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**HABOR**<sup>®</sup>



哈伯精密工業有限公司  
HABOR PRECISE INDUSTRIES CO., LTD.

**Oil cooler  
User manual**

Issue for  
HBO cooler series

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# 1 Introduction

## 1.1 Target groups / users according DIN 31000/VDE 1000/3.79

<b>Layperson</b>	A <b>Layperson</b> is somebody who is neither a qualified nor an instructed person
<b>Instructed person</b>	An <b>instructed person</b> is somebody who is instructed about his duties and possibly occurring risks in case of improper use. If required he was trained and also instructed about all necessary safety precautions. Appropriate written confirmations of these trainings and instructions have to be provided.
<b>Qualified person</b>	A qualified person is somebody who is capable to evaluate his duties and recognize possible dangers, based on his professional education, experiences and acknowledgement of relevant provisions.
<b>Additional remark:</b> For the rating of the professional education of staff, somebody of several years' experience in the respective field of work can be used as well.	

Chart 1: Definition of users according to DIN standard

## 1.2 General specifications / application of this user manual

**This user manual was translated from Taiwanese language. Mistakes in translation cannot be excluded entirely. The Taiwanese version is decisive.**

**This present user manual has to be read before installation and first starting-up.**

### Handling / application of the user manual

This user manual has to be regarded as part of the product or facility.

This user manual has to be stored in an appropriate place.

Please pass on this user manual to the next owner if you resell the product or facility.

Before starting up the product or facility, the manual has to be studied carefully.

Please request a substitute user manual from Habor Precise Industries Co., Ltd. in Taiwan or from a&g automation and gears GmbH if your copy got lost.


## 2 Safety


### 2.1 Safety policy

Every cooling unit from Habor Precise Industries Co., Ltd. is equipped with various safety features. In spite of any safety feature, improper use can result in severe accidents. In order to avoid improper use, make sure all operators using the machine have read this user manual carefully.


All described instructions must be complied while the cooling unit is operated or maintenance is done. Inobservance of the safety instructions can result in severe injuries of operators and damages to the cooling unit.

### 2.2 Note of warning and hazard symbols

Caution!	
	<p><b>Caution</b></p> <p>This symbol indicates a possibly dangerous situation. Inobservance of this warning can lead to light injuries or material damage.</p>

Warning!	
	<p><b>Dangerous situation</b></p> <p>This symbol indicates a possible danger to health and life of operators. Inobservance of this warning can have severe consequences on health and can cause life-threatening injuries.</p>

Danger!	
	<p><b>Impending danger</b></p> <p>This symbol indicates an impending danger to life and health of operators. Inobservance of this warning has severe consequences on health and causes life threatening injuries or death.</p>

Important!	
	<p>This symbol indicates important advice for the proper and designated use of the cooling unit. Inobservance of this symbol can lead to malfunction of the cooling unit or the machine tool.</p>


**2.3 Intended use**

This cooling unit is designed for the oil cooling of machine tools or industrial machines. It can control the machine tools' temperature precisely.

Every use which is not correlating from this designated use is illegitimate. Modifications of the cooling unit or the machine tool are illegitimate as well and prohibited for this reason.


**2.4 Special dangers**

**Danger! Electric voltage**



Danger to life by improper use of voltage. **Operations on electric devices / facilities have to be performed by qualified and skilled electricians**

**Warning! Danger of suffocation**



If maintenance or repair works of the refrigeration circuit should be required, please **notify a qualified refrigeration technician**. Leaking refrigerant can displace the air in poorly ventilated rooms. This can lead to suffocation.

**2.5 Qualification of staff**

Qualification of the operator	Operator	Authorized operations on the cooling unit
Instructed person	Operator machine tool	Cleaning, refilling coolant, removing and cleaning the air filter, removing cover for maintenance
Qualified person	Service technician	Maintenance and repair work including dismantling of housings and covers, opening of switch cabinet, services on the coolant circuit
	Electrician	Opening of switch cabinet and electrical devices, electrical wirings and repairs
	Refrigeration technician	<b>Service and repair work at the refrigeration circuit</b> , simple electrical operations

**Laypersons are only allowed to remain in the area of the cooling unit if they are accompanied by instructed persons.**

Chart 2: Qualification of people operating the cooling unit

## 2.6 General notes

**Please pay attention** to the general safety instructions before starting up the cooling unit in order to prevent fire, electric shocks or injuries.

**Do not place any items on top of the cooling unit:** Items may cause injuries to persons when falling down.

**Should welding or brazing operations be required during repair work,** it is advised to dismantle the coolant tank from the cooler. Wipe off any remaining coolant from the system completely before starting welding or brazing jobs. Do not carry out any welding or brazing work without explicit permission of the company.

## 2.7 Notes to the cooling fluid – the coolant

The company operating the cooling unit is solely responsible for an adequate quality and compounding of the coolant.

### Important!



The used coolant has to comply with the specifications of the tooling spindle manufacturer. The coolant consists of water and additives / cooling lubricants.

Only use additives / cooling lubricants approved by the manufacturer of the tooling spindle. Otherwise damage to the machine tool can be caused.

### 3 Product description

#### 3.1 Positions of warning signs

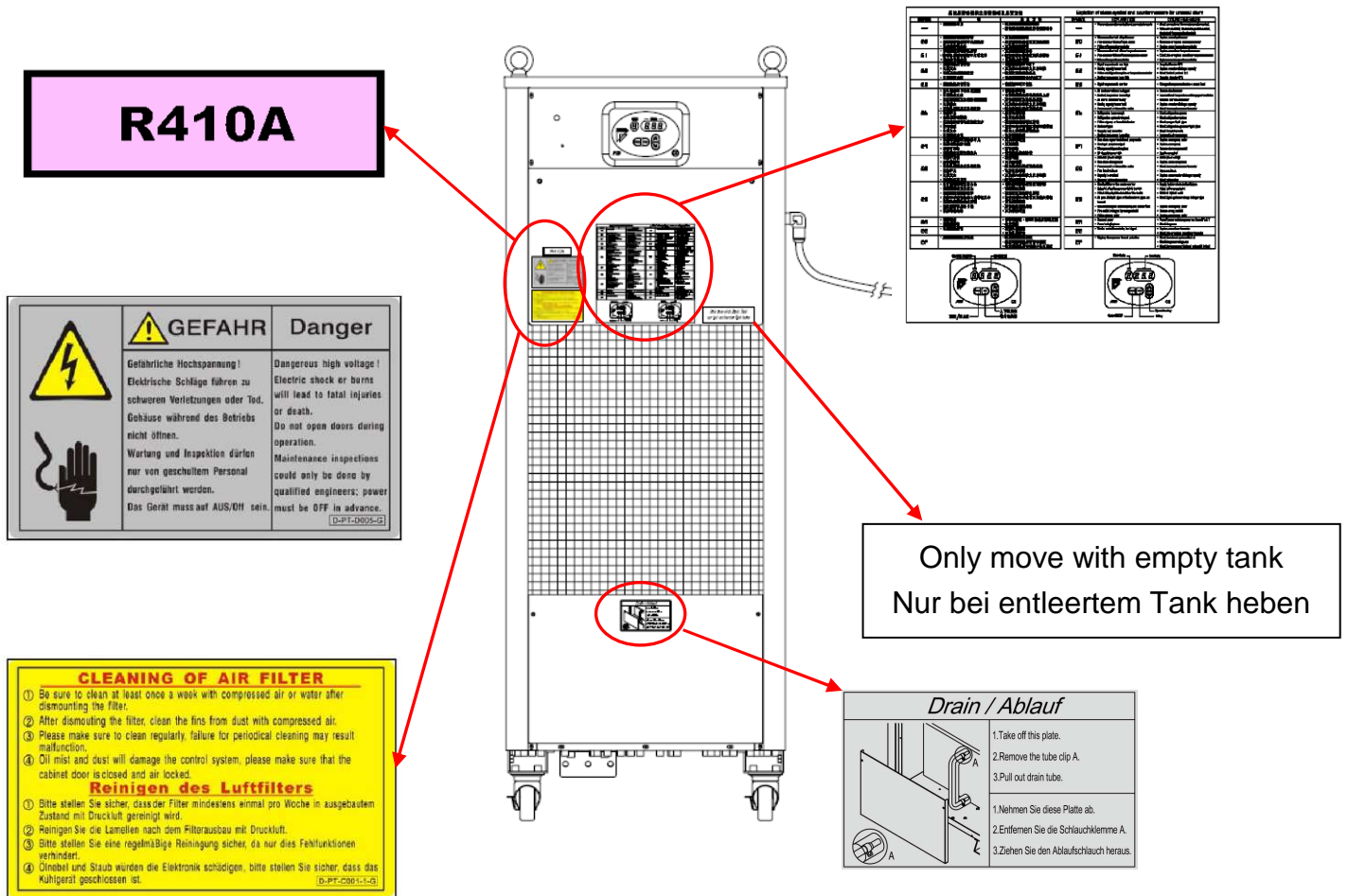


Illustration 1: Front view of the cooler and overview of the stickers attached to the cooler unit

Illustration shows a pictograph “R410A”. The effectively used refrigerant may vary.



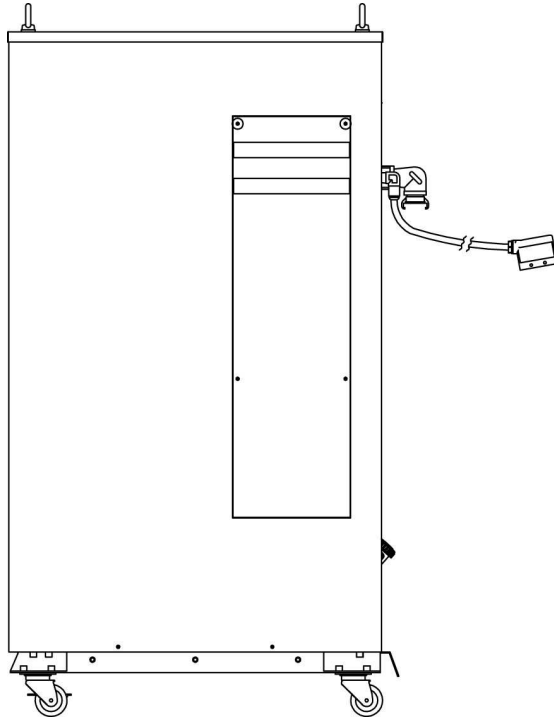


Illustration 2: Left view

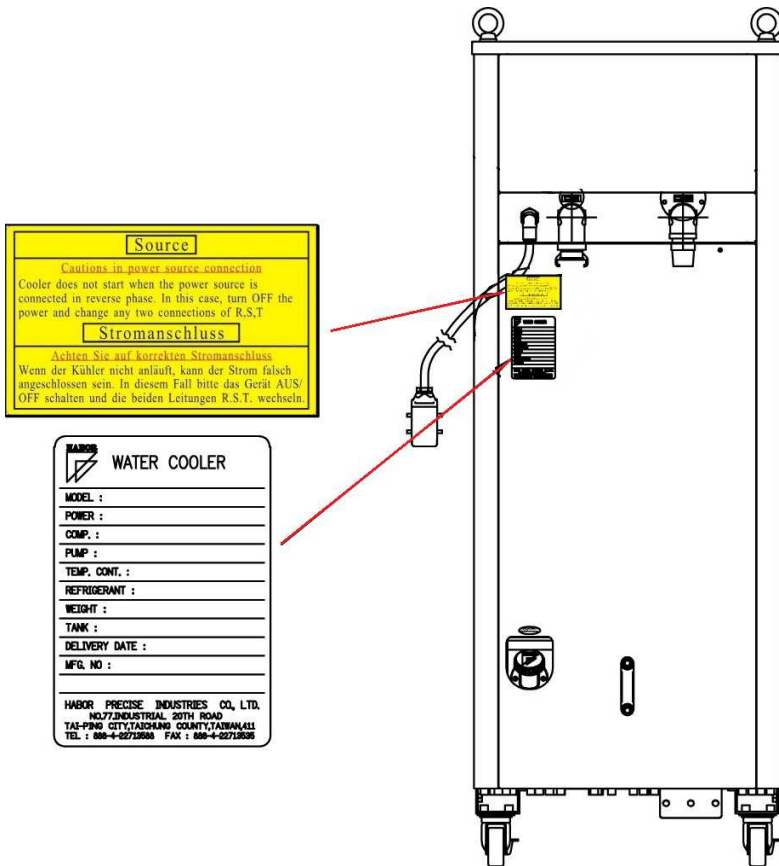


Illustration 3: Rear view

### 3.2 Safety instructions for transportation

The manufacturer does not accept any liability for damages caused by transportation or improper storage. After receiving the cooling unit, check it for damages caused during transportation immediately.

