

COMPRESSOR UNITS of the Model: BK20E

OPERATION MANUAL

ATTENTION: YOUR UNIT IS EQUIPPED WITH MICROPROCESSOR CONTROLLER PROVID-ING CONTROL AND DISPLAYING TECHNICAL INFORMATION ON UNIT OPERATION, NEED FOR TECHNICAL MAINTENANCE AND EMERGENCY SITUATIONS.

ATTENTION: WHILE OPERATING THE COMPRESSOR UNIT FOLLOW THE INSTRUCTIONS SET IN OPERATION DOCUMENTATION SUPPLIED WITH THE PRODUCT:

- THIS OPERATION MANUAL;
- CONTROLLER USER MANUAL;
- ENGINE OPERATION MANUAL;
- AIR DRYER OPERATION AND MAINTENANCE MANUAL;
- FILTER DRYER OPERATION AND MAINTENANCE MANUAL.

1 GENERAL INFORMATION

1.1 The present operation manual combined with the technical passport, contains technical description of a screw-rotor compressor (hereinafter referred to as a unit) **BK20E** and its modifications; operation directives and performance data guaranteed by a manufacturer.

The units are manufactured in compliance with the current safety rules. The failure to comply with the operation guidelines, improper intervention or the use of non-genuine original spare parts leads to automatic cancellation of the warranty.

ATTENTION: BEFORE INSTALLATION, SWITCHING ON OR ADJUSTMENT OF THE UNIT, PLEASE, STUDY THIS MANUAL. FOR OPTIMUM USE OF THE UNIT'S CHARACTERISTICS AND ITS RELIABLE OPERATION, AND COMPLIANCE WITH THE OPERATING PROCEDURES, PLEASE, STRICTLY ADHERE TO THE GUIDELINES CONTAINED IN THIS DOCUMENT.

ATTENTION: BEFORE PERFORMING ANY OPERATIONS WITH THE INSTALLATION DISCON-NECT THE UNIT FROM THE POWER SUPPLY NETWORK, RELIEVE EXCESSIVE PRESSURE.

ATTENTION: SOME INTERNAL COMPONENTS OF THE UNIT CAN HEAT UP TO HIGH TEM-PERATURES.

The five-position code is used for identification of the units of basic modifications:



Note - BK20E modification-...-500DBC (with dehydrator) the unit is equipped with an filter with a filtration degree of 3 μ m. EXAMPLE OF INDICATION (IN ORDER):

COMPRESSOR UNIT BK20E-15-500DBC

Characteristics: Electric motor – 15 kW; maximum working pressure – 15 bar; volume of the receiver – 500 L; with refrigerant dryer, with frequency inverter.

Ordering spare parts, please provide the following information:

a) Model (modification), unit capacity, working pressure;

б) Factory number;

B) Number (or part code, node code), exact part name and respective modification number.

The manufacturer reserves the right to introduce any additional changes to the design of the unit aimed at the product quality and reliability improvement without prior warning.

2 FUNCTIONALITY

2.1 The unit is a complex electromechanical product and is designed to provide pneumatic equipment and tools used in industry, car service and for other purposes with compressed air. Use of the product can significantly save electric power, mechanize labor and improve work quality.

According to the type of protection against electric shock the unit belongs to class I.

The operation of the unit in explosive and fire-hazardous premises, outdoors, or under the influence of atmospheric precipitation is forbidden.

2.2 The unit is powered by a three-phase alternating current network with a voltage of $(400 \pm 10 \%)$ V, frequency of $(50 \pm 1 \%)$ Hz.

Switching the motor on the mains:

BK20E - "star-triangle".

BK20E BC - direct.

Supply voltage for control and alarm circuits is 24 V AC.

2.3 Operating temperature range in the premises is from $+5^{\circ}$ C to $+40^{\circ}$ C, RH is below 90 %.

2.4 Mode of operation is continuous.

2.5 Pressure control in the receiver is automatic.

3 MAIN TECHNICAL CHARACTERISTICS

3.1 General safety requirements are compliant with IEC 60204-1.**3.2** The main technical characteristics are given in Table 1.

Table 1

	Indicator value								
Name of the indicator	BK20E-8	BK20E-8BC	BK20E-10	BK20E-10BC	BK20E-15	BK20E-15BC			
Capacity, $1/\min, \pm 10\%$	25	50	22	50	16	00			
Peak compressed air pressure, MPa (bar)	0,8	(8)	1,0	(10)	1,5	(15)			
Rated electric motor power, kW			1	5					
Equivalent sound level at a distance of at least 1 m from the unit is be- low, dBA		68							
Ingress Protection Degree is at least			IP	20					
Air end shaft speed, min ⁻¹	3478	15003478	3089	15003089	2510	15002510			
Difference between in- let and outlet air tem- perature, °C			1	2					
Air consumption for cooling and suction, m ³ /hour, is below			42	.00					
Compressed air oil content in nominal op- erating mode, mg/ m ³ , is below		3							
Transfer heat quantity (recycled energy), kcal/hour			110	000					
Height above sea level, is below, м			10	000					
Dimensions, mm, is below: length width height		1125 810 1180							
Receiver volume, L, ±5%	400	415	400	415	400	415			

	Indicator value											
Name of the indicator	BK20E-8-500	BK20E-8-500D	BK20E-8-500BC	BK20E-8-500DBC	BK20E-10-500	BK20E-10-500D	BK20E-10-500BC	BK20E-10-500DBC	BK20E-15-500	BK20E-15-500D	BK20E-15-500BC	BK20E-15-500DBC
Capacity, l/min, ± 10%		25	50			22	50			16	00	
Peak compressed air pressure, MPa (bar)		0,8	(8)			1,0	(10)			1,5	(15)	
Rated electric motor power, kW						1	5					
Equivalent sound level at a distance of at least 1 m from the unit is below, dBA						6	8					
Ingress Protec- tion Degree is at least		IP20										
Air end shaft speed, min ⁻¹	34	78	1500.	3478	3089 15003089			2510 1		1500	.2510	
Difference between inlet and outlet air temperature, °C	12	3	12	3	12	3	12	3	12	3	12	3
Air consumption for cooling and suction, m ³ /hour, is below						42	00					
Compressed air oil content in nominal operating mode, mg/ m ³ , is below						3	3					
Transfer heat quan- tity (recycled en- ergy), kcal/hour						11(000					
Height above sea level, is below, м						10	00					
Dimensions, mm, is below: length width height	1960 810 1780											
Receiver volume, L, ±5%						50)0					
Net weight, kg, is below	555	595	570	610	555	595	570	610	590	635	605	650

3.3 Driving belt characteristics are provided below in Table 2.

Table 2

14010 2							
		Number, pcs.					
Code	Nomenclature of components	BK20E-8	BK20E-10	BK20E-15			
4302100020 Driving belt XPA-1320 2							
Note – Two-belt drive. Belt profile A.							

3.4 Lubricant characteristics

Nominal coolant and lubricant capacity is 9 L.

For coolant and lubricant system the following brands of mineral compressor oils (or similar in terms of quality and requirements), without mixing, are recommended.

For installations with a working pressure of 8,10 bar - kinematic viscosity of 46 cSt at 40 ° C:

SHELLCORENA S3 R46MOBILRARUS 425REPSOLMERAK VDL46LUKOILSTABIO 46

For installations with a working pressure of 13,15 bar - kinematic viscosity of 68 cSt at 40 ° C: SHELL CORENA S3 R68 MOBIL RARUS 426 LUKOIL STABIO 68

MIXING OILS OF DIFFERENT BRAND NAMES AND ORIGIN IS FORBIDDEN.

To replace the oil remove it from the lubrication system (oil sump, air-end, heat sink, oil lines), replace the oil filter and oil separator filter.

4 COMPLETE SET

4.1 The delivery complete set is given in the Table 3

]	Number, pcs.		
Name	BK20E-8, BK20E-10, BK20E-15	BK20E-8BC, BK20E-10BC, BK20E-15BC	BK20E-8-500, BK20E-10-500, BK20E-15-500	BK20E-8-500D, BK20E-10-500D, BK20E-15-500D	BK20E-8-500BC, BK20E-10-500BC, BK20E-15-500BC	BK20E-8-500DBC, BK20E-10-500DBC, BK20E-15-500DBC,
Compressor unit				1		
Compressor unit. Operation manual				1		
Electric motor. Operation manual				1		
Controller. User manual.	see application C	see application D	see appli	cation C	see applic	ation D
Frequency con- verter. Operating manual	_	1	-	_	1	
Air dryer. Operation manual		_		1	_	1
Filter separator. Operation and maintenance man- ual		_		1	_	1
Oil separator. Declaration		1				
Receiver Declaration	- 1					
Key				2		
Complete packing set				1		

Table 3



Figure 1 – General view of the compressor unit BK20E-...(BC)



Figure 2 – General view of the compressor unit BK20E-...-500(BC)



Figure 3 – General view of the compressor unit BK20E-...-500D(BC)

5 TECHNICAL INFORMATION

5.1 DESIGN

Compressor unit is a compact machine for compressed air production in a soundproof body consisting of the following main units, assemblies and parts: air-end; air suction valve; electric motor with fan; heat sink; oil receiver; oil separator unit with a filter and a minimum pressure valve; oil filter; thermostat; air filter; cabinet with electrical equipment and protection devices; control panel with control elements on it, programmable controller and signaling equipment.

