Manufacturer

ait-deutschland GmbH
Industriestraße 3
95359 Kasendorf
Germany

T +49 9228 9977 0
F +49 9228 9977 149
E info@kkt-chillers.com
W www.kkt-chillers.com

Representative in the US and Service Center

KKT chillers, Inc.
1280 Landmeier Road
Elk Grove Village, IL 60007
USA

T +1 847 734 1600
F +1 847 734 1601
TF +1 866 517 6867
E support@kkt-chillersusa.com

YOUR LOCAL SERVICE CONTRACTOR IS:

COMPANY NAME:

_____

PHONE NUMBER: FAX NUMBER:

_____

Contents **page**

1 General Remarks, Safety Warnings

Manufacturer: ait-deutschland GmbH
Industriestrasse 3
95359 Kasendorf
Germany
T +49 9228 9977 0
F +49 9228 9977 149

After-sales: ait-deutschland GmbH
After sales dept.
Industriestrasse 3
95359 Kasendorf
Germany
T +49 9228 9977 7190
F +49 9228 9977 7474

Refrigerant **R134a**

Total filling weight **outdoor model 12,0 kg**
Permitted working pressure: **19 bar**

1.1 Maintenance

The cooling block must be serviced at least twice a year by a Chiller company. (e.g., KKT or SBT)

1.2 Warranty

The unit is supplied finished, tested and ready to work. The unit warranty will be void if any modification to the unit is carried out without written agreement of KKT.
For warranty purposes, the following conditions must be satisfied:

- The initial start of the unit must be carried out by trained personnel from an Authorized KKT Service Partner.
- Maintenance must be carried out by properly trained personnel.
- Only genuine KKT-Kraus spare parts must be used.
- For SC218-L-U/S: Ethylene glycol or Propylene glycol must be added to the rate of min. 35vol% to max. 38vol%.
- The manual (this document) must not remove from the chiller.
- All the scheduled maintenance operations detailed in this manual must be performed at the specified times. Please use a higher amount of services if the local conditions require it.
- **The “Warranty Registration” has to be send return to KKT**

Failure to satisfy any of these conditions will automatically void the warranty.

1.3 Safety Warnings:

-Cooling water circuit is pressurized.
Switch off the Chiller and depressurize before servicing the cooling water circuit.
-Drain water from pipes and spare parts before shipment.
-Do not operate the Chiller without ethylene glycol or propylene glycol! The cooling water must contain min. 35% to max. 38% ethylene glycol or propylene glycol.
-Nominal static filling pressure when Chiller has been switched off: 1,5bar.
-Don`t handle valves while the Chiller is running

-**Ethylene glycol or Propylene glycol** be added at the rate of min. 35% to max. 38% of the volume of water anytime otherwise warranty void.
-The rate depends not on the local ambient temperature.
-Don’t use automotive antifreeze.

-Voltage continuous to be present at the terminals, even after the MR system has been switched off.
-Parts in the refrigerant circuit are hot, even the Chiller has been switched off.

-WEAR SAFETY GLOVES AND GLASSES WHEN WORKING ON UNIT TO AVOID INJURY!
-WEAR LONG SLEEVE SHIRT AND PANTS WHEN WORKING ON UNIT!
-NO LOOSE CLOTHING ITEMS ALLOWED TO AVOID INJURY!
-PLEASE READ THE MANUAL!

Additional see the safety notes for refrigerant and oil page 113.

OBSERVE THE SAFETY RULES

Before commencing work on the unit, switch the plant to voltage-free

IN CASES OF EMERGENCY TURN OFF THE AGGREGATE BY THE MAIN SWITCH !

Caution! Work on electric and refrigerant circuits should only be performed by qualified operatives. Observe the safety rules!

Warranty void if manual removed from chiller.

2 General description

The chiller SC218-L-U/S are fully assembled, factory inspected and tested, and suitable for fully-automated operation. The water ethylene/propylene glycol mixture that undergoes cooling is constantly circulated by the pump in a closed system which is monitored by an flow switch and an expansion tank. The temperature is controlled by an 4 stage thermostat of Eliwell. The settings on the controller is kept automatically within the limits that are possible for the given range of temperature exactitude.
The process heat is transmitted from the water in the in-built heat exchanger (evaporator) to the refrigerant circuit (R 134a). The compressor raises the refrigerant to a higher temperature and pressure so that the warmth can be released via the condenser to the surrounding air. Consequently good air supply and escape are vital for the proper running of the plant. The condenser-pressure is controlled by two pressostats for the condenser fan speed (Y/D).
The chiller SC218-L-U/S are fitted with low-pressure pressostat as protection against freezing and excess temperature. With this, it is possible to set leaving water temperatures from +9°C to +12°C.

Ethylene glycol or Propylene glycol must be added at the rate of min. 35vol.% to max. 38vol.% and it depends not on the ambient temperature!
Do not use automotive antifreeze!!!

Changes in the settings should only be made by qualified operatives.

Chiller Type SC 218-L-U/S

Air-cooled design for outdoor use, consisting mainly of:

The housing with stable welded, galvanized framework-construction , lateral cover-plates with drawer-edges made of galvanized steel plate with ventilating nozzles worked into the top plate.

Framework-construction and top-plates, powder-coated on the inside and outside, RAL 1013 -pearl white. All outer fastening screws rust-proof, inspection-caps at the front easily removable for maintenance using casement-fastener caps.

Compressors, cooling and cold-water/ethylene/propylene-glycol mountings, additionally sound and rain-proofed using a galvanized cover-plate.

Condenser axial-fans controlled by two pressostats depends of the condenser pressure. Ventilators equipped with protective grating on the delivery side

Laterally mounted condenser heat-exchanger made of Cu-AL with covering galvanized framework.

Cooling-unit for fluid cooling, consisting of:

Stable base-frame construction made of steel-profiles, powder-coated. SCROLL-motor compressor, of fully hermetic construction with suction-gas cooled design complete with special shut-off valves placed at the pressure and suction side. Vibration-absorbing-mounted compressors. Cooling circulation with surge drum, coolant shut-off mounting, filter-dryer, inspection glass and moisture indicator, fluid solenoid-valve, service-valves as well as the complete internal cooling pipe work made of Cu-pipe with coolant and special oil filling. High-capacity plate-evaporator of plumbed design. Heat-exchanger plates with optimized profile for safety coolant and built in expansion-valve.

Evaporator and suction-side pipe work, diffusion-seal insulated.

Safety pack for the cooling circuit, consisting of:

Crankcase heater, high pressure pressostat as well as protective motor relay.

Shut-off ball valve at the cold water/glycol entry, dirt trap, expansion tank, feeder and safety valve. High-pressure centrifugal-pump adjusted to the overall system, filling and drainage valve with automatic, ventilation, manometer in forward and reverse flow. Quantity balancing-valve.

Temperature control as hot gas by-pass control with one solenoid valves for each circuit.

The temperature is controlled by a Eliwell electronic thermostat.

Condenser pressure control via two pressostats in the cooling circuit and automatically delta-wye switch.

Internal cold water / ethylene(Propylene)-glycol piping made of Cu-pipe, brazed, with diffusion sealer, surrounded by armaflex insulation.

All necessary block and clip angles used for cooling and cold water/ethylene(propylene)-glycol construction are made of rust-proof and powder-coated material.

Switch-cabinet integrated in cooling block, system of protection IP 54, wired according to VDE-regulations, supply-check indicator lamp, phase monitoring relay and Siemens components such as, overload release, sliding-panel, motor safety-switch, control-switch and indicator lamps.

A pump post-relay for the safety of the vaporizer as well as pot. proof contacts for "supply-control" and "collective fault messages".

The switch cabinet of the outdoor version contains a switch cabinet heater and a mechanical switch cabinet ventilator.

All parts described above are assembled into a ready-to-connect unit.

2.1 Functional description

The cold water pump starts as soon as the main switch 4Q1 and the pump switch 5S1 have been turned from “OFF” to “ON”.

Remark: All circuit breakers have to be switched on.

The pump switch is only to be turned to On when the aqueous medium circuit has been completely filled and all air has been removed.

The flow switch protecting of the refrigerating compressors is cut off during start-up.

The pressure on the delivery side of the pump rises directly with the system pressure.

Should this fail to be the case, the plant has either a leak or insufficient water. A flow switch acts to prevent running of the pump without water/glycol mixture. The refrigerating machines switch on as soon as the fail-safe

flow switch ,the control motor-protection pump is in order and the temperature controller will start the compressors.
A lag in connection time has been allowed for in the refrigeration compressors to avoid surges in the current. The refrigeration compressors keep running as long as cold is required and the reference value for the water temperature has not been reached. The fine adjustment is performed by the hot gas by-pass valve of each refrigerant circuit.

The water pump remains in constant operation.

Apart from which, the refrigerating machines are only ever switched off during circulation in cases of low or high pressure in the refrigeration cycle.

When switched off in the normal way, a restart timing relay provides overload protection to the compressor.

2.1.1 High-/Low- pressure control

The **high-pressure (HP) control** reacts to excess pressure of the magnitude of 19 bar by shutting off the compressors.

Causes of this include
- failure of condenser fans,
- high ambient temperature,
- a dirty condenser.

The compressor can only be put back in operation when the reset switch (blue) is activated on the HP-pressure control and the pressure has dropped.

An automatic start has not been provided for.

The **low-pressure (LP) control** also switches off the compressor when the pressure sinks to 1,0 bar. The switch is by-passed during start-up for 90 s.

If after being at rest the pressure rises to 2,0 bar, the compressor will switch on again automatically.

2.1.2 Electronic controls

The controller consists of a Eliwell temperature controller. The reference value is set at the works at 10°C for the outlet temperature. The sensor for the controller is installed on the outlet side.

Regulating refrigerating capacity

The exact regulation of the leaving temperature is achieved by means of controller and hot gas by-pass injectors with solenoid valves. The setting is based on approx. 50% of each machine’s refrigerating capacity.

Condenser pressure regulation

the condenser-pressure is regulated with help of two Pressotat which swiches the delta-wye contactors.

3 Brief operating instructions

See also chapter 5 – 10 in this operating instruction

3.1 Installing, maintenance and repair

Only qualified operatives with the requisite knowledge, equipment and facilities should maintenance and repair the KKT chiller.

If its necessary to change the filling weight of the refrigerant circuit, please note:

Fill only with the refrigerants listed on the manufacturer name plate, and only up to the indicated filling weight.
See also the enclosed Installing instruction

3.2 Linking to power supply

The size of the connection cable had to be conform to the local regulations. For current values and power input see “Switch gear” point 8.

The industrial coolers of the SC series are generally designed for a main supply of 480V 3Ph 60 Hz.

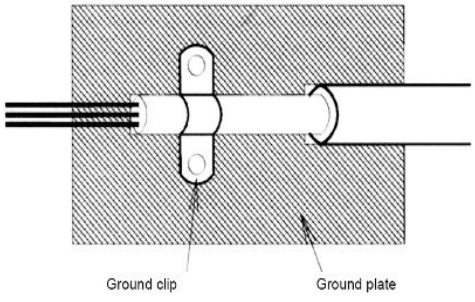
The connection L1, L2, L3, PE is performed via the terminal block in the switch cabinet.

The chiller is switched on via the main switch if performed.

3.3 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.

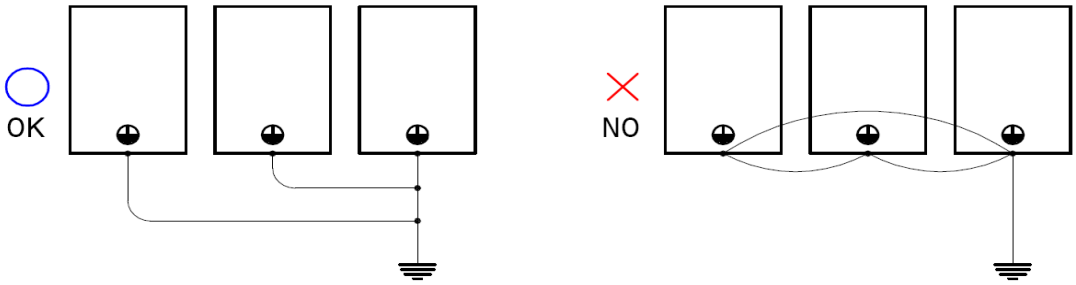
The width of the grounding wire must be min. 16mm² (AWG 6) or of the same width of the power supply. The grounding must be an isolated ground and must connected on the ground terminal (X1) in the switch cabinet. The ground resistance must be less than 10 Ohm.

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.
(e.g. a CT-Chiller KPC108-L-U/S or Avanto-Chiller KCC215-L-U/S, KSC215-L-U/S stands near a SC218-L-U/S))



3.3 Filling the unit with water-ethylene glycol-mixture

Fill with clean water (potable water quality) with Ethylene or Propylene-glycol at the rate of min. 35vol% to max. 38vol%.
Open front panel and fill to a pressure of min.1,5 bar via the feed cock.
After filling, check all connections for leakage.

After filling it is absolute necessary to remove the air of the complete water/glycol system particularly the head of the pump (see also next capture).

Don’t use automotive antifreeze
See also the enclosed Installing instruction

3.4 Draining air from the unit

The SC 218 includes a closed water system.
If air get out of the system the water pressure drops down. If that happens you had to check the water pressure and if its to low you had to refill the water circuit as shown in *fig. 1.4*

The procedure should be repeated until no more air is in the system

After all these steps, turn both switches to position "1". If all the prerequisites for operation have been met, the chiller will start *after 1 minute*.

In case of malfunctions: search for faults, take note of Chapter 9, TROUBLE SHOOTING, in this manual.
See also the enclosed Installing instruction

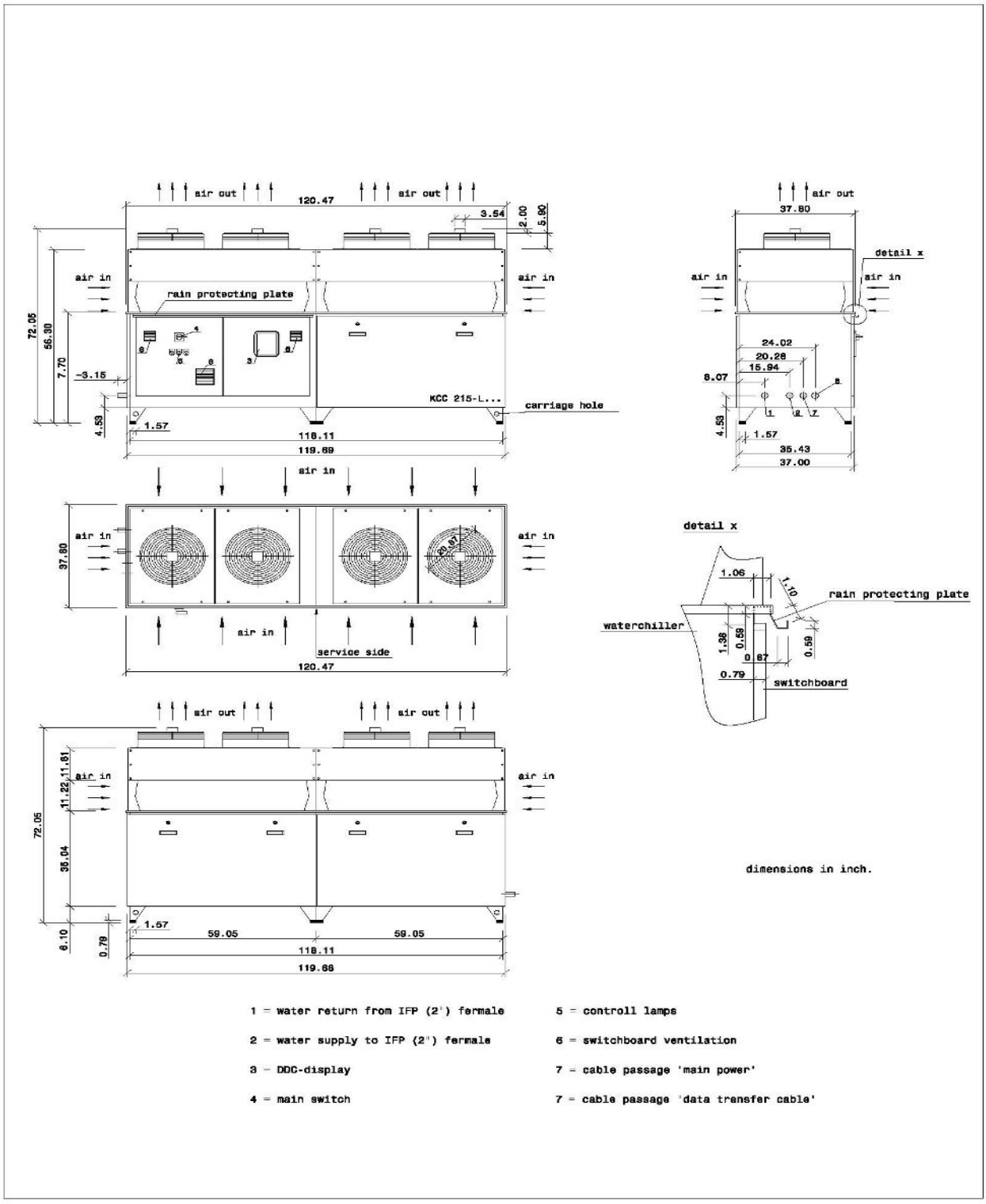
4 Technical Specifications

4.1 Data sheet

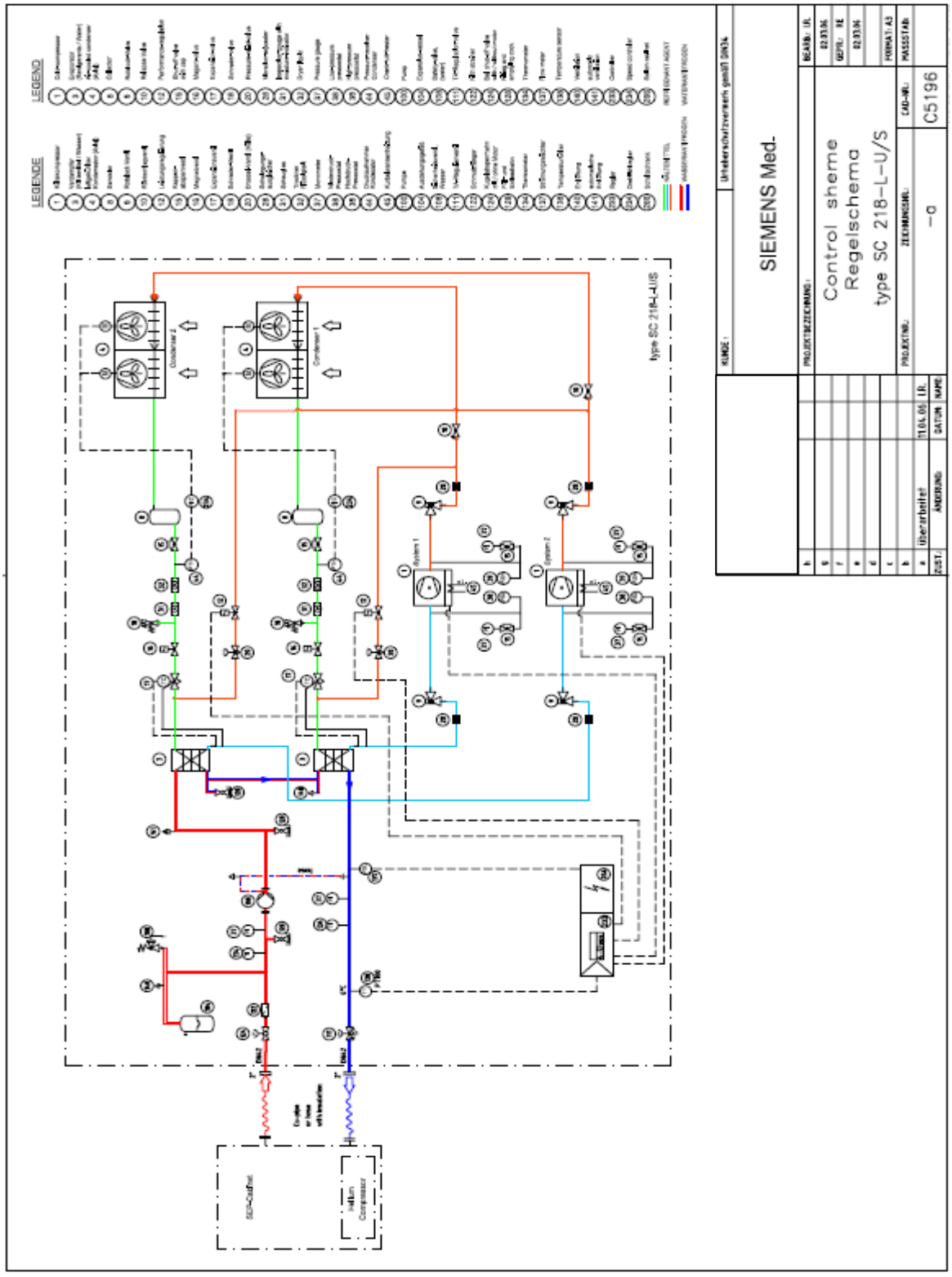
Model	Outdoor		
Dimensions	Depth	940	mm
	Breadth	3040	mm
	Height	1850	mm
Weight without refrigerant load	*ca.*	*1070*	*kg*
Weight with load	*ca.*	*1100*	*kg*
Shipping weight	ca.	1600	kg
Weight total refrigerant load		24,0	kg
Number of fans		4	
Quantity of air	2x	18000	m³/h
Refrigerant		R134a	
Required quantity of refrigerant	See name plate		
High-pressure switch		19	bar
Water connection inlet		2“	G" female
Water connection outlet		2 “	G" female
Cold water temperature outlet	min.	9	°C
Cold water temperature outlet	max.	12	°C
Tolerance		±1,0	K
Primary water pump type		IN-V 10 - 50	
Rated water capacity	min.	7,8	m³/h
Rated water pressure		6,5	bar
Ambient temperature	min.	-20	°C
	max.	+48	°C
Cooling capacity		63,0	kW
Rated cold water outlet temperature		12	°C
Temperature of surroundings		48	°C
Main supply		480 V / 3Ph / 60 Hz	
Control voltage		24	VAc
Fluctuations in main voltage	max.	-14/+10	%