When transporting or relocating the cooling unit, ensure appropriate lifting equipment is used, i.e. crane or forklift. Do not try to lift the cooling unit by hand only.


Keep the cooling unit in an upright position during transportation.

Do not incline the cooling unit, lay it down or turn it upside down. Disconnect the power cord and discharge the coolant unit before relocating the cooling unit.

WATER COOLER <b>CE</b>	
MODEL :	_____
POWER :	_____
COMP. :	_____
PUMP :	_____
TEMP. CONT. :	_____
REFRIGERANT :	_____
WEIGHT :	_____
TANK :	_____ ✓
DELIVERY DATE :	_____
MFG. NO :	_____

The weight of the cooling unit is given on the **type plate** and in the product specification sheet.

The transportation and lifting equipment has to be capable for carrying the respective weight.

<b>Caution!</b>	
	Keep the cooling unit in an upright position and avoid collisions or shocks during transportation.

### 3.3 Lifting with a forklift

While moving the cooling unit with a forklift, make sure that it is securely fastened and cannot overturn. The cooling unit should not be lifted higher than 20 cm above ground.

(See illustration below)

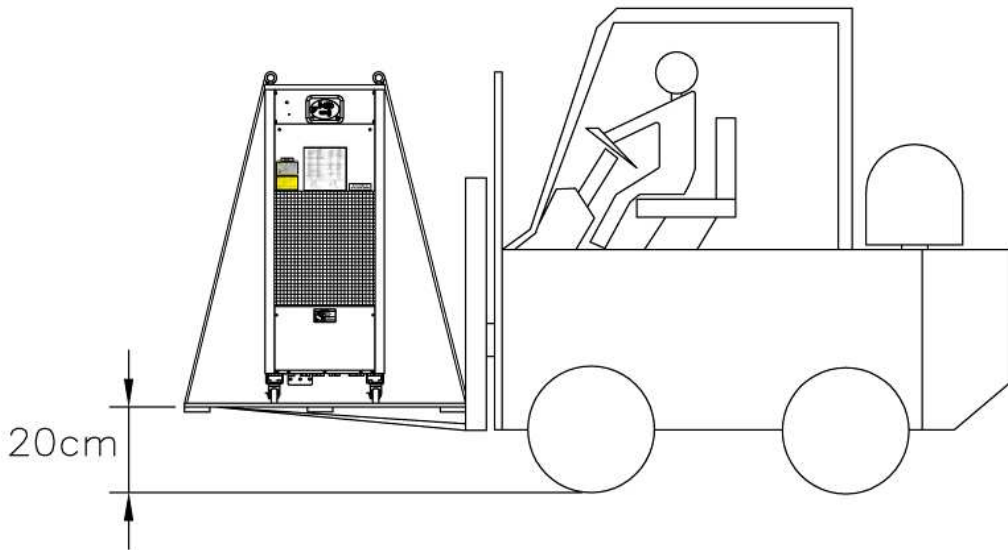
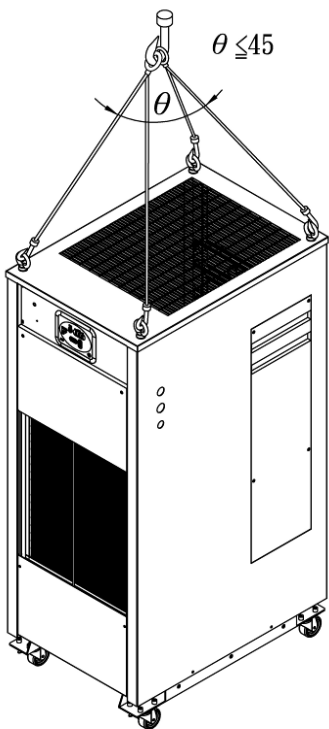


Illustration 4: Transportation with a forklift

### 3.4 Moving with a crane



- (A) Only use the four eyebolts which are located on the four suspension points.
- (B) Keep the cooling unit in an upright position and well-balanced.
- (C) While lifting, all persons must keep a sufficient clearance.
- (D) The inner angle of the wires may not be less than 45°.  
(← Please refer to the illustration on the left)


Illustration 5: Instruction for transportation with a crane

### 3.5 Choosing the location

Prevent unauthorized access: The working area around the cooling unit is for instructed staff only.

Provide a clean and sufficiently lit working area: Insufficient lighting and contamination can cause accidents.

Below you can find the permitted temperature range of the cooling unit and the required space around the cooling unit.

Caution! (Avoid dangers by environmental influences )	
	<p>Do not locate the cooling unit in damp or wet areas. Do not expose the cooling unit to direct sunlight. Locate the cooling unit in a clean environment and in well-ventilated areas.</p> <p>Do not locate the cooling unit at any place where the atmosphere contains corrosive or flammable dusts, liquid mist or conductive powder (such as carbon or metal)lt.</p>

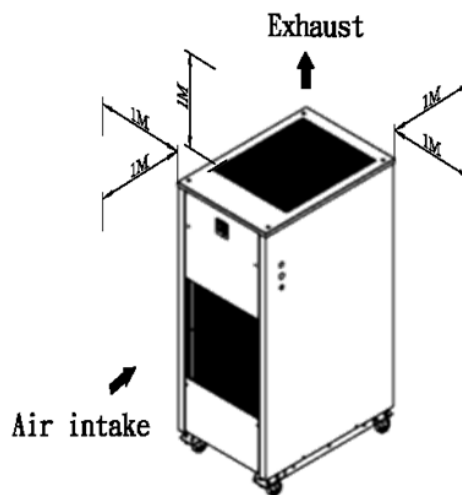
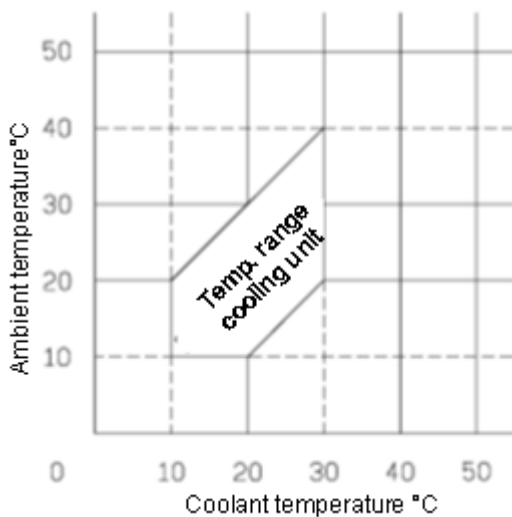



Illustration 6: Operating temperature range

Illustration 7: Required space around the cooling unit

Caution!	
	<ul style="list-style-type: none"><li>• This cooling unit may not be operated at ambient temperatures above 40°C or below 10 °C.</li><li>• Provide sufficient air circulation in the areas of air intake and exhaust.</li></ul>

### 3.6 Storage

#### Caution!



If the cooling unit is equipped with wheels, please secure it against unintended moving. Unlocked wheels might cause injuries and damage to the cooling unit.

Usually ensure protection of the interior components and condenser against dust and humidity in case of long term storage.

- (1) Store the cooling unit in a dry and dust-free environment.
- (2) Store the cooling unit on a flat surface.
- (3) Clean the power cord before storing away for a long time.
- (4) Use an adequate cover as protection against dust and humidity (e.g. VCI-film)

### 3.7 Tubing

#### Caution!



The coolant tubes and components used must be suitable to withstand a pressure of 15 bars at least.

- (1) All of the coolant tubes and parts for connecting the machine tool to the cooling unit have to be provided by the customer.
- (2) Do not use inflexible tubes. All tubes should be flexible. Use tubes free of contaminants to avoid malfunction of the heat exchanger and pump.
- (3) A filter is installed to the inlet of the coolant circuit. It comprises a filter element of stainless steel with a mesh size of 250 µm.
- (4) The external tubes leading from the machine tool into the cooling unit must not be thinner than the diameter of the inlet and outlet ends of the coolant circuit.

#### Important!



The use of sealing tape is recommended to avoid leakage or air infiltration into the system.

To avoid loss of flow rate or coolant pressure, keep the tube length as short as possible and use as little valves as possible.

### 3.8 Wiring

- Only use the power cord included in the delivery.
- Only use wires that are not damaged and that suit the systems' voltage.
- Connect the wires according to the wiring diagram.
- Illustrations on pages - 42 -and - 43 -show the basic wiring. The entire wiring is given in the specification of your cooler.

#### Important!



To operate the cooling unit by remote control, connect the signal cable to the RE1 and RE2 terminals.  
To receive error messages from the machine tool, please connect the signal cable to the 11 and 12 terminals of the control board.

#### Danger! Electric voltage



Take all necessary safety precautions before carrying out any wiring.  
Any electric wiring should comply with the electric regulations and should be carried out by qualified and certified technicians.  
Disconnect the main power supply from the machine tool and the cooling unit before performing any electric wiring or maintenance jobs.  
A circuit breaker has to be installed at the power source in order to avoid the risk of electric shocks.

### 3.9 Grounding



Make sure the grounding wire has been connected properly.  
Do not connect the grounding wire to gas tubes, lightning rods or grounding wire of phone sets in order to avoid electric shocks.

## 4 Starting up / check list

The following steps have to be carried out by qualified persons before starting up the cooling unit:

- Make sure the input voltage and phases are properly connected.
- Make sure the coolant tubes are properly connected. Check if the coolant circuit reveals any leakages.
- Make sure the electric wiring is properly connected, including grounding connection.
- Make sure the coolant level in the tank and system is within the operation range.  
**Attention:** Insufficient amount of coolant within the system will cause damage to the pump
- Check the location of the cooling unit. Provide an adequate working environment supplying ventilation and ambient temperatures, which are within the permitted temperature range.  
**Attention:** Excessive restarting operations will damage the cooling unit. After it has been switched off, do not restart the cooling unit within the following 3 minutes!
- It is possible that air penetrates into the coolant circuit, which decreases the flow rate and increases the noise level within the system.

To release the air from the coolant circuit, please perform the following steps:

- (A) Connect main power supply to the cooling unit to start the operation of the pump.
- (B) Loosen the tube at the outlet of the cooling unit slightly to deflate the air. After having released the air, tighten the tube again.
- (C) Disconnect the power supply.

## 5 Control panel


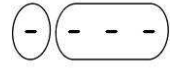


Illustration 8: Display of PID control panel


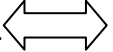






### 5.1 PID control

Control panel explanation

Please refer to the illustration above, functions are explained below:



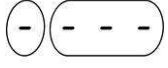
1.		<p>Cooling unit Start/Stop switches the cooling unit on and off.</p> <p>When connecting the cooling unit to the power supply, the display indicates the following:</p>	<p>Indication on display</p> 
		<p>Pressing the <b>POWER</b> key will start up the cooling unit. Pressing the <b>POWER</b> key while the cooling unit is operating will stop the cooler.</p> <p>If the cooling unit is remote-controlled by the machine tool, please disable this function.</p>	







2.		<p>Parameter key After pressing the <b>PARA</b> key, the panel will display the parameter information according to the control type.</p> <p><b>Steady temperature control:</b> Coolant temperature r.  Set temperature A. The parameter will change between r. and A. when pressing the <b>PARA</b> key repeatedly.</p> <p><b>Differential temperature control type:</b> Basic temperature b.  Coolant temperature r.  Set value A.  Basic temperature b. The display alternates between parameters b., r. and A. when pressing the <b>PARA</b> key repeatedly.</p>	
3.	<p>The display shows the current parameter values, temperatures and alarms/errors of the cooling unit.</p> <p>Modes of operation: b.= Basic temperature of sensor (differential temperature control type only) r. = Coolant temperature A. = Set value</p>	<p><u>Indication on display</u></p> 	
4.	 	<p><b>Set keys up / down</b> Changing set values.</p> <p>Press the <b>up</b> or <b>down keys</b> to set the temperature. The function of these keys is available only in set value A parameter.</p> <p>Standard setting range: - steady temperature control:  - Differential temperature control:</p>	<p><u>Indication on display</u></p> <p><b>10.0 – 40.0°C</b></p> <p><b>-9.9 – +9.9 K</b></p>


Explanation of operation

Procedure when starting up the cooling unit:

1.	 	<p><b>Starting up the cooling unit</b>                  When the cooling unit is connected to power, →→</p> <ul style="list-style-type: none"> <li>- In case of remote control connection, please establish the connection.</li> <li>- Without remote control: Press the <b>POWER</b> key on the panel.</li> <li>- The display shows the current temperature.</li> <li>- While cooler starts up, the dot next to the parameter on the <b>MODE</b> display will flash.</li> </ul>	<p><u>Indication on display</u></p> 
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2.	   	<p><b>(A) Changing the set value</b></p> <ul style="list-style-type: none"> <li>- The <b>MODE</b> display will show the current parameter when the <b>PARA</b> key is pressed.</li> <li>- Press the <b>PARA</b> key until "A." is indicated.</li> <li>- Use the <b>up</b> and <b>down</b> arrow keys to change the set value.</li> </ul>	
Setting the range of steady temperature control: Setting the range of differential temperature control:		<p><b>10.0 – 40.0 °C</b>  <b>-9.9 – +9.9 K</b></p>	

**Important!**



If the coolant temperature is below the ambient temperature, condensation inside of the coolant tank and on the tubes may occur.  
 Do not set the values below the ambient temperature if it is not required.

