KEYTRADE
your key to innovations

PRODUCT CATALOG

KEYTRADE Ltd.

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DEAR LADIES AND GENTLEMEN!

Our company is representative of lead Belarusian manufacturers of automation systems and electrical equipment (JSC “The Institute of Mining Electrical Engineering & Automation”), metal constructions (JSC “Mashhimprom”), mineral processing machines (JSC “SPE “PASSAT”) mainly for mining and chemical industries.

KEYTRADE was founded by above mentioned enterprises to expand export, find ways of cooperation between manufacturers of mining and chemical industry equipment and support scientific and technical development of the industries. We are ready to fulfill our customer needs with innovation solutions in automation of technological processes and energy-saving, to develop, supply and maintain technological equipment. Our catalogue contains wide range of equipment – from complex electrical products to mineral processing machines.

KEYTRADE – your key to innovations.

With kind regards,
director
Kirill Kirienko

SUMMARY:

PIT SHAFTS SIGNAL SYSTEMS

Pit Shafts Signal Systems are designed for coordination of process personnel actions and control of hoisting unit during trips of men, cargo and oversized equipment, as well as during examinations, inspections and overhauls in the pit shafts and head frame rig, and is also used in man and man-cargo hoisting units of mines (pits).

PIT SHAFTS SIGNAL SYSTEM PROVIDES:

• operational light (accompanied by acoustic) alarm;

• signaling by cager - signal tender on the landing all working places the hoisting unit operation modes "Men","Cargo""Oversized item";

• sending operation mode signal "Inspection" by hoisting unit operator;

• two landings version provides for selection by signal tender – cager on the landing of the active landing with this information displayed on his working place and that of the hoisting unit operator;

• selection by cager - signal tender being on the landing of the cage movement address: "Horizon "xxx m" (up to seven horizons) with this information displayed on his working place and that of the hoisting unit operator, selected shaft horizon;

• indication of the precise cage stop on the landing and selected horizon with this information displayed on his working places of the selected horizon, landing and the hoisting unit operator;

• automatic unlock of the door interlock upon actuation of the sensor of cage precise stop on the landing and selected horizon;

• possibility to send enabling signals to actuate mechanisms used in the hoisting unit;

• sending by cager - signal tender being on the landing movement commands 'Up", "Down", "Slowly up", "Slowly down", "Stop" to hoisting unit operator's cage and to horizons;

• sending by cagers being on horizons movement commands 'Up", "Down", "Slowly up", "Slowly down", "Stop" to the landing;

• sending by cager – signal tender being on the landing and cagers being on horizons to all working places the signal "Emergency stop", and display of the signal "Emergency stop" in the form of red blinking signal (red inscription "Emergency stop" on the board of hoisting unit operator's SSP), and interrupted acoustic alarm having tonality different from the totality of the signal that accompanies signal "Stop";

• possibility to cancel the signal only from the place from which it was sent;

• sending from the landing to operator's cabin the signal about position of fire protection folding doors and display of this information in the operator's cabin and on the landing;

• follow-up of movement commands 'Up", "Down", "Slowly up", "Slowly down" with enabling signal "Movement" to the hoisting unit movement with display of this signal on the working place of cager – signal tender;

• sending discrete commands "Emergency stop","Stop", "Movement", "Stop", "Cams", "Tilting landing", "Men", "Cargo", "Oversized item", "Inspection", "Braking ropes" by means of relays installed in the CCS (central control station).

IN ALL MODES (EXCEPT FOR THE MODE "INSPECTION) PIT SHAFTS SIGNAL SYSTEM PROVIDES THE FOLLOWING PROTECTIONS AND INTERLOCKS:

• impossibility to start up the hoisting unit if switches of landings selection are put in different positions;

• impossibility to start up the hoisting unit until movement command from cager on the landing is received;

• impossibility to send movement commands from non-active (unselected) horizon (except for command "Stop");

• impossibility to send movement commands from selected horizon when there is no cage in the range of precise stop sensor, except for command 'Stop";

• impossibility to send any signals after signal "Emergency stop" is given until it is cleared;

• impossibility to send the following movement command without clearing the preceding one with signal "Stop";

• impossibility to send movement commands with fire protection folding doors down;

• impossibility to send movement commands with tilting landing induced;

• impossibility to send movement commands with faulty sensor circuits "Cams","Tilting landings","Folding doors","Braking ropes","Precise stop sensor";

• impossibility to send two and more movement commands simultaneously;

• impossibility to unlock door interlock on non-active horizons;

- automatic formation of command "Stop" when trying to change operation mode ('Men", "Cargo", "Oversized items") during cage movement. In this case the preceding movement command is cleared by command "Stop";

- automatic formation of command "Stop" with faulty sensor circuits controlling braking ropes' state. In this case the preceding movement command sent from any horizon is cleared by command "Stop";

- automatic formation of command "Stop if upon expiration of holding time of relay "Movement" (3...5 s) the hoisting unit is not actuated;

- автоматическое формирование команды «Стоп» если по истечении времени на удержание реле «Ход» (3...5 с) не произошло включение подъёмной машины;

- automatic formation of command "Stop upon loss of communication with any device of the active landing or active horizon, as well as upon loss of communication with data transmission unit (DTU) or data acquisition device on the state of sensors for control of the position of shaft grating, cams, tilting landings, braking ropes of non-active landing or horizon.

Pit Shafts Signal System displays text message on the SSP of hoisting unit operator on the cause of cancelling sent movement command or automatic formation of command "Stop", as well as address of the working place where this event occurred.

Mode "Diagnostics" accessed from SSP of hoisting unit operator allows to monitor the state of all sensors included in the configuration, availability of communication with devices and other hardware faults.

To control trip of the oversized equipment remote control panel can be installed in the direct proximity to shaft collar.

WHEN CONNECTED TO PC PIT SHAFTS SIGNAL SYSTEM PROVIDES:

- logging the hoisting unit operation with possibility to archive address of the given command, date, time, working place from where it was sent;

- possibility to review and print out event log;

- display of the current state of controls and sensors of cagers – signal tenders and cagers' work places on PC mnemonics with details for each work place;

- installation of reserve copy of software in the controller.