Fluctuations in Frequency	max.	±1	Hz
Power input	max.	29	kW
Loudness	at 10 m	61	db(A)

4.2 Dimensional drawing Type SC 218-L-...



4.3 Water chiller control scheme



5 Transport

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,

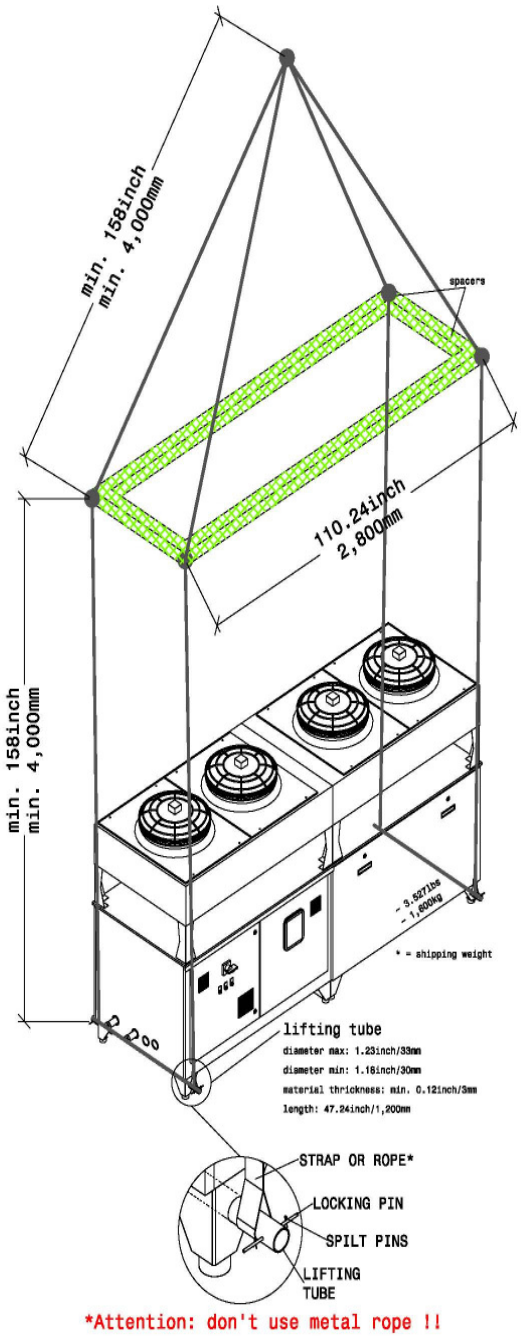
please ensure that the housing is not subjected to pressure at the sides.

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 in question.

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 “Data sheet”, chapter 4.1



6 Installing the chiller

The plant should be mounted in an upright position on a stable foundation.

(Weight with load: see technical specifications).

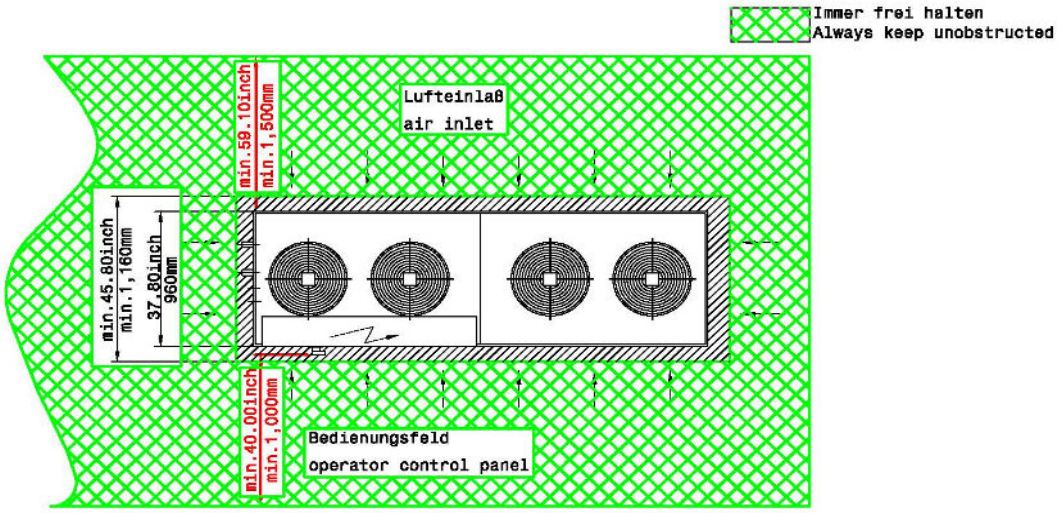
A distance should be kept free on all sides to allow sufficient access for operation and maintenance.

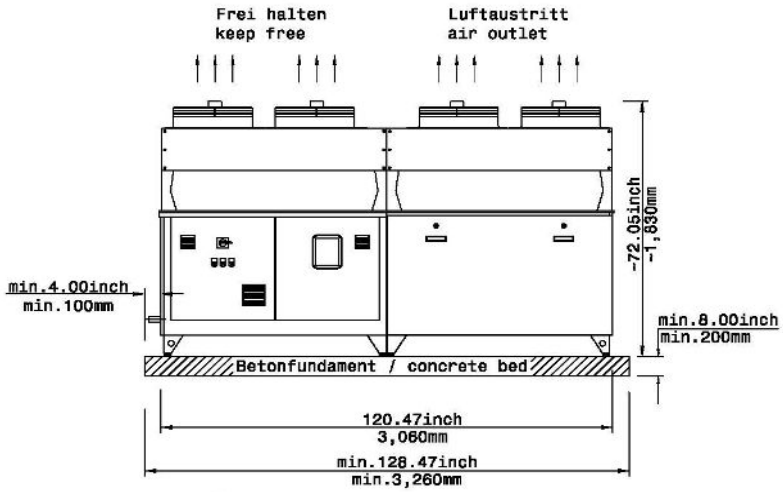
A space of 1,5 m must be left above the apparatus to ensure that air exhaust can leave freely.

Further details can be found in the following installation plans.

See also enclosed “ Installing Instruction “

waterchiller installation I





Maße für Betonfundamente, eventuell entsprechend den örtlichen Verhältnissen anpassen.

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

7 Notes on the water connections

The water connections between industrial coolers of the SC series and the SEP from Siemens can be made of steel, copper or plastic. The nominal widths of the piping for distances of up to approx. 25 m should match at least the dimensions of the fittings on the appliance. (see technical specifications)

Reductions in diameter should be avoided. In case of longer pipelines, the pump pressure should be tested. When choosing the pipe materials, ensure that no electrochemical series are created.

The proper way to seal the European fittings can be done with any of following steps.

1. Pipe sealing cord. There are a number of brands available, however we use Loctite 55
2. Teflon Tape and a Anaerobic sealant.
3. Teflon Tape an Nylog sealant.

As with any sealant, the application instruction must be followed for proper use.

See also enclosed “ Installing Instruction “

8 Power supply

The power supply is wired to the terminal block in the junction box (see technical specifications). The layout of the main cable must comply with the current values and the regulations of the local electricity company.

The Type SC 218 L-... must be run with fuses of no less than 80 in size.

The supply voltage must be 480V / 3ph /60 Hz.

The master and control switches must be in the "OFF" position when the plant is connected.
The supply line is attached to the terminal PE, L1 L2, L3, .

See also 11.24 “Circuit Diagram”

9 TROUBLE SHOOTING

KIND OF TROUBLE	CAUSE	ELIMINATION
• malfunction of plant/system	1. power failure asymmetry, over voltage or low voltage	- check mains connection and asymmetry relay 4A1
	2. temperature sensor defective	- check sensor 6B1 clamp feeler and measure the resistance
	3. controller eliwell malfunction	- check power supply 24VDC 6U1and - fuses 4F1 and 4F2 -
• malfunction of pump 25M1	1. main switch 4Q1 not switched on	- switch on main switch 4Q1
	2. control switch 5S1 on 'OFF'	- switch control switch to 'AUTO' 5S1
	3. motor protection relay 5Q1 defective	- replace relay 5Q1
	4. fuse for control current defective	- replace fuse
	5. pump motor 5M1 defective	- replace pump
	6. flow switch responded 5B1	- check water flow
	7. shortage of water	- check system pressure, clean strainer
• still malfunction of pump	1. overload trip 5Q1 of pump protection interrupted control circuit	- main switch to '0', push in overload trip
• pump makes gurgling noise	1. circuit is not completely vented	- vent and fill up with water/Ethylene glycol
• compressor 7M1 and 10M1 stops	1. Klixon/INT69 tripped 7A1 and 10A1	- Check motor protection 7Q1 and 10Q1 - wait until compressor cooled down; perhaps clean condenser or provide fresh air supply
	2. Klixon/INT69 7A1and 10A1defective	- replace Klixon/INT69
• malfunction of refrigerating machine	1. controller stopped machine, return temperature too cold	- to check function, level down adjustments, wait until return temperature rised

KIND OF TROUBLE	CAUSE	ELIMINATION
• still malfunction of refrigerating machine	1. low pressure in refrigerant circuit	
	- plant looses refrigerant	- find leak, seal, refill circuit
	- dryer in liquid pipe dirty	- replace dryer
	- pressure relief valve defective	- replace pressure relief valve
	- solenoid valve 8Y1 and 11Y1 in liquid pipe defective	- replace solenoid valve
	2. high pressure in refrigerant circuit	
	- condenser dirty	- clean condenser
	- fan defective	- put right electric cause; check fuses 9F2 and 12F2
	- outside temperature too high	- spray condenser with water
	- pressure sensor 9B1 and 12B1 for condenser control defective	- replace pressostate
	- Frequency inverter defective	- replace frequency inverter 9U1 and 12U1
• refrigerating machine starts and stops short-termed	1. not enough fresh air supply for condenser; high pressure pressostate tries to protect refrigerating machine against overload	- provide enough fresh air supply and fresh air removal; get rid of short-circuit across fresh air and exhaust air
	2. not enough pressure of refrigerant circuit; refrigerant partly escaped; diminished pressure switch shut down compressor	- find leak, seal, refill circuit
• not enough refrigeration power	1. air in water circuit	- vent system
	2. fallen below minimum water agitation quantity	- design cross-section of water pipe right; perhaps open check valve in water circuit completely, increase pipe cross-section
	3. not enough fresh air supply for condenser	- provide enough fresh air supply and fresh air removal; get rid of short-circuit across fresh air and exhaust air
	4. not enough refrigerant in circuit	- find leak, seal, refill circuit
•		-

10 Preventive Maintenance: Weekly Check, Two times a year Check

Service and maintenance should always be carried out by skilled technician and, where possible, under a maintenance contract. Nevertheless, certain routine work can be effectively carried out by non-specialists and may become important factor in preventing future damage to the plant.

Weekly Check

1. Check the working of the compressor:

   Look out for too high head temperatures or suspicious noises.

2. Check the refrigerant charge through the sight-glass

3. Check that fans are rotating normally and not making unusual noises

4. Check that the temperatures is within the accepted limit.

   If it is not, check that all the separate elements of the unit are working, by switching them on individually.

   If they are not, see the fault finding guide (9 TROUBLE SHOOTING).

Two times a year Check

KKT Kraus Inspection Requirements Task List

Tasks List	Task List

Control Cabinet
• Check and clean filter
• Replace filter if required
• Check for contamination, corrosion, damage
• Vacuum clean the panel
• Check and tighten cable connections
• Check all control connections
• Check cabinet gaskets, replace if leaking or damaged
• Check operation of controls
• Check and calibrate safeties
	CHILLER COMPRESSOR
	• Visual inspection of chiller, look for
	  ○ Signs of water, oil, or refrigerant leaks
	  ○ Contamination, Damage, corrosion
	• Check for noise or excessive vibrations of compressor
	• Log Compressor operation into maintellance report
	  ○ Compressor discharge and suction pressure
	  ○ Record refrigerant temperature at compressor, evaporator and condenser
	  ○ Chilled water outlet temperature
	  ○ Chilled water Inlet temperature
	  ○ Record Compressor current and compare to rated current
	  ○ Check oil level
	• Check operation of crankcase heater
	• Check operation of all electromechanical devices and refrigerant control valves
	• Check relief valves

	• Leak Test refrigerant circuit • Check setting HP and LP switch • Check refrigerant moisture indicator • Check function of refrigerant metering and shut of valves • Check refrigerant connections for leaks, tighten where required
AIR COOLED CONDENSER / FAN • Check for damage and corrosion • Check general condition of condenser and fan • Check operation of condenser fan • Check journal for noise or excessive vibration • Clean fan blade and check for vibration • Check operation of condenser safeties • Clean condenser coil as needed • Leak test condenser	**EVAPORATOR** • Check systems for contamination, damage, corrosion • Record refrigerant temperature • Record inlet and outlet water temperature • Record superheat temperature • Leak check refrigerant and water circuit
CHILLED WATER SYSTEM • Check chilled water piping and insulation for damage • Check compensators for damage • Check for water leaks • Check water filter for dirt • Check piping and fittings for damage and leaks • Check function of bypass valve • Check function and sealing of shut off valves	**CHILLED WATER PUMP** • Check for contamination, damage, and corrosion, • Check Operation of pump • Check rotary seals • Check operation on controls and safeties • Record current readings and compare to rated • Check strainer for damage • Clean strainer if required • Check for noise or excessive vibration of pump
PIPE AND EXPANSION VESSEL • Check for defilement, damage, corrosion, fixing • Check insulation for damage • Check operation of thermometers • Check operation of manometers • Fill system to to maintain operation level 1,5 bar • Check and maintain ethylene glycol at min. 35% to max. 38% concentration • Check operation of safeties • ventilate water circuit	**ELECTRIC CONTROL PANEL MSR** • Check for contamination, corrosion, damage • Check integrity of protection covers and panels • Check and tighten all connection • Check and tighten all operational components • Check contactors and relays for operation • Check contacts on contactors and relays • Check operation of switches, safeties and controls • Make adjustments on operational controls and safeties.

11 Description of the individual parts

11.1 Evaporator

In the form of a brazed plate heat exchanger Type GEA Ecoflex M25-60 GLX with thermal insulation.

Type-tested helium test at10 – 8 bar.

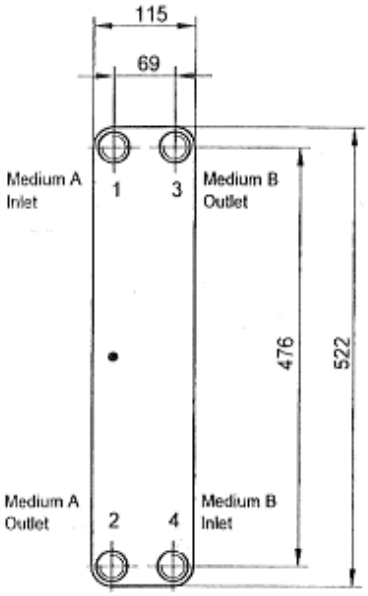
Test pressure

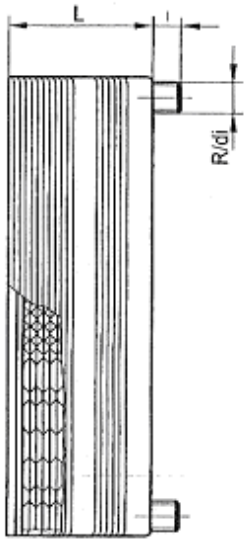
Water		24 bar
Refrigerant	R134a	37,5 bar

GEA Ecoflex GmbH

Dimension sheet
Model 25
brazed plate heat exchanger

No. of plates	L mm	weight empty kg
6	25	3,5
8	30	3,9
10	36	4,3
14	46	5,1
20	61	6,3
24	71	7,1
30	87	8,3
40	112	10,3
50	138	12,3
60	164	14,3
80	215	18,3





Connections

threaded connection:	R = 1”	l = 29,5 mm
soldered connection:	di = 35 mm	l = 29,5 mm

Materials

plates and connections:	W.-1.4401 (AISI 316)
solder:	copper 99,9 %

Operation Plate Heat Exchanger (PHE)

Before each operation make sure that the plate pack is clamped to the correct compression dimension "a" and that the plate heat exchanger is anchored to the ground.

Additionally make sure that all connection pipes are screwed tight and that the permitted values for pressure and temperature given on the fabrication label are not exceeded.

The correct compression dimension can be found on the supplied dimension sheet or fabrication label. Prevent pressure surges when starting up the PHE or after brief stoppages.

If an operating PHE is shut down, it should be cooled down and cleaned afterwards. The plate pack should be loosened to "a" + 10%, starting from the current "a" dimension. This action reduces the pressure on the gaskets
Please check regularly the tightening bolts and coat them with a rust-protection agent (oil or grease).

11.2 Compressor

1 Safety instructions

Copeland Scroll™ compressors are manufactured according to the latest European and US Safety Standards. Particular emphasis has been placed on the user's safety.

These compressors are intended for installation in systems according to the EC Machines directive. They may be put to service only if they have been installed in these systems according to instructions and conform to the corresponding provisions of legislation. For relevant standards please refer to Manufacturers Declaration, available on request.

These instructions should be retained throughout the lifetime of the compressor.

You are strongly advised to follow these safety instructions.

1.1 Icon explanation

	**WARNING** This icon indicates instructions to avoid personal injury and material damage.		**CAUTION** This icon indicates instructions to avoid property damage and possible personal injury.
	**High voltage** This icon indicates operations with a danger of electric shock.		**IMPORTANT** This icon indicates instructions to avoid malfunction of the compressor.
	**Danger of burning or frostbite** This icon indicates operations with a danger of burning or frostbite.	***NOTE***	This word indicates a recommendation for easier operation.
	**Explosion hazard** This icon indicates operations with a danger of explosion.		

1.2 Safety statements

- **Refrigerant compressors must be employed only for their intended use.**
- **Only qualified and authorized HVAC or refrigeration personnel are permitted to install, commission and maintain this equipment.**
- **Electrical connections must be made by qualified electrical personnel.**
- **All valid standards for connecting electrical and refrigeration equipment must be observed.**

Use personal safety equipment. Safety goggles, gloves, protective clothing, safety boots and hard hats should be worn where necessary.

1.3 General instructions

WARNING
System breakdown! Personal injuries! Never install a system in the field and leave it unattended when it has no charge, a holding charge, or with the service valves closed without electrically locking out the system.
System breakdown! Personal injuries! Only approved refrigerants and refrigeration oils must be used.