3.	<p><b>Shutting down the cooling unit</b></p> <ul style="list-style-type: none"> <li>- If the cooling unit is operated by remote control, disconnect it by pressing the <b>Off</b> key.</li> <li>- If no remote control is used, press the <b>POWER</b> key.</li> <li>- As soon as the power supply is disrupted, the display will remain off.</li> </ul>
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**Important note:**

Please contact Habor Precise Industries Co. Ltd. or a&g automation and gears GmbH if there is a demand for changing the parameter set!

5.2 Regular temperature control of ±1K

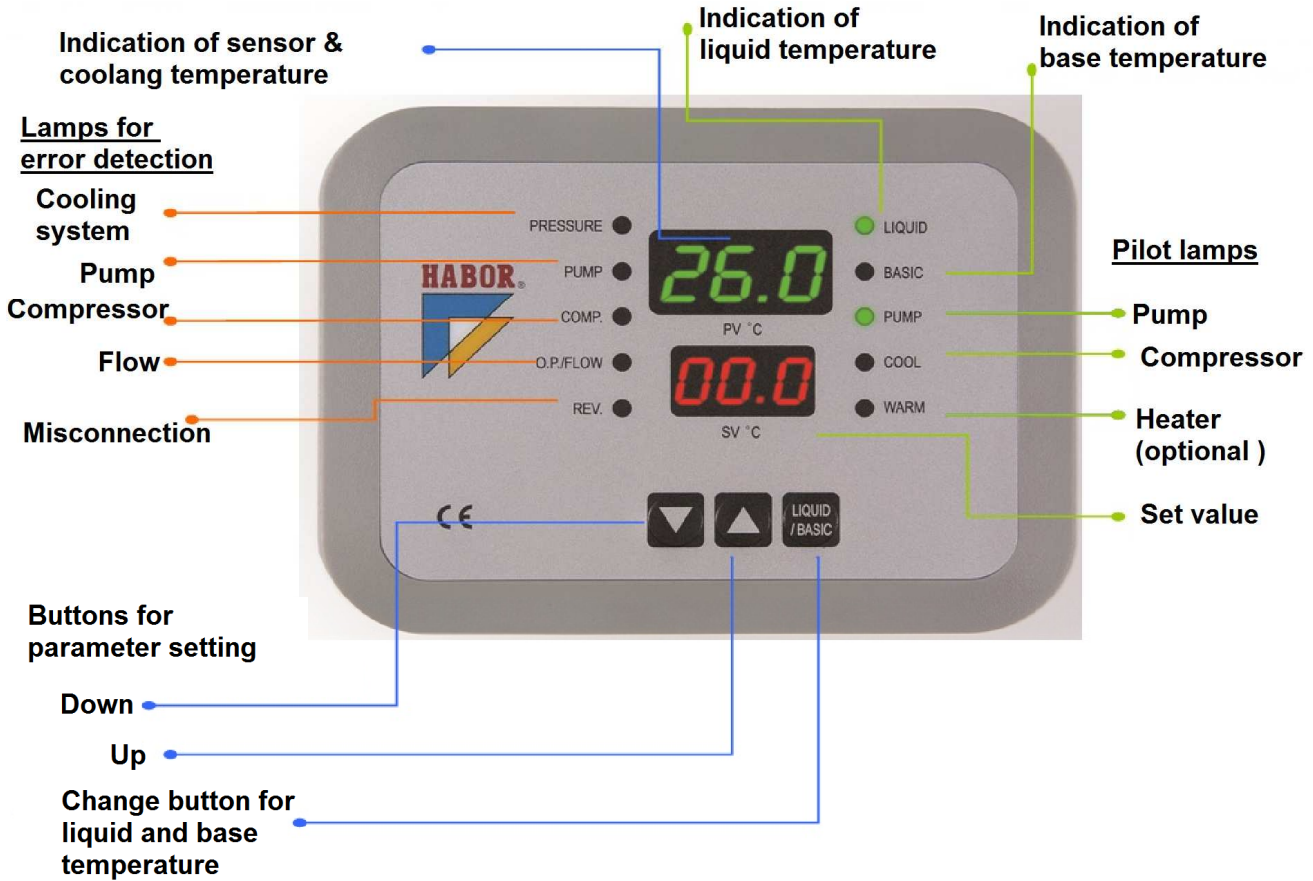


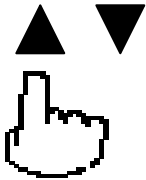

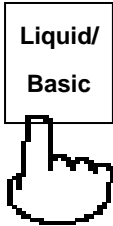


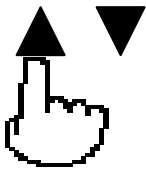

Illustration 9: Display of control panel (±1K)

**Explanation of operation**

**Procedure when starting up the cooling unit:**

The cooler starts operation as soon as it was connected to the power supply and indicates the values of PV°C and SV°C in the display. The pump starts running and the related pilot lamp will flash up.

1.	<b>PV°C:</b> indicates the temperature of the liquid in the tank (at the bottom of the cooling unit)	Display shows PV °C
	<b>SV°C:</b> indicates the currently set value	Display shows SV °C
2.	PUMP: Indicates, if the pump is running	Pilot lamp (green)
	COOL: Indicates if the compressor is running.	
	WARM: Indicates if the heater is running (optional).	
The <b>Liquid/Basic key</b> is <b>disabled</b> for coolers supplied with <b>steady temperature control</b> .		

3.1		For setting the temperature push the keys for at least ½ seconds, <b>steady temperature control: +10°C up to +40°C.</b>	<u>Display shows</u> <u>SV °C</u>
		As soon as <b>PV°C</b> is higher than <b>SV°C</b> the compressor is operating and the pilot lamp <i>Cool</i> will flash.  The cooling process continues <b>until PV°C ≤ SV°C</b> . The cooling process (compressor is powered off) is finished for the moment and the pilot lamp <i>Cool</i> goes off.	 Cool  <input type="radio"/> Cool
Coolers supplied with <b>differential temperature control</b> are equipped with a <b>second temperature sensor</b> outside of the cooling unit. (Temperature sensor for <b>machine body or ambient</b> ).			
3.2		If you press the <i>Liquid/Basic</i> key, then the pilot lamp <i>Basic</i> will flash green.  The <u>PV °C</u> display indicates the temperature of the second (Base-) temperature sensor	<input type="radio"/> Liquid  Basic
		As soon as you release the <i>Liquid/Basic</i> key, the pilot lamp <i>Liquid</i> will flash green  The <u>PV °C</u> display indicates the temperature of the second (Base-) temperature sensor	 Liquid <input type="radio"/> Basic
		For setting the temperature push the keys for at least ½ seconds, <b>differential temperature control within a range of ±10K.</b>	<u>Display shows</u> <u>SV °C</u>
		If the set value (SV°C) is negative (-1 up to -10) the cooling process will be started. Compressor and pilot lamp <b>Cool</b> will flash. The cooling unit will continue the cooling process until the difference of the temperature sensors ( $\Delta$ <i>Liquid-Basic</i> ) at the bottom of the tank ( <i>Liquid</i> ) and the second temperature sensor ( <i>Basic</i> ), equals the value of SV°C. Pilot lamp <i>Cool</i> goes off.	 Cool  <input type="radio"/> Cool
4.	<b>Error detection / malfunction indicator</b>		
	If there should occur a malfunction, disruption or any impermissible operating condition during operation, then the cooling unit will go off immediately and the cooling unit will indicate a possible cause for this breakdown. For further instruction for troubleshooting, please refer to chapter 7 starting from page - 23 - in this manual.		

**Important!**




If the coolant temperature is lower than the room temperature there may appear condensations inside of the coolant tank and in the hose lines.  
For this reason, please do not set temperature values below the ambient temperature as long as there is no need for it.

## 6 Maintaining, cleaning and repairing


**Do not place any items on top of the cooling unit:** Items may cause injuries when falling down.

**Danger! Electric voltage**



Please disconnect the main power supply before proceeding with any maintenance or cleaning work (includes removing the air filters). Removing any components during operation might cause damage to the cooler or even serious injuries.

**Caution!**



Please take all necessary safety precautions before performing any maintenance or repair work. To ensure the performance level and durability of the cooling unit, regular maintenance is required. A clean, well ventilated environment is also essential for an operation without disruption.

Cleaning:

List of components and items that need to be cleaned frequently

Component	Time interval	Procedure	Responsibility
Housing	As soon as contamination is observed	According to manual	Instructed person
Condenser	To be checked on contamination every 14 days		
Air filter	Every 14 days		
Coolant filter	Every 6 months		
Electrical components	As soon as contamination is observed		<b>Qualified person</b>
Coolant tank	Every 6 months		Instructed person

Chart 3: List of components and items that need to be cleaned frequently

**Important!**



The coolant filter on the inlet of the cooling unit has to be cleaned every day during the first three days of initial operation. Check the filter for contamination and residua.

**Please pay attention to the detailed information regarding the cleaning procedure as shown below.**



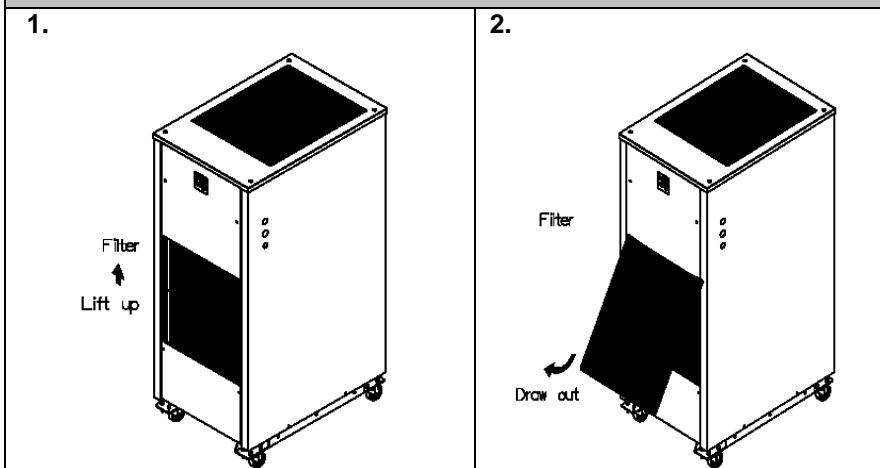
Component	Correct 	Incorrect 
Housing	Clean the surface of cooling unit with neutral detergent or suitable soap.	Do not use hot water, steel-brushes, polishing powder or any acidic solvents in order to prevent any damages to the paint of the housing.
Inner surface of the cooling unit	Dry cleaning (avoid wet cleaning)	Avoid exposing the electrical components to humidity when cleaning the inner surface
Electrical components	Dry cleaning only by qualified person	

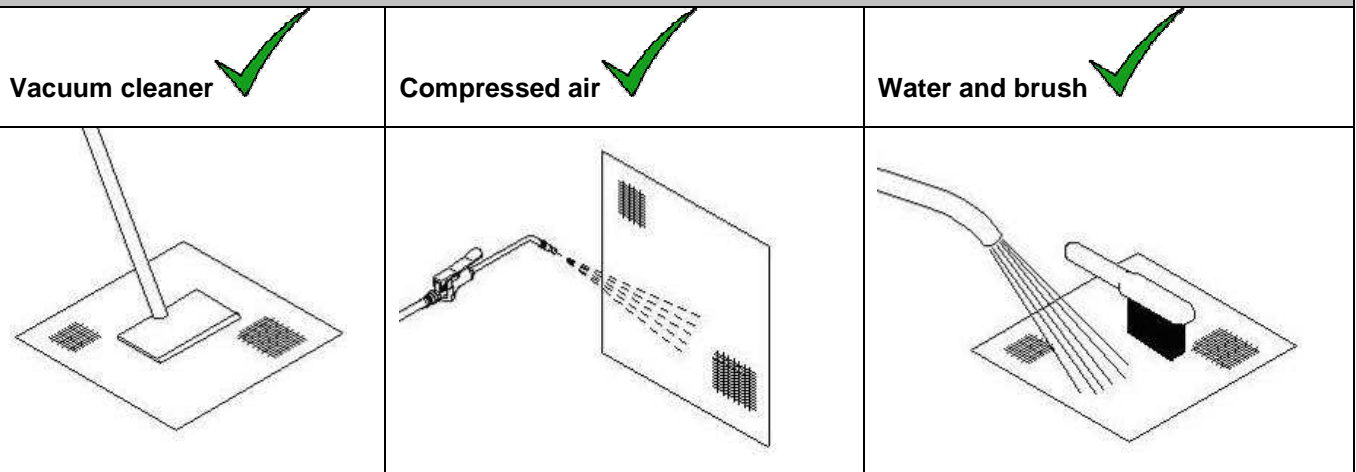
Chart 4 Detailed information on the cleaning procedure

## Air filter

To remove the air filter, please lift up the filter element and remove it out as shown below.