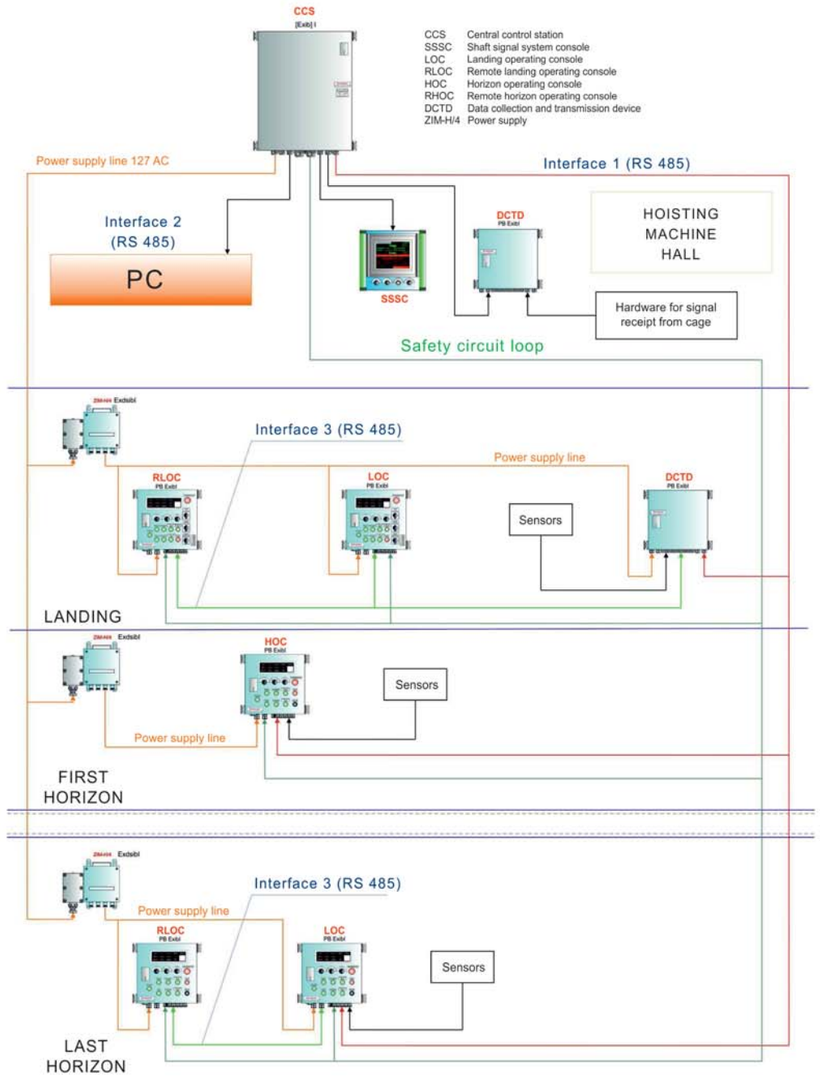
PRINCIPAL ADVANTAGES OF PIT SHAFTS SIGNAL SYSTEMS MANUFACTURED BY JSC "THE INSTITUTE OF MINING ELECTRICAL ENGINEERING AND AUTOMATION":

1. The use of intrinsically safe interface RS 485 as a communication line between shaft work places and machine hall relieves the necessity of laying multi-wire cable for signals transmission along the shaft. Two pairs of conductors are sufficient to set up communication line and safety loop circuit.
2. Low supply voltage of stabilized power sources (127 V) enhance electrical safety of hardware.
3. All cabinets on the landing and horizons are powered with stabilized intrinsically safe voltage of 12 V DC.
4. Only one source of power for pit shafts signal system hardware on each work place.
5. Spaced-apart layout of pit shafts signal system hardware allows reducing required footprint for cabinets' installation on work place.
6. In the mode "Cargo" pit shafts signal system equipment allows operation with exposed cams only on selected (active) work place.
7. In the mode "Oversized item" pit shafts signal system equipment allows operation with open doors only on selected (active) work place.
8. Pit shafts signal system equipment allows for operation with two types of chairs (cams and tilting platforms) installed in the shaft, with each type provided with its own interlock.
9. Pit shafts signal system equipment allows for diagnostics of states of all devices included in the configuration, and states of all connected sensors directly from the work place of hoisting unit operator.
10. When connected to PS the pit shafts signal system hardware can log events allowing to analyze operation of the equipment and maintenance personnel.

MAIN TECHNICAL DATA:

maximum hoisting height, m	1200
maximum number of landings, pc	2
maximum number of horizons (work places), pc	7
permissible fluctuations of mains supply voltage from 85 to 115% of rated value	
labeling of the version under State Standard 30852.0 and 51330.0	
of the power supply unit	PB Exdsib I
central station	[Exib] I
cabinets installed on horizons and landing	PB Exib I

Final configuration of the set is made on the basis of questionnaire and agreed upon manufacture specification requirements.



LOUDSPEAKING AND WARNING SIGNAL SYSTEMS

Loudspeaking and Warning Signal System is designed for talk-back communication and signaling within range of long wall set of equipment and with mine (pit) supervisor, interlock of power train switches mounted on the entry; indication of states of technological protections, machines and mechanisms of the complex.

THE EQUIPMENT PROVIDES:

- talk-back communication along face and gate conveyers, as well as on apparatus complex;
- single-stroke light and acoustic alarm ("knocking on");
- interaction with mine warning system of type STARR or AUD;
- calling supervisor and conducting talks with him;
- emergency call of supervisor;
- generating warning signals and speech messages;
- visualizing emergency modes;
- visual signaling of the operation modes of selected system elements (sensors of gate conveyer, face conveyer, gate crusher, heading crusher, shearer);
- emergency shut-down of drives, identification of drives' shut down site (visual together with speech message);
- monitoring of the system on the surface (when modem is used).

MAIN TECHNICAL CHARACTERISTICS OF THE COMMUNICATION SYSTEM:

- devices as part of the system are connected to one out of two trunks: gate (left-hand) and face (right-hand) against controller of CUKS-5BX type;
- maximum number of devices (network nodes) in the left-hand or right-hand trunk – 40 pcs;
- maximum number of loud-speaking devices in both trunks – 50 pcs;
- maximum number of devices of type CUKS 1BX/2 in one trunk – 16 psc;
- maximum number of modules of type UMP 485 connected to the trunk in device of type CUKS-1BX – 16 pcs;
- minimal supply voltage of devices (network nodes) – 12.5 V DC;
- maximum supply voltage of devices (network nodes) – 15.8 V DC;
- operating temperature range from 0° to 40 °C;
- relative air humidity at ambient temperature + 40° – 95% maximum.