General view of the **BK20E-...(BC**) units is shown in Figure 1, of the **BK20E-...500(BC**) units – in Figure 2, **BK20E-...-500D(BC)** – in Figure 3; connecting and installation dimensions of the units are shown in Appendix A; The functional scheme is shown in Figure 4; electrical schematic diagram - in Appendix B.

1 - Air-end is designed to produce compressed air (see figure 1). In the body of the air-end the following elements are located: screw group, air and oil passages, connecting flanges.

2 - Air suction valve (see figure 1) is designed to provide the compression chamber with air and prevent outward emission of compressed air and oil at the moment of the unit shutdown at any compressed air delivery pressure. The electromagnetic valve switches air suction valve to the "LOAD" or "IDLING" mode the electromagnetic valve is operated by the programmed controller activated by the signal of the pressure gauge.

When peak working pressure is reached, the valve opens releasing the air sucked in by the unit. The unit continues operation in idle mode in the absence of air consumption, which facilitates the transition to the "LOAD" mode with the corresponding pressure gauge signal.

3 – Electric motor (see figure 1) is designed to drive the air-end.

4 - Air-oil heat sink (see figure 1) is a two-section, compound device, performs the functions of cooling the oil and pre-cooling the air at the outlet of the unit. The heat sink is cooled by the air flowing through it, which is pumped by a fan mounted on the second end of the drive shaft of the unit drive motor of the unit.

5 – **Oil receiver** (see figure 1) performs the following functions:

- serves as a reservoir for lubricant with an oil filler, an oil drain valve, an oil level sight glass, a safety valve;

- serves as a body, on which the filter unit is assembled, consisting of an oil separator filter, an oil filter, a thermostat, a minimum pressure valve.

The oil filler is mounted on the body of the oil receiver and covered with the collar stopper. The oil level is controlled with the oil level sight glass placed under the filler. The oil level of the disconnected (cold) unit must be always higher than the bottom line of the oil level sight glass.

The oil drain valve is at the bottom of the oil receiver body and is designed to drain oil during its replacement. The oil drain valve also allows to regularly control the condensed moisture content in the oil and to eliminate it.

ATTENTION: THE CORK CAN BE REMOVED AND THE OIL CAN BE DRAINED ONLY IN CASE THERE IS NO EXCESS PRESSURE IN THE OIL RECEIVER BODY OF THE DISCONNECTED UNIT.

6 – **Pneumatic** safety valve (see figure 2 or 3) protects the oil receiver body and air receiver body from overpressure for one of the following reasons: "clogging" of the oil separator filter; malfunction of the suction or minimum pressure valves; malfunction of the pressure gauge, etc.

7 - **Minimum pressure valve** (see figure 1), mounted in the delivery line is designed for maintaining minimum pressure inside the unit within the range from 0.2...0.4 MPa until the supply network pressure is equal to the pressure inside the unit. At the same time this valve functions as a retention valve, blocking the unit from the supply network at the time of shutdown or idle running.

8-Thermostat (see figure 1) consists of a latch plunger and a thermal sensing glycerin element changing the direction of oil flow depending on the temperature and is mounted in a body with installed oil filter.

When the oil working temperature is higher than 71 °C, the thermal sensing element rod reaches out, it activates the latch plunger opening letting oil delivery into the heat sink. Maintenance of the minimum temperature of the charged oil is the main function of the thermostat, it helps to avoid condensate formation in the oil at the expense of moisture contained in the inlet air, which could lead to failure of air end bearings lubrication and its blocking.

9-Integral oil filter (see figure 1) is made in metal body. It is placed in the lubrication circuit and prevents solid particles from getting to the working surface of screws and bearings. Its replacement is required after

operating for the amount of hours, specified in the "Maintenance" section, and frequency of replacement directly depends on air filter technical maintenance and on the quality of the oil used.

10 - Open type air filter (see figure 1). The function of the air filter is to prevent the contaminants from getting into the area of the screw set and the lubrication system. Poor maintenance of the air filter leads to reduction of a air-end service life.

11 - Oil separator (separator) (see figure 1) completes separation of oil from the compressed air and ensures that the residual oil content in the compressed air is below 3 mg/m³. The capacity of the oil separator depends on the oil quality and its operating temperature.

12 - Oil return visualizer (see figure 1) is designed for the visual assessment of the amount of oil returning from the oil separator filter. The oil separated by the oil separator returns to the lubrication system of the unit. The visualizer makes it possible to check the effectiveness of oil-separating filter and separation system functioning.

13 – Control panel (see figure 1, 5). The following control elements, instrumentation and signaling equipment (see Figure 5) are place on the front side of the door of the electric cabinet:

1 – **electric controller** is designed to control the compressor unit operation (user manual for controller is provided in Appendix B);

2 -local switch is designed for connection of the compressor unit to the power grid and for its emergency shutdown;

3 - manometer is a device of direct action designed to monitor the air pressure at the output of the compressor unit and absence of excess pressure in the network when the compressor is powered off.

14 – Cabinet with electrical equipment (see figure 1) is a closed box with an installed board, on which the start-control equipment and protection devices are mounted.

ATTENTION: OPEN THE CABINET ONLY AFTER DISCONNECTING THE UNIT FROM THE ELECTRIC POWER SUPPLY.

15 - Air receiver (see figure 2 or 3) is designed to collect compressed air, eliminate pressure pulsations, preliminarily separate condensate and oil. The receiver is also the body on which the units of the compressor are mounted.

16 – Soundproof body (see figure 1) is designed to reduce noise in the working area.

17 – Condensate drain (see figure 2 or 3) is designed to remove condensate and oil accumulated in the receiver.

18 – Dehydrator (see figure 3) is designed to separate moisture contained in compressed air.

19 – **Frequency inverter** (see figure 1) is designed to reduce electricity consumption by changing the speed of the electric motor when the consumption of compressed air changes.

Description, functional scheme, operating procedure, maintenance and repair of the dehydrator are set forth in the operation and maintenance manual of the dehydrator.

ATTENTION: REMOVAL OF CONDENSATE AND OIL FROM THE RECEIVER IS PERMITTED ONLY IF THERE IS NO PRESSURE INSIDE THE RECEIVER AND THE UNIT IS SWITCHED OFF.

5.2 Protective devices of the compressor unit.

The compressor unit is equipped with the following protective devices which control its most important units and indicate eventual malfunctions:

1) Safety valve is installed on the air receiver;

2) Safety valve is installed on the oil receiver;

3) Circuit breaker provides protection of power circuits against short circuit;

4) Fuses provide protection of control circuits and alarming systems;

5) Voltage control block provide protection against incorrect phase rotation;

6) Thermal overload protection relay;

7) Programmable controller monitors the temperature of the oil-air mixture (between +5°C and +100°C), compressed air pressure and 4, 5, 6 protection operation.

If 3, 4, ..., 7 protection operation is activated, the compressor unit with the switching block switches off until the cause of the trip is eliminated. Blocking of self-start is possible in the event of voltage recovery after it has been switched off.







Figure 5

ATTENTION: IN CASE OF ANY EMERGENCY SIGNAL (SAFETY DEVICE TRIPPING) THE COMPRESSOR UNIT IS SWITCHED OFF.

TO RESTART THE UNIT ESTABLICH THE CAUSE OF SHUTDOWN CHECKING THE FOLLOW-ING:

1) IN CASE OF THE "SUPPLY NETWORK MALFUNCTION" SIGNAL CHECK:

- AVAILABILITY, VALUE AND ALTERNATION OF THREE PHASES OF POWER SUPPLY;

- SWITCH ON THE UNIT.

2) ACTIVATION OF ELECTRIC MOTOR PROTECTION:

- WAIT FOR AUTOMATIC SHUTDOWN OF THE HEAT PROTECTION;

- PRESS THE "RESET" BUTTON ON THE CONTROLLER;

- SWITCH ON THE UNIT;

3) ACTIVATION OF THE HEAT PROTECTION DEVICE. CHECK THE FOLLOWING:

- OIL LEVEL AND QUALITY;

- HEAT SINK CLEARANCE;

- TEMPERATURE OF THE ENVIRONMENT;

- CONTAMINATION OF THE FILTER;

- IN CASE OF TEMPERATURE DECREASE TO 97 °C PRESS THE "RESET" BUTTON, SWITCH ON THE UNIT.

4) ACTIVATION OF COMPRESSED AIR PRESSURE PROTECTION: CHECK THE PRESSURE IN THE CONSUMER NETWORK, REDUCE TO THE REQUIRED LEVEL.

In case all requirements are met: If the protection is activated again, contact the service company, the seller or the manufacturer.

Direction of the air-end shaft rotation is monitored (indicated by the arrow on the body of the air-end and electric motor) by a specialist directly during installation and startup of the unit. Voltage relay blocks the unit switching on in cases of improper phase connection or operation in the network with an unacceptable voltage, no earthing of the unit.

