

Instructions for installation and operation

Catalyst - Converter **BEKOKAT[®] CC-180** **BEKOKAT[®] CC-105**





Dear customer,

Thank you very much for deciding in favour of the BEKOKAT® CC-180 catalyst-converter. Please read these installation- and operating instructions carefully before mounting and starting up the catalyst-converter, and follow our directions. Perfect functioning of the catalyst-converter can only be guaranteed when the provisions and notes stipulated here are strictly adhered to.

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1 Type plate

Manufacturer:	
BEKO TECHNOLOGIES GmbH	
Im Taubental 7	
41468 Neuss, GERMANY	
Phone: +49 2131 988-0	
	
Year of manufacture:	<input type="text"/>
Type:	BEKOKAT® CC-180
Serial number:	<input type="text"/>
Approvals:	<input type="text"/>
Max. permissible pressure PS :	16,0 bar(g) / 232 psi(g)
Min./max. permissible temperature TS:	+195°C / 383°F
Min./max. compressed-air temperature at the INLET:	+5/45°C / 41/113°F
Max. volume flow at the INLET:	180 m ³ /h (ISO 1217) 105.9 scfm
Supply voltage:	460V/3Ph./60Hz/PE
Max. power input:	2,85 kW
Power consumption:	3,95 A
Weight:	180 kg
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2 General advice



Please check, prior to reading the operating instructions, whether or not these instructions correspond to the device.

Read these installation and operating instructions carefully prior to any intervention regarding the BEKOKAT®.

The operating instructions must be accessible at all times at the place of application of the device.

If you have any queries regarding these instructions, please contact BEKO TECHNOLOGIES.



To ensure safe operation, the device must only be operated and maintained in accordance with the indications in the operating instructions. In addition, the national and operational statutory provisions and safety regulations, as well as the accident prevention regulations required for the respective case of application, need to be observed during employment. This applies accordingly when accessories are used.

Non-observance of the installation and operating instructions involves risks for persons and systems.



Operation, system performance tests, installation, setting and service measures must only be carried out by authorised skilled personnel¹.

¹ Authorised skilled personnel are persons who are authorised by the manufacturer, with experience and technical training, who are well-grounded in the respective provisions and laws and capable of carrying out the required works and of identifying and avoiding any risks during the machine transport, installation, operation and maintenance. Qualified and authorised operators are persons who are instructed by the manufacturer regarding the handling of the BEKOKAT device, with experience and technical training, and who are well-grounded in the respective provisions and laws.

3 Safety instructions

3.1 General safety advice



DANGER!

Compressed air!

Risk of serious injury or death through contact with quickly or suddenly escaping compressed air or through bursting plant components.



It is the obligation of the operator to ensure that the connected pressure generator is protected against the exceeding of the maximum operating overpressure and the temperature limits at the BEKOKAT®.

Prior to integrating the BEKOKAT® device into the compressed-air system, make sure that the system is pressureless!

Any installation works or service measures must only be carried out on the pressureless BEKOKAT®. Only use fittings and connecting elements which have been approved for this application. It is imperative to observe the indications of the respective manufacturer.

Depressurise the plant prior to any maintenance or repair!

Check all connections before starting-up the device for the first time and retighten them where required.

For the maximum permissible operating overpressure, please refer to the type plate and to the technical data (see Chapter "Technical Data").

Sudden impact through pressure build-up can cause damage and escape of compressed air.

Avoid a sudden pressure build-up by operating the valves slowly.

Maintenance, inspection and installation works must be carried out by authorised and qualified personnel only. Prior to undertaking any measures on the BEKOKAT®, the qualified personnel shall read up on the device by carefully studying the operating instructions. The operator is responsible for the adherence to these provisions. The respective directives in force apply to the qualification and expertise of the qualified personnel.

Never make structural modifications at the plant!

Use genuine spare parts and accessories only!

The general safety and accident prevention regulations apply!



DANGER!

Supply voltage!

Operation and maintenance of electrically-powered machines and devices must only be undertaken by correspondingly qualified and authorised personnel. Prior to carrying out service measures, no matter which type, the following notes must be considered:

Make sure that no parts of the BEKOKAT® are energised and that the BEKOKAT® cannot be connected with the electric supply mains during service measures.

The power supply must be disconnected from the network prior to opening the device. The device shall be secured against re-activation.



WARNING!

Unauthorised intervention!

Unauthorised interventions may endanger persons or plants and lead to malfunction.

Tampering, modification and abuse of the pressure devices is forbidden.

Operators of the devices need to observe the local and national pressure equipment regulations in the country of installation.



In the event of fire, **do not use water to extinguish it** (neither in the vicinity of the BEKOKAT® nor directed directly at the BEKOKAT®).

3.2 Special advice for plants under pressure in accordance with the 97/23/EC Pressure Equipment Directive

The proper use of the BEKOKAT® device is the basic requirement for safe operation. Therefore, the operator must proceed as follows:

- The BEKOKAT® must only be employed within the pressure and temperature range limits indicated by the manufacturer on the type plate.
- No welding must be carried out on the housing and bottom of the devices.
- The BEKOKAT® must neither be set up in insufficiently ventilated rooms nor near heat sources or inflammable substances.
- To avoid fractures resulting from material fatigue, the BEKOKAT® should not be exposed to vibrations during operation.
- The maximum operating pressure indicated by the manufacturer on the type plate must not be exceeded. It is the operator's task to install the appropriate safety and control devices.
- The documents related to the BEKOKAT® device (manual, operating instructions, manufacturer's declaration etc.) must be kept safe for future reference.
- No objects whatsoever must be installed at or placed on the BEKOKAT® and the connecting lines.
- Never carry out welding works at the pressure tank or modify the tank in any form!
- The plant must be housed in a frost-protected room.
- Operation of the plant is only permissible when the housing and the casings are fully closed and in sound condition. Operation of the plant with damaged housing / casing is prohibited.
- The compressed-air plant into which the BEKOKAT® is integrated must have pressure-limiting devices.



WARNING!

Unauthorised intervention!

Unauthorised interventions may endanger persons or plants and lead to malfunction.

Tampering, modification and abuse of the pressure devices is forbidden.

Operators of the devices need to observe the local and national pressure equipment regulations in the country of installation.

3.3 Special safety instructions



DANGER!

Compressed-air parameters!



Exceeding the maximum pressure can lead to damage in the plant.

Observe the type plate indications regarding the maximum pressure!



NOTE!

Operational reliability at risk!

Incorrect installation can compromise the operational reliability and affect service measures.

The clear diameter of the pipe joint must at least be as large as the mounting dimension of the BEKOKAT®.

It is strongly recommended to install a shut-off valve both upstream and downstream of the BEKOKAT® for the implementation of service measures.

Furthermore it is strongly recommended to equip the BEKOKAT® with a lockable bypass line.

Overloading the BEKOKAT® can compromise the operational reliability! Adhere to the permissible temperature and pressure range!

Do not exceed the permissible volume flow and the permissible operating pressure!

Do not drop below the operating pressure!



NOTE!

Service measures!

All types of service measures at the BEKOKAT® must only be carried out when the catalyst-converter is switched off, pressureless and de-energised.

4 Field of application and proper use of the catalyst-converter

The BEKOKAT® device serves to eliminate oil in compressed air. Any other use is considered improper.

The manufacturer shall not be liable for the consequences of improper use; the operator alone is responsible for all risks that may arise.

The proper employment and use of the BEKOKAT® according to directions requires the exact compliance with the installation instructions, in particular in respect of:

- The place of installation, installation conditions
- The voltage supply and frequency
- The pressure and temperature of the inlet air
- The ambient temperatures
- The connection of the alarm contacts and their signal processing

The device is supplied as accepted in the factory. The operator only needs to establish the connections with the supply mains, which is described in the following chapters.



WARNING!

Employment for the prevention of dangerous conditions!

The BEKOKAT® device must not be employed as the sole means of preventing dangerous conditions at machines and plants. Machines and plants must be constructed in such a manner that malfunctions do not lead to a dangerous situation for the operating personnel.



WARNING!

Improper use!

The BEKOKAT® offers state-of-the-art technology and is operationally reliable. Residual risks may emanate from the device when improperly employed and operated by untrained personnel.

Considered as improper use, one must refrain from doing the following:

- Exceeding the maximum permissible operating pressure
- Exceeding the maximum permissible operating temperature
- Exceeding the permissible volume flow
- Non-use or manipulation of safety devices
- Wilful ignoring of alarm indications
- All cases of employment which are not described as "proper use" applications



The BEKOKAT® device must only be used by qualified and authorised personnel and exclusively in accordance with the technical data.