WARNING
High shell temperature! Burning! Do not touch the compressor until it has cooled down. Ensure that other materials in the area of the compressor do not get in touch with it. Lock and mark accessible sections.

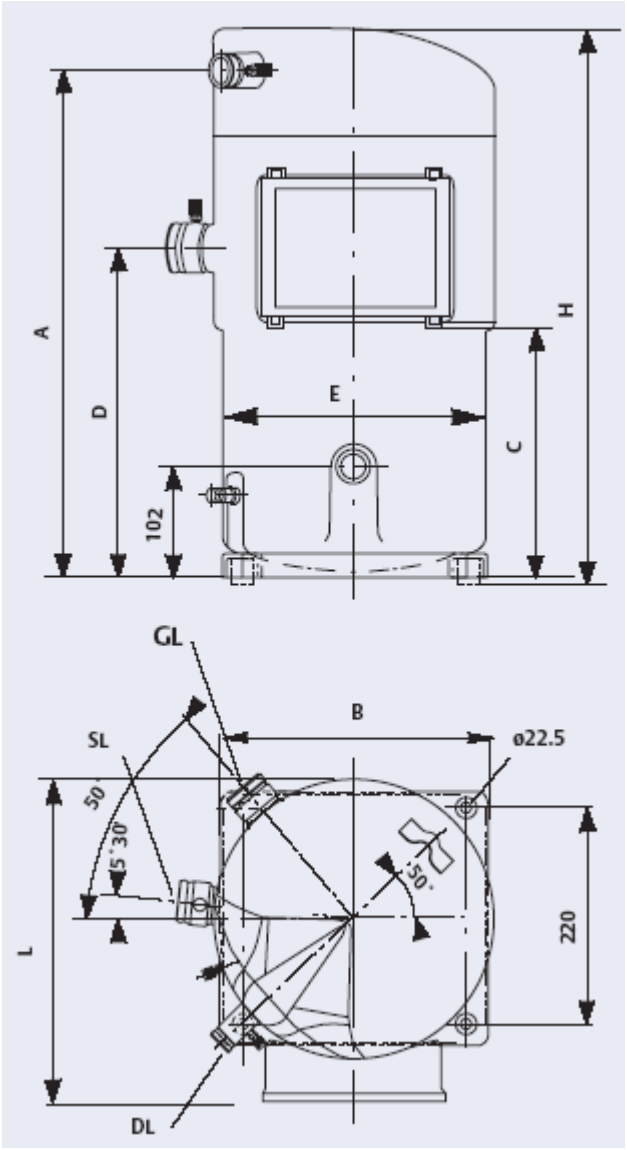
CAUTION
Overheating! Bearing damage! Do not operate compressors without refrigerant charge or without being connected to the system.

IMPORTANT
Transit damage! Compressor malfunction! Use original packaging. Avoid collisions and tilting.

Single-Stage Hermetic Compliant SCROLL Motor-Compressor
Type ZR 19 M3E-TWD

Data Sheet

Drawing



Model Modèle Modell	Dimensions / Dimensions / Abmessungen [mm] A	B	C	D	E	H	L
ZR							
ZR 90 K/E	497	268	224	318	283	538	360
ZR 11 M/E							
ZR 12 M/E							
ZR 16 M/E (2)	505					545	
→ ZR 19 M/E (2)	546					591	

Mechanical Data

Compressor Compresseur Verdichter	Nominal horsepower Puissance nominale Motor-Nennleistung HP (CV)	Displacement Volume balayé Volumenstrom @ 50 Hz, m³/h	Sound pressure level Niveau de Pression Sonore Schalldruck-pegel dBA (@1m)	Oil Quantity (1) Quantité d'huile (1) Ölmenge (1) l	Suction line Tube d'aspiration Saugleitungsanschluss SL Rotalock " (inch)	Brazed - Brasé Lötanschluss " (inch)	Discharge line Tube refoulement Druckleitungsanschluss DL Rotalock " (inch)	Brazed - Brasé Lötanschluss " (inch)	Length / Width Longeur / Largeur Länge / Breite L / B mm	Height Hauteur Höhe H mm	Gross / Net Weight (2) Poids brut / net (2) Gewicht brutto / netto (2) kg
ZR19M*	15	42,8	69	4,1	2 1/4	1 5/8	1 3/4	1 1/8	321/349	596	130 / 119

Electrical Data

Compressor Compresseur Verdichter	Maximum Operating Current (3) Intensité max. de fonctionnement (3) Max. Betriebsstrom (3) A PFJ	TF5	TFD	TWC	TWD	Locked Rotor Current (4) Courant rotor bloqué (4) Blockierter Rotorstrom (4) A PFJ	TF5	TFD	TWC	TWD	Winding Resistance Résistance bobinage Wicklungswiderstand (Ohm, Ω) PFJ (5)	TF5	TFD	TWC	TWD
ZR19M*	-	-	-	69,0	32,0	-	-	-	390,0	198,0	-	-	-	0,19	0,72

Accessories

- Crankcase Heater: 220 – 240 V 50 – 60 Hz

Single-Stage Hermetic Compliant SCROLL Motor-Compressor
Type ZR 19 M3E-TWD

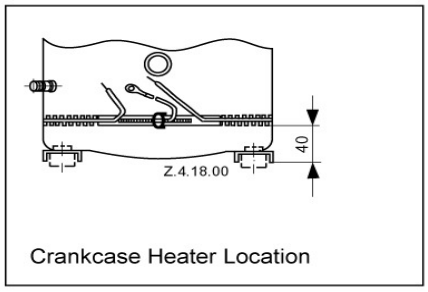
Introduction

This bulletin describes the operating characteristics, design features, and application requirements for 7.5 to 25 HP A/C Scroll Compressors in the range from ZR 90 K3 to ZR 300 KC. This family of scroll compressors is characterized by the pilot duty motor protection system that uses internal sensors and an external electronic module to protect the compressor against motor overheating and excessive discharge temperature. For additional information, please refer to the “Product Catalogue“ or to the “Copeland Selection Software” accessible from the Copeland website at www.ecopeland.com. There are several operating characteristics and design features described below that are different from those of the smaller Copeland Scroll compressor models. These guidelines are not meant to replace the system expertise available from system manufacturers.

***ARI-Conditions:**

7,2 °C	evaporating temperature	8,3 K	liquid subcooling
54,4 °C	condensing temperature	35 °C	ambient temperature
11 K	suction gas superheat		

Crankcase Heaters



Crankcase Heater Location

The crankcase heater must be mounted below the oil removal valve located on the bottom shell. **The crankcase heater must remain energized during compressor off cycles.**

The initial start in the field is a very critical period for any compressor because all load bearing surfaces are new and require a short break-in period to carry high loads under adverse conditions. **The crankcase heater must be turned on a minimum of 12 hours prior to starting the compressor**. This will prevent oil dilution and bearing stress on initial start up. If it is not feasible to turn on the crankcase heater 12 hours in advance of starting the compressor, then use one of the techniques listed below to prevent possible flooded-start damage to the compressor:

1) Direct a 500 watt heat lamp or other safe heat source **(do not use torch)** at the lower shell of the compressor for approximately 30 minutes to boil off any liquid refrigerant prior to starting; or
2) Bump start the compressor by manually energizing the compressor contactor for about one second. Wait five seconds and again manually energize compressor for one second. Repeat this cycle several times until the liquid in the shell has been boiled off and the compressor can be safely started and run continuously.

Due to the Compliant Scroll’s inherent ability to handle liquid refrigerant in flooded conditions, no crankcase heater is required when the system charge does not exceed following values:

· 7,7 kg	for	ZR 90 K3* ... ZR 19 M3*
· 11,3 kg	for	ZR 250 KC*
· 13,6 kg	for	ZR 300 KC*

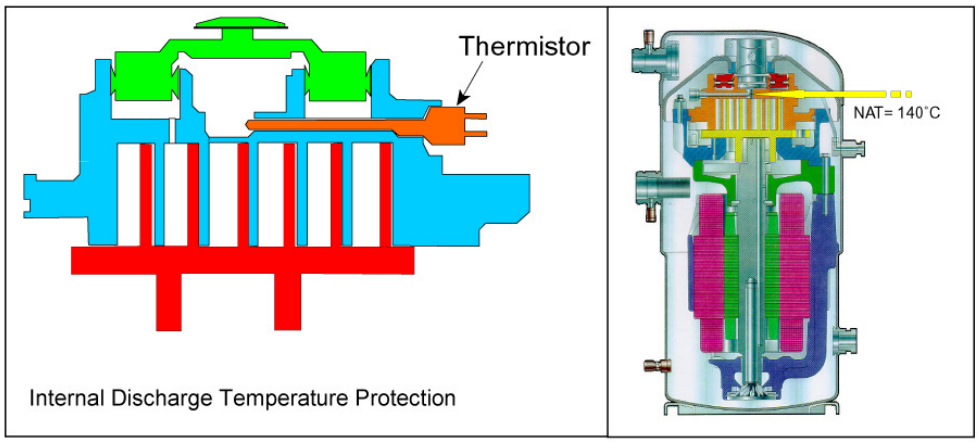
A crankcase heater is needed to drive out excessive amounts of refrigerant that have migrated into the shell during standstill periods and no accumulator is piped to provide free liquid drainage during the off cycle.

Minimum Run Time

There is no set answer to how often scroll compressors can be started and stopped in an hour, since it is highly dependent on system configuration. There is no minimum off time, because the scrolls start unloaded, even if the system has unbalanced pressures. The most critical consideration is the minimum run time required to return oil to the compressor after startup. This is easily determined since these compressors are equipped with a sight glass. The minimum on time becomes the time required for oil lost on compressor startup to return to the compressor sump and restore a normal level in the sight glass. Cycling the compressor for a shorter time than this, for instance to maintain very tight temperature control can result in progressive loss of oil and damage to the compressor.

Discharge Temperature Protection

A thermistor with a nominal response temperature of 140 °C is located in the discharge port of the fixed scroll. Excessive discharge temperature will cause the electronic protector module to trip (see also **Electronic Motor Protection**). The discharge gas sensor is wired in series with the motor thermistor chain



Internal Discharge Temperature Protection

Electronic Motor Protection

The electronic motor protection system as used in all ZR 90 K3* ... ZR 300 KC* models is identified by a “W” as the center letter in the motor code. This system utilizes the temperature dependent resistance of thermistors (also called PTC-resistances) to read the winding temperature. A chain of four thermistors connected in series is embedded in the motor windings so that the temperature of the thermistors can follow the winding temperature with little inertia. An electronic module is required to process the resistance values and trip a control relay depending on the thermistor resistance. The characteristic gradient of a thermistor resistance curve is shown in **Fig. 6**. The resistance curve can be designed for different operating points, the nominal response temperature (NAT), e.g. 80°C, 100°C, 140°C, and must comply with the tolerances laid out in the standard DIN 44081.

Single-Stage Hermetic Compliant SCROLL Motor-Compressor
Type ZR 19 M3E-TWD

Module

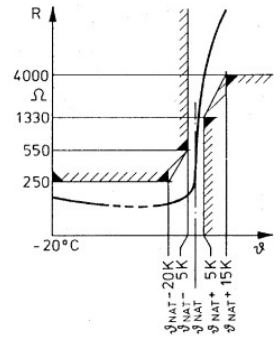
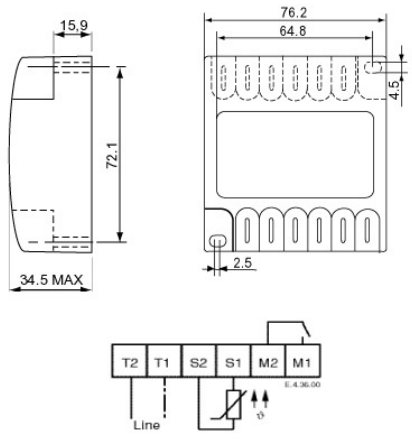


Fig. 6: Thermistor Resistance Curve

Protector Specifications :

Type:	Kriwan INT 69 SC/ Carel
Voltage:	24 V AC; 230 V AC,120/240 V AC
Control Rating:	60 VA, 25 A Inrush 300/375 VA 25/15 A Inrush
Normal PTC resistance:	250 to 1000 Ohms
Trip resistance:	>4500 Ohm +/- 20%
Reset resistance:	<2750 Ohms
Module time out:	30 minutes +/- 5 minutes
Low Voltage Sensing:	None
Phase Monitor:	No



L1/T1 neutral connection
L2/T2 line voltage connection
S1, S2 thermistor chain connection
M1, M2 control circuit connection

Fig. 7: Motor Protection Module

For protection in case of blocked rotor one thermistor for each phase is embedded in the winding heads on the upper (suction gas) side of the compressor motor. A fourth thermistor is located in a winding head at the lower end of the motor. A fifth sensor is located in the discharge port of the fixed scroll to control discharge gas superheat. The entire chain is internally led to the fusite from where it is connected to the module connections S1 and S2 (see **Fig. 7**). When any resistance of the thermistor chain reaches the tripping value, the module interrupts the control line and causes the compressor to switch off. After the thermistor has cooled sufficiently, its resistance drops to the reset value but the module itself resets after a time delay of 30 minutes and restarts the compressor.

Single-Stage Hermetic Compliant SCROLL Motor-Compressor
Type ZR 19 M3E-TWD

Protector Functional Check and Failure Detection

Prior to start-up of the compressor a functional check shall be carried out:
- Switch off power!
- Disconnect one terminal either S1 or S2 of the electronic module. If the compressor is now switched on, the motor should not start.
- Switch off power.
- Reconnect the disconnected thermistor line. If the compressor is now switched on the motor must start.

Protector Fault Diagnosis:

If the motor does not start-up during the functional check, this indicates a disturbance in operation:
- Switch off power.
- Check the connection of the thermistor leads in the terminal box and at the protection module for possible loose connections and check the connection cable for possible breakage.
- The resistance of the thermistor chain shall be measured in a cold condition, i.e. after the motor has sufficiently cooled down.

Caution: Use maximum measuring voltage of 3 V!
In doing so, the thermistor leads at terminals S1 and S2 of the module shall be disconnected and measured between the leads. Resistance must be between 150 and 1250 ohms.
If the thermistor chain has a higher resistance (2750 ohms or greater) the motor temperature is still too high and it has to be allowed to cool.
If the resistor is 0 ohms, the compressor has to be exchanged due to shorted sensor circuit. ∞ ohms indicates an open sensor circuit and the compressor has to be replaced.
If no defect is located in the thermistor chain or there is no loose contact or conductor breakage, the module shall be checked. Then the control connections at M1 and M2 have to be removed (Caution! Switch off voltage supply first!) and check the switching conditions by an ohmmeter or signal buzzer:
- short-cut the already disconnected thermistor contactors S1 and S2 and switch on the voltage supply; the relay must switch; connection established between contactors M1 and M2
-remove the jumper between S1 and S2, the relay must switch off; no connection between contactors M1 and M2
- shortcut the contactors S1 and S2 again, the relay remains switched off; no connection between contactors M1 and M2
- switch off the voltage supply for approximately 4 sec and switch it on again, the relay must switch on now; connection between contactors M1 and M2
If one of the above conditions is not met, the module is defective and has to be exchanged.

Note: The power should be switched off between the tests, in order to avoid short circuits and accidental touching of contacts. The function of the module should be tested each time the fuse in the control circuit breaks the power supply. This makes sure that the contacts did not stick.

Shell Temperature

Certain types of system failures, such as condenser or evaporator fan blockage or loss of charge, may cause the top shell and discharge line to briefly but repeatedly reach temperatures above 177ºC as the compressor cycles on its internal protection devices. Care must be taken to ensure that wiring or other materials, which could be damaged by these temperatures, do not come in contact with these potentially hot areas.

Single-Stage Hermetic Compliant SCROLL Motor-Compressor
Type ZR 19 M3E-TWD

Compressor Functional Check

A functional compressor test with the suction service valve closed to check how low the compressor will pull suction pressure is **not** a good indication of how well a compressor is performing. **Such a test will damage a scroll compressor**. The following diagnostic procedure should be used to evaluate whether a Copeland Scroll compressor is working properly.

1. Proper voltage to the unit should be verified.
2. The normal checks of motor winding continuity and short to ground should be made to determine if an internal motor short or ground fault has developed. If the protector has opened, the compressor must be allowed to cool sufficiently to allow it to reset.
3. Proper indoor and outdoor blower/fan operation should be verified.
4. With service gauges connected to suction and discharge pressure fittings, turn on the compressor. If suction pressure falls below normal levels, the system is either low on charge or there is a flow blockage in the system.
5. If suction pressure does not drop and discharge pressure does not rise to normal levels, reverse any two of the compressor power leads and reapply power to make sure compressor was not wired to run in reverse direction. If pressures still do not move to normal values, either the reversing valve (if so equipped) or the compressor is faulty. Reconnect the compressor leads as originally configured and use normal diagnostic procedures to check operation of the reversing valve.
6. To test if the compressor is pumping properly, the compressor current draw must be compared to published compressor performance curves using the operating pressures and voltage of the system. If the average measured current deviates more than ±15% from published values, a faulty compressor may be indicated. A current imbalance exceeding 15% of the average on the three phases may indicate a voltage imbalance and should be investigated further.
7. **Before replacing or returning a compressor:** Be certain that the compressor is actually defective. As a minimum, recheck a compressor returned from the field in the shop or depot for winding resistance and ability to start before returning. More than one-third of compressors returned to Copeland for warranty analysis are determined to have nothing found wrong. They were misdiagnosed in the field as being defective. Replacing working compressors unnecessarily costs everyone.

Installation System Charging Procedure

Because scrolls have discharge check valves, systems should be charged on both the high and low side simultaneously to assure refrigerant pressure is present in the compressor before it is tested or operated. The majority of the charge should be placed in the high side of the system to prevent bearing washout during first-time start on the assembly line. It is best to charge only vapor into the low side of the system.

Do not operate compressor without enough system charge to maintain at least 0.5 bar suction pressure. Do not operate with a restricted suction. Do not operate with the low pressure cut-out jumpered.

Allowing pressure to drop below 0.5 bar for more than a few seconds may overheat scrolls and cause early drive bearing damage. Do not use compressor to test opening setpoint of high pressure cutout. Bearings are susceptible to damage before they have had several hours of normal running for proper break in.

Caution: If you change a damaged compressor it is necessary to change the contactor or soft starter!

2.4 Application range

2.4.1 Qualified refrigerants and oils

IMPORTANT
It is essential that the glide of refrigerant blends (primarily R407C) is carefully considered when adjusting pressure and superheat controls.

Oil recharge values can be taken from Copeland Scroll™ compressors brochures or Copeland® Brand Products Selection Software.

Qualified refrigerants	R22	R407C, R134a, R22	R410A
Copeland® Brand Products standard oil	White oil / Suniso 3 GS	Emkarate RL 32 3MAF	
Servicing oil	Suniso 3 GS / White oil	Emkarate RL 32 3MAF	
		Mobil EAL Arctic 22 CC	

Table 1: Qualified refrigerants and oils

2.4.2 Application limits

CAUTION
Inadequate lubrication! Compressor breakdown! The superheat at the compressor suction inlet must always be sufficient to ensure that no refrigerant droplets enter the compressor. For a typical evaporator-expansion valve configuration a minimum stable superheat of at least 5K is required.

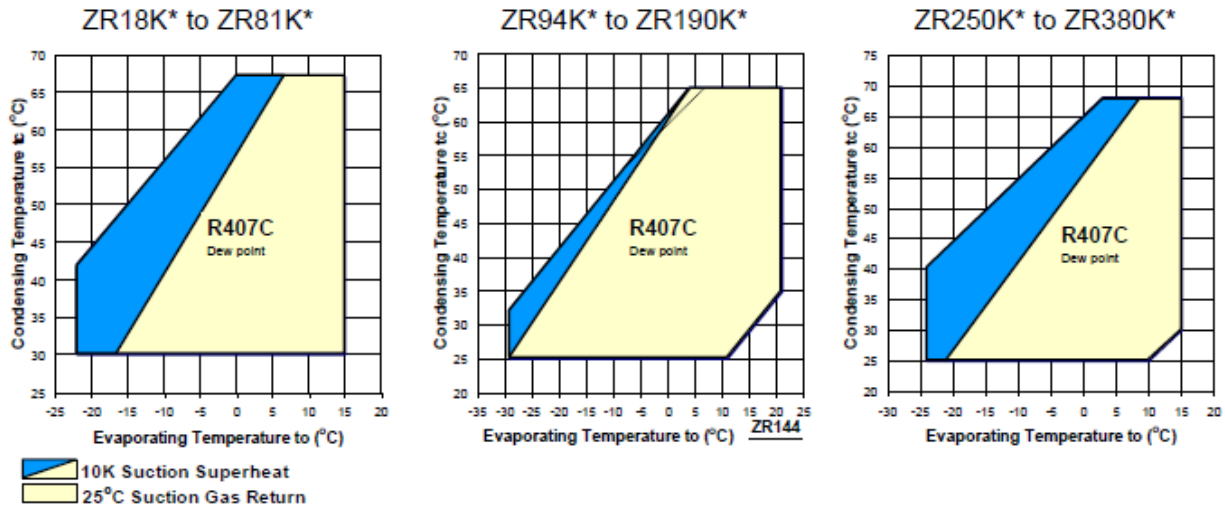


Figure 1: Application envelopes for compressors ZR18K* to ZR380K* with R407C

3 Installation

WARNING
High pressure! Injury to skin and eyes possible! Be careful when opening connections on a pressurized item.

