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1. Warranty

This warranty covers the material design and quality during the first 12 months starting from the delivery date. Within this defined period our Company will either repair, or replace (with ex works delivery) all parts which on the sole opinion of the supplier, have caused quality problems which are not a result of poor maintenance, inexperience of the operators, faulty installation or failures which are caused because this instruction was not followed. This warranty does not include the expenses, travel hours and travel allowance related to our technicians in case their presence is required at the customer's factory. These expenses will be totally invoiced as working hours. The customer shall not have the right to claim any refund from our Company for the time during which the machine shall remain inactive, related to repairs. No refund will be acknowledged for expenses, damages, either direct or indirect, which are a result of the above.

Sperate agreements with customers have to be agreed in written form may vary from this paragraph.

2. Safety

General: these instructions have to be read by the installer and personnel in charge for operation, before starting the chiller.

All safety and security instructions given in this manual have to be observed!

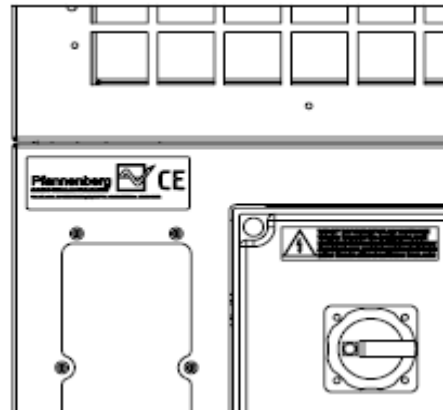
Only qualified personnel is allowed, to install and operate the chiller and to do the maintenance work.

Non observance of the instructions may cause injuries and will cancel the manufacturers liability for subsequent damage.

National regulations on accident prevention, regulations of the local power supply authorities as well as any specific safety instructions for chiller must be observed.

The safety of the unit is only guaranteed, if it is used as intended

The chiller is CE conform; please find the CE lable on the unit as showed:

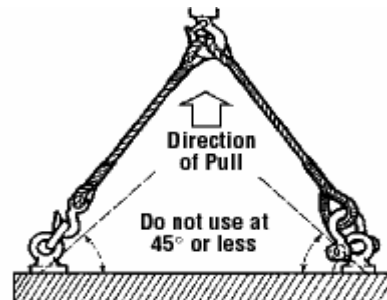


3. Functional Description

The Chiller has been designed for the cooling and the control of liquids in a closed circuit. The refrigerant circuit is designed out of a heat exchanger (evaporator) in which the coolant evaporates, a compressor which sucks up the evaporated fluid and compresses it into another heat exchanger (condenser) in which the coolant condenses (becomes liquid) and passing through the expansion device (thermostatic valve, capillary tube) to the evaporator. The temperature of the liquid to be cooled is controlled by the thermostat. Some safety devices as pressure switch and thermostat, circuit fault indicators, are shown in the attached electrical diagram.

4. Receiving and Unpacking

For the operations of lifting and movement it is necessary to use a fork lift truck with proper load capacity and with forks longer than the base of the chiller. Avoid sudden movements which can damage the framework and the internal components. PFANNENBERG Std chiller (above 45Kg weight) are also provided with 4 eye bolts for lifting and transportation; to be used for vertical loading/unloading only

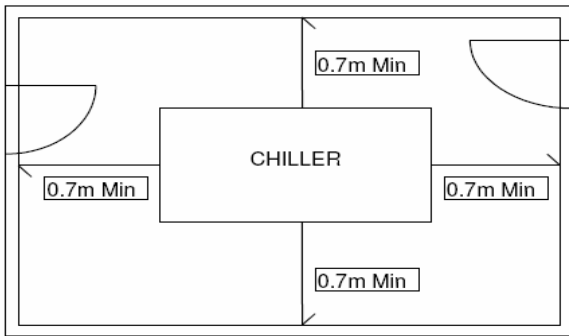


Check after the final positioning of the chiller the internal connections to avoid damage during operation.

5. Positioning the Chiller

Place the Chiller in an area shielded from any possible manufacturing residuals (shavings, dust, etc.) and **well-ventilated**, away from heat sources and direct influence of sun light ; if possible, near the user system, in order to avoid load losses along the hydraulic connection pipes. Use the adjustable feet to level off the cooling unit.