Name of parameter	Norm
Number of trunk lines to be connected to subscriber terminals, pcs	2
Maximum number of subscriber terminals in one trunk line, pcs, at least	32
Level of sound pressure along loudspeaker axis upon actuation of prestarting alarm, dB, at least	96
Types of sound alarm:	prestarting; coded; speech.
Time of loud speaking communication operation after de-energizing all power units, h, minimum	4

Name of parameter	Norm
Level and type of implosion protection:	
• central subscriber terminal	Exia I
• subscriber terminal	Exia I
• analog signals' discriminator	Exia I
• power unit	Exdsia I
Make in degree of protection against humidity and dust:	
• central subscriber terminal	Ip54
• subscriber terminal	IP54
• analog signals' discriminator	IP54
• power unit	IP54
Overall dimensions, mm, maximum:	
• central subscriber terminal	448 x 636 x 116
• subscriber terminal	442 x 330 x 110
• analog signals' discriminator	360 x 340 x 180
• power unit	345 x 290 x 195
Mass, kg, maximum:	
• central subscriber terminal	16
• subscriber terminal	8
• analog signals' discriminator	6
• power unit	9
DC supply voltage, V/current drain, mA, maximum:	
• central subscriber terminal	from 12,5 to 15/220
• subscriber terminal	from 12,5 to 15/90
• analog signals' discriminator	from 12,5 to 15/70
Power unit:	
• operation range of AC supply voltage at frequency [50 +/- 1] Hz, V	from 90 to 250
• stability of output voltages at variation of supply voltage in the range from 90 to 250 V and load variation, %	2
• DC output voltage for each output, V	15,0 ± 0,3
• maximum output current of each output, A, minimum	1,5 ± 0,3
• protection of each output:	
- for input voltage, V	89,5
- for output voltage, V	15,3
- for output current, A	1,5± 0,3

LASER ALIGNMENT SYSTEMS

Laser Alignment System is designed for fixing horizontal and incline reference directions in mine workings, hazardous in mine gas and combustion dust.

OPERATION CONDITIONS:

- environment contains explosive mixture of category I (methane in underground works) and aggressive to metals dust salt in the air;
- ambient air temperature from 5 to + 35 °C;
- ambient relative humidity 98% at temperature 35 °C;
- height above sea level – 1000 m, maximum;
- depth below sea level – 1500 m, maximum.

LASER ALIGNMENT SYSTEM CAN BE MOUNTED ON THE ARM FIXED TO WORKING WALL OR GEODETIC TRIPOD.

Laser Alignment System is powered by accumulator. The battery is charged on the charging stand of the lamp room. Time of laser work from fully charged battery – 4 days minimum.

Name of parameter	Value
Range within which size of central core of laser benchmark are retained, m	from 10 to 500
Size of core of the central laser benchmark, mm, maximum	25
Background luminance at which the pointer retains its parameters, lx, maximum	200
Luminance of plane on which laser benchmark is formed, lx, maximum	15
Direct current supply voltage, V	3,6±1
Current drain, mA, maximum	100
Radiation power, mW, maximum	1,5
Class of laser hazard	II
Class of protection by enclosure, not less than	Ip54
Type and level of explosion protection	PB Exia I X
Class by method of human protection against electric shock	III
Overall dimensions, mm, maximum: - laser module in assembly with orientation device - power source - adjusted erection arm in operating condition	 255x240x140 138x108x49 1100x255x320
Mass, kg, maximum: - laser module in assembly with orientation device - power source - adjusted erection arm	 2,750 0,9 9

CONTROL STATIONS (CS)

Control Station (CS) is designed for remote control (switching on and off), protection of asynchronous electric motors with short-circuited rotor (from 1 to 10 pc) against overload currents and short-circuiting, and diverging connections in mine electric networks with transformer insulated by neutral.

MAIN TYPES OF COMPACT STATIONS:

- compact station with automatic switch and light transformer for control of cutter-loader, adzing machine and refrigerating unit;
- compact station for control of face conveyer with transformer (P=40 kVA, U= 1140/660 V);
- compact station for control of face and gate conveyers;
- compact station for control of filling raise complexes.

STATION CAN BE DELIVERED IN NORMAL AND EXPLOSIONPROOF TYPES.

DISTINGUISHING FEATURE OF CONTROL STATIONS OF NORMAL TYPE IS ELECTRICAL CIRCUIT THAT PROVIDES:

- switching on and off power contactors according to set algorithm;
- switching on and off power contactors without supplying voltage to power circuit (testing);
- possibility of connecting remote control panels;
- intrinsically safe inputs for connection of external control circuits;
- intrinsically safe outputs for generation of signals on the state of power contactors.

ON TOP OF CONTROL FUNCTIONS THE STATION ELECTRIC CIRCUIT PROVIDES:

- protection of diverging power circuits against short-circuit currents;
- protection of diverging power circuits against current overload;
- protection of connected equipment against impermissible overheating;
- protection against breaks and short-circuiting;
- protection against self-actuation when supply voltage increases over 150% of the rated value;
- protection against breaks, short-circuiting or rise of resistance over permissible level of the grounding circuit of diverging connections;
- interlock preventing actuation of taps during damage or degradation of insulation in tapping circuits against ground below permissible level;
- protection against current leaks in the internal power circuits 42 V and 220 V;
- protection against current leaks in diverging connections and "5 meter long section" of supply line;
- zero protection;
- indication of supply network voltage;
- indication of protections actuation;
- indication of taps actuation;
- verification of protection operation.

ON TOP OF CONTROL FUNCTIONS IN DOWNSTREAM CIRCUITS 127V AFTER ILLUMINATION TRANSFORMER:

- protection against current leaks;
- interlocks preventing taps actuation upon damage or deterioration of downstream circuits insulation against ground below permissible level;
- protection against break out, short-circuiting or resistance rise over permissible level of grounding circuit of downstream connections;
- protection against short-circuit currents of downstream circuits;
- protection against overload of downstream circuits current.

OPERATING CONDITIONS:

- underground mine workings, salt mines including, aired by flow of fresh air due to general shaft depression;
- ambient temperature, °C – from –5 to 35;
- relative air humidity at ambient temperature (25±2)°C, % – (98±2);
- atmospheric pressure , kPa – (99,75±13,3);
- air dust level, maximum, mg/m² – 1500;
- vibration, maximum, Hz – 25;
- acceleration at vibration, maximum, m/s² – 10
- absence of jerks and shocks;
- working position in space – vertical; deviation of working position by no more than 15° to each side is allowed;
- permissible fluctuations of supply network voltage – from 85 to 110% of rated value.

FREQUENCY CONVERTERS

Frequency Converter is designed for changing frequency and voltage of power circuit, control of start and stop actions, adjustment of speed, protection against current overloads and short-circuiting of 3-phase alternating current electric motors with power up to 200 kW.

FACILITIES FOR PROGRAMMING FREQUENCY CONVERTER ARE PERSONAL COMPUTER WITH INSTALLED SOFTWARE "DRIVE MONITOR" VERSION 5.4 AND CONNECTION CABLE OF COMMUNICATION INTERFACE RS232.