5.3 OPERATION PRINCIPLES

The air sucked from atmosphere passes through the air filter, sucking valve and reaches the screw pair where it is mixed with oil and compressed. Air-oil mixture under pressure is delivered to the oil receiver where the first rough separation takes place. Oil being heavier fraction is partially settled down and settles out to a lower part of the oil receiver body.

Then the mixture is delivered to the oil separating filter where the mixture is finally separated to air and oil.

The settled oil moves through the oil line to the heat sink where it is cooled down, filtered by the oil filter and then returns to the screw pair zone (see figure 4). The function of the oil is to cool down the product of compression, lubricate the bearings and seal the screw seats.

The air cleaned from remaining particles of oil is cooled going through the heat sink air circuit (see figure 4), and is delivered to the compressor outlet at low temperature and with insignificant level of remaining water and oil particles.

6 SAFETY PRECAUTIONS

6.1 Installation and start-up of the compressor unit must be carried out by qualified personnel with corresponding permit to provide maintenance of electric equipment of up to 1,000 V, as well as pressure vessel maintenance. Maintenance can be provided by people who have duly studied this manual, who are familiar with the compressor unit design and operation procedures, and who have been instructed on safety precautions and know how to apply first aid.

6.2 Avoid exposure of the unit to precipitation.

6.3 The premises where the compressor unit is installed must be provided with proper ventilation (airing); besides, ambient temperature should be maintained in the range of $+5^{\circ}$ C to $+40^{\circ}$ C. Switching the unit on at the temperature below $+5^{\circ}$ C is blocked.

6.4 The air sucked in by the compressor unit should not contain dust with abrasive or reactive particles, vapors of any kind, explosive and flammable gases, dispersed oil, solvents or dyes, and toxic smokes of any kind.

6.5 The unit is designed to compress the atmospheric air; compression of any other gas is prohibited.

6.6 Compressed air produced by the compressor unit without any subsequent special filtering cannot be used for pharmaceutical, food or sanitary purposes.

6.7 Use of compressed air for various purposes shall be followed by awareness and compliance of the regulations stipulated in each particular case.

6.8 When the compressor unit is connected to a distribution line or any actuating device, pneumatic fittings and pipelines of appropriate sizes and specifications (internal diameter, pressure, and temperature) must be used.

6.9 Compressed air is an energy flow and is therefore potentially dangerous. Pipelines containing compressed air must be in good condition and properly connected. Before installing flexible pipes under pressure, it must be ensured that their endings are firmly secured.

6.10 To transfer the unit (completely disconnected), use only the recommended tools.

6.11 Prior to operation check the following:

- proper connection to the mains supply and earthing;

- integrity and good running order of the safety valve and all controls and alarms.

6.12 For technical inspection, use this manual, "Rules for Design and Safe Operation of Pressure Vessels" (IEC 60204), "Safety of Machinery. Electrical Equipment of Machines".

6.13 Upon completion of any repairs, all blocks and parts must be put back to their proper positions with observation of the safety measures as in case of the first compressor switching.

6.14 Any handling operation must be performed in conformity with the transportation marking on the package.

6.15 Used oil and condensate should be disposed of in compliance with the relevant regulations because these materials contaminate the environment.

6.16 During operation of the compressor, follow the regulations for fire safety.

6.17 If the operating conditions and maintenance instructions given in this manual are observed, there is no danger of oil deposit formation in the unit.

DO NOT:

- START OPERATION OF THE COMPRESSOR UNIT WITHOUT GETTING FAMILIAR WITH THIS MANUAL;

- OPERATE THE DEFECTIVE UNIT OR VIOLATE WORKING CONDITIONS AND MODES SPEC-IFIED IN THIS MANUAL;

- OPERATE THE COMPRESSOR UNIT WITHOUT EARTHING IN ACCORDANCE WITH THE TECHNICAL REGULATIONS;

- OPERTE THE UNIT WITH DEFECTIVE OR DISCONNECTED PROTECTION DEVICES;

- MAKE ANY CHANGES OR MODIFICATIONS IN THE ELECTRICAL OR PNEUMATIC CIR-CUITS OF THE COMPRESSOR UNIT OR THEIR ADJUSTMENTS. IN PARTICULAR, DO NOT CHANGE THE VALUE AND SETTING OF THE MAXIMUM COMPRESSED AIR PRESSURE IN THE SAFETY VALVE;

- SWITCH ON THE COMPRESSOR UNIT WITH BODY PANELS REMOVED;

- DURING ANY TECHNICAL MAINTENANCE OPERATIONS, TOUCH EXTREMELY HEATED PARTS (COMPRESSOR PANELS, HEAT SINK, PARTS OF THE DISCHARGING AIR-LINE AND OIL-LINE, COOLING FINS OF ELECTRIC MOTOR) IMMEDIATELY AFTER SHUTTING DOWN THE COM-PRESSOR UNIT;

- TOUCH THE COMPRESSOR UNIT WITH WET HANDS;

- POINT THE COMPRESSED AIR STEAM TO PEOPLE NEARBY;

- ALLOW UNAUTHORISED PERSONS TO THE WORKING AREA;

- STORE KEROSENE, GASOLINE AND ANY OTHER HIGHLY FLAMMABLE SUBSTANCES AND LIQUIDS WHERE THE UNIT IS SET UP;

- LEAVE INACTIVE UNIT PLUGGED IN AND UNATTENDED FOR A LONG TIME;

- MAKE REPAIRS OF THE COMPRESSOR UNIT CONNECTED TO THE POWER SUPPLY OR WITH PRESSURE IN THE RECEIVER;

- TRANSPORT THE UNIT UNDER PRESSURE;

- IMPLEMENT MECHANICAL TREATMENT OR WELDING OF THE RECEIVER. IN CASE OF DEFECTS OR UNACCEPTABLE CORROSION EXTRAORDINARY TECHNICAL SURVEY OR COM-PLETE RECEIVER REPLACEMENT IS REQUIRED AS SOON AS IT IS SUBJECT TO SPECIAL SECU-RITY STANDARDS;

- OPERATE THE COMPRESSOR UNIT WITHOUT SCHEDULED TECHNICAL MAINTENANCE.

ATTENTION! APPLIED MARKING MEANS THE FOLLOWING:

- Danger! Electric shock risk

- Danger! Under pressure

- Maintenance staff shall read the respecting instructions
- Do not open the valve until the air hose is connected
- The equipment has remote control and can be started without warning
- Start-stop device

7 OPERATING INSTRUCTIONS

7.1 START-UP

7.1.1 General instructions

- To place the unit correctly, please see Appendix A (Overall and Mounting Dimensions of the Compressor Unit).

- Remove the compressor unit from the pallet and packing, make sure there are no damages or obvious defects. If this is not the case, contact the Supplier immediately.

- Check the availability of the operating manual and filling of its corresponding sections, the presence of the date of sale and stamp of the Seller.

- Remove the side walls.

- Make sure there is no oil leakage.

- Check oil level through the oil sight glass.

It is recommended to acquire the type of oil used in the compressor unit for further refilling or replacement as well as the spare parts indispensable for servicing and maintenance, such as oil filter, air filter cartridge, oil separating filter, set of belts.

7.1.2 Location and installation

Handling of the compressor unit should be performed by a forklift loader with the forks at least 900 mm long or a trolley with lifting platform.

There is no need to provide a special basement or foundation. It will be sufficient to locate the compressor unit on a flat horizontal floor. It is recommended to install four standard rubber steel mounts under the receiver supports.

The distance from the end points of the unit to walls or other equipment shall be at least 1 m, to the ceiling - at least 2 m (in the absence of an exhaust duct or a fan).

The area with the compressor unit should be spacious enough, well ventilated and protected from any atmospheric exposure. The floor should be free from a dust-generating layer.

The compressor unit consumes a considerable volume of air, which is also necessary for its internal ventilation; therefore the presence of dust in the premises will eventually lead to deterioration of its normal functional capabilities. A portion of dust will be sucked in through the air filter causing its fast clogging, and the other portion of dust will settle down on various blocks and surfaces such as the air/oil heat sink impeding the heat exchange. Therefore, room cleaning is regarded as one of the factors to ensure proper operation of the equipment making it possible to reduce the relevant costs.

IF AIR IS CONTAMINATED BY FRACTIONS OF ORGANIC OR MINERAL DUST, OR CORRO-SIVE CHEMICALS, IT IS NECESSARY TO PROVIDE CLEAN AIR SUPPLY TO THE UNIT THROUGH THE SUPPLY-EXHAUST VENTILATION.

To facilitate access to the compressor unit during maintenance and to provide sufficient air exchange, there must be enough space around the unit.

It is important to have enough space near the floor and the ceiling in the premises to ensure natural ventilation. If it is impossible, an exhaust fan shall be foreseen to guarantee the necessary air exchange.

After the selection of an installation place, make sure that:

- the unit is placed strictly horizontally;
- there is maintenance access to the unit;
- the unit is grounded;
- the consumer's pneumatic circuit is sealed.

7.1.3 Ambient temperature

For normal operation of the compressor unit, it is essential that the ambient temperature should not drop below $+5^{\circ}$ C and above $+40^{\circ}$ C. Operation at lower temperatures leads to oil condensation, changing its lubricating properties, which reduces the service life of the screw set and increases the risk of its failure.