To clean the air filter, please use



Do not install the filter before it is completely dried.

## Important!

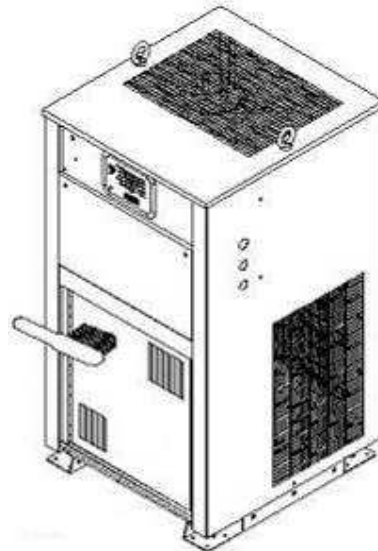
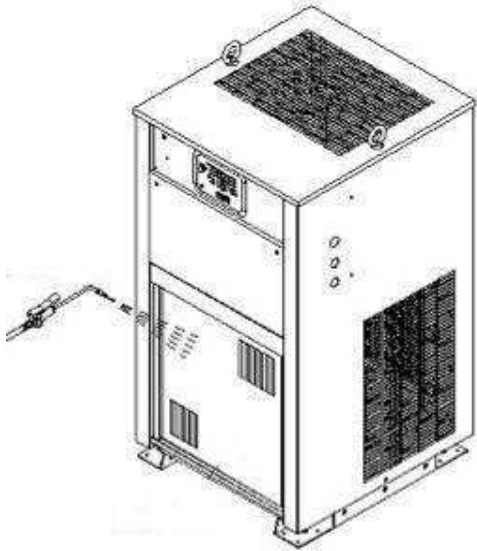


If the air filter is contaminated, then you need to clean it more frequently than required.

## Condenser

Check the condenser once a week for contamination.

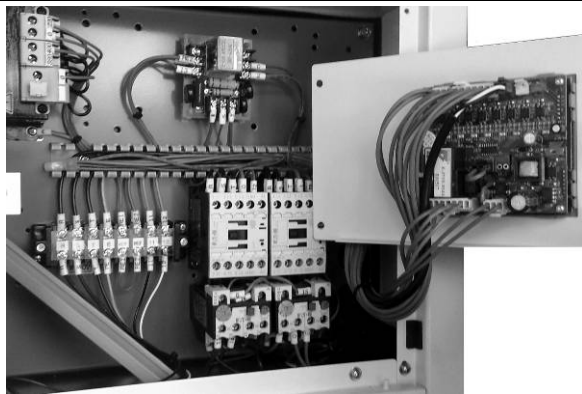
**Location: behind the filter** (front side of cooling unit)



Use **compressed air** or a **brush** to remove dust.

## Electrical components: Example of control unit

Check the main board for contamination.



To clean electrical and electronic components use a suitable vacuum cleaner or fan.

## Coolant tank

If the cooler is located in a rather humid climate zone, the water might be formed within the tank and might settle on the bottom. Empty the tank at least every 30 days. Use the sealed maintenance opening on top of the coolant tank for cleaning it.



**Important!**



To clean the coolant tank, it is recommended to use a common vacuum cleaner for industrial use.  
If you use detergents, make sure that there are no residua left inside before refilling the tank.

## 7 Troubleshooting

Before starting any repair work you must take all necessary safety precautions. Make sure that all the inspections and repair works are performed by qualified professional technicians.

If any errors or abnormal modes of operation occur, the cooler will stop automatically and the display will indicate an error message.

In the subsequent section you will find the error message list, which will help to eliminate errors.

The cooling unit has to be restarted after error correction.

**Important!**



When replacing defective components, only spare parts from Habor or parts, which are identical in construction and performance, are permitted for use. The most important components are listed in the chart on page - 38 -.

For requests of spare parts, information on the cooler **Type** and **MFG number** has always to be provided. You find this information on the type plate of the cooling unit. The contact information of Habor and their representatives are included in this manual.

OIL COOLER CE	
MODEL :	✓
POWER :	
COMP. :	
PUMP :	
TEMP. CONT. :	
REFRIGERANT :	
WEIGHT :	
TANK :	
DELIVERY DATE :	
MFG. NO :	✓

For service cases please refer to our service form on page 38

## 7.1 Leakage

Leakages at tubes or their connections can be fixed by sealing or by replacing defective parts.

Make sure that inspections and repair works are carried out by service and refrigeration technicians only. For Situation of the failure mode, please contact Habor or their representatives.

### Should repair works require welding or brazing jobs:

- (1) Choose a well-ventilated area to avoid suffocation when releasing the refrigerant.
- (2) Make sure the removal of the refrigerant from the cooling unit is carried out by a qualified refrigeration technician.
- (3) Remove the entire coolant from the cooling unit and disconnect all the tubes between the machine tool and the cooling unit in order to avoid the danger of fire.

#### Warning! Danger of suffocation



If maintenance or repair works of the refrigeration circuit should be required, please **select a qualified refrigeration technician to undertake this job.** In narrow and poorly ventilated rooms refrigerant fume can lead to suffocation.





#### .Warning! Fire hazard



**Do not carry out any welding or brazing jobs without explicit permission of the company.**

## 7.2 Sudden stop during operation with error messages displayed

### 7.2.1 For high-precision coolers ( $\pm 0.1K$ )

(A)	Situation	<b>The power phase at the input of the cooling unit has been reversed.</b>
	Possible causes	<ul style="list-style-type: none"> <li>• Phases of main power source are connected incorrectly.</li> <li>• Power source is single phased.</li> <li>• Reverse-phase relay failure.</li> <li>• Temperature controller failure.</li> </ul>
	Identification	<ul style="list-style-type: none"> <li>• Check if the power phase input is correct.</li> <li>• If the power phase is connected correctly, check reverse-phase relay or temperature controller for defects.</li> </ul>
	Corrective action	<ul style="list-style-type: none"> <li>• Reconnect the power cable with correct phase.</li> <li>• A three-phase cooling unit must be connected to three-phase power source.</li> <li>• Replace the defective parts.</li> </ul>
(B)	Situation	<b>Coolant level in the tank is too low.</b>
	Possible causes	<ul style="list-style-type: none"> <li>• Not enough coolant in the tank.</li> <li>• Level switch failure.</li> </ul>
	Identification	<ul style="list-style-type: none"> <li>• Check if the coolant level in the coolant tank is sufficient.</li> <li>• If the coolant level is sufficient, the level switch is defective.</li> </ul>
	Corrective action	<ul style="list-style-type: none"> <li>• Make sure there is always enough coolant in the coolant circuit.</li> <li>• Replace the defective level switch.</li> </ul>
(C)	Situation	<b>Fan motor overloaded</b>
	Possible causes	<ul style="list-style-type: none"> <li>• The overload protector switch of the fan motor was triggered: Fan motor is defective</li> </ul>
	Identification	<ul style="list-style-type: none"> <li>• Reset the overload protector switch to check if a sudden overload occurred.</li> <li>• Check the fan motor on defects.</li> </ul>
	Corrective action	<ul style="list-style-type: none"> <li>• Reset the overload protector switch.</li> <li>• Replace the fan motor.</li> </ul>
(D)	Situation	<b>Coolant temperature sensor failure</b>
	Possible causes	<ul style="list-style-type: none"> <li>• Connection to the coolant temperature sensor is disrupted.</li> <li>• Coolant temperature sensor failure.</li> <li>• Temperature controller failure.</li> </ul>
	Identification	<ul style="list-style-type: none"> <li>• Check the wires and connections of the coolant temperature sensor on damages.</li> <li>• If the wires and connections are intact, a defect of the temperature controller or sensor is likely.</li> </ul>
	Corrective action	<ul style="list-style-type: none"> <li>• Reconnect the wire or replace the wire if required.</li> <li>• Replace the defective parts.</li> </ul>

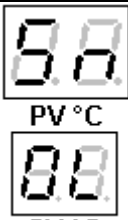
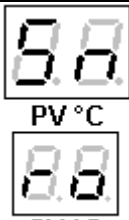
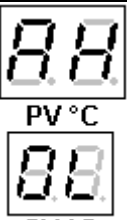
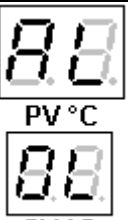
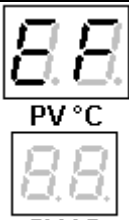
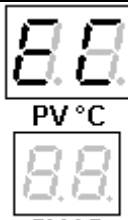
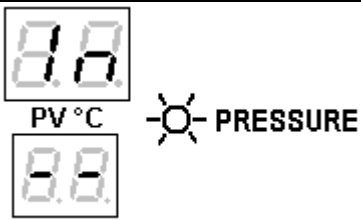
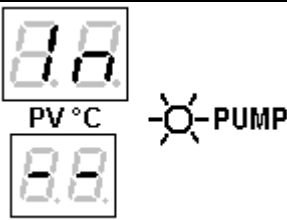
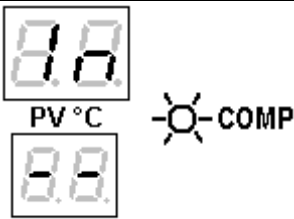
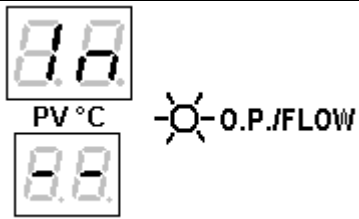
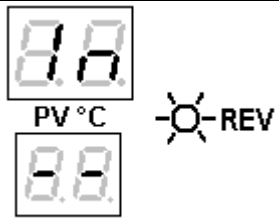
(E)	<i>Situation</i>	<b>Coolant temperature is too high for operation of the cooling unit</b>
E 2	<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• Coolant temperature exceeds 40°C.</li> <li>• Process load (cooling capacity demand) exceeds the limit of the cooling unit's capacity.</li> <li>• Coolant temperature sensor is defective.</li> <li>• Refrigeration system failure</li> </ul>
	<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check if the ambient and coolant temperatures are above the limit of 40°C.</li> <li>• Check if the cooling unit's capacity suits the process load.</li> <li>• The copper pipe at the low pressure side of the compressor is not cold.</li> <li>• Fins of the condenser are not hot. <b>CAUTION:</b> touching hot surfaces causes burnings!</li> <li>• The temperature of the dryer is lower than the exhaust heat.</li> <li>• Check if the coolant temperature sensor works properly.</li> </ul>
	<i>Corrective action</i>	<ul style="list-style-type: none"> <li>• Make sure that the coolant temperature remains below 40°C. Make sure that the cooling unit and the machine tool start up simultaneously.</li> <li>• Replace the cooling unit by a cooling unit with higher cooling capacity.</li> <li>• Replace the coolant temperature sensor.</li> <li>• Contact a refrigeration technician regarding refrigeration circuit failures.</li> </ul>
(F)	<i>Situation</i>	<b>Coolant / ambient temperature is too low for operation of the cooling unit</b>
E 3	<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• Coolant temperature is too low.</li> <li>• Ambient temperature is too low.</li> <li>• Temperature controller is defective.</li> <li>• Coolant / ambient temperature sensor is defective.</li> </ul>
	<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check if the coolant temperature and the ambient temperature are above 10°C.</li> <li>• Check if the temperature sensors function properly.</li> <li>• If the checks above did not reveal any failures, the temperature controller is defective.</li> </ul>
	<i>Corrective action</i>	<ul style="list-style-type: none"> <li>• Make sure the coolant temperature is above 10°C. Make sure that the cooling unit and the machine tool start up simultaneously.</li> <li>• Keep the ambient temperature above 10°C.</li> <li>• Replace defective parts.</li> </ul>

