19 December 2016

STAHL CraneSystems GmbH
Daimlerstraße 6
74653 Künzelsau

Your contact for questions on the content:
Heike Metzger
Tel. +49 7940 128-2388
Fax +49 7940 128-2300
heike.metzger@stahlcranes.com
www.stahlcranes.com

Author:
Dipl.-Ing. Jan Türk
VISUELL Studio für Kommunikation
Tel. +49 711 64868-0
jan.tuerk@visuell.de

Crane technology for LNG systems

Protected against explosions as standard

Cranes are mostly used in LNG systems for routine maintenance. However, in times of urgency, when work needs to be carried out on the LNG pumps or compressors soonest, it is vital that the crane and hoist – even after a long period of inactivity – are immediately operational and work reliably. The requirements for the crane technology on and in LNG systems differ depending on the operator, plant manufacturer, national specifications and local climatic conditions. For the first LNG tank in Finland, it was necessary to develop a special maintenance crane capable of standing up to the extreme temperature conditions on the Finnish coast and still able to work in severe frost. On the Chinese coast, on the other hand, the problem is more heat than cold, but the challenge in designing LNG cranes for this region still lies on the constructional level: for maintenance cranes on Chinese LNG tanks, hoists with special rope drums had to be designed to fulfil the specific requirements for Chinese LNG systems.

Near-series special construction

As individual as the requirements for LNG hoists are, as big is the wish for safe, reliable products at an affordable price. In addition to explosion protection, further and stricter requirements than those in ATEX or IECex standards must be met in LNG applications depending on the operator and country of use. With its near-series special constructions, the German crane technology manufacturer STAHL CraneSystems has adopted an approach that meets exactly this demand. The SH ex and AS 7 ex wire rope hoist series act as basis for customised explosion-proof wire rope hoists. As modular building block system, the wire rope hoists can be manufactured in various S.W.L. variants and designs. The advantages are clear: The individual components stem from own serial production, their technical design is well-conceived and fully developed and a supply of spare parts is ensured for years to come. The period of use is difficult to estimate, especially in the case

of energy plants and offshore solutions – it is not seldom that the calculated period of use is exceeded and systems are used significantly longer than planned. The reliability and safety of the crane system can only be guaranteed over the long term if all important components are easily accessible for maintenance work and spare parts quickly available.
Based on STAHL CraneSystems' series hoists, the company's engineering department develops special solutions adapted to the respective requirements – by changing the rope drum, using stronger motors, adding enclosure or heaters or simply by using a tougher coating.

Protected against explosion in any wind and weather
Case study: Pori, Finland

Temperatures below –20 °C are no rare occurrence in the port of Pori in winter. Here, on the west coast of Finland, the LNG supplier Skangas is currently building the country's first LNG terminal with a capacity of 30,000 cubic metres of liquid gas. The Spanish EPC contractor FCC Industrial was contracted to construct the plant. The international supplier of chemical, energy and industrial plants contracted STAHL CraneSystems to develop an LNG crane capable of withstanding the cold: special cold-resistant steel and heated motors enable use in temperatures between –29 and +40 °C; in lower temperatures the hoist drives into its covered park position and overwinters there. To guarantee explosion protection according to ATEX 95, which is certified for the hoists of STAHL CraneSystems to –20 °C by the German PTB national metrology institute, thermistors monitor the inside of the explosion-proof enclosure and the motors. Heaters keep the crane in working order even in heavy frost. Only when outdoor temperatures drop below –29 °C or when the sensors inside the enclosure measure temperatures under –20 °C, does the crane switch itself off for safety reasons. Thanks to a special coating, the moist sea air and high salt content are also unable to harm the crane. In spite of explosion protection and special climatic requirements, STAHL CraneSystems succeeded in developing a technically superior and economical solution.