Operation of the equipment at temperatures above maximum will not provide normal heat exchange and oil cooling in the system. As a result, operational temperature will increase which may trigger the thermal protection device and shut down the compressor unit. The operating temperature is determined on the operating unit and displayed on the controller's liquid crystal display.

ATTENTION: THE EQUIPMENT HAS A REMOTE CONTROL AND MAY START AUTOMATI-CALLY.

7.1.4 Power supply

For the correct connection of the unit, please see Appendix B (Basic Electrical Circuit Diagram for the Compressor Unit).

The permissible network voltage fluctuations must correspond to the data specified in this operating manual.

The power supply line shall meet all safety standards and its wire cross-section shall correspond to the power consumption parameters. All electrical connections shall be supervised by a technician.

The data on the wire cross-section of the supply cable are given in Table 4.

Table 4

The recommended wire cross-section of	ВК20Е
the supply cable (a copper strand no more than 10 m long) shall be minimum, mm ² :	6,0

The connection of the compressor unit to the power line shall be fixed. During repair, preventive and other works, the compressor unit shall be disconnected from the electrical and pneumatic circuit.

The protective conductor shall be connected to the **PE** terminal according to IEC 60204-1. The unit must be grounded.

The electrical grounding of the unit shall be carried out with the following wires (see table 5):

Table 5

Minimum cross-section of the outer cop-	ВК20Е
per protective wire, mm ² :	6,0

Inclusion of a short-circuit protection device in the network line (up to the unit) is mandatory, in accordance with IEC 60204-1, for instance, a circuit breaker (see table 6).

Table 6

Automatic circuit breaker	ВК20Е
	C(D, K)50A

7.1.5 Piping

The diameter of the supply pipelines shall be equal to that of the outlet. At the point of supply, a valve shall be installed by connecting it to the unit using a triple nozzle and a hose, so as to disconnect the unit from the pipeline network for the purpose of repair or maintenance.

A receiver (air collector) with a volume (m^3) of at least 30% of the unit capacity (m^3/min) shall be installed between the unit (a model with no receiver) and the compressed air consumer.

ATTENTION: DO NOT TURN ON THE UNIT WITHOUT THE RECEIVER OR IF THE RECEIVER VOLUME (PNEUMATIC CIRCUIT) (m3) IS LESS THAN 30% OF THE UNIT CAPACITY (m3/min), IF THERE IS A CLOSED ISOLATION VALVE BETWEEN THE UNIT AND THE RECEIVER.

7.1.6 Recycling of the released calorific energy

It is recommended to install systems of calorific energy transfer (retracting of hot ventilation air) to further use it for heating of the premises or some other purposes.

It is important that the cross section of the receiver taking heat is larger than the dimensions of the radiator operating area, it is also necessary to supply the equipment with a forced suction system (fan) to ensure a continuous flow.

At the time of heat receiver installation, make sure the radiator guards are easily removed for maintenance. All installation and start-up operations must be carried out by the specialist responsible for the unit service.

7.2 OPERATION PROCEDURE

7.2.1 Initial run

The unit is connected to the supply voltage network by fixing the input switch in the "**I**" position. The controller will display the air pressure and temperature parameters of the screw set. To start the unit it is necessary to push a "START" button on the controller. If the unit is not activated upon pushing the "START" button, follow the trouble-shooting guides.

At the initial run and after long breaks, it is necessary to allow the unit to run for several minutes with a fully open air valve at the outlet and the air consumers switched off, i.e. at no load.

ATTENTION: PRIOR TO THE INITIAL RUN IT IS NECESSARY:

- TO EXAMINE ALLTHE SYSTEMS AND ASSEMBLY UNITS OF THE COMPRESSOR;

- TO ENSURE BY A QUICK (1...2 SECONDS) SWITCHING ON, THAT THE DIRECTION OF THE AIR-END SHAFT ROTATION CORRESPONDS TO THE DIRECTION SPECIFIED BY THE ARROW LINE ON THE CASE OF THE AIR-END, AND THE DIRECTION OF THE AIR FLOW FROM THE COOLER MUST BE OUTSIDE (UP). IF THE DIRECTION OF THE AIR-END SHAFT ROTATION IS WRONG, IT IS NECESSARY TO READJUST PHASING OF THE FEEDING CABLES IN THE PLACE OF CONNECTION TO THE POWER SUPPLY;

- IT IS NECESSARY THAT THE VENTILATION FUNCTIONS ACCORDING TO TECHNICAL SPECIFICATIONS;

- ALL THE PANELS OF THE UNIT MUST BE FIRMLY FIXED.

7.2.2 Control and monitoring during operation

At the pre-set maximum pressure value, the controller sends a control signal to switch over the control valve and to open the solenoid release valve, and the unit automatically switches over to the free-run mode of operation. At the same time, the sucking valve is closed and the compressor is discharged. When pressure drops down to the pre-set minimum value, the controller sends a control signal to close the solenoid release valve and to open the sucking valve, the pressure increases, and so forth.

Apart from operation of the compressor unit in the free-run and charge modes, its transition to the "STAND-BY" mode has been foreseen – temporary shutdown of the unit in case of termination of the compressed air consumption. "Stand-by" mode is activated only if the compressor runs free for over 5 minutes. The compressor remains in that state until pressure drops down below the minimum pre-set value ($P_{Max} - 0.2$ MPa). Then the unit starts automatically and the cycle repeats itself.

The restart is performed by pressing the "START" button.

The unit is switched off manually:

- by pressing the "STOP" button;

ATTENTION: AFTER PRESSING THE "STOP" BUTTON, THE UNIT SWITCHES TO THE "FREE-RUN" MODE AND TURNS OFF AUTOMATICALLY AFTER SOME TIME (20 SEC). THE UNIT CAN BE DISCONNECTED FROM THE NETWORK BY THE MAIN SWITCH ONLY IF THE ELECTRIC MOTOR IS OFF.

- restart of the unit is allowed not earlier than in 2 minutes after the motor switch-off.

Disconnection from the electrical network is made after the motor has been switched off by fixing the main switch in the "0" position.

8 TECHNICAL MAINTENANCE (TM)

8.1 Proper maintenance is one of key factors to secure the unit's long-term service.

Technical maintenance consists in permanent monitoring of the unit's devices operation, checking the equipment performance, cleaning, etc.

Technical maintenance of the compressor unit includes:

- daily shift maintenance (SM);

- scheduled technical maintenance carried out every 500 running hours (TM).

The list and frequency of maintenance works for the compressor unit are given in Table 7.

ATTENTION! TECHNICAL MAINTENANCE SHALL BE CARRIED OUT BY SKILLED AND TRAINED PERSONNEL ONLY.

ATTENTION! THE FIRST REPLACEMENT OF OIL AND OIL FILTER SHALL BE CARRIED OUT AFTER 500 RUNNING HOURS (RUNNING-IN). IF THE UNIT HAS NOT BEEN IN OPERATION, REPLACE THE ITEMS IN A YEAR'S TIME FROM THE PRODUCTION DATE.

Table	7 - I	ist a	and f	requenc	v of	maintenance	works	for the	compresso	r unit
1 4010	/ 1	JISU	and n	requeite	y OI	mannenance	, works	ior the	compresso	i unit

Procedure		Ma	intenance	frequency	y	
	daily	500	2 000	4 000	8 000	20 000
	(SM)	run-	running	runni	runni	running
		ning	hours	ng	ng	hours
		hours	(at least	hours	hours	(at
			twice a	(at	(at	least
			year)	least	least	once
				once	every	every
				а	other	five
				year)	year)	years)
- Exterior check for mechanical damages, abnormal noises	+	+	+	+	+	+
and slaps, oil leakage. If required, take measures;						
- Check the oil level. If required, fill up;						
- Check the values and performance of the units and						
equipment;						
- Check the air-tightness of joints. If required, tighten up;						
- Check the oil separation in the oil return visualizer.						
- Check the heat sink state. If required, clear up (blow with	—	+	+	+	+	+
compressed air);						
- Check the oil cleanliness (dense darkening or turbidity). If						
required, replace;						
- Maintenance of the electric equipment, feeder cable and						
clamp connections.						
- Replace the air filter;	-	-	+	+	+	+
- Check the tension of belts. If necessary, adjust.						
- Replace the oil*;	-	-	-	+	+	+
- Replace the oil filter*;						
- Replace the filter (oil separator);						
- Check the safety valves. If necessary, replace;						
- Check the receiver.						
- Replace the belts;	—	-	—	—	+	-
- Replace the repair kit of the intake valve;						
- Replace the repair kit of the minimum pressure valve;						
- Replace the repair kit of the thermostatic regulator;						
- Replace the repair kit of the air-end seals.		1				

Table 7 – List and frequency of maintenance works for the compressor unit: page 2

			-			
- Replace the repair kit of the air-end;	Ι	_	-	_	-	+
- Replace the repair kit of the electric motor bearings.						
Notes:						

1 The procedures listed for longer periods also include those for shorter periods.

2 *The first oil and oil filter replacement is to be carried out after 500 running hours, follow-up replace-

ments in 400 hours, but not less than once a year.