3.1 Compressor handling

3.1.1 Transport and storage

WARNING
Risk of collapse! Personal injuries! Move compressors only with appropriate mechanical or handling equipment according to weight. Keep in the upright position. Stack pallets on top of each other when not exceeding 300 kg. Do not stack single boxes on top of each other. Keep the packaging dry at all times.

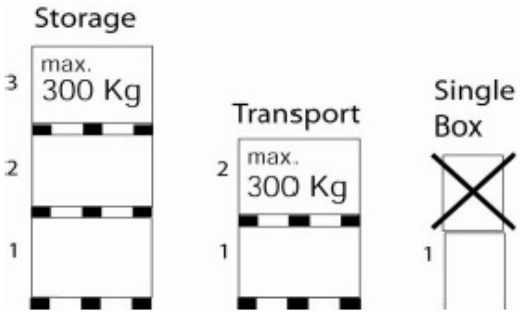


Figure 3

3.1.2 Positioning and securing

IMPORTANT
Handling damage! Compressor malfunction! Only use the lifting eyes whenever the compressor requires positioning. Using discharge or suction connections for lifting may cause damage or leaks.

For models ZR94K* to ZR190K* and ZP103K* to ZP182K*, because oil might spill out of the suction connection located low on the shell, the suction connection plug must be left in place until the compressor is set into the unit. If possible, the compressor should be kept vertical during handling. The discharge connection plug should be removed first before pulling the suction connection plug to allow the dry air pressure inside the compressor to escape. Pulling the plugs in this sequence prevents oil mist from coating the suction tube making brazing difficult. The copper coated steel suction tube should be cleaned before brazing. No object, eg, a swaging tool should be inserted deeper than 51 mm into the suction tube or it might damage the suction screen and motor.

3.1.3 Installation location

Ensure the compressors are installed on a solid level base.

4 Electrical connection

4.1 General recommendations

The compressor terminal box has a wiring diagram on the inside of its cover. Before connecting the compressor, ensure the supply voltage, the phases and the frequency match the nameplate data.

Attention: Motorcode 650 need Molded Plug for Re power connection!

4.2 Electrical installation

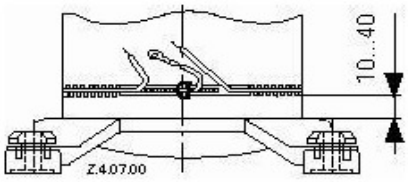
Crankcase heaters

IMPORTANT
Oil dilution! Bearing malfunction! Turn the crankcase heater on 12 hours before starting the compressor.

A crankcase heater is required when the system charge exceeds the compressor charge limits listed in **Table 3**.

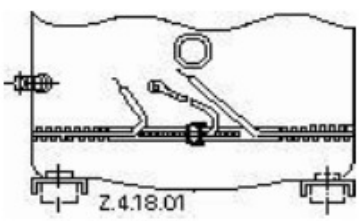
Model	Refrigerant charge limit
ZR18K*	2.7 kg
ZR22K* to ZR81K* / ZP24K* to ZP91K*	4.5 kg
ZR94K* to ZR190K* / ZP103K* to ZP182K*	7.0 kg
ZR250K* / ZP235K*	11.3 kg
ZR310K* to ZR380K* / ZP295K* to ZP385K*	13.6 kg
ZP485K*	16.0 kg

Table 3



For compressors ZR18K* to ZR81K* and ZP24K* to ZP91K*, the crankcase heater must be mounted 10 to 40 mm above compressor legs (see **Figure 12**).

Figure 12: Crankcase heater location, models ZR18K* to ZR81K* & ZP24K* to ZP91K*



For all other compressor models, the crankcase heater must be mounted below the oil removal valve located on the bottom shell (see **Figure 13**).

Figure 13: Crankcase heater location, models ZR94K* to ZR380K* & ZP103K* to ZP485K*

Internal pressure relief valve

There is an internal pressure relief valve on all ZR18K* to ZR81K* and ZP24K* to ZP91K* compressors, which opens at a differential pressure of 28 bar ± 3 bar for ZR compressors and 40 bar ± 3 bar for ZP compressors between high- and low-pressure sides. A high-pressure cut-out may be required according to national regulations and is strongly recommended due to the capabilities of pumping to high pressures once the discharge is obstructed. The internal pressure relief valve is a safety device, not an HP switch. It is not designed for repeated operation and there is no guarantee that it will reset correctly if it does have repeated operation.

The following compressors do NOT have any internal pressure relief valve: ZR94K* to ZR190K* and ZP90K* to ZP182K* (Summit range), ZR250K* to ZR380K* and ZP235K* to ZP485K*.

Discharge temperature protection

The ZR18K* to ZR81K* and ZP24K* to ZP91K* compressors have an internal thermo-disc discharge gas temperature protection. This thermo-disc opens a gas passage from the discharge port to the suction side near the motor protector when the discharged gas reaches a critical temperature. The hot gas then causes the motor protector to trip shutting down the compressor.

ZR94K* to ZR190K* and ZP103K* to ZP182K* Scroll compressors built in October 2004 and later (04J) have the addition of the Advanced Scroll Temperature Protection (ASTP). Advanced Scroll Temperature Protection is also a temperature sensitive thermo-disc that acts to protect the compressor from discharge gas overheating. Once the discharge gas reaches a critical temperature, the ASTP feature will cause the scrolls to separate and stop pumping although the motor continues to run. After running for some time without pumping gas, the motor protector will open.

To identify compressors with Advanced Scroll Temperature Protection, a label has been added above the terminal box.

Figure 14: Advanced Scroll Temperature Protection (ASTP)

***NOTE:* Depending upon the heat build-up in the compressor, it may take more than one hour for the ASTP and motor protector to reset!**

For compressors ZR250K* to ZR380K* and ZP235K* to ZP485K*, a thermistor is located in the discharge port of the fixed scroll. Excessive discharge temperature will cause the electronic protector module to trip. The discharge gas thermistor is wired in series with the motor thermistor chain.

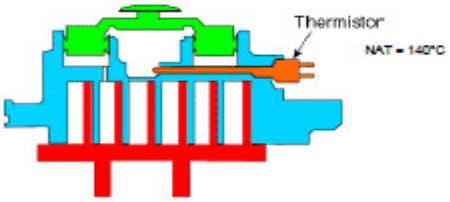
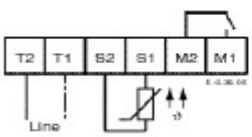


Figure 15: Internal discharge temperature sensor position

Motor protection

For the ZR18K* to ZR190K* and ZP24K* to ZP182K* range of compressors, conventional inherent internal line break motor protection is provided.

The electronic motor protection system used in all ZR250K* to ZR380K* and ZP235K* to ZP485K* models is identified by a "W" as the centre letter in the motor code. This system utilizes the temperature-dependent resistance of the thermistors (also called PTC-resistance) to read the winding temperature. A chain of four thermistors connected in series is embedded in the motor windings so that the temperature of the thermistors can follow the winding temperature with little inertia. An electronic module is required to process the resistance values and trip a control depending on the thermistor resistance.



L1/T1 neutral connection
L2/T2 line voltage connection
S1, S2 thermistor chain connection
M1, M2 control circuit connection

Figure 16: Wiring of the motor protection module

Module

For protection in case of blocked rotor one thermistor for each phase is embedded in the winding heads on the upper (suction gas) side of the compressor motor. A fourth thermistor is located in a winding head at the lower end of the motor. A fifth sensor is located in the discharge port of the fixed scroll to control discharge-gas superheat. The entire chain is internally led to the

fusite from where it is connected to the module connections S1 and S2. When any resistance of the thermistor chain reaches the tripping value, the module interrupts the control line and causes the compressor to switch off. After the thermistor has cooled sufficiently, its resistance drops to the reset value but the module itself resets after a time delay of 30 minutes and restarts the compressor.

Supply voltage: Dual voltage	115-230V AC 50 Hz, -15%...+10%, 3VA
Supply voltage: Dual voltage	120-240V AC 60 Hz, -15%...+10%, 3VA
Supply voltage	24V AC 50/60 Hz, -15%...+10%, 3VA
Supply voltage	24V DC ± 20%, 2W
Ambient temperature range	-30…+70°C
R_{25}, total	< 1,8kΩ
Trip resistance	4,50kΩ ± 20%
Reset time delay type 1 / type 2	30 min ± 5 min / 60 min ± 5 min
Reset of running time	Power interruption / mains failure for approx. 5 sec
Short circuit monitoring system	Typically < 30Ω
Protection class according to EN 60529	IP00
Weight	Approximately 200 g
Mounting	Screw in or snap in
Housing material	PA66 GF25 FR

Table 4: Protection module specifications INT69SC2

Protector functional check and failure detection

WARNING
Conductor cables! Electrical shock! Shut off power supply before and between each test.

Prior to start-up of the fully connected compressor a functional check shall be carried out:

- Disconnect one terminal either S1 or S2 of the protection module. If the compressor is now switched on, the motor should not start (simulation of an open thermistor chain).
- Reconnect the disconnected thermistor line. If the compressor is now switched on, the motor must start.

If the motor does not start up during the functional check, this indicates a disturbance in operation. The following steps should be followed:

Checking the connection

- Check the connection of the thermistor leads in the terminal box and at the protection module for possible loose connections or cable breakage.

If there is neither loose connection nor cable breakage the resistance of the thermistor chain must be checked.

Checking the compressor thermistor chain

Caution: Use maximum measuring voltage of 3V!

The thermistor leads at terminals S1 and S2 of the module shall be disconnected and the resistance measured between the leads. The resistance must be between 150 Ω and 1250 Ω.

- If the thermistor chain has a higher resistance (2750 Ω or higher), the motor temperature is still too high and it must be allowed to cool. Then measure again.
- If the resistance is below 30 Ω, the compressor has to be exchanged due to shorted sensor circuit.
- An infinite value indicates an open sensor circuit and the compressor has to be replaced.

If no defect is detected in the thermistor chain the module must be checked.

Checking the protection module

The control connections at M1 and M2 have to be removed and the switching conditions must be checked by an ohmmeter or signal buzzer:

- Simulation of a short circuit in the thermistor chain (0 Ω): Bridge the already disconnected thermistor terminals S1 and S2 and switch on the voltage supply; the relay must switch on then off again after a short period; connection established then interrupted between terminals M1 and M2.
- Simulation of an open thermistor chain (∞ Ω): Remove the jumper used for the short-circuit simulation and switch on the voltage supply; the relay remains switched off; no connection between terminals M1 and M2.

If one of the above conditions is not met, the module is defective and has to be exchanged.

***NOTE:* The function of the module should be tested each time the fuse in the control circuit breaks the power supply. This ensures the contacts did not stick.**

High-potential testing

WARNING
Conductor cables! Electrical shock! Shut off power supply before high-potential testing.

CAUTION
Internal arcing! Motor destruction! Do not carry out high-voltage or insulation tests if the compressor housing is under vacuum.

Emerson Climate Technologies subjects all Scroll compressors to a high-voltage test after final assembly. Each motor phase winding is tested, according to EN 0530 or VDE 0530 part 1, at a differential voltage of 1000V plus twice the nominal voltage. Since high-voltage tests lead to premature ageing of the winding insulation additional tests of that nature are not recommended.

If it has to be done for any reason, a lower voltage must be used. Disconnect all electronic devices, eg, motor protection module, fan speed control, etc prior to testing.

5 Starting up & operation

Charging procedure

CAUTION
Low suction pressure operation! Compressor Damage! Do not operate with a restricted suction. Do not operate with the low-pressure cut-out bridged. Do not operate compressor without enough system charge to maintain at least 0.5 bar suction pressure. Allowing pressure to drop below 0.5 bar for more than a few seconds may overheat scrolls and cause early drive bearing damage.

The system should be liquid-charged through the liquid-receiver shut-off valve or through a valve in the liquid line. The use of a filter drier in the charging line is highly recommended. Because R410A and R407C are blends and scrolls have discharge check valves, systems should be liquid-charged on both the high and low sides simultaneously to ensure a positive refrigerant pressure is present in the compressor before it runs. The majority of the charge should be placed in the high side of the system to prevent bearing washout during first-time start on the assembly line.

Initial start-up

CAUTION
Oil dilution! Bearing malfunction! It is important to ensure that new compressors are not subjected to liquid abuse. Turn the crankcase heater on 12 hours before starting the compressor.

CAUTION
High discharge pressure operation! Compressor damage! Do not use compressor to test opening set point of high-pressure cut-out. Bearings are susceptible to damage before they have had several hours of normal running in.

Liquid and high pressure loads could be detrimental to new bearings. It is therefore important to ensure that new compressors are not subjected to liquid abuse and high-pressure run tests. It is not good practice to use the compressor to test the high-pressure switch function on the production line. Switch function can be tested with nitrogen prior to installation and wiring can be checked by disconnecting the high-pressure switch during the run test.

Rotation direction

Scroll compressors, like several other types of compressors, will only compress in one rotational direction. Direction of rotation is not an issue with single-phase compressors since they will always start and run in the proper direction. Three-phase compressors will rotate in either direction depending upon phasing of the power. Since there is a 50-50 chance of connecting power in such a way as to cause rotation in the reverse direction, **it is important to include notices and instructions in appropriate locations on the equipment to ensure proper rotation direction when the system is installed and operated**.

Observing that suction pressure drops and discharge pressure rises when the compressor is energized allows verification of proper rotation direction. There is no negative impact on durability caused by operating three-phase Copeland Scroll™ compressors in the reversed direction for a short period of time (under one hour) but oil may be lost. Oil loss can be prevented during reverse rotation if the tubing is routed at least 15 cm above the compressor. After several minutes of operation in reverse, the compressor's protection system will trip due to high motor temperature. The operator will notice a lack of cooling. However, if allowed to repeatedly restart and run in reverse without correcting the situation, the compressor will be permanently damaged.

All three-phase scroll compressors are identically wired internally. Therefore, once the correct phasing is determined for a specific system or installation, connecting properly phased power leads to the identified compressor terminals will ensure proper rotation direction.

Deep vacuum operation

CAUTION
Vacuum operation! Compressor damage! Scroll compressors should never be used to evacuate a refrigeration or air-conditioning system.

The scroll compressor can be used to pump down refrigerant in a unit as long as the pressures remain within the operating envelope. Low suction pressures will result in overheating of the scrolls and permanent damage to the compressor drive bearing. ZP and ZR scrolls incorporate internal low vacuum protection; the floating seal unloads when the pressure ratio exceeds approximately 10:1.

Pump down cycle

A pump down cycle for control of refrigerant migration may be used in conjunction with a crankcase heater when the compressor is located so that cold air blowing over the compressor makes the crankcase heater ineffective.

If a pump down cycle is used, a separate external check valve must be added. The scroll discharge check valve is designed to stop extended reverse rotation and prevent high-pressure gas from leaking rapidly into the low side after shut off. The check valve will in some cases leak more than reciprocating compressor discharge reeds, normally used with pump down, causing the scroll compressor to recycle more frequently. Repeated short-cycling of this nature can result in a low oil situation and consequent damage to the compressor. The low-pressure control differential has to be reviewed since a relatively large volume of gas will re-expand from the high side of the compressor into the low side after shutdown.

Pressure control setting: Never set the low-pressure control to shut off outside of the operating envelope. To prevent the compressor from running into problems during such faults as loss of charge or partial blockage, the control should not be set lower than 12 to 15 K equivalent suction pressure below the lowest design operating point.

Minimum run time

Emerson Climate Technologies recommends a maximum of 10 starts per hour. There is no minimum off time because scroll compressors start unloaded, even if the system has unbalanced pressures. The most critical consideration is the minimum run time required to return oil to the compressor after start-up. To establish the minimum run time obtain a sample compressor equipped with a sight tube (available from Emerson Climate Technologies) and install it in a system with the longest connecting lines that are approved for the system. The minimum on time becomes the time required for oil lost during compressor start-up to return to the compressor sump and restore a minimal oil level that will ensure oil pick-up through the crankshaft. Cycling the compressor for a shorter period than this, for instance to maintain very tight temperature control, will result in progressive loss of oil and damage to the compressor.

Shut-off sound

Scroll compressors incorporate a device that minimizes reverse rotation. The residual momentary reversal of the scrolls at shut off will cause a clicking sound, but it is entirely normal and has no effect on compressor durability.

Frequency

There is no general release of standard Copeland Scroll™ compressors for use with variable speed AC drives. There are numerous issues that must be considered when applying Scroll compressors with variable speed, including system design, inverter selection, and operating envelopes at various conditions. Only frequencies from 50 Hz to 60 Hz are acceptable. Operation outside this frequency range is possible but should not be done without specific Application Engineering review. The voltage must vary proportionally to the frequency.

If the inverter can only deliver a maximum voltage of 400V, the amps will increase when the speed is above 50 Hz, and this may give rise to nuisance tripping if operation is near the maximum power limit and/or compressor discharge temperature limit.

Oil level

The oil level should be maintained at mid-point of the sight glass. If an oil regulator is being used the level should be set within the top half of the sight glass.

6 Maintenance & repair

Replacing a compressor

CAUTION
Inadequate lubrication! Bearing destruction! Exchange the accumulator after replacing a compressor with a burned out motor. The accumulator oil return orifice or screen may be plugged with debris or may become plugged. This will result in starvation of oil to the new compressor and a second failure.

Compressor replacement

In the case of a motor burnout, the majority of contaminated oil will be removed with the compressor. The rest of the oil is cleaned through the use of suction and liquid line filter driers. A 100% activated alumna suction line filter drier is recommended but must be removed after 72 hours. **It is highly recommended that the suction accumulator be replaced if the system contains one.** This is because the accumulator oil-return orifice or screen may be plugged with debris or may become plugged shortly after a compressor failure. This will result in starvation of oil to the replacement compressor and a second failure. When a single compressor or tandem is exchanged in the field, it is possible that a major portion of the oil may still be in the system. While this may not affect the reliability of the replacement compressor, the extra oil will add to rotor drag and increase power usage.

Start-up of a new or replacement compressor

Rapid charging only on the suction side of a scroll-equipped system or condensing unit can occasionally result in a temporary no start condition for the compressor. The reason for this is that, if the flanks of the compressor happen to be in a sealed position, rapid pressurisation of the low side without opposing high-side pressure can cause the scrolls to seal axially. As a result, until the pressures eventually equalise, the scrolls can be held tightly together preventing rotation. The best way to avoid this situation is to charge on both the high and low sides simultaneously at a rate which does not result in axial loading of the scrolls.

A minimum suction pressure of 1.75 bar must be maintained during charging. Allowing pressure to drop below 0.5 bar for more than a few seconds may overheat scrolls and cause early drive bearing damage. Never install a system in the field and leave it unattended when it has no charge, a holding charge, or with the service valves closed without securely electrically locking out the system. This will prevent unauthorised personnel from accidentally operating the system and potentially ruining the compressor by operating with no refrigerant flow. **Do not start the compressor while the system is in a deep vacuum.** Internal arcing may occur when a scroll compressor is started in a vacuum causing burnout of the internal lead connections.

Lubrication and oil removal

CAUTION
Chemical reaction! Compressor destruction! Do not mix up ester oils with mineral oil and/or alkyl benzene when used with chlorine-free (HFC) refrigerants.

