



MWM ELEKTRO

## COMPLETED PROJECTS



## DELIVERY OF MACHINES AND EQUIPMENT FOR THE SINKING OF SHAFT GG-1 AT KGHM POLSKA MIEDŹ S.A.

Shaft GG-1 will be the deepest shaft in the Copper Basin, a strategic investment of KGHM Polska Miedź S.A. – a global leader in mining and processing copper, precious metals (gold and silver), molybdenum and rhenium. All works related to sinking shaft GG-1 are performed by Przedsiębiorstwo Budowy Kopalń PeBeKa S.A. (Mine Construction Company) – a leader in shaft sinking and accessing underground mineral deposits.



## Objective of the project

The main objective was the supply of modern and energy-saving core machinery and equipment for shaft sinking.

## Scope of the project

MWM Elektro Sp. z o.o. was commissioned to supply, install and hand over:

- two B-4300/DC-8m/s hoisting machines
- eight WBW 45T slow-speed drum winches,
- 30 guiding rope pulleys for machines and winches,
- ZUSWBW joint winches control system,
- two RG-3 logging devices,
- technical documentation for the entire project,
- supply and installation of equipment,
- overseeing the procedures related to the approval of equipment for use in mining plants,
- start-up of the supplied equipment.

The comprehensive supply of machines, structures and systems for the mine shaft hoist was provided in accordance with the customer's requirements.

## B-4300/DC-8m/s hoisting machine

The B-4300/DC-8m/s hoisting machine is equipped with a 4,300 mm diameter winding reel, driven from two sides by two direct current motors via toothed gears. It is intended for the transport of personnel, materials, output haulage and inspections.

The machine is controlled:

- manually from the machine operator's panel,
- remotely from control panels at stations or with an ECHO-S radio device.

The main components of the machine:

- main shaft unit with roller bearings and winding reel,
- two toothed gears,
- two DC motors,
- disc brake unit with the H-C MWM-4/VER.IID electrohydraulic control and supply unit,
- inverter transformers,
- inverter drive,
- control, monitoring and safety systems,
- ergonomic hoisting machine operator's station with a system for displaying the statuses of individual components of the mine shaft hoist and emergency signalling.

photo 1 – B-4300/DC-8m/s hoisting machine

In order to ensure the highest quality of supplied elements and services, inter-stage inspections, investor acceptance and industry designers' supervision were provided during the production.

photo 2 - inter-stage inspection of the main shaft





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The installation of bearings on the shaft is hydraulic. This method enables easy future disassembly and installation.

The hoisting machine is equipped with a hydraulic-controlled disc brake system, which includes the following elements:

- two brake discs,
- four brake columns,
- eight pairs of BSGF 408-A00-02-00-5 brake actuators – two pairs per column,
- H-C MWM-4/VER.IID electrohydraulic control and supply unit, manufactured by MWM Elektro Sp. z o.o., comprising a hydraulic unit with a redundant pumping system (primary and backup) as well as the supply and control system.

The brake's electrohydraulic control and supply unit enables the performance of the emergency braking process with two constant braking moment values or a variable, automatically controlled braking moment value. The application of this type of braking guaranteed the alleviation of the emergency braking effect on persons and materials transported in hoist containers and on the elements of the mine shaft hoist, such as wire ropes, container guides, suspensions, etc.

photo 3 - H-C MWM-4/VER.IID electrohydraulic control and power unit

The inverter drive comprises two DCS800-S01-2000-07 non-reversing thyristor inverters connected in a series and a reversing DCS800-S02-0075-05 for motor activation. The special "Multidrive" software enables the common shaft operation of the motors, providing the balance of electric moments for each of the motors, both in the steady and dynamic states.

In order to limit the interferences and occurrence of higher harmonics, a 12-impulse system impact was provided by supplying the main circuit inverters from two dry transformers with an appropriate configuration of hourly connections. The applied configuration enables the possibility of hoist operation with half the rated speed and full overload in case one of the inverters or main transformers is damaged.

photo no. 4 – Thyristor drive system

Both the main motors and thyristor inverters have independent ventilation systems.