ATTENTION! AFTER THE FIRST 50 RUNNING HOURS, PROCEDE WITH AN OVERALL CHECK OF THE UNIT: OIL LEVEL, HEAT SINK AND AIR FILTER CONDITION, FIRM MOUNTING OF UNITS AND DEVICES, BELT TENSION, ELECTRIC CONNECTIONS AND EQUIPMENT.

8.2 Daily shift maintenance (SM)

8.2.1 Execute the procedures listed in Table 7 for SM.

8.2.2 After switching off the unit:

- relieve excess pressure in the receiver or the air line;

- drain condensate from the receiver and the filter dryer;

- inspect the unit, make sure there are no oil leaks from the joints. If necessary, fix the leak.

8.3 Scheduled technical maintenance TM (carried out every 500 running hours)

ATTENTION! IN CASE OF INTERVENTION (TM OR PLANNED REPAIR), SWITCH OFF THE UNIT POWER SUPPLY, BLOCK THE AIR NETWORK WITH THE VALVE, ELIMINATE THE RISK OF UNAUTHORIZED START OF THE UNIT.

Before TM, make sure that:

- the unit is disconnected from the electrical network;

- the unit and the receiver are unloaded.

During technical maintenance, pay attention to possible oil leaks and crud build-up caused by dust and oil. If necessary, clean.

8.3.1 To replace the oil:

- remove the right panel of the unit;

- start the unit to heat the oil up to more than 70 °C (the radiator will heat the entire surface evenly);

- switch the unit off;

- wait minimum 5 minutes, then unscrew the plug and slowly open the oil drain valve, allowing the oil to drain into a prepared container;

- turn the pulley of the air-end (3 to 5 turns) in the direction indicated by the arrow on the face of the air-end;

- dismantle the oil filter;

- install a new filter (before installing the filter, fill it with a little oil to soak the filter element, lubricate the filter ring seal with oil used to refill the compressor unit);

- dismantle the filter-separator;

- install a new oil separator, pre-lubricating the filter ring seal with oil used to refill the compressor unit;

- close the valve and fill the oil through the oil filler neck to the top of the sight glass – oil indicator, screw the stopper up tight;

- start the unit and let it heat up to more than 70°C; switch it off and check the oil level, when the foam disappears; if required, fill up;

- put the panel back.

ATTENTION: HIGH QUALITY OIL FOR ROTARY-SCREW COMPRESSORS SHALL BE USED – VISCOSITY 46 CS AT 40 °C, POUR POINT – FROM MINUS 8 TO 10 °C, FLAMMABILITY POINT ABOVE 200 °C.

NOTICE: DO NOT MIX OILS OF DIFFERENT BRANDS. OIL APPLICATION GUIDELINES ARE GIVEN IN CHAPTER 3 OF THIS MANUAL.

ATTENTION: IN AREAS WITH DUSTY CONDITIONS FREQUENT MAINTENANCE SHALL BE FORESEEN. IN PARTICULAR, REPLACE AIR FILTER AND CLEAN UP HEAT SINK MORE FREQUENTLY.

8.3.2 De-oiling valve

The de-oiling valve is located at the bottom of the oil sump and is designed to replace the oil at maintenance intervals. The de-oiling valve is used to drain condensate (if necessary). All operations and actions with this valve shall be carried out in the absence of pressure inside the oil sump with the unit switched off.

8.3.3 Oil filler hole

The oil filler hole is located directly on the oil sump and is closed by a special stopper (see Figure 6). Access to the oil filler hole is only allowed, if there is no excess pressure inside the unit.



Figure 6

8.3.4 Oil level

The oil level is controlled visually (see Figure 7). The maximum oil level is the lower section of the filler neck, the minimum is the middle of the sight glass (on a cold unit).



8.3.5 Belt tension

Power transmission is achieved due to frictional forces at the place of contact of belts and pulleys. For normal operation, it is necessary to comply with the conditions of cleanliness of the contacting surfaces and ensure the required belt tension force.

Check the belt tension immediately after installation and periodically during the work of the device, in particular after work breaks for a week or more. Belt tension check is carried out by measuring free frequency or by a dynamometric method. Data for V-belt tension control are given in Table 8.

After belt replacement, belt tension control during 3-5 hours is necessary, since intensive belt stretching can lead to creeping and failure.

Belt tension is adjusted correctly if, when applying force f, the deflection h of the belt loop is 6 to 6.5 mm (see table 8, figure 8). To adjust the tension, remove the front panel, loosen the nuts and bolts in pos. 1 and pos. 2, fastening the moving plate, then adjust the tension by means of uniform rotation in pos. 3. Tighten the nuts and bolts in pos. 1 and pos. 2. Replace the front panel.

Table 8 – Data for V-belt tension control.

Belt tension contr	rol by measuring t	he natural frequency	Belt tension control by a dynamometric method		
Model	Estimated cen- ter-to-center distance, mm	Предварительное натяжение ветви одного ремня, Н	Deflection of a belt loop h, mm	Force for a new belt f, N	Force for a run- in belt f, N
BK20E-8(10)	412430	320335	60 65	28 20	22 22
BK20E-15	438442	370	0,00,3	2029	2223



Figure 8

8.3.7 Checking the safety valve on the receiver (air tank)

The safety valve, spring type (see Figure 9) is factory-adjusted, has a preset opening pressure and sealed. Its opening, adjustment during operation is prohibited and impossible without disrupting the integrity of the valve body. The seal of the valve seat is made of heat-resistant rubber. During operation, functional tests are foreseen to check the safety valve. Checking the valve (pressure relief) is possible with a pressure in the receiver $\geq 85\%$ of the opening pressure. There is a manual pressure relief device on the relief valve – the ring, located in the upper part of the valve. The test procedure is as follows: after the above-mentioned pressure is reached in the receiver, pull the ring along the valve axis, until it opens (trigger the pressure relief) and release (stop the pressure relief). If there is a leak in the valve seat, the valve shall be replaced.



- 1 Valve
- 2 Ring

Figure 9 - Spring-type safety valve

Note – If your receiver is equipped with a safety valve without a device for manual testing of unloading (pressure relief), the valve shall be removed for the purposes of control (on the unloaded receiver with the compressor off). An annual test bench of the operability is mandatory.

8.4 For the list of spare parts used for maintenance, please see Table 9.

Table 9 – List of spare parts used for maintenance

Code	Name	Applicability			
4052407003	Oil filter, pcs.	1			
4092100100	Air filter, pcs.	1			
4060200300	Filter-separator, pcs.	1			
4083200204	Filter dryer cartridge (filter element 14050 P), pcs *	1			
See p.3.5	Oil, kg (l)	8,1 (9,0)			
See p.3.3	Belts, pcs.	2			
Note – * For D-type models.					

9 TRANSPORTATION ANS STORAGE

9.1 Transportation

The compressor unit shall be transported at temperatures ranging from -25 to $+55^{\circ}$ C in a closed vehicle only. The compressor unit in a transport package must be securely fastened to the pallet.

The package of compressor units depends on the shipping conditions and the place of destination.

Prior to the unit transportation, check the weight and dimensions in this manual and lift it with special tools, keeping the pallet as low as to the floor as possible.

In case of the unit transportation using a forklift, the forks shall be placed as wide as possible to avoid falling.

9.2 Storage

The packed compressor units shall be stored in a warehouse, so that they are not affected by the adverse atmospheric conditions.

The compressor unit shall be kept in closed store-rooms at temperatures ranging from - 25 to +55 $^{\circ}$ C and a maximum relative humidity of 80%.

Dust, vapors of acids and alkalis, hostile gases and other adverse substances in the storage area are strictly prohibited.

ATTENTION: IN CASE OF EXTENDED STORAGE OR IF MOISTURE CAN BE CLEARLY SEEN, CHECK THE PACKAGE AND REMOVE THE CONDENSATE.

9.3 Decommissioning

To decommission the unit, follow the instructions:

- 1) Turn off the unit.
- 2) Switch off the power supply and disconnect the unit from the mains.
- 3) Relieve the excess pressure inside the unit and part of the air network connected to the installation. Disconnect the unit from the air network.
- 4) Drain the oil.
- 5) Remove the oil filter and oil separator.
- 6) Drained oil and filters shall be handed over to specialized waste recycling centers.
- 7) Hand over the unit to an authorized recycling company.

ATTENTION: FOR MODELS WITH AN AIR DRYER: THE DRYER CONTAINS A REFRIGERANT AGENT AND OIL IN THE AIRTIGHT CIRCUIT. THEREFORE, THESE PARTS SHALL BE DISMAN-TLED AND DISPOSED OF BY THE AUTORIZED ENTITY (PERSON).

