Original User Manual
ECO-Chiller

Models: ECO122L
ECO133L

Serial number: 122/6002/00/XXX/XXXX
133/6002/00/XXX/XXXX

0036

Following shall be filled by the owner

Inventory number _____

Place of installation _____

Place of installation _____

Safety first:
The owner of this unit is responsible that everyone who is working on the unit observ the safety rules and read the whole Manual/Install instructions and understand it.
A wrong or sloppy maintained unit could cause high body risk or even risk of death.

Contents

1 Warranty registration

To make use of possibly warranty rights, it is necessary to complete the warranty registration, and send it back to KKT chillers.
This have to be done by the end-user or installer promptly after the first start-up.

KKT chillers (ait-deutschland GmbH) will only accept warranty, if KKT chillers (ait-deutschland GmbH) has received the correct and completely filled out warranty registration.

2 Product specification

2.1 Intended use

The ECO-Chiller is an factory tested compression refrigerant system and shall only be used to cool liquids regarding EN 378-1 4.4.2.2., with all for the fully automatic required components.
The ECO-Chiller is for outdoor use only.
Housing, roofing or other constructions which is interrupting the airflow are prohibited.

The unit is fully automatically operating.
The two operating modes are controlled through the CAN-Bus by Siemens!

- Daymode (Measuring mode – Scanner is in operating or in stand by) Supply temp.:20°C
- Nightmode (also called ECO-Mode or Helium-Mode) MR is off and only Helium need to be cooled. Supply temp.: 19°C - 26°C

You can find a complete description of controll functions
→ #6.1.2.Generell function of the controll |outline

	The system have to be de-energized before opening!	
	Only qualified mechanics are allowed to work on the system!	
	Refrigerant and water pipes are under pressure!	
	Refrigerant parts could be hot and cold!	
	Use only allowed liquids!	

2.2 Technical data

2.2.1 ECO122L

Chiller	ECO	
Typ	ECO122L	
Produce.-No.:	122 4002 / 00 / xx / xxxx ← see nameplate	
Year of Manufacturing	20xx ← see nameplate	
Manufacturer	ait-deutschland GmbH Industriestraße 3 95359 Kasendorf Germany T +49 9228 9977 0 F +49 9228 9977 149	
Refrigerant	R407c	
GWP	1774	
Filling weight [kg]	13 - refrigerant	
CO_2 equivalent	23,1 t CO_2	
Cooling capacity [kW]	45	
Operating liquid (water circuit)	distilled water and 35-38% Ethylene Glycol	
Chiller volume [l]	10 liter	
Discharge temperature [°C]	20 - 19/22	Set value - min/max
Temperature swing [K]	+/- 0,5	
Ambient temperature limit [°C]	-20 / 48	
Air flow [m³/h]	20000	
Protection classification EN 60529	IP54 [with closed housing]	
Electrical connection [power supply]	380V-460V/50-60Hz	480V/60Hz
Maximum Overcurrent protection device [A]	60A	45A
Controll circuit	24VDc	
Noise level dB(A) in 5 m distance	60	
dimensions [mm]	l=2145 d=1100 h=2050	
weight / operating weight [kg]	707 / 730	
Flowrate [m³/h]	7,8	
Max. pressure rise of the pump [bar]	max. 6,8	

Leak-Test Attention:
Safety valve-water 3bar/43PSI!

2.2.2 ECO133L

Chiller	ECO	
Typ	ECO133L	
Produce.-No.:	133 4002 / 00 / xx / xxxx ← see nameplate	
Year of Manufacturing	20xx ← see nameplate	
Manufacturer	ait-deutschland GmbH Industriestraße 3 95359 Kasendorf Germany T +49 9228 9977 0 F +49 9228 9977 149	
Refrigerant	R407c	
GWP	1774	
Filling weight [kg]	13 - refrigerant	
CO_2 equivalent	23,1 t CO_2	
Cooling capacity [kW]	60	
Operating liquid (water circuit)	distilled water and 35-38% Ethylene Glycol	
Chiller volume [l]	10	
Discharge temperature [°C]	20 - 19/22	Set value - min/max
Temperature swing [K]	+/- 0,5	
Ambient temperature limit [°C]	-20 / 48	
Air flow [m³/h]	25000	
Protection classification EN 60529	IP54 [with closed housing]	
Electrical connection [power supply]	380V-460V/50-60Hz	480V/60Hz
Maximum Overcurrent protection device [A]	80A	60A
Controll circuit	24VDc	
Noise level dB(A) in 5 m distance	61	
dimensions [mm]	l=2145 d=1100 h=2050	
weight / operating weight [kg]	760 / 770	
Flowrate [m³/h]	7,8	
Max. pressure rise of the pump [bar]	max. 6,8	

Leak-Test
Attention: Safety valve-water 3bar/43PSI!

2.2.3 IFP

IFP	
Typ	**IFP 1TX**
Produce.-No.:	IFP 00 / xx / xxxx ← see nameplate
Year of Manufacturing	20xx ← see nameplate
Manufacturer	ait-deutschland GmbH Industriestraße 3 95359 Kasendorf Germany T +49 9228 9977 0 F +49 9228 9977 149
Suitable chiller	ECO122L/ ECO133L
Suitable MR	Aera, Skyra
Operating liquid (water circuit)	distilled water and 35-38% Ethylene Glycol
IFP volume [l]	6
Discharge temperature [°C]	20 - 19/22 Set value - min/max
Ambient temperatur [°C]	Indoor use [max. 30°C]
Protection classification EN 60529	IP54 [with closed housing]
Electrical connection [power supply]	380-480V/50-60Hz [3phases + grounding]
Overcurrent protection [A] performeed by siemens	Ask your PM
Controll circuit	24VDc
dimensions [mm]	l=1145 d=180 h=800
weight / operating weight [kg]	67 / 74
Flowrate [m³/h]	7,8

LEAK-TEST: DO NOT PRESSURIZE THE IFP WITH MORE THAN 2,9BAR/42PSI WHEN THE SIEMENS SYSTEM IS CONNECTED!

IFP	
Typ	IFP 090
Produce.-No.:	IFP 00 / xx / xxxx ← see nameplate
Year of Manufacturing	20xx ← see nameplate
Manufacturer	ait-deutschland GmbH Industriestraße 3 95359 Kasendorf Germany T +49 9228 9977 0 F +49 9228 9977 149
Suitable chiller	EC0122L/ EC0133L
Suitable MR	Avanto, Espree, Verio, TaTs
Operating liquid (water circuit)	distilled water and 35-38% Ethylene Glycol
IFP volume [l]	6
Discharge temperature [°C]	20 - 19/22 Set value - min/max
Ambient temperatur [°C]	Indoor use [max. 30°C]
Protection classification EN 60529	IP54 [with closed housing]
Electrical connection [power supply]	380-480V/50-60Hz [3phases + grounding]
Overcurrent protection [A] performeed by siemens	Ask your PM
Controll circuit	24VDc
dimensions [mm]	l=1145 d=180 h=800
weight / operating weight [kg]	67 / 74
Flowrate [m³/h]	7,8

LEAK-TEST: DO NOT PRESSURIZE THE IFP WITH MORE THAN 2,9BAR/42PSI WHEN THE SIEMENS SYSTEM IS CONNECTED!

2.3 Generell function and application range

The ECO-Chiller is an factory tested compression refrigerant system according EN 378-1 to cool liquid.

The liquid to be cooled is circulating through the system with 24/7.
The heat transfere between liquid and refrigerant happens in the evaporator.
The condenser will reject the heat from the refrigerant to the ambient air.

Refrigeration is defined as “the movement of heat from a place it is not wanted to a place it is unobjectionable”. In this slide, the heat is rejected to the outside ambient air. The basic components in an cooling system are: the compressor, the condenser, TXV-valve and evaporator, connected with refrigerant pipes. Other components are added as needed for specific applications, such as the system shown → #10.1.Piping and Instruments Diagram P&ID|outline

The developed PCB board is controlling any part within the ECO chiller and the FCU plus IFP panel.

Daymode is activated if the PCB board recognize the heartbeat from the CAN-Bus.
Supply temperature will be controlled at 20°C and a pressure differential at the IFP of approx. 3-4bar.

Nightmode is activated when the heartbeat is turned off.
In this state is the VFD compressor running between 19 and 26°C at a fixed speed (50%).The difference pressure at the IFP is reduced to 1,4bar.
With a ECO133L chiller is the VFD compressor during Nightmode disabled. The small compressor will run between 19 and 26°C.

2.3.1 Chiller

2.3.1.1 Compressor

The compressor is the heart of the system, which circulates the refrigerant. It creates the necessary pressure differences, between the low and high sides of the system. Another function of the compressor is to raise the pressure and temperature of the refrigerant vapor above the ambient (surrounding) temperature. This is accomplished by adding work, or heat of compression to the refrigerant vapor during the compression cycle. Compressors pump vapor only. Liquid refrigerant can damage or disable the compressor.
The contactor have to be exchanged anytime if you exchange the compressor.
Optional: Noise Reduction Kit available!
Please contact KKT chillers.

One VFD controlled compressor is installed in ECO 122L chiller. The ECO 133L have an additional compressor which is not speed controlled.

2.3.1.2 Condenser

The condenser coil is cooled with one VFD FAN (additional one small fan on ECO133L chiller) to liquidate the hot refrigerant gas and to subcool it. Piping is made of copper, the fins are aluminium.

The Condenser is the component in which the high pressure refrigerant changes from a hot gas to a sub-cooled liquid, as it displaces the absorbed heat. The first few passes of the condenser de-superheats the discharge line gases. Once the condenser has rejected heat from the superheated vapor and the saturation temperature has been reached, these gases will be 100% saturated vapor. This is when the refrigerant will begin to change its state, from saturated vapor to liquid. Subcooling of the refrigerant liquid will begin in the end of the condenser after the refrigerant is 100% liquid.

2.3.1.3 Fans

The Fans are protected agains contact and sucking the air through the condenser coil. Air outlet is on top of the unit. The Fans are thermally protected.
They are controlled with the PCB board according to the refrigerant pressure.

2.3.1.4 Evaporator

The Evaporator is the component in which the low pressure, low temperature refrigerant absorbs heat from the medium (water/glycol - liquid) being cooled. This enormous volume of added heat from the product load causes the refrigerant to change its state, from a cold temperature liquid to a super-heated vapor. The temperature difference between the lower pressure refrigerant and the product load is the driving potential for heat transfer to take place. The last pass of the evaporator coil acts as a superheater to ensure all liquid refrigerant has been vaporized. This also prevents the liquid refrigerant from returning to the compressor and causing compressor damage.

2.3.1.5 Pressure limiter

2.3.1.5.1 Low pressure sensor (PSL)

Protect the compressor and the system from too low pressure. Automatic reset function is integreated. The compressors will be shut down if the low pressure sensor reaches the allowed limit 3 times within 60 minutes. Please push the reset button for 1sec. to unlock. Setpoint 0.5bar

2.3.1.5.2 High pressure limiter (PZH)

The high pressure limiter is equipped with an seperate reset button. It will lock the contactor/enable signal for the VFD compressor.
Setpoint=31bar

2.3.1.6 switch cabinet

The switch cabinet is factory tested and ready to use.
Specification EN60204-1
(see also wiring diagramm).

2.3.1.7 PCB board (printed circuit board)

The temperature controll is performed by the board. According to the liquid temperature in the supply line are the compressors changing state nor speed. Also all controll devices within the system.
Any failures are transmitted with 8 LED´s on the board.
The Errorcode are → #10.10.8-Bit-Failure code|outline
The board is completely programmed and need no more modification during startup or maintenance.
Different values are changed through the CAN-Bus.
CAN-Bus is connected at the IFP connector X810.
The communication between IFP and chiller is done through the light conductor.

2.3.1.8 Pump

The speed controlled pump in the chiller is running 24/7.
The operating point is the difference pressure at the IFP panel what is communicated through the CAN-Bus by Siemens.
The pump will be switched off In case of too low pressure in the return line (IFP or chiller) nor if the pressure differnce at the IFP is too low and if there is a recoginzed VFD failure.

3 IFP

IFP (Interface Panel) is the transfere station between Chiller and MRI.
The chiller is unable to run without the IFP panel.
Do not handle any valves while the chiller is running.

All valves have to be in open position 24/7.
Turn off the chiller before closing or opening any valve in the system.

Consequence of non-compliance can be a defective MRI water system or a flooded electronic within the MRI system.
The difference pressure values to controll the pump speed are measured at the IFP and transmitted to the chiller through the light conductor.
Also with the supply water temperature.

The cooling positions are as follows:

CBB = Cabinet building block (only at IFP 1TX)
MBB = Magnet building block
TX-Box = Switchbox (only at IFP 1TX)
MREF = Helium compressor

The MREF is not seperate monitored. That is given by the correct difference pressure values of min. 1,4bar to max. 4,0bar.

Attention: A too high static pressure at the IFP cause damage in the Siemens equippment!
KKT or Siemens will not pay the expenses of such operations!

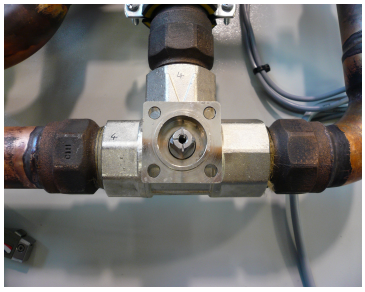
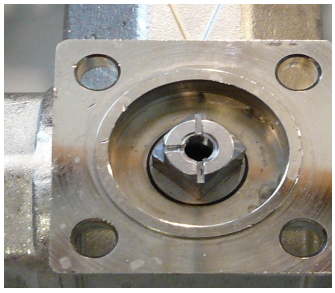
LEAK-TEST
DO NOT PRESSURIZE THE IFP WITH MORE THAN 2,9BAR/42PSI
WHEN THE SIEMENS SYSTEM IS CONNECTED!

Reason: The TX-Box maximum pressure is 3bar.

3.1.1 3 way valve – IFP panel

The 3 way valve is allways open.(during operating)
If the supply temperature drop down to 16°C or a power down will de-energize the bypass valve. The spring actuator is moving to position „bypass“.
The MRI electronic will be protected against condensation.
Bypass valve will be re-energized if the temperature in the waterpipe rise above 18°C.
8bit LED on the PCB board show the defective sensor code if triggered.

Pictures show the valve position in **Bypass-Mode (not-energized)**


Mounting!
The Actuator shall be mounted when it is de-energized.
The arrester will be in position 0.
Be aware the valve position have to be as shown on the picture.

3.1.2 Flow switch
(only existent at IFP 1TX)

CBB,MBB and TX-Box are all seperate monitored with a flow switch and communicated to the CAN-Bus.
CBB+MBB flow switch is only used as a alarm.
The pump for the TX-Box will be turned off, if the flow switch (TX-Box) is fault or turn off.
8bit LED on the PCB board show the defective sensor code if triggered.

3.1.3 TX Pump
(only existent at IFP 1TX)

Is installed at the IFP panel and is responsibility to keep the flow through the TX-Box constant. MR will shut down if the TX-Box have no flow. (20l/min)
The flow direction arrow can be found at the nameplate of the pump.
8bit LED on the PCB board show the defective pump code if triggered.

3.1.4 Pressure sensor

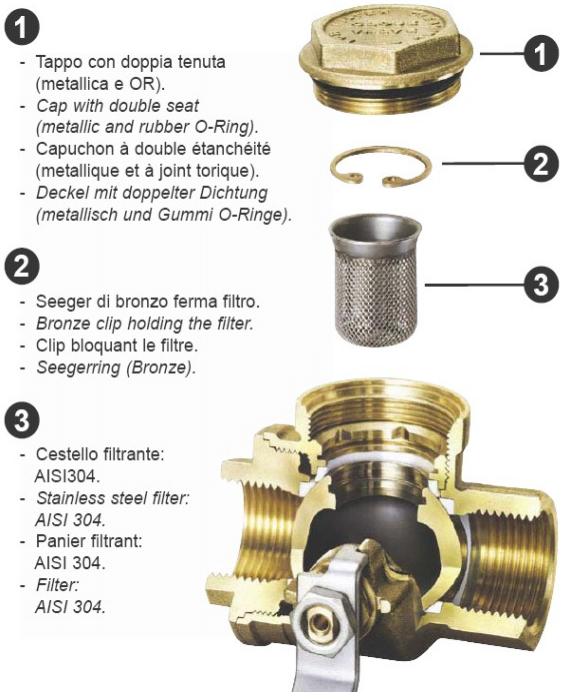
The difference pressure values to controll the pump speed are measured at the IFP and transmitted to the chiller through the light conductor.
8bit LED on the PCB board show the defective sensor code if triggered.

3.1.5 Temperaturesensor forerun
(only existent at IFP 1TX)

This sensor is used if the supply temperature sensor at the chiller is defective. Temperature range will be enlarged. This sensor also detect the 16°C safety shut down of the 3way valve. (protect from condensing water)
8bit LED on the PCB board show the defective sensor code if triggered.

3.1.6 Filter ball valve

Filter ball valve is installed in the supply line at the IFP panel and return line chiller.
It have to be cleaned twice during startup and at least once per year. This can be done without loosing water. Spareparts are available!



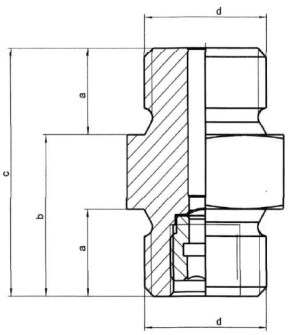
3.1.7 Temperaturesensor FLOW MREF
(only existent at IFP 090)

The sensor KAL1308 is instaleld in the forerunline to the MREF. It is a real temperaturesensor but is used for flow detection via calorimetric ioperating principle.
The Sensor is not connected to the PCB, it is triggerd from the MRI-controller.

3.1.8 rupture disc

If t have ter / glycol mixture
ple laws

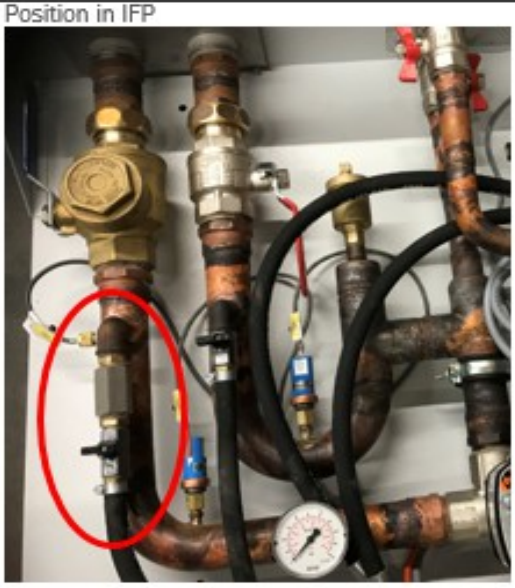
For xture we recommend to
pro rox. 9



d	a	b	c	SW	DN	burst pressure
1/2"	14mm	26 mm	40 mm	27	5,5 mm	8 - 10 bar

3.1.9 Disassembly of the flow limiter

ATTENTION: The flow limiter in the IFP must be removed when using a **Helium Compressor ST-7H.**
This compressor is used on **Magnetom Vida and Magnetom Sola**
Please proceed according to the following steps.

1	Position in IFP 	2	Pull the hose from the hose nozzle  
3	Open fitting on the pipe bend ATTENTION: hold against the pipe bend  	4	Unscrew flow restrictor ATTENTION: hold against screw connection 
5	Seal the nipple and screw it back into the pipe bend ATTENTION: hold against the pipe bend  	6	Pull the hose back onto the hose nozzle and fasten 

3.2 Remaining risk-phrases

3.2.1 Electrical risk

If all safety regulations are followed: None

3.2.2 Mechanical risk

If all safety regulations are followed: None

3.2.3 Chemical risk

	Refrigerant Gas R407C is a fluorinated greenhouse gas blend of R32 (CH2F2), R125 (CH2CF3), and R134a (CF3CH2F) in a 23/25/52 ratio by mass. Non-combustible, but toxic gases can be produced by thermal decomposition in a fire.
	Do not place a open fire near the chiller Do not smoke

3.3 Other risk

	Risk of death, when the unit is inside a too small room (danger of suffocation) If the unit is used inside the European union, you have to follow the EN378 regulations. Also take care about the local laws!

3.3.1 Safety data for refrigerant

Please look into the attached files.

3.3.2 Safety data for Mineral oils

Please look into the attached files.

First aid
Breath
- Move victim to fresh air and let him relax
- Contact the ambulance or a doctor

Skin contact
- Remove the clothing
- Wash the skin with portable water
- Contact the ambulance or a doctor

Eye contact
- Wash the eyes with clean portable water with open eyelid for min.10 minutes
- Contact the ambulance or a doctor

Swallow
- Do not throw up
- flush the mouth with portable water or drinking water
- Contact the ambulance or a doctor

Fire fighting measures

Low fire danger. Product burns only while a high heat input.

	**Toxic gases can be produced by thermal decomposition in a fire.**

Safety regulation during fire fighting:

- Wear a self-contained breathing apparatus and fire safety clothes

Safety

- Protect your enviroment from Oil
- Use sand or dry earth to absorb the oil
- Fill this mixture in a seperate and closed container
- Clean the rest with an damp cloth

	**In any case of oil loss to the environment contact your local fire department or the next police station!**

Handling an storage

Handling

- Avoid skin contact
- Don´t breath burned oil or oil dust

Storage

- storage only in provided containers
- Don´t open new drum´s
- seperate

Storagetemperature: -40 till +60°C
max. Storage time:

Original closed	- limitless
after opening	- same day

Personel protection

	**Wear eye protection!**
	**Wear gloves!**

	Wear protective clothing!

4 Definition

	Attention!
	The system have to be de-energized before opening!
	Danger HOT!
	Danger COLD!
	Attention, risk of electrical shock!
	Risk of snag on sharp fins and may other metal parts inside the units!
	Wear eye protection!
	Wear gloves!
	Wear protective clothing!

5 Check before installing

Check the chiller for any transport damage!

Do not install the Chiller more than 8m above the IFP.
Do not install the Chiller lower than 17m below the IFP.
High difference between IFP in/out and chiller inlet.
Do not use old piping until you know exactly what material (complete piping run) and what kind of pipe size you are connecting.
Do not use old pipes with unknown old liquids or anything else inside.

5.1 Transport and Storage

The chiller can be moved by crane or forklift. Check out the balance point at the wooden crate packing. Transport notice → see next page!

Transport on company premises may be done with a forklift truck. The appliance must however be kept in an upright position and on no account tipped to the side. A visual inspection should be made on delivery to check for any damage. Complaints should be made immediately to the haulage contractor and the insurance company must be notified at once. When transporting by crane

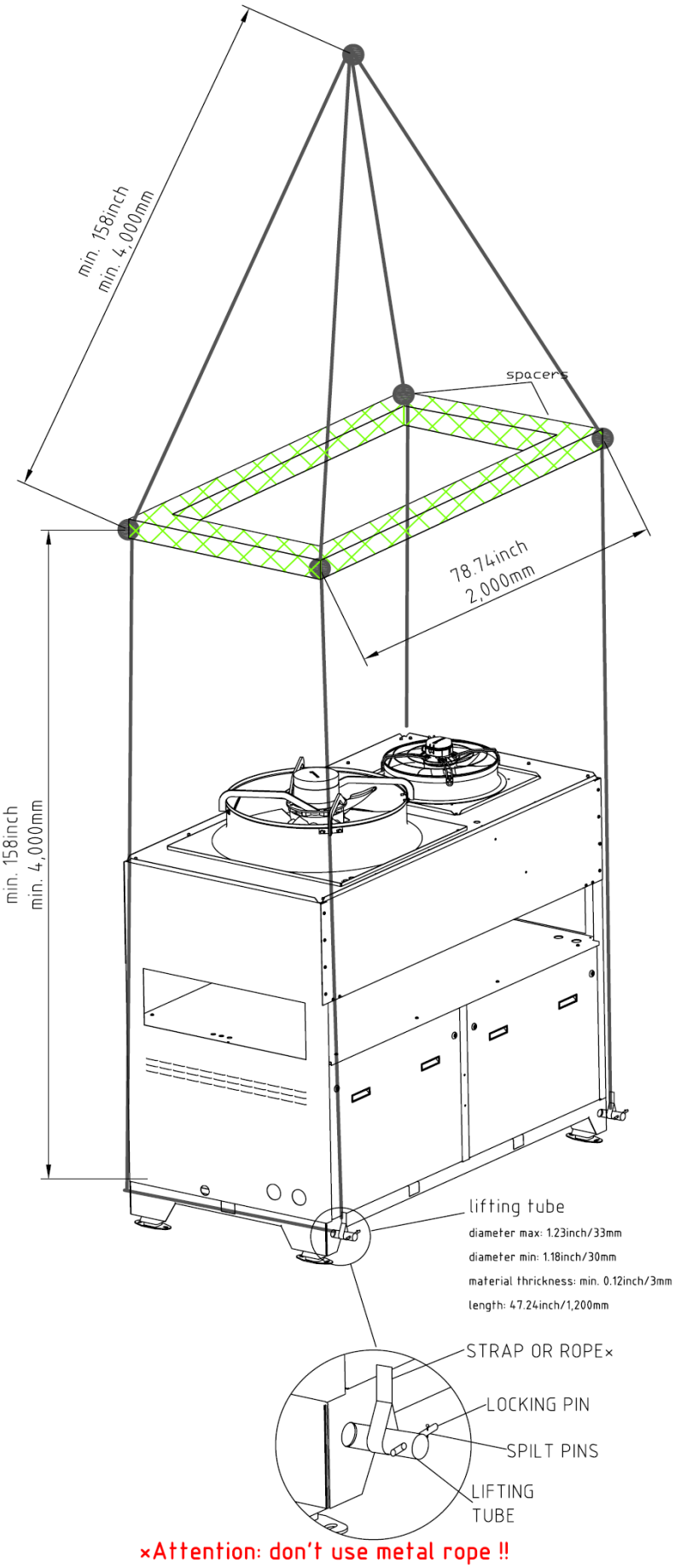
Please ensure that the housing is not subjected to pressure at the sides.

Place the lifting tubes in the holes in the feet at the base of the chiller. Lock the ends of the tubes in position with locking pins and split pins as shown.

The capacity of the lifting gear must be adequate to lift the load Chiller+IFP+Tools.

Check the weight of the chiller units, the capacity of the lifting gear and ropes and the condition and suitability of the aforementioned equipment.

Weight and dimensions see Technical Data



×Attention: don't use metal rope !!