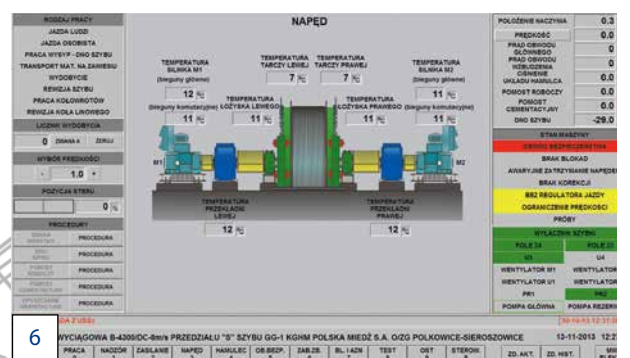
The control and safety system as well as the digital hoisting machine travel regulator are based on a redundant system of logical controllers.

The GRZ-08A digital travel regulator is another solution successfully implemented in previous hoisting machines. GRZ-08A enables the control of the single-end hoisting machine's travel diagram according to the requirements of the user, taking the nature of the mine shaft hoist into account. GRZ-08A works as the continuous and end speeds control system simultaneously.

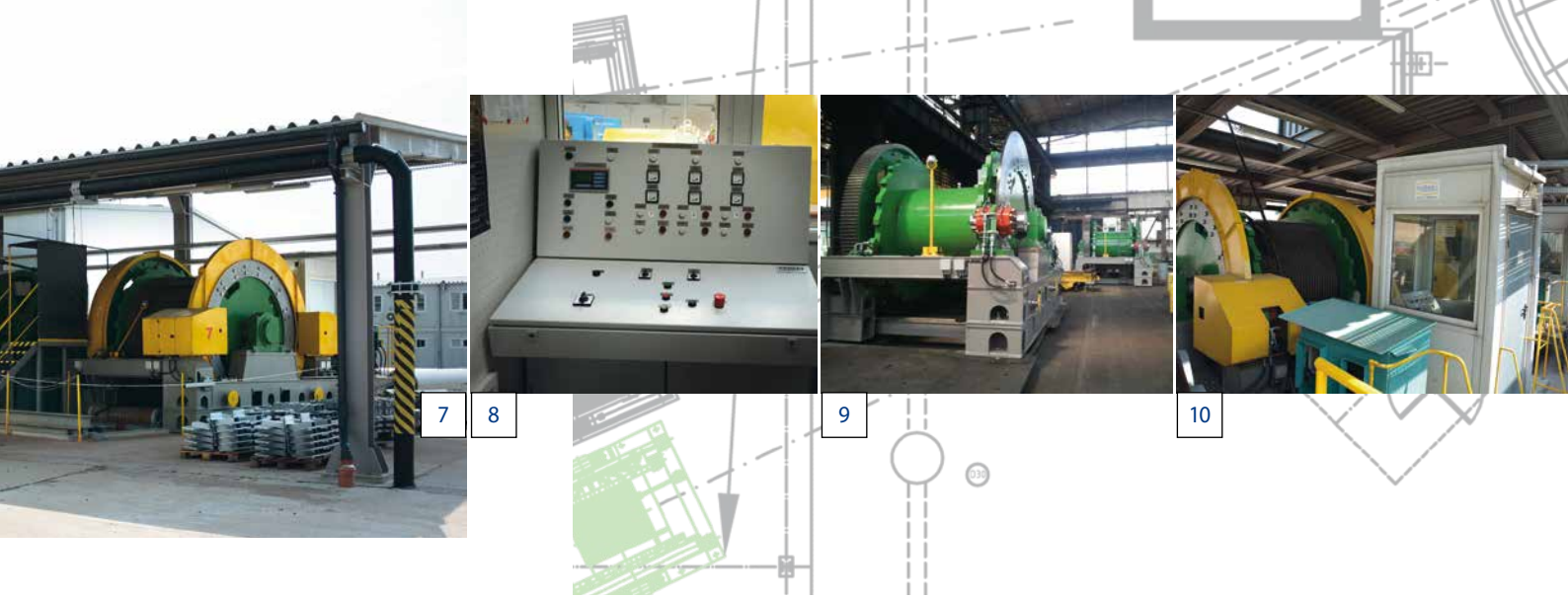
The functional and ergonomic machine operator's station, equipped with the hoisting machine's status display system as well as shaft signalling and communication equipment, is installed in an air-conditioned and soundproof booth.

photo 5 – Hoisting machine operator's station

photo 6 – View of one of the display system screens



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## WBW 45T slow-speed drum winch

The WBW 45T slow-speed drum winch is intended for use in mining plants, for all investment, repair/maintenance, liquidation and operation works in shafts and foreshafts, on towers, in shaft sumps and shaft bottoms and tops near shafts.