10 POSSIBLE FAULTS AND TROUBLESHOOTING

Table 10		
FAULTS	POSSIBLE CAUSES	TROUBLE-SHOOTING
The compressor unit won't switch on.	- Power supply voltage is absent.	- Check the power supply param- eters in compliance with IEC 60204-1
	- An automatic circuit breaker of the power circuit or fuses in the control and signaling circuit are triggered	- Check the activation of the QS auto-switch or replace the safety fuses FU.
	The supply voltage phase is miss- ing or the fuse in the control cir- cuit has blown.	Check, replace the fuse, if neces- sary.
	The phase alternation is dis- rupted.	Change phasing at the connec- tion point.
	Tripping of the motor drive over- load protection.	Check: -electric motor serviceability; - belt tension; - air temperature in the electrical compartment; - supply network parameters; - operating pressure; - frequency of starting.
	Excess temperature of the screw set (≥ 100 °C)	Check oil level, filters, thermo- stat operation, radiator cleanli- ness.
	- The thermal relay is malad- justed or faulty.	- Check the connection, the ther- mal relay. Replace it, if neces- sary.
	The temperature of the screw set is below the set value (plus $5 \circ C$)	Check the ambient air tempera- ture, heat up the compressor room.
The compressor unit starts with difficulty.	Unsuitable oil due to long use. Excessive belt tension.	Replace the oil and the oil filter. Check the tension of the belts.
No air intake through the air filter.	The air filter is clogged.The intake valve failed to open.	Replace or clean the air filter.Check the intake valve operation parameters.
Increased oil consumption.	Faulty air-oil separation system.Oil leaks.	Check the oil filter-separator and the oil return line. If necessary, replace.
	Increased oil temperature (over 97 °C).	Ensure adequate ventilation of the room and normal air intake.
The safety valve releases air.	- The safety valve is defective.	- Replace the valve.
	-Wrong pressure setting.	- Adjust (check with the manufacturer). P_{Max} - according to the manual.
	- Defective discharge valve.	- Replace the valve.

11 PRECIOUS METAL CONTENT

11.1 The content of Ag-CdO silver alloy (90% -10%) and non-ferrous metals in the compressor plant is indicated in Table 11.

Table 11

Compressor unit model	Alloy silver, g
BK20E-8(10; 15)-500 (D)	6,4
BK20E-8(10; 15)-500 (D) BC	0,95

12 MANUFACTURER'S WARRANTY

12.1 Unless otherwise specified in the agreement, the guaranteed service life is 12 months from the date of purchase, but no more than 18 months from the date of manufacture. In the absence of the Seller's note of sale, the guaranteed service life is 12 months from the date of manufacture.

The Manufacturer warrants:

• the product compliance with the given specifications, provided the observation of the terms and conditions, the rules of operation, transportation and storage by the Customer.

• free elimination of defects and malfunctions or replacement of components and assembly units, which became out of operation through the fault of the manufacturing plant within the warranty period.

12.2 The Manufacturer's warranty obligations shall cease, if:

• the requirements and operation instructions with regard to the product and the applied equipment provided in the operating manual supplied together with the product were not observed;

• there are mechanical and other damages as a result of violation of the operation, transportation and storage conditions;

• modifications of the electrical and pneumatic control circuits, the structure or design of the product and its parts without prior written consent of the Seller/Supplier;

• faulty original manufacturing plant seals on the equipment parts and evidence of unauthorized access to the settings (control data);

• maintenance was carried out untimely or below the required quality standards; and any notes regarding the operation and maintenance are missing in the operational documentation or a special log;

• not original spare parts and oil have been used, the labelling is absent or damaged;

• the used compressor oil was not recommended by the Manufacturer/Supplier

• there is an evidence of non-authorized dismantling of the equipment assemblies, aimed at finding the cause for malfunction, repair or replacement without a written consent of the Manufacturer/Supplier.

• there is a disparity of the supplying power cable parameters (voltage drop at the supplying cable more than 5% of the nominal value);

12.3 This warranty does not cover:

• wear and tear consumables, which should be replaced within the warranty period according to the maintenance regulations;

• product damages occurred due to unpredictable events, force majeure or third party intervention.

12.4 This warranty does not include:

• maintenance and cleaning of the product, callouts to the product installation site in view of its connection, adjustment, repairs or advising. These services are rendered under a separate agreement;

• warranty servicing package does not include transportation costs.

12.5 For all the issues regarding warranty servicing, replacement and spare parts purchasing, please contact the Seller (Regional Authorized Representative of the Manufacturer).

When contacting the Seller, please specify the model and the factory number of the product, its operating hours, load percentage, the compressor temperature, room temperature, external signs of the malfunction (default), conditions of the emergency switch off, and suspected cause for the default, etc.

12.6 To order warranty repairs, please send to the Manufacturer/Supplier a reclamation report drawn up in the established form and accompanied by a cover letter, providing the following additional information (or copies of documents):

- exact address of the Customer (the Product Owner);
- number of the document, confirming the purchase and obligations of the Seller;
- Certificate of Acceptance and Packaging (attached in this OM);

• information on operation (number of the Act and the date of commissioning, operational hours and total run, records about carried out maintenance and repairs, etc.)

13 CERTIFICATE OF ACCEPTANCE AND PACKAGING

mpressor unit	
rformance 1/	/min,
rking pressure, b	ar.
complete with:	
air-end	Factory number :
electric motor	Factory number ;
oil receiver (oil separator) PM17.17.0	00 Factory number;
heat sink	Factory number;
frequency converter	Factory number;
receiver	Factory number;
air dryer	Factory number;
moisture- and oil-separating filters:	
Filled with: compressor oil of	(brand),
Conforms to the design documentation on	d is acconted for anoration
Comornis to the design documentation, an	u is accepted for operation.
acked by	
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anufacturing date ""	20
Ianufacturing date "" Juality Control	20 place for seal
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EC DECLARATION OF CONFORMITY EG-KONFORMITAETSERKLAERUNG DEKLARACJA ZGODNOŚCI

HEREWITH WE DECLARE, HIERMIT ERKLAEREN WIR, NINIEJSZYM DEKLARUJEMY

Company / Firma / Firma

Joint-Stock Company "REMEZA" 65- Alexander Pushkin str., Rogachev Gomelsky reg., 247672, Republic of Belarus

DECLARE, THAT THE DESIGN AND CONSTRUCTION OF THE DASS DIE KONSTRUKTION UND AUSFUEHRUNG DER DEKLARUJE, ŻE PROJEKT I KONSTRUKCJA

ROTARY SCREW COMPRESSOR UNIT: SCHRAUBENKOMPRESSOR: SPREŻARKI ŚRUBOWEJ:

Тур/ ТҮРЕ/ ТҮР	YEAR OF MANUFAC- TURE/ Baujahr/ Rok produkcji	SERIAL №/ SERIENNUMMER/ NUMER SERYJNY	TECHNICAL DATA/ TECHNISCHE DATEN/ DANE tECHNICZNE	POWER/ LEISTUNG/ Moc	OPERATING PRESSURE/ Be- triebsdruck/ Ciśnienie ro- bocze	AMBIENT TEMPERATURE/ UMGEBUNGS- TEMPERATUR/ Temperatura otoczenia
-	-	-	V / PH / HZ	KW	BAR	°C
						+5+40

COMPLIES WITH THE FOLLOWING REGULATIONS AND STANDARDS KONFORM IST MIT DEN FOLGENDEN EINSCHLAEGIGEN BESTIMMUNGEN JEST ZGODNY Z NASTĘPUJĄCYMI NORMAMI I STANDARDAMI

EC MACHINERY DIRECTIVE: EG-MASCHINENRICHTLINIE: WE DYREKTYWA MASZYNOWA:

EC machine directive (2006/42/EC) EU low-voltage directive (2014/35/EU) EU EMC directive (2014/30/EU)

APPLIED AND HARMONIZED STANDARDS, IN PARTICULAR: ANGEWANDTE UND HARMONISIERTE NORMEN, INSBESONDERE: NORMY ZASTOSOWANE ORAZ ZHARMONIZOWANE: EN 1012-1:2010, EN 60204-1:2018; EN IEC 61000-6-2:2019, EN IEC 61000-6-4:2019, EN IEC 61000-3-2:2019, EN IEC 61000-3-11:2019

AUTHORIZED REPRESENTATIVE FOR COMPILATION OF SPECIAL TECHNICAL CE-DOCUMENTATION: BEVOLLMAECHTIGTER FUR DIE ZUSAMMENSTELLUNG DER SPEZIELLTECHNISCHEN CE-UNTERLAGE: OSOBA UPOWAŻNIONA DO PRZYGOTOWANIA DOKUMENTACJI TECHNICZNEJ

ACI - Air Center International GmbH - Zur Eisenhütte 12 - 46047 Oberhausen - GERMANY - Miroslaw Gruschka

JSC "REMEZA"

Rogachev, ____

(Data/Date/Datum)

(Podpis, Pieczęć/Post, Signature, Name/ Stempel, Unterschrift, Nname)

Appendix A Overall and Mounting Dimensions of the Compressor Unit



Note - * Dimensions are provided for reference.





Note - * Dimensions are provided for reference.





- 1 air intake;
- 2 warm air discharge;
- 3 network cable;
- 4 earthing bolt;
- **5** compressed air outlet from the dryer (G3/4);
- 6 compressed air outlet from the receiver (Air crane k1- G3/4);
- k2 valve for draining condensate from the receiver

Note - * Dimensions are provided for reference.

