

Things are on the up-and-up – everywhere!

Special lifts from Sweden for hazardous areas

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Figure 1: 'Things are on the up-and-up – everywhere'

The Alimak AB company in Skelleftea, Sweden (part of the Intersect Group of companies), manufactures special lifts operating on the basis of the rack-and-pinion principle. Due to the advantages it offers, this lift principle has gained major acceptance in many sectors of industry, including areas where there are explosion hazards resulting from gases, vapours or dusts, e.g. in oil and gas production, in oil and gas processing as well as in the chemical industry. Alimak was founded in 1948 and initially manufactured conventional wire rope driven construction hoists. The first elevator with a rack and pinion drive was supplied as early as 1962. Nowadays, this technology is used worldwide at many industrial locations and Alimak is the most important and most successful manufacturer of lifts featuring this drive system.

The rack and pinion system

Unlike conventional lifts whose drive comprises a stationary machine with traction and suspension wire ropes the lifts which operate on the basis of the rack and pinion concept are moved in a manner comparable to a rack railway. The lift car is moved by means of the driven pinion which engages in a permanently mounted rack. The electrical drive with the control system is arranged on the top of the lift cage and travels with the lift itself. This technology offers a

whole number of crucial advantages over conventional solutions. No separate machine room and, above all, no load-bearing lift-well or hoist-way trunk, are required. On free-standing structures, the forces occurring are transferred directly to the foundation through the rack mast. On designs on which the rack is connected to a building structure, the building structure absorbs these forces. However, the crucial aspect is that the route allows differing inclinations and can even be matched in the shape of a curve to the local situation (Figure 1).

Elevators in hazardous areas

Besides the general construction sector, one of the first fields of application of these special elevators was mining. This sector was the first to be subject to requirements for explosion protected or firedamp-proof designs.

Expansion of oil and gas production in the North Sea led to the first explosion protected Alimak lifts being used in the early seventies on offshore platforms. The design concept of

this lift technology allows optimum matching to the existing, external steel structure. The rack and pinion system is insensitive to external conditions such as those occurring in stormy seas in the offshore sector. This ensures safe and convenient access for material and personnel to the platform modules, the drilling decks and, in some cases, the underwater pump and propulsion rooms. The required inspection, maintenance and repair work inside the supporting steel construction of the platform is made possible by installation of lifts operating on the basis of the rack and pinion concept. The steel construction which supports the platform are inclined and have a conical shape so that a conventional elevator would have been able to be used only with major difficulties (Figure 2).

One other challenge is the use of this lift technology on FPSO tankers. An FPSO is a ship which is equipped for **F**loating **P**roduction **S**torage and **O**ffloading to the ferrying tankers. Generally speaking, FPSO tankers are classified as explosion hazardous areas to a large extent. The possible pitching and rolling movement of the ship poses a danger as regards safe operation of the lifts. Besides taking other measures, this also necessitates installation of an additional guide rail on the opposite so that the lift car can be moved with no problems even at the greatest occurring inclination of the ship.

After sinking a bore hole, drilling rigs for developing gas and oil fields are dismantled, transported to the next operating location – frequently worldwide – and re-erected. Such equipment is also used for long periods at the most remote locations of the earth, locations which are frequently not easily accessible. Besides the requirements for explosion protection of the electrical equipment, it is necessary to ensure easy installation and dismantling, reliable and safe operation under extreme conditions and low maintenance effort. The modular design and the drive system of the Alimak lifts are important factors of success for such applications.

All materials used are subjected to detailed



Figure 2: Repair and maintenance elevators inside the supporting steel construction of an offshore platform

trials and tests in order to be able to ensure reliable operation even under extreme ambient conditions. The lifts are assembled at the manufacturer's factory, including the control and cabling, and are then subjected to a thorough test before they leave the factory in Skelleftea.

Individual key components are subjected to a particularly severe endurance test in simulated continuous duty (24 hours per day) for one year on a 70 m-high test tower. Skelleftea, located just south of the arctic circle with temperatures fluctuating between $-35\text{ }^{\circ}\text{C}$ and $+25\text{ }^{\circ}\text{C}$ during the course of the year has proven to be an ideal test site for this.

Besides application in gas production, in transport and processing of oil and gas, in the power-generation sector and the chemical industry, applications for explosion protected lifts incorporating this technology





Figure 3: Lift cage with top-mounted explosion protected drive and explosion protected control panel



Figure 4: Explosion protected control panel 8125 (with connection chamber open) on the top of the lift car

→ are also increasing in sectors with explosion hazards due to the presence of combustible dusts. Besides using classic materials such as cement and sand, the construction material industry uses more and more frequently materials such as cellulose or other combustible substances in dust form in further processing. This also necessitates explosion protected designs for the lifts installed in this sector.

Hazardous, potentially explosive flour dust concentrations may occur in the mill industry, in particular when storing and processing grain. Special explosion protected Alimak lifts can also be used here as well.

Explosion protected control and instrumentation technology

Owing to the use of its explosion protected lifts in very many parts of the world, Alimak requires a component supplier, who operates just as internationally and is just as experienced with its control and instrumentation technology and who also has the required approvals in all important countries. Besides approval according to European Standards and certification in North America (UL, FM and CSA), compliance with the IEC Explosion Protection Standards of Series 60079 is an important precondition for worldwide success. R. STAHL Schaltgeräte GmbH is an ideal partner with its full product range and its international approvals for the use in hazardous areas by risk of flammable gases and combustible dusts, thus complying with the precondition for standardisation which is required for economic reasons.

Besides the flameproof encapsulated type 8225 which is mounted on the top of the lift car (Figures 3 and 4), the new CUBEx modular enclosure system, which saves both space and weight has proven successful. Integrated in the lift cage wall within the lift cage, one finds the explosion protected operating panel, Type 8125/8146, with pushbuttons, operating and indication elements, key switch and



Figure 5: Interior view of the lift cage with explosion protected operating panel 8146, explosion protected emergency light fitting 6008 and explosion protected telephone



Figure 6: Explosion protected operating panel



Figure 7: Explosion protected main switch 8543

emergency-stop button (Figures 5 and 6), which does not differ from a non-explosion protected version in respect to operation. An explosion protected emergency light fitting, type 6008, with emergency power supply comprising a back-up battery ensures lighting for one hour or three hours so that the user doesn't need to remain in the dark, even in the event of power failure. An explosion protected telephone allows communication from the lift cage. Position switches manufactured by R. STAHL (Type 8060) whose safety function has been specially certified ensure safe door locking. The entire installation can be disconnected from the electrical power supply by means of an explosion protected main switch (Figure 7).

The majority of the explosion protected lifts are designed and manufactured to cus-

tomer specifications. Consequently, particular care is required in production and trials. This is checked and ensured by certifications according to the Lift Directive EN 81 and the ETL Directive by independent organisations (third-party certification). Cooperation between Alimak and R. STAHL have proven successful in many completed projects, including projects for lifts for all the major production installations in the North Sea, where Kvitebjorn and Valhall are the latest, and Shah Denize for the Caspian Sea. For onshore installation to the chemical, medical and gas plants we have recently finished projects for Basel, Astra-Zeneca, Gas De France and Enagas.