(G)	<i>Situation</i>	<b>Pressure increase/decrease within the refrigeration circuit</b>
<b>E 6</b>	<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• Too less or too much refrigerant in the system</li> <li>• Obstructions or leakages happened in the refrigeration circuit.</li> <li>• Condenser/air filter is contaminated or clogged.</li> <li>• Insufficient maintenance.</li> <li>• Poor heat dissipation.</li> <li>• Fan failure</li> </ul>
	<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check if the cooling unit's inside temperature is too high.</li> <li>• Check if the air intake or exhaust is clogged.</li> <li>• Check if the air filter or the condenser is contaminated.</li> <li>• Check if the fan is broken.</li> <li>• The copper pipe at the low pressure side of the compressor is not cold.</li> <li>• Fins of condenser are not hot. <b>CAUTION:</b> touching hot surfaces causes burnings!</li> <li>• The temperature of the dryer is below the heat waste</li> </ul>
	<i>Corrective action</i>	<ul style="list-style-type: none"> <li>• Clean the air filter and the condenser regularly to improve the heat dissipation. Remove any items from air intake or exhaust.</li> <li>• Please contact the refrigeration technician regarding defects in the refrigeration circuit.</li> <li>• Replace defective parts.</li> </ul>
(H)	<i>Situation</i>	<b>Failure of the pump, which triggered the overload protector</b>
<b>E 7</b>	<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• Trigger of overload protector.</li> <li>• Deficient insulating or burned out pump motor.</li> <li>• Obstruction in the coolant circuit.</li> </ul>
	<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check if the pump motor still operates.</li> <li>• Check if the pump bearing is clogged.</li> <li>• Check if the overload protector was triggered.</li> <li>• Check if the coolant flow in the tubes is sufficient.</li> </ul>
	<i>Corrective action</i>	<ul style="list-style-type: none"> <li>• Replace defective pump motor.</li> <li>• Reset the overload protector.</li> <li>• Clean the tubes. Add a filter if required.</li> <li>• In case the coolant filter is clogged, please clean it.</li> </ul>

(I)	<i>Situation</i>	<b>Failure of the compressor, which triggered the overload protector.</b>
E 8	<i>Possible cause</i>	<ul style="list-style-type: none"> <li>• Incorrect input power supply.</li> <li>• Insufficient maintenance.</li> <li>• Compressor is burned out.</li> <li>• Trigger of overload protector.</li> <li>• Poor heat dissipation.</li> <li>• Fan failure.</li> </ul>
	<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check if the input power supply is correct.</li> <li>• Check if the compressor is burned out.</li> <li>• Check if the overload protector was triggered.</li> <li>• Check if the cooling unit's inside temperature is too high.</li> <li>• Check if the fan is out of order.</li> </ul>
	<i>Corrective action</i>	<ul style="list-style-type: none"> <li>• Connect the cooling unit to the correct input power supply.</li> <li>• Clean the cooling unit regularly.</li> <li>• Replace the compressor.</li> <li>• Reset the overload protector.</li> <li>• Improve the working environment by providing better ventilation.</li> <li>• Replace the fan.</li> </ul>
(J)	<i>Situation</i>	<b>Failure in the coolant circuit</b>
E 9	<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• No or insufficient coolant flow</li> <li>• Coolant flow rate switch failure.</li> <li>• Air penetrates into the coolant circuit.</li> <li>• Pump motor failure.</li> </ul>
	<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check if there is enough coolant in the coolant circuit.</li> <li>• Too long, too thin and flattened coolant tubes will cause coolant pressure loss.</li> <li>• Clogged tubes cause lower flow rate and failure of the pump motor.</li> <li>• Check if air penetrated into the coolant circuit.</li> <li>• If the checks above did not reveal any failures, the coolant flow rate switch might be defect.</li> </ul>
	<i>Corrective action</i>	<ul style="list-style-type: none"> <li>• Pour coolant into the coolant circuit until the determined level is reached.</li> <li>• Increase the diameter or reduce the length of tubes.</li> <li>• Replace the defective pump motor.</li> <li>• Release the air from the coolant circuit.</li> <li>• Replace defective parts.</li> </ul>

7.2.2 For coolers equipped with regular temperature control ( $\pm 1K$ )

Overview of fault alarm messages

 <p>PV °C SV °C See (A)</p>	 <p>PV °C SV °C See (B)</p>	 <p>PV °C SV °C See (C)</p>	 <p>PV °C SV °C See (D)</p>	 <p>PV °C SV °C See (E)</p>
 <p>PV °C SV °C See (F)</p>	 <p>PV °C SV °C See (G)</p>		 <p>PV °C SV °C See (H)</p>	
 <p>PV °C SV °C See (I)</p>		 <p>PV °C SV °C See (J)</p>		 <p>PV °C SV °C See (K)</p>

(A)

**Situation**

**Temperature sensor for coolant is defective.**

*Possible causes*

- Connection to the coolant temperature sensor is disrupted.
- Coolant temperature sensor failure.
- Temperature controller failure.
- Check the wires and connections of the coolant temperature sensor on damages.

*Identification*

- If the wires and connections are intact, a defect of the temperature controller or sensor is likely.

*Corrective action*

- Reconnect the wire or replace the wire if required.
- Replace the defective parts.

(B)

**Situation**

**Coolant temperature sensor failure**

*Possible causes*

- Connection to the coolant temperature sensor is disrupted.
- Coolant temperature sensor failure.
- Temperature controller failure.
- Check the wires and connections of the coolant temperature sensor on damages.

*Identification*

- If the wires and connections are intact, a defect of the temperature controller or sensor is likely.

*Corrective action*

- Reconnect the wire or replace the wire if required.
- Replace the defective parts.

**(C)**

**Situation**

**Coolant temperature is too high for operation of the cooling unit**

*Possible causes*

- Cooling process exceeded the operation limit of the cooling unit.
- Liquid temperature sensor is defective.
- Cooling system failure.
- Check if ambient or room temperature are outside of the permitted range
- Check if the cooling unit is dimensioned adequately for the cooling process.

*Identification*

- The copper pipes of the compressor are not cold at the low pressure side.
- The fins of the condenser are not hot.
- The temperature of the dryer is lower than the heat waste.
- Check if the sensor is working correctly.
- Make sure that the coolant temperature remains below 40°C. Make sure that the cooling unit and the machine tool start up simultaneously.

*Corrective action*

- Replace the cooling unit by a cooling unit with higher cooling capacity.
- Replace the coolant temperature sensor.
- Contact a refrigeration technician regarding refrigeration circuit failures

**(D)**

**Situation**

**Coolant / ambient temperature is too low for operation of the cooling unit**

*Possible causes*

- Coolant temperature is too low.
- Ambient temperature is too low.
- Temperature controller is defective.
- Coolant / ambient temperature sensor is defective.
- Check if the coolant temperature and the ambient temperature are above 5°C.

*Identification*

- Check if the temperature sensors function properly.
- If the checks above did not reveal any failures, the temperature controller is defective.

*Corrective action*

- Make sure the coolant temperature is above 5°C. Make sure that the cooling unit and the machine tool start up simultaneously.
- Keep the ambient temperature above 5°C.
- Replace defective parts.

**(E)**

**Situation**

**The surface temperature of the compressor is too high.**

*Possible causes*

- Heat dissipation is too low.
- Incorrect current supply.
- Failure of the compressor.
- Check if the air supply is jammed.

*Identification*

- Check the power supply.
- Check the condition of the compressor during starting up. Check the starting current.
- Make sure the heat dissipation in the environment of the cooler is adequate for operation.

*Corrective action*

- Reconnect the wires for current supply.
- Replace the defective compressor.

**(F)**

**Situation**

**Coolant level in the tank is too low.**

*Possible causes*

- Not enough coolant in the tank.
- Level switch failure.

*Identification*

- Check if the coolant level in the coolant tank is sufficient.
- If the coolant level is sufficient, then the level switch is defective.

*Corrective action*

- Make sure there is always enough coolant in the coolant circuit.
- Replace the defective level switch.



**(G)****Situation****Pressure loss was detected in the cooling system.***Possible causes*

- Too less or too low load of refrigerant in the cooling system.
- Obstructions or leakages occurred in the refrigeration circuit.
- Condenser or air filter are dirty or jammed.
- Insufficient heat dissipation.
- Failure of fan.

*Identification*

- The copper pipe at the low pressure side of the compressor is not cold.
- The fins of the condenser are not hot.
- The temperature of the dryer is lower than the heat waste.
- Check if the sensor is working correctly.
- Check if the inside temperature of the cooler is too high.
- Check if the air inlet or air outlet is jammed.
- Check the air filter and the condenser for contamination.

*Corrective action*

- Contact a refrigeration technician regarding refrigeration circuit failures
- Clean the air filter and the condenser regularly to improve the heat dissipation. Remove any foreign objects from air intake or exhaust.
- Replace the defective parts.

**(H)****Situation****Failure of the pump, which triggered the overload protector.***Possible causes*

- Trigger of overload protector.
- Deficient insulating or burned out pump motor.
- Obstruction in the coolant circuit.
- Check if the pump motor still operates.

*Identification*

- Check if the pump bearing is clogged.
- Check if the overload protector was triggered.
- Check if the coolant flow in the tubes is sufficient.
- Replace defective pump motor.

*Corrective action*

- Reset the overload protector.
- Clean the tubes and add a filter if required.
- In case the coolant filter is clogged, please clean it thoroughly.

**(I)****Situation****Failure of the pump, which triggered the overload protector.***Possible causes*

- Incorrect input power supply.
- Insufficient maintenance.
- Compressor is burned out.
- Trigger of overload protector.
- Poor heat dissipation.
- Fan failure.
- Check if the input power supply is correct.

*Identification*

- Check if the compressor is burned out.
- Check if the overload protector was triggered.
- Check if the cooling unit's inside temperature is too high.
- Check if the fan is out of order.
- Connect the cooling unit to the correct input power supply.
- Clean the cooling unit regularly.

*Corrective action*

- Replace the compressor.
- Reset the overload protector.
- Improve the working environment by providing better ventilation.
- Replace the fan.

**(J)**

**Situation**

**Pressure loss or insufficient coolant level in the circulation system**

*Possible causes*

- No or insufficient coolant flow
- Coolant flow rate switch failure.
- Air penetrates into the coolant circuit.
- Pump motor failure.
- Check if there is enough coolant in the coolant circuit.
- Too long, too thin and flattened coolant tubes will cause coolant pressure loss.

*Identification*

- Clogged tubes cause lower flow rate and failure of the pump motor.
- Check if air penetrated into the coolant circuit.
- If the checks above did not reveal any failures, the coolant flow rate switch might be defect.

*Corrective action*

- Pour coolant into the coolant circuit until the determined level is reached.
- Increase the diameter or reduce the length of tubes.
- Replace the defective pump motor.
- Release the air from the coolant circuit.
- Replace the defective parts.

**(K)**

**Situation**

**The power phase at the input of the cooling unit has been reversed.**

*Possible causes*

- Phases of main power source are connected incorrectly.
- Power source is single phased.
- Reverse-phase relay failure.
- Temperature controller failure.

*Identification*

- Check if the power phase input is correct.
- If the power phase is connected correctly, check reverse-phase relay or temperature controller for defects.

*Corrective action*

- Reconnect the power cable with correct phase.
- A three-phase cooling unit must be connected to three-phase power source.
- Replace the defective parts.

