

More light in the Hüttenwerke "HKM"

Modern explosion protected lighting fittings in hazardous areas at risk by coal dust

by F. Knickenberg



Figure 1: Continuously operating coal sweepers convey 4,000 metric tons of coal every day to the further-processing systems of the HKM coking plant in Duisburg, Germany. Over 400 explosion protected luminaries ensure safe illumination of the uphill and downhill walkways

The Hüttenwerke Krupp Mannesmann (HKM) in Duisburg, Germany Group produces around 5.6 million metric tons of high-grade steel as the feedstock for tubes and flat bar steel products every year. Around 5.2 million metric tons of pig iron is required for this production volume. This is produced in two blast furnaces with coke as the reducing agent and fuel for generating heat. Every year, around 1.5 million metric tons of coke is required for supplying the blast furnaces, and 1.1 million metric tons of this originates from the smelting plant's own coking plant. The heart of the coking plant is a battery of 70 furnace chambers, in which high-grade coke and coke oven gas are obtained by dry distillation. The process occurs by supplying heat at chamber temperatures of around 1,050 °C and with coking times of 21.5 hours with hermetic exclusion of the outside atmosphere. The coke produced in this plant offers the advantage of

constant high quality in comparison with the bought-in share.

The crucial precondition for complying with the quality objective is an ingenious mixture of various coal grades as the feedstock for the battery. The coal is purchased from Australia, Canada and the Deutsche Steinkohle AG. The charging coal is prepared in an extensive mixing and grinding plant. Since it is endeavoured to achieve as low a moisture content of the coal fractions as possible, coal dust may also arise within the related plant building. This dust must be removed at regular intervals.

Owing to the fact that the new European Directives on explosion protection 94/9/EC and 1999/92/EC had come into force, in addition to the new national German regulations, Explosion Protection Regulation (Explosionsschutzverordnung, ExVO) and the Operating Health and Safety Regulation

(Betriebssicherheitsverordnung, BetrSichV), HKM commissioned the German Rheinisch-Westphälischer TÜV (Technical Inspection Authority (RWTÜV)), Essen, Germany, to investigate the risk of a dust explosion in the mixing and grinding plants and of the enclosed transportation systems and to define any protection measures necessary. The 3-zone concept introduced as the result of European harmonisation of the dust explosion protection standards was to be taken into consideration in this study.

One example in this respect was the statement that a coal dust layer of 1 mm thickness, swirled up in a room with a height of 3 m, can produce a hazardous explosive dust atmosphere.

To date, the electrical installation of the plant, was in correspondence with Zone 11 requirements as defined for the 2-zone concept previously used in Germany for less critical areas.

The investigation determined parts of the lighting system to be vulnerabilities due to excessive surface temperatures. The surface temperature of the lighting fittings shall not exceed 145 °C, if the defined safety distances are observed, in areas endangered by coal dust.

Consequently, the expertise recommended exchanging the existing lighting system with lighting fittings complying with equipment category 2D for use in Zone 21 and whose maximum surface temperature does not exceed 145 °C.

The ECOLUX 6600 lighting fittings

There are three versions of the lighting fitting of the ECOLUX Series, suitable for use in Zones 2, 21 and 22, each with either one lamp or two lamps for operation with bi-pin fluorescent lamps (18 W to 58 W). Owing to their better technical equipment, these luminaires offer a higher light efficiency and a longer lamp service life than the luminaires used to date. Their main field of application relates to normal lighting and group-powered as well as centrally powered emergency lighting. The rugged and impact-resistant enclosure made of glass fibre-reinforced plastic with a transparent trough made of impact-resistant polycarbonate ensures adequate mechanical strength in rough industrial use. The basic principle of the type of protection described in EN 50281-1-1 is based on the dust-tight design of the enclosure, IP 6x for apparatus of Category 2D (Zone 21) and Category 3D (Zone 22) in the case of conductive dust; otherwise IP 5X in the case of apparatus of Category 3. In the case of coal dust in Zone 22, i.e. at least IP 6X. Even after rough treatment during high-temperature and low-temperature endurance test followed by an impact test, the IP degree of protection must be maintained. One other important criterion for safe operation of the lighting fittings is their surface temperature. Even in continuous operation, this surface temperature shall not exceed 145 °C. The



Figure 2: The maintenance catwalks along the coal conveyor belts are illuminated with ECOLUX 6600 lighting fittings



Figure 3: Special-purpose floodlights for metal-vapour lamps with a wattage of 250 and 400 W

ECOLUX 6600 equipped with two fluorescent lamps comply with this requirement just as safely as they comply with the requirement in respect of avoidance of electrostatic, high-energy, ignitable propagating brush discharge.

Lighting fittings with 2 x 36 W, 1 x 58 W and 2 x 58 W were installed in the HKM coking plant (Figures 1 and 2). Floodlights with halogen-metal vapour lamps of Series 6525 for use in Zone 21 with wattages of 250 W and 400 W (Figure 3) were selected for lighting particularly large feed hoppers and conveyor belt transfer points. These floodlights

feature a rugged aluminium enclosure with a swivelling transparent front cover made of safety glass, which ensures a high safety standard. The interior silicone gasket provides degree of protection IP 66.

R. STAHL produces all lighting fittings mentioned at its lighting division in Weimar, Germany. Currently, the range of products covers 150 different explosion protection types of lighting fittings, suitable for use in Zones 1, 2, 21 and 22.