Special case: not all areas are potentially explosive

Due to the operator's Ex zone classification for the area above the LNG tank, it was possible to design a comparatively simple maintenance crane for the LNG pump. According to this classification, not all the technical equipment is located in a potentially explosive atmosphere, as a result of which some crane components could be implemented without explosion protection. Merely the area up to two metres above the tank top was classified as potentially explosive. This area contains the main control system, the crane controls and the power supply line – they were implemented for applications in Zone 2 in accordance with EC Directive 94/9/EC (ATEX 95).
It was possible to install the drive of the slewing crane, the travel limit switches and the main junction box in the safe area. All the electrical components of the wire rope hoist were integrated in the main junction box, making it possible to dispense with the explosion-proof control box in "de" enclosure at the wire rope hoist. Although the solution involved considerably more cabling work between the junction box and wire rope hoist,

the customer saved costs as a result. The lower weight of the wire rope hoist had an effect on the construction of the slewing crane – an interesting aspect under the difficult climatic conditions on site that necessitate construction in cold-resistant steel. The slewing crane of the type "Boss Exn 32–16" (Vetter Krantechnik) has a cantilever arm of six metres. A modified STAHL CraneSystems wire rope hoist SH 50 ex with a lift of 46 metres is used as wire rope hoist. The "light LNG slewing crane" is an invention by STAHL CraneSystems Spain, which can under certain circumstances (as in the LNG terminal in Pori) represent an alternative to the classical LNG hoists. The subsidiary has had four such cranes built by Vetter since 2005 – in addition to the numerous smaller cranes that Vetter delivers to Spain every year.

How does explosion protection "work"?

Neither standard equipment boxes nor explosion-proof boxes can prevent gas from penetrating the housing – though this is less likely with the flameproof box because of its design. The gas can be ignited by an ignition source inside the box – e.g. by a contact spark when contactors are pulled in. With the standard box the explosion would pass into the environment, which would ignite the gas mixture in the environment. Flameproof boxes are designed such that the ignition cools down or is extinguished via the threaded joint or flat joint of the cover. This means that the surrounding area is not at risk. In 1926, exactly 90 years ago, STAHL CraneSystems started to develop explosion-proof cranes and controllers. Much has happened since then technically – but nothing has changed regarding the mode of action and importance of explosion protection. The explosion-proof controllers from STAHL CraneSystems are mainly in the "flameproof enclosure" and "increased safety" ignition protection class (Ex de). The difference between standard control boxes and boxes in flameproof design for Zone 1 lies in the more stable and solid construction – heavy cast aluminium and steel enclosures have stood the test of time here. The installation materials such as the cables, screw connections and cable lead-ins also have to comply with the standards and directives, and must be tested and certified accordingly. In addition to this, STAHL CraneSystems uses an antistatic coating on plastic housings. A second separate housing made of sheet steel or stainless sheet steel is usually fitted as connection box in the case of most hoists. Both housings are connected using explosion-proof wire leadthroughs. STAHL CraneSystems has, as one of the leading manufacturers in the world, made a name for itself internationally with special hoists and explosion-proof crane technology and is a coveted partner for crane technology in the field of industrial and LNG applications from Europe to America, in the Arabian region, and from Australia to China.

Rope drum for mathematical wizards

Case study: Shenzhen, China

A change in scene: The new LNG terminal in Shenzhen consists of four 160,000 m^3 liquefied gas tanks and was commissioned towards the end of 2015. Every LNG tank is equipped with a crane to place the liquefied gas pump on the bottom of the tank and to lift it out into the open air again for maintenance or repair work. Due to the potential explosion risk from evaporating gas, all electrical components on Chinese tanks must be constructed in explosion-proof design, which also applies to the crane technology used. Around 12,000 kilometres south-east of Finland, the demands placed on the crane builder are different: The specifications for LNG wire rope hoists in Chinese plants require a ratio between rope diameter and rope drum diameter (D/d ratio) that cannot be achieved with a standard hoist. The developers at STAHL CraneSystems have therefore developed rope drums with a larger diameter specifically for these wire rope hoists and deployed them successfully in the past years on the gas tanks at the Ningbo LNG and Tianjin LNG terminals.