### 7.3 Sudden stop during operation without error messages displayed

For coolers equipped with PID-control:

<b>(A) Situation</b>	<b>Power supply is connected; cooling unit and pump do not operate. Display of the control panel remains dark.</b>
<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• The supply voltage is not connected properly or the circuit breaker disrupted the circuit.</li> <li>• Control board failure.</li> <li>• Fuse of the control circuit is blown.</li> </ul>
<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check if the main power supply is provided and if the circuit breaker is on "ON".</li> <li>• Check if the main power supply is connected properly.</li> <li>• Check the fuse in the control circuit.</li> <li>• If the checks above did not reveal any failures, the control board is defective.</li> </ul>
<i>Solution</i>	<ul style="list-style-type: none"> <li>• Reconnect the main power supply.</li> <li>• Replace the blown fuse.</li> <li>• Replace the control board.</li> </ul>
<b>(B) Situation</b>	<b>Power supply is connected; cooling unit and pump do not operate. Display of the operating control is switched on.</b>
<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• Cable of circuit breaker is not connected properly or failure of circuit breaker.</li> <li>• Failure of electromagnetic switch.</li> <li>• Incorrect input voltage.</li> <li>• Pump failure.</li> </ul>
<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check the connection and if the relay of circuit breaker conducts any voltage.</li> <li>• Check the electromagnetic switch.</li> <li>• Check the input voltage.</li> <li>• Check the pump motor.</li> </ul>
<i>Solution</i>	<ul style="list-style-type: none"> <li>• Correct any power input failures.</li> <li>• Replace defective parts.</li> </ul>
<b>(C) Situation</b>	<b>Sudden stop of the cooling unit during operation. Alarm signal sent to the control panel of the machine tool.</b>
<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• The vibration of the machine tool loosened the wire connections.</li> <li>• Remote control connection is disrupted.</li> <li>• Temperature controller connection is disrupted.</li> <li>• Temperature controller failure.</li> </ul>
<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check the connections of the remote control and the temperature controller.</li> <li>• If the connections are intact, the temperature controller is defective.</li> </ul>
<i>Solution</i>	<ul style="list-style-type: none"> <li>• Reconnect the connections.</li> <li>• Replace the temperature controller.</li> </ul>

For coolers equipped with regular temperature control:

1) Power supply; cooling unit and pump will not run.

<b>(A) Situation</b>	<b>PV°C, SV°C are not indicated on the display.</b>
<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• The supply voltage is probably not connected properly or the circuit breaker of the main supply voltage has been switched off.</li> <li>• Control circuit board failure.</li> <li>• Fuse of the control circuit has blown.</li> </ul>
<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check if the supply voltage is providing the power properly. (if the circuit breaker is ON)</li> <li>• Check if the connection wire is connected properly.</li> <li>• Check if the fuse of the control circuit is broken.</li> <li>• If the situations given above are not applicable, then the controller board is broken.</li> </ul>
<i>Solution</i>	<ul style="list-style-type: none"> <li>• Reconnect the main power source.</li> <li>• Replace the blown fuse.</li> <li>• Replace the controller board.</li> </ul>

<b>(B) Situation</b>	<b>PV°C, SV°C are indicated on the display; pilot lamp PUMP on.</b>
<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• Remote control function is not connected properly.</li> <li>• Power supply input is incorrect.</li> <li>• Electromagnetic switch is defective.</li> <li>• Motor failure.</li> </ul>
<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check the remote control connection.</li> <li>• Check the input voltage.</li> <li>• Check operation of electromagnetic switch.</li> <li>• Check if the motor is still working properly.</li> </ul>
<i>Solution</i>	<ul style="list-style-type: none"> <li>• Reconnect the remote control function.</li> <li>• The power supply of the motor must be identical with the input voltage of the cooler unit.</li> <li>• Replace the defective parts.</li> </ul>

(2) Pump is operating while the pilot lamp PUMP is on; but there's abnormal condition with the liquid circulating system.

<b>(A) Situation</b>	<b>Liquid flow rate is decreasing and noise is emerging from the pump.</b>
<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• Cloggy filter (supplied by the user).</li> <li>• Due to liquid pressure loss in the system the pressure regulator was triggered.</li> <li>• Insufficient liquid quantity in the tank.</li> <li>• Air penetrated into the liquid circulating system.</li> </ul>
<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check if the filter (supplied by the user) is clogged by contaminants.</li> <li>• Check if there's any liquid pressure loss or if the bypass valve is opened.</li> <li>• Check if the liquid level in the tank is in the permitted range.</li> <li>• Check if air penetrated into the liquid circulating system.</li> </ul>
<i>Solution</i>	<ul style="list-style-type: none"> <li>• Clean the filter (supplied by user).</li> <li>• Increase the diameter and shorten the length of the hoses to avoid pressure loss.</li> <li>• Pour in more liquid into the tank.</li> <li>• Remove the air enclosed in the circulating system.</li> </ul>

(3) Pump is operating, but there's abnormal condition of the refrigerating system.

<b>(A) Situation</b>	<b>No cooling performance identifiable (i.e. compressor is down)</b>
<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• The compressor will stop operating when the temperature of the liquid has met the set value (SV°C).</li> <li>• Electromagnetic switch failure.</li> <li>• Poor heat dissipation.</li> </ul>
<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check if the liquid temperature has met the required cooling range.</li> <li>• Check if the electromagnetic switch is intact.</li> <li>• Check if cooler unit's inside temperature is too high.</li> </ul>
<i>Solution</i>	<ul style="list-style-type: none"> <li>• The compressor usually stops when the liquid temperature has met the set value.</li> <li>• Replace the electromagnetic switch.</li> <li>• Improve the working environment. Make sure the ambient temperature is suitable and make sure the ventilation around the cooler is optimized.</li> </ul>
<b>(B) Situation</b>	<b>Cooling process continues even when set value is met.</b>
<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• Cooling process exceeded the operation limit of the cooling unit.</li> <li>• Poor heat dissipation.</li> <li>• Leakage of refrigerant.</li> <li>• Temperature sensor failure</li> </ul>
<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check if the capacity of the cooler unit is suitable for the process load.</li> <li>• Check if the inside temperature of the cooler unit is too high.</li> <li>• The copper pipes of the compressor are not cold at the low pressure side.</li> <li>• If the situations given above are not applicable, then the temperature sensor is broken.</li> </ul>
<i>Solution</i>	<ul style="list-style-type: none"> <li>• Replace the cooling unit by a cooling unit with higher cooling capacity.</li> <li>• Improve the working environment to lower ambient temperature and create better ventilation.</li> <li>• Replace the coolant temperature sensor.</li> <li>• Contact a refrigeration technician regarding refrigeration circuit failures</li> </ul>

(4) Sudden stop of the cooler while operating and an alarm signal sent to the machine tool.


<b>(A) Situation</b>	
<b>PV°C and SV°C are indicated on the display.</b>	
<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• The vibration of the machine tool will loose the connection wires.</li> <li>• Remote control connection is broken.</li> <li>• Temperature controller connection is broken.</li> <li>• Temperature controller failure.</li> </ul>
<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check the connections of the remote control and the temperature controller.</li> <li>• If the connections are intact, then the temperature controller is defective.</li> </ul>
<i>Solution</i>	<ul style="list-style-type: none"> <li>• Reconnect the connections.</li> <li>• Replace the temperature controller.</li> </ul>
<b>(B) Situation</b>	
<b>PV°C and SV°C do not indicate on the display.</b>	
<i>Possible causes</i>	<ul style="list-style-type: none"> <li>• Circuit breaker of the cooler unit may have jumped.</li> <li>• The vibration of the machine tool will loose the connection wires.</li> <li>• The Remote control connection is broken</li> <li>• Temperature sensor connection is broken.</li> <li>• Failure of temperature sensor.</li> <li>• Failure of power supply</li> </ul>
<i>Identification</i>	<ul style="list-style-type: none"> <li>• Check if the circuit breaker is trip-off</li> <li>• Check the connections of the remote control and the temperature sensor.</li> <li>• Check if the power supplier still works properly.</li> <li>• If the situations given above are not applicable, then the temperature sensor is broken.</li> </ul>
<i>Solution</i>	<ul style="list-style-type: none"> <li>• Set the circuit breaker back on.</li> <li>• Reconnect the wires of the remote control and the temperature sensor.</li> <li>• Replace the defective parts.</li> </ul>


## 8 Decommissioning and disposal

If the cooling unit is put out of operation, drain the coolant tank completely.

Disconnect all tubes, sensor cables and the power supply from the cooling unit.

The HBO cooling units are compressor-controlled and have a sealed refrigeration circuit.

<b>Caution!</b>	
	<p>The refrigeration circuit has to be emptied by a refrigeration technician. The components containing refrigerant have to be disposed by a recycling company with appropriate certification.</p>

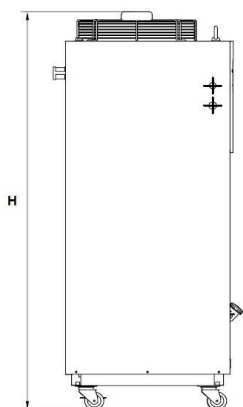
<b>Important!</b>	
	<p>The mechanical, electrical and electronic components have to be disposed according to the law and regulations of the country where the cooling unit has been operated.</p>

## 9 Specific features of the cooling unit

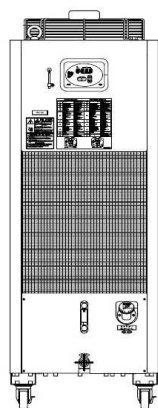
### 9.1 Outside dimensions

Model HBO		Unit	HBO-250PTS	HBO-400PTS	HBO-600PTS	HBO-750PTS	HBO-1000PTS	HBO-2RPTS	HBO-3RPTS	HBO-4RPTS	HBO-5RPTS	
Cooling capacity at 35°C ambient and 35°C oil temperature (50 Hz mains freq.)		W	980	1,630	1,980	2,900	4,350	5,820	8,720	11,630	14,540	
Power consumption	Compressor		478		845	1,185	1,700	2,480	3,350	4,400	5,500	
	Fan		200			180	150	250	350	500		
	Pump				400		750		2,200			
Supply voltage		V	3x220V or 3x400V – other supply voltages on request									
Temperature control modes	Type A	Steady – temperature setting range 10-40°C										
	Type B	Differential temperature control – setting range ±9,9K related to ambient or machine body temperature										
Ambient temperature		°C	Range 10-40°C									
Oil temperature			Range 10-45°C									
Pump flow rate (50 Hz)		l/min	3.7	4.7	10	16.6	25	33	57	64		
Termination diameter of inlet/outlet*		In	PT ½			PT 1			PT 1 ¼			
Tank capacity		l	7	20	26	30	36	35	31	90		
Dimension WxDxH		mm	270x475x436	373x470x686	370x475x840	575x430x1045	480x580x1340	500x770x1295	554x690x1525	1085x740x1400		
				370x475x950	370x475x1030	575x430x1200	550x580x1340			1085x780x1400		
Weight	without tank	kg	51	61	66	96	147	176	181	291		
	with tank		51	71	77	118	150	179	209	325		
Noise emission		dBA)	<70						<80			

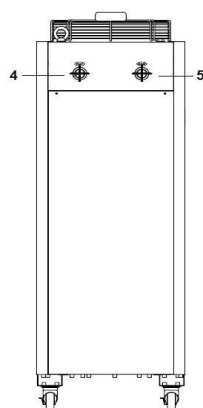
Chart 5: Technical data, dimensions and application parameters for HBO series



View from left

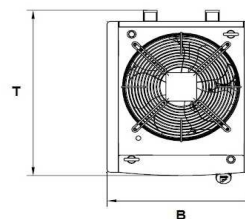


front view



rear view

(\*connections 4 & 5)



top view

1	CONTROL PANEL
2	AIR FILTER
3	POWER ENTRANCE
4	OUTLET PT 1"
5	INLET PT 1"
6	OIL TANK DRAIN PT 1/2"
7	FLUID LEVEL & OIL FILLER