	**Don´t tip the chiller to the side!**

5.2 Safety regulating before use!

Use the ECO-Chiller only outside. Do not build a roof above the chiller.
Do not use the ECO-Chiller inside

	**Do not place a open fire near the chiller** **Do not smoke**

5.3 Unpack

	**Plastic or metall packing straps can be dangerous and jump up during cutting!**

Adamaged chiller during unpacking, is no part of the warranty! Therefore, please be carefull!

5.4 Disposal of packing waste

The IPPC-Standard wooden box can be recycled.
Also all plastic and styrofoam.

5.5 Checklist before and during installation

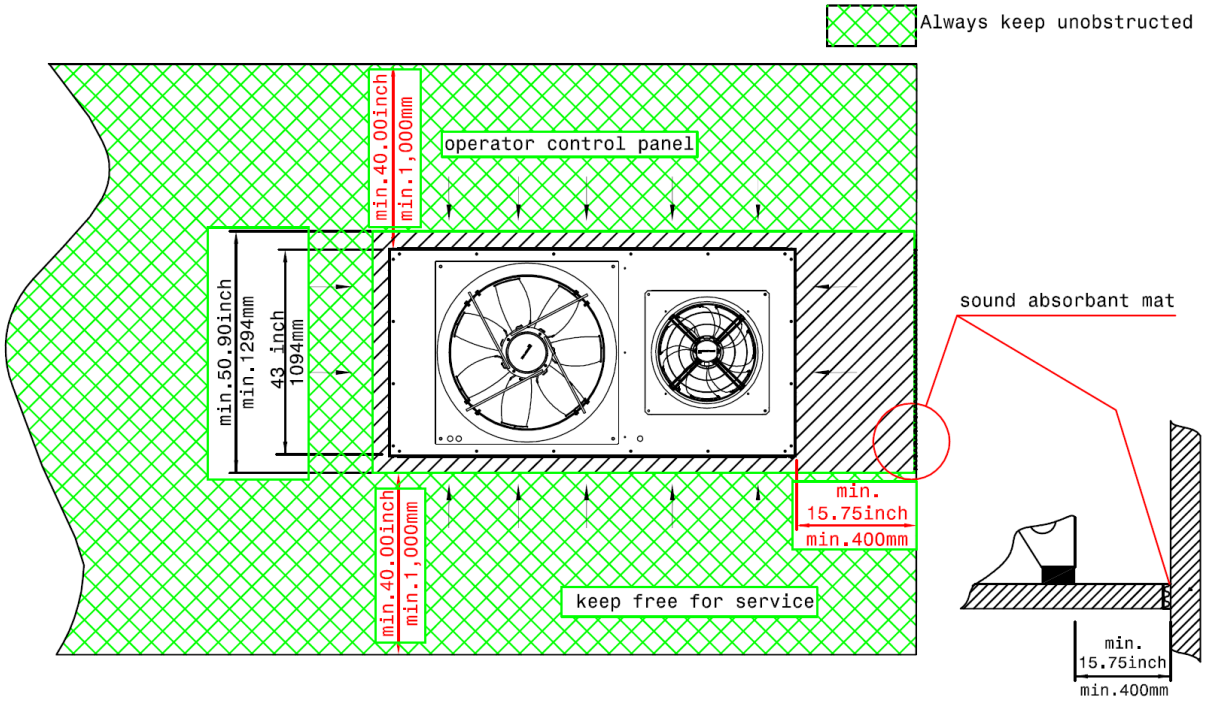
- Check the typicall ambient temperature in your area according to the chiller Spec.
- The chiller shall be placed on a body reference plan basement. See also Spec. For chiller weight.
- There shall be at least 1m space around the chiller
- Place the chiller where the fresh air intake is not blocked
- KKT chillers can not provide Hurricane safety instructions for this unit. Better find another place.
- Piping between IFP and Chiller shall be stainless steel, copper or plastic.
- See also install instructions

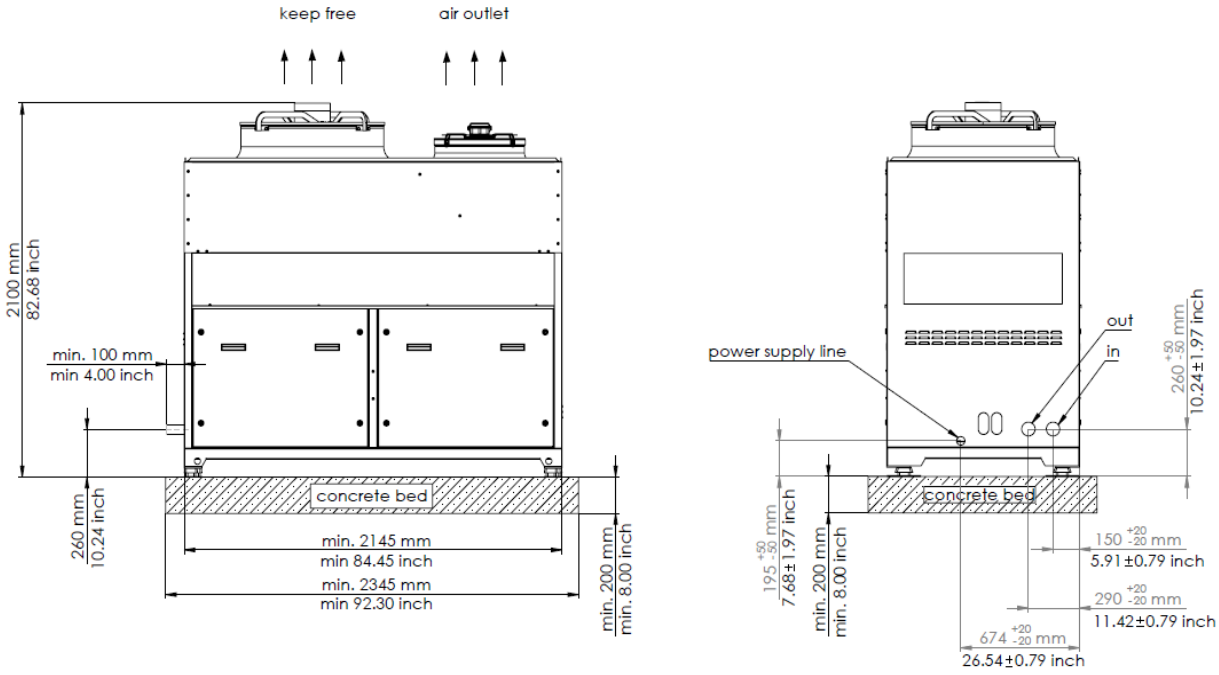
Sludge accumulation will occur when using iron pipes!
The MRI can be totally damaged by using iron piping!

- Piping diameter shall be at least 2“. See install instruction for more informations.
  → see also #10.16.System sketch (see also install instuction for proper air venting)|outline
- Install the Chiller and IFP piping vibration-coshioned and static unencumbered.
- Install automatic air vents after each vertical run in supply and return pipe.

Risk of snag on sharp fins and may other metal parts inside the units!

waterchiller installation I

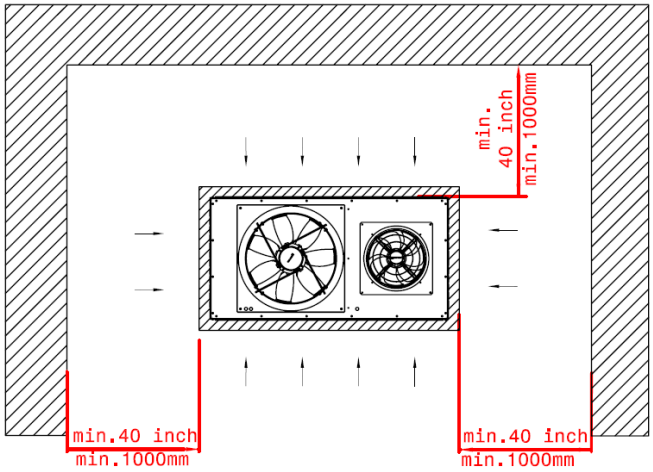




Dimensions for the concrete bed should be
adjusted according to local circumstances.

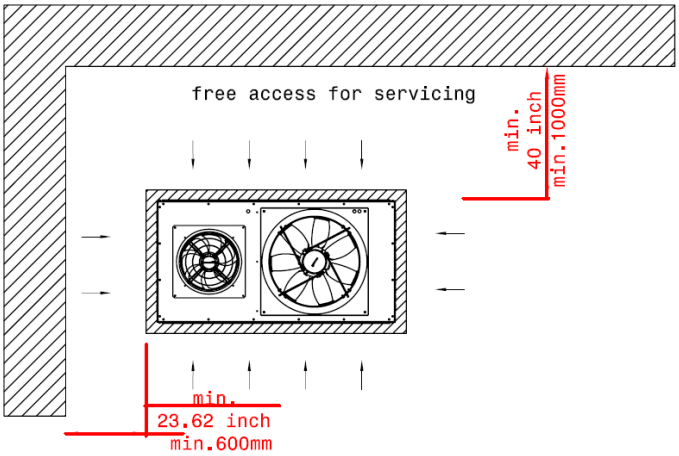
waterchiller installation II

installation example A

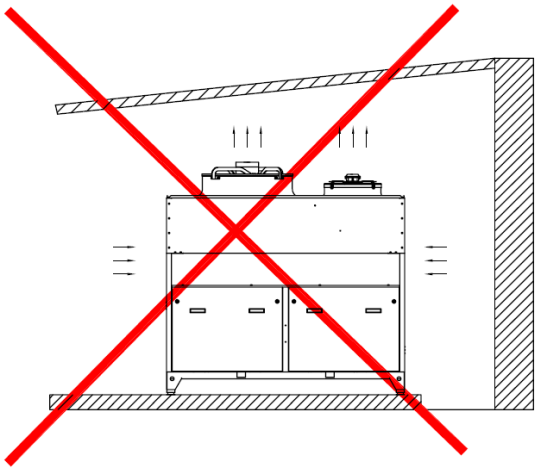


free access for servicing

installation example B



installation example C



Air outlet keep free!

6 Freeze protection – Requirement from Siemens

- The ECO-Chillers have to run with anti freeze/water mixture
- Water to be used (de-ionized water / destilled water / VE water / partly de-ionized water)
  This type of water has to be purchased and provided locally

- Allowed antifreeze is: Antifrogen N (eg. Safeflow EG) from Clariant **or**
  DowTherm SR1 from Dow Chemical

- Forbidden antifreeze is: propylene glycol based antifreeze
- automotive antifreeze mixtures
- pure ethylene glycol

- The glycol rate have to be 35% - 38% at any time
- The glycol rate depend not on you local ambient temperature, area or water temperature!

This requirement has to be addressed to the PG

6.1.1 Installation

6.1.2 Installation

See install instruction

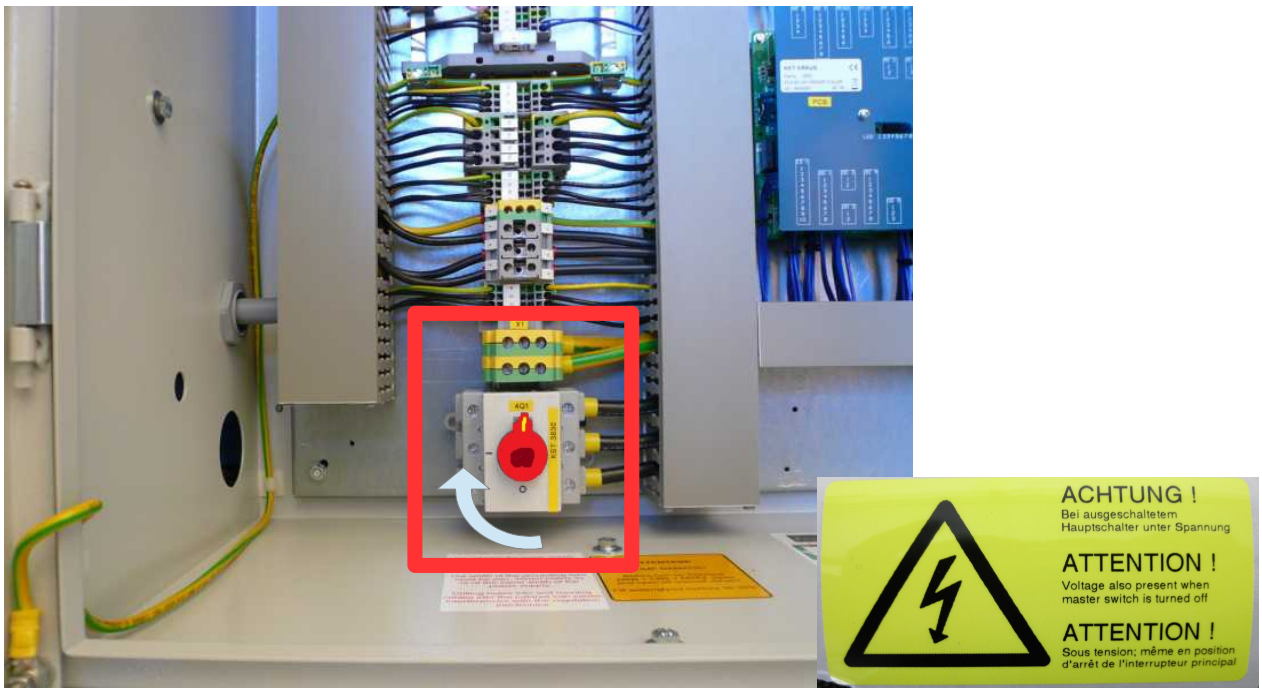
6.1.3 Piping connections

	**Sludge accumulation will occur when using iron pipes!** **The MRI can be totally damaged by using iron piping!**

See also → #5.5.Checklist before and during installation|outline

6.1.4 Electrical connection

The power supply to the chiller have to be connected at the main switch inside the switch cabinet.
The minimum Wiring size is 16mm² (AWG 6) or higher. Be aware of local regulations!
Warrant will be void if you run the power supply not through the provided hole in the bx.



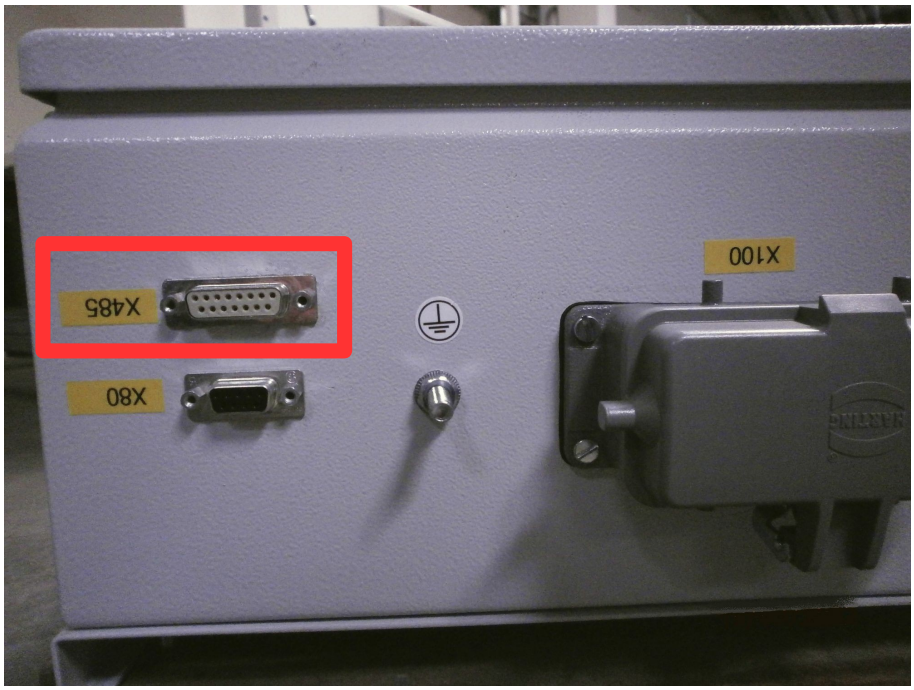
The power supply for the IFP is performed from MRI ⟶ connector X100.

May the Grounding contact shall be used also if provided by the power supply.

The CAN-Bus has to be connected at X820 (only existent at IFP 1TX)

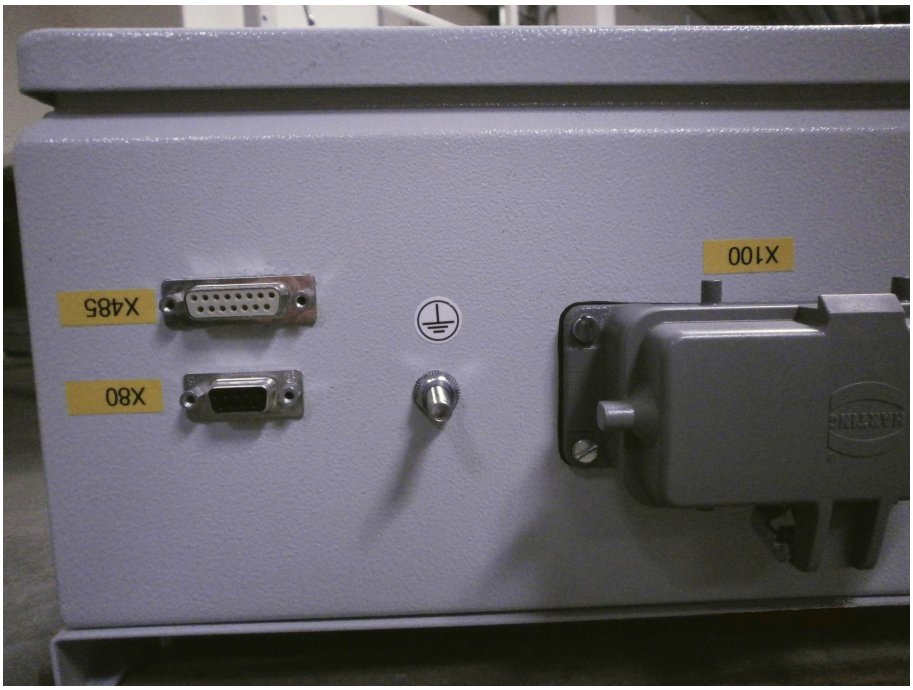
A removed or non working CAN-Bus will result in a permanent Nightmode sequence.

The RS485-Bus has to be connected at X485 (only existent at IFP 090)



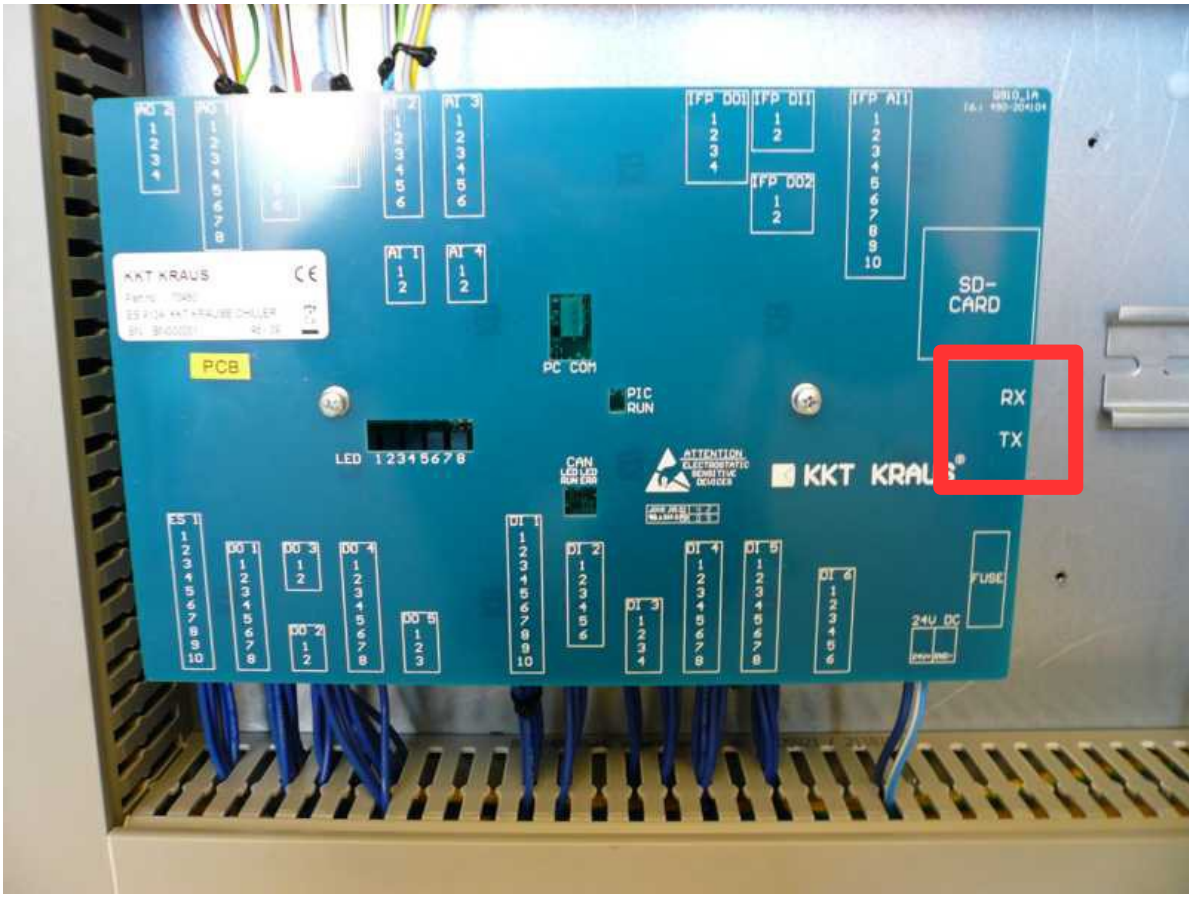
A removed or non working RS485-Bus will result in a communication error at IFP. If communication is lost for over 10 minutes the chiller will proceed with daymode.

The X80 has to be connected with X80 at MRI (only existent at IFP 090)



This connector provides the Temperaturesensor FLOW MREF to the MRI.

The communication between IFP and chiller is done through the light conductor.
Cable to use is W 10401 and shall be connected at RX and TX connector on the PCB board at the IFP and Chiller.
T=transmitt
R=recieve
Just follow the label at the light conductor
(TechTip: „The blinking cable shall be connected to the RX-port“)



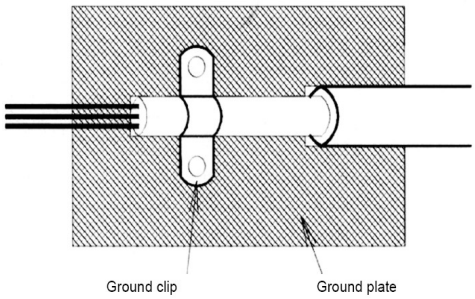
⚠	Startup and electrical installation shall be performed by professional and qualified technicans. They have to be also familiar with the local regulation.

⚠	Do not turn on the system before everything is correct installed and the system is completely filled with pre mixed water/glycol mixture. Otherwise the pump get damaged and will break down much faster!

6.1.5 EMC Compatibility and Grounding

This comments are compiled to help the field electrician to install the grounding of the power supply and to get a EMC Compatibility.
All electrical equipment produces radio and line-borne interference at various frequencies. The cables pass this on to the environment like an aerial.
The basic countermeasures are isolation of the wiring of control and power components, proper grounding and shielding of cables.

A large contact area is necessary for low-impedance grounding of HF interference. The use of grounding straps instead of cables is therefore definitely advisable.



Moreover, cable shields must be connected with purpose-made ground clips.

The grounding surface must be highly conductive bare metal. Remove any coats of varnish and paint.

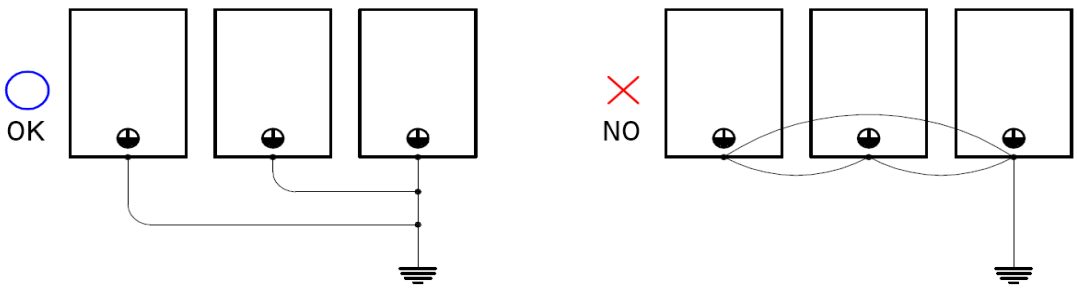
The width of the grounding wire must be min. 16mm² (AWG 6) or the same width of the power supply.
The grounding must be an isolated ground and must connected on the ground terminal (X1) in the switch cabinet. The ground resistance must be less than 5 ohm.

Metal cable conduits are not allowed for grounding.

The piping of the chiller (supply and return) have to be grounded too.

Do not share the ground wire with other devices.
Always use a ground wire that complies with technical standards on electrical equipment and minimize the length of the ground wire.

When using more than one Inverter, be careful not to loop the ground wire.



6.1.6 Filling the system

	**Fill only 250µm filtered liquids!** **Use only allowed liquids!** **Use only premixed water/glycol!** **The concentration have to stay in a range of 35vol% bis 38vol%**

See also #5.6.Freeze protection|outline

The system shall be filled at the lowest point. If the IFP is installed below the chiller it would be recommended to have some drain/fill valve in front of it.

	**Vent all pumps!**

Water properties: requirements from Siemens

Water to be used (de-ionized water / destilled water / VE water / bartly de-ionized water)
This type of water has to be purchased and provided locally

6.1.7 High differences – Fill pressure

This drawing is only a sketch and is not a exact model down to the last detail!

Chiller is installed below the IFP panel!