The customer has to place a suitable room at disposal, as shown in the figure:



Room minimum dimensions

CAUTION!: For standard unit the outdoor installation is absolutely forbidden, even if under a roof. Only special designed outdoor units can be used in outdoor installation. For regular maintenance or adjustment, the chiller shall be located between 0,3 m and 1,0 m above the servicing level

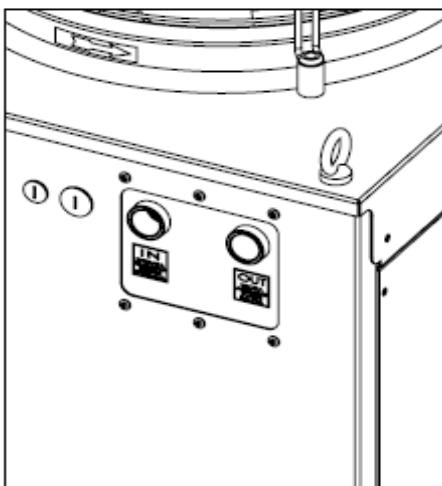
6. Foundation

PFANNENBERG chillers should be set on a concrete slab. The slab should extend a minimum of 30cm (12 inches) beyond the perimeter of the chiller to prevent damage from lawn maintenance equipment, etc. The chiller should be level and properly anchored.

7. Connections

Warning! Hydraulic connections are the first ones to be assembled during installing operation, to be followed by electric connections.

Hydraulic connections. For the hydraulic connection please refer to the **enclosed hydraulic plan**. The flow rate and the fluid circulation direction must be respected during connection in accordance with INLET-OUTLET identification plates.

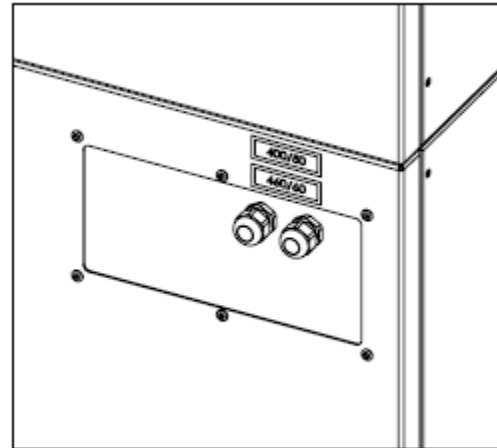


Example of Hydraulic connection plate

CAUTION!: In case of unit with tank, please fill the tank before connecting Hydraulic tubes.

Electric connections. The unit must be electrically connected by the customer. Note, however, that electrical installation must respect all valid safety standards. It's advisable to install a magnetic-thermal cutout upstream

power cable. Make sure the system is adequately earthed. Check that the voltage and frequency of the power supply correspond to the specifications on the unit's data plate and/or **enclosed electrical plan**.



Example of Electric connection plate

CAUTION!: In case units that can work with different voltages (400V or 460V), connect the transformer of the auxiliary circuit located inside the e-box in the right way.

Voltage Limitations:

- Unit Nameplate - 115V/60Hz/1Ph: 103V to 127V
- Unit Nameplate - 230V/50-60Hz/1Ph: 207V to 253V
- Unit Nameplate - 400V/50Hz/3Ph: 360V to 440V
- Unit Nameplate - 460V/60Hz/3Ph: 414V to 506V

8. Process Water / Fluids

PFANNENBERG chillers should be filled to the proper level with an **inhibited glycol** designed for Industrial chillers systems. **Do not use automotive antifreeze!** The inhibitors used in automotive antifreeze can break down quickly and accelerate the degradation of the coolant base (glycol); as well as promote corrosion in a system. Silicates used in automotive antifreeze coat heat exchangers, resulting in reduced heat transfer. Also, silicates can gel causing fouling and plugging of a system.

The ratio of inhibited glycol to water should be adequate to prevent freezing at the lowest ambient temperature. Check the level with all lines filled. **The glycol mixture should be checked periodically (3 to 6 months) for proper concentrations.** When filling the system, always use a pre-mixed solution in the proper ratio to maintain freeze and corrosion protection. Distilled water is **recommended** because many municipal water supplies contain large amounts of chlorine, which can react unfavorably with glycol.

NOTE: If supply and return lines are overhead, the fluid in the piping may drain back and overflow the chiller reservoir if the chiller is shut down. This can be prevented by using a check valve in the supply line, and either a solenoid valve on the return line.

Corrosion protection:

PFANNENBERG recommends that Glycol is also used as a rust inhibitor. The minimum percentage of glycol (in a mixture with water) recommended by some important glycol supplier (Clariant, Total, Dowfrost, etc..) is **between 20% and 30%**.