The design of the winch also makes it capable of working outside shafts. Due to the electrical equipment installed, the WBW-45T winch is intended for use outside of zones with potentially explosive atmospheres.

The WBW-45T slow-speed drum winch is capable of local control from the panel. Furthermore, the winch control system uses the remote control option in individual or joint (central) control from a remote control device for slow speed drum winches – ZUSWBW.

[photo 7 – Winches unit working in the area of shaft GG-1](#)  
[photo 8 – ZUSWBW control panel](#)

In the area of shaft GG-1, the winches units are used to move the suspended working platform and machines used for shaft sinking.

In order to ensure the highest quality of the supplied elements and services, inter-stage inspections, investor acceptance and industry designers' supervision were provided during the production.

[photo 9 – WBW-45T slow-speed winch at the production plant](#)

Each of the WBW-45T winches is fully supported by the integrated steel frame. The compact construction of the winch makes the transport and assembly easier.

The B-1650 winding reel is capable of holding rope with a maximum diameter of 65 mm. The winch is compatible with one lifting rope reeled inward and outward, which makes it more versatile.

The intermediate drive of the winch is an AC motor supplied from the frequency inverter installed in the power supply cabinet. The torque from the motor is transferred to the winch drum through two gears: toothed cylindrical gear and open gear comprising a pinion installed on the drum shaft and a rack connected to the slow-speed shaft of the cylindrical gear via a coupling.

In order to prevent the movement of the winch during downtime, the winch is equipped with a hydraulically controlled ratchet mechanism.

The elements of the winch control system are installed in the control cabinet located next to the power supply cabinet. The power supply and control system of the winch enables stepless speed control from zero to maximum speed.

The winch is equipped with a hydraulic-controlled disc brake system, which includes the following elements:

- one brake disc,
- two brake columns,
- two pairs of BSFB 635-S-100 brake actuators,
- hydraulic unit equipped with electrically controlled valves for supplying the disc brake's actuators and ratchet actuator.

The functional and ergonomic winch operator's station is equipped with a system of required lights and signalling devices for operating the winch.

[photo 10 – Hoisting machine operator's station](#)

## Summary

The applied technical solutions enabled us to provide the Customer with a modern product, compliant with the highest quality and safety standards.

All machinery and equipment was commissioned according to the schedule.

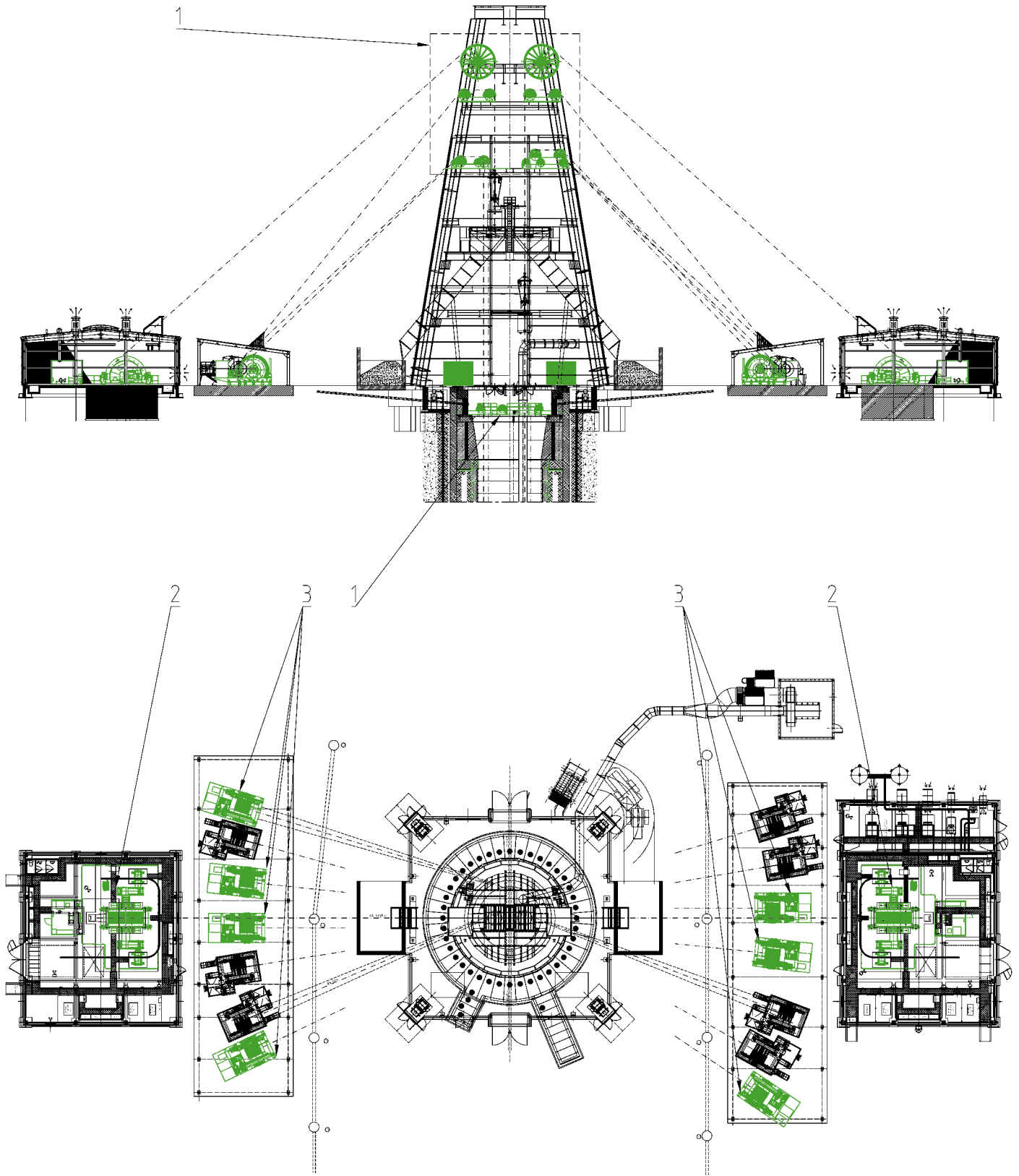
The experience gained during the performance of such an extensive project enabled us to improve the machinery, equipment and technologies.