5 Technical specifications

In the delivered version, the BEKOKAT® device allows the processing of correspondingly contaminated compressed air.

The BEKOKAT® was designed as a "stand alone" plant and is usually installed downstream of the compressor(s). The use as a terminal device at the point of use is also possible when designed accordingly. The converter can be installed and operated downstream of compressors of any type (piston compressors, screw compressors, etc.), provided that the indicated respective maximum operating conditions are observed.

In the sense of high energetic efficiency, heat exchanger systems are used which allow recirculation of the emergent thermal energy into the system.

The percentage of external energy required subsequent to the heating-up period is reduced correspondingly.

6 Technical Data

Name	BEKOKAT® CC-180 / CC-105
Manufacturer	BEKO TECHNOLOGIES GMBH Germany, 41468 Neuss, Im Taubental 7
Type	Catalyst-converter BEKOKAT®
Medium	Compressed air saturated up to 100%, free from water or condensate
Connection	NPT 1", DN 25
Min. permissible operating overpressure	4 bar(g) / 58 psi(g)
Max. permissible operating overpressure	16 bar(g) / 232 psi(g)
Pressure difference of the plant	< 0,6 bar / 8.7 psi at a 100% load
Nominal pressure	7 bar(g) / 101.5 psi(g)
Max. volume flow at the inlet (ISO 1217) at nominal pressure	180 m³/h / 105.9 scfm based on +20°C and 1 bar(a)
Permissible compressed-air temperature at the inlet	+55°C / 131°F ¹⁾
Operating temperature compressed air	+35°C / 95°F
Min./max. ambient temperature	+5/45°C / 41/131°F
Supply voltage	460 V / 3 Ph / 60 Hz
Nominal capacity	2,85 kW
Power consumption	3,95 A
Temperature sensor	Thermocouple type "K" NiCr-Ni
Safety valve	Setting value 12 bar(g), see technical documentation in the appendix
Weight	180 kg
Total width x height x depth	1000 mm x 1450 mm x 640 mm

1) Inlet temperatures above +40°C can result in temperatures of > +60°C at the outlet of the BEKOKAT®. Please ensure that downstream components are designed accordingly.

General advice

Design data for pressure vessels

Max. permissible operating overpressure PS	16 bar(g) / 232 psi(g)
Min. / max. permissible operating temperature TS	-10°C / +300°C / 14/572°F
Test pressure (hydraulic) PT	37,86 bar(g) / 549.1 psi(g)
Pressure vessel volume V	28,5 l
Pressure device category in accordance with PED	II
Load alternation	1 000 start-ups and shut-downs
Design and construction	In accordance with PED 97/23/EC and AD-2000
Labelling	0035



7 Transport and installation



IMPORTANT!

Dangerous if transported incorrectly!

The BEKOKAT® may only be transported and installed by qualified and authorised personnel.

Only use suitable and technically unobjectionable lifting tools!

Only use lifting tools with a sufficient carrying capacity!

The respective national regulations and directives in force must be adhered to. Otherwise, personal injuries may occur.



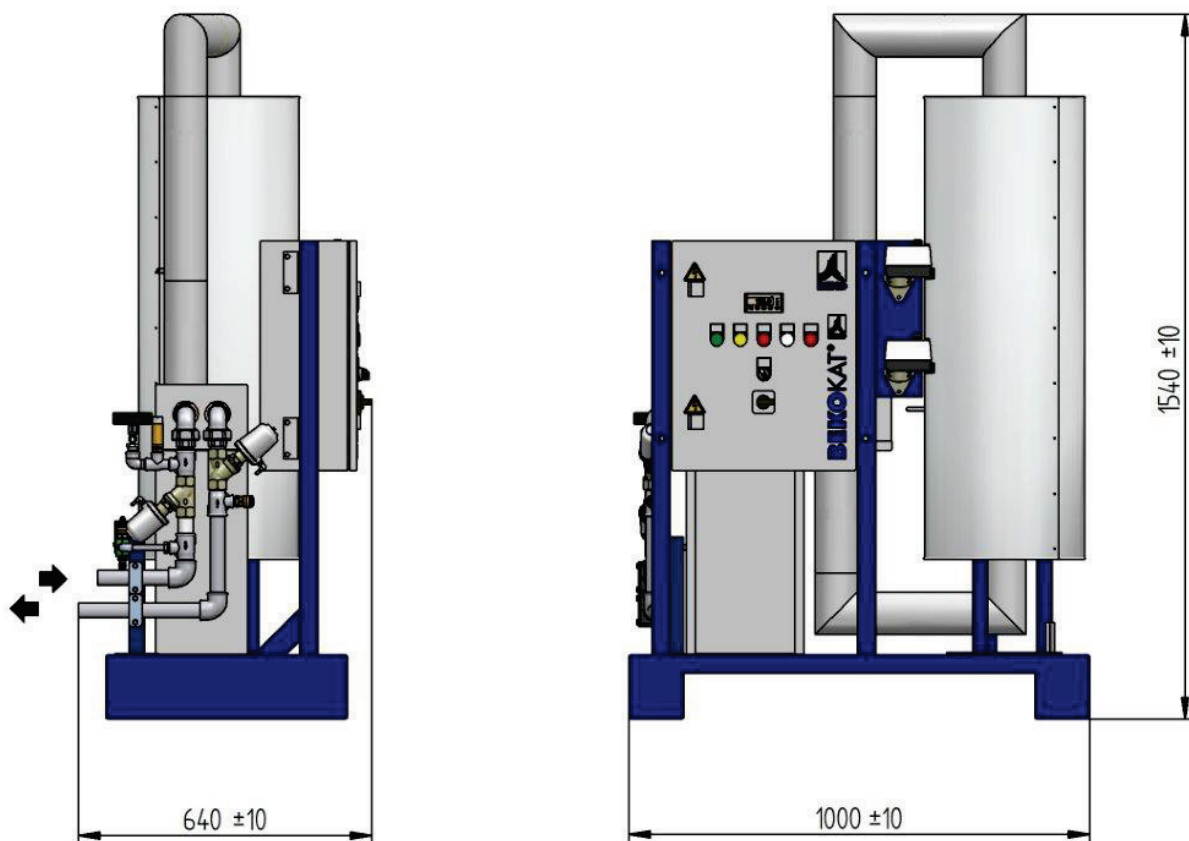
IMPORTANT!

Dangerous when components are damaged!

Under no circumstances should you start-up a damaged BEKOKAT®. Defective components can impair the operational reliability and cause further damage.

The BEKOKAT® is generally supplied in a firmly-closed wooden case.

Despite all due care and attention, transport damage cannot be excluded. Therefore, check the BEKOKAT® for possible damage subsequent to transport and removal of the packaging material. The forwarding agent and BEKO TECHNOLOGIES or the BEKO TECHNOLOGIES agency shall be informed immediately about any kind of damage.



Provide suitable lifting tools for the transport and installation.

Secure the BEKOKAT® against shifting on the load platform or fork-lift truck.

Move the BEKOKAT® to the place of installation.

The function and service life of the BEKOKAT® depends on the conditions at the place of installation. This place must meet the following requirements:

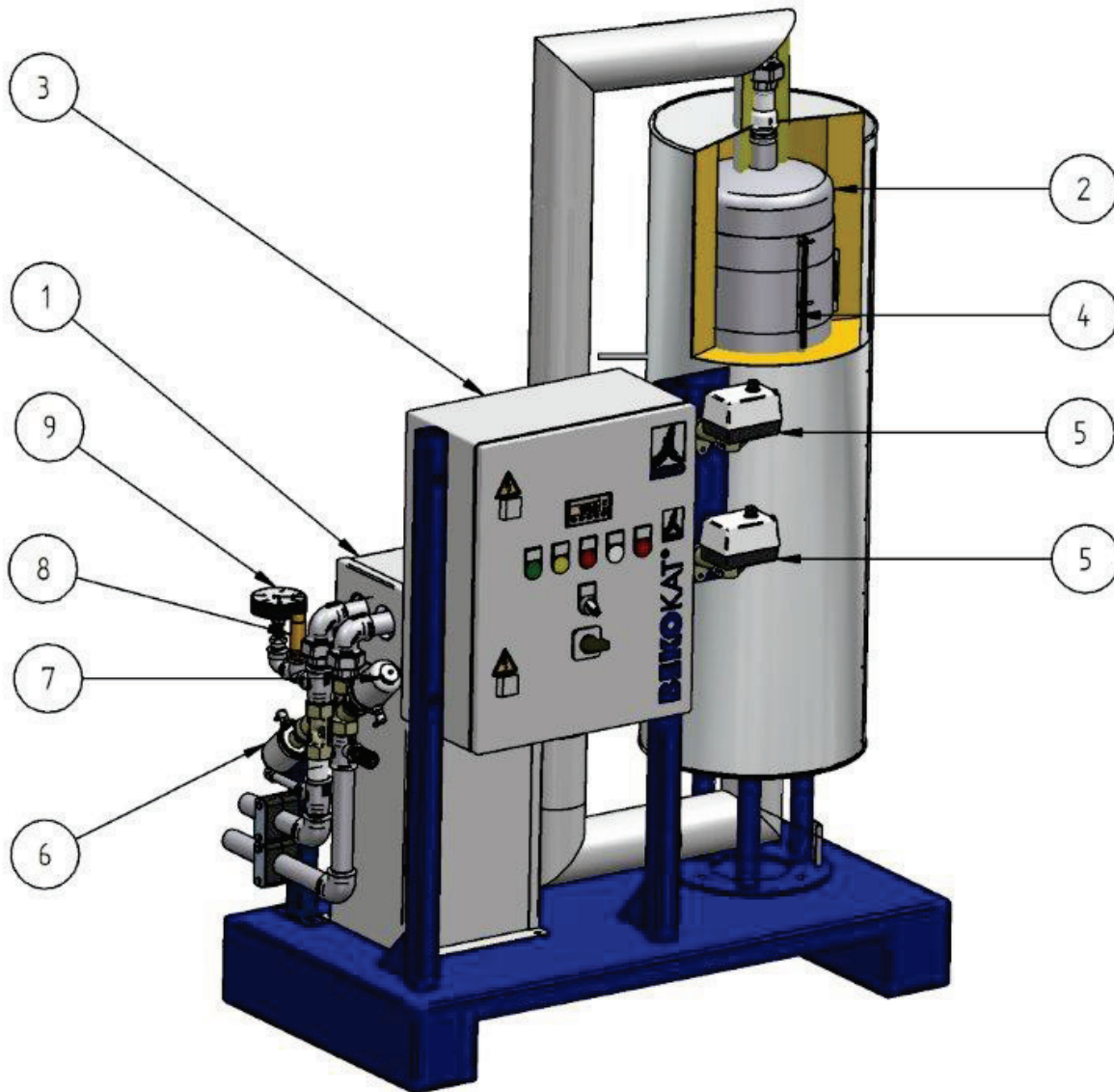
- The device is installed within a building.
- The BEKOKAT® must be protected against moisture.
- The ambient temperature must not drop below / exceed the indications on the type plate.
- Choose an even, solid and vibration-free set-up area with a maximum slope of < 5% to all sides. The weight of the BEKOKAT® must be taken into account when choosing the area.
- Set up the converter in such a manner that the plant is easily accessible from the sides and from the top.
- Ensure sufficient ventilation and heat removal.
- Keep a safe distance from transport routes when setting up the BEKOKAT®.
- The blow-off direction of the safety valve must face away from transport routes.
- Equip the plant with a suitable start-up protection.
- Make sure that no water or condensate can get into the BEKOKAT®.

In the event of doubt, we recommend obtaining expert advice regarding the place of installation.

Remove the packaging (open the wooden case) of the BEKOKAT®.

Move the BEKOKAT® to the place of installation.

8 Description structure



- 1 Plate heat exchanger for air heating
- 2 Catalyst reactor (converter) with catalyst agent
- 3 Temperature control unit
- 4 Heating system
- 5 Safety temperature monitor / limiter F01 and F02
- 6/7 Slanted seat valves V1 (inlet) and V2 (outlet, oil and grease-free)
- 8 Safety valve X4
- 9 Manometer

9 Description of the component parts

Plate heat exchanger (1)

The air / air heat exchanger is approved for a maximum operating overpressure of 16 bar / 232 psi and a maximum operating temperature of +200°C / 392°F.

Catalyst reactor (2)



The maximum permissible operating overpressure is 16 bar / 232 psi. The maximum permissible operating temperature of the vessel wall is +300°C / 572°F.

The catalyst reactor is a pressure device in accordance with PED 97/23/EC.

The reactor is not designed for pressure cycling.

Temperature control unit (3)

A temperature sensor in the catalyst bed continuously measures the operating temperature and the temperature control unit adjusts the catalyst temperature to the setpoint temperature set at the operating control.

Heating system (4)

To heat up the catalyst in the converter to the necessary operating temperature of +150°C / 302°F, a heating system is used. The power supply requires 460 VAC/3Ph/60Hz. The nominal heating capacity is 2.6 kW.

Slanted seat valves (6/7) and safety valve (8)

To ensure safe operation of the plant (also in the unlikely event of an oil leak), valves V1 and V2 are installed in the inlet and outlet pipe to be able to automatically shut off the compressed air. The valves are controlled via the temperature measured in the catalyst bed. Through the closing of the valves, pressures of over 16 bar / 232 psi can be produced. Therefore, a safety valve is placed between the converter and the outlet solenoid valve.



When temperatures fall below $T < +60^{\circ}\text{C}$ / 140°F or exceed $T > +215^{\circ}\text{C}$ / 419°F, you will hear an alarm signal and the display flashes.

When the adjusted alarm temperatures fall below the lower limit or are exceeded, valves V1 and V2 at the inlet and outlet of the BEKOKAT® are closed. In the event that the temperature falls below the lower limit, this prevents unprocessed compressed air from leaving the device, as catalysis does not reliably take place when temperatures are too low. Should the temperature be exceeded, the further supply of compressed air, and thus the supply of oxygen, is stopped by closing the inlet and outlet valves and a possible fire is prevented.

BEKO TECHNOLOGIES shall be informed in **any case** when the temperature is exceeded. The device will then need to be checked.

By closing valves V1 and V2, a pressure increase may occur in the system when the temperature is exceeded, which goes beyond the permissible 16 bar / 232 psi. The installation of the X4 safety valve reliably prevents this pressure increase.

Safety devices to prevent exceeding of the maximum temperature (5)

The reactor vessel is calculated and tested for a maximum operating temperature of +300°C / 572°F. Two safety thermostats are installed at the external wall of the vessel.

TW +260°C / 500°F F01 lamp H2 yellow

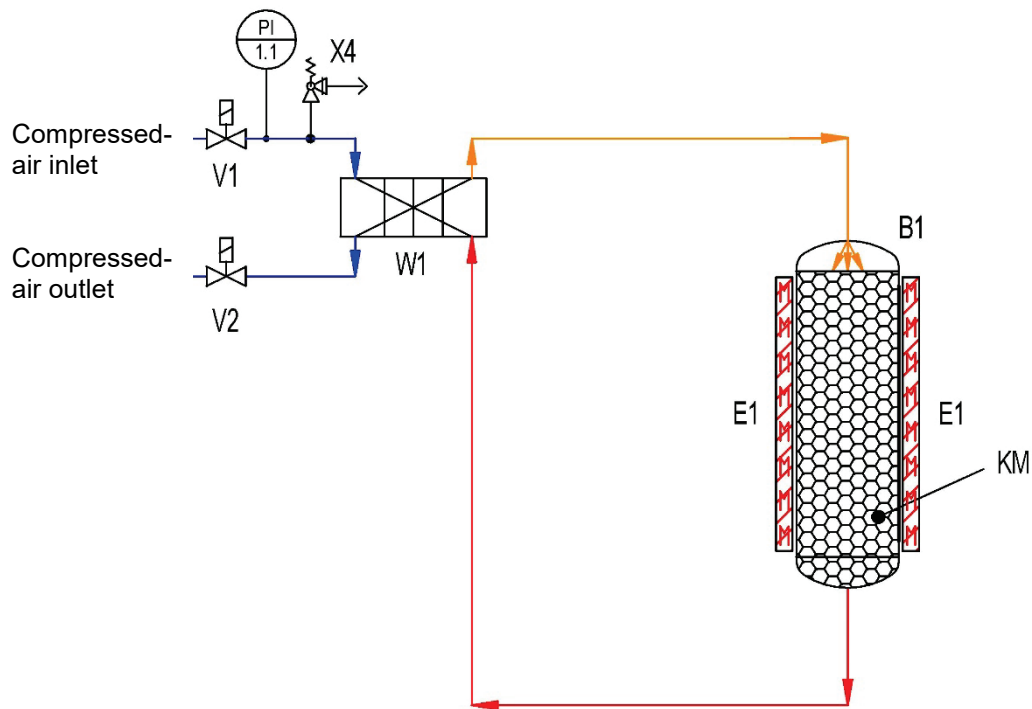
STW +300°C / 572°F F02 lamp H3 red

When an adjusted limit value of +260°C / 500°F is exceeded, the TW temperature monitor opens, the power supply for the heating system is interrupted and an alarm will be indicated.