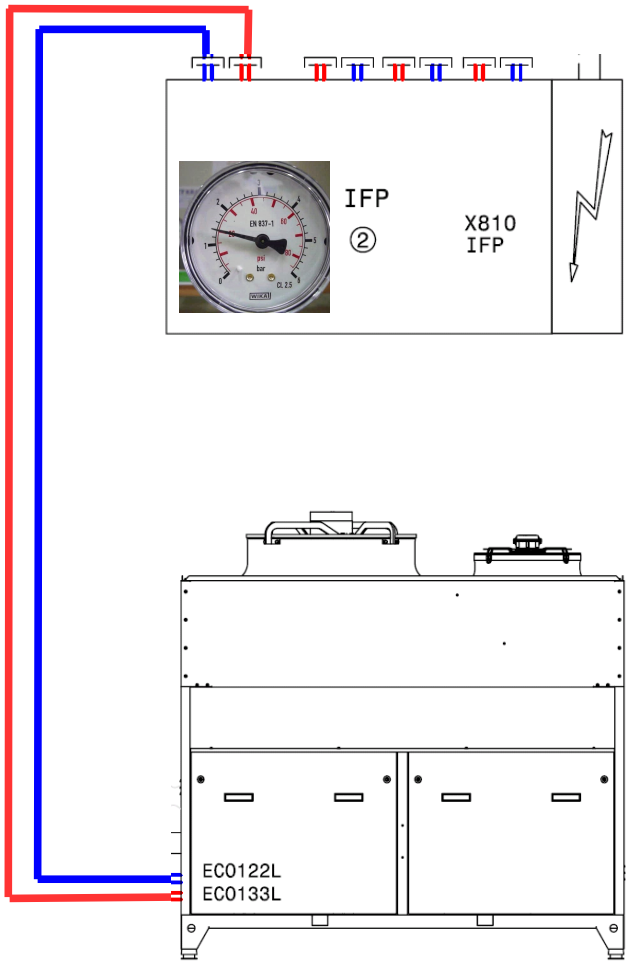
Before filling the system:

- Whole system is installed with all options
- All valves are in open position
- System is OFF

Fill the system only with premixed water/glycol!
→ see also 6.1.9 Draining air from the unit|outline

Read the static pressure of your system
at the pressure gauge on the IFP panel.

Chiller lower than the IFP panel → 1,2 – 1,3 bar
Limitation: 17m below IFP



The maximum permitted length of the piping between ECO Chiller and IFP is 45m one way.

A installed and working automatic Airvent in supply & return piping with a correct static pressure will determin most of the failures and is recommended for this system.

chiller location	adjusted value at expansion vessel 40 l	filling pressure at chiller gauge
	[bar]	[bar]
2,5 m below IFP	0,9	1,5
5 m below IFP	1,1	1,7
7,5 m below IFP	1,4	2
10 m below IFP	1,6	2,2
12,5 m below IFP	1,8	2,4
15 m below IFP	2	2,6
17 m below IFP	2,2	2,8

The heights refer to the base plate of the chiller and the upper edge of the IFP !

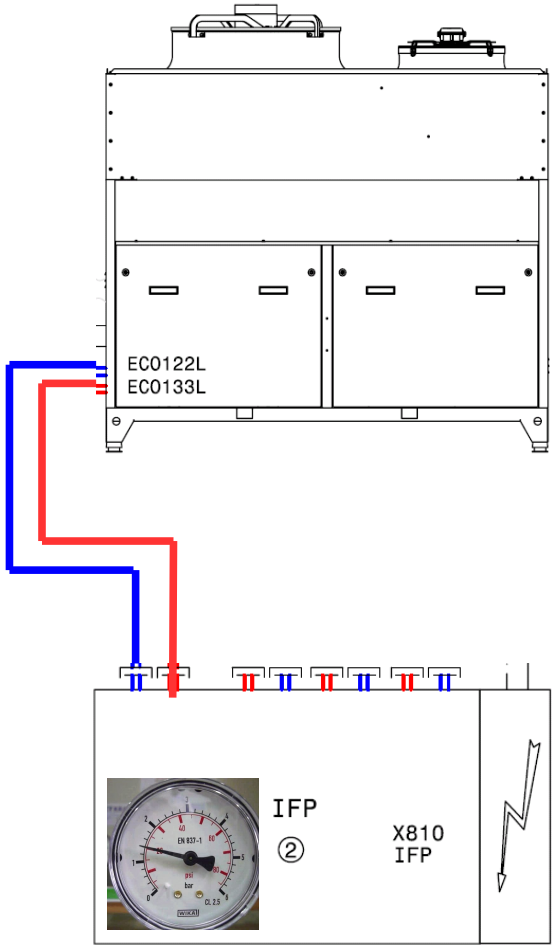
Chiller is installed above the IFP panel!
This drawing is only a sketch and is not a exact model down to the last detail!

Before filling the system:

- Whole system is installed with all options
- All valves are in open position
- System is OFF

Fill the system only with premixed water/glycol!
→ see also 6.1.9 Draining air from the unit outline

Read the static pressure of your system
at the pressure gauge on the IFP panel.



Chiller higher than the IFP panel → 1.7–1.8bar
Limitation: 8m above IFP

Chiller on the same level panel → 1.7–1.8bar

The maximum permitted length of the piping between ECO Chiller and IFP is 45m one way.

A installed and working automatic Airvent in supply&return piping with a correct static pressure will determin most of the failures and is recommended for this system.

chiller location	adjusted value at expansion vessel 40 l	filling pressure at chiller gauge
	[bar]	[bar]
same level as IFP	1	1,6
8 m above IFP	0,4	1
6 m above IFP	0,4	1
4 m above IFP	0,6	1,2
2 m above IFP	0,9	1,5

The heights refer to the base plate of the chiller and the upper edge of the IFP !

6.1.8 Fill expansion expansion vessel (40L)

To maintain a constant pressure in the water circuit.
SERIAL: (January 2020)
EC0133 → 2372

The system can be filled as described.
Remark: The expansion vessel is pre ressurized with 0.6bar nitrogen.
Be aware to check any replacement part by yourself.

Overall Picture:
expansion vessel 40l

6.1.9 Draining air from the unit

The following procedure should be followed to properly the air vent, a Chiller and Piping before start-up or after any major hydraulics repair.

1) Open all individual (not the fill or drain valves) unit valves to assure circulation.
   Also open all valves on the IFP Panel.

2) Fill system with premixed water/ethylene glycol (35-38%glycol), from the lowest point. In case of repair on the water circuit (also change of water cooled component in the electronic cabinets of Siemens) refill system with premixed water/ethylene glycol (35-38%glycol) from the lowest point.

3) The static pressure at the IFP-pressure gauge (pump is OFF) shall have the following value:Chiller
   Chiller same level oder above the IFP panel → see also 6.1.7 High differences – Fill pressure
   Chiller lower than the IFP panel → see also 6.1.7 High differences – Fill pressure

4) Vent all air by the automatic air vent (black or brass coloured small tank on the top of the suction side of pump, at the IFP panel and in the piping)

5) If static pressure decreases during air vent the water circuit must be refilled with premixed water/ethylene glycol (35-38%glycol) up to: see point 3

6) Now bleed all air out of the system and chiller again (expansion vessel, pump, automatic and manual air bleeder). If the static pressure decreases again → refill according to point 3

7) If all air is bled out of the system start pump for a few minutes. Then switch off the pump and vent air again. If the static pressure decreases again → refill according to point 3

8) Now start pump again. Monitor pump and bleed points to insure all trapped air is removed.

9) Check pressure on suction side of the pump after a few minutes and again after a few hours and refill the system if necessary up to: → refill according to point 3

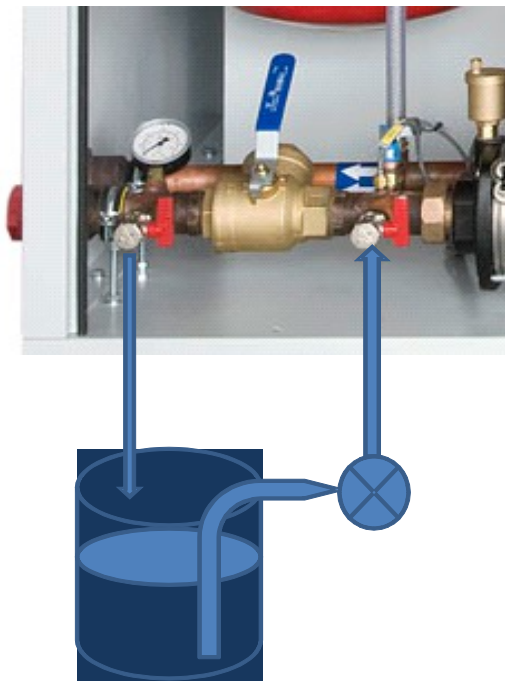
10) For a proper adjustment of the suction pressure it is necessary to have the right pressure of nitrogen filling in the expansion vessel. The correct pressure of the nitrogen filling is 0,6-0,8bar

11) The suction pressure should be re-checked within 24hours by someone on-site who can advise of any changes.

12) Generally is it necessary to check the suction pressure four times a year even if nothing is changed.

TechTip:

How can i fill the System faster and vent the air out of the system in one step?
Refer to point 5.6.7/8 choose the following procedure.



Open all installed ball valves in the system.
Now close only the Filte ball valve in the chiller.
Attache one hose to the left drain valve and put it into a bucket.
Use a electrical pump (minimum difference pressure 2bar).
Ensure that the pump intake hose is allways below the water level and pump the water/glycol mixture through the 2. drain valve into the entire system.

Keep that running until no more air leave the 1. valve.
Check Glycol rate during the mixture is cycling. You can add water or glycol during the processing.

May install a filter strainer infront of the pump to protect the unit from dirt.

Done! Your system is filled and vented.

Filling pressure shall be provided according to Point. 5.6.7

6.1.10 Placing out of operation

Storage the unit indoor in frost free rooms.

	**Placing out of operation shall be performed by professional and qualified technicans.** **They have to be also familiar with the local regulation.**
	**Disassembling have to be performed by professional and qualified technicans.** **Water and refrigerant pipes are under pressure!** **They have to be also familiar with the local regulation.**

After the unit is relocated or longer than 2years out of operation it have to be started according to EN 378-2 (A – D) or to the local regulations..

6.2 Demounting

All parts (e.g. refrigerant, oil, glycol, metal, eletronics...) have to be recycled, re-used or disposed. Please contact your local waste management center.
You could also send the unit back to KKT chillers for proper recycling.
Take the local waste management regulation into account.

6.3 Re-packaging

The chiller is delivered in a throw-away pack. Don't use it twice!

7 Instructions for use

7.1 Bringing into service

(1) Check that all water-valves at the chiller and IFP are complete open
(2) Check that all drain and fill valves are closed
(3) Check that the light conductor ist installed and connected (TX-RX transmitt/recieve rotation!)
(4) Ambient temperature have to be in range: -20°C (-4°F) till +48°C (118.4°F)
(5) Close all covers and switch box when ready
(6) Main switch should stay at „0“ System OFF
(7) Check correct power supply and phase rotation
(8) Turn on the main switch to enable power supply to the unit.

(9) The pump start to run automatically (approx. 20sec. delay time)
(10) The unit is delivered in Nightmode. The supply temperature will stay in a range of 19°C till 26°C. The chiller is changing automatically to Daymode after the MRI is up and running and the communication works. (CAN-Bus connected)
(11) The big condenser fan is speed controlled and maintain 20bar.
The small condenser fan run in range between 24/21bar
(12) Check the correct static pressure
(13) Check that the IFP supply pressure is below 6bar
(14) Check the ampere rate of all electrical components

motor	labeling	ampere
Pump	17U1	Nightmode 0,5-1,0A Daymode 2,8-3,5A
Compressor 1	18U1	13,0 - 27,0A
Compressor 2	20M1	10,0 – 17,0A
Condenser fan 1 (800mm)	19U1	1,0 - 4,0A
Condenser fan 2 (500mm)	21M1	1,7 – 2,2A
FCU Fan (in FCU switch box)	4M1	1,7 – 2,2A

7.1.1 Delivery status

The unit is deliveredy in Nightmode. The supply temperature will stay in a range of 19°C till 26°C. The chiller is changing automatically to Daymode after the MRI is up and running and the communication works. (CAN-Bus connected)

There is a service tool required to change the Day/Nightmode manually!
Contact adress: info@kkt-chillers.com or support@kkt-chillers.com

7.1.2 Generell function of the controll

Description about the control of ECO-Chiller:

General

Power Supply
The Power Supply is monitored by a phase sequence relay.
The phase sequence switch the Chiller off in case of one or more phases are lost.
The phase sequence relay switch off the Chiller if the phase rotation is wrong.

If the phase sequence is correct or the phases are back the Chiller starts automatically.

Temperature and Pressure Sensors
All Temperature and Pressure Sensors are monitored. Broken wire or short winding.

Daymode / Nightmode

Chiller works in two Modes. The Modes will be switched by the Siemens MRI.
If the Siemens MRI is “ON” the Chiller is in Daymode. Green LED on PCB board is blinking
IF the Siemens MRI is “OFF” the Chiller is in Nightmode. Green LED on PCB board is 24/7 ON

Daymode means:
The difference pressure on the IFP between supply and return line is approx. 3.4-3.8bar.
So the flow rate is 130l/min for the Siemens XQ-Engine and 95l/min for the Siemens XJ-Engine.
The temperature of the water supply will be constant 20°C and is controlled regarding the heat load of the MRI.
Nightmode means:
The difference pressure on the IFP between supply and return line is 1,4bar.
So the flow rate is 85l/min for the Siemens XQ-Engine and 60l/min for the Siemens XJ-Engine.
The temperature of the water supply swings between 26°C and 19°C. In that case only the Helium compressor is on and have no problem with this temperature swing.

Service Mode see capture “Run and Fault Messages”

Chiller

When the Chiller is connected to the power supply and the main switch is “ON” the Chiller starts automatically.
Take care of connected pipes and POF data cable to IFP.
The Chiller Software is programmed and the settings are fixed for autonomous run.
For the several control circuits see the captures below.

IFP

The IFP is the interface between MRI water hoses and local build pipes to the Chiller.
The IFP gets her own power supply from the MRI to X100 on top of the switch cabinet.
The IFP have a power connector and hoses for water supply and return to the MREF.
On the IFP are two pressure sensors for the value of the differential pressure control circuit of the pump.

Only at IFP 1TX:
The flow to MBB, CBB and the return flow from TX-Box is monitored by flow switches.

The temperature sensor is only for display to the service software from Siemens in case of normal operation.

If the supply temperature sensor in the Chiller is defective the cooling capacity control circuit gets the real value as a back up from this temperature sensor on the IFP.

The 3-way-valve on the IFP is normally closed. This means the IFP is “bypassed”. If the 3-way-valve isn't energized the IFP is bypassed and no water flow to the MRI.
The MREF is still supplied with cold water.
If the water supply temperature drop below 16°C in Day- or Night Mode the 3-way-valve will be de-energized. The spring actuator is closing.

When the water supply temperature reach 18°C the 3-way-valve will be energized and the water flow to the MRI (CBB/MBB) is open.

Emergency cooling is not performed at the IFP.
If some emergency cooling is necessary contact your local Siemens Project Manager in advance.

Description of the CAN Settings/Values

Siemens can **change** via CAN-Bus most of the Settings [*1:]
Here follows the most important

Description	CANopen Index	Standard Setting	Location of Sensor
Day Mode/Night Mode	201B	ON/OFF	Heartbeat
Water Low pressure Warning Threshold	2025	0,5bar	Suction line of Pump in Chiller
Water Low pressure Error Threshold	2026	0,3bar	Suction line of Pump in Chiller
Water Low pressure Switch off Threshold	2027	0,1bar	Suction line of Pump in Chiller
Water differential pressure setpoint Daymode (Heartbeat ON)	2011/1	3,8bar	Supply and return line on IFP
Water differential pressure setpoint Nightmode (Heartbeat OFF)	2011/2	1,4bar	Supply and return line on IFP
Water Temp Supply Threshold High	202A	25°C	Water supply line IFP
Water Temp Supply Threshold Low	202B	18°C	Water supply line IFP
Water Temperature Supply Set Point	202C	20°C	Water supply line in Chiller
IFP Pressure Supply Threshold High	2014	6,0bar	Supply line IFP
IFP Pressure Return Threshold Low	2017	0,5bar	Return line IFP
Temperature Ambient Threshold	2031	48°C	Below switch cabinet FCU

Siemens is monitoring much more DI/DO/AI and AO Values to there Service Software via CAN-Bus as you can see here.

[*1:] only possible at IFP 1TX

Description of each control circuit

For a optimal operation and a high grade according to expectations of Siemens in the Software there are 6 control circuits realized.

Pressure and On/Off control of the pump

The pump runs 24/7 after the main switch is “ON”.
In Daymode the pump speed is controlled by a PID-controller to a difference pressure on the IFP of 3 - 4bar.

The pump stops if following occurs:

1. power supply off or phase sequence relay switch off, restart automatically
2. emergency stop (optional, not installed at KKT)
3. water temperature above 35°C more than 10min, restart with reset
4. pressure sensor suction side pump is defective, restart with reset
5. pressure sensor on IFP is defective, restart with reset
6. difference pressure is below 0,4bar after 5min
7. pressure in suction line of pump is below 0,1bar, restart with reset.

If the pressure in supply line on IFP reach ~6,0bar the pump speed decreases automatically.
This is a safety function to protect all Siemens electronic components from too high pressure.

Cooling Capacity and ON/Off control of the compressor 1 and 2

Daymode

The compressor 1 starts if following terms are given:

1. pump run
2. high pressure below 28bar
3. low pressure above 0,5bar
4. low pressure sensor okay
5. temperature sensor suction line okay
6. no emergency stop pressed
7. phase sequence relay okay
8. water supply temperature over 22°C

The compressor speed is controlled by a PID-Controller to a constant water supply temperature at 20°C.
If the temperature sensor in the supply line in Chiller is defective the temperature sensor on the IFP is used. (result: higher temp. swing)
Compressor 1 switch off if the supply water temperature drop below 19°C

If the high pressure reach 28bar the compressor speed will be reduced step by step.
The cooling capacity decreases but the compressor still runs and cool the water down as much as possible.

Nightmode

The compressor 1 starts if following terms are given:

1. Pump runs
2. High pressure below 28bar
3. Low pressure above 0,5bar
4. Low pressure sensor okay
5. temperature sensor suction line okay
6. Frequency drive okay
7. No emergency stop
8. phase sequence relay okay
9. Water supply temperature over 26°C

The compressor switch off as soon the supply temperature drop below 19°C.

Following explanations are only valid for the ECO133L!

Daymode

The compressor 2 starts if following terms are given:

1. Pump runs
2. High pressure below 28bar
3. Low pressure above 0,5bar
4. Low pressure sensor okay
5. temperature sensor suction line okay
6. Motor protection is okay
7. No emergency stop
8. phase sequence relay okay
9. control signal to compressor 1 is over 9,0Volt

In the case of compressor 2 turn on the control signal of compressor 1 will be reduced by a fixed value. This action can be heard by a significant noise of compressor 1.

Compressor 2 turn off if the control signal to compressor 1 is below 3,0Volt.
In the case of compressor 2 turn off the control signal of compressor 1 will be added by a fixed value. This action can be heard by a significant noise of compressor 1

Nightmode

The cooling capacity in Night Mode of the ECO133L will be realized by the compressor 2 by switch on at water supply temperature above 26°C and switch off at water supply temperature below 19°C

If compressor 2 is defective compressor 1 turn on by a fixed value.

Pressure control of the refrigerant circuit

The pressure control of the refrigerant circuit is equal in Daymode and Nightmode.

Fan 1 runs if one compressor (1 or 2) runs.
The speed of the fan 1 is controlled by a PID-Controller and depends on the high pressure of the refrigerant
The speed rise up if the pressure increases.
The speed ramp down if the pressure decreases.

Fan 1 stop if:

1. high pressure is below 20bar
2. Frequency drive defective
3. emergency stop
4. phase sequence relay is off

Fan 2 run if:

1. One compressor runs
2. Motor protection and winding protection fan 2 okay
3. high pressure reach ~25bar

Fan 2 stop if:

1. No compressor run
2. Motor protection or winding protection is fault
3. high pressure is below ~22bar

Control superheat of the evaporator

The expansion valve is controlled by a PID-Controller to keep the superheat of the suction gas at 6Kelvin.

If no compressor runs the expansion valve is completely closed.
The PID-Controller for the expansion valve runs if one compressor runs.

IF the superheat is below 3K or above 15K for 60sec. 3 times in one hour then the compressors shut down and a error message will be displayed at the PCB board.

Control of the Hotgas-Bypass-Valve

The Hotgas-Bypass-Valve is NC (normally closed).
If Compressor 1 or Compressor 2 starts the Hotgas-Bypass-Valve is energized for 30sec.
This function is for start help.
If the last compressor turns off, the Hotgas-Bypass-Valve is energized for 4sec.
This function is for pressure balance.

The Solenoid valve will be also energized if the output Signal to compressor1 (0-10V) drop below 1Volt.
The Valve will be de-energized when the signal reaches 6Volt.

Control of the FCU (Optional)

The Free Cooling Unit controller is already implemented in the software.
FCU-Option is designed to save Energy.
The Chiller runs with or without Free Cooling Unit.
If the Free Cooling Unit will be installed afterwards there is no upgrade or setting necessary.
The FCU try to maintain 20°C supply water temp. During Nightmode and Daymode!

The fan of the Free Cooling Unit (FCU) and the 3-Way-Valve works if:

1. Thermal contact of fan FCU is okay
2. Motor protection of fan FCU is okay
3. Ambient temperature is below 18°C for more than 20sec.

The fan runs 100% all the time if above terms are given.
The 3-way-Valve is controlled by a PID-Controller.
The 3-way-Valve try to mix the water to 20°C in the return line to the evaporator.

The fan will stop if:

1. ambient temperature is below -20°C
2. Motor protection drip
3. temperature sensor ambient, return Chiller or sensor behind the 3-way-valve is defective
4. temperature sensor after the 3-way-valve is higher then the temperature sensor return Chiller. Reason: In this case is the FCU heating and not cooling.

Run and Fault messages

Daymode is signed with blinking green LED.

Nightmode is signed with steady on LED.

See also #6.3.Signals at the PCB board|outline

Customer Contact

Any fault of the system (refer to 8bit failure code) are combined to one relay which open if one of the fault appears.
This contact can be used by any customer for there system.
See wiring diagram page 12 terminal DO5 P1, P2 and P3.

Maximum 24V AC or DC
PIN3=COM
3-2 closed = RUN everything OK no Error
3-1closed = FAULT
Contact KKT for the correct connector if needed.

Service Mode

All fault messages to Siemens are during the service mode disabled.
This can be done by pressing the black reset button on the right switch cabinet door for min.10sec.
The yellow light on the PCB board is now illuminated.
Push the reset button again for min.10sec. to leave the service mode.
The automatic reset is activated latest after 2hours to leave the service mode without hands on.

Service Tool

The Service Tool show most of Digital In- and Outputs and Analog Values.
This allows to solve a problem with the Chiller, IFP and FCU more quickly and reliable.

Following values are shown:

Digital Values	Analog Values
Pump ON/OFF	Pressure Water Chiller return
Chiller Fan 1 ON/OFF	Temperature Water Chiller return
Chiller Fan 2 ON/OFF	Temperature Water Chiller supply
Compressor 1 ON/OFF	Temperature Water FCU supply
Compressor 2 ON/OFF	Temperature Suction gas
Hotgas-Bypaß-Valve ON/OFF	High Pressure Refrigerant
IFP Bypaß-Valve ON/OFF	Low Pressure Refrigerant
Superheat Error ON/OFF	Temperature IFP Supply
Motor Protection Compressor 2 ON/OFF	Pressure Water IFP return
Frequency Drive Compressor 1 ON/OFF	Pressure Water IFP supply
Booster connected	Control signal to VFD Pump
Free Cooling Unit connected	Control signal to VFD 3-Way-Valve FCU
Compressor 2 connected	Control signal to Expansion Valve
	Control signal to VFD Compressor 1
	Control signal to VFD Fan 1

Service tool is available only from KKT chillers directly! (Browse your CD)
Contact adress: info@kkt-chillers.com or support@kkt-chillers.com

Requirements: XP nor W7 System installed. USB 2.0

7.2 Unexpected situation

3way valve is turning to bypass when the supply temperature drop below 16°C

7.2.1 Emergency stop

Your on-site installed emergency stop can be connected at clamp: X4 17/18 (remove the jumper)
Emergency stop button shall be purchased seperate and is no equippment in the chiller.
This Emergency function is more or less a control circuit break. It will not remove the power supply from the parts.
Main voltage is still present at all VFD´s/Contactors/Fuses/Mainswitch.....

7.2.2 Procedure after a unexpected chiller off

- Reset at the switch box for 2sec. (hold the button 2sec. But not longer then 5sec)
- If the system don´t start, check the 8BIT LED´s at the PCB board.
- Call KKT Service if needed

7.2.3 Procedure after high pressure fault

- Ambient temperature in range?
- Check free air flow through the condenser coil
- Clean Condenser coil
- Reset at high pressure switch
- Push the reset button at the switch box for 2sec. → 18K1 shall be energyzed now
- The high presure switch failure is not shown on the 8Bit LED´s.
- Call KKT service if needed

7.2.4 In case of an emergency/fire

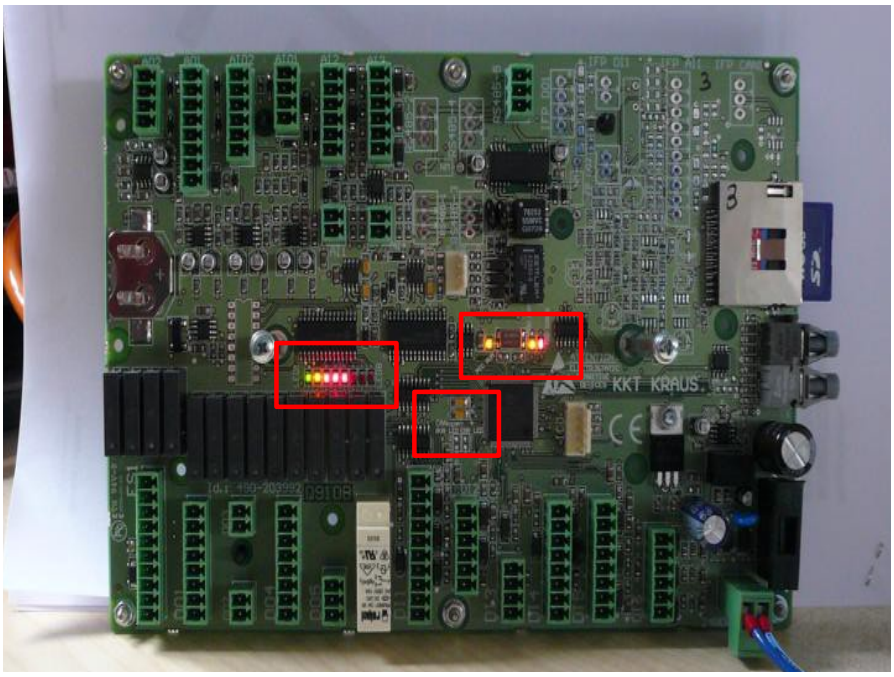
See safety data sheet for oil/refrigerant/glycol

7.3 Signals at the PCB board

1. The left marked field are the 8Bit-LED´s and show any failure in the system.
2. The single yellow LED in the right marked field signals a running processor.

2a. The two yellow/red LED´s in the right marked field are continuously cycling. That indicate a proper light conductor connection. Get confirmed by double check this also at the IFP board.