The compressor is supplied with an initial oil charge. The standard oil charge for use with refrigerants R407C / R410A / R134a is a polyolester (POE) lubricant Emkarate RL 32 3MAF. In the field the oil level could be topped up with Mobil EAL Arctic 22 CC if 3MAF is not available. The standard mineral oil for R22 is Suniso 3GS or Copeland White Oil according to compressor model. See nameplate for original oil charge shown in litres. A field recharge is from 0.05 to 0.1 litre less.

One disadvantage of POE is that it is far more hygroscopic than mineral oil (see **Figure 17**). Only brief exposure to ambient air is needed for POE to absorb sufficient moisture to make it unacceptable for use in a refrigeration system. Since POE holds moisture more readily than mineral oil it is more difficult to remove it through the use of vacuum. Compressors supplied by Emerson Climate Technologies contain oil with low moisture content, and it may rise during the system assembling process. Therefore it is recommended that a properly sized filter-drier is installed in all POE systems. This will maintain the moisture level in the oil to less than 50 ppm. If oil is charged into a system, it is recommended to use POE with a moisture content no higher than 50 ppm.

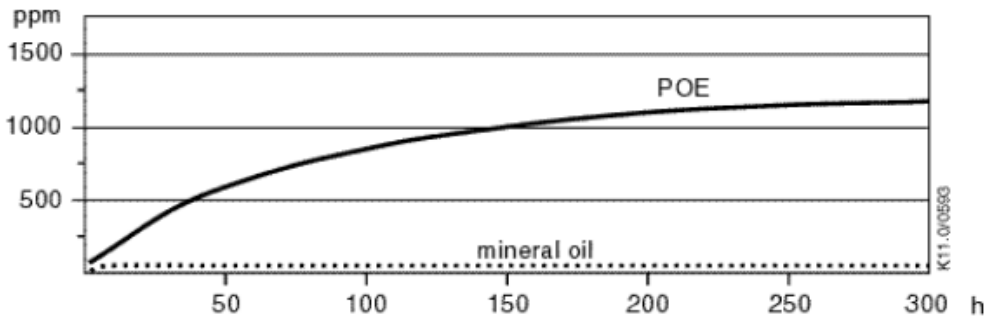


Figure 17: Absorption of moisture in ester oil in comparison to mineral oil in ppm by weight at 25°C and 50% relative humidity (h=hours)

If the moisture content of the oil in a refrigeration system reaches unacceptably high levels, corrosion and copper plating may occur. The system should be evacuated down to 0.3 mbar or lower. If there is uncertainty as to the moisture content in the system, an oil sample should be taken and tested for moisture. Sight glass/moisture indicators currently available can be used with the HFC refrigerants and lubricants; however, the moisture indicator will just show the moisture content of the refrigerant. The actual moisture level of POE would be higher than the sight glass indicates. This is due to the high hygroscopicity of the POE oil. To determine the actual moisture content of the lubricant, samples have to be taken from the system and analysed.

Oil additives

Although Emerson Climate Technologies cannot comment on any specific product, from our own testing and past experience, we do not recommend the use of any additives to reduce compressor bearing losses or for any other purpose. Furthermore, the long term chemical stability of any additive in the presence of refrigerant, low and high temperatures, and materials commonly found in refrigeration systems is complex and difficult to evaluate without rigorously controlled chemical laboratory testing. The use of additives without adequate testing may result in malfunction or premature failure of components in the system and, in specific cases, in voiding the warranty on the component.

11.3 Condenser

The condenser is a refrigerant-air heat transferor consisting of copper pipes heat exchanger with aluminum plates and two axial fans.

The fans are fitted internally with a full motor protector (Klixon).

The fans are controlled by the Frequency Inverter.

The process heat is transmitted here to the surrounding air.

In order to guarantee optimal heat transmission, the condenser must be kept constantly clean and the fans must be protected from damage.

Fabr. H.T.E. Typ VH24

11.4 Fans

The axial flow-fans suck the surrounding air through the condenser package and blow the warm air out at the top. The chiller Type KCC215-L-... are fitted with 4 fans Type FE050 VDD.41.6.
The fans are fitted internally with a full motor protector (Klixon).
The fans are controlled by the Frequency Inverter.

ZIEHL-ABEGG

Axial Fan FE-Series

Technical Description

Fan designs

FE - Series
sickle bladed die cast aluminium impeller
∅ 315.....1000 mm
exellent noise spectrum
100 % speed controllable
especially suited to installation in applications

Application:
refrigeration technology
design A / direction of air flow „V“
design K / direction of air flow „VD“
design Q / direction of air flow „AD“

Application:
ventilation technology
design A / direction of air flow „A“
design Q / direction of air flow „AS“
design F / direction of air flow „VD“

Application:
heating technology on request

Axialventilator FE - Reihe
Axial fan FE - Series

Materials/
Corrosion protection

*Axial fans in **series FC, FE** and **FH** are die cast in aluminium alloy that is not resistant to sea water. A two-component plastic paint finish ensures adequate protection against corrosion for the requirements of free air. Please tell us the area of application, especially if there are increased climatic requirements or for use in areas with increased humidity such as breweries, cheese manufacturing, etc.*

Contact protection

The contact protection can only then be included, if a motor suspension, respectively in some cases, a motor suspension with a wall ring, is included in the delivery.

*Depending on the air flow direction, the contact protection is mounted either on the inlet or discharge side of the fan blades. **Please pay attention to the notes to the contact protection in the technical data sheets.***

The range of accessories contains separate guard grilles which can be mounted to DIN EN 294 on either the discharge or inlet side of the fan, as necessary, and depending on the installation situation.

Please note the section “Effect of guard grille” in the General Notes.

Fan characteristics

Series FE
The sickle-shaped design of the profiled die cast aluminium blade reduces the blade passing noise considerably. Optimal sound behavior, however, can only be achieved in an air guiding system that is well designed in terms of flow technology and with a full bell mouth inlet (see the section on installation notes).

The characteristic curve in Fig. 3 shows fan type FE056-SD_.4F._ in a two speed 3~ design without guard grille.
Characteristic curve (2) to (3) = high speed
Characteristic curve (5) to (6) = low speed through ΔY switching.

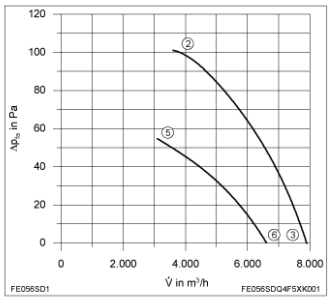


Fig. 3 FE056-SD_.4F._

ZIEHL-ABEGG

Axial Fan FE-Series

Technical Description

Fan drive

*The in the fan hub integrated external rotor motor in three- or single phase design correspond to the regulations for rotating electrical machines in conformity with **DIN EN 60 034-1 (VDE 0530 part 1)**.*
The rated voltage for motors in three phase design is 400 V, for motors in single phase design 230 V.

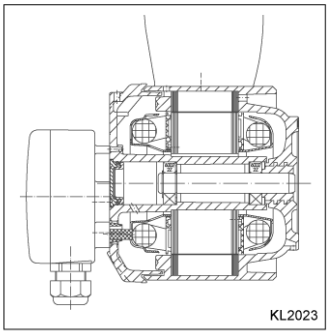
Motor protection
***IP54** in conformity with **DIN VDE 0470 part 1 (EN 60 529)** categorie 2*

Thermal class
F** in conformity with **DIN EN 60 034-1

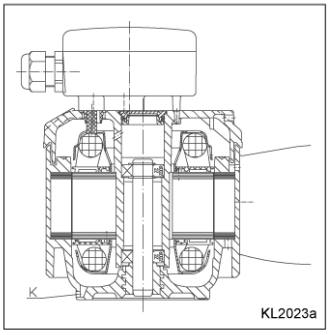
Bearing arrangement
*Deep-groove ball bearing **DIN 625**, closed at both sides, with high temperature grease for thermal class F including subzero temperature range down to -40 °C.*
Applications up to -60 °C upon request.

Balancing quality
***G6.3** according to **DIN ISO 1940 part 1** (**G 2.5** for 2-pole fans)*

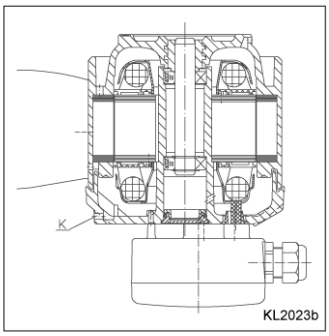
Condensation drain holes
The lower of the condensation drain holes „K“ must be open depending on whether mounting position Vo (rotor above) or Vu (rotor below) is used. With mounting position H, the condensate can escape via the gap between stator and rotor.



Axial fan FE, mounting position H



Axial fan FE, mounting position Vu



Axial fan FE, mounting position Vo

Mounting position and air flow direction

Installation position
The axial fans are suitable for all installation positions.

Airflow direction
Depending on the design of fan, at present there are different options for air flow direction. See the table below for the different airflow directions.

Warning:
Not all axial fans are supplied in the airflow directions shown. Please read the information on the data and dimensions sheets.

ZIEHL-ABEGG

Axial Fan FE-Series

Technical Description

Motor protection

The motors (excluding ex-motors) are equipped with over-temperature protectors (thermal contacts "TC"). Commercial protective switches or bi-metal relaser in the motor feed line work dependent of current and thus offer only incomplete protection, as the current does not allow conclusions to be made about the motor winding temperature under all conditions.
On the other hand, over-temperature protectors are bimetal switches, which are embedded in the motor winding and react directly to the winding temperature. They open an electrical contact, as soon as their nominal switch temperature (NST) is attained.
Thus, also those fans can securely be protected,

- *that are speed control led by voltage*
- *that are operated with excessive switching frequency*
- *that are locked*
- *that are exposed to excessive ambient temperatures*
- *whose cooling has been changed*

The TC's are imbedded in the winding in such a way that they lie between the winding-lines, and are thus heated by both branches, so that they are still effective during the failure of one phase.
Therefore, there are necessary for fans with:

- *1~motor (2 branches): 1 single-TC*
- *3~motors with one winding (3 branches):*
  - *BG 074 to 085: 1 single-TC*
  - *BG 092 to 205: 1 twin-TC (2 TC's switched in series)*
- *3~motors with two separate windings (2x3 branches): 2 twin-TC (4 TC's switched in series)*

*Thermal contacts have to be integrated into the control circuit in a way as to **avoid any automatic switching on** in emergencies after cooling down. Common protection of several motors is possible by one protection device. In order to do this, the thermal contacts of the individual motors have to be connected in series. Please pay attention to the fact that **all** motors are disconnected at the same time in case of a temperature failure at one single motor. In practice, motors therefore are grouped in order to be able to run with reduced power in the **emergency operation** in case the motor fails.*

Thermal contacts

*You can find the shortened-form **technical specifications** for the thermo contacts used in our fans on our web page **www.ziehl-abegg.com** in the „Download“ area.*

Installation and safety instructions

Air flow conditions
It is important to ensure good air inlet discharge conditions when fans are installed.

I free air flow into fan mounted upstream of coil

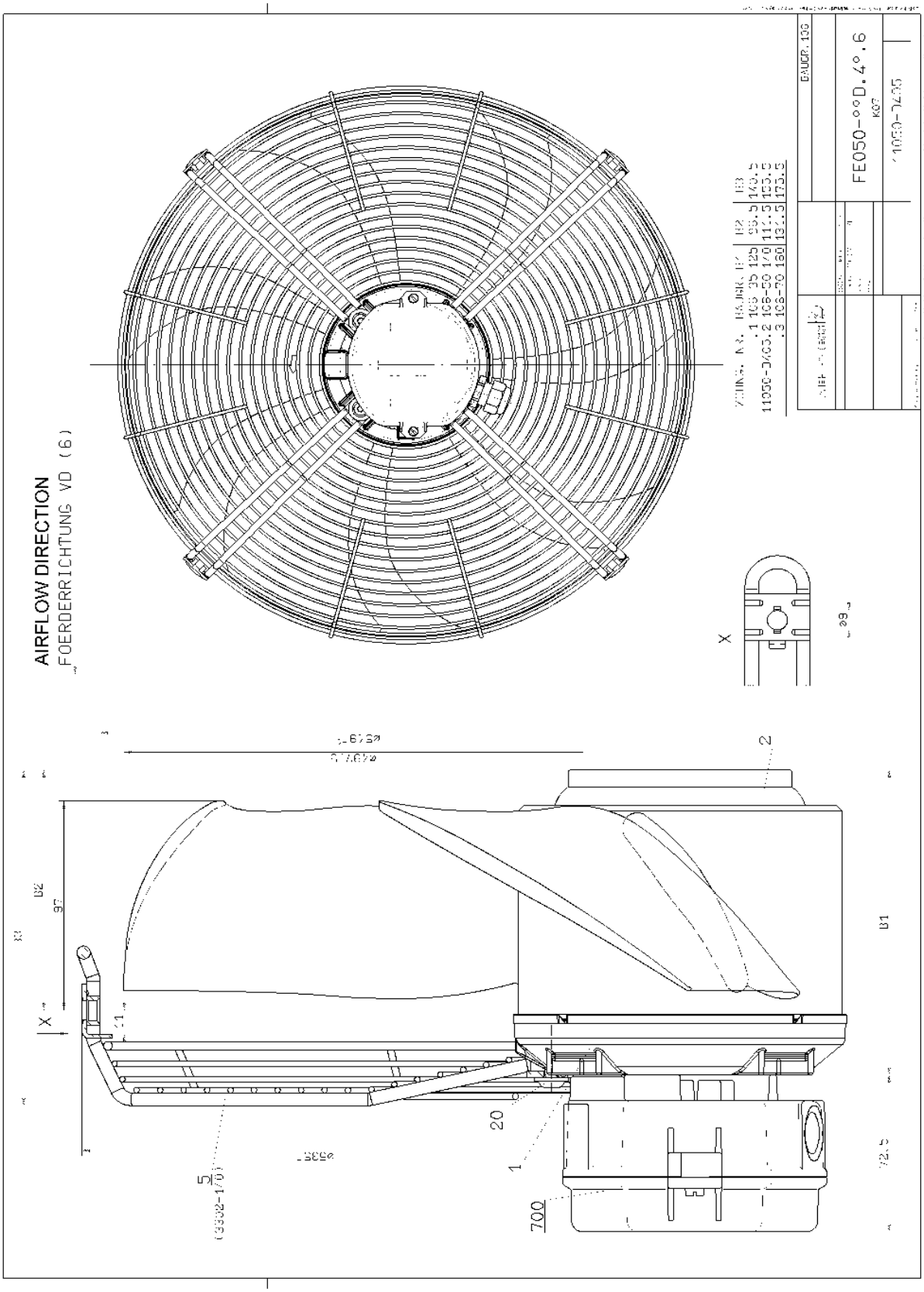
II free blowing fan mounted downstream of coil

III Bell mouth inlet to fan

IV Affect of the bell mouth on performance

Safety information
Ziehl-Abegg axial fans are designed to be installed within systems, and are thus integral components within such equipment or systems.

*The manufacturer is therefore responsible for maintaining the safety specifications for the equipment or system according to **DIN EN 294.***


AIRFLOW DIRECTION
FOERDERRICHTUNG VD (6)
FE050-
700

ZIEHL-ABEGG

Axial Fans

Operating Instructions

Application

- *Ziehl-Abegg axial fans of the series* **FA, FB, FC, FE, FH, FK, FS** *with integrated external rotor asynchronous motor are not ready-to-use products, but designed as components for air-conditioning, air supply and air extraction. A special motor design makes the speed control by voltage reduction possible. By operation with frequency inverters see the notes in the section Operating Conditions. The fans may only be operated when they are installed as intended, and when safety is ensured by safety equipment according to DIN EN 294 (DIN EN 292) or by other protection measures.*

Safety information

- *The fans are only intended for the transfer of air or air-like mixtures. They cannot be used in hazardous areas for the transfer of gas, mist vapours or mixtures. Nor can they be used for the transfer of solid components in the transfer medium.*
- *Mounting, electrical connection and commisioning must only be carried out by trained personnel (definition in DIN EN 50 110 or IEC364)*
- *The fan is only to be operated within the ranges specified on the type plate! Use the fan only in the authorised fashion and only for the tasks and flow media specified in the order!*
- *The maximum permissible operating data given on the rating plate are valid from air density ρ=1,2 kg/m³.*
- *The temperature monitors or PTC resistors built in to the winding serve as motor cut-out switches and must be connected!*
- *Allowable testing voltage for thermistors max. 2.5 v.*
- *For motors without temperature monitors, it is imperative that a motor cut-out switch should be employed!*
- *The EMC guideline is to be observed in connection with our control units. If the fans are completed with components of other manufacturers, the manufacturer or operator of the entire plant is responsible for keeping to the EMC guideline 89/336/EWG.*
- *Pay attention to the notes which concerning maintenance and service*
- *The Operating Instructions are part of the product and have to keep carefully.*

Transport, storage

- *Ziehl-Abegg axial fans are packaged at the factory to comply with requirements for the agreed mode of transport*
- *Transport the fan(s) either in the original packaging or greater fans using the transport fixtures provided (the bored holes in the supporting arms, wall ring plates or motor housing intended for screwing in lifting eye bolts). Use suitable lifting equipment.*
- *Do not transport the fan by the connecting cable !*
- *Avoid excessive vibration and shockloads.*
- *Be on the alert for any damage to the packaging or the fan.*
- *Store the fan in the original packaging in a dry area protected from the weather or protect it from dirt and weather until final installation.*
- *Avoid exposure to extreme heat and cold.*
- *Avoid excessive storage periods (we recommend a one year max.) and inspect the motor bearings for proper operation prior to installation.*

Installation

Installation, electrical connection and commissioning are only to be performed by trained service personnel.

- *The system manufacturer or the machine builder is responsible that the inherent installation and security informations are harmonized with the valid standard and guidelines (DIN EN 292 / 294).*
  - ***Fans design A**, for mounting on static motor flange. Use screws of class 8.8 and secure with Loctite. Starting torques allowed: M6 = 9.5 Nm; M10 = 46 Nm; M12 = 79 Nm*
  - ***Fans design Q with plastic wall plate**: Use U-plates DIN 125 to secure. Starting torques allowed: M8 = 10 Nm; M10 = 21 Nm*
- *The following applies for **all** axial fans:*
  - *Do not install without adequat support. Mounting surfaces must be even.*

  - *Ensure that the clearance (gap) „a“ see fig. between the fan impeller and the stationary housing section is constant. Distortion due to uneven surface may lead to fan failure.*
  - *For motors mounted with shaft vertical, the condensation water drain underneath the shaft must be open.*
  - *Electrical connection corresponding to connection diagram*
    a) in terminal box
    b) by cable design connection diagram on stator housing or on wall ring.
  - ***Do not use metal compression-gland fittings with plastic terminal boxes. Danger of an electric shock if connection is not made correctly !***
  - *Use a dummy plug seal for the compression-gland fitting as well.*
  - *For operation under extreme conditions (damp operating environment, open-air installation) use pre-installed sealing elements.*
  - *Depending on the type of cable gland, attach a water drain sleeve or use a sealing compound.*
  - *Screw on plastic terminal box covers should be sealed with sealant.*
  - *Starting torque for screw on covers*
    Plastic version 1.3 Nm
    Metal version 2.6 Nm
  - *Secure fan connection cable to the contact protection grille or the motor struts with cable fasteners.*
  - *Temperature monitors and PTC resistors with triggering device must be connected.*
  - *Temperature monitors must be integrated in the control circuit in such a way that, if a fault occurs, **the motor cannot switch on again automatically** after it has cooled down. The protection of several motors using one protection device is possible by connecting the temperature monitors of the individual motors in series. It must be remembered that, if a temperature fault occurs at one motor, **all** motors will then be switched off. In practice, motors are therefore assembled in groups so that **emergency operation** with reduced performance is still possible if a motor fails.*

ZIEHL-ABEGG

Axial Fans

Operating Instructions

Operating Conditions

- *Do not operate the fan in an explosive atmosphere*
- *Switching frequency:*
  - *The fan is rated for S1 continuous operation.*
  - *Controls must not allow extreme switching operation.*
- *Ziehl-Abegg axial fans are suitable for operation with frequency inverters when the following points are observed:*
  - *Between the inverter and the motor, sinusoidal filters should be incorporated which are effective for all phases (sinusoidal output voltage, phase against phase, phase against protective conductor) as offered by manufacturers. Please ask for our technical information L-TI-0510.*
  - ***du/dt filters (also called motor or suppression filters) cannot be used in place of sinusoidal filters.***
  - *When using sinusoidal filters, screened motor leads, metal terminal boxes and a second earth connection to the motor can, if necessary, be omitted. Check-back by the supplier of the sinusoidal filter.*
- *If the operational leakage current exceeds 3.5 mA, earthing in compliance with DIN VDE 0160/5.88, Art. 6.5.2.1 must be provided.*
- *In the case of speed control by voltage reduction (phase cutting), increased noise may be caused by resonance depending on the mounting position and location. We recommend the additional installation of a noise filter type GFD3 resp. GFD3E for control cabinets.*

Commissioning

- *Before initial operation, check the following:*
  - *Installation and electrical connection have been properly completed.*
  - *Safety equipment is in place (→ Contact protection).*
  - *All leftover installation materials and other foreign materials have been removed from the fan cavity.*
  - *Protective conductor has been connected.*
  - *Temperature monitor motor cut-out switch has been properly installed and is operational.*
  - *Cable gland is sealed (see "Installation").*
  - *Installation position and the arrangement of condensation water drains correspond to each other.*
  - *Connection data complies with the specifications on the type plate.*
  - *Motor operating capacitor data (1~ motors) complies with the specifications on the type plate.*
- *Commissioning may only take place if all safety instructions have been checked and danger can be excluded.*
  - *Check sense of rotation / air feed direction .* ***Definition of the sense of rotation according to the different designs with view to the rotor.***
  - *See to smooth running*
    Intensive vibrations due to uneven running (out-of-balance) e.g. because of damage intransit or improper handling may lead to outage.