The STW (STB) safety temperature limiter opens when an adjusted limit value of +300°C / 572°F is exceeded, the power supply for the heating system is interrupted and an alarm will be indicated.

When the temperature stays below the limit value, resetting takes place via automatic reset TW F01 and STW F02.

10 Operating principle of the catalyst-converter



- B1: Catalyst reactor (2)
- E1: Heating system (4)
- KM: Catalyst agent
- V1: Slanted seat valve – inlet (6)
- V2: Slanted seat – outlet (oil and grease-free) (7)
- W1: Plate heat exchanger (1)
- X4: Safety valve (8)

The **BEKOKAT**[®] operates with a catalytic system (catalyst) which has been developed and optimised in particular for the total oxidation of hydrocarbons (lubricants, oil) in compressed air.

The air components can exist in the form of gas, vapour and aerosol and are converted into carbon dioxide (CO₂) and water (H₂O) in the **BEKOKAT**[®].

The oil-saturated air supplied by the compressor usually has a temperature of 10 K above the ambient temperature. In heat exchanger W1, this air is pre-heated to temperatures of approx. +100°C / 212°F to +130°C / 266°F by the hot air from reactor B1. Subsequently, it passes the catalyst in the converter which, by means of the electric heating system E1, is heated to the operating temperature of 150°C, adjusted at the operating panel.

In the converter, the hydrocarbons contained in the air are oxidised catalytically using atmospheric oxygen. The accumulating reaction heat is negligible, considering the normal hydrocarbon concentrations in compressed air. Subsequently, the cleaned compressed air is cooled down to a temperature of approx. 10 K... 15 K above the inlet temperature in heat exchanger W1.

11 Installation



DANGER!

Compressed air!

Risk of serious injury or death through contact with quickly or suddenly escaping compressed air or through bursting plant components.



It is the obligation of the operator to ensure that the connected pressure generator is protected against exceeding of the maximum operating overpressure and the temperature limits at the catalyst-converter.

The pressure relief valves used must be arranged in such a manner that danger to persons is excluded. Observe possible additional advice of the manufacturer.

For the maximum permissible operating overpressure, please refer to the type plate and to the technical data (see Chapter "Technical Data").

Prior to integrating the BEKOKAT® device into the compressed-air system, make sure that the system is pressureless! All types of installation works must only be carried out when the BEKOKAT® is switched off, pressureless and de-energised.

Only use fittings and connecting elements which have been approved for this application. It is imperative to observe the indications of the respective manufacturer.

Make sure that the connections are mounted according to good professional practice.



CAUTION!

Dangerous when components are damaged!

Under no circumstances should you start-up a damaged BEKOKAT®. Defective components can impair the operational reliability and cause further damage.



DANGER!

Supply voltage!

Contact with non-insulated parts carrying supply voltage involves the risk of an electric shock resulting in injuries and death.

It is imperative to observe the voltage indicated on the type plate!

The connection to the electric mains and the corresponding protective equipment must comply with the legal provisions in force at the place of installation of the BEKOKAT®; the connection and installation must be carried out by specialists who are qualified accordingly.



It is of utmost importance to observe all indications and advice of the installation and operating instructions.

If you have any queries regarding these instructions, please contact BEKO TECHNOLOGIES.

**NOTE!****Operational reliability at risk!**

Incorrect installation can compromise the operational reliability and affect service measures.

The clear diameter of the pipe joint must at least be as large as the mounting dimension of the BEKOKAT®.

Make sure that no water or condensate can get into the BEKOKAT®.

It is strongly recommended to install a shut-off valve both upstream of the BEKOKAT® inlet and downstream of the BEKOKAT® outlet for the implementation of service measures.

Install a bypass line, where required.

Ensure perfect function of the BEKOKAT®, of the involved pressure devices and of the safety fittings.

All types of service measures must only be carried out when the BEKOKAT® is switched off, pressureless and de-energised.

To ensure safe operation, the device must only be operated and maintained in accordance with the indications in the operating instructions. In addition, the national and operational statutory provisions and safety regulations, as well as the accident prevention regulations required for the respective case of application, need to be observed during employment. This applies accordingly when accessories are used.

Non-observance of the installation and operating instructions involves risks for persons and systems.



Operation, system performance tests, installation, setting and service measures must only be carried out by authorised skilled personnel².

² Authorised skilled personnel are persons who are authorised by the manufacturer, with experience and technical training, who are well-grounded in the respective provisions and laws and capable of carrying out the required works and of identifying and avoiding any risks during the machine transport, installation, operation and maintenance. Qualified and authorised operators are persons who are instructed by the manufacturer regarding the handling of the BEKOKAT device, with experience and technical training, and who are well-grounded in the respective provisions and laws.

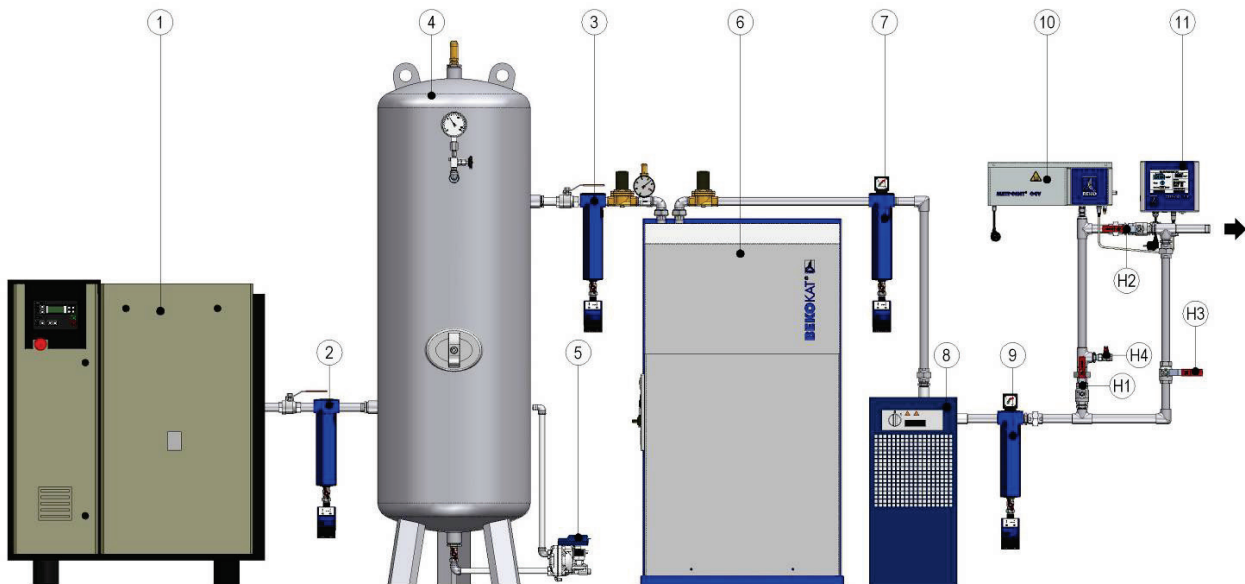
11.1 Procedure

Set up the converter in such a manner that the plant is easily accessible from the sides and from the top.

Make sure the device is set up on suitable ground (sufficiently stable and even).

When installing the BEKOKAT® downstream of a compressor with aftercooler, make sure that no liquid water or condensate can get into the BEKOKAT®. Liquid water may affect the function of the BEKOKAT®. Should this occur, please install a suitable system for water and condensate removal. We recommend employing our CLEARPOINT® water separator and CLEARPOINT® filter.

Example installation:



- | | | |
|-------|--|--|
| 1 | Compressor (oil-lubricated) | |
| 2 | Cyclone separator with BEKOMAT | |
| 3 | Universal filter (G) with BEKOMAT (OPTIONAL at strongly contaminated compressed air) | |
| 4 | Compressed-air tank | |
| 5 | BEKOMAT for the tank drainage | |
| 6 | BEKOKAT | |
| 7 | Dust filter (F) with BEKOMAT | |
| 8 | Minimum requirement: refrigeration dryer | |
| 9 | Super-fine filter (S) with BEKOMAT | |
| 10 | Sensor unit METPOINT® OCV | |
| 11 | Evaluation unit with user interface (display) METPOINT® OCV | |
| H1/H2 | Shut-off valves of the measuring section | |
| H3 | Shut-off valve of the bypass | |
| H4 | Vent valve of the measuring section | |

Oil-and grease-free zone

It is strongly recommended to install a shut-off valve both upstream and downstream of the BEKOKAT®. Furthermore, it is strongly recommended to equip the BEKOKAT® with a lockable bypass line.