CAUTION!: Please contact the Glycol supplier to know the minimum percentage needed in order to use the Glycol as rust inhibitor

CAUTION!: All the typelabel of the STD Pfannenberg unit are provided with a percentage of glycol of 20%

The percentages of glycol into the mixture is related to the minimum working temperature of the mixture (that must be in line with the minimum working set point of the unit, please see the technical data of the unit):

percentage	Water temperature up to :
10%	+ 3 °C
15%	0 °C
20%	- 3 °C
25%	- 6 °C
30%	-10 °C

CAUTION!: The greater the concentration of glycol the lower the amount of heat rejection you will be able to get out of the fluid.

CAUTION!: The type of glycol (propylene or ethylene) must be in conformity with the Standard requested by the application, please contact the Glycol supplier

9. Waterquality

To keep the hydraulic circuit correct and trouble-free, it is necessary, to check the water quality and if necessary, carry out water treatment. The standard circuit of a water chiller is a half open system, that means, part of the water steams/evaporates out during operation. That means, that the concentration of chloride is getting higher and the system water will cause corrosion on the installed components.

When using water, please consider the following:

- Do not use deionized water.
- Do not allow mechanical contamination to get in the water. Use water filters if this could be a problem.
- Water hardness should not be too high. (see below)
- Watch for chemical contamination. If this is to become a problem, treat the water with passivators and/or inhibitors.
- Do not allow biological, slime bacteria, and algae contamination. If this does happen, treat the water with biocides.

PFANNENBERG recommends that the properties of the water has to be checked in order to identify the quality

Water quality A (No water treatment necessary):

Fresh water from the tap, free of contamination
 Ph-level:7-9
 Hardness: <5 °dH
 Conduction: <50µS/cm
 Chloride: <20 mg/l

Water quality B (Water treatment is recommended):

Fresh water from tap, free of contamination
 Ph-level:7-8, 5
 Hardness: <10 °dH
 Conduction: <300µS/cm
 Chloride: <50 mg/l

Water quality C (Water treatment mandatory):

Fresh water from tap, free of contamination
 Ph-level:7-8,5
 Hardness: <20 °dH
 Conduction: <500µS/cm
 Chloride: <100 mg/l

10. Process Oil / Fluids

PFANNENBERG chillers (in the std oil version) are designed to work with the following oil viscosities:

- Fluids and oil's with viscosity ranging between ISO VG22 and ISO VG68 (*)

CAUTION!: do not utilize oils with sulphur-base additives; the copper-made exchanger could be damaged (*)

CAUTION!: a suitable filtering system, for the oil to be cooled, has to be adopted, with filtration degree ranging from 60 to 90 mm (*).

NB (*) should any doubt arise, consult PFANNENBERG Technical Office.

OIL CHILLER w/o pump

Usually, the pumpless CHILLERS are inserted in a circuit already provided with pump. Refer to instructions provided by the system manufacturer and check that the flow rate and pressure entering the REFRIGERATOR are compatible with the values set down in the chapter of technical data

OIL CHILLER with pump

Usually, the CHILLERS with pump are utilized to cool an hydraulic system provided with reservoir; therefore, the filling is directly carried out on the machine. Refer to the instructions provided by the system manufacturer

11. Ambient temperature

When ambient temperatures are above 35 degrees C. (95 degrees F.) or below 10 degrees C. (50 degrees F.), PFANNENBERG should be consulted. High ambient temperatures reduce chiller capacity. Low ambient temperatures require special controls. Special conditions apply when temperatures drop below 0 degrees C. (32 degrees F.). Fluid heaters may be required to prevent

freezing and to hold the fluid in the chiller reservoir at a constant temperature in order to reduce start-up delays while the fluid warms up to operating temperature.

12. Start up of the chiller

CAUTION!: WORK ON THE ELECTRICAL AND REFRIGERANT CIRCUITS MAY ONLY BE PERFORMED BY QUALIFIED PERSONEL!!!!!!!

- Turn main switch, control switch, all circuit breakers to switches to the - 0 - (off) position.
- Check the internal hydraulical connection (clamps and fittings) that may get loose during transportation
- CHILLER with tank: Remove cap of filling connection located at the top side of the chiller (external) or reservoir top plate (internal). Fill reservoir with water-glycol mixture until the maximum level is reached. (water quality and treatment should be established according to the application specifications)
- All water inlet and outlets connections should be fitted and a visual inspection should be made.
- Main power feed and control interlock should be established with customer's equipment.
- CHILLER with pump: Purge pumps by loosening purging screw that is located on the side of pump. Be advised that the pump has been purged correctly when only water is visible.
- CHILLER with pump: Main power switch and circuit breaker for the pump (pumps) should be switched to the on position. (all other circuit breakers should stay in the off position)
- CHILLER with pump: Main switch should be switched to the - I - (on) position and the pump (pumps) should be checked for the correct rotation. (Please note that there is an arrow located at the back part of the pump for direction indication). Reverse two phases R-S-T on the terminal board in case of incorrect rotation