3. The lower box in the middle shows a working CAN-BUS communication between IFP and Siemens. Whenever the green LED is continuous on indicate a working CAN-BUS. If the RED light is flashing indicate a **lost** Heartbeat-Signal.
4. Do not remove the SD-Card. This will end in a monitored Errorcode and impossible update routine.



7.3.1 Collective fault / Customer Contact

This contact can be used by any customer for there system.
See wiring diagram page 12 terminal DO5 P1, P2 and P3.

Maximum	24V AC/DC 100mA
PIN3	COM
3-2	closed = RUN everything OK no Error
3-1	closed = FAULT

7.3.2 Safety first – Personell protection

This unit is produced, constructed and tested to run safety if it is installed and repaired according to this manual and the local regulations.

Because of this you have to read this user manual carefully and completely.
This unit contains electrical parts who work with high voltage and moving parts e.g. Fans, pump, compressors.
Turn off the power supply before access the unit!
Only qualified service technicans shall perform start-up, maintenance and repairs.

Generell

Most accidents happen because of carelessness and none safety background.
Most accidents would be prevented if risk where identified soon enought.

The owner of this unit is responsible that everyone who is working on the unit observ the safety rules, read the whole Manual and understand it.
A wrong or sloppy maintained unit could cause high body risk or even risk of death.

Don´t run this equipment under potentially explosive atmosphere.

Safety during operating

The chiller is fully automatically operating.
It is prohibited to remove/change any safety and protective gear nor the installed insulating materials.
The switch box stay closed and shall not be opened without any reason. Only for Service, measurement and repair.

8 Keep in service and cleaning

	Only qualified mechanics are allowed to work on the system!
	The system have to be de-energized before opening!
	Wear eye protection!
	Wear gloves!
	Wear protective clothing!

8.1 Safety regulating during Maintenance and Service

	**Only qualified mechanics are allowed to work on the system!**
	**Non insulated parts could be hot or cold even if the chiller is switched off.** 

Do not dispose any liquid in canalization or burn combustible waste.
This product and all parts should be disposed of as controlled waste.

Use only original spareparts provided by KKT chillers or Siemens Medical!

	**Refill only the type of refrigerant displayed at the nameplate**

The saftey regulations according to this manual have to be followed.
Temperature nor pressure sensors and gauges have to be exchanged if they are out of range.
Keep the unit clean at any time. Cover all opened piping or parts within the system during Service and Maintenance to protect from dust and moisture. Welding near oil and other flammable liquids and parts are prohibited. Welding on expansion vessel is highly prohibited!

8.2 Clean the condenser

To prevent the system from too high pressure, please clean the condenser coil at least twice per year or more often if necessary.
This cloud be performed with water or a brush.
Attention: The fins are verry thin and could be bend!

	**Risk of snag on sharp fins and may other metal parts inside the units!** 

8.3 Keep in service and cleaning - performed by qualified technician

Undertakings operating refrigeration, air conditioning or heat pump equipment, or fire protection systems, including their circuits, which contain controlled substances shall ensure that the stationary equipment or systems:
(a) with a fluid charge of 3kg or more of controlled substancesare checked for leakage at least once every 12 months; thisshall not apply to equipment with hermetically sealed systems, which are labelled as such and contain less than 6kg of controlled substances;
(b) with a fluid charge of 30kg or more of controlled substancesare checked for leakage at least once every 6 months;
(c) with a fluid charge of 300kg or more of controlled substances are checked for leakage at least once every 3 months;
and that any detected leakage is repaired as soon as possible and in any event within 14 days.

Service and Maintenance shall be provided by KKT or qualified service technican:

- Check all safety devices according to EN 378-2 or local laws
- Check for any refrigerant leak, also inside of heat exchangers
- Check all heat exchangers
- Check that all safety, controll, measurement and alarmsystems work and operating correctly.
- Check glycol rate
- Check for any leak

After the unit is relocated or longer than 2years out of operation it have to be started according to EN 378-2 (A – D) or to the local regulations..
All exchanged parts (e.g. drier, refrigerant, liquids, electronics.....) have to be recycled.

Attention:
If any compressor is changed because of burned winding, there shall be a oil test performed.
In case of acid, exchange the oil and refrigerant. Also install a suction line filter dryer plus exchange the liquid filter dryer also.

The mandatory inspection schedules according to BGV A3 shall be performed dependence to the electrical equipment.

8.4 System log guidelines

The owner or operator have to place the system logfile in written paper or digital on a computer near the chiller and keep it available for the service tech.
This file have to keep updated!

These include the following information:

- Who, When What
- Full data of all performed work: Service, Maintenance and repair
- After service, type and amount of (new, used or recycled) used/refilled or recovered refrigerant.
- System log have to be updated if any analyzed refrigerant is used,
- Source of pre-used refrigerant
- What parts are changed or replaced
- Result of all testings
- non-operating periods

This page have to be carried out by the operator and placed visible close to the chiller!

Responsibility for the system

Name

Street

Zip Code/Town

phone

Fire department

Street

Zip Code/Town

phone

Police

Street

Zip Code/Town

phone

Hospital

Street

Zip Code/Town

phone

Center for burned injury victims

Street

Zip Code/Town

In case of any emergency turn off the power supply!

9 Failureanalyze and Maintenance/Service

All work have to be performed by qualified technicans. Observ the local safety rules.

General				
Kind of failure	**symptoms**	**Possible cause**	**solution**	**remarks**
Emergency stop	Chiller don't run	1.Emergency stop button used 2. Jumper on Terminal missed		
Ambient temperature high DI 6 P3/P4	Compressor 1 reduce power and supply water temperature rise	Ambient temperature above 48°C		
SD-Card removed	No update possible VTZ Compressor does not start		Please insert SD-Card 1Gbyte	Do not remove the Card without permission
Data cable broken	1.Pump runs with 50% speed all the time 2. No change from DAY to ECO-Mode 3. see PCB Signals	1. Cable disconnected 2. Cable wrong connected 3. Cable destroyed 4. Cable missing	1. Connect cable 2. Change TX/RX connector on PCB Chiller or IFP 3. Change cable	
Service mode	No errors will be send to the CAN-Bus	Black resett button 10S1 pressed for 10sec.	Press black reset button 10S1 for 10sec.	2hours after pressing reset button Service Mode closed automatically
Service required	Yellow LED on PCB is flashing	Last Service longer than 6 month ago	Do Service	

Water Circuit				
Kind of failure	**symptoms**	**Possible cause**	**solution**	**remarks**
Water temperature return/supply high	See failure	1. MRI power to high 2. Flow to low 3. Sensor defective 15B1, 15B2	1. Talk to Siemens PM 2. Check the pressure sensors 8B2, 8B2 and pressure difference on IFP for Flow control 3. Check temperature sensors 15B1, 15B2 in Chiller and IFP 8B1	
Water temperature return / supply low	See failure	1. Ambient temperature too low. 2. Refrigerant circuit fault 3. Sensor defective 15B1, 15B2	1. 2.Check refrigerant circuit 3. Check temperature sensor 15B1, 15B2 in Chiller.	
Pump 17U1 stops	No flow on CBB/MBB and TX-Box	1.Fuse on PCB Chiller/IFP broken 2. VFD pump 17U1 malfunction 3. fuse pump broken 4. suction pressure 14B1 infront pump below 0.1bar	1. Replace new fuse 350mA 2. Replace pump 3. Replace new 10A inserts in 4. check strainer and check system pressure	

Water Circuit				
Kind of failure	**symptoms**	**Possible cause**	**solution**	**remarks**
Flow error	Pressure difference 8B2, 8B3 <1bar	Pressure supply high 8B2 on IFP	Pump will reduce the flow automatically	1. Too high static pressure 2. Too high pressure loss in the return line from IFP to Chiller or in the MRI
		Flow MBB/CBB	No flow on MBB/CBB	1. Valves on IFP closed 2. Malfunction flow switch 6B1, 6B2
		40°C safety cut of for the pump	Pump do not run and Refrigerant circuit don' work.	1. First start in a hot area. 2. Refrigerant circuit is fault.
		Pipes connected wrong or pressure sensor 8B2, 8B3 IFP changed	No correct flow through the MRI possible	1. Supply and return pipe mixed 2. Pressure sensors 8B2, 8B3 mixed

Refrigerant				
Kind of failure	**symptoms**	**Possible cause**	**solution**	**remarks**
High Pressure Warning	The compressor speed will be reduced for not crossing the pressure border of 28bar	1.Fans defective 19U1, 21M1 2.Condenser coil dirty 3.Ambient temperature over 48°C	1. Check fans 19U1, 21M1 and change if defective 2.Please clean the condenser coil	2.Do only use brushes for clean the condenser coil. Don't use tools with forks and spikes
Low Pressure Warning	When the low pressure side of refrigerant circuit is below 0,5 for 60sec the compressor stops and starts again automatically if the pressure low reach 1,0bar	1.Ambient temperature too low 2.Expansion Valve defective 16Y1 3. Filter dryer blocked	1. 2. Check the Expansion Valve 16Y1 3. Change filter dryer	
Low Pressure Error	If the Low pressure warning is 3 times in one hour the compressor stops without automatically restart	1.Ambient temperature too low 2.Expansion Valve defective 16Y1 3. Filter dryer blocked	1. 2. Check the Expansion Valve 16Y1 3. Change filter dryer	A restart is only possible when the reset button is pressed
High Pressure Error	Compressors 18M1, 20M1 stop when reached 31bar			
Superheat below 3K	Compressor stops	1.Temperature sensor 15B3 on suction line defective or detached 2. Pressure sensor 14B3 on suction line defective 3.Expansion Valve defective		

Refrigerant				
		16Y1 4. Too less amount of refrigerant		

Electrical				
Kind of failure	**symptoms**	**Possible cause**	**solution**	**remarks**
Phase sequence relay 4A1	Chiller stops	1. Phase sequence incorrect 4A1 2. One, Two or three phase are gone	1. Change two phases of power supply	After one or more gone phases are back the chiller starts automatically
Thermally contact Fan 2	Fan 2 stops	1. Motor too hot 2. Ambient temperature too high	1.Check current consumption of fan2 and change if necessary 2.	
Thermally (intern) contact Compressor 2	Compressor 2 stops	Motor too hot	Check current consumption and suction gas temperature of compressor 2 and change if necessary	If suction gas temperature over 25 °C check overheating of the evaporator and check expansion valve
Frequency drive pump	Pump do not run		Change pump	1. Check also 10A pump fuse
Frequency drive compressor 1	Compressor 1 do not run		Change Frequency Drive	1. Check also 50A Compressor fuse
Frequency drive fan 1	Fan 1 do not run		Change Fan 1	1. Check also 10A Fan fuse
Motor protection Fan2 21Q1	Fan 2 do not run if the high pressure is over 25bar	1. Fan Motor 21M1defective 2. Motor protection 21Q1 defective		

Electrical				
Kind of failure	**symptoms**	**Possible cause**	**solution**	**remarks**
Motor protection Compressor 2 20Q1	Compressor 2 do not run if heat load is over 45kW	1. Compressor Motor 20M1 defective 2. Motor protection 20Q1 defective		
Motor protection 4Q1, 4Q2 TX Pump 1/2	TX-Pump not energized. So it isn't enough flow through the TX-Box	1. Pump 4M1, 4M2 defective 2. Motor protection 4Q1, 4Q2 defective. 3.Flow switch 6B3, 6B4 defective	1. Check current of pump. 2. Check Motor protection 4Q1, 4Q2 3. Check flow switch 6B3, 6B4	The Pump is still running although the pump isn't energized.
MREF switched off	MREF do not work	Pump 17U1 stops	Run Pump	MREF is in responsibility of Siemens. Please call Siemens

Generel VFD-Error Concept since LW-VA01-W

Start with IFP-Serial:1123

EC0122: Serial-1036 // EC0133: Serial-1084

10 Optinal modules, extras and specifications

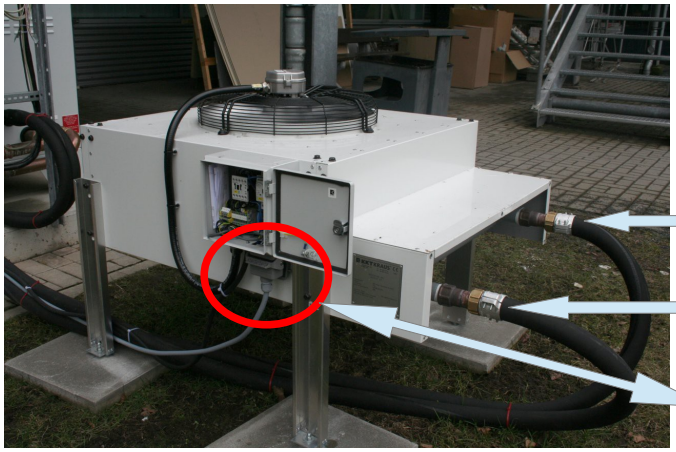
10.1 FCU – Free Cooling Unit

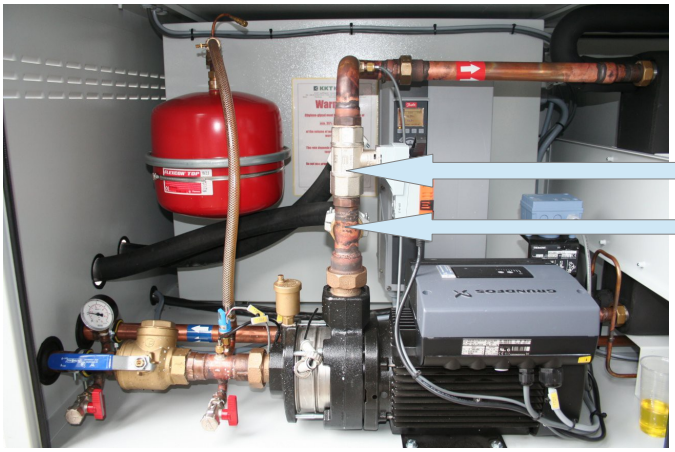
Typ	FCU	
Produce.-No.:	FCU 00 / / xx / xxxx ← see nameplate	
Year of Manufacturing	20xx ← see nameplate	
Manufacturer	ait-deutschland GmbH Industriestraße 3 95359 Kasendorf Germany T +49 9228 9977 0 F +49 9228 9977 149	
Cooling capacity [kW]	max. 60	
Operating liquid (water circuit)	distilled water and 35-38% Ethylene Glycol	
Volume [l]	8,1	
Discharge temperature [°C]	20 - 19/22	Set value – min/max 26°C in Nightmode
Temperature swing [K]	+/- 0,5	
Ambient temperature limit [°C]	18 ← FCU enabled	
Air flow [m³/h]	8000	
Protection classification EN 60529	IP54 [with closed housing]	
Electrical connection [power supply]	380-480V/50-60Hz [3phases + grounding]	
Electrical connection [kW]	1,15	
Overcurrent protection [A]	6	
Controll circuit	24VDc	
Noise level dB(A) in 5 m distance	55	
Abmessungen [mm] ca.	L=1200 B=1015 H=895	
Leergewicht / Betriebsgewicht [kg] ca.	69 / 77,6	
Volumenstrom[m³/h]	0,1 – 8,0	

10.2 FCU – Connections

The FCU require a seperate power supply from the facility source.

Water piping



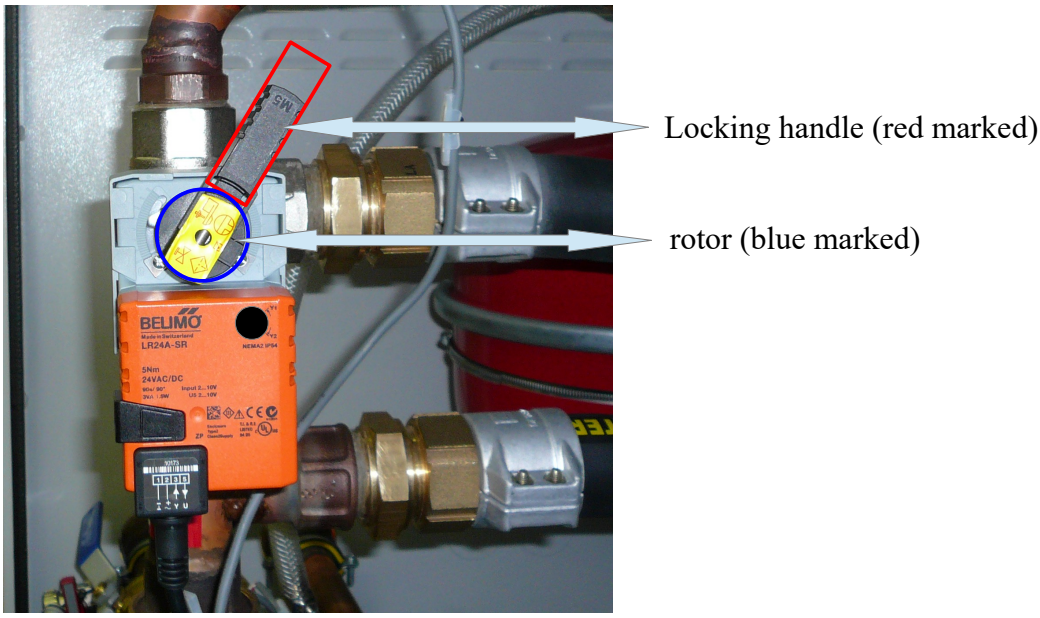


3way-valve

Next 2 pictures shows the Motor and Valve in OFF position! (FCU not operating - 0Volt)

Valve Characteristic Y1

Next picture show the Motor turning! (FCU-Valve operating -)



Attention:
Valve will get damaged if the RED marked locking handle is attached to the „wrong“ side of the rotor!
Make sure, that you install the RED marked locking handle only when the Valve is OFF (0Volt) on TOP of the Rotor.

pressure vessel

11 Sparepartlist

11.1 Chiller

Attention: Do not mix SAP and PDS Order No.:

No.		SAP KKT-Order-No.		Siemens partnumber
1	Controller board chiller	65847801		10591297
2	Fuse for compressor 45kW	658363B01	3pieces	10591298
3	Overload switch compressor 15kW	65664401		10591299
4	Fuse chiller pump or chiller fan (800)	658362B01	3pieces	10591300
6	Overload switch chiller fan 500	65662401		10591302
7	Power supply 24 VDC IFP	65569601		10591276
8	Circuit breaker 24VDC prim	65662201		10591277
9	Circuit breaker 24VDC sec 4A	65624901		10591303
10	Circuit breaker 24VDC sec 2A	65624701		10591278
11	Controller board fuse 500mAT	60966601	10pieces	10591279
12	Contactor compressor 15kW	65658501		10591305
13	Contactor chiller fan 500	65686201		10591306
14	Cable W10401, 50m	65643401		10433606
15	Cable W10401, 100m		Only Siemens	10590992
16	Compressor 45kW	66002501		10591307
17	Frequency converter compressor Change Parameter 3-41 Ramp up time to 1second	66002601		10591308
18	Compressor 15kW	65998001		10591309
19	Chiller fan 800	65051801		10591310
20	Chiller fan 500	65051901		10591311
21	Pressure sensor 30bar	66058701		10591312
22	Temperature sensor chiller / IFP Please order also swagelock screw (#651246)	65878901		10591271
23	Coil for magnetic valve	66044101		10591314
24	Plug for magnetic valve	657807B01		10591315
25	Pump chiller 098	61504301		10591281
26	Water relief valve	65453701		10591268
27	Pressure sensor 10bar	66058801		10591269
28	Air bleeding valve	65493301		10591270
29	expansion vessel	65461301	to Serialnumber 122.6002.01.1075.1212 or 133.6002.01.1152.1212	10591282
29a	Tightening strap/Metal	65458701		

31	sieve insert for filter ball - SET	928001	KKTUSA-091954	10433066
50	cabinet fan	65800601		10591645
51	refrigerant filter dryer	66068601		10591646
70	expansion vessel 5L Nitrogen pressure 0.6 - 0.8bar	67145701	from Serialnumber 122.6002.01.1076.1212 or 133.6002.01.1153.1212	
71	expansion vessel 25L Nitrogen pressure 0.6 – 0.8bar (see also Strap below)	60671601	from Serialnumber 122.6002.01.1076.1212 or 133.6002.01.1153.1212	
72	Strap for expansion vessel	65458801		
73	Pressure gauge – (expansion vessel) 0-10bar	65494401		
74	Pressure limiter 0,5bar	67006501		
75	expansion vessel 40L	60671701		

11.2 IFP

Attention: Do not mix SAP and PDS Order No.:

No.		SAP KKT-Order-No.		Siemens partnumber
30	Temperature sensor chiller/IFP Please order also swagelock screw (#651246)	65878901		10591271
31	Sieve insert for filter ball - SET	928001	KKTUSA-091954	10433066
32	Flow sensor-MBB,CBB,TX-Box	65472001		10591272
33	Actuator for 3/2-wayvalve	65969401		10591273
34	Pressure sensor 10bar	66058801		10591269
35	Air bleeding valve	65493301		10591270
36	Circuit breaker MREF	65625501		10591274
37	Controller board IFP	65847701		10591275
38	Power supply 24VDC IFP	65569601		10591276
39	Circuit breaker 24VDC prim	67116801		10591277
40	Circuit breaker 24VDC sec 2A	65624701		10591278
41	Controller board fuse	65648401 (10pieces)	10 pieces	10591279
42	booster pump IFP	65548501		10591482
43	contactor booster pump	65655901		10591543
44	overload switch booster pump	65661101		10591544
45	Rupture disc	61390101		11281454

I/O converter box

	converterbox	60914701		10850064
	cable set	60913501		10849814

11.3 FCU

Attention: Do not mix SAP and PDS Order No.:

No.		SAP KKT-Order-No.		Siemens partnumber
70	overload switch chiller fan 500	65662401		10591302
71	contactor chiller fan 500	65656801		10591306
72	chiller fan 500	65051901		10591311
73	temperature sensor chiller / IFP	65878901		10591271
74	actuator for 3/2-wayvalve FCU	65969501		10591313

11.4 Service display

Attention: Do not mix SAP and PDS Order No.:

No.		SAP KKT-Order-No.	.	Siemens partnumber
90	Service tool	928026		Only from KKT

11.5 Aera/Skyra Complete systems

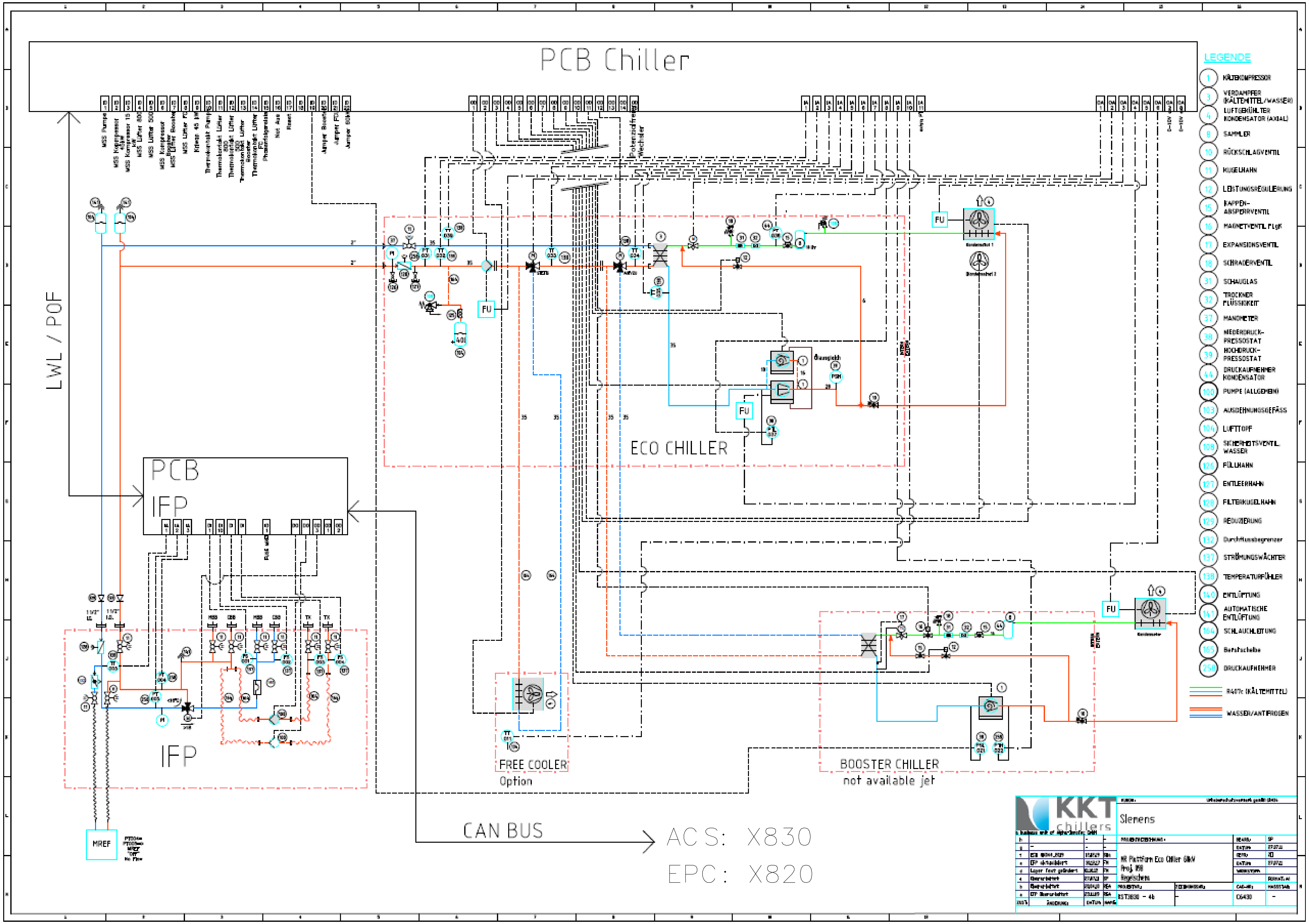
No.		SAP KKT-Order-No.		Siemens partnumber
100	Chiller 45kW 098 ECO122L		Only from Siemens	10433165
101	Chiller 60kW 098 ECO133L		Only from Siemens	10433166
102	Free Cooling Unit 15kW 098		Only from Siemens	10433167
103	Chiller Booster 15kW 098		Only from Siemens	10433168
104	Interface Panel IFP 098		Only from Siemens	10433169
105	Interface Panel IFP 2CH		Only from Siemens	10591466
106	cable W10401, 50m	65643401		10433606
107	cable W10401, 100m		Only from Siemens	10590992

