the cable from overheating due to excessive heat exposure or being processed without sufficient heating.

According to Cuvelier, Excelitas tailored the oven to SLB's needs: 'We needed an IR oven with high-quality IR emitters and, in addition, a very safe system with first-class build quality. The oven also had to fit into our two production lines, where it is used in different stages of the process. The IR oven has already proven itself in this regard.' The advantages of the IR oven are obvious. In a short time and in a small space, SLB is able to continuously shrink the sheathing onto the cables without moving parts or contact with the cable over the very long lengths typical of borehole cables. The IR ovens score points with their high reproducibility of production parameters. Cuvelier sums it up: 'Since it was installed, the oven has been working precisely and without fluctuations.'

The charm of IR technology

Infrared heating technology works by transmitting electromagnetic waves that generate heat in the product. This does not require a transmission medium such as air or gas – nor does it require direct contact with the material. Compared to air, which has a maximum heat transfer capacity of around 40 kW/m², infrared radiation has a capacity of up to 1 MW/m².

Part of the electromagnetic radiation is absorbed by the material, while part is reflected. Only the absorbed portion contributes to heating. Each material has its own absorption spectrum, which is the range in which electromagnetic radiation is best absorbed. For this reason, Excelitas has selected the emission spectrum of the IR emitters for SLB so that they optimally heat the plastic of the cable sheathing.



SLB cables are used for onshore and offshore oil production.

Photo: Zach Theo/Unsplash

www.slb.com
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