50 years University of Mining and Geology "St. Ivan Rilski"
Annual,vol.46,part III, Mechanization, Electrification and Automation in Mines, Sofia, 2003, pp.161-164

INNOVATIONS IN CMC-C ELECTROENGINEERING

Stephan Chobanov

CMC – C Ltd
Pirdop 2070, Bulgaria
St.St. Kiril I Methodi St. 5
E-mail: cmc_c@mail.bg

Mento Menteshev

CMC – C Ltd
Sofia 1164, Bulgaria
8 Krivolak St.
E-mail: cmc_c@mail.orbitel.bg

ABSTRACT
CMC-C EOOD is an electrical engineering company established in 1995, which develops activities mainly in the mining and metallurgical industries. These activities involve expert assessments, consultancy services, design and implementation of electricity supply and electrical equipment of electrical systems up to 35 kV, design and manufacturing of switchboards, LV and MV electrical systems and special control and protection devices.
A Quality Control System was introduced in 2001 in compliance with the ISO 9001 standard.
Innovations are priority activities in the company. By using its own investigation results and with the active participation of university lecturers, the company has proposed, developed and implemented new engineering and technological designs at the request of our clients in this country and abroad. These designs are in the field of efficient utilization of electric power, updating of the electrical equipment of mine battery locomotives, electrical safety, electric devices, electricity supply and electrical equipment.

CMC – C EOOD was established in 1995 and provides full engineering services in the field of electricity supply and electrical equipment of industrial, public and household sites. The activity is mainly focused on the mining and metallurgical industries.

The basic company activities involve research, design, construction, manufacturing, erection, adjustment, maintenance, repair and reconstruction of cable and aerial lines, distribution switchgear and substations, lightning protection and earth wiring systems, electric power equipment, indoor electrical systems, material-handling equipment, automatic control of technological units and processes.

The company has been certified under ISO 9001-94. A type-C Control Section has been set up at CMC-C and certified by the Bulgarian Accreditation Agency.

A priority in the all-round activity of the company is the application of the most modern electrical devices, equipment and technologies as well as the development of original new designs for solving practical problems.

In the field of innovations the company works in collaboration with university lecturers and specialists. Its strongest connections are with the University of Mining and Geology and, primarily, with the Departments of Mining Electrification and Electrical Engineering. Contacts have also been established with the Department of Electrical Devices at the Technical University.

It is worth mentioning in advance that all innovatory engineering and technological designs have been implemented and introduced in practice and very well accepted by our clients.

Updating of MV switchgear

Our company is one of the first in this country (1995) that developed and implemented a technology for updating obsolete and outdated switchgear by replacing the electromechanical protections with multifunctional microprocessor ones and the oil-minimum breakers with sulfur and vacuum ones (Fig. 1). The updating thus performed offers functional possibilities and reliability corresponding to new switchgear but at 2–2.5 times lower prices (Navan-Chelopech).

Figure 1

Electric switchboards and LV distribution switchgear

General and special purpose switchboards and switchgear are designed and manufactured by using modern components and technologies including the Schneider Electric PRISMA system.

Lightning-discharge protectors with active lightning arresters

Active lightning arresters have been designed and manufactured (Fig. 2). The protected area is tens of times larger than that protected by lightning pointed rods with considerably higher reliability (Umicor Med, petrol stations, gas stations, public buildings in Sofia, Koprivshtitsa, Turgovishte).

Figure 2

Integrated moving electrical systems.

An integrated moving electrical system has been designed (Fig.3) which consists of a steel container (a) integrating switch and protection apparatus for 6 kV (b), for low voltage 0.4 kV (c) and an automated management and control system (d). This original engineering design has been applied for the electrical equipment of the Sever Shaft fan at Chelopech Mine.

a

b c d

Figure 3

Updating of the electrical equipment of mine battery electric locomotives

CMC-C integrates the efforts of specialists from the University of Mining and Geology "St. Ivan Rilski", the Technical University, Energia AD, Tzar Kaloyan CRP for updating the mine battery locomotives by:

- Replacing the alkaline traction storage batteries with lead-acid ones.
- Introducing modern technology for battery charging.
- Applying static control of the electric locomotive dc drive.

This combination allows for the locomotive to be completely updated at the cost of the alkaline batteries only with considerably higher energy efficiency, convenient operation and facilitated explosion protection.

This concept has been realized by the substantial support of the manufacturers of lead-acid traction batteries – Energia AD in Turgovishte; of battery chargers - Tzar Kaloyan CRP in Razgrad. The concept has been fully implemented at Malamovo Mine (Bobov Dol) and partially at Marbas and the Elatsite Med Tunnel.

Mass implementation in the Ukraine coal mines at Donetsk started in 2000 in active collaboration with NPP Energia.

Updating of the electrical equipment of machine tools

Modernization of the electrical equipment of machine tools has been carried out which involves replacement of the electric machines of Г-Д groups with static controllable rectifiers and all switch and control apparatus with modern designs characterized by smaller overall dimensions, higher precision as well as reliability and performance.