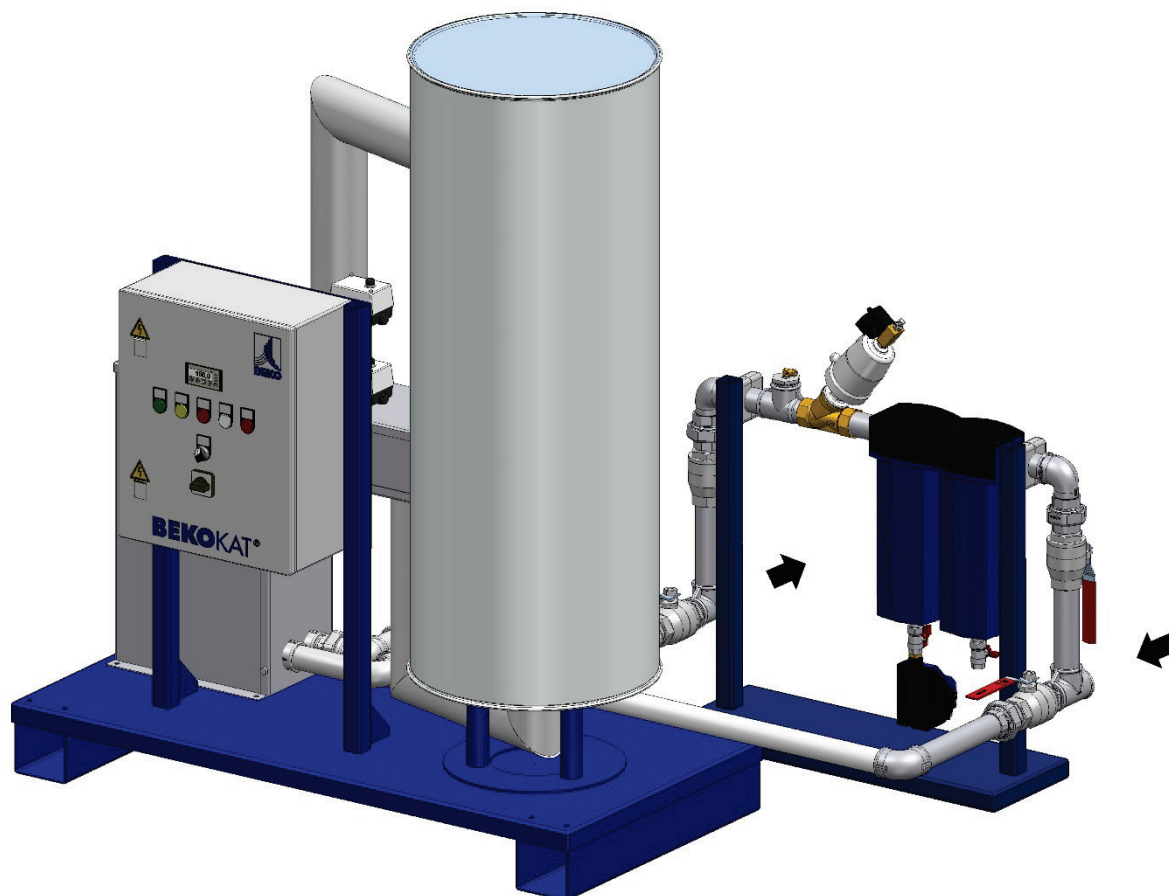
Example installation:

BEKOKAT® CC-360

Bypass with an automatic valve

Pre-filter CLEARPOINT M018SWT

Activated carbon filter CLEARPOINT M018AWM



Please take into account that the activated carbon filter in the bypass has a service life of only approx. 100 operating hours.

Use oil- and grease-free components only for any installation downstream of the BEKOKAT®. Otherwise the system will be re-contaminated with hydrocarbons.

The maximum permissible pressure of the converter is 16 bar / 232 psi.

The ambient temperature must lie between +5°C / 41°F and +45°C / 113°F.

Implement the electrical terminal assignment of the mains connection according to the circuit diagram. Maximum mains input voltage of 460 V / 3 Ph / 60 Hz.

Connect the alarm contacts for minimum and maximum temperature. Switch off the compressor or the compressed-air supply in the event of an alarm. Check the condition of the BEKOKAT®.

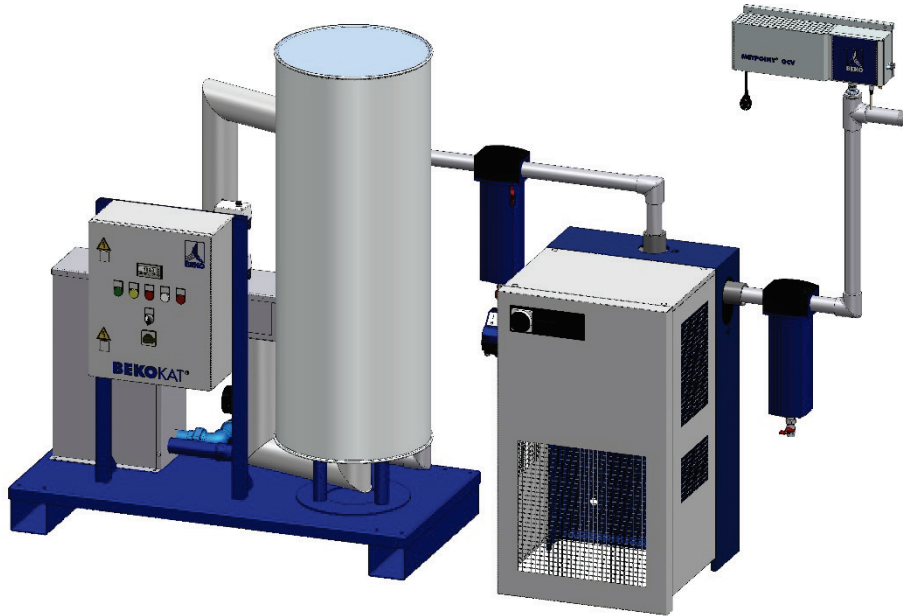
When the reactor temperature shown in the display is > +250°C / 482°F, it must be assumed that an increased oil introduction into the BEKOKAT® has taken place. Further operation is only permissible subsequent to an inspection by the BEKO service.

11.2 Installation examples

Installation examples BEKOKAT® with DRYPOINT refrigeration or adsorption dryers and METPOINT® OCV

Generally, it is advisable to integrate the BEKOKAT® device as a complete unit into your system, with corresponding drying of the compressed air and monitoring of the residual oil content by means of the METPOINT® OCV.

The complete units are available with both a DRYPOINT RA refrigeration dryer or a



DRYPOINT AC adsorption dryer.



12 Start-up



DANGER!

Compressed air!

Risk of serious injury or death through contact with quickly or suddenly escaping compressed air or through bursting plant components.



Sudden impact through pressure build-up can cause damage and escape of compressed air!

Check all pipe and cable connections before starting-up the device for the first time and retighten them, where required.

Do not exceed the maximum permissible operating overpressure (see type plate).

Avoid a sudden pressure build-up by operating the valves slowly.



DANGER!

Supply voltage!

Contact with non-insulated parts carrying supply voltage involves the risk of an electric shock resulting in injuries and death.

It is imperative to observe the voltage indicated on the type plate!

The connection to the electric mains and the corresponding protective equipment must comply with the legal provisions in force at the place of installation of the BEKOKAT®; the connection and installation must be carried out by specialists who are qualified accordingly.



CAUTION!

Operational reliability at risk!

Overloading the BEKOKAT® can compromise the operational reliability!

Adhere to the permissible temperature range!

Do not exceed the permissible volume flow!



WARNING!

Hot surface!

Personal injury and damage to objects – fire hazard!

Allow the plant to cool down prior to carrying out works on the BEKOKAT®! Close off accessible areas and mark them.



WARNING!

Development of smoke!

Endangering and annoyance of persons – fire hazard!

Please install a smoke detector in the vicinity of the BEKOKAT®.



It is of utmost importance to observe all indications and advice of the installation and operating instructions.

If you have any queries regarding these instructions, please contact BEKO TECHNOLOGIES.



To ensure safe operation, the device must only be operated and maintained in accordance with the indications in the operating instructions.