12 Attachement

12.1 Piping and Instruments Diagram P&ID

	German	English
1	Kältekompressor	Compressor
3	Verdamper	Evaporator
4	Kondensator	Condenser
8	Sammler	Reciever
9	Rotalock ventil	Rotalock valve
10	Rückschlagventil	No-return valve
11	Kugelhahn	Ball valve
12	Leistungsregulierung	Hotgas bypass / power regulation
15	Kappenabsperrventil	Shut off valve (with cap)
16	Magnetventil	Solenoid valve
17	Expansionsventil	Expansion valve
18	Schraderventil	Schrader valve
28	Schwingungsausgleich	Compensator
31	Schauglas	Sign glass
32	Trockner	Dryer
37	Manometer	Pressure gauge
38	Niederdruckpressostat	Low pressure switch
39	Hochdruckpressostat	High pressure switch
44	Druckaufnehmer	Pressure sensor
100	Pumpe	Pump
103	Ausdehnungsgefäß	expansion vessel
104	Lufttopf	Air camber
108	Sicherheitsventil-Wasser	Safety valve water
124	Kugelabsperrhahn	Ball valve
126	Füllhahn	Filling valve
127	Entleerhahn	Drain valve
128	Filterkugelhahn	Filter ball valve
137	Strömungswächter	Flow switch
138	Temperaturfühler	Temperature sensor
140	Entlüftung	Air bleeder
141	Automatische entlüftung	Automatic air bleeder
164	Schlauchleitung	Flexible hose line
258	Druckaufnehmer	Pressure sensor

General				
Kind of failure	**symptoms**	**Possible cause**	**solution**	**remarks**
Emergency stop	Chiller don't run	1.Emergency stop button used 2. Jumper on Terminal missed		
Ambient temperature high DI 6 P3/P4	Compressor 1 reduce power and supply water temperature rise	Ambient temperature above 48°C		
SD-Card removed	No update possible VTZ Compressor does not start		Please insert SD-Card 1Gbyte	Do not remove the Card without permission
Data cable broken	1.Pump runs with 50% speed all the time 2. No change from DAY to ECO-Mode 3. see PCB Signals	1. Cable disconnected 2. Cable wrong connected 3. Cable destroyed 4. Cable missing	1. Connect cable 2. Change TX/RX connector on PCB Chiller or IFP 3. Change cable	
Service mode	No errors will be send to the CAN-Bus	Black resett button 10S1 pressed for 10sec.	Press black reset button 10S1 for 10sec.	2hours after pressing reset button Service Mode closed automatically
Service required	Yellow LED on PCB is flashing	Last Service longer than 6 month ago	Do Service	



PCB Chiller
LWL / POF
PCB
IFP
IFP
ECO CHILLER
FREE COOLER
Option
BOOSTER CHILLER
not available jet
CAN BUS
ACS: X830
EPC: X820
MREF
LEGENDE
1 KÄLTEKOMPRESSOR
3 VERDAMPFER (KÄLTEMITTEL/WASSER)
4 LUFTGEKÜHLTER KONDENSATOR (AXIAL)
8 SAMMLER
10 RÜCKSCHLAGVENTIL
11 KUGELHAHN
12 LEISTUNGSREGULIERUNG
15 KAPPEN-ABSPERRVENTIL
16 MAGNETVENTIL FLgK
17 EXPANSIONSVENTIL
18 SCHRADERVENTIL
31 SCHAUGLAS
32 TROCKNER FLÜSSIGKEIT
37 MANOMETER
38 NIEDERDRUCK-PRESSOSTAT
39 HOCHDRUCK-PRESSOSTAT
44 DRUCKAUFNEHMER KONDENSATOR
100 PUMPE (ALLGEMEIN)
103 AUSDEHNUNGSGEFÄSS
104 LUFTTOPF
108 SICHERHEITSVENTIL WASSER
126 FÜLLHAHN
127 ENTLEERHAHN
128 FILTERKUGELHAHN
129 REDUZIERUNG
132 Durchflussbegrenzer
137 STRÖMUNGSWÄCHTER
138 TEMPERATURFÜHLER
140 ENTLÜFTUNG
141 AUTOMATISCHE ENTLÜFTUNG
164 SCHLAUCHLEITUNG
165 Berstscheibe
258 DRUCKAUFNEHMER
R407c (KÄLTEMITTEL)
WASSER/ANTIFROGEN
KKT chillers
Siemens
KST3830 - 4b
C6430

PCB Chiller

LEGENDE

LWL / POF

PCB
IFP

IFP

MREF

ECO CHILLER

FU

FREE COOLER
Option

BOOSTER CHILLER
not available jet

X80 → ACS/ X80

RS485 → IO-Converter Board IFP090/ X485

KKT chillers

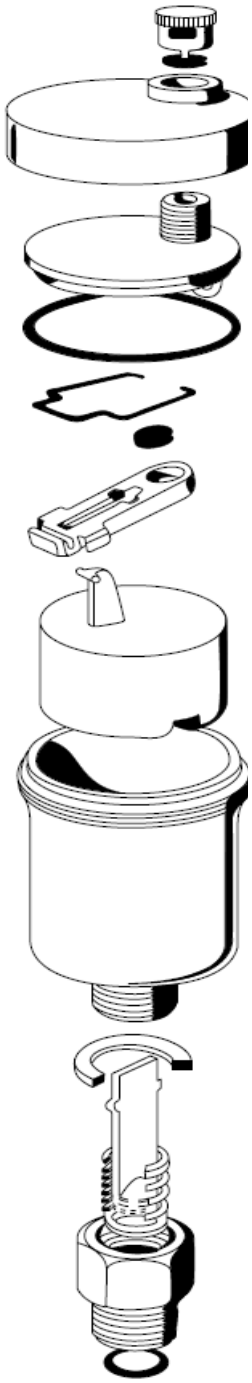
Siemens

MR Plattform Eco Chiller 60kW
Proj. 090
Regelschema

P5829 – IFP090

C6749

13 Automatic Airvent (shall be cleaned twice per year)



1. Installation

The local regulations, as well as the general instructions and installation instructions must be observed when installing. The mounting place must be free from frost and accessible at all times.

1.1 Assembly

1. Flush pipe thoroughly.
2. Screw air vent at the highest position of the heating plant into a pipe.
   ☞ Use fork wrench and screw-in tightly.

2. Maintenance

The air vent must be checked regularly, since dirt can lead to malfunctions.

1. Unscrew and remove cover together with float.
2. Clean all parts carefully and assemble again.
3. Check if cap is open.

3. Range of application

Warm-water heating plants.
Not suitable for mineral oil or liquids with addition on a mineral oil basis.

4. Technical Data

Operating temperature	max. 110 °C
Operating pressure	max. 10 bar
Connection sizes	R 3/8" or R 1/2 "

5. Accessories

Z 121 - 3/8	shutoff valve 3/8"
Z 121 - 1/2	shutoff valve 1/2"

13.1 FAN 1 (800mm)

Attention, automatic restart!

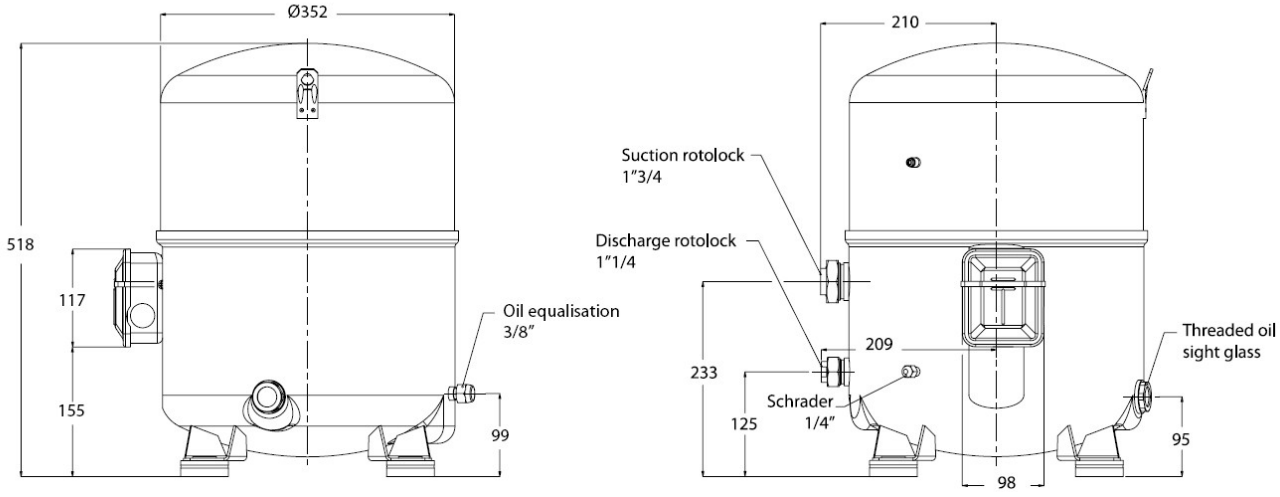
- The fan may switch on and off automatically for functional reasons.
- After power failure or mains disconnection an automatic restart of the fan takes place after voltage return.
- Wait for the fan to come to a complete standstill before approaching it.

For more information brows your CD!

13.2 Compressor 1 (speed controlled)

Operating voltage and cycle rate Operating voltage range
The operating voltage limits are directly managed by the CD302 frequency converter generating a constant U/f ratio equal to the one of the motor design and factory preset in the inverter.

Cycle rate limit
There may be no more than 12 starts per hour. A higher number reduces the service life of the motor-compressor unit. If necessary, use an anti-shortcycle timer in the control circuit.
A time-out of five minutes is recommended. The system must be designed in such a way to guarantee a minimum compressor running time in order to provide proper oil return and sufficient motor cooling after starting. Note that the oil return rate varies as a function of the system design.
Note: when using “process loop” control with the frequency converter
these control operations are factory preset in the CD302 on “Smart Logic Control” section.
Parameter 13.00 has to be set at ON then:
Compressor Minimum On Time preset at 0 can be adjusted Delay between two starts is set at 5 minutes A pump down function is preset: Cut-out pressure 3 bar(g) Cut-in pressure 1 bar(g)

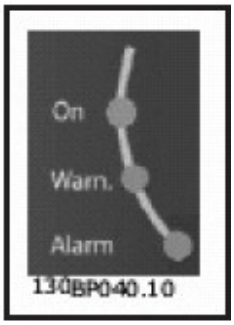


13.3 VFD-Drive for Compressor 1

The VFD is delivered and setup to run automatically.
NO changing can be done.

Indicator lights (LEDs)

If certain threshold values are exceeded, the alarm and/or warning LED lights up.
A status and alarm text appear on the control panel.
The on is activated when the frequency converter receives mains voltage.
. Green LED/On: Control section is working.
. Yellow Warn.: Indicates a warning.
. Flashing Red Alarm: Indicates an alarm.

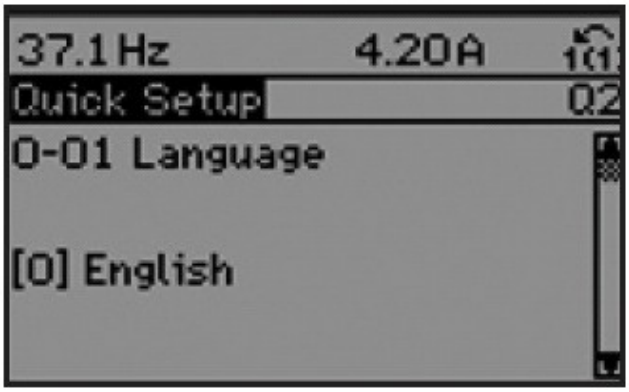


Change Language

0-01 Language

Option:

*English (ENGLISH) [0]
German (DEUTSCH) [1]
French (FRANCAIS) [2]
Danish (DANSK) [3]
Spanish (ESPANOL) [4]
Italian (ITALIANO) [5]
Defines the language to be used in display.



[Quick Menu] allows quick access to different Quick Menus such as: *
01 - My Personal Menu
02 - Quick Set-up
03 – PID Process Loop
04 - Changes Made
05 – Loggings

Any changes are prohibited and password protected by KKT chillers!

*See also additional Datasheet on this CD

13.4 Possible pump failures

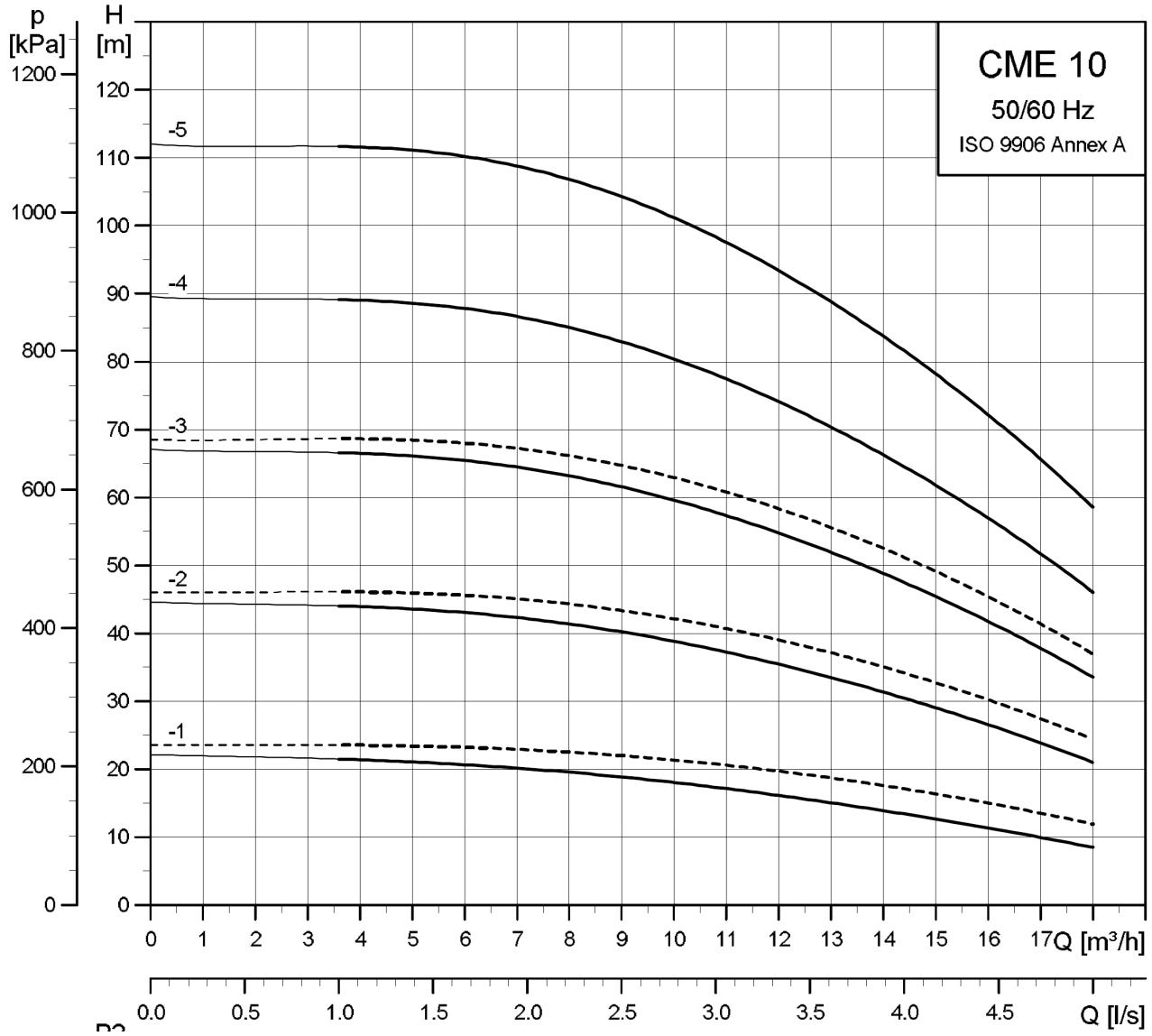
Warning! Before removing the terminal box cover, make sure that the electricity supply has been switched off. The pumped liquid may be scalding hot and under high pressure. Before any removal or dismantling of the pump, the system must therefore be drained, or the isolating valves on either side of the pump must be closed.

Fault		Cause	Remedy
1	The pump does not run.	a) Supply failure.	Switch on the switch. Check cables and cable connections for defects and loose connections.
		b) Fuses are blown.	Check cables and cable connections for defects, and replace the fuses.
		c) Motor protection tripped.	See 2. a), b), c), d), e), f).
		d) Control-current circuit defective.	Repair or replace the control-current circuit.
2	Motor-protective circuit breaker has tripped (trips out immediately when supply is switched on).	a) Fuses are blown.	See 1. b).
		b) Contacts of the motor-protective circuit breaker or magnet coil defective.	Replace the contacts of the motor-protective circuit breaker, the magnet coil or the entire motor-protective circuit breaker.
		c) Cable connection is loose or faulty.	Check cables and cable connections for defects, and replace the fuses.
		d) Motor winding is defective.	Repair or replace the motor.
		e) The pump is mechanically blocked.	Switch off the electricity supply, and clean or repair the pump.
		f) The setting of the motor-protective circuit breaker is too low.	Set the motor-protective circuit breaker according to the rated current of the motor (I1/1). See nameplate.

Fault	Cause	Remedy
3 The motor-protective circuit breaker trips out occasionally.	a) The setting of the motor-protective circuit breaker is too low.	See 2. f).
	b) Periodic supply failure.	See 2. c).
	c) Periodically low voltage.	Check cables and cable connections for defects and loose connections.
		Check that the supply cable of the pump is correctly sized.
4 The motor-protective circuit breaker has not tripped out, but the pump is inadvertently out of operation.	a) See 1. a), b), d) and 2. e).	
5 The pump performance is unstable.	a) Pump inlet pressure too low.	Check the inlet conditions of the pump.
	b) Inlet pipe is partly blocked by impurities.	Remove and clean the inlet pipe.
	c) Leakage in inlet pipe.	Remove and repair the inlet pipe.
	d) Air in inlet pipe or pump.	Vent the inlet pipe/pump.
		Check the inlet conditions of the pump.
6 The pump runs, but gives no water.	a) Pump inlet pressure too low.	See 5. a).
	b) Inlet pipe partly blocked by impurities.	See 5. b).
	c) The foot or non-return valve is stuck	Remove and clean, repair or replace the
	in its closed position.	valve.
	d) Leakage in inlet pipe.	See 5. c).
	e) Air in inlet pipe or pump.	See 5. d).

Fault		Cause	Remedy
7	The pump runs backwards when switched off.	a) Leakage in inlet pipe.	See 5. c).
		b) Foot or non-return valve defective.	See 6. c).
		c) The foot valve is stuck in completely or partly open position.	See 6. c).
8	The pump runs with reduced performance.	a) Wrong direction of rotation.	**Three-phase pumps only:** Switch off the electricity supply with the external circuit breaker and interchange two phases in the pump terminal box. It is possible to check the direction of rotation by means of the installation indicator. Black: The direction of rotation is correct. White: The direction of rotation is incorrect.
		b) See 5. a), b), c), d).	

CME 10



For more Informations see Grundfos page or contact KKT chillers.
A installed and working automatic air vent in supply&return piping with a correct static pressure will determin most of the failures and is recommended for this system.

13.5 3-way valve with spring actuator

LF24 (-S) US

On-off, spring return safety, 24 V

Torque min. 35 in-lb, for control of air dampers

Application

For on-off, fail-safe control of dampers in HVAC systems. Actuator sizing should be done in accordance with the damper manufacturer's specifications. Control is on-off from an auxiliary contact, digital output, or a manual switch.

The actuator is mounted directly to a damper shaft from 3/8" up to 1/2" in diameter by means of its universal clamp, 1/2" shaft centered at delivery. For shafts up to 3/4" use K6-1 accessory. A crank arm and several mounting brackets are available for applications where the actuator cannot be direct coupled to the damper shaft.

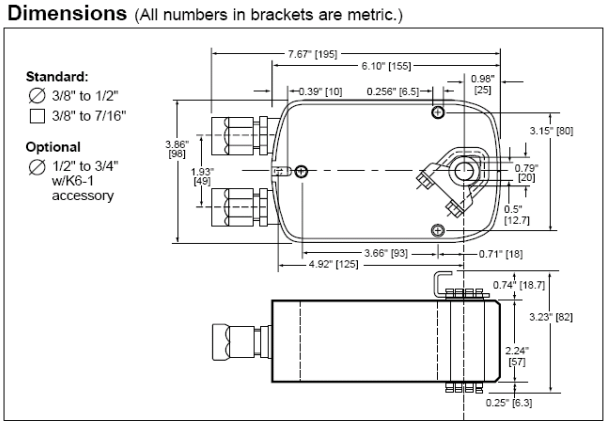
Operation

The LF series actuators provide true spring return operation for reliable fail-safe application and positive close off on air tight dampers. The spring return system provides consistent torque to the damper with, and without, power applied to the actuator. The LF series provides 95° of rotation and is provided with a graduated position indicator showing 0° to 90°.
The actuator may be stalled anywhere in its normal rotation without the need of mechanical end switches. Power consumption is reduced in holding mode.

The LF24-S US version is provided with 1 built in auxiliary switch. This SPDT switch is provided for safety interfacing or signaling, for example, for fan start-up. The switching function is adjustable between 0° and 95°. The auxiliary switch in the LF24-S is double insulated so an electrical ground connection is not necessary.

Technical Data	LF24 (-S) US
Power supply	24 VAC ± 20% 50/60 Hz 24 VDC ± 10%
Power consumption	running: 5 W holding: 2.5 W
Transformer sizing	7 VA (class 2 power source)
Electrical connection	3 ft, 18 GA appliance cable (LF24-S US has 2 cables) 1/2" conduit connector
Overload protection	electronic throughout 0 to 95° rotation
Angle of rotation	max. 95°, adjust. with mechanical stop
Torque	35 in-lb [4 Nm]
Direction of rotation	reversible with cw/ccw mounting
Position indication	visual indicator, 0° to 90° (0° is spring return position)
Auxiliary switch (LF24-S)	1 x SPDT 6A (1.5) @ 250 VAC, UL listed adjustable 0° to 95° (double insulated)
Running time (nominal)	motor: < 40 to 75 sec spring: < 25 sec @-4°F to +122°F [-20°C to +50°C] < 60 sec @-22°F [-30°C]
Humidity	5 to 95% RH non-condensing
Ambient temperature	-22°F to +122°F [-30°C to +50°C]
Storage temperature	-40°F to +176°F [-40°C to +80°C]
Housing	NEMA type 2 / IP54
Housing material	zinc coated steel
Agency listings	UL 873 listed, CSA C22.2 No.24 certified, CE
Noise level	max: running < 50 db (A) spring return 62 dB (A)
Servicing	maintenance free
Quality standard	ISO 9001
Weight	LF24 3.1 lbs (1.40 kg.) LF24-S 3.2 lbs (1.45 kg.)

Dimensions (All numbers in brackets are metric.)



LF24 US ⚠2

⚠1 Provide overload protection and disconnect as required.

⚠2 Actuators may be connected in parallel. Power consumption must be observed.

⚠3 Actuator may also be powered by 24 VDC.

On-off wiring for LF24 US

sumption must be observed.

⚠3 Actuator may also be powered by 24 VDC.

⚠4 For end position indication, interlock control, fan start-up, etc., LF24-S US incorporates a built-in auxiliary switch: 1 x SPDT, 6A (1.5A) @250 VAC, UL listed, adjustable 0° to 95°.

⚠5 Meets UL and CSA requirements without the need of an electrical ground connection.

On-off wiring for LF24-S US

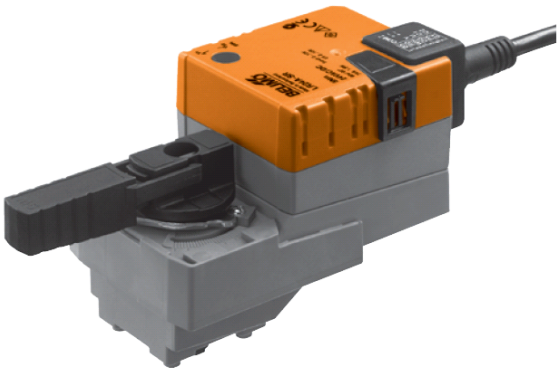
13.6 3-way valve for FCU (0-10VDC)

BELIMO

Technical data sheet LR24A-SR

Modulating rotary actuator for 2 and 3-way control ball valves

- **Torque 5 Nm**
- **Nominal voltage AC/DC 24 V**
- **Control: Modulating DC 0 ... 10 V**
- **Position feedback: DC 2 ... 10 V**



Technical data

Electrical data	Nominal voltage		AC 24 V, 50/60 Hz DC 24 V
	Power supply range		AC/DC 19.2 ... 28.8 V
	Power consumption	In operation	1 W at nominal torque
		At rest	0.4 W
		For wire sizing	2 VA
	Connection		Cable 1 m, 4 x 0.75 mm²
	Parallel connection		Possible, note performance data
Functional data	Torque (nominal torque)		Min. 5 Nm at nominal voltage
	Control	Control Signal Y	DC 0 ... 10 V, typical input impedance 100kΩ
		Operating range	DC 2 ... 10 V
	Position feedback		DC 2 ... 10 V, max. 1 mA (Measuring voltage U)
	Position accuracy		±5%
	Manual override		Gearing latch disengaged with pushbutton (temporary-permanent)
	Running time		90 s / 90°∢
	Noise level		Max. 35 dB (A) (without the valve)
	Position indication		Mechanical, add-on
Safety	Protection class		III Extra low voltage
	Degree of protection		IP54 in any mounting position
	EMC		CE according to 89/336/EWG
	Mode of operation		Type 1 (to EN 60730-1)
	Rated impulse voltage		0.8 kV (to EN 60730-1)
	Control pollution degree		3 (to EN 60730-1)
	Ambient temperature range		0 ... +50°C
	Media temperature		+5 ... +110°C in control ball valve (–10°C with stem heating upon request)
	Non-operating temperature		–40 ... +80°C
	Ambient humidity range		95% r.H., non-condensating (to EN 60730-1)
	Maintenance		Maintenance-free
Dimensions / Weight	Dimensions		See «Dimensions» on page 2
	Weight		Approx. 550 g

Safety notes

⚠

- **The rotary actuator has been designed for use in stationary heating, ventilation and air conditioning systems and is not allowed to be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.**
- **It may only be installed by suitably trained personnel. All applicable legal or institutional installation regulations must be complied with.**
- **The switch for changing the direction of rotation may only be operated by authorized personnel. The direction of rotation must not be reversed in a frost protection circuit.**
- **The device may only be opened at the manufacturer's site. It does not contain any parts that can be replaced or repaired by the user.**
- **The cable must not be removed from the device.**
- **The device contains electrical and electronic components and is not allowed to be disposed of as household refuse. All locally valid regulations and requirements must be observed.**

LR24A-SR

Modulating rotary actuator, AC/DC 24 V, 5 Nm

BELIMO

Product features

Mode of operation
The actuator is controlled by means of a standard control signal DC 0 ... 10 V. It opens to the position dictated by this signal. The measuring voltage U allows the damper position (0 ... 100%) to be electrically indicated and serves as a follow-up control signal for other actuators.