ELECTRICAL CIRCUIT OF THE FREQUENCY CONVERTER PROVIDES:

- conversion of voltage 660 V with frequency 50 Hz of supply network to frequency 12.5 – 60 Hz and voltage 0-690 V for consumer;
- shock-free connection to rotating electric motor of the technological unit;
- display of operation parameters on operator's panel PMU;
- protection against accidental actuation of taps and during short-time (up to 0.1 s) rise of network voltage up to 150% of Uh;
- protection against output circuit leak;
- warning of overload, short-circuiting, ground short-circuit in power circuit, control of electric motor temperature, as well as state of the load.

FREQUENCY CONVERTER IS INTENDED FOR OPERATION UNDER THE FOLLOWING CONDITIONS:

- underground mine workings, salt mines including, aired by flow of fresh air due to general shaft depression;
- atmospheric pressure (84.0-106.7) kPa;
- dust level – not more than 500 mg/m³;
- height above sea level – no more than 1000 m and depth below sea level – not more than 1000 m;
- bottom working value of air temperature during operation +10 °C and top value of relative air humidity (98+/-2)% at temperature (25+/-2) °C.

MAIN PARAMETERS OF THE FREQUENCY CONVERTER

Name of parameter	Value
Nominal supply voltage, V	660
Nominal frequency of supply voltage, Hz	50±1
Nominal voltage of control circuits, V	18/24/42/220
Cooling Heat carrier	liquid water-oil emulsion
Rated power, kW, maximum	200
Overall dimensions, mm	2053x826x2083
Mass, kg, maximum	900
Degree of protection	Ip54

ADDITIONAL PARAMETERS OF FREQUENCY CONVERTER STATION:

- deviation of mains voltage – plus 10% and minus 15% of nominal value;
- working position in space – vertical; deviation of working position by no more than 15° to each side is allowed.

WATER COOLERS

Water Cooler is designed for heat exchange between liquid heat carrier (water emulsion liquid, water) in closed circulation loop and gaseous heat carrier (air) in open loop.

Name of parameter	Value
Nominal voltage of power circuits, V	660
Nominal frequency of supply voltage, Hz	50±1
Power drain, kW, maximum	1,12
Mass of the unit, kg, maximum	450
Volume of storage tank, l	200
Overall dimensions: -storage tank, mm, max -cooler section, mm, max	 960x1380x390 725x690x490
Degree of protection	Ip54

ADDITIONAL PARAMETERS OF WATER COOLER:

- deviation of mains voltage – plus 10% and minus 15% of nominal value;
- cooling liquid must not contain solid, chemically aggressive particles; particles with size 100 μ maximum is allowed;
- working position in space – vertical. Tilt of 15° in any direction is allowed. Hydraulic circuit provides uninterrupted circulation of cooling liquid in the loop and possibility to adjust pressure in the hydraulic system.

WATER COOLER IS DESIGNED FOR OPERATION UNDER THE FOLLOWING CONDITIONS:

- underground mine workings, salt mines including, aired by flow of fresh air due to general shaft depression;
- atmospheric pressure (84.0-106.7) kPa;
- dust level – not more than 500 mg/m³;
- height above sea level – no more than 1000 m and depth below sea level – not more than 1000 m;
- with bottom working value of air temperature during operation +10 °C and top value of relative air humidity (98+/-2)% at temperature (25+/-2) °C.

Storage conditions – heated and ventilated premises with air temperature from plus 5 to plus 40 °C and relative humidity not higher than 80% at 25 °C. Position of water cooler during storage – vertical. Tilt of 15° in any direction is allowed.

EXPLOSION-PROOF LUMINESCENT LAMPS

Explosion-Proof Luminescent Lamp is designed for general illumination of underground mine workings, shafts and their above-ground buildings hazardous in mine gas and/or combustible dust of faces, and mine workings hazardous in gas and dust.

Name of parameter	Value
Nominal voltage, V	127
Frequency of supply mains, Hz	50
Nominal power consumption, VA	29
Current drain, A	0,21
Luminous flux, lm	1000
Lamp power, W	9
Lamp type/amount	Luminescent/3
Dimensions when connecting inputs, mm, max, sideways behind	 426x410x149 295x410x215
Class of human protection against electrical shock	I
Mass, kg	16
Operation mode – prolonged	S1
Level and type of explosion protection	PB 1B X (ExdI)
Degree of shell protection, not less than	Ip54
Class of insulation thermal resistance	B
Mean time between failures, h	16000
Mean service life, years, minimum	6

PRINCIPAL ADVANTAGES OF THE LAMP IS THE ABILITY TO PERFORM THE FOLLOWING FUNCTIONS:

- emergency stop of face equipment by actuating built-in emergency switch;
- remote control of power source;
- control of grounding conductor integrity;
- search and localization of failures in the illumination line.

MINE POWER UNITS

Mine Power Unit is designed to provide control and automatic devices with DC stabilized voltage and AC non-stabilized voltage, microprocessor systems of industrial equipment, as well as provide automatic devices with information on presence of supply voltage at the unit output by means of discrete output.

THE UNIT IS DESIGNED FOR OPERATION UNDER THE FOLLOWING CONDITIONS:

- ambient air temperature from -5 to 35°C;
- relative ambient humidity at temperature (25+/-2) °C is 98% maximum;
- dust level up to 1200 mg/m³;
- working position in space – vertical; deviation from working position by no more than 150° to any direction is allowed;
- height above sea level is 1000 m, maximum;
- depth below sea level is 1500 m, maximum;
- permissible fluctuations of supply mains voltage are from 85 to 110%.