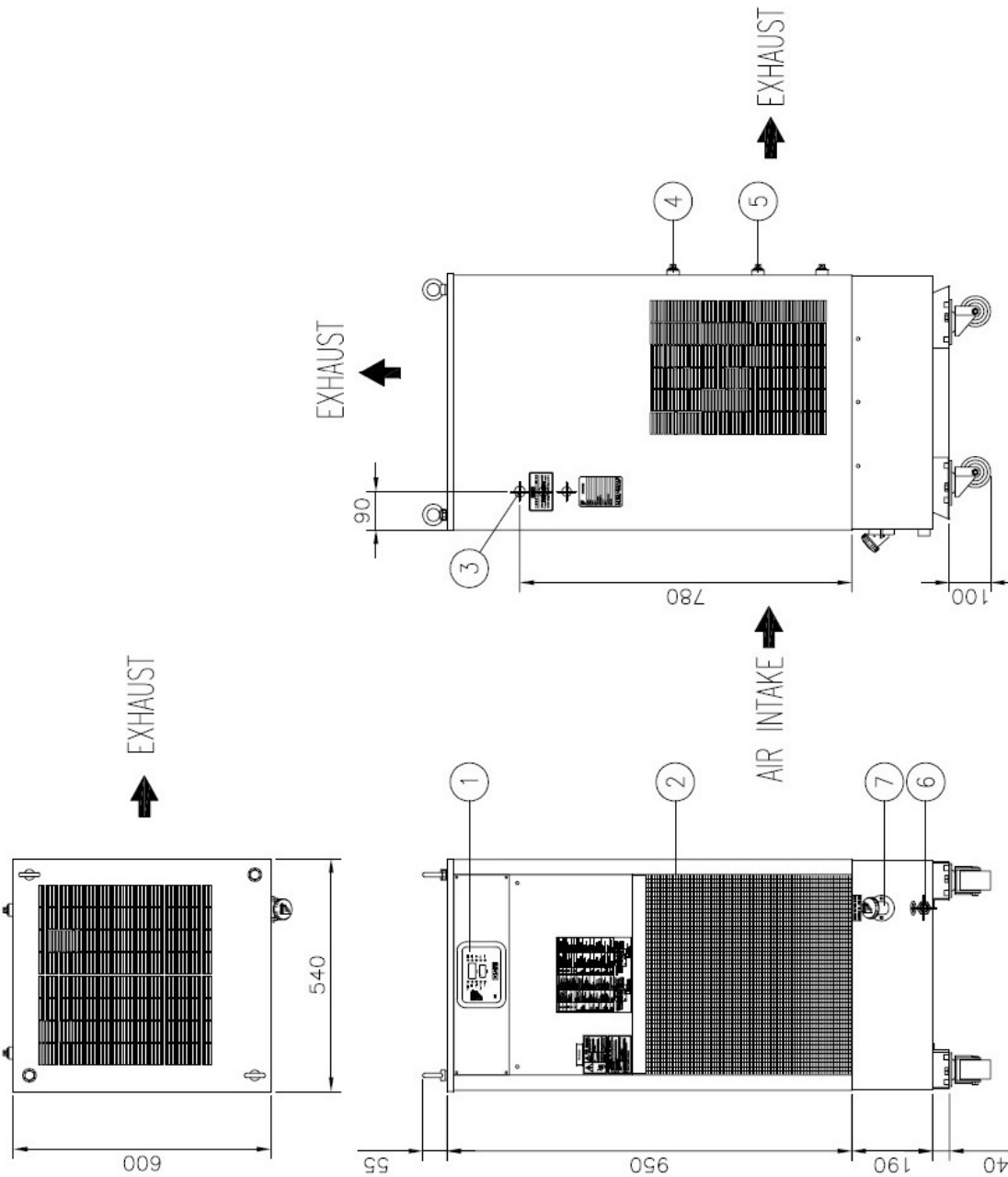
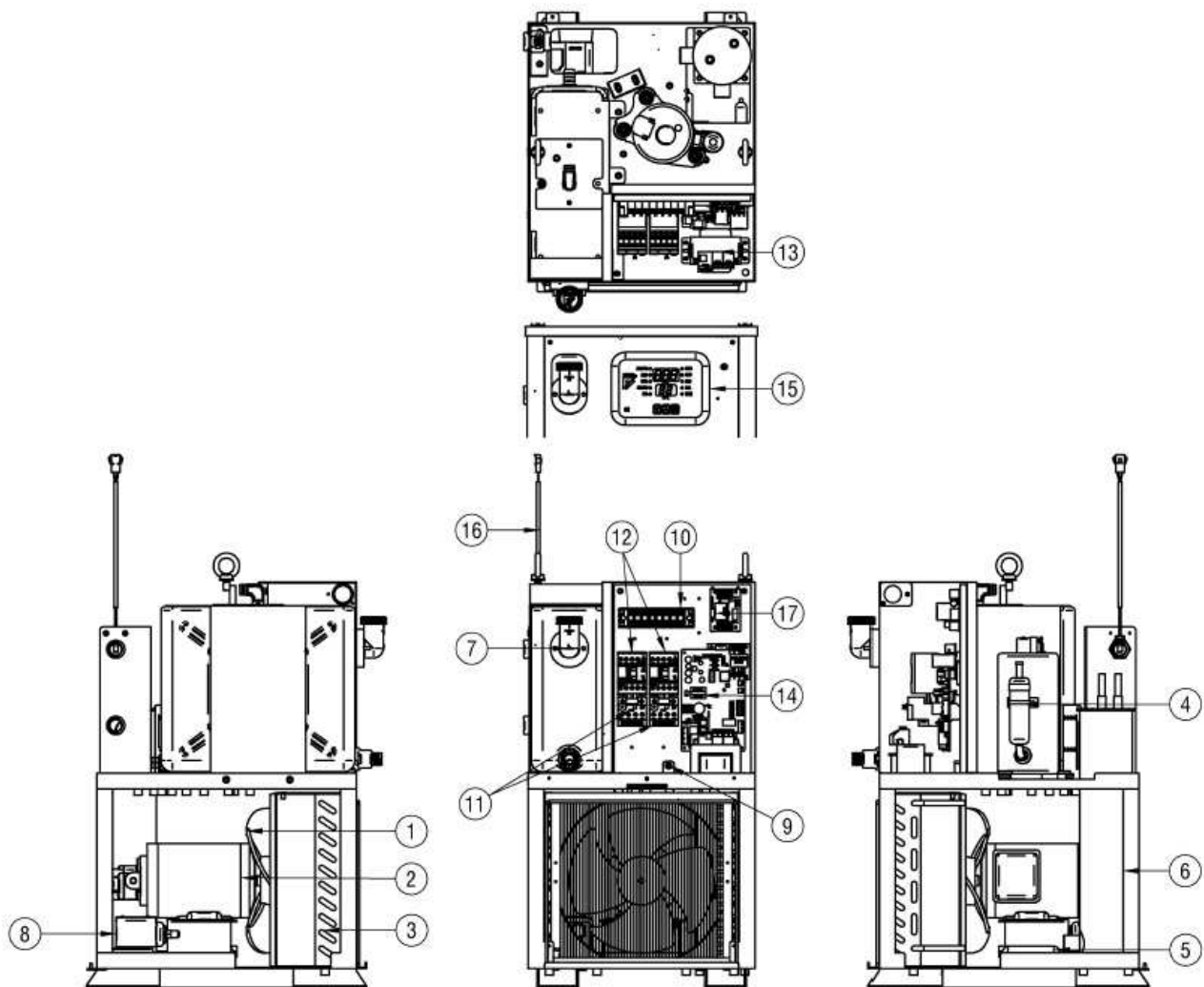


Illustration 10: Outside dimensions of the cooling unit (e.g. HBO-1000)

## 9.2 Parts list

Number	English	German	Number	English	German
item	name	Appellation (German language)	item	name	Appellation (German language)
1	compressor	Kompressor	16.	control panel <sup>2</sup> ±0.1K	Bedienelement <sup>2</sup> ±0,1K
2	condenser <sup>1</sup>	Kondensator <sup>1</sup>	17	control main board	Steuerplatine
3	fan motor	Lüftermotor	18	transformer	Transformator
4	pump motor <sup>3</sup>	Pumpenmotor <sup>3</sup>	19	phase reverse relay	Phasenrelais
5	plate type heat exchanger	Plattenwärmetauscher	20	contactor	Kontaktgeber/Schütz
6	filter <sup>1,3</sup>	Filter <sup>1,3</sup>	21	overload protector of fan motor	Überlastschutz Lüftermotor
7	expansion valve	Expansionsventil	22	overload protector of pump motor	Überlastschutz Pumpenmotor

Chart 6: Main components and spare parts of the cooling unit



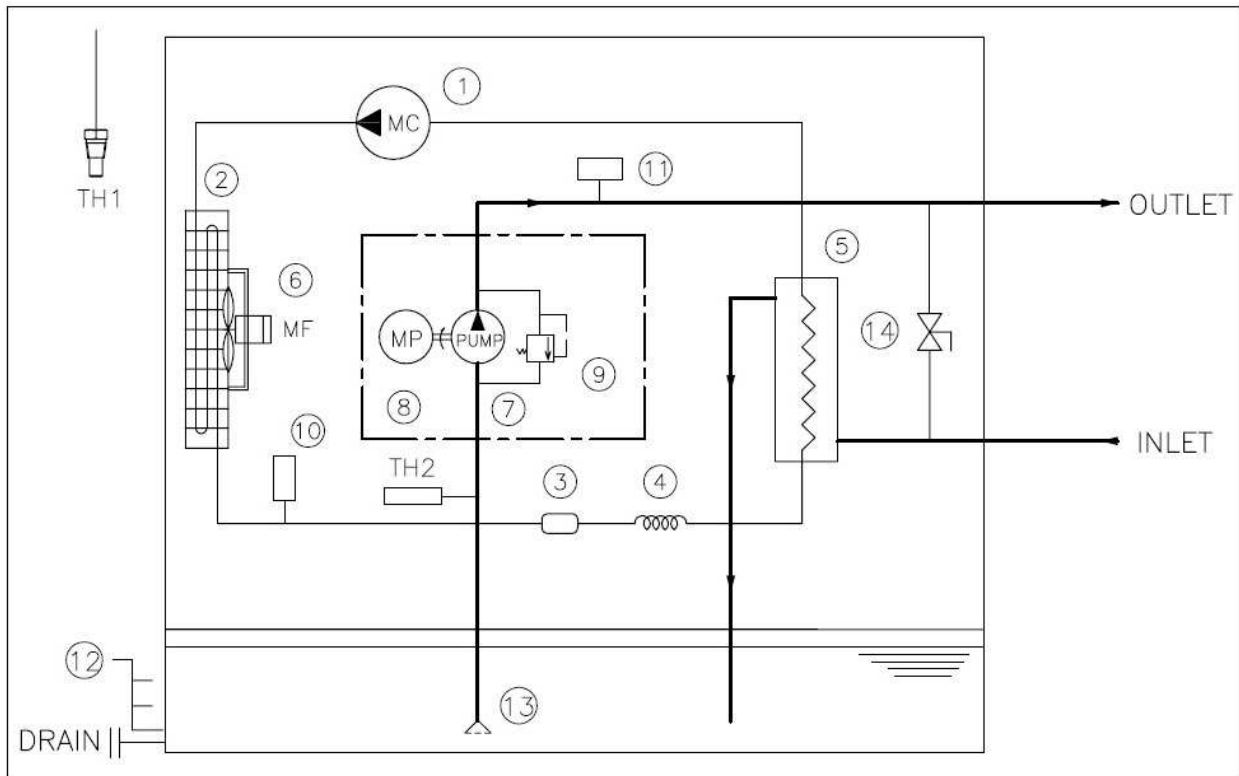


### Important!



The cleaning procedure of the items marked with <sup>1</sup> is described in chapter 6 on page - 19 - in this manual.  
These items are highlighted in green colour in the following drawing.