Simple direct mounting
Straightforward direct mounting on the ball valve with only one screw. The assembly tool is integrated in the plug-on position indicator. The mounting position in relation to the ball valve can be selected in 90°◁ steps.

Adjustable angle of rotation
Adjustable angle of rotation with mechanical end stops.

High functional reliability
The actuator is overload-proof, requires no limit switches and automatically stops when the end stop is reached.

Position feedback U5
Operation of the ball valve is optimised by a limiting ring. This ring reduces the angle of rotation from 95° to 90°◁, i.e. U5 will deviate from Y by approximately 0.3 V when the valve is closed.

Accessories

	Description	Data sheet
Electrical accessories	Auxiliary switch S..A..	T2 - S..A..
	Feedback potentiometer P..A..	T2 - P..A..

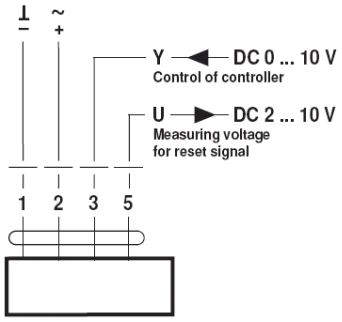
Electrical installation

Wiring diagram

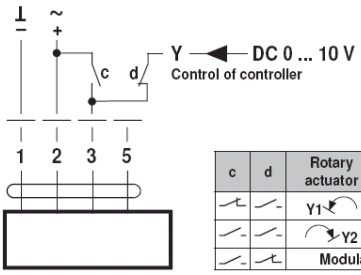
Notes
- Connect via safety isolation transformer.
- Parallel connection of other actuators possible. Note performance data.
- Direction of rotation switch is covered. Factory setting: Direction of rotation Y2

Direction of rotation

Standard connection



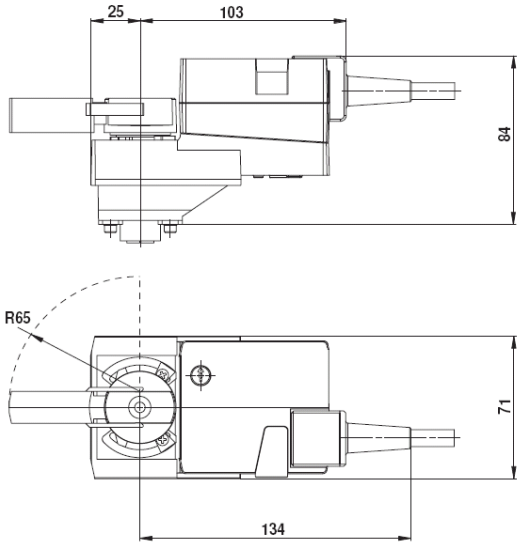
Override control (frost protection circuit)



c	d	Rotary actuator	Rotary valve
⊥	-	Y1	A – AB = 100%
-	-	Y2	A – AB = 0%
-	⊥	Modulating operation	

Dimensions [mm]

Dimensional diagrams

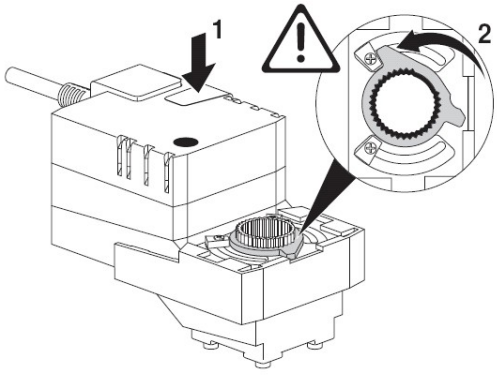


Further documentations
- Complete overview of actuators for water solutions
- Data sheets for ball valves
- Installation instructions for actuators and/or ball valves
- Notes for project planning (hydraulic characteristic curves and circuits, installation regulations, commissioning, maintenance etc.)

BELIMO

TR..A.. / LR..A.. / NR..A.. / SR..A..

1



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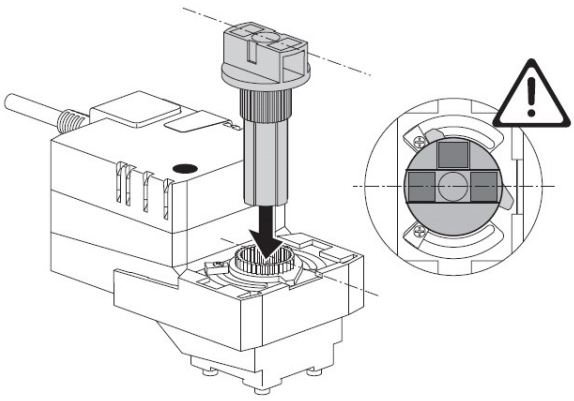

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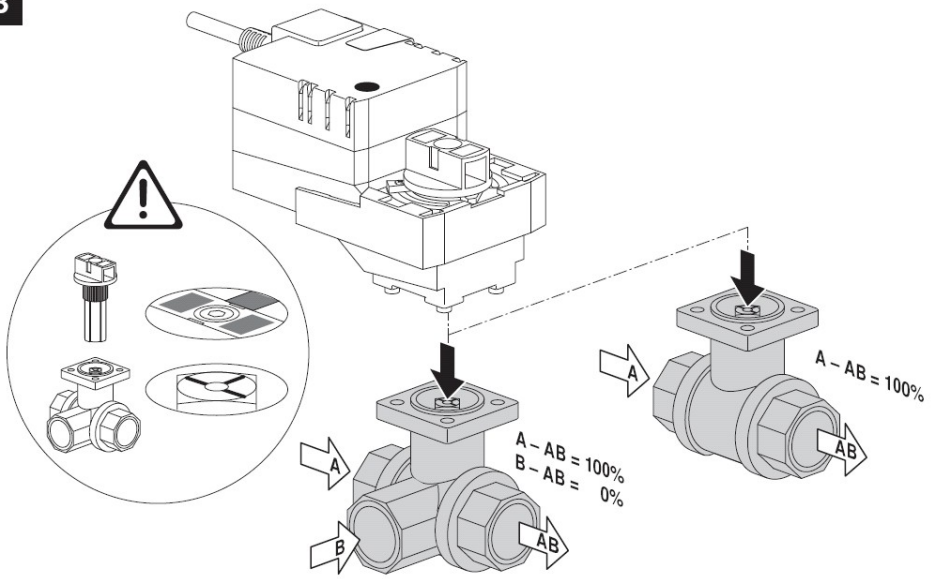

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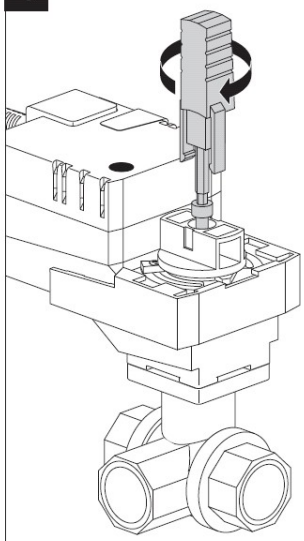
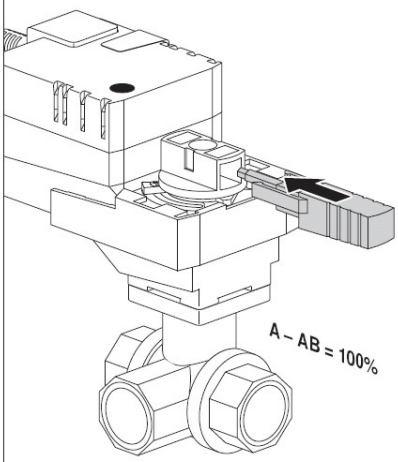
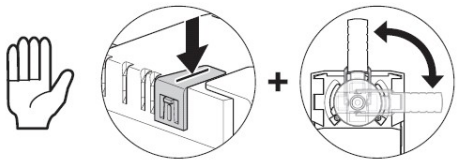
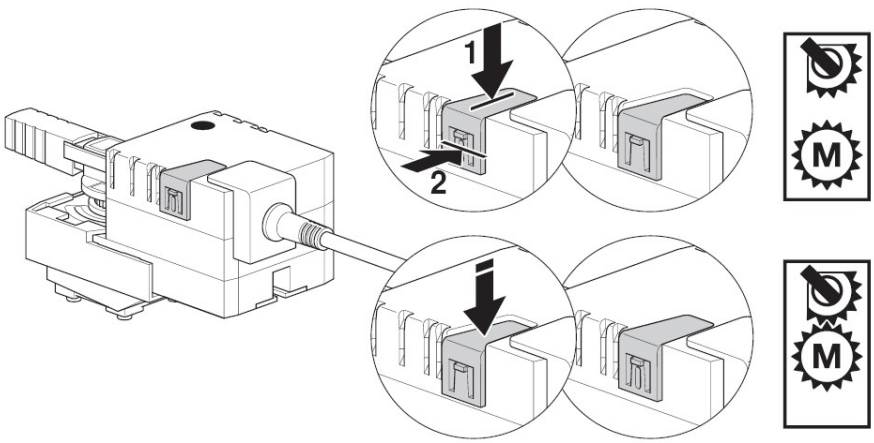


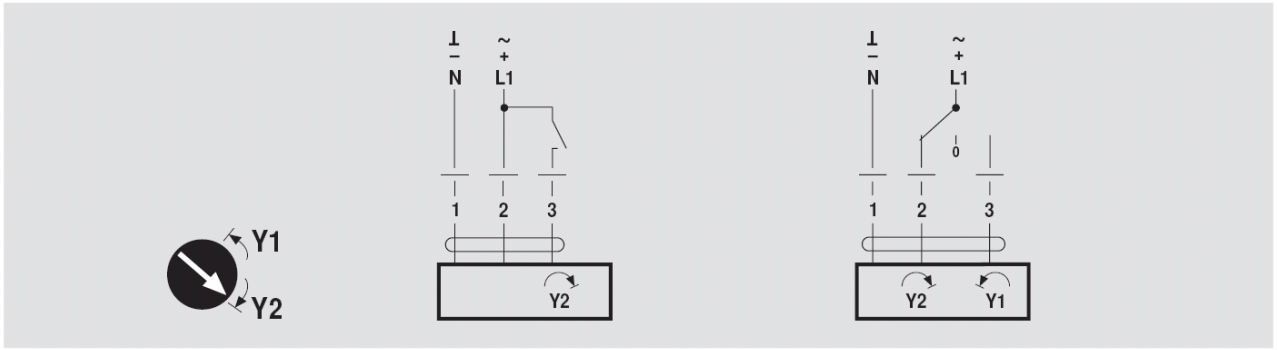
5



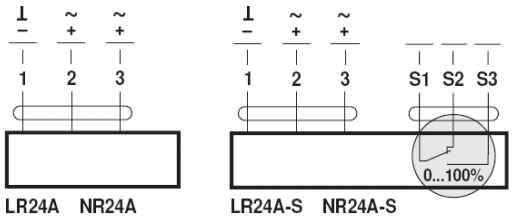




TR..A.. / LR..A.. / NR..A.. / SR..A..



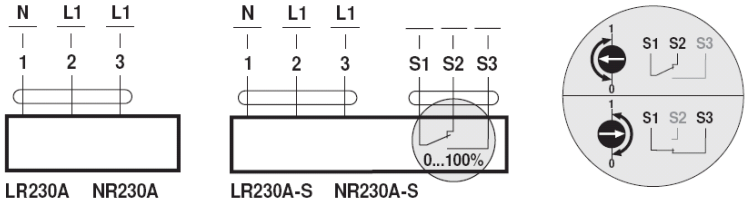
AC 24 V / DC 24 V



LR24A NR24A
SR24A

LR24A-S NR24A-S
SR24A-S

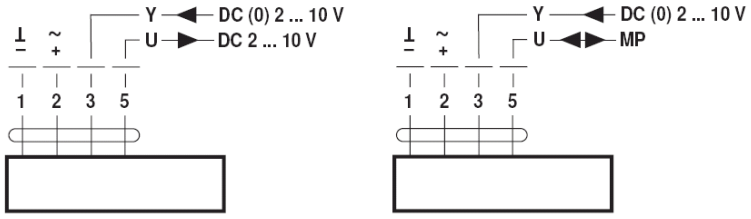
AC 100 ... 240 V ⚠



LR230A NR230A
SR230A

LR230A-S NR230A-S
SR230A-S

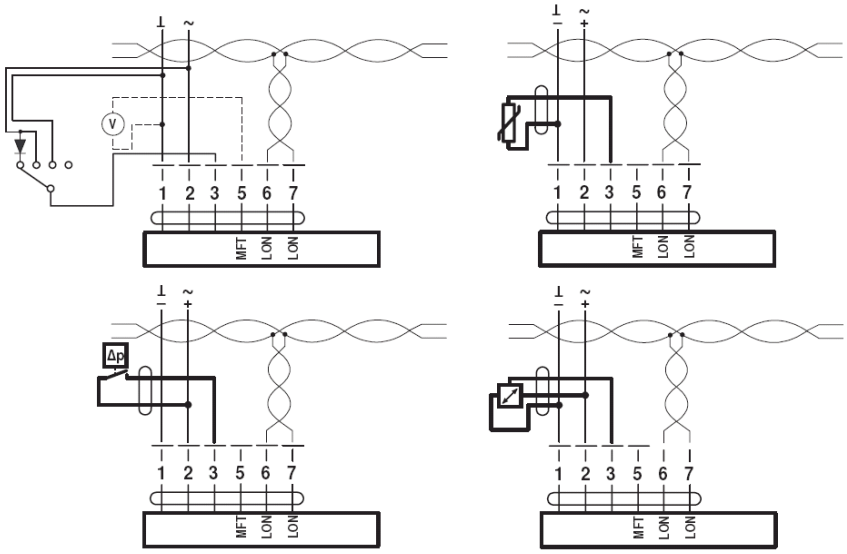
AC 24 V / DC 24 V



TRC24A-SR LR24A-MF
LR(C)24A-SR NR24A-MF
NR(C)24A-SR SR24A-MF
SR24A-SR

LR24A-MP NR24A-MP
SR24A-MP

LONWORKS® AC 24 V / DC 24 V



13.7 Electronic Expansion valve

Overview
Modulating refrigerant valves with magnetic actuator, PN40, hermetically sealed, for safety refrigerants
Hermetically sealed 2-port valves for modulating control
of chillers and heat pumps.

- Expansion, hot-gas and suction throttle applications with one type of valve
- PN40, stainless steel with soldering connections
- Integrated power electronics with positioning control and calibration
- For safety refrigerants such as R22, R134a, R404A, R407C, R744 (CO_2) etc.

PN class	PN 40
Operating voltage	AC 24 V; DC 20...30 V
Positioning signal	DC 0...20 mA; DC 4...20 mA
Positioning time	<1 s
Spring return function	Closed
Position feedback	DC 0...10 V; DC 2...10 V; DC 0...20 mA; DC 4...20 mA
Degree of protection	IP65
Ambient temperature, operation	-25...55 °C
Mounting position	Upright to horizontal
Permissible operating pressure	4000 kPa
Leakage rate	<0.002 % of k_{vs} value
Medium temperature	-40...120 °C
Valve characteristic	Linear
Stroke resolution $\Delta H/H_{100}$	1:1000
Material, valve body	Steel/ CrNi steel
Material, inside set	CrNi steel/brass
Data sheet	N4714
Power consumption	22 VA

14 8-Bit-Failure code

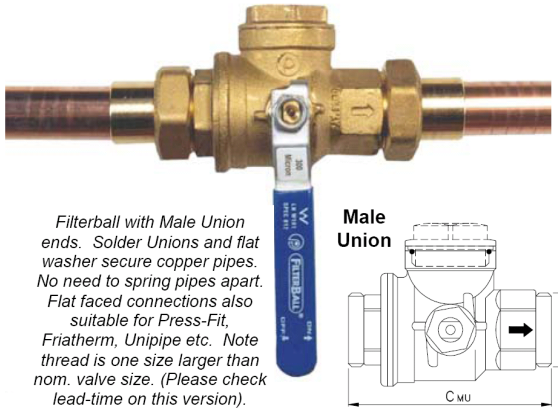
1	2	3	4	5	6	7	8	description
x	x	x	x	x	x	x	x	LAMP TEST/RESET
		x	x					emergency stop
							x	RefrigerantHighPressureWarning
						x		RefrigerantLowPressureWarning
		x				x	x	water temp return high
		x			x			superheat 3K
		x			x		x	temp. Sensor suctipon gas
		x			x	x		superheat 15K
		x			x	x	x	water temp supply high
		x		x				LP chiller kälte
		x		x			x	Sensor booster water
		x		x		x		Sensor FCU water
		x		x		x	x	Water Return pressure sensor broken Chiller AI1
		x		x	x			Refrigerant high pressure AI7
		x		x	x		x	Refrigerant low pressure AI8
		x		x	x	x		FCU temp. Mailfunction
		x		x	x	x	x	water returnpressure pump stop
		x	x	x				phase supervision
		x	x	x			x	flow error protection ~1bar differenzdruck
			x	x		x		Low pressure switch booster
		x	x	x		x	x	TK FAN2
		x	x	x	x			FU pumpe
		x	x	x	x		x	TK FCU FAN
		x	x	x	x	x		FU compressor
		x	x	x	x	x	x	FU FAN 1
			x				x	HP Booster AI9 > SET=39
		x	x			x		HP chiller kälte
		x	x			x	x	FU booster FAN
		x	x		x			Motorprotec Komp.2
		x	x		x		x	Motorprotec Komp. Booster
		x	x		x	x		Motorprotec. FAN2
		x	x		x	x	x	Motorprotec. FCU
		x					x	Booster cooling capacity too low AI5 vs AI2&AI4

1	2	3	4	5	6	7	8	description
	B							service required
	x							Service mode
	x						x	Pipes connected wrong or sensors on IFP changed
	x					x		40°C safety cut off for the pump
	x					x	x	water supply pressure high
	x				x			sensor temp return error chiller
	x				x		x	water temp supply low
	x				x	x		sensor temp supply error IFP
	x				x	x	x	return pressure LOW
	x			x				volume MBB
				x			x	ChillerCommunication / POF-PCF
				x		x		SD Card removed
				x		x	x	HP-Switch Booster
	x			x	x			volume CBB
	x			x	x		x	Auxilery switch MREF
	x			x	x	x		Ambient high
	x			x	x	x	x	sensor temp supply error chiller
			x					IFP supply pressure AI2
			x	x				IFP return pressure AI3
			x	x			x	Ambient temperture AI10
			x	x		x	x	Refrigerant high pressure sensor booster AI9
			x	x	x			I/O IFP-ACC communication Error
			x	x	x		x	### not used ###
			x	x	x	x		### not used ###
	x		x	x	x	x	x	supply pressure high
			x				x	MSS Pump1 TX Box
			x			x		MSS Pump2 TX Box
			x			x	x	Flow Pump1 TX Box
			x		x			Flow Pump2 TX Box
			x		x		x	### not used ###
			x		x	x		### not used ###
			x		x	x	x	### not used ###

14.1 Filter ball valve

Description

Quarter turn Isolating Ball Valve with removable Strainer inside the ball. In the closed position, both upstream and downstream connections are isolated and the Strainer can be inspected and removed through the side port. This single unit replaces the traditional Y Strainer and two Isolating Valves. The single unit reduces installation time, joints, space and cost. Furthermore the headloss is less than a comparable Y Strainer due to the straight-through design.



Filterball with Male Union ends. Solder Unions and flat washer secure copper pipes. No need to spring pipes apart. Flat faced connections also suitable for Press-Fit, Friatherm, Unipipe etc. Note thread is one size larger than nom. valve size. (Please check lead-time on this version).

Connection Pipes

Copper – Compression fittings or male flat-faced (use solder unions for copper tube – see Pipe Connectors)
Steel – Female BSPP
Plastic – Fittings available for most plastic systems.

Specification

Pressure / Temp.	16 bar max @ 100° C.
	10 bar max @ 150° C
Differential Pressure	16 bar

Materials

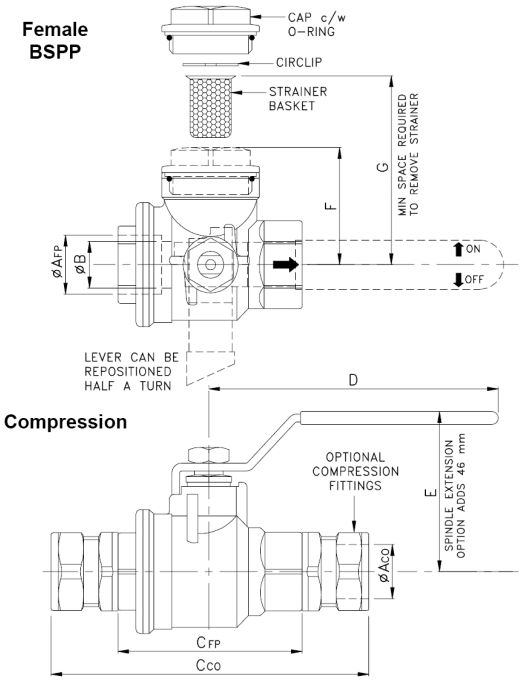
Body, Cap Nut	DZR Brass CZ132
Ball	Chrome Plated DZR Brass CZ132
Seat	Virgin P.T.F.E
Strainer Basket	AISI 304 Stainless Steel
Circlip	Bronze Cu Sn 7 UNI 2527-74 H5

Strainers

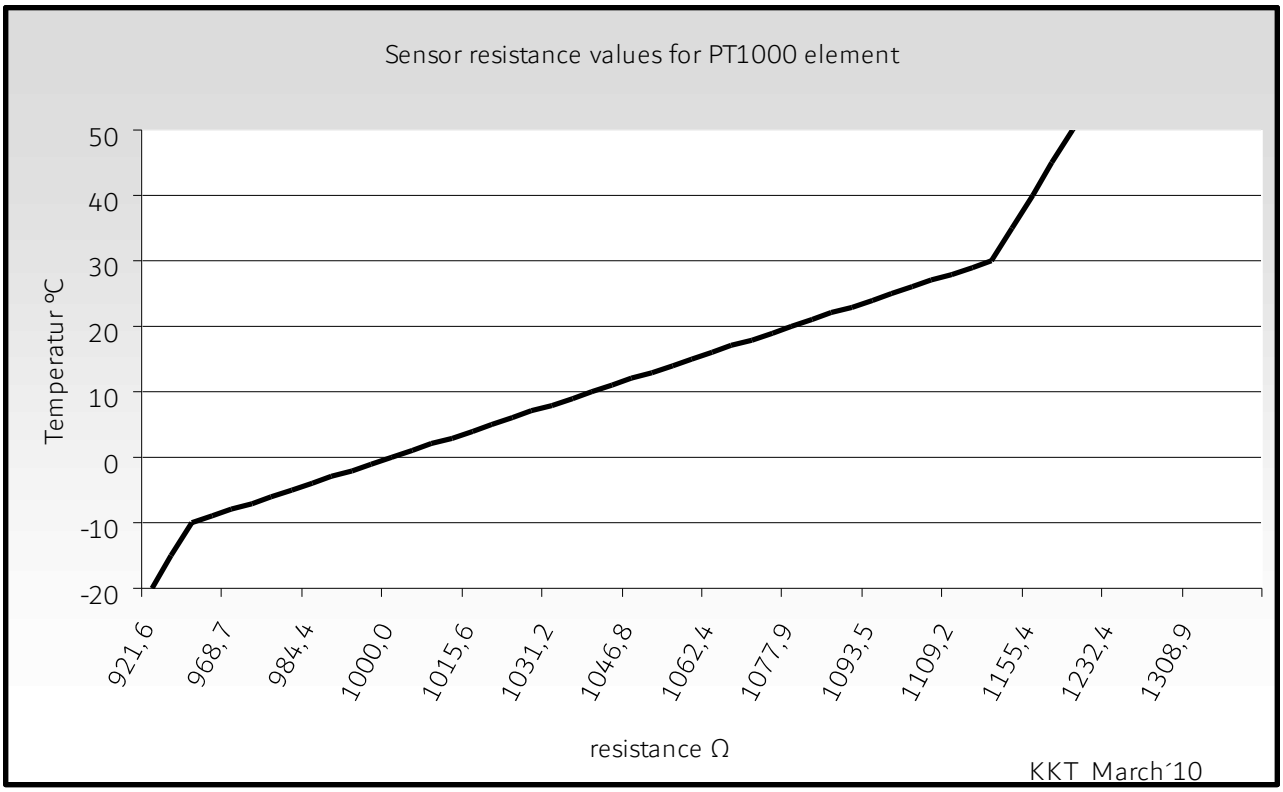
The standard Strainer coarseness is 700 µm (0.7 mm). Finer Strainers have a higher headloss and are more likely to block prematurely. The valve should be not be used as a control valve (i.e. partially open) since debris can bypass the Strainer in this position. Always replace the Circlip after cleaning Strainer.

Options

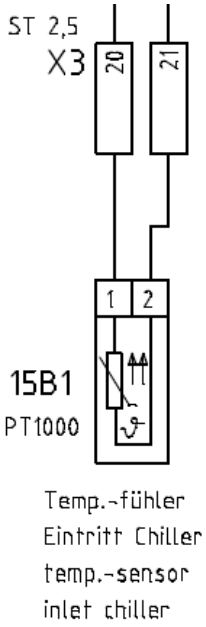
- Spindle extensions, raising lever by 46 mm to accommodate insulation. Existing lever is re-used.
- Tee and geared handles
- Lift & Lock tamperproof spindle cap.
- Backflush version, where Strainer can be cleaned without removing



14.2 Tempearturesensor PT1000 resistance



Example:
Disconnect the sensor where it is connected and measure the ressistance between the legs.
(At this example 20 + 21)
Notification: Have a swagelock screw available when replacing any temperature sensor in the water circuit!
It can be used only once!