The rope, which is firmly connected to the LNG pump, measures 13 mm in diameter. The standard diameter of the drum of the SH 6 wire rope hoist is 356 mm. STAHL CraneSystems welds a drum from the larger AS 7 wire rope hoist series on to this standard drum to increase the already very good D/d ratio without complex modification of the design of the series hoist. At the same time, it is possible to fulfil the customer's requirement for an additional rope drum brake based on the proven module system of the SH series without problem by using the standard drum and standard frame. In this way the Chinese operator benefits, in spite of extensive modifications, from a well-engineered and economical solution.

International teamwork between EPC contractor and supplier

Shenzen LNG is already the third Chinese LNG terminal after Ningbo and Tianjin for which STAHL CraneSystems has supplied the explosion-proof crane technology to the plant manufacturer TGE Gas Engineering. The successful collaboration between the two German firms has already proven its worth in numerous other LNG and gas plants in Europe and Asia. While TGE and STAHL CraneSystems have been working together for decades, it was the first joint project with the German crane technology specialists for the Spanish EPC contractor FCC Industrial. Looking for explosion-proof hoists, it came across STAHL CraneSystems' Spanish subsidiary, which ultimately managed to convince it of its solution.

The successful commissioning of the Finnish LNG crane was preceded by intensive planning and teamwork between the companies involved. The wire rope hoist, junction box and all electronic and control systems were manufactured in STAHL CraneSystems' factory in Germany. The slewing crane with its drives was built by Vetter in its plant in Siegen, followed by pre-assembly of the wire rope hoist. An initial function test was also carried out there before delivery to Finland – albeit without load. The crane was mounted on the LNG tank by technicians from the Finnish company Erikkila under the supervision of STAHL CraneSystems. Commissioning and the overload test were carried out by STAHL CraneSystems' customer service and certified by the independent company Inspecta.

STAHL CraneSystems GmbH | Daimlerstr. 6 | 74653 Künzelsau | Germany
Tel. +49 7940 128-0 | Fax +49 7940 128-2300 | marketing.scs@stahlcranes.com | www.stahlcranes.com

Reliably on schedule

The first proposal for the Finnish slewing crane was submitted in January 2015, and the order placed in April. The order was preceded by technical talks and numerous telephone calls. Technical competence, professional advice and close, constant contact between the companies concerned resulted in the order being placed and in the end to successful completion of the project. November 3, 2015 was agreed as delivery date. The delivery period for STAHL CraneSystems for the wire rope hoist and all electrical components therefore amounted to five months. The crane builders Vetter thus had six months to complete the complete crane in order to meet the agreed assembly date. Production of the crane technology proceeded smoothly, but due to delays in the construction of the tank, the customer postponed delivery to March 2016. Assembly was carried out on schedule in spite of difficult weather conditions – the strong wind on the coast repeatedly complicated matters for the crane experts. At wind speeds of 14 m/s and gusts up to 19 m/s, the load test had to be put off several days until the wind had subsided into a safe range of under 8 m/s again.

Conclusion

Both the operators and EPC contractors of LNG systems are interested in safe and simultaneously economical crane systems that work reliably over the long term. Like the other technology in potentially explosive atmospheres, cranes and hoists in plant construction usually involve complex special solutions developed specifically for the project and country in question. At the same time, the documentation and verification of prescribed certificates represent a hurdle that only a few suppliers on the international market are able to overcome. Thanks to the extensive experience of STAHL CraneSystems, the EPC contractor FCC Industrial was able to supply its customer Skangas with a special crane optimally designed for outdoor use even at very low temperatures. TGE Gas Engineering, too, has relied for decades on the intensive advice and explosion-protection competence that has distinguished STAHL CraneSystems time and again. Through intelligent design, it was possible both in Finland and for the LNG tanks in China to offer a reliable and economical solution that fulfilled all (explosion-protection) specifications.