Figure A.3 – Connection and installation dimensions of compressor units BK20E-...-500D(BC)

Appendix B Basic Electrical Circuit Diagram for the Compressor Unit



Figure B.1 – Basic Electrical Circuit Diagram for Compressor Units BK20E



Figure B.2 – Basic Electrical Circuit Diagram for Compressor Units BK20E BC

Appendix C OPERATING MANUAL FOR AIRMASTER P1 CONTROLLER



1 Technical specifications

A multi-purpose industrial control electronic unit (AirMaster P1 controller) conforms to the IEC standards and is designed to operate air compressors. The controller is produced in aluminum-alloy frame with corrosion-resistant coating and polyethylene keyboard. Protection level is IP65 for frontal elements and IP20 for the others. Operating temperature is from 0 to +55 °C with relative humidity up to 95% (without condensation), storage temperature is from -25 to +75 °C. Inlet and outlet signal commutation is performed through the pin connectors. The controller is powered from the 24VAC \pm 15% power supply with 50...60 Hz frequency, maximum consumption current is 1A, contact socket **X01**. The information display is performed with the help of a 45x25 mm liquid crystal display with accent lighting:



The controller has a long-term memory for operating data store: operating time, counter values and system condition.

Inlet and outlet signal commutation is performed through the jack connections located on the backboard of the controller. **Inputs:** analog – contact socket **X02**, contact points 1 and 2 – to connect the pressure-sensitive detector, contact points 3 and 4 – to connect the temperature detector; digital – contact socket **X03** – input 24VAC to control the condition: emergency stop button, the thermo relay for protection electric motor of the drive and the ventilator, the Phase control relay.

Outputs: contact socket **X04** - R1 - a relay output for operating of the loading solenoid valve (up to 4A reactive loading 24VAC); R2...R4 - relay outputs for operating of: the line contactor, "star" contactor, "triangle" contactor (up to 2A reactive loading 230VAC).

The operation of the controller is performed with the help of the function buttons:



ATTENTION! The controller switches off the compressor when the supply voltage is interrupted (absence of one or more phases) for more than 40 ms, and when the low voltage is detected (less than 19,8 VAC in the controller power-supply circuit).

2 Operation description

When the compressor unit is switched on, the indication of the compressor unit delivery pressure and oil-air mixture temperature in the screw pair appears on the display. There are three operation modes of the compressor which are displayed as the following status symbols:

- () "Standby" mode the motor is on, when the start pressure is achieved, the unit will start operating automatically, there is no pressure increase;
- **IDLE** mode –the motor is on, the operating valve is disconnected, the intake valve is closed, the time register shows countdown in seconds to the changeover of the unit to "Standby" mode or "Loading" mode, there is no pressure increase;
- (Loading" mode the motor is on, the operating valve is under voltage, the intake valve is open and there is pressure increase into the customer system.
 The share of the new of
- To choose other user menus press (up) or \bigtriangledown (down). 23456_H Total operating time of the compressor unit (hours)

IE420LH- Operating time in a "Loading" mode (hours)

 420_{H-} V Operating time left to the maintenance (the time register counts the total operating time).

3 Screen messages

Warning – signal \bigwedge s on constantly, the compressor keeps operating.

Code	Message
A:2050	Setting error in digital input C5 (not used)
A:2060	Setting error in digital input C6 (not used)
A:2118	High pressure, alarm signal when the prescribed limit is exceeded
A:2128	High temperature, alarm signal when the prescribed limit is exceeded
A:2816	Power drop is registered
A:3423	Low oil temperature
A:4804	Time to change air filter is up
A:4814	Oil filter operation time is up
A:4824	Separator filter replace time is up
A:4834	Oil change time is up
A:4844	Maintenance time is up

4 Emergency messages

Warning – the signal inks, the compressor will be stopped.

Code	Error	Actions
E:0010	Emergency shutdown	Emergency stop button is pressed, after the clear- ing of the emergency situation unblock the button.
E:0020	Motor overload	Check: the operability of the electric motor, the adjustment of the thermal relay, belt tension, air temperature in the electrical equipment section.
E:0030	Fan motor overload	Check fan motor operability
E-0040	The absence of one of the	Check the phases, rephase the power cable at the
E.0040	phases or incorrect phasing	connection point
F·0115	Pressure sensor failure	Check the connection, replace the sensor if neces-
E.0115	Tressure sensor failure	sary
E-0119	Pressure exceeds the set alarm	Reduce the pressure in the consumer energy net-
L.0117	limit	work
E-0125	Temperature detector fault	Check the connection, change the detector, if nec-
E.0125	Temperature detector raut	essary.
E-0120	The oil-air temperature is more	Check the oil level, filters, thermostat operation,
15.0129	than 100 °C	radiator pollution
A:3123	The oil temperature is below 3 °C	It is necessary to heat up the ambient air.

5 Programming of the controller parameters

To enter programming mode you should press simultaneously "up" and "down" buttons when the compressor is off. The four signs "0" will appear on the display, the first one will be blinking. Press "up" or "down" to enter the first number of the code. Press "Enter" to go to the second number of the code. When all four numbers are entered and the last one is blinking, press "Enter". If the access code is correct, the first point of the menu will appear on the display. The choice of the parameter is made with the help of "up" and "down" buttons. To change the parameter press "Enter", the parameter value will be blinking. To change the parameter, use "up" and "down" buttons. To confirm press "Enter". To leave programming mode press "Cancel".

There are 2 levels of access to the parameters.

User password 1 - two numbers 0 and two numbers of compressor model: BK5 - 0005; BK15E - 0015 User parameters (password 1)

Code	Parameter	Range	By default	Set
1.Pu	Stop pressure, Bar	1 68	7,0	Upon request
1.PL	Start pressure, Bar	0,8 67,8	6,8	Upon request
1.P-	The choice of pres- sure units on the dis- play	Bar, psi	bar	BAR
1.t-	Temperature	°C, °F	°C	°C

6 Counter reset after the maintenance

To reset the counter after the maintenance set the corresponding change parameters in the service menu to the original state (password 2):

Code	Parameter	Set
2.AF	Time remaining to change the air filter, hour	2000
2.oF	Time remaining to change the oil filter, hour	4000
2.SE	Time remaining to change the filter separator, hour	4000
2.oc	Time remaining to change oil, hour	4000
2.Sh	Time remaining to the maintenance, hour	500

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Appendix D AirMaster S1 Controller User's Manual

1 Specifications

AirMaster S1 is a multifunctional industrial electronic controller compliant with IEC standards and specially designed for air screw compressors. The controller is equipped with IP65 enclosure for the front panel version and IP20 enclosure for other panels. Power supply: 19,2...28,8)VAC at (50...60) Hz. Maximal consumption: 1A. Operating temperature: 0 to +55°C at relative humidity up to 90% (non-condensing). Storage temperature: -25 to +75°C.

All data are visualized on the backlit LCD.

A red LED and a green LED and control buttons are located on the front panel of the controller. Jack connections are used for input/output switching. The following terminals are located on the rear panel of the controller: **X01** – 24VAC power supply; **X02** – two programmable relay outputs; **X03** – four relay outputs designed for switching alternating current to 8A of active load at 250VAC: R1 - line connector, R2 – star connector, R3 – triangle connector, R4 – load-idle connector; **X04** – eight digital inputs for functional control: C1 – emergency stop; C2 – fan overload; C3 – air filter pressure switch; C4 – phase sequence control; C5,C6,C7 – remote control; C8 – motor overload or frequency converter error; **X05** – three analog inputs: to connect oil-air temperature control at the output from the screw unit at the operating range –10 to +130°C, resolution 1°C and accuracy ± 1°C; compressed air pressure sensor in the consuming circuit at 0 to 16 Bar range, resolution 0,1 Bar and accuracy ± 0,1 Bar; the third input is not used; **X06** – analog output – currency signal 4...20 mA used to control the frequency converter ; **X07**, **X08** – two RS485 terminals.

2 User's Interface

2.1 Keyboard

The small keyboard consists of seven buttons:

Symbol	Buttons	Functions	
I	START	Compressor start	
0	STOP	Compressor shutdown	
	RESET	Reset of errors	
L)	ENTER	Confirmation of selection or changes made	
▼	MINUS/DOWN	Menu scroll down, decrease of values	
A	PLUS/UP	Menu scroll up, increase of values	
C	EXIT	One step back	

2.2 Display

The display is divided into 4 areas (Figure 1).



Fig. 1. Controller Display

Top right: **Indication Field –** four-digit 7-segment code used to visualize circuit air pressure in the normal operating mode or the number of the menu page in the programming mode.

Top left: Error Symbol Field – symbolic visualization of common errors (fault conditions).

Centre: Data Field – the visualization of compressor state.

Bottom: Parameter Field:

- two-digit alphanumeric 14-segment code - parameter;

- four-digit 7-segment code parameter value;
- three-digit alphanumeric 14-segment code parameter unit measure;

Display Working Symbols:

Image: second second

- compressor switched to idle mode at stop pressure or after pressing STOP button. Parameter field: time in seconds to motor shutdown;
- pressure equal or under set minimal value (start pressure);
- pressure equal or under set maximal value (stop pressure);
- Pressure between set stop and start values;
- 🔻 condensate drainage activated; 🅮 automatic reset after reenergizing;
- remote pressure adjustment; remote start / stop;

- operating mode: selected parameter is used for visualization only; in the programming mode: the parameter is blocked (correction blocked)

Error Symbols

 ▲
 - general error;
 ■
 - motor overload or inverter error

 ▲
 emergency stop;
 for compressors equipped with frequency converters;

 ▲
 - no power supply;
 I
 - service required;

 ▲
 - oil overheated;
 - replace air filter.