Name of parameter	Norm								
	BPR-01	BPR-02	BPR-03	BPR-04	BPR-05	BPR-06	BPR-01M	BPR-04M	BPR-06M
Supply voltage, V	660	660	380	660	380/660	2x660	660/1140	660/1140	2x660/ 2x1140
Supply mains frequency, Hz	50								
Output AC non-stabilized voltage, V	36±3	36±3	-	-	-	-	36±3	-	-
Maximum load current of AC output, A	5	2	-	-	-	-	5	-	-
Output DC stabilized voltage, V	-	24±0,3	24±0,3 12±0,6	-	24±0,3	-	-	-	-
Maximum load current of DC output when operating from mains, A	-	3	7,5 1	-	3	-	-	-	-
Maximum load current of DC output when operating from battery, A	-	-	-	-	1	-	-	-	-
Operation time from battery, minutes, minimum	-	-	-	-	30	-	-	-	-
Discrete output, number	1	1	1	1	1	2	1	1	2
Maximum voltage commuted by contacts of discrete output relay, V	48								
Maximum current commuted by contacts of discrete output relay, A	2								
Degree of shell protection	Ip54								
Operation mode – prolonged	S1								
Class of human protection against electrical shock	I								
Dimensions, mm, maximum	434x380x245								
Mass, kg, maximum	17	17	13,5	17	20	22	17	17	22

DEPENDING ON DESIGN VERSION THE UNITS CAN BE USED AS:

- BPR-01 and BPR-01M as power source with 36 V, 50 Hz, power 150 W;
- BPR-2 as power source with 36 V, 50 Hz, power 150 W and direct stabilized voltage 24 V with power 75 W;
- BPR-03 as power source of DC stabilized voltage 12 V, power 12 W, and 24 V with power 190 W;
- BPR -04 and BPR -04M for generation of information on the state of power contacts of one starter, one tab of the control station;
- BPR-05 as power source of DC stabilized voltage 24 V with power 75 W when operating from mains, and power 25 W when operation from built-in storage battery;
- BPR -06 and BPR-06M for generation of information on the state of power contacts of two starters, two tabs of the control station.

REED MAGNETIC SENSORS

Reed magnetic sensor is designed for control of object position and generation of signals about location of object in given zone. The sensor can be used in underground main workings of shafts and pits, including salt ones hazardous in mine gas.

THE UNIT IS DESIGNED FOR OPERATION UNDER THE FOLLOWING CONDITIONS:

- ambient air temperature from -5 to 35 °C;
- relative ambient humidity at temperature (25+/-2) °C is 98% maximum;
- vibration on the site of installation with frequency up to 60 Hz and acceleration up to 2 g;
- dust level up to 500 mg/m³;
- height above sea level is 1000 m, maximum.

Name of parameters	Norm
Actuation time, m/s, maximum	1,5
Drop-out time, m/s, maximum	0,5
Level and type of explosion protection	PB Exib I X
Degree of protection against dust and humidity	Ip54
Maximum switching current, mA	200
Maximum switching DC voltage, V	24
Resistance at sensor output, kOhm - in open position - in closed position	11 1
Number of output contacts	2 NO
Input parameters: -maximum internal inductance, Li, μHn -maximum internal capacity, CI, pF	30 3000
Operational life, cycles B-O	$5x10^6$
Distance from reed switch to permanent magnet, mm, maximum	100
Axial displacement of reed switch and permanent magnet, mm, maximum	20
Class of human protection against electrical shock	III
Overall dimensions, mm: - reed switch - magnet	154x60x34 165x82,5x34
Mass, kg: - reed switch - magnet	1,63 0,96

RELAYS OF LEVEL AND GUMMING CONTROL

Relay for control of the level and gumming is designed for control of the availability of loose material on the conveyer belt, in bunkers, as well as for monitoring push-fit of transfer loading points of conveyers during transportation of ore and other solid materials.

LEVEL RELAY IS DESIGNED FOR OPERATION UNDER THE FOLLOWING CONDITIONS:

- underground mine workings, salt mines including, aired by flow of fresh air due to general shaft depression;
- ambient air temperature from -30 to +50 °C;
- relative ambient humidity at temperature (25+/-2) °C is 98 +/- 2% ;
- atmospheric pressure (84.0 -106.7) kPa;
- dust level – 1500 mg/m³, maximum;
- vibration is not higher than 100 Hz;
- acceleration at vibration is not higher than 20 m/s².

MOVEMENT CONTROL SENSORS

Movement Control Sensor is designed for monitoring movement of movable operating elements of face and gate drag conveyers in underground mine workings hazardous in explosion of gas and dust.

OPERATING PRINCIPLE IS BASED ON VARIATION OF THE FREQUENCY OF RADIO SYGNAL REFLETED FROM A MOVING OBJECT.

SENSOR CAN BE MOUNTED ON CONVEYER LONGITUDINAL AXIS AND PARALLEL TO CONVEYER BLADES IN UNDERGROUND MINE WORKINGS, INCLUDING SALT ONES HAZARDOUS IN EXPLOSION OF GAS AND DUST.

The sensor has anodized and polymer coating.

MEDIUM VOLTAGE SWITCHGEARS

Medium Voltage Switchgear is used for receipt and distribution of electric power on transformer and distribution substations, as well as for performance of commutation functions in industry. Field of application covers nominal voltages up to 20 kV and nominal currents up to 2500 A.

HARDWARE

- Ready for use switchgear with metal air-tight reservoir and metal partitions is designed to be installed inside premises.
- Welded stainless steel gas-tight reservoir.
- SF6 gas insulated compartment of switches.
- One-pole insulation of cable connections and collecting buses.
- Erection and extension of switchgear using no SF6 gas.
- Shielded system of collecting buses insulated by silicon rubber.
- Cable connection from the front side via plug-in adapter.
- No maintenance is required.

PERSONAL SAFETY

- Contact safety owing to metal encapsulation of live parts.
- Visual mnemonics with mechanical indication of commutation positions.
- High-voltage fuses and end cable boxes are accessible only with tab lines grounded (option).
- Control is possible only with closed body (only for cells with high-voltage fuses).
- Answering interlocks.
- Capacitive system of no voltage control.
- Grounding of feeders by means of ground wire for short circuiting.
- Resistance to emergency arc impact – version of connection compartments is pressure-resistant – channel for pressure release is from rear (with loose installation).
- Indication of operational readiness with self-check function is just read out, doesn't depend on temperature and ambient pressure fluctuations, has non-contact definition of parameter under measurement and signal contacts (option) – 1 closing + 1opening for remote transmission.
- Minimum fire load.
- Switchgear reservoir is made as sealed pressure system under IEC 62 271-200, i.e., SF6 with which the reservoir is filled requires no maintenance.

HIGH OPERATIONAL RELIABILITY AND READINESS

- Air-tight arrangement of primary circuits inside reservoirs protects against such environmental hazards as mud, humidity and petty animals.
- Switchgear welded reservoir retains air-tightness over entire service life.
- Access is provided to drives of commutation equipment installed beyond switchgear reservoir.
- Erroneous commutation operations are practically ruled out owing to interlocks and logical arrangement of drive elements.