Maintenance, service

- *Due to the selection of bearings with "lifetime lubrication", the axial fan is maintenance-free. Once the grease consumption period has expired (for standard applications, approx. 30-40,000 hrs.), it is necessary to replace the bearings.*
- *On 1~ motors, condenser rating can decrease with time. Life expectancy approx. 30,000 hrs. per DIN EN 60252.*
- *Regular inspection, if required and cleaning where necessary to prevent imbalance due to ingress of dirt.*
  - *Achieve smooth running by carrying out periodic maintenance to limit level of dirt.*
- ***Outdoor fans:***
  If a fan is stationary for long periods in a humid atmosphere, it should be switched ON for minimum of two hours every month to remove any moisture that may have condensed within the motor.
- *Maintenance operation is only to be performed by trained service personnel !*
- *Please observe the safety regulations and the worker´s protection rules by all maintenance and service work. (DIN EN 50110)*
- ***Fan impeller has come to a standstill!***
  - ***Power supply interrupted and secured against restoration!***
  - ***No maintenance work at running fan !***
  - ***Do not clean running fan with a high-pressure cleaner ("steam jet")!***
  - ***Wet cleaning under voltage may lead to an electric shock - danger to life !***
  - ***Keep the airways of the fan free - danger because of objects dropping out !***

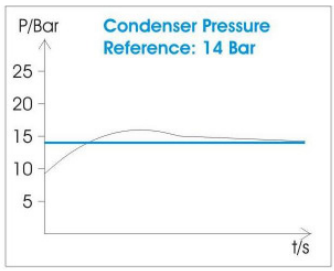
- *Take note of abnormal operating noise!*
- *Replace the bearings at the end of the grease-consumption period, or if they should become damaged. Ask for our Maintenance Guide or contact our Repair Department (special tools may be required!).*
- *Replace bearings only with original parts (Ziehl-Abegg special-grease).*
- *In the event of any other damage (e.g. winding damage), please contact our Repair Department.*

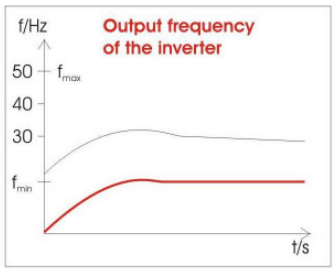
11.5 Frequency Inverter

The Frequency Inverter controls the speed of the condenser fans to get a constant pressure of refrigerant gas.

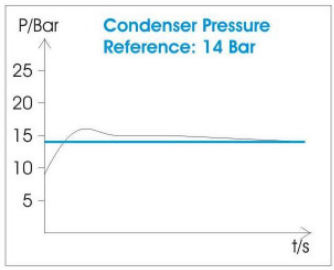
YASKAWA Mechatronics Solutions	Frequency Inverter YASKAWA E7–Series

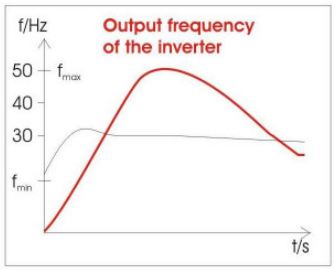
Shot Menu
Software for
Condenser fan application



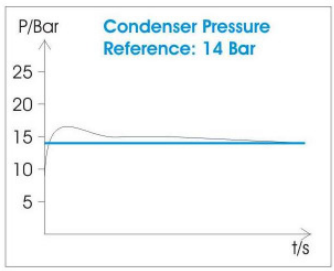


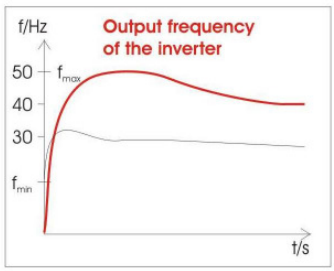
Condenser “ON” at low ambient temperatures.





Condenser “ON” at normal ambient temperatures.





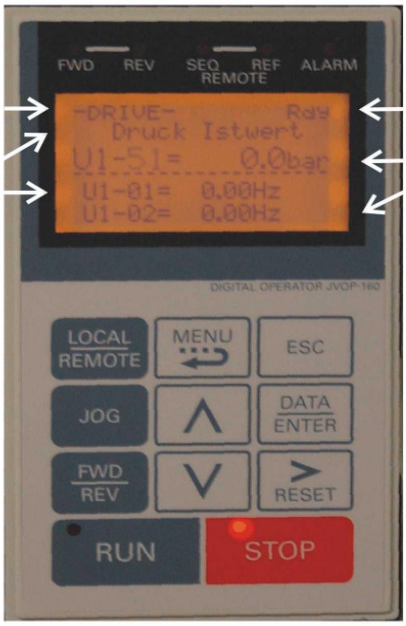
Condenser “ON” at high ambient temperatures.

Settings for the modified parameter values – see chapter 4.5 Operating Instruction Industrial Cooler of the KCC series.

YASKAWA Mechatronics Solutions

Frequency Inverter YASKAWA E7–Series

Digital Operator Display



Text display

Line 1 Left Corner “DRIVE” is lit
The inverter is in DRIVE mode.

Line 2 Text description of the parameter indicated in line 3

Line 4 Reference frequency in Hz

Line 1 Right Corner Rdy is lit:
Rdy = Ready

Line 3 Parameter No: Displays the feedback value in “Bar”.

Line 5 Displays the output frequency

MENU Pressing the MENU Key changes the mode:

> Drive mode
> Quick Programming mode
> Advanced Programming mode
> Modified Constants
> Auto-Tuning

Pressing the DATA / ENTER Key is used to enter the menus: DATA ENTER

> Access to operation data
> Access to quick programming mode
> Access to all parameters
> Access to all modified parameters
> Access to auto tuning mode

Increment - Key
Selects user constant numbers
Increments setting values

Decrement - Key
Selects user constant numbers
Decrements setting values

RESET Shift/Reset Key
Sets the no. of digits
Acts as the RESET-key

ESC - Key
Returns to the status before DATA/ENTER key was pressed

LOCAL REMOTE **LOCAL/REMOTE** - Key
Local: Operation via Operator
Remote: Operation via terminals

JOG - Key
Enables jog operation if the inverter is controlled by the operator

FWD REV **FWD/REV** - Key
Selects the rotation direction when the motor is controlled via Operator

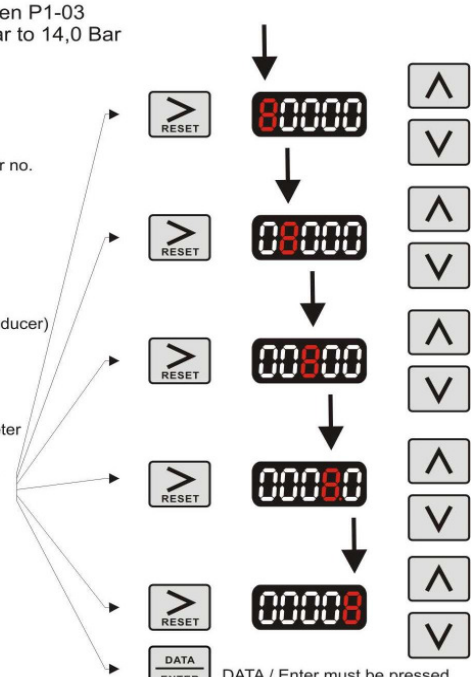
RUN **RUN** - Key
Starts the inverter via Operator

STOP - Key
Stops inverter operation with the operator

Operation Example:

Changing the reference in screen P1-03
from a pressure setpoint of 12,0 Bar to 14,0 Bar

Press key until this text will be displayed:	Remarks:
MENU Advanced Programming Mode	Enables Access to all Parameter
DATA ENTER	The left two characters of the parameter no. are blinking.
P1-01 minTransducer	**P1**- is blinking Parametergroup P1 is now active.
P1-**01** minTransmitter	**01**- is blinking Parameter P1-01 is now active. (E.g. Low pressure setpoint of the transducer)
P1-**03** Pressure reference	**03**- is blinking Parameter P1-03 is now active.
DATA ENTER	**12.0** is blinking (default value) P1-03 displays the value of this parameter (e.g. pressure reference in “Bar”)
14.0 Pressure-reference	The value can be changed by pressing the increment, decrement or shift key as per the example.
DATA ENTER **P1 - 03 14.0 Bar** New pressure reference	Reference has been changed. To start the inverter it is neccessary to select the “Drive” menu.
MENU **Drive**	Changes the menu by pressing the “MENU” key.
DATA ENTER **Druck Istwert U1-51 = XX.X Bar**	The value is depending on the system pressure.



YASKAWA Mechatronics Solutions

Frequency Inverter YASKAWA E7-Series

Short discription of the most useful parameters.

Para-meter No.:	Default value:	Range: min.	Range: max.	Change during Operation Yes/No	Manual Page:	Parameter name:	Parameter MENU:- ADVANCED PROGRAMMING Select Parameter group with inc. / dec. key. RESET: Changes to the individual parameter Selects parameter
A1-03	0	0	9999	N	P. 5.43	Parameter name:	
A1-03	0	0	3330	N	P. 5-7	Initialize to factory settings	Mode: 2220 sets the inverter back to factory settings.
b1-01	5	0	5	N	P. 6-4	Reference selection	Sets the reference input method; 0=Operator; 1=Terminals 2= Comms; 3=Option-PCB; 5=Case-Software (Value in Bar)
b1-02	5	0	5	N	P. 6-8	Operation method selection	Set the run command input method: 0=Operator; 1=Terminals; 2,3=Comms; 5=Case-Software (Auto-Switch-Off)
b1-03	1	0	3	N	P. 6-10	Stopping method selection	Used to set the stopping method: 0=deceleration to stop; 1=Coast to stop; 2= DC-Injection brake stop; 3=delay stop
b5-01	1	0	3	N	P. 6-64	PI control mode selection	Mode: 0=Disabled (Off); 1=Enabled (On)
b5-02	1.8	0.00	25.00	Y	P. 6-64	Proportional gain (P)	Sets the proportional gain as a factor from 0.00 to 25.00. P-control is not active when the setting is 0.00.
b5-03	3	0.0	360.0	Y	P. 6-64	Integral - time (I)	Sets the integral time (I) in 1s steps from 0.0 to 360.0s. I-control is not active whenn the setting is 0.00.
b5-09	1	0	1	N	P. 6-64	PI-Output characteristic	PI output characteristic : 0=output is positive; 1=output is negative (Reference increases --> output frequency increases)
C1-01	3	0.0	600.0	Y	P. 6-15	Acceleration-time 1	Sets the acceleration time to accelerate from 0 Hz to the max. output frequency. C1-02 sets the deceleration time.
d2-02	25.0	0	100	N	P. 6-24	Frequency refer-ence lower limit	Sets the output frequency lower limit as a percentage of the max. output frequency.
E1-01	480	310	510	N	P. 6-72	Input voltage setting	Sets the inverter input voltage. This setting is used as a reference value in protection functions.
E1-03	6	0	F	N	P. 6-72	V/f - pattern selection	Modus 6 = 60Hz, Variable torque Modus 5 = 50Hz, Variable torque
E2-01	4	0.5	10.6	N	P. 6-71	Motor rated current	These values will become the reference values for motor pro-tection, torque limits and torque control.
H3-09	b	0	b	N	P. 6-65	Function Analog Input A2	Mode “b” fixes analogue Input A2 as a reference source of the PI control..
L5-01	10	0	10	Y	P.6-41	Number of Auto-Restarts	Automatically restarts after a supply fault occurs. The counter is reset once normal operation has continued for 10 Minutes.
L5-03	1	0.5	180	Y	P.6-41	Fault retry time	Sets the time after the inverter restarts once a fault has occured.
P1-01	0.0	0.0	50.0	N	CASE	Transducer range low pessure	Indicates the min. pressure level of the transducer (e.g. 4_20mA = 0 to 30 Bar: min. level is 0.0 Bar)
P1-02	30.0	0.0	50.0	N	CASE	Transducer range high pressure	Indicates the max. pressure level of the transducer (e.g. 4_20mA = 0 to 30 Bar: max. level is 30.0 Bar)
P1-03	14.0	0.0	50.0	N	CASE	Pressure reference	Determines the pressure level setpoint of the condenser. Pressure level unit is “Bar”.
P1-04	13.0	0.0	30.0	N	CASE	Pressure sleep level	If the pressure feedback level is below this value, inverter should go to sleep mode. This function is off when 0.0 is set.l
P1-05	0	0	3000	N	CASE	Pressure sleep start delay time	Determines a delay time for the sleep function in P01-04. This mode is active if the level is less than P01-04 within this time.
P1-06	0.5	0.0	10.0	N	CASE	Pressure on - hysteresis	Determines the pressure difference to re-start the inverter from sleep mode. (E.g: P01-04=10Bar/P01-06=5Bar: On level=15Bar.
P1-07	0	0.0	3000	N	CASE	Pressure start delay time	Determines a delay time for the re-start function in P01-06.
P2-01	16.0	5.0	25.0	N	CASE	Pressure level “Summer”	If the feedback level has exceeded this value, “Summer” settings will be active for the time adjusted in P2-04 during power on.
P2-02	8.00	0.00	25.00	Y	CASE	Proportional gain (P) “Sommer”	Proportional gain “Summer”, if the pressure feedback level is exceeding the level adjusted in P2-01 during power on.
P2-03	0.5	0.0	360.0	Y	CASE	Integral time (I) “Summer”	Integral time “Summer”, if the pressure feedback level is exceeding the level adjusted in P2-01 during power on.
P2-04	10.0	0.0	60.0	Y	CASE	“Summer” start time	Determines the time after power on where as “Summer” PI-control is active.
P3-01	2.0	0.00	15.00	N	CASE	Pressure level “Winter”	If the feedback level has below this value, “Winter” settings will be active for the time adjusted in P3-04 during power on.
P3-02	1.0	0.00	25.00	Y	CASE	Proportional gain (P) “Winter”	Proportional gain “Winter”, if the pressure feedback level is below the level adjusted in P3-01 during power on.
P3-03	5.0	0.0	360.0	Y	CASE	Integral time (I) “Winter”	Integral time “Winter”, if the pressure feedback level is below the level adjusted in P3-01 during power on.
P3-04	5.0	0.0	600.0	Y	CASE	“Winter” start time	Determines the time after power on where as “Winter” PI-control is active.

YASKAWA Mechatronics Solutions

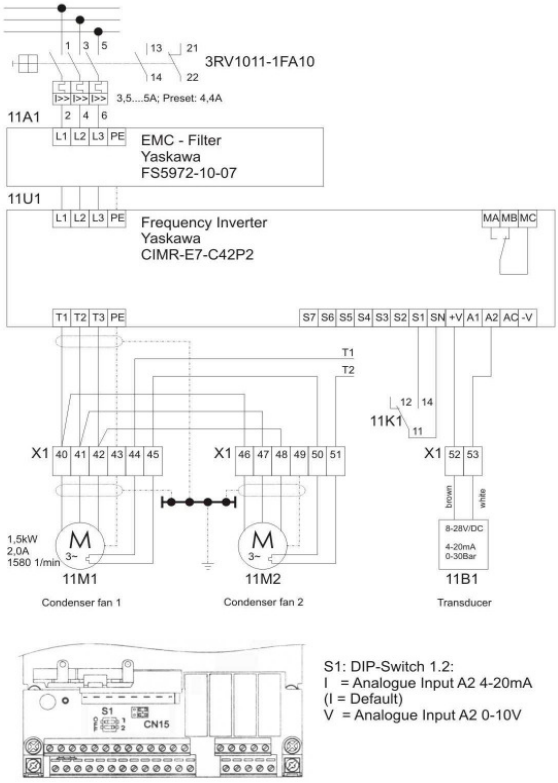
Frequency Inverter YASKAWA E7–Series

Technical Data

Frequency inverter: Yaskawa CIMR E7C42P2

Specification:	Data:
Input ratings	
Rated supply voltage	380 - 480 V/AC -15/+10%
Rated supply frequency:	50 - 60 Hz +/-5%
Output ratings	
Recommended motor power:	2,2 kW
Rated output capacity:	4 kVA
Rated output current:	5,3 A
Max. output current:	6,4 A
Max. output frequency:	120 Hz
Control characteristics	
Control method:	Sine wave PWM
Speed controm range:	1:40
Frequency accuracy:	+/- 2%
Frequency setting signal:	4-20 mA (250 Ohm); 0-10 V (20 kOhm)
Acc.- Deceleration time:	0,01 - 6000 s
V/Hz - Pattern:	Free programmable
Protective functions	
Motor protection:	Thermal elektronic algorythm
Overload protection:	120% rated current for 60s
Overvoltage protection	Trips at 820V/DC
Undervoltage protection:	Trips at 268V/AC
Power loss ride through:	for < 2 s
Heatsink temperature:	Thermistor protected
Stall prevention:	During acceleration, Decelerationand while running
Earth fault protection:	By electronic circuits
In- and Outputs	
Digital Inputs:	7, 5 free programmable
Digital Outputs:	3, 2 free programmable
Analogue Inputs:	2, 0-10 V - 4-20 mA free programmable
Analogue Outputs:	2, 0-10 V - 4-20 mA free programmable
Digital Operator	
LCD Display:	Textdisplay, 5-lines; 9 keys
Enviroment	
Ambient operating temperature:	-10 - +40°C at rated load -10 - +60°C ati 80% rated load = 4 A
Storage temperature:	-20 - + 60°C

Standard-wiring



S1: DIP-Switch 1.2:
I = Analogue Input A2 4-20mA
(I = Default)
V = Analogue Input A2 0-10V

Monitor screens

MENU - DRIVE
Select screen by pressing **inc** or **dec** key

Refer to page 5-36 for further information and more details.

U1-01	**Frequency-reference**	Displays the calculated value for the frequency reference in Hz
U1-02	**Output frequency**	Displays the output frequency in Hz. Scaling can be adjusted in o1-03.
U1-03	**Output current**	Displays the output current in A.
U1-06	**Output voltage**	Displays the output voltage in V.
U1-07	**DC-Bus voltage**	Displays the DC-Bus voltage in V. Mains voltage = U/DC * 1,414
U1-08	**Ausgangs-leistung**	Display the output power in kW (internal detected value).
U1-10	**Input terminals**	Monitors the status of the digital input terminals:
0.0.0.0.0.1		Signal has been detected on Input S1 All other inputs are not in use or off.
U1-09	**Output terminals**	Monitors the status of the digital output terminals:
0.1.0.0.0.1		Fault relay MA/MB-MC is indicating M1/M2 Relay is on; M3/M4 Relay is off
U1-13	**Operation time**	Monitors the total operation time of the inverter.
U1-14	**Software-No.**	Shows manufacturers ID-No...
U1-16	**Terminal A2 Input level**	Displays the level at terminal A2 in percent. 100% = 10V/DC
U1-24	**PI-Feedback value**	Monitors the feedback value when PI-control is used
U1-36	**PI-input volume**	PI- feedback volume, given as max. frequency is 100%.
U1-37	**PI-output volume**	PI control output, given as max. frequency =100%
U1-38	**PI-command**	PI command + PI command bias given as max. frequency = 100%
U1-50	**PI-pressure referene**	Displays the pressure reference in “Bar”.
U1-51	**PI-pressure feedback**	Displays the pressure feedback value in “Bar”.