3 Menu Description

3.1 Principal Menu

When power is supplied to the compressor, all display components and LEDs are switched on for 3 sec. The software version is displayed on the screen for 3 sec, then the controller passes to the operating mode. Current circuit air pressure is visualized in the Indication Field. P00 values are visualized in the Parameter Field for 35 sec, then the oil-air temperature appears on the screen. All values accessible in the Parameter Field (temperature, pressure, operating hours counter) may be selected by UP and DOWN buttons.

3.2 Password-Protected Parameters

Pages over P00 are code-protected. Press UP and DOWN buttons simultaneously, the entry field appears on the screen: **CD:0000** with the first symbol flashing. Use UP and DOWN buttons to insert the first digit of the code and press ENTER. The next symbol starts flashing. Similarly insert the next 3 digits and press ENTER to confirm. Press EXIT to return to the previous symbol of the code. Codes of different levels are used to access various programming pages. If you have entered a wrong code, the unit returns to P00 page.

User's Password – 0 and three digits of the compressor model: BK25 – 0025; BK180 – 0180, BK220 - 0220

Indication Field is flashing in the programming mode. A relevant page number is displayed. Use UP and DOWN buttons to select the page. The first line in the list is visualized on each page of the Parameter Field. Press ENTER to review the whole list on the page. The page number stops flashing, as well as the name of the selected parameter. Press UP and DOWN to review the parameters of the selected page. Press ENTER to change the parameter, the parameter name stops flashing while the value starts flashing. Change the value using UP and DOWN buttons. Press ENTER to save the value; if no changes have been made, press EXIT to save initial values.

Pres EXIT to return one step back. Press EXIT twice to return to P00 operating mode when the page number is flashing. Press RESET button and hold for 2 sec to exit from the programming mode and to return to the operating mode. All unsaved values will be ignored. In this case initial values will be saved.

The flashing Key symbol **•** displayed next to a values shows that this value cannot be changed. It means that such value is a view-only parameter or the compressor is in operating mode when no changes are allowed.

3.3 Menu Structure

3.3.1 P00 User's Menu

The User's menu contains normal operating parameters and data screens. This operating mode is set as default; no codes are required to review the parameters.

	Parameter	Range	Indication
C>	Time Indication		C 13:00
Td	Oil-air temperature, °C		Td 55.5 ℃
Pd	Air pressure, <i>Bar</i>		Pd 4.5 BAR
H1	Total working time, hours	099999	H1 1430
H2	Working time under load, hours	099999	H2 1270
H3	Time to air filter replacement, hours	-99999999	H3 1570
H4	Time to oil filter replacement, hours	1003000	H4 3570
H5	Time to separator replacement, hours	10010000	H5 3570
H6	Time to oil replacement, hours	10010000	H6 3570
H7	Compressor control – time to service, hours	1003000	H7 500
Sr*	Motor rate, <i>RPM</i>	07200	Sr 3000 RPM
Sp*	Motor rate, %	0,0100,0	Sp 100.0 %

* for compressors equipped with frequency converters

3.3.2 P01 Operating Menu

General working parameters that can be changed by the user.

	Parameter	Range		Indication
Pu	Stop pressure, Bar	PL+0,214,0	Pu	8.0 BAR
PL	Start pressure, <i>Bar</i>	5,0…Pu	PL	6.0 BAR
P>	Pressure measuring unit: 0=bar, 1=psi, 2=kPa	02	P>	0
T>	Temperature measuring unit: 0=°C, 1=°F	01	T >	0

3.3.3 P02 Error Log

The error log contains 15 most recent errors in chronological order. The most recent error is placed the first in the list. Code, working hours, time, day, year, month, date are displayed in a successive order. **01.X** message is displayed in the top left corner with the error number before the dot and the value from 1 to 7 after the dot changed together with changing value in the parameter field of the relevant error (value 1 corresponds the error code, 2 – working hours, etc.) Review-only values.

Example: 01: 0010 E <> 12340<>15:34 -3-<>2009<>08<>26

This value, the last fixed error, is an emergency stop and subsequent shutdown after 12340 working hours occurred at 15:34 on Wednesday, August 26, 2009.

4 Error Messages

4.1 Error messages before the compressor shutdown

Error code	e Cause		Remedy		
Digital Input Errors					
Er: 0010 E	Emergency button activated	Reset the emergency button			
Er: 0020 E	Fan overheated	Check the fan			
Er: 0040 E	Wrong phasing. No phase.	Check phases. Check circuit breakers. Adjust power supply phasing.			
Fr: 0080 E	For compressors except BC models: motor overload, electric motor thermal protection activated	Check: e perature	electric motor, thermostat, belt tension, air tem- inside the electric unit casing		
	For BC models: frequency converter er- ror	If the frequency converter error (Fxxx) is displayed, check MICROMASTER440 manual. Press Fn buttor reset the unit or cut off power supply for 2-3 min.			
	Analog In	put Errors	3		
Er: 0115 E	Air pressure sensor failure	Check connection. Never perform continuity test to check the sensor and the controller. Replace the sensor if necessary.			
Er: 0119 E	High air pressure	Lower the circuit pressure			
Er: 0125 E	Oil-air pressure sensor failure	Check connection and the sensor. Replace the sens if necessary.			
Er: 0129 E	High oil-air temperature	Check oil level, filters, thermostat, radiator, sensor			
	Functior	al Errors			
Er: 0821 E	Low resistance at analog or digital input	Check	connection of analog or digital input		
4.2 Signals Bl	ocking Compressor Start-Up				
Er: 3123 R	Low oil temperature	Raise	the ambient temperature		
4.3 Warning S	Signals on Errors or Service Required Witho	ut Compr	essor Shutdown		
Er: 2030 A	Dryer stop*		Check the dryer		
	Air filter clogged		Replace the filter		
Er: 2118 A	High air pressure		Check the circuit, verify that no shutters are installed at the output		
Er: 2128 A	High oil temperature		Check the radiator, ambient temperature, fan, arrange servicing		
Er: 2816 A	Power supply failure during operation		Check power supply		
Er: 4804 A	Time to air filter replacement expired		Replace the air filter cartridge		
Er: 4814 A	Time to oil filter replacement expired		Replace the oil filter		
Er: 4824 A	Time to separator replacement expired		Replace the separator		
Er: 4834 A	Time to oil replacement expired		Replace the oil		
Er: 4844 A	Time to service expired		Arrange servicing		

* - for BK20D, BK25D, BK30D

04.2011

Warranty Certificate

This Warranty Certificate is a liability to perform warranted repairs of the compressor unit

The Warranty Certificate gives the right to free repairs and replacement of parts and assemblies that fail due to the manufacturer's fault during the warranty period.

Dear customer! Please make sure that all the sections in this Warranty Certificate are filled out legibly and without corrections.

Product	
Model	
Factory No.	
Date of sale	
Seller's surname and signature	
Seller's seal	
Warranty period months from the data	ate of sale.
The product has been tested in wor	king modes
in the presence of:(Buyer's signature)	
The product has not been tested due to:	
(Seller's seal and signature)	
At the time of sale or purchase, please adhere to the general requ	irements

For warranty repairs, please provide:

- 1. Warranty Certificate.
- 2. Documents confirming the purchase.
- 3. Acceptance and Packaging Certificate.

If any of the above documents are missing, repair service may be denied to you.

The Manufacturer's warranty obligations shall cease, if:

- 1. The requirements and operation instructions with regard to the compressor and the applied equipment provided in the operating manual supplied together with the product were not observed;
- 2. There are mechanical and other damages as a result of violation of the operation, transportation and storage conditions;
- 3. Changes have been made to the electrical and pneumatic control circuits, the structure or design of the product and its parts without prior written consent of the Seller/Supplier;
- 4. The original manufacturing plant seals on the equipment units are tempered, and there is an evidence of unauthorized access to the settings (control data);
- 5. Maintenance was carried out untimely or below the required quality standards; and any notes regarding the operation and maintenance are missing in the operational documentation or a special log;
- 6. Spare parts and materials, other than specified in operational documentation have been used;
- 7. There is evidence of non-authorized dismantling of the compressor assemblies aimed at finding the cause for malfunction, repair or replacement without a written consent of the Manufacturer/Supplier.
- 8. Violation of the operation modes specified in the operational documentation (operating manual, etc.).
- 9. There is a disparity of the supplying power cable parameters (voltage drop at the supplying cable more than 5% of the nominal value);

The warranty does not cover:

- 10. Wear and tear consumables, which should be replaced within the warranty period according to the maintenance regulations;
- 11. Product damages occurred due to unpredictable events, force majeure or third party intervention.

The warranty does not include:

- 12. Maintenance and cleaning of the product, callouts to the product installation site with a view of its connection, adjustment, repairs or advising. These services are rendered under a separate agreement;
- 13. Warranty servicing package does not include transportation costs.