14.3 Pressure sensor

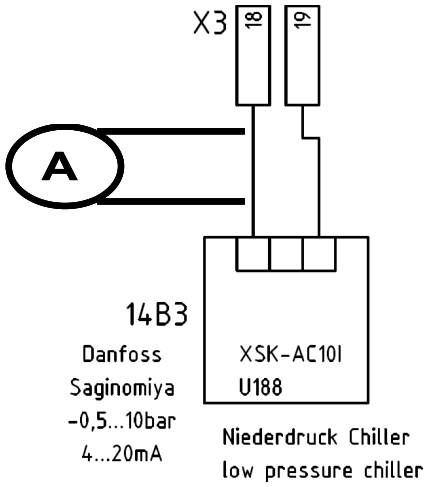
- 1 bar = 14.5psi
- power supply 10,5 - 28VDC
- output range 4-20mA
- pressure range 0-30bar

Example in bar:
- output = 4-20mA à 16mA range
- input = 0-30bar à 30bar range
- 16/30=0,5333 proportional
- every bar will add 0,5333mA on top of 4mA
- 15bar=middle 15 * 0,5333 + 4 = 12mA

Example in psi: 441psi - refrigerant sensor
- output 4-20mA à 16mA range
- input 0-441psi à 441psi range
- 16/435=0,03678 proportional
- every PSI will add 0,03678mA on top of 4mA
- 220psi=middle 220 * 0,03678 + 4 = ~12mA

Example in psi: 145psi - water sensor
- output 4-20mA à 16mA range
- input 0-145psi à 145psi range
- 16/145=0,11034 proportional
- every PSI will add 0,11034mA on top of 4mA
- 72psi=middle 72 * 0,11034 + 4 = ~12mA

Note: Ampere range have to be measured in serial **not parallel!**



14.4 Pressure, Temperature and Flow chart

Pressure	
bar	psi
0	0
1	14,5
2	29,0
3	43,5
4	58,0
5	72,5
6	87,0
7	101,5
8	116,0
9	130,5
10	145,0
11	159,5
12	174,0
13	188,5
14	203,1
15	217,6
16	232,1
17	246,6
18	261,1
19	275,6
20	290,1
21	304,6
22	319,1
23	333,6
24	348,1
25	362,6
26	377,1
27	391,6
2	406,1
29	420,6
30	435,1
	1bar = 14.5psi

Temperature		
°C	°F	K
-25	-13	248
-20	-4	253
-15	5	258
-10	14	263
-5	23	268
0	32	273
5	41	278
10	50	283
15	59	288
20	68	293
25	77	298
30	86	303
35	95	308
40	104	313
45	113	318
50	122	323
	1K ~ 1,8°F	
	1K = 1°C	

Flow		
m³/h	l/s	gpm
0,5	8	2,2
1	17	4,4
1,5	25	6,6
2	33	8,8
2,5	42	11
3	50	13,2
3,5	58	15,4
4	67	17,6
4,5	75	19,8
5	83	22
5,5	92	24,2
6	100	26,4
6,5	108	28,6
7	117	30,8
7,5	125	33
8	133	35,2
	1m³ = 1000l = 264gallon	
	10l = 2,64gallon	
	3,78l = 1 gallon	

15 Decleration of Conformity (affect inside Europe)

16 Chiller

EG-Konformitätserklärung
EC declaration of conformity
Déclaration de conformité CE

KKT chillers
alt-deutschland GmbH
Industriestraße 3 · 95359 Kasendorf

Gerät (machine; machine):	Industriekühler (Industrial Chiller, Refroidisseur industriel)
Maschinentyp (type; type):	Alle Modelle der Baureihen (All models of the series, Tous les modèles des séries) ECO133L
Seriennummer:(serial number, numéro de série)	ECO133: 2300-2800
Zur bestimmungsgemäßen Verwendung als (usage; utilisation):	Prozesskühler (Process Water Chiller, Refroidisseur de processus)

Hiermit erklären wir die Konformität des Gerätes im Sinne folgender Richtlinien und Normen.
Herewith we declare the conformity of the machine according to following instructions and standards.
Par la présente, nous déclarons que cette machine satisfait les dispositions suivantes.

Richtlinie (instruction; directives):	Maschinenrichtlinie 2006/42/EG (EC machinery directive, Directives CEE relatives aux machines) Druckgeräterichtlinie 2014/68/EU (PED; Directives CEE relatives aux pressions) Niederspannungsrichtlinie 2014/35/EU (Low voltage instructions, Directives CEE relatives aux basses tensions) Elektromagnetische Verträglichkeit 2014/30/EU (EMV-instructions, Compatibilité électromagnétique) RoHS 2011/65/EU (Restriction of certain Hazardous Substances, restriction de l'utilisation de certaines substances)) 2009/125/EG Ökodesignrichtlinie (Directive ecodesign)
Angewandte harmonisierte Normen (applied harmonized standards; normes harmonisées utilisées):	DIN EN 60204-1:2019-06 DIN EN 61000-3-2:2017-03 DIN EN 61000-3-3:2014-03 DIN EN ISO 13857:2008-06 EN ISO 12100:2011-03 EN 378 1-4 (2017)
Angewandtes Konformitätsbewertungsverfahren (used EG-conformity-module; module de conformité):	Modul A2 der Druckgeräterichtlinie 2014/68/EU für alle oben genannten Modelle (Modul A2 - for all models above, pour tous les modèles):
benannte Stelle (Notified Bodies; autorité, corps notifiés):	TÜV SÜD Industrie Service GmbH Westendstr. 199 80686 München GERMANY CE Kenn-Nr.: 0036
Technischer Dokumentar (documentalist; documentaliste technique):	Markus Zobler
Verantwortlicher des Herstellers (person responsible of the manufacturer; responsable chez le fabricant):	i.V.
Kasendorf, 2019-Dez-19	Leiter Entwicklung Kühlung Markus Zobler Gültigkeit/Valid/Valable: 2019-2020

81800301.Kc Konformitätserklärung_ECO133

17 IFP + FCU

Herstellererklärung
manufacturers declaration
déclaration du fabricant

ait-deutschland GmbH
Industriestraße 3 · 95359 Kasendorf

Gerät (machine; machine):	Herstellererklärung einer Baugruppe Declaration of conformity of an assembly
Maschinentyp (type; type):	Alle Modelle der Baureihen (All models of the series, Tous les modèles des séries) FCU (Freikühler; free cooling unit; radiateur), IFP098, IFP090, IFP084,TSA.02, TSN
Zur bestimmungsgemäßen Verwendung als (usage; utilisation):	Wärmetauscherstation (heat transfer station, station de échangeur de thermique

Hiermit erklären wir die Konformität der Baugruppe im Sinne folgender Richtlinien und Normen wenn die Maschine in die sie eingebaut werden soll den Bestimmungen der EG-Richtlinie entspricht.
Herewith we declare the conformity of the machine according to following instructions and standards if the Machine where it is installed, is also produced according to EC-machinery directives)

Richtlinie (instruction; directives):	Maschinenrichtlinie 2006/42/EG (EC machinery directive, Directives CEE relatives aux machines) Niederspannungsrichtlinie 2014/35/EU (Low voltage instructions, Directives CEE relatives aux basses tensions) Elektromagnetische Verträglichkeit 2014/30/EU (EMV-instructions, Compatibilité électromagnétique) RoHS 2011/65/EU (Restriction of certain Hazardous Substances, restriction de l'utilisation de certaines substances)) 2009/125/EG Ökodesignrichtlinie (Directive ecodesign)
Angewandte harmonisierte Normen (applied harmonized standards; normes harmonisées utilisées):	DIN EN 60204-1:2019-06 DIN EN 61000-3-2:2017-03 DIN EN 61000-3-3:2014-03
benannte Stelle (Notified Bodies; autorité, corps notifiés):	Nicht erforderlich (Not required, non requise)

Verantwortlicher des Herstellers
(person responsible of the manufacturer;
responsable chez le fabricant):

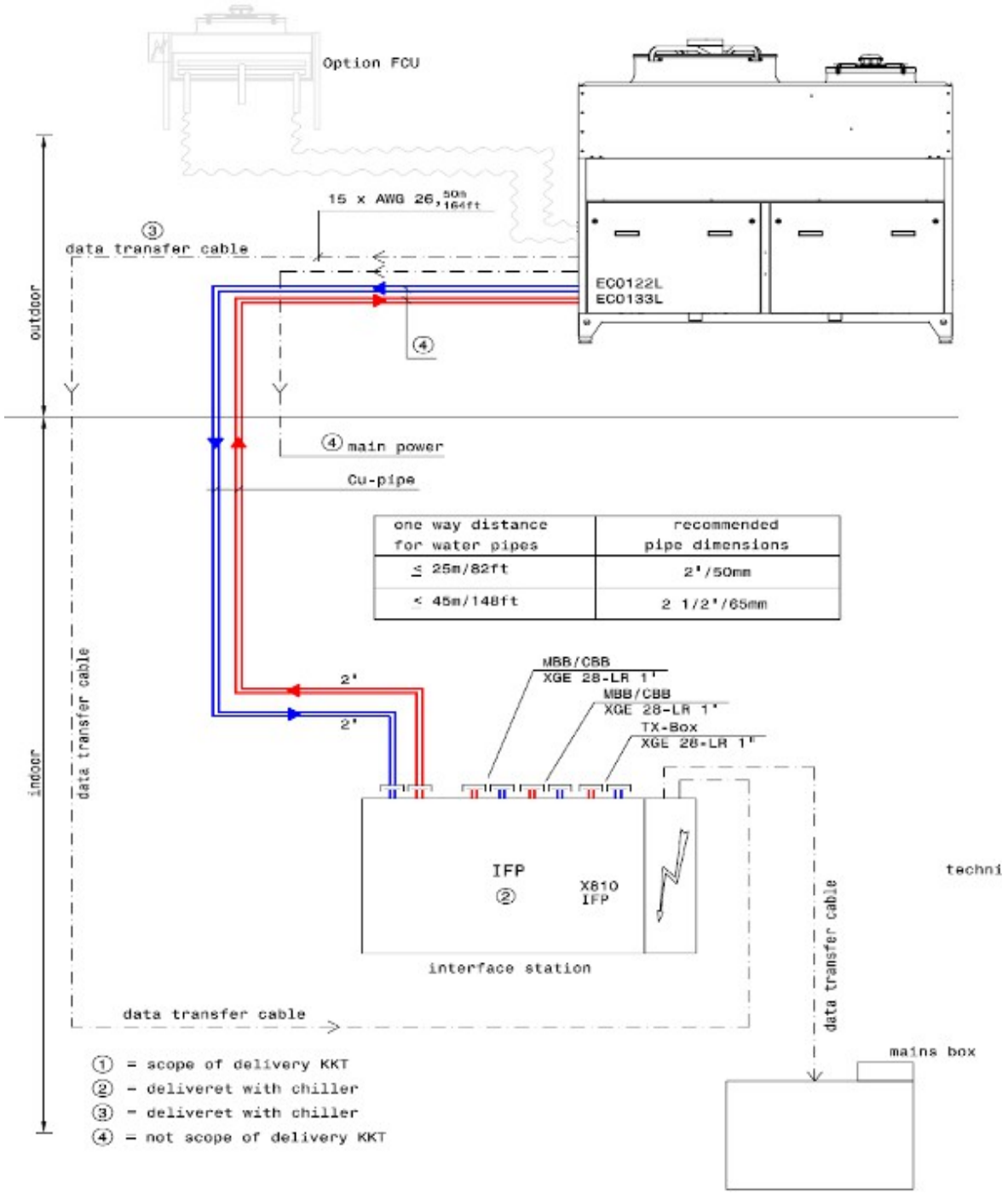
i.V.

Kasendorf, 2019-Nov-11

Leiter Entwicklung Kühlung
Markus Zobler
Gültigkeit/Valid/Valable: 2019-2020

18 FCU

18.1 System sketch (see also install instuction for proper air venting)



18.2 Safety data for Antifrogen N

Safety data sheet in accordance with 2001/58/EC ANTIFROGEN N

Substance key: SXR024717 Version : 1 - 33 / EU Revision Date: 25.03.2004 Date of printing : 23.08.2004

1. Identification of the substance/preparation and company

Trade name
ANTIFROGEN N

Use of the substance/preparation.
Industry sector : Functional Fluids
Type of use : Brine for refrigeration

Identification of the company
Clariant GmbH

65926 Frankfurt am Main
Telephone no. : +49 69 305 18000

Information about the substance/preparation
Division Functional Chemicals
++49(0)69-305-2092/15315/32251

Emergency telephone number : +49 69 305 6418

2. Composition/information on ingredients

Chemical characterization
Monoethylene glycol (1,2-ethane diol) with inhibitors

Hazardous ingredients

Ethanediol
Concentration : 90 - 95 %
CAS number : 107-21-1
EINECS number : 203-473-3
Hazard symbols Xn
R phrases 22

Sodium nitrite
Concentration : < 0,5 %
CAS number : 7632-00-0
EINECS number : 231-555-9
Hazard symbols O T N
R phrases 8 25 50

Potassium nitrite
Concentration : < 0,2 %
CAS number : 7758-09-0
EINECS number : 231-832-4
Hazard symbols O T N
R phrases 8 25 50

3. Hazards identification

Harmful if swallowed.

Substance key: SXR024717 Version : 1 - 33 / EU

Revision Date: 25.03.2004 Date of printing : 23.08.2004

4. First aid measures

General information
Remove soiled or soaked clothing immediately

After inhalation
In the event of symptoms seek medical advice.

After contact with skin
In case of contact with skin wash off immediately with plenty of water

After contact with eyes
In case of contact with eyes rinse thoroughly with plenty of water and seek medical advice

After ingestion
Summon a doctor immediately.

5. Fire-fighting measures

Suitable extinguishing media

water spray jet
alcohol-resistant foam
carbon dioxide
dry powder

Special hazards from the substance itself, its combustion products or from its vapours
In case of fires, hazardous combustion gases are formed: Carbon monoxide (CO)
Nitrous gases (NOx)

Special protective equipment for firefighting
Use self-contained breathing apparatus

6. Accidental release measures

Personal precautions

Ensure adequate ventilation.
Wear suitable personal protective equipment.

Environmental precautions
Do not allow to enter drains or waterways

Methods for cleaning up/taking up
Pick up with absorbent material (eg sand, kieselgur, acid binder, universal binder, sawdust).
Dispose of as prescribed

7. Handling and storage

Advice on safe handling

Open and handle container with care.
Provide good ventilation of working area (local exhaust ventilation if necessary).

Advice on protection against fire and explosion
Observe the general rules of industrial fire protection

Advice on storage compatibility Do not store with alkalies

8. Exposure controls/personal protection

Ingredients with occupational exposure limits to be monitored

ETHYLENE GLYCOL
CAS number : 107-21-1
EU. Indicative Exposure and Directives relating to the protection of risks related to work exposure to chemical, physical, and biological agents.
EU Exposure Limit Values Data
Revision : 07 2000
Time Weighted Average (TWA):
Values: 52 mg/m3 20 ppm

ETHYLENE GLYCOL
CAS number : 107-21-1
EU. Indicative Exposure and Directives relating to the protection of risks related to work exposure to chemical, physical, and biological agents.
EU Exposure Limit Values Data
Revision : 07 2000
Skin designation:
Can be absorbed through the skin.

ETHYLENE GLYCOL
CAS number : 107-21-1
EU. Indicative Exposure and Directives relating to the protection of risks related to work exposure to chemical, physical, and biological agents.
EU Exposure Limit Values Data
Revision : 07 2000
Short Term Exposure Limit (STEL):
Values: 104 mg/m3 40 ppm

General protective measures

Do not inhale vapours
Avoid contact with eyes and skin

Hygiene measures

Keep away from foodstuffs and beverages.

Respiratory protection : Use respiratory protection in case of insufficient exhaust ventilation or prolonged exposure

Full mask to standard DIN EN 136
Filter A (organic gases and vapours) to standard DIN EN 141
The use of filter apparatus presupposes that the environment atmosphere contains at least 17% oxygen by volume, and does not exceed the maximum gas concentration, usually 0.5% by volume. Relevant guidelines to be considered include EN 136/141/143/371/372 as well as other national regulations.

Substance key: SXR024717
Version : 1 - 33 / EU

Revision Date: 25.03.2004 Date of printing : 23.08.2004

Hand protection :

For long-term exposure: Butyl rubber gloves Minimum breakthrough time / gloves : 480 min Minimum thickness / gloves 0,7 mm

For short-term exposure (splash protection): Nitrile rubber gloves. Minimum breakthrough time / gloves : 30 min Minimum thickness / gloves 0,4 mm

These types of protective gloves are offered by various manufacturers. Please note the manufacturers´ detailed statements, especially about the minimum thickness and the minimum breakthrough time. Consider also the particular working conditions under which the gloves are being used.

Eye protection : safety glasses

9. Physical and chemical properties

Form : Liquid

Colour : light yellow

Odour : perceptible

Pourpoint : approx. -70 °C Method : DIN 51583

Boiling temperature : approx. 170 °C (1.013 mbar) Method : ASTM D 1120

Flash point : approx. 120 °C Method : DIN 51758 (closed cup)

Ignition temperature : approx. 410 °C Method : DIN 51794

Oxidizing properties : Not applicable

Self-ignition temperature : not determined

Lower explosion limit : 3 %(V)

Upper explosion limit : not determined

Evaporation rate : not determined

Vapour pressure : < 0,1 mbar (20 °C) Method : Calculated by Syracuse.

Density : approx. 1,14 g/cm3 (20 °C) Method : DIN 51757

Bulk density : Not applicable

Vapour density in relation to air : not determined

Solubility in water : (20 °C) miscible in all proportions

Soluble in ... : fat
not determined

pH value : 8 - 9 (20 °C, 300 g/l) Method : DIN EN 1262

Octanol/water partition coefficient (log Pow) : Not applicable

Viscosity (kinematic) : 26 - 29 mm2/s (20 °C) Method : DIN 51562

Combustion number : Not applicable

10. Stability and reactivity

Thermal decomposition : approx. 260 °C Method : DSC

Hazardous reactions
Reactions with alkalies.

11. Toxicological information

Acute oral toxicity : LD50 4.000 mg/kg (rat) Source : IUCLID
Information based on the main component.

Acute inhalation toxicity : not determined

Acute dermal toxicity : not determined

Irritant effect on skin : non-irritant

Irritant effect on eyes : slightly irritant

Sensitization : not determined

Mutagenicity : not determined

Remarks
Vapours and mists cause irritation/burns to eyes and the respiratory tract
There is a possibility of kidney damage
Poisoning affects the central nervous system

12. Ecological information

Biodegradability : 90 % good degradability Method : Zahn-Wellens test

Fish toxicity : LC50 1.500 mg/l (golden orfe)

Substance key: SXR024717 Version : 1 - 33 / EU Revision Date: 25.03.2004 Date of printing : 23.08.2004

Remarks If handled correctly it causes no disturbanc e in treatment plants.

13. Disposal considerations

Product In accordance with local authority regulations, take to special waste incineration plant

14. Transport information

ADR ADNR RID IATA IMDG not restricted not restricted not restricted not restricted not restricted

15. Regulatory information

Labelling in accordance with EC-Directives hazard warning labelling compulsory Classification according to the calculation procedure of the Dangerous Preparations Directive (1999/45/EC). Hazard symbols Xn Harmful Hazardous component(s) to be indicated on label Ethanediol R phrases 22 Harmful if swallowed. S phrases 2 Keep out of the reach of children. 24/25 Avoid contact with skin and eyes.

16. Other information

Text of the R-phrases which are allocated to the ingredients/components mentioned in section 2 of this Safety Data Sheet. 22 Harmful if swallowed. 25 Toxic if swallowed. 50 Very toxic to aquatic organisms. 8 Contact with combustible material may cause fire.

Substance key: SXR024717 Version : 1 - 33 / EU Revision Date: 25.03.2004 Date of printing : 23.08.2004

18.3 Safety data for Dowtherm SR1

Material Safety Data Sheet
PAGE 1 OF 8
SAFETY DATA SHEET
11/ 6/2004

---

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING
DOW CHEMICAL COMPANY LTD 2 HEATHROW BOULEVARD
284 BATH ROAD
WEST DRAYTON
MIDDLESEX
UB7 0DQ
24 HOUR EMERGENCY RESPONSE NUMBER : +44-1553-761-251
For product information: +44-0208-917-5000
Product Name: DOWTHERM* SR-1 HEAT TRANSFER FLUID, DYED
LV70: 25630 Issue Date: May 02 Ref: KE005
Revised: June 04 (Section(s) 8)
Use of the substance/preparation
For industrial use only.

---

2. COMPOSITION/INFORMATION ON INGREDIENTS
Inhibited glycol formulation
Dangerous components (see section 16 for complete R-phrases):
CAS EC No
Ethylene glycol >95 % Xn; R22 000107-21-1 203-473-3

---

3. HAZARDS IDENTIFICATION
Harmful if swallowed.

---

4. FIRST-AID MEASURES
Never give fluids or induce vomiting if patient is unconscious or is having convulsions.
Inhalation
Move person to fresh air; if effects occur, consult a physician.

---

* Trademark of The Dow Chemical Company.

Skin Contact
Immediately flush skin with water while removing contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Destroy contaminated articles including leather items such as shoes.
Eye Contact
Flush eyes thoroughly with water for several minutes. Remove contact lenses after initial 1-2 minutes and continue flushing for several additional minutes. If effects occur, consult a physician, preferably an ophthalmologist.
Ingestion
Do not induce vomiting. Seek medical attention immediately. If person is fully conscious give 1 glass of water. If medical advice is delayed and if an adult has swallowed several grams of chemical, then give ca. 100 ml (gram) hard liquor such as 40% whisky. For children give proportionally less liquor at a dose of 8mL (8 gram, 1.5 teaspoon) of liquor for each 5 kg body weight or 2 mL per kg bodyweight (36 mL for an 18 kg child).
Note to Physician
If several grammes of ethylene glycol have been ingested, early administration of ethanol may counter the toxic effects (metabolic acidosis, renal damage). Consider hemodialysis or peritoneal dialysis and thiamine 100mg plus pyridoxide 50mg every 6 hours.
If ethanol is used, a therapeutically effective blood concentration in the range of 100-150 mg/dL may be achieved by a rapid loading dose followed by a continuous intravenous infusion. Consult standard literature for details of treatment.
4-Methyl pyrazole (Antizol (R)) is an effective blocker of alcohol dehydrogenase and should be used in the treatment of ethylene glycol, di- or triethylene glycol, ethylene glycol butyl ether, or methanol intoxication if available.
Fomepizole protocol (Brent J. et al., New Eng J Med, Feb 8, 2001 344:6, p. 424-9): loading dose 15 mg/kg intravenously, follow by bolus dose of 10 mg/kg every 12 hours; after 48 hours, increase bolus dose to 15 mg/kg every 12 hours.
Continue fomepizole until serum methanol, ethylene glycol, diethylene glycol or triethylene glycol are undetectable. The signs and symptoms of poisoning include anion gap metabolic acidosis, central nervous system depression, renal tubular injury, and possible late stage cranial nerve involvement.
Respiratory symptoms, including pulmonary edema, may be delayed. Persons receiving significant exposures should be observed 24-48 hours for signs of respiratory distress.
In severe poisoning, respiratory support with mechanical ventilation and positive end expiratory pressure may be required.
If lavage is performed, suggest endotracheal and/or oesophageal control. Danger from lung aspiration must be weighed against toxicity when considering emptying the stomach.

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5. FIRE-FIGHTING MEASURES

Extinguishing Media

Water fog or fine spray. Carbon dioxide fire extinguishers. Dry chemical fire extinguishers. Foam.

Do not use direct water stream. May spread fire.

Alcohol resistant foams (ATC type) are preferred. General purpose synthetic foams (including AFFF) or protein foams may function, but will be less effective.

Hazardous Combustion Products

During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/ or irritating.

Combustion products may include and are not limited to: Carbon monoxide. Carbon dioxide.

Protection of Firefighters

Wear positive-pressure self-contained breathing apparatus and protective fire fighting clothing (includes fire fighting helmet, coat, trousers, boots and gloves). If protective equipment is not available or not used, fight fire from a protected location or a safe distance.

Specific Fire or Explosion Hazards

Keep people away. Isolate fire area and deny unneccessary entry. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed. Fight fire from a protected location or safe distance. Consider use of unmanned hose holder or monitor nozzles. Immediately withdraw all personnel from area in case of rising sound from venting safety device or discolouration of the container. Burning liquids may be extinguished by dilution with water. Do not use direct water stream. May spread fire. Move containers from fire area if this is possible without hazard. Burning liquids may be moved by flushing with water to protect personnel and minimise property damage.

Other flammability information

Container may rupture from gas generation in a fire situation. Violent steam generation or eruption may occur upon application of direct water stream to hot liquids. Liquid mist of this product can burn. Flammable concentrations of vapour can accumulate at temperatures above 111 deg.C.

---

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions

Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls/Personal Protection.

May be a slipping hazard.

Environmental Precautions
Prevent from entering into soil, ditches, sewers, waterways and/or groundwater. See section 12, Ecological Information.
Methods of Cleaning Up
Small spills: Absorb with materials such as:
Cat litter. Sawdust. Vermiculite. Zorb-all (R).
Collect in suitable and properly labelled containers.
Large spills: Dike spill immediately. Contain spill if possible. See Section 13, Disposal Considerations, for additional information.

---

7. HANDLING AND STORAGE
Handling
Do not swallow. See Section 8, Exposure Controls/Personal Protection.
Spills of these organic liquids on hot fibrous insulations may lead to lowering of the autoignition temperatures, possibly resulting in spontaneous combustion.
When performing maintenance activities, proper care should be taken to prevent spilled fluid from entering the environment. Any spilled fluid should be absorbed and disposed of in accordance with all regulations.
Storage
Store in original unopened containers.
Do not store in containers made of: Galvanised steel.
Avoid exposure to UV-light as this can adversely affect quality.

---

8. EXPOSURE CONTROLS/PERSONAL PROTECTION
Exposure Guidelines
Ethylene glycol: The UK Health and Safety Executive has established an Occupational Exposure Standard(OES) of 10mg/m3 (8-hour TWA) for particulate; 60mg/m3 (8-hour TWA) and 125mg/m3 (15-min STEL) for vapour.
Engineering Controls
Provide general and/or local exhaust ventilation to control airborne levels below the exposure guidelines.
Personal Protective Equipment
- Respiratory Protection
Atmospheric levels should be maintained below the exposure guideline. For most conditions, no respiratory protection should be needed; however, if material is heated or sprayed, use an approved airpurifying respirator.
Use a CE approved air-purifying respirator with cartridge/filter for:
Organic vapours and particles, type AP2.

- Skin Protection
When prolonged or frequently repeated contact could occur, use protective clothing chemically resistant to this material. Selection of specific items such as face shield, gloves, boots, apron, or full bodysuit will depend on operation. If hands are cut or scratched, use gloves chemically resistant to this material even for brief exposures. When handling hot material, protect skin from thermal burns as well as from skin absorption.
-Hand protection
Use chemical resistant gloves classified under standard EN 374: Protective gloves against chemicals and micro-organisms.
Examples of preferred glove barrier materials include: Butyl rubber. Natural rubber ("latex"). Neoprene. Nitrile/butadiene rubber ("nitrile" or "NBR"). Polyethylene. Ethyl vinyl alcohol laminate ("EVAL"). Polyvinyl alcohol ("PVA"). Polyvinyl chloride ("PVC" or "vinyl").
When prolonged or frequently repeated contact may occur, a glove with a protection class of 2 or higher (breakthrough time greater than 30 minutes according to EN 374) is recommended.
NOTICE: The selection of a specific glove for a particular application and duration of use in a workplace should also take into account all requisite workplace factors such as, but not limited to: Other chemicals which may be handled, physical requirements (cut/puncture protection, dexterity, thermal protection), as well as the instructions/specifications provided by the glove supplier.
- Eye/Face Protection
Use safety glasses. If exposure causes eye discomfort, use a full-face respirator.