The BEKOKAT® and the included pressure devices are not designed for alternating loading!

Observe the technical data on page 11.

In addition, the national and operational statutory provisions and safety regulations, as well as the accident prevention regulations required for the respective case of application, need to be observed during employment. This applies accordingly when accessories are used.

Non-observance of the installation and operating instructions involves risks for persons and systems.



Operation, system performance tests, installation, setting and service measures must only be carried out by authorised skilled personnel³.

12.1 Check prior to the start-up

As far as the check prior to the start-up is concerned, the respective country-specific regulations shall be observed.

³ Authorised skilled personnel are persons who are authorised by the manufacturer, with experience and technical training, who are well-grounded in the respective provisions and laws and capable of carrying out the required works and of identifying and avoiding any risks during the machine transport, installation, operation and maintenance. Qualified and authorised operators are persons who are instructed by the manufacturer regarding the handling of the BEKOKAT device, with experience and technical training, and who are well-grounded in the respective provisions and laws.

12.2 Initial start-up

Procedure:

1. Prior to the initial start-up, it must be ensured that the line network is free from impurities and that installation is carried out in an almost grease-free manner.
2. Connect the bus bar to the power supply. Connect the alarm contacts.
3. Connect the compressed air. As shut-off devices are installed in the compressed-air lines at the BEKOKAT®, a safety valve is provided in the compressed-air inlet to limit pressures above 16 bar resulting from this shutting.
4. Switch on the S0 / S1 "Converter operation" starting switch: the white indicator lamp "heat up BEKOKAT®" lights up (H4), the converter is heated up. While the temperature of +150°C / 302°F has not yet been reached, the valves remain closed. The heating phase takes approx. 3 hours. After expiration of this time, the valves open. The heating-up period of the BEKOKAT® depends on the following factors:
 - Voltage
 - Ambient temperature
 - Air circulation at the place of installation
 - Shutdown period of the plant

The indicated value for the heating-up time may thus be exceeded or reduced.

5. After a heating-up time of approx. 3 hours, the setpoint temperature of +150°C / 302°F is reached in the catalyst bed, the white indicator light goes out and the green indicator lamp "Reactor ON" (H1) lights up. The compressed-air supply is opened automatically via the valve. In the following, a stable operating point is reached where the actual temperature can vary by approx. +/- 5°K around the adjusted setpoint. This is the result of the varying operating conditions by reason of load operation and idle time of the compressor.
6. Subsequent to the successful start-up, no other settings are required. The BEKOKAT® is now ready to operate. Operation is fully automatic. Should unexpected faults occur during running operation, please inform the responsible service technician.

12.3 Restart of operation

When the BEKOKAT® is restarted after a longer rest period, please proceed as if you started up the device for the first time.

Check, above all after service measures or repair, whether or not the BEKOKAT® is tubed completely and electrically connected. If this is not the case, carry out installation in due form.

13 Operation



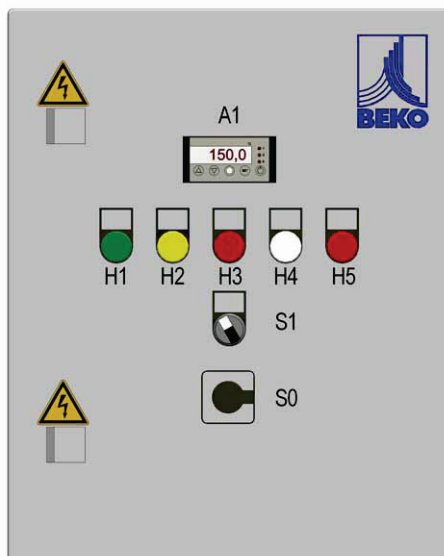
To ensure safe operation, the device must only be operated and maintained in accordance with the indications in the operating instructions. In addition, the national and operational statutory provisions and safety regulations, as well as the accident prevention regulations required for the respective case of application, need to be observed during employment. This applies accordingly when accessories are used.

Non-observance of the installation and operating instructions involves risks for persons and systems.



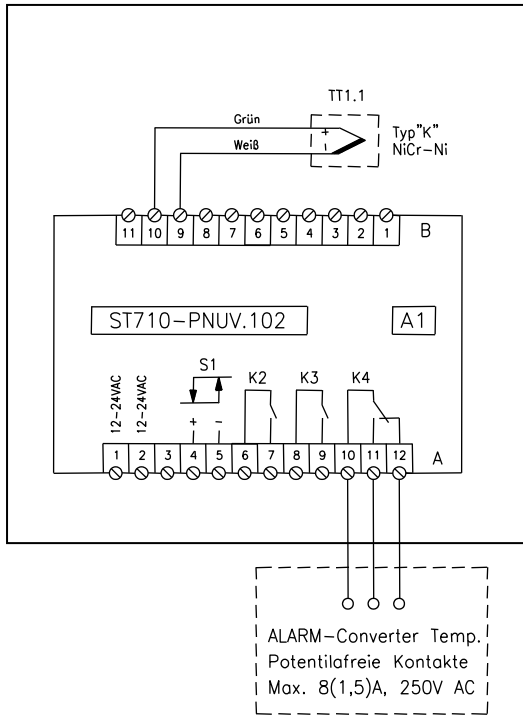
Operation, system performance tests, installation, setting and service measures must only be carried out by authorised skilled personnel⁴.

13.1 Electric control



A1	-	Temperature controller
S0	-	Main switch
S1	-	Starting switch
H1	-	Converter operation / "Green" light
H2	-	ALARM: Temperature monitor AUTO-RESET / "Yellow" light
H3	-	ALARM: Safety temperature monitor AUTO-RESET / "RED" light
H4	-	Reactor heating phase BEKOKAT® AUTO-RESET / "White" light
H5	-	ALARM reactor min/max.

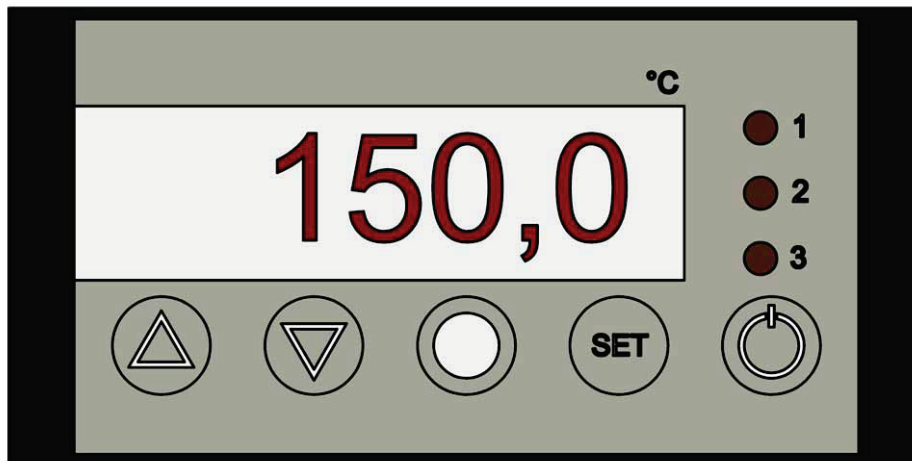
⁴ Authorised skilled personnel are persons who are authorised by the manufacturer, with experience and technical training, who are well-grounded in the respective provisions and laws and capable of carrying out the required works and of identifying and avoiding any risks during the machine transport, installation, operation and maintenance. Qualified and authorised operators are persons who are instructed by the manufacturer regarding the handling of the BEKOKAT device, with experience and technical training, and who are well-grounded in the respective provisions and laws.



Grün = Green
 Weiß = White

ALARM – converter temp.
 Potential-free contacts
 Max. 8(1,5)A, 250 VAC

13.2 Setting options



UP BUTTON

By pressing this button, the parameter or parameter value is increased or the list of parameters browsed.



DOWN BUTTON

By pressing this button, the parameter or parameter value is decreased or the list of parameters browsed. In the event of an alarm, the buzzer function is switched off by pushing the button.



FUNCTION BUTTON 2 – Standard setting setpoint changeover

Switching-on or -off of the control, setpoint changeover and/or coupling to an output relay. After power failure, the status will remain stored.



SET BUTTON

The setpoint is displayed when pressing this button. The button is also used for parameter setting.



FUNCTION BUTTON 1 – Standard setting standby

Switching-on or -off of the control, setpoint changeover and/or coupling to an output relay. After power failure, the status will remain stored.

13.3 Operation

**DANGER!****Bleeding compressed air at the safety valve!**

Risk of serious injury through contact with quickly or suddenly escaping compressed from the safety valve.