Name of parameter	Parameter value		
Nominal voltage, kV	6,3	10,5	20
Maximum operation voltage, kV	7,2	12	24
Nominal frequency, Hz	50/60		
Nominal operation current, A - collecting bus - power switch	1250/1600/2000/2500 630/1000/1250/2000/2300/2500		1250/1600/2000/2500 630/1000/1250/2000
Nominal breaking current at short circuit kA, maximum: - at nominal operation current 630 A - at nominal operation current 1000 A, 1250 A, 2000 A - at nominal operation current 2300 A, 2500 A	 25 31,5 31,5		 25 25 -
Nominal latching current at short circuit (surge current), kA, maximum: - at nominal operation current 630 A - at nominal operation current 1000 A, 1250 A, 2000 A - at nominal operation current 2300 A, 2500 A	 63 80 80		 63 63 -
Time of short-time thermal current flow, s	3		
Nominal operation current of load switch cell (depending on fuse), A	250		
Nominal operation current of contactor cell without fuses, A	450		
Nominal operation current of contactor cell with fuses, A, maximum	450 [2)]		
Nominal AC/DC voltage of auxiliary circuits, V	220; 110		
Yearly leak of SF6, %, maximum	0,1		
Filling pressure, kPa	150		
Mass of SF6 gas, kg, maximum	2,3		

1) Deliveries are possible with higher one-minute test voltage: 42/95 kV phase/phase, phase/ground between switch contacts, 48/110 kV between disconnector contacts.

2) Depends on nominal current of high-voltage fuse.

EFFICIENCY

Switchgear needs very modest outlay over entire service life and has the highest possible readiness for operation owing to:

- there is no need in maintenance whatsoever;
- independence from climatic conditions;
- minimal footprint;
- long service life.

Switchgear can be mounted on ships and platforms.

SWITCHGEAR OF SERIES IGEA S IS DESIGNED FOR OPERATION UNDER THE FOLLOWING CONDITIONS:

- degree of shell protection Ip65;
- ambient air temperature from -5 to 55 °C;
- relative ambient humidity at temperature 25 °C is 98% maximum;
- height above sea level is 1000 m, maximum.

LIFETIME OF VACUUM POWER SWITCHES USED IN SWITCHGEAR IS 10 000 COMMUTATION CYCLES BEFORE MAINTENANCE.

THICKENERS

Thickener is intended for thickening suspensions of concentrating mills in chemical industry with content of solid material 15-35 g/l in order to obtain filtered mother solution and its separation from thickened slurry.

The Thickener is complete with deaeration reservoir where functions of deaeration of fed pulp, its contacting and mixing with flocculant are performed simultaneously. Algorithm of flocculant flow rate control is realized by content of solid component in thickener. In the Thickener pulp is supplied directly to thickening zone under layer of flocculated solid particles that provides drain filtration and additional flocculation. Realized technical solutions provide high flow capacity per unit of area.

The Thickener is equipped with central drive of agitator on which "turners" are mounted to efficiently remove liquid phase and air out of solidified sediment.

Algorithm of sediment discharge from the thickener provides retention of required layer of solidified sediment in the unit, steady and high density with continuous discharge. The Thickener is provided with system of foam removal off its surface.

The Thickener is fit to be run in the open air in macroclimatic regions with moderate climate.

Compact high- throughput Thickener has been designed on the basis of long-term study of the process of clarifying return lye and thickening clay-salt slurry of selwynite ores. Overall Thickener dimensions provide optimal conditions for slurry compaction and sufficient zone of clarified layer at the same time.

The Thickener can be used for concentration of ores and minerals, and purification of sewage waters.

The Thickener operation is based on the principle of sedimentation of solid substance particles suspended in liquids under gravity forces impact.

THE SYSTEM OF THICKENER CONTROL IS DESIGNED FOR CONTROL OF PURIFICATION OF SATURATED SALT SOLUTIONS THAT ARE RETURNED INTO TECHNOLOGICAL PROCESS FOR FURTHER USE AND COMPRISES:

- electromagnetic systems for measurement of flow rate of initial mother water, flocculant and discharge product arranged on relevant pipelines;
- probes of top and bottom levels of product in the thickener with proper instrumentation on each site;
- inductive sensor mounted on agitator electric motor;
- thermistors built-in electric motors of agitator and pumps' drives;
- pneumatic servo drives ganged up with ball valves correspondingly;
- acoustic radiators, luminaries;
- control cabinet.

In their chemical protection modern materials used in Thickener bowl manufacture allow to use the assembly for clarifying and thickening of hot pulps with temperature up to 105°C.

ADVANTAGES OF COMPACT HIGH-THROUGHPUT THICKENER:

1. high specific output. In its output ten meter thickener equals P-30 unit (for clay-salt slurries);

2. high density of thickened slurry;

3. scraper provides additional dehydration in thickening zone;

4. possibility to adjust and maintain clarified layer and complete automation of the operation mode;

5. small area of production premises.

TECHNICAL CHARACTERISTIC OF THICKENER:

Name of parameter	Value
inside diameter of cylindrical section, m	10
nominal precipitation area, m^2	78,5
working volume, m^3	300
overall dimensions (including maintenance area), m: - length - width - height	 12,870 10,484 9,554
thickener mass, t	40,1

COMPACT THICKENER CAN BE USED FOR WIDE RANGE OF MATERIALS IN VARIOUS BRANCHES OF INDUSTRY:

Concentration of minerals	
Material	**Field of application**
Gold Silver Platinum group metals Diamonds Base metals Copper Iron Coal Nickel Mineral sands Uranium Aluminum/bauxite	Crushing Leaching Concentrates Mill tailings Countercurrent decantation (CCD) Paste-like backfill Clarifying HDS (high-density suspension)
Water purification	
Treatment of sewage waters Desalination plants Water purification	
Chemical industry / Industrial production	
Oil refineries Metallurgy works Cement industry	

FLOATATION CELLS

Floatation Cell is designed for concentration of suspensions in production of mineral fertilizers.

Principle of Flotation Cell operation is based on difference of physical-chemical properties of minerals' surface manifested themselves in different water wettabilty. Being in finely ground state in water medium particles of some minerals are not wetted with water but stick to air bulbs in water and surface, whereas particles of other minerals are wetted with water and sink in it, or are in suspended state.

Flotation Cell has vertical design (type V) and has common direction of pulp movement and floating mineralized bulbs, as well as calm zone of foam settlement.

Specific feature of Jet Cells is high aeration of pulp and substantial emission of gases from solution. Jets are designed for uniform distribution of pulp-air mixture across entire volume of flotation chamber, as well as additional suction of non-floated mineral material from lower section of flotation chamber in order to increase flotation effectiveness.

Jet Flotation Cells can provide output up to 600 m³/ hour.

Scope of delivery includes flotation chambers, pumps for supply of pulp to aerator, deaeration tanks, control system with control algorithm as a whole.