Caution: **This short menu does not act as a replacement of the original manual No.: YEG-TOE-S616-56.1. All adjustment were made as a conclusion of various field tests and the results of these adjustments. Due to local environmental changes some or other constant differs from the original values.**
Revision: 24. August 2003 Rev A2; SF_E7_KKT7_E_A4.CDR

11.6 Electronic Temperature Controller

Temperature regulation is attended to by the temperature controller installed in the switch cabinet. It controls the leaving temperature of the medium and switches the refrigeration compressors and/or the capacity reducing valve (hot gas solenoid valves) on or off.

The controller shows the actual readings of the initial medium temperature.

dixell | Operating instructions | cod. 1592001320

1. GENERAL WARNING

1.1 Please read before using this manual

- This manual is part of the product and should be kept near the instrument for easy and quick reference.
- The instrument shall not be used for purposes different from those described hereunder. It cannot be used as a safety device.
- Check the application limits before proceeding.

1.2 Safety Precautions

- Check the supply voltage is correct before connecting the instrument.
- Do not expose to water or moisture: use the controller only within the operating limits avoiding sudden temperature changes with high atmospheric humidity to prevent formation of condensation
- Warning: disconnect all electrical connections before any kind of maintenance.
- The instrument must not be opened.
- In case of failure or faulty operation send the instrument back to the distributor or to "DIXELL s.r.l." (see address) with a detailed description of the fault.
- Consider the maximum current which can be applied to each relay (see Technical Data).
- Ensure that the wires for probes, loads and the power supply are separated and far enough from each other, without crossing or intertwining.
- Fit the probe where it is not accessible by the end user.
- In case of applications in industrial environments, the use of mains filters (our mod. FT1) in parallel with inductive loads could be useful.

2. General description

The XC650C is designed to manage both compressors and fans in a condensing system such as a pack.
The compressors can be simple, multistage or with different capacities.
Control is by means of a neutral zone or proportional band and is based on the pressure or temperature sensed in the LP suction (compressors) and HP (condenser) circuits. A special algorithm balances the run hours of the compressors to distribute the work load uniformly.
The controllers can convert both LP and HP pressures and display them as temperatures.
The front panel offers complete information on the system's status by displaying the suction and condenser pressure (temperatures), the status of the loads, possible alarms or maintenance conditions.
Each load has its own alarm input that is able to stop it when activated. To guarantee the total system's safety, there are also two inputs for low and high pressure switches: when these are activated, the system is stopped.
By means of the HOT KEY the controller can be easy programmed at power on.
The controller can be connected to the XJ500, controlling and monitoring system, thanks to the serial TTL output, using the standard ModBus RTU protocol.

3. First installation

At first installation, it's necessary the following:

1. **Select the kind of gas.**
2. **Set the range of the pressure probes.**

In the following paragraph a short cut for the above operations.
Chapters 6 Parameters programming and 12 will show in detail these operations.

3.1 How to set the kind of gas

The controller has memorised the relation between temperature and pressure for some gases.

The pre-set gas is: r404.

If another gas is used, act as in the following:
1. Enter the Programming mode by pressing the **Set** and **DOWN** key for 3s.
2. Select the "**Pr2**" parameter. Then enter the password 3 –2 1.
3. Select the **FtyP, kind of gas,** parameter.
4. Press the "**SET**" key: the value of the parameter will start blinking.
5. Use "**UP**" or "**DOWN**" to change the gas amount the following: . Select the gas among the following: **r22**= R22; **r404**=R404A; **507**=R507; **134**=134; **r717**= ammonia.
6. Press "**SET**" to store the new value and move to the following parameter.

To exit: Press **SET + UP** or wait 30s without pressing a key.

NOTE: the set value is stored even when the procedure is exited by waiting the time-out to expire.

3.2 How to set the range of the pressure probes

If a instrument with the following part number is used: XC650C – xxxxF, it is pre-set to work with pressure probe with the following range:
Probe 1: -0.5 ÷11 bar (relative pressure);
Probe 2: 0÷30 bar (relative pressure)

If the probes you're using have a different range act as in the following:

To set the pressure range of the **Probe 1** use the parameter::
PA04: Adjustment of read out corresponding to 4mA
PA20: Adjustment of read out corresponding to 20mA

Practically these parameters has to be set with the start and end scale of the probe range.

WARNING: set a value correspondent to **absolute pressure**. If the transducer measures relative pressure increase the range of 1 bar.
E.I. PP11 relative pressure transducer, range -0.5÷11.0 bar. PA04=0.50; PA20=12.00.
PP30 relative pressure transducer, range: 0÷30bar. PA04=1.00; PA20=31.00.

How to do:

1. Enter the Programming mode by pressing the **Set** and **DOWN** key for 3s.
2. Select the "**Pr2**" parameter. Then enter the password 3 –2 1.
3. Select the **PA04, adjustment of read out corresponding to 4mA,** parameter.
4. Press the "**SET**" key: the value of the parameter will start blinking.
5. Set the lower value of the probe range (lower value +1 if the probe detects relative pressure).
6. Push the **SET** key to confirm the value. The **PA20: adjustment of read out corresponding to 20mA** parameter will be displayed.
7. Set the higher value of the range (higher value +1 if the probe detects relative pressure).
8. Push the **SET** key to confirm the value. Next parameter will be displayed.

Do the same things for the Probe 2, **FA04, FA20** parameters.

3.3 How to set the kind of display: relative or absolute pressure

After setting the probe range by means of the PA04, PA20, FA04 and FA20 parameters, it's possible to select if the absolute or relative pressure has to be displayed.

The controller is pre-set for RELATIVE PRESSURE displaying.

If the **absolute pressure** has to be displayed, act as in the following:

9. Enter the Programming mode by pressing the **Set** and **DOWN** key for 3s.
10. Select the "**Pr2**" parameter. Then enter the password 3 –2 - 1.
1. Select by pushing the **UP** key the **rELP** parameter.
2. Push the **SET** to modify the value.
3. Set the **AbS** value and push the **SET** key to confirm it.

To exit: Press **SET + UP** or wait 30s without pressing a key.

4.1 Displaying

	UPPER DISPLAY	LOWER DISPLAY	ICONS
1 probe enabled	Temperature	Pressure	- Working loads - Measurement unit - Alarm or status Icons
2 probes enabled	Probe 1	Probe 2	- Working loads - Measurement unit - Alarm or status Icons

4.2 Keyboard

SET To see or modify the set point. in programming mode it selects a parameter or confirm an operation.
Alarm menu: By holding it pressed for **3s,** the current alarm is erased.

▲ **(UP) To enter the Alarm menu.**
In programming mode: it browses the parameter codes or increases the displayed value.
With Hot key inserted: it starts the Hot key programming procedure.

▼ **(DOWN) In programming mode:** it browses the parameter codes or decreases the displayed value.
Manual restart of loads: By holding it pressed for **3s,** it switches on again loads previous locked by a safety digital input alarm.

CLOCK To display the loads running hours.
By holding it pressed for 3s the **Maintaining menu** is entered.

KEY COMBINATIONS

▲ + ▼ To lock and unlock the keyboard.
SET + ▼ To enter the programming mode.
SET + ▲ To exit the programming mode.

4.3 Icons

LED	FUNCTION	MEANING
°C	ON	Celsius degrees
°F	ON	Fahrenheit degrees
bar	ON	bar displaying
PSI	ON	PSI displaying
1	ON	Load 1 on
1	Flashing	Load 1 is waiting to start (1HZ). or digital input alarm for Load 1 (2Hz). o Load 1 in maintenance status (2Hz).
2	ON	Load 2 on
2	Flashing	Load 2 is waiting to start (1HZ). or digital input alarm for Load 2 (2Hz). o Load 2 in maintenance status (2Hz).
3	ON	Load 3 on
3	Flashing	Load 3 is waiting to start (1HZ). or digital input alarm for Load 3 (2Hz). o Load 3 in maintenance status (2Hz).
4	ON	Load 4 on
4	Flashing	Load 4 is waiting to start (1HZ). or digital input alarm for Load 4 (2Hz). o Load 4 in maintenance status (2Hz).
5	ON	Load 5 on
5	Flashing	Load 5 is waiting to start (1HZ). or digital input alarm for Load 5 (2Hz). o Load 5 in maintenance status (2Hz).
	ON	The Maintenance menu has been entered
	Flashing	One or more loads have been placed in maintenance status
	ON	Alarm is happening
	ON	All the stored alarms have been seen.
	Flashing	A new alarm has happened

5. How to see and modify the set point(s)

5.1 How to see the set point of compressors and/or fans

If the controller is managing both compressors and fans, both the set points are displayed in sequence, otherwise only the set point of the enabled section will be displayed.

1) Push and release the **SET** key;
2) The Lower display will show the **“SEtC”** label, will the Upper display will show its value.
3) To see the fan set point push again the **SET** key.
1) The Lower display will show the **“SEtF”** label, will the Upper display will show the fan set point.

To exit: push the **SET key** or wait for 30 without pressing any keys.

5.2 How to modify the set point of compressors and/or fans

WARNING: before setting the target set points for the first time, check and, if necessary, modify the type of freon (par. FtyP) and the default unit of measurement (par. dEU) for compressors and fans

PROCEDURE

1. **Set the kind of freon by means of the FtyP parameter (see 3.1 How to set the kind of gas)**
2. **Set the measurement unit (dEU par.).**
3. **Check and if necessary modify the set point limits (LSE and HSE par.).**

1. Push the **SET** key for more than 2 seconds;
2. The Lower display will show the **"SEtC"** label, will the Upper display will show its value flashing.
3. To change the Set value push the ▲ or ▼ within 30s.
4. To memorise the new value and pass to the fan set point push the **SET** key.
5. The Lower display will show the **"SEtF"** label, will the Upper display will show the fan set point flashing.
6. To change its value push the ▲ or ▼ within 30s.

To exit: push the **SET key** or wait for 30 without pressing any keys.

6. Parameters programming

6.1 How to enter the "Pr1" parameter list

To enter the "Pr1" parameter list, user accessible, operate as follows:

1. Hold pressed the **SET** and **DOWN** key for 3s.
2. The controller displays the name of the parameter in the Lower display, its value on the Upper display.
3. Press the "**SET**" key: the value of the parameter will start blinking.
4. Use "**UP**" or "**DOWN**" to change the value.
5. Press "**SET**" to store the new value and move to the following parameter.

To exit: Press **SET + UP** or wait 30s without pressing a key.

NOTE: the set value is stored even when the procedure is exited by waiting the time-out to expire.

6.2 How to enter in parameters list "Pr2"

The "Pr2" parameter list is protected by a security code (Password).

SECURITY CODE is 321

To access parameters in "**Pr2**":

1. Enter the "Pr1" level.
2. Select "Pr2" parameter and press the "**SET**" key.
3. The flashing value "0 --" is displayed.

4. Use ▲ or ▼ to input the security code and confirm the figure by pressing "**SET**" key.
5. Repeat operations 2 and 3 for the other digits.

NOTE: each parameter in "Pr2" can be removed or put into "Pr1" (user level) by pressing "**SET**" + ▼. When a parameter is present also in "Pr1" decimal point of the lower display is on.

6.3 How to change parameter values

1. Enter the Programming mode.
2. Select the required parameter with ▲ or ▼.
3. Press the "**SET**" key the value start blinking.
4. Use ▲ or ▼ to change its value.
5. Press "**SET**" to store the new value and move to the following parameter.

To exit: Press **SET + UP** or wait 15s without pressing a key.

NOTE: the new programming is stored even when the procedure is exited by waiting the time-out.

7. How to disabled an output

To disabled an output during a maintenance session means to exclude the output from the regulation.

7.1 How to disabled an output during a maintenance session.

1. Push the **CLOCK** key for 3s.
2. The LED's of the first output is switched on, the Lower display shows the "**StA**" label, while the Upper display shows the "**On**" label if the first output is enabled, or the "**oFF**" label if the output is disabled for a maintenance section.

   With compressor with more steps all the LED's linked to the compressor and the valves are switched on..
3. Select the output by pressing the **UP** or **DOWN** key.
4. **To modify the status of the output**: push the **SET** key, the status of the output starts flashing, then push the UP or DOWN to pass from "On" to "OFF" and viceversa.
5. Push the **SET** key to confirm the status and pass to the next output..

To exit: push the **CLOCK** key or wait 30 sec

7.2 Output disabled signalling.

If an output is disabled its led blinks (2 Hz)

7.3 Regulation with some outputs disabled.

If some outputs are disabled they don't take part to the regulation, so the regulation goes on with the other outputs.

8. Running hours of loads

8.1 How to display the running hours of a load.

The controller memorises the running hours of each load.

To see how long a load has been working follow this procedure:

1. Press and release the "CLOCK" key.
2. The led of the first output is switched on, the Upper Display shows the **"HUr"** label, while the Lower Display shows the shows the running hours of the first output.
3. To see the running hours of the following load press the UP key .

To exit: push the CLOCK key or wait 30 sec

8.2 How to reset the running hours of a load.

1. Display the running hour according to the above procedure.
2. Select the load by pressing the UP key.
3. Push the **SET** key (immediately on the lower display the **rSt** label is displayed).
4. Hold pushed the key for some seconds till the **"rSt"** label starts flashing and the lower display shows zero.

To exit: push the CLOCK key or wait 30 sec

NOTE: if the **SET** key is released within 2s, the controller reverts to display the running hours of the selected loads..

9. Alarm Menu

The controller memorises the last 20 alarms happened, together with their duration..
To see the alarm codes see par. **par. 18 Alarm list.**

9.1 How to see the alarms

1. Push the ▲ key.
2. The last alarm happened is showed on the Upper display, while the lower display shows its number.
3. Push again the ▲ key and the other alarm are displayed starting from the most recent.
4. To see the alarm **duration** and push the **SET** key.
5. By pushing again the ▲ **or SET** key the next alarm is displayed.

Alarms erasing.

1. Enter the Alarm Menu.
2. To erase the displayed alarm push the "**SET**" key till the "rSt" label will be displayed in the Lower Display,
   NOTE the running alarms cannot be erased..
3. To erase the whole Alarm Menu, hold pressed the "**SET**" key for 10s.

10. Use of the programming “HOT KEY “

10.1 How to program a hot key from the instrument (UPLOAD)

1. Program one controller with the front keypad.
2. When the controller is ON, insert the “Hot key” and push ▲ key; the "uPL" message appears followed a by flashing “End”
3. Push “SET” key and the End will stop flashing.
4. Turn OFF the instrument remove the “Hot Key”, then turn it ON again.

NOTE: the “Err” message is displayed for failed programming. In this case push again ▲ key if you want to restart the upload again or remove the “Hot key” to abort the operation.

10.2 How to program an instrument using a hot key (DOWNLOAD)

1. Turn OFF the instrument.
2. Insert a programmed “Hot Key” into the 5 PIN receptacle and then turn the Controller ON.
3. Automatically the parameter list of the “Hot Key” is downloaded into the Controller memory, the “doL” message is blinking followed a by flashing “End”.
4. After 10 seconds the instrument will restart working with the new parameters.
5. Remove the “Hot Key”..

NOTE the message “Err” is displayed for failed programming. In this case turn the unit off and then on if you want to restart the download again or remove the “Hot key” to abort the operation.
The unit can UPLOAD or DOWNLOAD the parameter list from its own E2 internal memory to the “Hot Key” and vice-versa.

11. Keyboard locking

11.1 How to lock the keyboard

1. Keep the ▲ and ▼ keys pressed together for more than 3 s the ▲ and ▼ keys.
2. The “POF” message will be displayed and the keyboard is locked. At this point it is only possible to view the set point or enter the HACCP menu.

11.2 To unlock the keyboard

Keep the ▲ and ▼ keys pressed together for more than 3s till the “POn” flashing message appears.

12. List of parameters

12.1 Plant dimensioning and type of regulation.

oA1, oA2, oA3, oA4, oA5 Outputs 1- 5 configuration: by means of these parameters the plant can be dimensioned according to the number and type of compressors and/or fans and the number of steps for each one.

Each relay according to the configuration of the oA(i) parameter can work as:

- **Compressor**: oAi = cPr,
- **Step:** oAi = StP
- **Fan:** oAi = FAn
- **Alarm:** oAi = ALr
- **Not used:** oAi = nu

NOTE: also the "Lin" value is present. This value **must not** be used..

According to the oA1÷oA5 configuration, 3 kinds of plant can be defined:

Rack with compressors only: all the oAi different from FAn
Rack with fans only: all the oAi different from CPr of StP
Rack with compressors and fans: both FAn and CPr are used for oAi.

COMPRESSORS CONFIGURATION

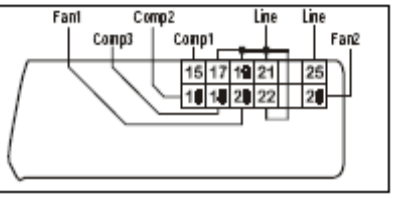
The regulation is **always** performed by the **P1** Probe.
With **step compressors** the output of compressor has to be set before the output of the step.
ES. Compressor with 3 steps: **oA1 = cPr, oA2= StP, oA2 = StP.**
If an oAi set as step without any previous oAi set as cPr the configuration alarm "CStP" will be activated.

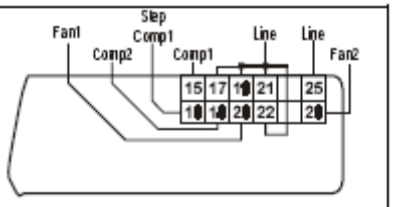
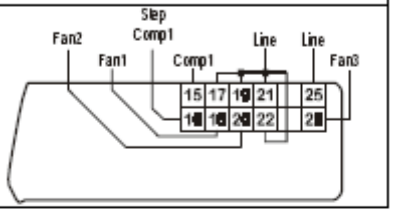
If compressor with different capacities are used **(CtyP=dPo)**, all the oAi must to be configured as **cPr** (compressor) otherwise the ***configuration alarm "CStP" will be activated.***

RACK WITH FANS ONLY

If none compressor is present, the regulation of the fans is performed through the P1 probe.
If are present both compressors and fans (Cpr+Fan) the regulation of the fans is performed through the P2 probe.
In this case if the probe P2 is set not present (par. P2P=no) configuration alarm "AoP2" will be activated..

PLANT CONFIGURATION EXEMPLA:

Plant with 3 compressors e 2 fans: oA1 = CPr, oA2 = CPr, oA3 = CPr, oA4 = FAn, oA5 = FAn	

Plant with 1 compressor with 1 step, 1 compressor, and 2 fans: oA1 = CPr, oA2 = StP (step of first compressor), oA3 = CPr, (second compressor) oA4 = FAn, oA5 = FAn	
Plant with 1 compressor with 1 step and 3 fans: oA1 = CPr, oA2 = StP (step of first compressor) oA3 = FAn, oA4 = FAn, oA5 = FAn	

CtyP: **Compressor type**: it sets if compressors have the same power (homogeneous) or not.
dPo = compressor with different capacities: in this case the regulation is neutral zone.
StP = homogeneous: the regulation can be neutral zone or proportional band.
Scr = don't set it

StPP: valve outputs polarity: polarity of the outputs for capacity valves. It determines the state of the relays associated with the capacity valves (only for homogeneous and stepped-capacity compressors):
oP=valve enabled with open contact;
cL= valve enabled with closed contact.

PC1 ..PC5 **Power of compressor 1...5**: for setting the power of single compressors. Available only if CtyP=dPo. The power is identified by a value (range 1÷255) proportional to the capacity of single compressor.
E.I. 3 compressors with following capacity: 10, 20, 40 HP. The parameters have to be set in these way: PC1=10, PC2=20, PC3=40.

FtyP: **Freon Type**: set the kind of freon used in the plant
r22 = R22; **r404**= R404A ; **507**= R507; **134**=134; **r717**=r717 (ammonia)

rTy: **Type of regulation (see par. 13 Type of regulation)**
db = neutral zone, **Pb** = proportional band.

rot **Activation: type of sequence**
YES = rotation: this algorithm distributes the working time between the various loads to ensure even run times.
no = fixed sequence: the compressors are enabled and disabled in fixed sequence: first, second etc.