It is imperative to make sure that the permissible operating overpressure is not exceeded (red mark at the manometer) when carrying out works at the plant (maintenance / control / repair). Caution during bleeding of the safety valve. The operator must instruct the operating personnel correspondingly about this danger.

Main switch S0 and starting switch S1 are used to switch the plant on or off.

The reactor temperature can be read on display A1. This temperature should be +150°C / 302°F +/- 5K.

The BEKOKAT®'s operation is fully automatic.

Should any faults occur during running operation, please inform the responsible service technician.

At rated operating conditions, a reactor temperature between +145°C / 293°F and +160°C / 320°F is reached.

Please check the following points when the reactor temperature is $T < +110^{\circ}\text{C} / 230^{\circ}\text{F}$:

- Volume flow too high
- Operating pressure too low
- A heating system out of service
- Check the setting of the setpoint of the reactor temperature (+150°C / 302°F) (see Chapter 13.2)
- Observance of the heating-up time subsequent to de-activation.

Please contact the BEKO service in the event of a heating system being out of service.

Please check the following points at a reactor temperature of $T > +180^{\circ}\text{C} / 356^{\circ}\text{F}$:

- Volume flow deviating from the rated values of the plant
- Operating pressure too low
- Oil introduction very high
- Check the setting of the setpoint of the reactor temperature (+150°C / 302°F) (see Chapter 13.2)

In these cases, modification of the setpoint of the reactor is possible in order to minimise the thermal stress of the system and the energy consumption. The setpoint can be reduced in steps of 5 K to approx. +140°C / 284°F (see Chapter 13.2, page 30). In this respect, please confer with the BEKO TECHNOLOGIES service.

14 Faults and malfunctions



DANGER!

Compressed air!

Risk of serious injury or death through contact with quickly or suddenly escaping compressed air or through bursting plant components.



Sudden impact through pressure build-up can cause damage and escape of compressed air.

Check all connections before starting-up the device for the first time and retighten them where required.

Do not exceed the maximally permissible operating overpressure (see type plate).

Avoid a sudden pressure build-up by operating the valves slowly.



DANGER!

Supply voltage!

Contact with non-insulated parts carrying supply voltage involves the risk of an electric shock resulting in injuries and death.

It is imperative to observe the voltage indicated on the type plate!

The connection to the electric mains and the corresponding protective equipment must comply with the legal provisions in force at the place of installation of the BEKOKAT®; the connection and installation must be carried out by specialists who are qualified accordingly.



CAUTION!

Operational reliability at risk!

Overloading the BEKOKAT® can compromise the operational reliability!

Adhere to the permissible temperature range!

Do not exceed the permissible volume flow!



WARNING!

Hot surface!



Personal injury and damage to objects – fire hazard!

Allow the plant to cool down prior to carrying out works on the BEKOKAT®! Close off accessible areas and mark them.



DANGER!

Supply voltage!

Operation and maintenance of electrically-powered machines and devices must only be undertaken by correspondingly qualified and authorised personnel. Prior to carrying out service measures, no matter which type, the following notes must be considered:

Make sure that no parts of the BEKOKAT® are energised and that the BEKOKAT® cannot be connected with the electric supply mains during service measures.



NOTE!

Observe the temperature!

At a reactor temperature of $< +130^{\circ}\text{C} / 266^{\circ}\text{F} \dots +150^{\circ}\text{C} / 302^{\circ}\text{F}$, the specific period of time of K1T of approx. 3 hours needs to be observed. Only after a reactor temperature of $> +130^{\circ}\text{C} / 266^{\circ}\text{F} \dots +150^{\circ}\text{C} / 302^{\circ}\text{F}$ has been reached can the option of the reset button at relay K3A be used.

Malfunction 1

The actual temperature exceeds the tolerance range of $T > +215^{\circ}\text{C} / 419^{\circ}\text{F}$.
Valves V1 / V2 close. The compressed-air supply is interrupted.

Possible reason	Measure
The air flow through the reactor was interrupted for a longer period of time.	Check whether or not the compressor provides the reactor continuously with compressed air. Establish compressed-air supply.
The amount of oil at the inlet into the BEKOKAT® is too high.	Check the oil separator of the compressor.

Malfunction 2

The actual temperature drops to below the tolerance range of $T < +60^{\circ}\text{C} / 140^{\circ}\text{F}$.
Valves V1 / V2 close. The compressed-air supply is interrupted.

Possible reason	Measure
The heating system went out of service. The supplied air flow is too high (overload) and is not heated.	As full catalysis cannot be ensured, the compressed air is switched off via valves V1 and V2.

Malfunction 3

The safety temperature monitor (TW) of the reactor's heating system responds; $T > +260^{\circ}\text{C} / 500^{\circ}\text{F}$

Possible reason	Measure
The setpoint of the reactor temperature ($+150^{\circ}\text{C}$ on the display) was modified.	Check the temperature at the display with the set button to see whether or not the setpoint of $+150^{\circ}\text{C} / 302^{\circ}\text{F}$ is set. (see Chapter 13.2)
Compressed-air volume flow too low.	Increase flow volume.
Inadmissibly high oil concentration, e.g. as a result of a rupture of the oil separator cartridge of the compressor.	Replacement of the oil separator cartridge at the compressor. Restart the BEKOKAT®.

Reset of the alarm via auto reset (see Chapter 9, page 17).

The response of the safety temperature monitor (STW) during the heating phase is not a failure. Here, it is in fact a normal control status.

Malfunction 4

The safety temperature monitor (STW) of the reactor's heating system responds; T > +300°C / 572°F

Possible reason	Measure
The setpoint of the reactor temperature (+150°C on the display) was modified.	Check the temperature at the display with the set button to see whether or not the setpoint of +150°C / 302°F is set. (see Chapter 13.2, page 30).
Compressed-air volume flow too low.	Increase flow volume.
Inadmissibly high oil concentration, e.g. as a result of a rupture of the oil separator cartridge of the compressor.	Replacement of the oil separator cartridge at the compressor. Restart the BEKOKAT®.

Reset of the alarm via auto reset (see Chapter 9, page 17).

The response of the safety temperature monitor (STW) during the heating phase is not a failure. Here, it is in fact a normal control status.

Malfunction 5

Short-term power outage.

Valves V1 / V2 close. The power supply is interrupted. An alarm is not indicated.

Possible reason	Measure
Interruption of the power supply.	The solenoid valves close automatically. When power supply is re-established, the period of approx. 3 hours runs once again via K1T (see circuit diagram page 6). If the reactor temperature is approx. +130°C/266°F...+150°C/302°F, then proceed as for reset K1T. (page 37)
Exceeding of the permissible voltage range. As a result, response of the fuses and interruption of the voltage supply.	The solenoid valves close automatically. When power supply is re-established, the period of approx. 3 hours runs once again via K1T (see circuit diagram page 6). If the reactor temperature is approx. +130°C/266°F...+150°C/302°F, then proceed as for reset K1T. (page 37).

Malfunction 6

Reactor setpoint temperature on the display > +250°C / 482°F.
Solenoid valves V1 / V2 close. The compressed-air supply is interrupted.

Possible reason	Measure
See malfunction 1 to 5	Switch off the plant and find out the cause. Rectify the cause. If the setpoint temperature on the display has increased to over +300°C / 572°F, the reactor needs to be submitted to periodic inspection. Please contact the BEKO service.

Malfunction 7

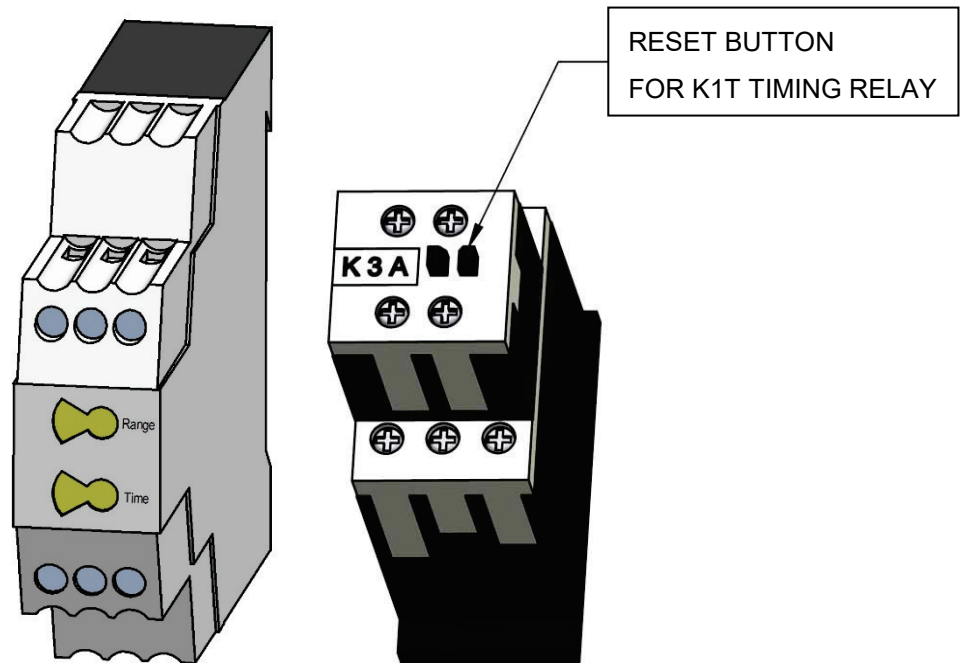
"Err" indication on the display, valves V1 / V2 close.