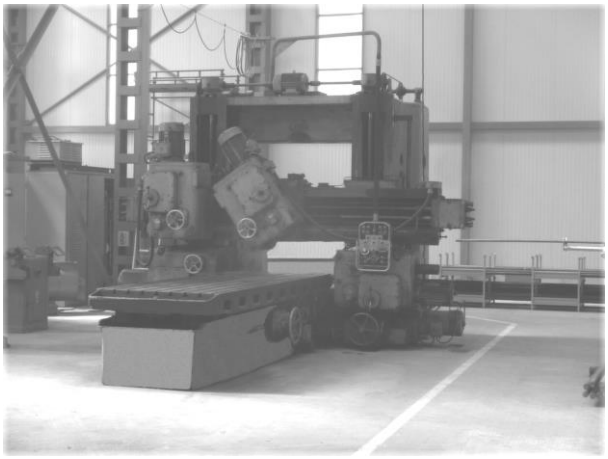

Figure 4

12 000A circuit breaker.

A dc circuit breaker has been designed, manufactured and put into operation in collaboration with ET Metalplast and intended for shunting of electrolysis baths. It has the following characteristics:

- Voltage 100 V
- Rated current 12 000 A
- Remote control, electric motor drive
- Contact bodies: Ag -Cu

The circuit breakers (Fig. 5) have been applied in the electrolysis shop at Umicor Med, Pirdop.

Figure 5

Plug connector with a high level of protection from external actions

A plug connector has been designed with the following parameters:

- Voltage 1000V
- Rated current 250A
- Number of poles 3+1
- Level of protection IP54

It has been applied in connecting powerful mining machines at Chelopech Mine (BIMAK). It is manufactured as an individual item or supplied with an automatic switch (Fig. 6)

Figure 6

Earth leak protection devices (ELPD) in mains of up to 220V

The company manufactures a variety of earth leak protection relays for IT systems (with sources insulated to ground) based on own designs in compliance with BSS 10880-83. Basic parameters:

- Mains voltage 110; 127; 220V;
- Type of mains current – dc/ ac
- Natural actuation time <100ms

Various types of earth leak protection relays (Fig. 7) have been applied successfully in shovels and spreaders – AZU 127 and AZU 220 V, in substations AZU 110, AZU 220 V, in chargers for traction batteries (AZU-120 Ex), etc.

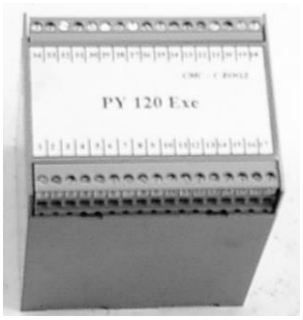

Figure 7

Current leak control device LCD-M

The current leak control device LCD-M is a special-purpose apparatus used for bus systems and electrolysis baths. The dc mains in the electrolysis shops are characterized by low insulation resistance - 10^{-1}-$10^{3}\Omega$. The current leak control is related mainly to limiting electric energy losses.

The device has been designed especially for Unicor Med-Pirdop (Fig. 8) and is used to control:

- Leakage current, A
- Leakage power, κW
- Energy lost from leakage currents, kW/h
- Asymmetry of voltage to ground, %

The device contains a PIC processor that computes and scans the quantities listed above by means of digital indicators. The light signalization, doubled by remote control, indicates three levels of leakage current: “normal”, “higher” and “unallowable” thus requiring measures for limiting the losses.

Figure 8

Electricity demand control and management systems

Electricity demand control, measuring and management systems have been developed and put into service. The system implemented at Elatsite Med AD in 2000 (Fig. 9) can perform the following functions:

- Measuring the active and reactive power at the input and outputs;
- Determining the consumed active energy in three zones: peak zone, day zone and night zone;
- Determining the moments of the mean values of cos φ in the day and night zones as of the beginning of the month;
- Determining the reactive energy returned to the mains with a possibility to signal its generation;
- Daily, monthly and yearly information about the consumed electric energy by tariff zones. The information contains the electricity costs corrected in relation to cos φ and the reactive energy returned to the mains;
- Possibility for extracting daily, monthly and yearly load curves by terminals and generally at the input, including a choice of random periods within up to 3 years back;
- Automatic print-out of daily, monthly (on every first day of the month) data on energy consumption and the amounts paid for electricity;

Figure 9

Indication of short circuits in electrolysis baths

An indicator has been designed for identifying short circuits between the anodes and cathodes in electrolysis baths for recovering copper. The needle instruments, strongly vulnerable in an aggressive environment, as well as digital instruments causing sight fatigue, have been replaced with original engineering designs. The indicator indicates the occurrence of a short circuit by a light-emitting diode mounted in the upper base of the cylinder (tube). The sensor is positioned in the lower widened part of the measuring instrument (Fig. 10).

The indicator has been applied at Umicor Med AD, Pirdop.

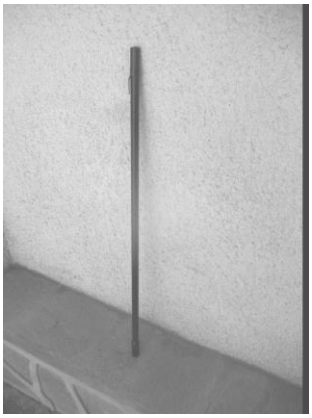

Figure 10

A short-circuit centralized control system is being developed as a prerequisite for shortening the duration of a short circuit and hence, improving the efficiency of the electrolytic process.

Flameproof units for remote control of explosion-protected mine starters

Flameproof units for remote control of PVI mine starters in Exdil design have been developed and manufactured.

The units are completely interchangeable with the original RC units of the starters but have been designed and manufactured by using modern electronic components in integral design.

The units have been certified as flameproof.

Recommended for publication by Department of Electrical Engineering, Faculty of Mining Electromechanics