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9. PHYSICAL AND CHEMICAL PROPERTIES
Density : >1.0
Boiling point/range : 163 deg.C
Water solubility : infinite
Vapour pressure : 2.2 mmHg (20 deg.C)
Specific gravity : 1.1295 (16 deg.C)
Flash point : 111 deg.C (ethylene glycol) (TCC)
Auto-ignition temp. : 398 deg.C (ethylene glycol)
Flammability-LFL : 3.2 %vol/vol (ethylene glycol)
Flammability-UFL : not determined

---

10. STABILITY AND REACTIVITY
Chemical Stability
Thermally stable at recommended temperatures and pressures.
Exposure to elevated temperatures can cause product to decompose.

Materials to Avoid
Avoid contact with: Strong acids. Strong bases. Strong oxidising agents.
Hazardous Decomposition Products
Decomposition products depend upon temperature, air supply and the presence of other materials.
Decomposition products may include and are not limited to: Aldehydes. Alcohols. Ethers.
Generation of gas during decomposition can cause pressure in closed systems.
Hazardous Polymerisation
Will not occur.

---

11. TOXICOLOGICAL INFORMATION

Data for: Ethylene glycol:
- Ingestion
Oral toxicity is expected to be moderate in humans even though tests with animals show a lower degree of toxicity. Excessive exposure may cause central nervous system effects, cardiopulmonary effects (metabolic acidosis) and kidney failure. Swallowing may result in severe effects, even death. The lethal dose in humans is estimated to be 100 ml.
May cause nausea or vomiting. May cause abdominal discomfort or diarrhea.
The oral LD50 for rats for a similar material is 8200 mg/kg.
- Skin Contact
Brief contact is essentially nonirritating to the skin. Prolonged contact may cause slight skin irritation with local redness. May cause more severe response if skin is abraded (scratched or cut). Prolonged skin contact is unlikely to result in absorption of harmful amounts. Repeated skin exposure to large quantities may result in absorption of harmful amounts. Massive contact with damaged skin or with material sufficiently hot to burn skin may result in absorption of potentialy lethal amounts.
The LD50 for skin absorption in rabbits for similar materials is >2000 mg/kg.
- Inhalation
At room temperature, exposure to vapour is minimal due to low volatility. With good ventilation, single exposure is not expected to cause adverse effects. If material is heated or areas are poorly ventilated, vapour/mist may accumulate and cause respiratory irritation and symptoms such as headache and nausea.
- Eyes
May cause slight temporary eye irritation. Corneal injury is unlikely. Vapour or mist may cause eye irritation.

Mutagenicity
In vitro genetic toxicity studies were negative. Animal genetic toxicity studies were negative.
Carcinogenicity
Did not cause cancer in laboratory animals.
Developmental/Reproductive Effects
Based upon animal studies, ingestion of very large amounts of ethylene glycol appears to be the major and possibly only route of exposure to produce birth defects. Exposures by inhalation or skin contact, the primary route of occupational exposure, had minimal effect on the fetus in animal studies.
Ingestion of large amounts of ethylene glycol has been shown to interfere with reproduction in animals. Specifically, growth retardation and decreased litter size in rats and mice and decreasing mating frequency in mice were observed.
Systemic effects
Repeated excessive exposures may cause irritation of the upper respiratory tract.
In humans, effects have been reported on the following organs: Central nervous system.
Observations in humans include: Nystagmus (involuntary eye movement).
In animals, effects have been reported on the following organs: Kidney. Liver.

---

12. ECOLOGICAL INFORMATION
Mobility and Bioaccumulation Potential
Based largely or completely on information for: Ethylene glycol: Bioconcentration potential is low (BCF less than 100 or log Pow less than 3). Potential for mobility in soil is very high (Koc between 0 and 50).
Degradation
Based largely or completely on information for: Ethylene glycol: Material is readily biodegradable. Passes OECD Test(s) for ready biodegradability.
Aquatic Toxicity
Based largely or completely on information for: Ethylene glycol: Material is not classified as dangerous to aquatic organisms (LC50/EC50/IC50 greater than 100 mg/L in most sensitive species).

---

13. DISPOSAL CONSIDERATIONS
Do not dump into any sewers, on the ground, or into any body of water. Any disposal practice must be in compliance with all local and national laws and regulations.

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SAFETY DATA SHEET
11/ 6/2004
DOWTHERM* SR-1 HEAT TRANSFER FLUID, DYED

---

14. TRANSPORT INFORMATION
Product is not classified for any mode of transportation.

---

15. REGULATORY INFORMATION
Classification according to the UK Chemicals (Hazard Information and Packaging) Regulations, CHIP.
Hazard Symbol : Xn - Harmful
Risk Phrases : Harmful if swallowed (R22).
Safety Phrases : Keep container tightly closed (S7).
In case of accident or if you feel unwell, seek medical advice immediately (Show the label where possible) (S45).
Chemical name: Contains: Ethylene glycol

---

16. OTHER INFORMATION
Risk-phrases in Section 2
R22 - Harmful if swallowed.

The information herein is given in good faith and to the best of our knowledge but no warranty, express or implied, is made.

18.4 Safety data for refrigerant oil

MINERAL OIL
- . .
MSDS Number. **M7700** * * * * * ***Effectrve Dute: 05/19/08*** * * * * * ***Supercedes: 08/18/05***

Page 1 of 4
-
MINERAL OIL
1. Product Identification
Synonyms: Paraffin oil; liquid petrolatum, White Mineral Oil; Nujol
CAS No.: 8012-95-1
Molecular Weight: Not applicable.
Chemical Formula: Not au.u. l icable.
Product Codes:
J.T. Baker: 2705
Mallinckrodt: 6357, 6358
2. Composition/Information on Ingredients
Ingredient CA5 NO Percent Hdzardous

Oil, Mineral 8017-95-1 **90 - 100% Yes**
-
3. Hazards Identification
Emergency Overview
WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION T 0 SKIN, EYES AND RESPIRATORY TRACT.
COMBUSTIBLE LIQUID AND VAPOR.
SAF-T-DATA("") Ratings (Provtded here for your convenience)
Health Rating: 2 - Moderate
Flammability Rating: 1 - Slight
Reactivity Rating 0 - None
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES
Storage Color Code: Green (General Storage)
Potential Health Effects
Inhalation:
Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Inhalation of mist or vapor may produce aspiration pneumonia.
Ingestion:
Material is a cathartic and can cause serious diarrhea. Nausea and vomiting may also occur and possibly abdominal cramping. Aspiration of mineral oil into the
lungs can cause chemical pneumonia.
Skin Contact:
Prolonged contact may cause irritation; occasionally dermatitis due to hypersensitivity occurs.
Eye Contact:
Mists or fumes can irritate the eyes. Can cause discomfort similar to motor oil.
Chronic Exposure:
Prolonged or repeated skin exposure may cause dermatitis. Highly refined mineral 011s are not classified as human carcinogens. However, related forms
(untreated and mildly-treated oils) are listed as human carcinogens by both NTP and IARC.
Aggravation of Pre-existing Conditions:
Persons with pre-existing Skin disorders or impaired respiratory function may be more susceptible to the effects of the substance.
MINERAL OIL Page 2 of 4
4. First Aid Measures
Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:

If swallowed, D0 NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious Person. Get medical attention
immediately. Aspiration hazard.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical aitention. Wash clothing before reuse.
Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Flash point: 135C (275F) CC
Autoignition temperature. 260 - 370C (500 - 698F)
Combustible Liquid and Vapor!

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Water spray, dry chemical, alcohol foam, or carbon dioxide. Water or foam may cause frothing. Do not allow water runoff to enter sewers or watenvays.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand
or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep
unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an
appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible
materials, such as saw dust Do not flush to sewer!

7. Handling and Storage

Keep in a tightly closed container. Store in a cool, dry, ventilated area away from sources of heat or ignition. Protect against physical damage. Store separately
from reactive or combustible materials, and out of direct sunlight. Containers of this material may be hazardous when empty since they retain product residues
(vapors, liquid); obsewe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For Mineral Oil; Mistedl:
-0SHA Permissible Exposure Limit (PEL): 5 mgim3
-ACGIH Threshold Limit Value (TLV).
5 mgim3 (TWA) 10 mgIm3 (STEL)
(las sampled by method that does not collect vapor)
(IRefers to airborne mist of mineral oil)

Ventilation System:

A system of local andlor general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is
generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the
ACGIH document, *Industrial Ventilaiion. A Manual of RecommendedPractices,* most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering conbols are not feasible, a half facepiece particulate respirator (NIOSH type P95 or R95 filters) may be worn
for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is
lowest.. A full-face piece particulate respirator (NIOSH type P100 or RIOO filters) may be wom up to 50 times the exposure limit, or the maximum use
concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. Please note that N filters are not recommended for this
material. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING. Airpurifying
respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impewious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles andor a full face sbield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Clear oily liquid.

Odor:

Odorless.

Solnbility:

MINERAL OIL Page 3 of 4
Insoluble in water.

Specific Gravity:

Heavy: 0.845 to 0.905 Light. 0.818 to 0.880

pH:,

No inforrnation found

% **Volatiles by volume @ 21C (70F):**

0

Boiling Point:

260 - 330C (500 - 626F)

Melting Point:

No information found

Vapor Density (Air=l):

ca. 9

Vapor Pressure (mm Hg):

< 0 5

Evaporation Rate (BuAc=l):

No inforrnation found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. May solidify at room temperature

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition

Hazardous Polymerization:

Will not occur.

lucompatibilities:

Strong oxidizers.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles

11. Toxicological Information

Irritation Data, rabbit (Std Draize). skin- 100 mg/24H, mild; eye= 500 mg, moderate. Investigated as a tumorigen. Oral rat LD50: 22 gdkg

——\Cancer Llsts\-.–..– . .- .....

---NTP **Carclnoyen—**

Ingred~ent Known Rnticipated IARC Category
------------- . - . - . - - - -
011, Mineral (8012 95 11 NO NO None

12. Ecological Information

Environmeutal Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility Processing, use or contamination
of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container
and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulator~I nformation

——\Chemical Inventory Status - Part I\--------------------------- ---
Inyredlent TSCA EC Japan Australla
------------- -... .---------------------- ------ -------- --- ---
011, Mineral (8012-95-11 Yes Yes No Yes
. - - . - . - \Chernical Inventory Status - Part 2\--------- --- -----------
- Canada–
Ingredient Korea DSL NDSL Phil.
.... -- - ------------- ----- --- ---- -----
011, MInerdl (8012-95-11 Yes Yes No Yes
MINERAL OIL Page 4 of 4
- - - - - - - - \Federal, State & International RegulPtions - Part I\--------
- S m 302- ------ SARA 313- ----
-I-ng-r-e-d-i-e-n-t- -
R-Q-- -T-P-Q- - -L-is-t- Che-m-i-c-a-l- -C-a-t-g-.-011, MIneral (8012-95-11 NO No NO NO
- - - - - - - - \Federal, State & International Requlations - Part 2\----------------
-RCRA- -TSCAIngredient
CERCLA 261.33 8 (d)
------ - - - - - - - - - - - -
Oil, Mineral (8012 -95-11 NO No No
Chemical Weapons Convention: No TSCA 1 2 (b) : No CDTA: No
SARA 311/312: Acute: Yes Chronic: No Fire: Yes Pressure: No
Reactivity: No (Pure / Liquid)
Australian Hazchem Code: None allocated.
Poison Schedule: S5
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information
required by the CPR.

16. Other Information

NFPA Ratings: Health: 0 Flammability: 1 Reactivity 0
Label Hazard Waruing:
WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. COMBUSTIBLE
LIQUID AND VAPOR.
Label Precautions:
Avoid breathing mist.
Keep container closed.
Use only with adequate ventilation.
Avoid contact with eyes, skin and clothing.
Wash thoroughly after handling.

Keep away from heat, sparks and flame.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention
immediately. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash
clothing before reuse If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases, get medical
attention.
Product Use:
Laboratory Reagent.
Revision Information:
No Changes.
Disclaimer: .....
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This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product.
Individuals receiving the information must exercise their independeut judgment in determining its appropriateness for a particular purpose.
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Prepared by: Environmental Health & Safety
Phone Number. (3 14) 654-1600 (U.S.A.)

18.5 Safety data for refrigerant R407c

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION
PRODUCT NAME: R-407C
DISTRIBUTOR: For Example:
National Refrigerants, Inc.
661 Kenyon Avenue
Bridgeton, New Jersey 08302
FOR MORE INFORMATION CALL: IN CASE OF EMERGENCY CALL:
(Monday-Friday, 8:00am-5:00pm) CHEMTREC: 1-800-424-9300
1-800-262-0012
2. COMPOSITION / INFORMATION ON INGREDIENTS

INGREDIENT NAME CAS NUMBER WEIGHT %
Difluoromethane (HFC-32) 75-10-5 23
Pentafluoroethane (HFC-125) 354-33-6 25
1,1,1,2-Tetrafluoroethane (HFC-134a) 811-97-2 52
Trace impurities and additional material names not listed above may also appear in Section 15 toward the end of the MSDS.
These materials may be listed for local “Right-To-Know” compliance and for other reasons.
3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Colorless, volatile liquid with ethereal and faint sweetish odor. Non-flammable material. Overexposure may cause dizziness and loss of concentration. At higher levels, CNS depression and cardiac arrhythmia may result from exposure. Vapors displace air and can cause asphyxiation in confined spaces. At higher temperatures, (>250°C), decomposition products may include Hydrofluoric Acid (HF) and carbonyl halides.
POTENTIAL HEALTH HAZARDS
SKIN: Irritation would result from a defatting action on tissue. Liquid contact could cause frostbite.
EYES: Liquid contact can cause severe irritation and frostbite. Mist may irritate.
INHALATION: R-407C is low in acute toxicity in animals. When oxygen levels in air are reduced to 12-14% by displacement, symptoms of asphyxiation, loss of coordination, increased pulse rate and deeper respiration will occur. At high levels, cardiac arrhythmia may occur.

INGESTION: Ingestion is unlikely because of the low boiling point of the material. Should it occur, discomfort in the gastrointestinal tract from rapid evaporation of the material and consequent evolution of gas would result. Some effects of inhalation and skin exposure would be expected.
DELAYED EFFECTS: None known.
Ingredients found on one of the OSHA designated carcinogen lists are listed below.
INGREDIENT NAME NTP STATUS IARC STATUS OSHA LIST
No ingredients listed in this section
4. FIRST AID MEASURES

SKIN: Promptly flush skin with water until all chemical is removed. If there is evidence of frostbite, bathe (do not rub) with lukewarm (not hot) water. If water is not available, cover with a clean, soft cloth or similar covering. Get medical attention if symptoms persist.
EYES: Immediately flush eyes with large amounts of water for at least 15 minutes (in case of frostbite water should be lukewarm, not hot) lifting eyelids occasionally to facilitate irrigation. Get medical attention if symptoms persist.
INHALATION: Immediately remove to fresh air. If breathing has stopped, give artificial respiration. Use oxygen as required, provided a qualified operator is available. Get medical attention. Do not give epinephrine (adrenaline).
INGESTION: Ingestion is unlikely because of the physical properties and is not expected to be hazardous. Do not induce vomiting unless instructed to do so by a physician.
ADVICE TO PHYSICIAN: Because of the possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, should be used with special caution and only in situations of emergency life support. Treatment of overexposure should be directed at the control of symptoms and the clinical conditions.
5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES
FLASH POINT: Gas, not applicable per DOT regulations
FLASH POINT METHOD: Not applicable
AUTOIGNITION TEMPERATURE: Unknown for mixture
UPPER FLAME LIMIT (volume % in air): None*
LOWER FLAME LIMIT (volume % in air): None*
*Based on ASHRAE Standard 34 with match ignition
FLAME PROPAGATION RATE (solids): Not applicable
OSHA FLAMMABILITY CLASS: Not applicable
EXTINGUISHING MEDIA:
Use any standard agent – choose the one most appropriate for type of surrounding fire (material itself is not flammable)

UNUSUAL FIRE AND EXPLOSION HAZARDS:
R-407C is not flammable at ambient temperatures and atmospheric pressure. However, this material will become combustible when mixed with air under pressure and exposed to strong ignition sources.
Contact with certain reactive metals may result in formation of explosive or exothermic reactions under specific conditions (e.g. very high temperatures and/or appropriate pressures).
SPECIAL FIRE FIGHTING PRECAUTIONS/INSTRUCTIONS:
Firefighters should wear self-contained, NIOSH-approved breathing apparatus for protection against possible toxic decomposition products. Proper eye and skin protection should be provided. Use water spray to keep fire-exposed containers cool.

6. ACCIDENTAL RELEASE MEASURES

IN CASE OF SPILL OR OTHER RELEASE: (Always wear recommended personal protective equipment.)
Evacuate unprotected personnel. Protected personnel should remove ignition sources and shut off leak, if without risk, and provide ventilation. Unprotected personnel should not return until air has been tested and determined safe, including low- lying areas.
Spills and releases may have to be reported to Federal and/or local authorities. See Section 15 regarding reporting requirements.

7. HANDLING AND STORAGE

NORMAL HANDLING: (Always wear recommended personal protective equipment.)
Avoid breathing vapors and liquid contact with eyes, skin or clothing. Do not puncture or drop cylinders, expose them to open flame or excessive heat. Use authorized cylinders only. Follow standard safety precautions for handling and use of compressed gas cylinders.
R-407C should not be mixed with air above atmospheric pressure for leak testing or any other purpose.
STORAGE RECOMMENDATIONS:
Store in a cool, well-ventilated area of low fire risk and out of direct sunlight. Protect cylinder and its fittings from physical damage. Storage in subsurface locations should be avoided. Close valve tightly after use and when empty.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS:
Provide local ventilation at filling zones and areas where leakage is probable. Mechanical (general) ventilation may be adequate for other operating and storage areas.
PERSONAL PROTECTIVE EQUIPMENT
SKIN PROTECTION:
Skin contact with refrigerant may cause frostbite. General work clothing and gloves (leather) should provide adequate protection. If prolonged contact with the liquid or gas is anticipated, insulated gloves constructed of PVA, neoprene or butyl rubber should be used. Any contaminated clothing should be promptly removed and washed
before reuse.

EYE PROTECTION:
For normal conditions, wear safety glasses. Where there is reasonable probability of liquid contact, wear chemical safety goggles.
RESPIRATORY PROTECTION:
None generally required for adequately ventilated work situations. For accidental release or non-ventilated situations, or release into confined space, where the concentration may be above the PEL of 1,000 ppm, use a self-contained, NIOSH- approved breathing apparatus or supplied air respirator. For escape: use the former or a NIOSH-approved gas mask with organic vapor canister.
ADDITIONAL RECOMMENDATIONS:
Where contact with liquid is likely, such as in a spill or leak, impervious boots and clothing should be worn. High dose-level warning signs are recommended for areas of principle exposure. Provide eyewash stations and quick-drench shower facilities at convenient locations. For tank cleaning operations, see OSHA regulations, 29 CFR 1910.132 and 29 CFR 1910.133.
EXPOSURE GUIDELINES
INGREDIENT NAME ACGIH TLV OSHA PEL OTHER LIMIT
Difluoromethane None None **1000 ppm TWA (8hr)
Pentafluoroethane None None **1000 ppm TWA (8hr)
1,1,1,2-Tetrafluoroethane None None **1000 ppm TWA (8hr)
* = Limit established by National Refrigerants, Inc.
** = Workplace Environmental Exposure Level (AIHA)
*** = Biological Exposure Index (ACGIH)
OTHER EXPOSURE LIMITS FOR POTENTIAL DECOMPOSITION PRODUCTS:
Hydrogen Fluoride: ACGIH TLV: 3 ppm ceiling

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Clear, colorless liquid and vapor
PHYSICAL STATE: Gas at ambient temperatures
MOLECULAR WEIGHT: 86.2
CHEMICAL FORMULA: CH_2F_2, CF_3CHF_2, CH_2FCF_3
ODOR: Faint ethereal odor
SPECIFIC GRAVITY (water = 1.0): 1.16 @ 21.1°C (70°F)
SOLUBILITY IN WATER (weight %): Unknown
pH: Neutral
BOILING POINT: -43°C (-45.4°F)
FREEZING POINT: Not determined
VAPOR PRESSURE: 156.2 psia @ 70°F
356.7 psia @ 130°F
VAPOR DENSITY (air = 1.0): 3.0
EVAPORATION RATE: >1 **COMPARED TO:** $CC1_4$ = 1
% VOLATILES: 100
FLASH POINT: Not applicable
(Flash point method and additional flammability data are found in Section 5.)

10. STABILITY AND REACTIVITY

NORMALLY STABLE? (CONDITIONS TO AVOID):

The product is stable.

Do not mix with oxygen or air above atmospheric pressure. Any source of high temperature, such as lighted cigarettes, flames, hot spots or welding may yield toxic and/or corrosive decomposition products.

INCOMPATIBILITIES:

(Under specific conditions: e.g. very high temperatures and/or appropriate pressures) – Freshly abraded aluminum surfaces (may cause strong exothermic reaction). Chemically active metals: potassium, calcium, powdered aluminum, magnesium and zinc.

HAZARDOUS DECOMPOSITION PRODUCTS:

Halogens, halogen acids and possibly carbonyl halides.

HAZARDOUS POLYMERIZATION:

Will not occur.

11. TOXICOLOGICAL INFORMATION

IMMEDIATE (ACUTE) EFFECTS:

HFC-32: LC_{50} : 4 hr. (rat) - 520,000 ppm / Cardiac Sensitization threshold (dog) 350,000 ppm

HFC-125: LC_{50} : 4 hr. (rat) - > 800,000 ppm / Cardiac Sensitization threshold (dog) 75,000 ppm

HFC-134a: LC_{50}: 4 hr. (rat) - > 500,000 ppm / Cardiac Sensitization threshold (dog) > 80,000 ppm

DELAYED (SUBCHRONIC AND CHRONIC) EFFECTS:

HFC-32: Teratogenic NOEL (rat and rabbit) – 50,000 ppm

Subchronic inhalation (rat) NOEL – 50,000 ppm

HFC-125: Teratogenic NOEL (rat and rabbit) – 50,000 ppm

Subchronic inhalation (rat) NOEL - ≥ 50,000 ppm

Chronic NOEL – 10,000 ppm

HFC-134a: Teratogenic NOEL (rat and rabbit) – 40,000 ppm

Subchronic inhalation (rat) NOEL – 50,000 ppm

Chronic NOEL – 10,000 ppm

OTHER DATA:

HFC-32, HFC-125, HFC-134a: Not active in four genetic studies

12. ECOLOGICAL INFORMATION

Degradability (BOD): R-407C is a gas at room temperature; therefore, it is unlikely to remain in water.

Octanol Water Partition Coefficient: Unknown for mixture

13. DISPOSAL CONSIDERATIONS

RCRA

Is the unused product a RCRA hazardous waste if discarded? Not a hazardous waste.
If yes, the RCRA ID number is: Not applicable.
OTHER DISPOSAL CONSIDERATIONS:
Disposal must comply with federal, state, and local disposal or discharge laws. R-407C is subject to U.S. Environmental Protection Agency Clean Air Act Regulations Section 608 in 40 CFR Part 82 regarding refrigerant recycling.
The information offered here is for the product as shipped. Use and/or alterations to the product such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

14. TRANSPORT INFORMATION

US DOT PROPER SHIPPING NAME: Refrigerant gas R 407C
US DOT HAZARD CLASS: 2.2
US DOT PACKING GROUP: Not applicable
US DOT ID NUMBER: UN3340
For additional information on shipping regulations affecting this material, contact the information number found in Section 1.

15. REGULATORY INFORMATION

TOXIC SUBSTANCES CONTROL ACT (TSCA)

TSCA INVENTORY STATUS: Components listed on the TSCA inventory
OTHER TSCA ISSUES: None
SARA TITLE III / CERCLA
“Reportable Quantities” (RQs) and/or “Threshold Planning Quantities” (TPQs) exist for the following ingredients.
INGREDIENT NAME SARA / CERCLA RQ (lb.) SARA EHS TPQ (lb.)
No ingredients listed in this section
Spills or releases resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center [(800) 424-8802] and to your Local Emergency Planning Committee.
SECTION 311 HAZARD CLASS: IMMEDIATE PRESSURE
SARA 313 TOXIC CHEMICALS:
The following ingredients are SARA 313 “Toxic Chemicals”. CAS numbers and weight percents are found in Section 2.
INGREDIENT NAME COMMENT
No ingredients listed in this section

STATE RIGHT-TO-KNOW
In addition to the ingredients found in Section 2, the following are listed for state right-to-know purposes.
INGREDIENT NAME WEIGHT % COMMENT
No ingredients listed in this section
ADDITIONAL REGULATORY INFORMATION:
R-407C is subject to U.S. Environmental Protection Agency Clean Air Act Regulations at 40 CFR Part 82.
WARNING: Do not vent to the atmosphere. To comply with provisions of the U.S. Clean Air Act, any residual must be recovered. **Contains Pentafluoroethane (HFC-125), Difluoromethane (HFC-32), and Tetrafluoroethane (HFC-134a)**, greenhouse gases which may contribute to global warming.
WHMIS CLASSIFICATION (CANADA):
This product has been evaluated in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.
FOREIGN INVENTORY STATUS:
EU – EINECS # 2065578 – HFC-125
2008394 – HFC-32
223770 – HFC-134a
16. OTHER INFORMATION

CURRENT ISSUE DATE: August, 2007
PREVIOUS ISSUE DATE: October, 2006
OTHER INFORMATION: HMIS Classification: Health – 1, Flammability – 1, Reactivity – 0
NFPA Classification: Health – 2, Flammability – 1, Reactivity – 0
ANSI / ASHRAE 34 Safety Group – A1
Regulatory Standards:

1. OSHA regulations for compressed gases: 29 CFR 1910.101
2. DOT classification per 49 CFR 172.101

Toxicity information per PAFT Testing

17. DISCLAIMER

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18.6 Wiring diagram

Please see seperate files on this CD
Wiring diagram for ECO122L, ECO133L, IFP and FCU

19 KKT Service

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