Possible reason	Measure
Fault in the temperature sensor	Check the temperature sensor, replace if required. Operation, system performance tests, installation, setting and service measures must only be carried out by authorised skilled personnel ⁵ . Please contact the BEKO TECHNOLOGIES service.
Capillary rupture in the thermostat	Check the temperature sensor, replace if required. Operation, system performance tests, installation, setting and service measures must only be carried out by authorised skilled personnel ⁵ . Please contact the BEKO TECHNOLOGIES service.

⁵ Authorised skilled personnel are persons who are authorised by the manufacturer, with experience and technical training, who are well-grounded in the respective provisions and laws and capable of carrying out the required works and of identifying and avoiding any risks during the machine transport, installation, operation and maintenance. Qualified and authorised operators are persons who are instructed by the manufacturer regarding the handling of the BEKOKAT device, with experience and technical training, and who are well-grounded in the respective provisions and laws.

Reset for timing relay K1T

In the e-box, there is a contactor K3A (see circuit diagram in the appendix). At a reactor temperature of $> +130^{\circ}\text{C}/266^{\circ}\text{F} \dots +150^{\circ}\text{C}/302^{\circ}\text{F}$, it is possible, upon contacting the BEKO TECHNOLOGIES service technician, to press the reset button of the K3A and thus to bridge the timing relay. The valves open when pressing the reset button. In such a way, the waiting time, for example subsequent to a short-term voltage drop, can be reduced.



NOTE!

Observe the temperature!

At a reactor temperature of $< +130^{\circ}\text{C}/266^{\circ}\text{F} \dots +150^{\circ}\text{C}/302^{\circ}\text{F}$, the specific period of time of K1T of approx. 3 hours needs to be observed. Only after a reactor temperature of $> +130^{\circ}\text{C}/266^{\circ}\text{F} \dots +150^{\circ}\text{C}/302^{\circ}\text{F}$ has been reached can the option of the reset button at relay K3A be used.

To ensure safe operation, the device must only be operated and maintained in accordance with the indications in the operating instructions. In addition, the national and operational statutory provisions and safety regulations, as well as the accident prevention regulations required for the respective case of application need to be observed during employment. This applies accordingly when accessories are used.

15 Maintenance



DANGER!

Compressed air!

Risk of serious injury or death through contact with quickly or suddenly escaping compressed air or through bursting plant components.



Sudden impact through pressure build-up can cause damage and escape of compressed air.

Check all connections before starting-up the device for the first time and retighten them where required.

Do not exceed the maximum permissible operating overpressure (see type plate).

Avoid a sudden pressure build-up by operating the valves slowly.



DANGER!

Supply voltage!

Contact with non-insulated parts carrying supply voltage involves the risk of an electric shock resulting in injuries and death.

It is imperative to observe the voltage indicated on the type plate!

The connection to the electric mains and the corresponding protective equipment must comply with the legal provisions in force at the place of installation of the BEKOKAT®; the connection and installation must be carried out by specialists who are qualified accordingly.



CAUTION!

Operational reliability at risk!

Overloading the BEKOKAT® can compromise the operational reliability!

Adhere to the permissible temperature range!

Do not exceed the permissible volume flow!



WARNING!

Hot surface!

Personal injury and damage to objects – fire hazard!

Allow the plant to cool down prior to carrying out works on the BEKOKAT®! Close off accessible areas and mark them.



NOTE!

Possible faults regarding the function and safety!

Poor maintenance can compromise the functional performance and safety.

Undertake the service measures listed below at regular intervals!

It is imperative to observe the safety instructions for maintenance, inspection and installation works!

In the event of malfunctions which are not listed here or which cannot be eliminated, please contact BEKO TECHNOLOGIES.



To ensure safe operation, the device must only be operated and maintained in accordance with the indications in the operating instructions. In addition, the national and operational statutory provisions and safety regulations, as well as the accident prevention regulations required for the respective case of application need to be observed during employment. This applies accordingly when accessories are used.

Non-observance of the installation and operating instructions involves risks for persons and systems.

**NOTE!****Service measures!**

All types of service measures at the BEKOKAT® must only be carried out when the catalyst-converter is switched off, pressureless and de-energised.

Operation, system performance tests, installation, setting and service measures must only be carried out by authorised skilled personnel⁶.

Only use fittings and connecting elements which have been approved for this application. It is imperative to observe the indications of the respective manufacturer.

Depressurise the plant prior to any maintenance or repair!

Make sure that the connections are mounted according to good professional practice.

15.1 Weekly inspections

The BEKOKAT® is designed for maintenance-free operation. The plant should nevertheless be inspected once a week and the following points considered:

- Indication of the setpoint and actual temperature
- Operating pressure, volume flow
- Leaks
- Regular check for damage of the BEKOKAT®

15.2 Monthly inspections

The following controls should be carried out once a month:

- Functional tests of valves V1 and V2
- Functional test of safety valve X4 (turn the lifting button anti-clockwise until you can hear a clear blowing off of the operating medium. Then turn the lifting button clockwise to the limit. It is the obligation of the operator to make sure that these works are carried out by authorised and skilled personnel only.
- Check whether or not port X5 (see P&I diagram) on the back of the catalyst reactor is tight and firmly closed.
- Analysis of the compressed-air quality at the outlet of the BEKOKAT®. We will be happy to give you advice.

⁶ Authorised skilled personnel are persons who are authorised by the manufacturer, with experience and technical training, who are well-grounded in the respective provisions and laws and capable of carrying out the required works and of identifying and avoiding any risks during the machine transport, installation, operation and maintenance. Qualified and authorised operators are persons who are instructed by the manufacturer regarding the handling of the BEKOKAT device, with experience and technical training, and who are well-grounded in the respective provisions and laws.

15.3 Annual service measures

The following service measures should be undertaken once a year:

- Replacement of valves V1 and V2
- Maintenance of safety valve X4; maintenance of the safety valve and the maintenance intervals need to be fixed by the operator, depending on the application conditions.
- Replacement of the filter element at the afterfilter (option)
- Replacement of the set of wear parts of the BEKOMAT 20 FM at the afterfilter (option)

The annual maintenance of the BEKOKAT® can only be carried out by BEKO TECHNOLOGIES or by skilled personnel authorised by the manufacturer.

15.4 Periodic inspections

The determination of the time limits regarding periodic inspections is incumbent on the operator and, depending on the classification into the pressure device category in accordance with the Pressure Equipment Directive, must be carried out by a certified inspection agency.

15.5 Exchange catalyst agent

It is recommended to replace the catalyst granules in the reactor after approx. 20 000 hours of continuous operation.

The replacement of the catalyst granules can only be implemented by BEKO TECHNOLOGIES or by skilled personnel authorised by the manufacturer.

The catalyst agent employed is not subject to the labelling obligation in accordance with the Ordinance on Hazardous Substances. However, the usual precautions regarding the handling of chemicals need to be taken.

In case of fire don't use water to extinguish the fire.

Waste code number (European Waste Catalogue) 1608 – used catalysts

15.6 Removal from service for maintenance or repair

Procedure:

1. Switch off the BEKOKAT®.
2. Open the bypass line (not included in the scope of delivery).
3. Close the shut-off valves upstream and downstream of the BEKOKAT®.
4. Prior to starting the works, the BEKOKAT® plant must be rendered pressureless. For this purpose, use the safety valve X4 installed at the compressed-air inlet.
5. Allow the plant to cool down. Cooling may take up to 48 hours.

16 Appendix

The circuit diagram and the flow chart are enclosed separately.

The TÜV (Technical Inspection Agency) declaration of conformity is dispatched separately and is not a constituent part of this delivery.