TECHNICAL CHARACTERISTICS OF FLOTATION CELL WHEN USED IN POTASSIUM INDUSTRY:

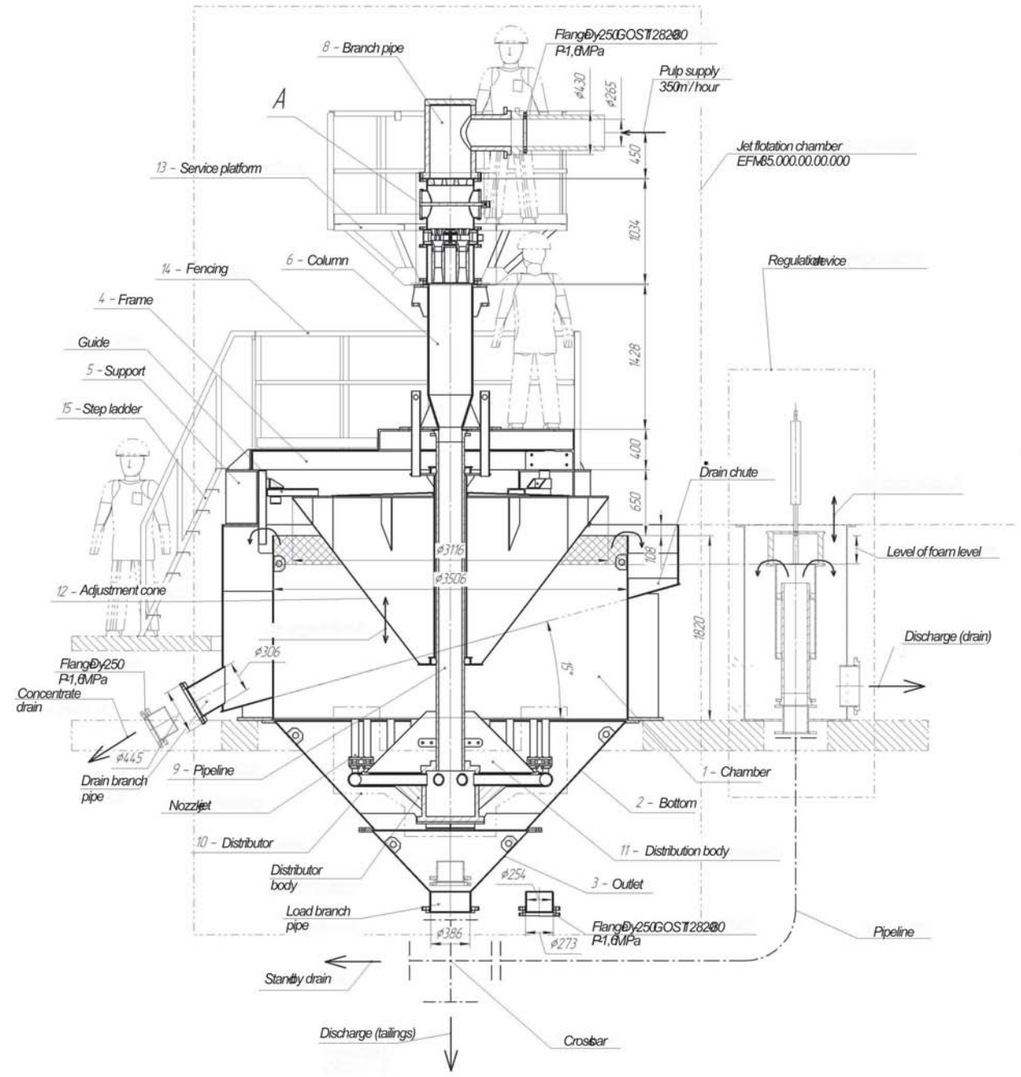
Name of parameter	Norm
Inside diameter of cylindrical section, m	3,5
Taper angle, degrees	85
Output for suspension, m³/h	up to 600
Density of initial suspension, kg/m³	1250-1450
Temperature of initial suspension, °C	from +12 to+50
Pressure in the pipeline for supply of initial suspension, kPa	200-350
Supply voltage of regulation valve with tilted spindle, V, DC	24
Operation pressure of regulation valve with tilted spindle, kPa	600
Overall dimensions, m, maximum length width height	 5,36 4,49 8,02
Mass, t, maximum: - empty state - loaded state with pulp density 1.36 t/m³	 10,3 28,2
Operation mode	continuous

THE MOST IMPORTANT PARAMETERS OF PROCESS CONTROLARE:

- dosage of reagent;
- air supply;
- contents of solids in pulp;
- thickness of foam layer.

SUBSTITUTION OF TRADITIONALLY USED MECHANICAL CELLS FOR JET ONES GIVES THE FOLLOWING ADVANTAGES:

- low operating costs (no moving parts);
- high technical efficiency owing to selectivity of process of foam density.



BELT FILTERS

Belt Filter is designed for filtering fast-precipitating suspensions with non-uniform solid phase in chemical and other branches of industry.

Flight and other metal filter parts that contact initial product, filter cake, rinsing water, and products of filter fabric and belt rinsing are made of corrosion-resistant steel. Vacuum chamber can be manufactured of high-molecular polyethylene (HDPE) or corroding steel. Design of vacuum chamber allows to rinse it in order to remove precipitation. Automatic adjustment of filter fabric movement prevents its lateral displacement and skewness. Discharge assembly is designed in coordination with customer depending on the existing premises and can be equipped with sampling equipment. Vacuum filter is provided with precipitation rinsing device across entire width with adjustment of rinsing liquid amount. On both sides of the filter steel rope for emergency stop is provided. All rotating parts are fenced.

FILTER IS DELIVERED TO OPERATION LOCATION DISASSEMBLED.

FILTER SERVICE LIFE IS 20 YEARS MINIMUM (EXCEPT FOR FAST-WEARING PARTS THAT REQUIRE PERIODIC REPLACEMENT.

APPROXIMATE TECHNICAL CHARACTERISTICS FOR POTASSIUM INDUSTRY:

Name of parameter	Norm
Nominal filtering area	15-17 m²
Output	100-600 t/hour
Residual humidity	5%, maximum
Belt speed	4-36 m/s
Drive power	30-45 kW
Operating voltage	380 V
Degree of protection of driving drum electric motor	not lower than IP54
Approximate overall dimensions: – length – width with drive – height	 15 m 3 m 2,6 m

BELT FILTERS ARE RELIABLE AND EFFICIENT EQUIPMENT FOR SEPARATION OF SOLID/LIQUID PHASES, THAT IS SUCCESSFULLY USED FOR DEHYDRATION OF WIDE RANGE OF MATERIALS. THE USE OF VACUUM FILTRATION PRESUPPOSES LOW CAPITAL, OPERATION OUTLAYS AND MAINTENANCE EXPENSES. VACUUM FILTRATION EXCEEDS TRADITIONAL DRUM DISK AND TIPPING BELT FILTERS WHERE HIGH OUTPUT, EFFICIENT WASHING AND MINIMAL DILUTION OF FILTRATE ARE REQUIRED.