CAUTION!: The pump must not flat running or in inverse direction; therefore the checking of the correct rotation must be quick

- At this time a visual inspection of the hydraulical circuit and all connections for leaks should be made..
- CHILLER with tank: While water circuit is running make sure proper water level is maintained and if necessary fill reservoir to the proper level.
- CHILLER with tank: After the water circuit has run for approx. 5 minutes, switch off the main switch and check again the visual level of the tank; refill the tank in case of need.
- CHILLER without pump: check the fan direction of rotation (see the arrow on the fan case). Reverse two phases R-S-T on the terminal board in case of incorrect rotation

Switch all circuit breakers to the "on" position. At this time the chiller should operate automatically according to the controllers "set point values". If necessary, set controller according to customers temperature requirements. (Please refer to the manual of the thermostat delivered with the unit)

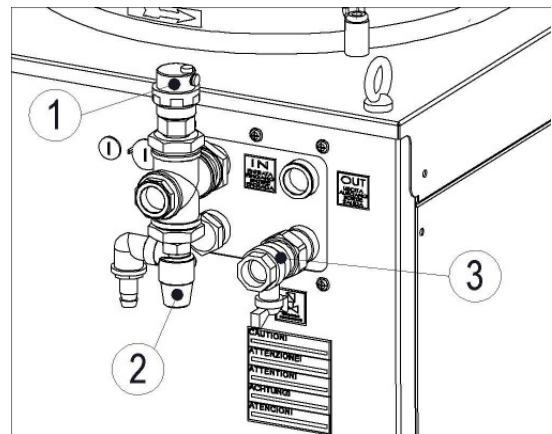
After installation, the REFRIGERATOR does not need intervention by the Qualified Operator.

Every calibration operation on thermostats, pressure switch and whatever component of the refrigerating circuit, the personnel of the Technical Servicing or the Refrigerator Technician only is competent.

For further information on chiller installation, start-up or troubleshooting please contact PFANNENBERG

CLOSE LOOP CHILLER

The difference between the Start up of an open loop and a close loop water chiller is the filling of the system. PFANNENBERG units are equipped with a manual (or automatic on request) refill connection, Air discharge valve and Safety valve



- | | |
|----|--------------|
| 1. | Air valve |
| 2. | Safety valve |
| 3. | Refill |

- Make sure that all the connection (hydraulical and Electrical) are done as explained above for the Std units
- Connect the Refill line with a pump (external refilling pump) in order to refill the system with the correct mixture (water/glycol, please see the section 8)
- Open the hand valve of the refill line and start the filling by switching on the refilling pump
- The pressure into the system after the refill must be appr. 2 bar

CAUTION!: The system is provided with a safety valve, opening at 6 bar

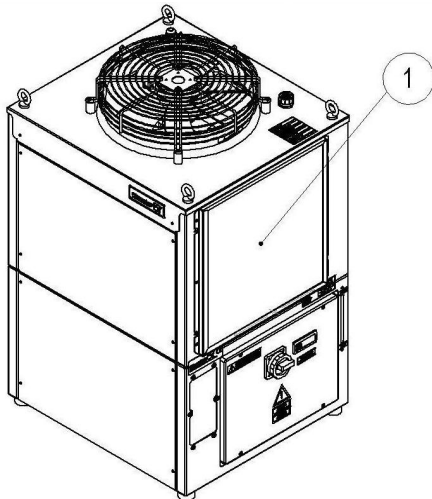
- Make sure that all the air goes out to the air valve
- After the filling, close the hand valve of the Refill line
- Start the system in the same way like described above for the Std units
- After the water circuit of the unit has run for approx. 5 minutes, switch off the main switch and check again the pressure of the system

13. Maintenance / Check and Inspections

CAUTION! Before any maintenance intervention, not needing the machine running, disconnect the supply voltage and have a sign MAINTENANCE IN PROGRESS to be posted to the general breaker

To carry out the tests and check program described here will extend the life of the equipment and avoid possible breakdowns.