Due to the technical and organisational solutions developed by the engineers of MWM Elektro Sp. z o.o., the main objective was achieved within the assumed timeframe.

# Mine shaft hoist

Cross-sectional drawing of the shaft and hoist building, modernised elements highlighted:

- 1 - Rope pulleys
- 2 - B-4300/DC-8m/s hoisting machine
- 3 - WBW-45T slow-speed winch



## Technical specifications of the B-4300/DC-8m/s hoisting machine

Control types	manual control
Operation modes	haulage, materials transport, personnel transport, individual transport, inspections
Travel speeds for:	
haulage and materials transport	8 m/s
personnel transport	6 m/s
Inspections	up to 1 m/s
Acceleration / deceleration	0,6 m/s <sup>2</sup> / 0,8 m/s <sup>2</sup>
Main supply	3–30 kV
Auxiliary supply	500 V
Drive	inverter
Rated motor specifications:	
type	DMI 400R
power	Pn = 1,043 kW

## Design specifications of the hoisting machine

Winding reel diameter	Dn = 4,300 mm
Number of lifting ropes	1
Maximum diameter of the lifting rope	43 mm
Number of layers	4
Main shaft bearings	rolling, barrel
Brake	disc-type, hydraulic control, two brake discs, four brake columns
Number of actuators	eight pairs, two pairs on each column
Brake actuators	BSFG 408-A00-02-00-S
Brake control and supply system	H-C MWM-4/VER.IID
Maximum static force in the wire rope	240 kN
Maximum lifting rope breaking force	1,900 kN

## Technical data of the WBW45T winch

Maximum rope diameter	65 mm
Rope reeling direction	inward or outward
Maximum static force in the wire rope on drum	450 kN
Maximum load moment for the winch drum	392 kNm (for 60 mm rope)
Drum lining external diameter	1650 mm
Rope entry angles:	
for inward reeling	$\alpha_{1-2} = -10^\circ - 70^\circ$
for outward reeling	$\alpha_{3-4} = -4^\circ - 10^\circ$
Rope deflection angles for entering next layer	$\beta_{\min-\max} = 0^\circ 20' - 1^\circ 20'$
Drive motor power	90 kW
Control types	local, remote from the control device with slow-speed drum
winches	
Allowed rope speed for:	
shaft works	0,25 m/s
works outside the shaft	0,6 m/s
Brake:	
type	disc – one brake disc
number of brake columns	2
number of pairs of actuators	2 (1 pair per column)
Power supply	500 VAC, 230 VAC
Control circuits power supply	24 VDC
Data transmission	PROFIBUS DP, SAFEBUS
Total weight	~ 65,000 kg



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