Filter design, its technical capability and completeness are determined by initial data and performance specification of the customer.

MANUFACTURE OF STEEL CONSTRUCTIONS

MANUFACTURE OF NON-STANDARD, PREFABRICATED WELDED CONSTRUCTIONS BY CUSTOMERS' PERFORMANCE SPECIFICATION OR DRAWINGS.

The enterprise is constantly extending its production capacity and carries out technical re-equipment of manufacturing potential, uses in manufacturing steel structures and non-standard equipment advanced and innovative technologies, up-to-date equipment that provide high-quality and highly effective work of any complexity and within the shortest time possible.

EXISTING TECHNOLOGIES, HIGH-PRECISION EQUIPMENT AND HIGHLY SKILLED PERSONNEL ALLOW TO MAINTAIN INVARIABLY HIGH QUALITY IN MANUFACTURE OF BEARING AND FENCING STEEL STRUCTURES FOR INDUSTRIAL BUILDINGS, OVERHEAD ROADS, CONVEYOR GALLERIES, NON – STANDARD EQUIPMENT. THE PRODUCTS WE MANUFACTURE ARE RIGOROUSLY INSPECTED BY QUALITY CONTROL DEPARTMENT, AND EACH ELEMENT IS ACCOMPANIED WITH QUALITY CERTIFICATE.

ALL STEEL STRUCTURES ARE MANUFACTURED IN STRICT COMPLIANCE WITH DRAWINGS OF GRADE KM, STEEL STRUCTURES DETAILS ACCORDING TO STATE STANDARDS AND CONSTRUCTION NORMS AND REGULATIONS. THE ENTERPRISE HAS ITS OWN DESIGN DEPARTMENT THAT PROVIDES ENGINEERING PLANNING AND MANAGEMENT OF PRODUCTION, DEVELOPMENT OF PRODUCTION TOOLINGS' DRAWINGS AND DESIGN DOCUMENTATION.

We are ready to assume entire complex of works in manufacture, arrangement of anticorrosion protection, erection of equipment and relevant steel structures, and their fitting with process pipelines made both of steel and polymer materials.

KEYTRADE COMPANY OFFERS COMPLETE PACKAGE OF SERVICES IN DESIGN, MANUFACTURE, DELIVERY AND ERECTION OF STEEL STRUCTURES FOR INDUSTRIAL, CIVIL ENGINEERING AND ROAD CONSTRUCTION PROJECTS, IN PARTICULAR:

• manufacture of construction, technological, individual steel structures, non-standard equipment and their erection, including steel structures for buildings, hoisting machines and conveyor galleries, bodies of reservoirs for storage, processing and precipitation of concentration and flotation products up to 30 meters in diameter (thickeners, flotation machines, conditioning tanks), other technical devices and assemblies thereof used in hazardous production projects, where hoisting mechanisms, boiler equipment is used, mining works, concentration works and transfer of minerals are carried out.

• execution of construction-erection and special works in capital construction, reconstruction, technical re-equipment of industrial enterprises, overhaul of buildings and structures, projects of chemical and mining industries under operating enterprise conditions, including replacement hoisting mechanisms' parts (hoisting pulleys, turn-over skips), conveyor galleries, reconstruction of concentration mills' sections with complete replacement of equipment, overhaul of band conveyors with replacement of driving mechanisms and flight steel structures.

OUR ACHIEVEMENTS

By efforts of our companies' personnel the following projects were realized:

1. Reengineering of the electric drive of cage hoisting machines, JSC BELARUSKALI.

2. Reengineering of the electric drive of main ventilation units GVU-1 and GVU-1 VRCD-4, 5 of the mine, manufacture and delivery of equipment, execution of erection and commissioning works, JSC BELARUSKALI.

3. Manufacture, delivery and commissioning/contract supervision of pit shafts signal system, JSC BELARUSKALI, JSC STOYLENSKY MCW, JSC NOVOSHYROKYNSKY RUDNIK, JSC URALKALI, JSC VORKUTAUGOL, OJSC APATIT.

4. Development and manufacture of electric power supply and control systems of automated regulated drive of conveyor transport, frequency convertors' stations, water cooling devices, control system cabinets, periphery modules, modules for control of conveyor band loading – about 100 sets were manufactured and introduced at JSC BELARUSKALI mines.

5. Inspection and substantiation of modernization of conveyor of type 2LU-120 at JSC URALKALI with installation of frequency convertors.

6. Putting into operation of adjustable electric drive from BARTEK company for mine headway conveyor on RASPADSKAYA shaft.

7. Research, substantiation and development of initial data for design of adjustable electric drives of main band conveyors at VORGOSHORSKAYA mine.

8. Development of initial data for design of electric power supply, automation of technological processes for mine and mill of VOLGA-KALY company (Gremyachenckoe potassium salt deposit, Volgograd region, Russia).

9. Modernization of thickening sections at JSC BELARUSKALI using compact thickeners of own production (over 40 units of equipment were delivered and commissioned). Development of technical, algorithmic, software and organizational tools of thickeners' ACS on the project.

10. Execution of the complex of commissioning works on systems of automation and tie-up of software for cleaning flotation at JSC BELARUSKALI. Reengineering of cleaning flotation using pneumatic jet flotation machines IMF-35 of own production.

11. Manufacture and erection of steel structures for projects of capital construction and repair on industrial sites of existing mining departments of JSC BELARUSKALI.

12. Manufacture and erection of steel structures for buildings of hoisting machines and conveyor galleries, reservoirs for storage, processing and precipitation of concentration and flotation products with up to 30 m in diameter.

13. Reconstruction of drying and granulation department with replacement of roll presses and bag filters.

14. Overhaul of band conveyors with complete replacement of flight driving mechanisms and steel structures.

Products we manufacture and solutions we offer are in practical use and are functioning at one of the world's largest mining and concentrating mills - JSC BELARUSKALI. Specialists of our companies are highly skilled and have great experience in running equipment we produce and technologies we offer in most sophisticated industrial environment, which allows us to positively address tasks of any degree of complexity – from research and design to development, manufacture and erection of high-technology and innovative equipment.

WE'LL BE HAPPY TO SEE YOU AMONG OUT PARTNERS!