- Check mechanical working of the compressor : the absence of metallic vibrations and a temperature between +20°C and +70°C, measured on the compressor head during running, show a regular working of the compressor.
- Inspection of the condenser to see if it is clean. The fins of the condenser must not have any dust deposits or residual products or sludges on their surface .
- Check the operation of the fan.
- Check the electrical alarm systems and controls.
- Check the filling of the tank (visual level). If the system is filled with a glycol-mix, refill only with the same mix. Only water will reduce the concentration of glycol.
- The condenser must be cleaned in monthly intervals, or, if required in shorter time intervals.
- If the chiller is equipped with an air filter, the filter has to be changed/cleaned monthly, or, if required in a shorter time interval



1. | Air filter

- Longer standstill of the chiller requires draining of the tank and complete water circuit.
- Check of the thermal charge of the chiller: the temperature and the delivery of the hydraulic circuit must not exceed to the set limits of the unit
- If the chiller is equipped with a filter on the hydraulic side, the filter has to be checked/cleaned monthly, or, if required in a shorter time interval

14. Design Characteristics

Closed loop applications

If we have a closed loop water circuit, under pressure, application, there is no problem placing the chiller above or below the application.

A closed loop water circuit is where there is no contact between the water and the air. Typically there is no tank in the chiller. When there is a tank, it is under pressure. This allows the water a place to expand and contract.

Open loop applications

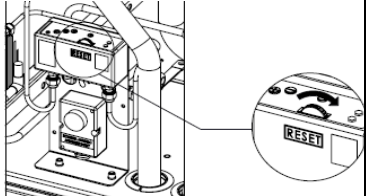
An open loop application is where there is some contact between the air and the water. Our standard chillers, with tanks, allow contact between air and water. Typically when we cool a customer reservoir, the reservoir allows contact between air and water.

In an open loop application, there is no problem placing the chiller above the application.

There are some precautions we need to take when placing a chiller below the application when we are in an open loop application. There needs to be a check valve in the water pipes on the outlet of the chiller. (A check valve allows water to go out, but it does not allow it to come back.) There also need to be an electrical solenoid valve placed on the inlet of the water chiller. This valve needs to close when the chiller is not running. These two valves will prevent water from flowing back into the chiller, and overflowing out of the tank

15. Debug Table

The information shown in this table is designed for the service staff at the factory. The faults that require the intervention of a refrigeration engineer must be carried out only by specialized staff. Follow all electrical legislation when working on the unit based on valid laws of the countries where the unit is placed.

Chiller		
Problem	Cause	Possible corrective Action
The unit does not start up	No supply voltage	Check the supply main voltage line
	Not working thermostat	Inspect the connection, check and correct the parameter settings and if there is no fault, replace the thermostat,
	The compressor protector (KLIXON) has switched off	<p>Important: After the shut down of the compressor, the resetting time will depend on the environment of the compressor: In a hot closed environment it will be 2 hours, in ventilated 1 hour.</p> <p>Note: The compressors are protected against high temperatures and currents, with of an internal or external device (Klixon). The internal/external device protects the compressor against the following situations:</p> <ul style="list-style-type: none"> overheating due to an inadequate cooling of the compressor motor. Blocked compressor due to a high temperature of the motor or a high current. Loose connections which may cause high currents
It works, but does not cool	There is not enough gas in the equipment	Service by a refrigeration engineer
	Faulty thermostatic valve	Service by a refrigeration engineer
	Too high heat load	Possible wrong application, to be checked with our staff
Refrigerant Cycle is not working		
Problem	Cause	Possible corrective Action
Switching of the double pressure switch (low pressure side)	<p>The unit works for short periods, it stops and starts again after a while. The causes are:</p> <ul style="list-style-type: none"> Low gas level in the equipment Outlet line of the compressor is blocked and more in detail: saturated dehydrating filter, blocked thermostatic valve. 	Service by a refrigeration engineer
Switching of the double pressure switch (high pressure side)	The unit does not work. The causes are:	
	<ul style="list-style-type: none"> Dirty condenser 	Clean the condenser with compressed air if it is full of dust, or use proper solvents suitable to remove sludges.
	<ul style="list-style-type: none"> The fan is broken 	Replace the fan
	<ul style="list-style-type: none"> Too high ambient temperature 	Check that the chiller is located in a place that can guarantee suitable ventilation of the refrigerating unit. Check also that the ambient temperature does not exceed +40 °C.
		<p>Note: after solving the cause of the fault, start the chiller by pressing the reset button (RESET) located on the external body of the pressure switch itself (see the picture)</p> 
Compressor		
Problem	Cause	Possible corrective Action
The compressor works continuously and the chiller can't control the liquid temperature:		
<ul style="list-style-type: none"> too low temperature of the liquid too high temperature of the liquid 		
Too low temperature	Broken thermostat (contact blocked)	Replace the thermostat
Too high temperature	Broken thermostat	Replace the thermostat
	Not enough Freon in the unit	Please ask for the service by a refrigeration engineer
	Too high heat load	Possible wrong application, to be checked with our staff