### 9.3 Hydraulic chart



**Illustration 11:** Hydraulic chart of coolers equipped with regular temperature control (equipped with tank)

Number	Name of item
1	compressor
2	condenser
3	dryer
4	control of refrigerant, capillary tube
5	evaporator
6	fan motor
7	circulating pump
8	pump motor
9	oil pressure control valve
10	high-pressure switch
11	oil pressure switch
12	fluid level & oil filler
13	oil filler
14	ball valve

**Important!**

**The cooling unit may only be operated within its specified operation range.**

**Chart 7:** Caption for hydraulic system

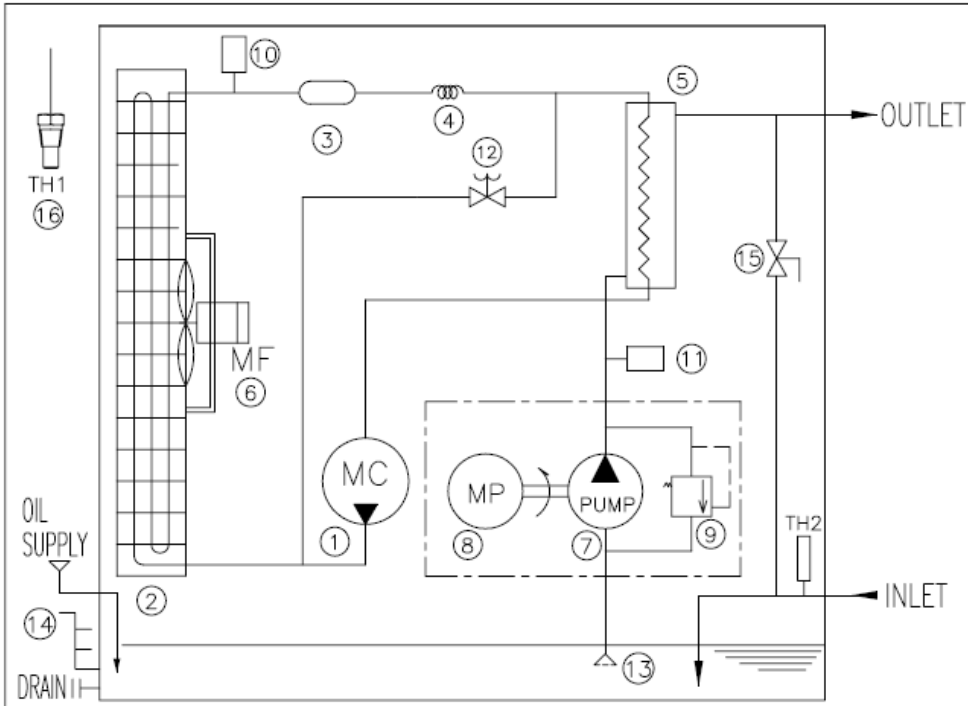


Illustration 12: Hydraulic system of the cooling unit (HBO-V series)

Number	Designation
1	compressor
2	condenser
3	dryer
4	control of refrigerant,
5	evaporator
6	fan motor
7	circulating pump
8	pump motor
9	oil pressure control switch
10	high pressure switch
11	oil pressure switch
12	control valve
13	oil filter
14*	fluid level gauge
15	bypass
16	machine body temperature sensor

Chart 8: Caption for hydraulic system

9.4 Circuit layouts

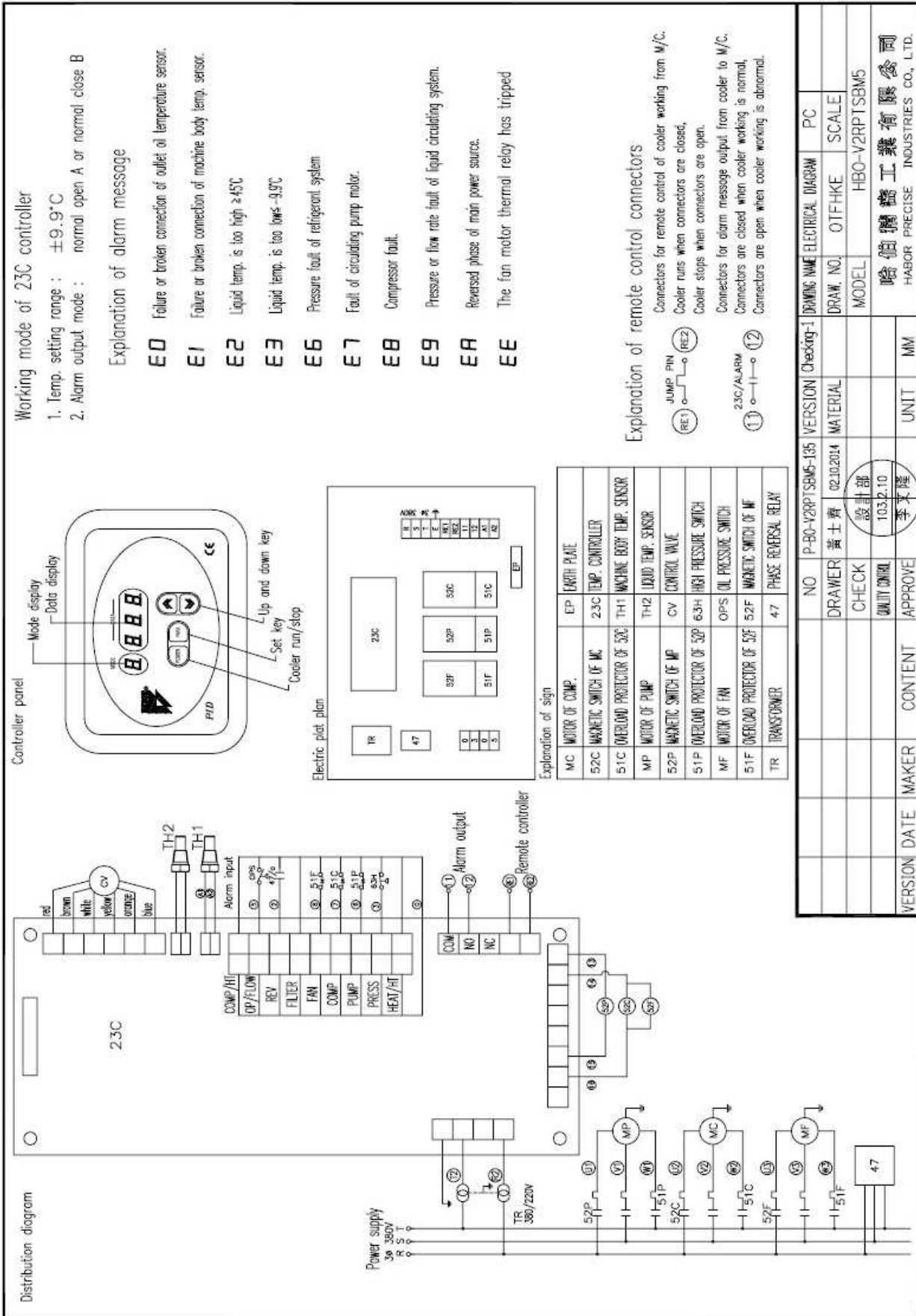


Illustration 13: Basic wiring of a cooler equipped with PID control ( $\pm 0.1\text{K}$ )

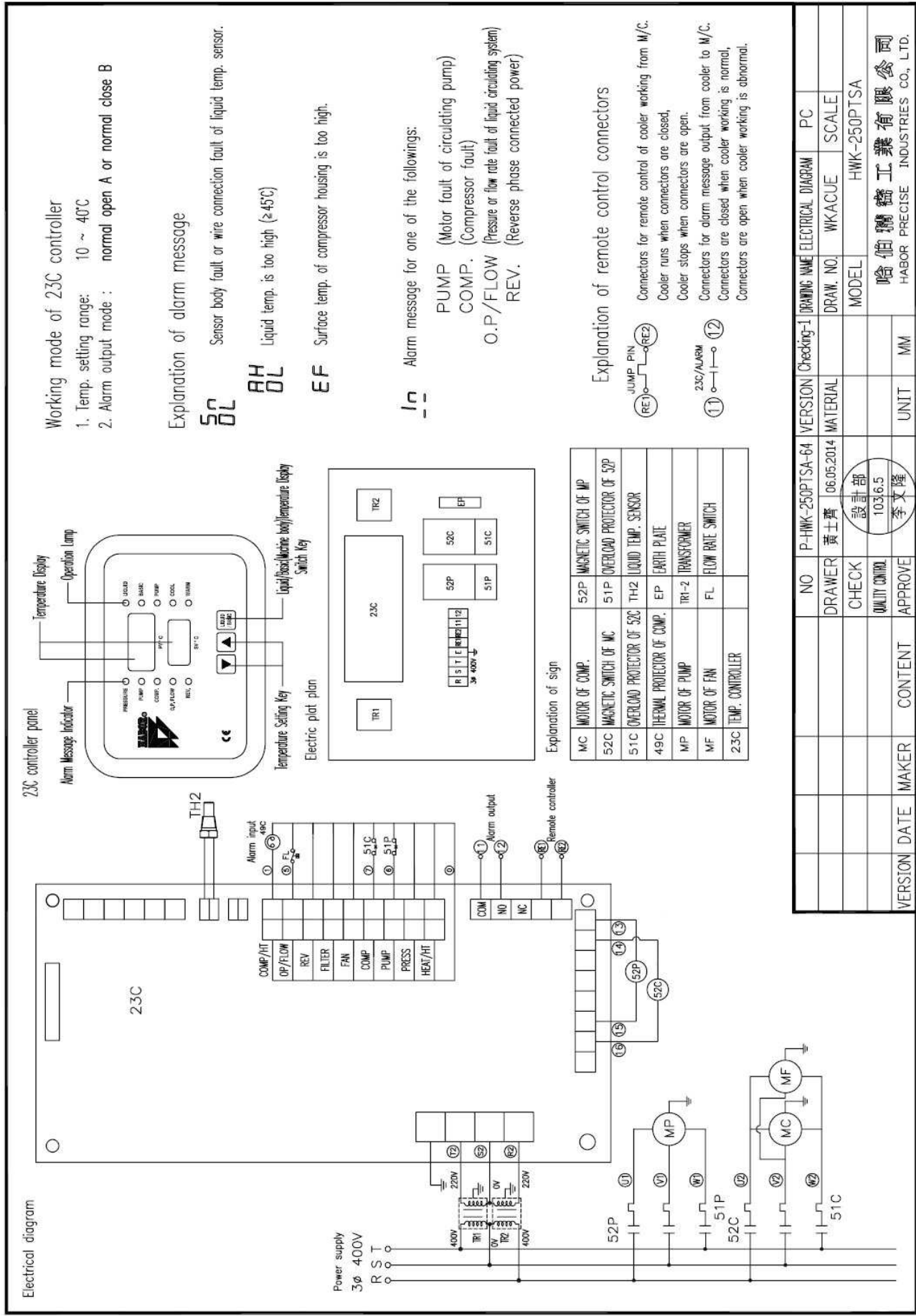


Illustration 14: Basic wiring of a cooler equipped with a regular temperature control ( $\pm 1\text{K}$ )

# 10 Declaration of Conformity

Date: 2014/01/14

## Declaration of conformity

### Manufacturer:

Habor Precise Industries Co., Ltd.  
No.77 Industrial 20<sup>th</sup> Rd. Taiping City,  
Taichung 411, Republic of China, Taiwan

### Entity authorized to compile the technical file:

a&g automation and gears GmbH  
Am Sandbuehl 2  
88693 Deggenhausertal (Wittenhofen), Federal Republic of Germany

### Product description:

General description: cooling unit  
Item description: oil cooler

### Model\*:

HBO – [H] [V] 50 [P] T [H] [C] S [A/B] [M]	HBO – [H] [V] 1R [P] T [H] [C] S [A/B] [M]
HBO – [H] [V] 250 [P] T [H] [C] S [A/B] [M]	HBO – [H] [V] 2R [P] T [H] [C] S [A/B] [M]
HBO – [H] [V] 400 [P] T [H] [C] S [A/B] [M]	HBO – [H] [V] 3R [P] T [H] [C] S [A/B] [M]
HBO – [H] [V] 600 [P] T [H] [C] S [A/B] [M]	HBO – [H] [V] 4R [P] T [H] [C] S [A/B] [M]
HBO – [H] [V] 750 [P] T [H] [C] S [A/B] [M]	HBO – [H] [V] 5R [P] T [H] [C] S [A/B] [M]
HBO – [H] [V] 900 [P] T [H] [C] S [A/B] [M]	

Serial number range: 234000 - 325000

\* The parameters put in “[ ]” are optional parts of the model name and identify the product clearly by non-indication or indication at the respective position of the model name

We, the manufacturer, hereby confirm that the products are in compliance with the following directives of the European Community:

**Machinery Directive: 2006/42/EC**  
**Low Voltage Directive 2006/95/EC**

The following harmonized standards are applied:

**EN ISO 12100: 2010**  
**EN 60204-1+A1: 2009**  
**EN 4413: 2010**

Taichung, 2014/01/14

Habor Precise Industries Co., Ltd.

Deggenhausertal, 2014/01/14

a&g automation and gears GmbH

\_\_\_\_\_  
Wally Lee, R&D department vice manager

\_\_\_\_\_  
Eckhard Schmied, Managing Director



Our international sales network covers every jurisdiction. Our global shipping partners mean you can be sure we're on hand whenever you need us.

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