12.2 Probes configuration

Probes can be used in different ways according to plant features, as described in the following table:

Kind of plant	Probe 1 - NTC/PTC: term. 4-5 // - 4-20mA: term. 6(+), 5 (in)	Probe 2 - NTC/PTC: term. 4-7 // - 4-20mA : term. 6(+), 7 (in)
Compressors and fans	Compressor regulation	Fan regulation
Compressors only	Compressor regulation	- Absent (P2P=no) or - For Dynamic set point or - For 4-20mA output (if present)
Fans only	Fans regulation	- Absent (P2P=no) or - For Dynamic set point or - For 4-20mA output (if present)

12.2.1 Probe 1 configuration

Pbc: Probe 1 setting. Cur = 4 ÷ 20 mA probe; **ntc** = NTC probe, **Ptc** = NTC probe.

PA04: Adjustment of read out for the Probe 1 (used only if Pbc=Cur). corresponding to **4mA** input signal, given by the suction probe (0 ÷31 bar or 0÷450 PSI or 0÷3100KPA)
Warning: set a value correspondent to absolute pressure. If the transducer measures relative pressure increase the range of 1 bar.
See also par. **3.2 How to set the range of the pressure probes**
E.I. PP11 relative pressure transducer, range -0.5÷12.0 bar. PA04=0.5 (-0.5+1); PA20=12.0 (11+1).
PP30 relative pressure transducer, range: 0÷30bar. PA04=1; PA20=31.

PA20: Adjustment of read out for the Probe 1 corresponding to **20mA** input signal, given by the suction probe (0 ÷ 31.0 bar or 0÷450 PSI or 0÷3100KPA)) **SEE THE WARNING FOR PA04.**

CAL: Probe 1 calibration (-12.0÷12.0 bar; -12.0÷12.0°C or -20÷20 PSI/°F)

12.2.2 Probe 2 configuration

P2P Probe 2 presence: no = probe 2 absent; **yES** = probe 2 present.

Pbc2: Probe 2 setting. Cur = 4 ÷ 20 mA probe; **ntc** = NTC probe, **Ptc** = NTC probe.

FA04: Adjustment of read out for the Probe 2 (used only if Pbc2=Cur). corresponding to **4mA** input signal, given by the suction probe (0 ÷31 bar or 0÷450 PSI or 0÷3100KPA)
Warning: set a value correspondent to absolute pressure. If the transducer measures relative pressure increase the range of 1 bar.
See also par. **3.2 How to set the range of the pressure probes**
E.I. PP11 relative pressure transducer, range -0.5÷12.0 bar. PA04=0.5 (-0.5+1); PA20=12.0 (11+1).
PP30 relative pressure transducer, range: 0÷30bar. PA04=1; PA20=31.

FA20: Adjustment of read out for the Probe 2 corresponding to **20mA** input signal, given by the suction probe (0 ÷ 31.0 bar or 0÷450 PSI or 0÷3100KPA)) **SEE THE WARNING FOR PA04.**

FCAL: Probe 2 calibration (-12.0÷12.0 bar; -12.0÷12.0°C or -20÷20 PSI/°F)

12.3 Others inputs configuration

SEP: Polarity of Low pressure-switch alarm (terminals 9-10)
oP =alarm with open contacts; cL= alarm with closed contact

HPP: Polarity of High pressure-switch alarm (terminals HP)
oP = alarm with open contacts; cL= alarm with closed contact

i1c Configurable digital input polarity (terminals 3-4):
oP: the digital input is activated by opening the contact;
CL: the digital input is activated by closing the contact.

i1F Configurable digital input polarity functions (terminals 3 - 4)
ES = Energy saving; oFF = instrument shut down; LLi = liquid level alarm

did Configurable digital input delay: (enabled only if i1F=LL) 0÷255min

ALIP: Alarm input for compressors and fans polarity
oP: the digital input is activated by opening the contact;
CL: the digital input is activated by closing the contact.

ALMr Manual reset of alarms for compressors and fans.
no = automatic recover of alarm: regulation restart when the correspondent digital input is disabled
yES = manual recover for the alarms of compressors and fans See also par.18.1.3 EA1÷EA5: Compressors and fans safeties alarm.

12.4 Display and Measurement unit

dEU: Default measurement unit for displaying (bar=bar; °C=°C, PSI=PSI; °F=°F)
NOTE1: The dEU parameter sets the measurement unit also for the set point and the following parameters: **CAL, FCAL, Pbd, ESC, LSE, HSE, Pb, ESF, LSF, HSF, LAL, HA, LAF, HAF**.
NOTE2: The controller automatically converts values of set point and following parameters **CAL, FCAL, Pbd, ESC, LSE, HSE, Pb, ESF, LSF, HSF, LAL, HA, LAF, HAF** in the measurement unit set in dEU parameter. In any case after modifying this parameter it's better check and modify if necessary the set point and the above parameters.

rES Resolution for °C and bar (in = integer; dE= decimal point)

rELP Pressure displaying: **AbS** = absolute pressure; **rEL** = relative pressure.
NOTE: In this case the pressure displayed, the set point and the following parameters LSE HSE, LSF and HSF are automatically decreased by 1.0 bar or 14 PSI

12.5 Compressors regulation

Pbd: Proportional band or neutral zone width (0.10÷5.00bar/0.5÷30°C or 1÷80PSI/1÷50°F)
The band (or zone) is symmetrical compared to the target set point, with extremes: set+Pbd/2 ... set-Pbd/2. The measurement unit depends on the dEU par.

ESC Energy saving value for compressors: (-20÷20bar; -50÷50°C) this value is add to the compressor set point.

onon: Minimum time between 2 following switching ON of the same compressor (0÷255 min).

oFon: Minimum time between the switching off of a compressor and the following switching on. (0÷255min). *Note: usually onon is greater than oFon.*

don: Time delay between the insertion of two different compressors (0÷99.5min; res. 10s).

doF: Time delay between switching off of two different compressors (0÷99.5 min; res. 10s)

donF: Minimum time a stage stays switched ON (0÷99.5 min; res. 10s)

FdLy: "don" delay enabled also for the first call. If enabled, the triggering of the step is delayed for a "don" value, respect to the call. (**no** = "don" not enabled; **yES**="don" enabled)

FdLF "doF" delay enabled also for the first switching off. It enables the "doF" delay between the request of a release and the actual switching off.
(**no** = "doF" not enabled; **yES**="doF" enabled)

odo: Regulation delay on start-up: (0÷255s) on switching ON the instrument starts working after the time delay imposed in this parameter.

LSE: Minimum set point: The measurement unit depends on dEU parameter. It sets the minimum value that can be used for the set point, to prevent the end user from setting incorrect values.

HSE: Maximum set point: The measurement unit depends on dEU parameter. It sets the maximum acceptable value for set point.

12.6 Fans regulation

Pb Proportional band zone width (00.10÷5.00bar/0.5÷30°C or 1÷80PSI/1÷50°F).

Set the dEU par. and the target set point for fans before setting this parameter. The band is symmetrical compared to the target set point, with extremes: set+Pb/2 ... set-Pb/2. The measurement unit depends on the dEU par.

ESF Energy saving value for fans: (-20÷20bar; -50÷50°C) this value is add to the fans set point.

Fon: Time delay between the insertion of two different fans (0÷255sec).

FoF: Time delay between switching off of two different compressors (0÷255 sec)

HSF Energy saving value for fans: (-20÷20bar; -50÷50°C) this value is add to the fans set point.

12.7 Alarms – compressor section

PAo: **Alarm probe exclusion at power on.** it is the period starting from instrument switch on, before an alarm probe is signalled. (0÷255 min). During this time if the pressure is out of range all the compressor are switched on.

LAL: Low pressure (temperature) alarm – compressor section: The measurement unit depends on dEU parameter. It's always subtracted to the set point. When the value **SET-LAL** is reached the A03C alarm is enabled, (possibly after the **tAo** delay time).

HAL: High pressure (temperature) alarm– compressor section: The measurement unit depends on dEU parameter. It's always added to the set point. When the value SET+HAL is reached the A04C alarm is enabled, (possibly after the **tAo** delay time).

tAo: Low and High pressure (temperature) alarms delay– compressor section: (0÷255 min) time interval between the detection of a pressure (temperature) alarm condition and alarm signalling.

Ser: Service request: (1÷9990 hours, res. 10h) number of running hours after that the "A14" maintenance call is generated.

PEn: Low pressure-switch intervention numbers: (0÷15). If the low pressure-switch is enabled PEn times in the PEI interval, the controller is locked. **Only the manually unlocking is possible**. See also the alarms table at paragraph 17. Every time the pressure-switch is enabled all the compressor are turned off.

PEI: Pressure-switch interventions time (0÷15 min) Interval, linked to the Pen parameter, for counting interventions of the low pressure-switch..

SPr: number of steps engaged with faulty probe. (0÷#compr).

PoPr: capacity engaged with faulty probe (0÷100%) It's used only if CtyP=dPo.

12.8 Alarms – fans section

LAF: Low pressure alarm – fans section: The measurement unit depends on the dEU parameter. It's always referred to fan set point When the value SETF-LAF is reached the LA2 alarm is enabled, (possibly after the **AFd** delay time).

HAF: High pressure alarm – fans section: The measurement unit depends on the dEU parameter. It's always referred to the set point. When the value SETF+HAF is reached the HA2 alarm is enabled, (possibly after the **AFd** delay time).

AFd: Low and High pressure alarms delay – fans section: (0÷255 min) time interval between the detection of a pressure alarm condition in the fans section and alarm signalling.

PnF: High pressure-switch intervention numbers – fans section: (0÷15 with 0 the manually unlocking is disabled) if the high pressure-switch is enabled PnF times in the PiF interval, the controller is locked. **It can be unlocked only manually**. See paragraph 17. Every time the pressure-switch is enabled all the compressors are turned off and all the fans are turned on.

PiF: Pressure-switch interventions time – fans section (1÷15 min) Interval, linked to the PEn parameter, for counting interventions of the high pressure-switch..

FPr Number of fans engaged with faulty probe. (0÷#fans).

12.9 Dynamic set point

dSEP Dynamic set point enabling (**no** = dynamic set point disabled; **yES** = dynamic set point enabled)
WARNING the dynamic set point requires a dedicated probe, so it's necessary that all the loads are the same kind. (El. fans).

dSES External temperature set point to start dynamic regulation (-50.0 ÷ 150.0 °C)

dSEb External band width for dynamic set point (-50.0 ÷ 50.0°C)

dSEd Set point differential for dynamic set point: -20.0÷20.0bar; -50.0÷50.0°C

12.10 Analog output (optional)

AOP Probe for analog output nP = no probe; **P1**= Probe 1; **P2**= Probe 2

LAO Start of scale for analog output: it's temperature (pressure) detected by the probe which is associated the 4mA value: (0.0÷51.0bar; -50.0÷150.0°C)

UAO End of scale for analog output: it's temperature (pressure) detected by the probe which is associated the 20mA value: (0.0÷51.0bar; -50.0÷150.0°C)

AOM Minimum value for analog output (4 ÷ 20mA)

SAO Percentage of analog output in case of probe failure: (0 ÷ 100%)

12.11 Other

tbA Alarm relay silencing: by pushing one of the keypad buttons. **no**= alarm relay stays on; **yES**= alarm relay is switched off by pushing any keys.

oFF Switching ON/OFF enabling from keyboard: (**no** = disabled; **yES**= enabled) It permits the switching ON/OFF of the instrument by pressing the SET key for more than 4s.

Ad1: Compressors address (1 –247) It is used in monitoring system.

Ad2: Fans address (1 –247) It is used in monitoring system.

Ptb Parameter table code: readable only.

rEL Software release for internal use.

13. Type of regulation

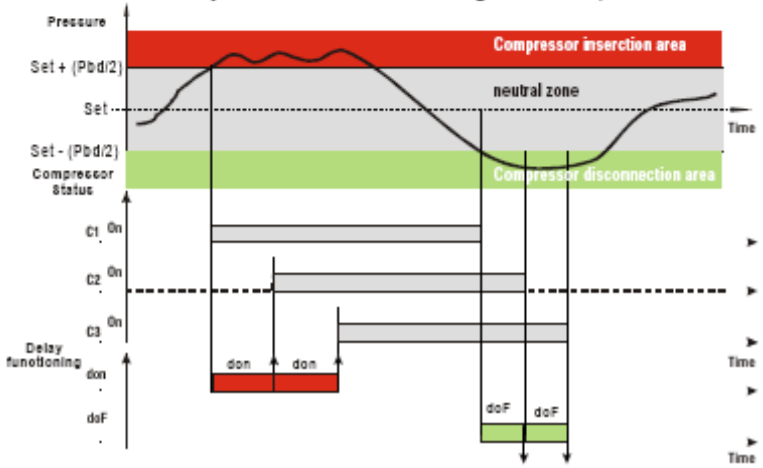
13.1 Dead band – Only for compressors

This kind of regulation is available only for compressors. The neutral zone (Pbd) is symmetrical compared to the target set point, with extremes: set+Pbd/2 ... set-Pbd/2. If the pressure (temperature) is inside this zone the controller maintains the same number of loads switched on and off, without changing anything.
When the pressure (temperature) go out from the zone, regulation starts. If the pressure is greater than SET+Pbd/2, the loads are switching on with timing given by parameters: don and doF.
A load is turned on only if the his safety times **onon, oFon, donF** are over.
Regulation stops when the pressure (temperature) come back into the neutral zone.

In the following a simplify exemplum that explains the regulation in neutral zone for compressor homogeneous with 1 step for each compressors. The safety times onon, oFon and donF are not considered. In the real regulation the a load is entered or turned off only if these times are over.

Ex. Dead band control, compressors with same capacities, 1 step for each compressor.
In this example:

oA1 = cPr; oA2 = cPr; oA3 = cPr; oA4 =nu; oA5 = nu number of compressors
CtyP = SPo homogeneous compressors;
rty = db dead band regulation
Sty = yES rotation
FdLy = no "don" delay not enabled at first calling after an equilibrium condition.
dLF = no "doF" delay not enabled at first calling after an equilibrium condition.



13.2 Proportional Band – for compressors and fans

The regulation band (Pbd) is divided into as many parts as there are stages according to the following formula:

 # step = oAi = CPr or StP (number of compr. or steps).

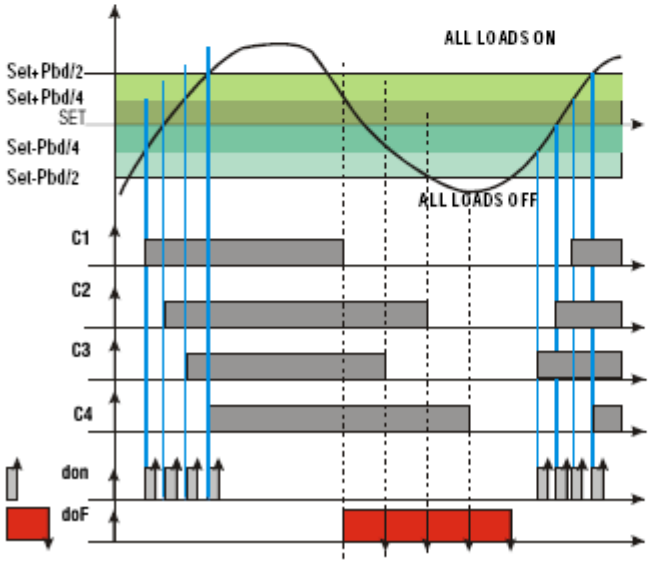
The numbers of stages switched ON is proportional to the value of the input signal: when this distances itself from the target set point and enters the various bands, the compressors are switched ON, to be then turned OFF when the signal brings near the set point.

In this way if the pressure is greater than regulation band, all the compressors are on, if the pressure (temperature) is lower than the regulation band all the compressors are off.
Naturally also for this regulations all the delays (don and doF) safety times (onon, oFon and donF) are valid.

Regulation according to the running hours
The algorithm switch on and off the loads according to the running hours of each load. In this way the running hours are balanced.

Example

oA1 = cPr; oA2 = cPr; oA3 = cPr; oA4 = cPr:	**4** compressors
CtyP = SPo	homogeneous compressors.
rty = Pb	proportional band regulation
Sty = yES	rotation
FdLy = no	"don" delay at first call not enabled.
dLF= no	"doF" delay at first call not enabled.



This draw highlights the doF time: the loads are in fact turned off only when the doF time is over.

14. Mounting & installation

The instruments are suitable only for internal use. Instruments shall be mounted on panel, in a 29x71 mm hole, and fixed using the special brackets supplied.
To obtain an IP65 protection grade use the front panel rubber gasket (mod. RG-C) as shown in figure. The ambient operating temperature range is between 0÷60°C.
Avoid locations subject to heavy vibration, corrosive gases or excessive dirt. The same applies to the probes. Ensure ventilation around the instrument.

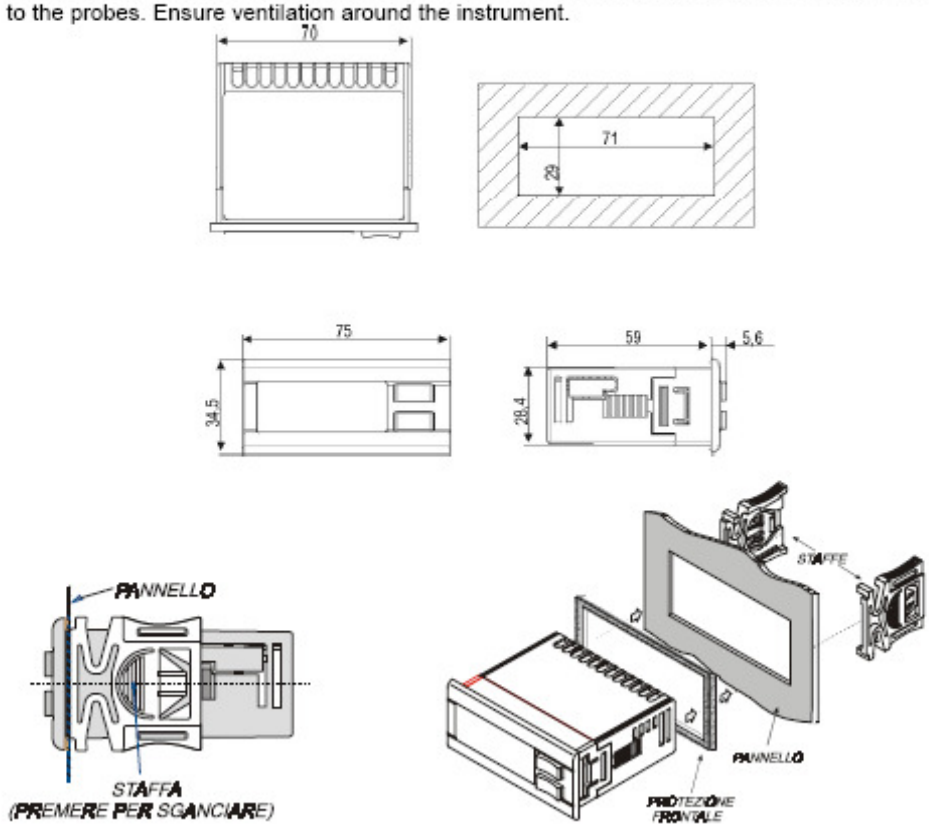


Figure 1

15. Electrical connections

The controller is provided with removable terminal blocks for wires having section not bigger than 1.0 mm^2: 14 ways for analogue and digital inputs, 12 ways for relays

Note: terminals 17-19 are connected inside the controller, they are the common for the "relay n°1" with terminal 15 and "relay n°2" with terminal 16
Terminals 21-22 are connected inside the controller, they are the common for the "relay n°3 " with terminal 18 and "relay n°4" with terminal 20.
A 5-ways connector is dedicated to the TTL / RS485 interface.

Four connectors having 2-way for 0.2 mm^2 wires are dedicated to: HP digital input, 12Vdc open collector alarm, LP digital input, 4..20mA analogue output.

Check power supply data before connection wires.
Keep the probe and the digital input wires separate from the power cable.
Do not exceed the maximum rating current for each relay, check technical data and if the load is bigger, use filtered contactors.
Before connecting cables make sure the power supply complies with the instrument's requirements. Separate the input connection cables from the power supply cables, from the outputs and the power connections. **Do not exceed the maximum current allowed on each relay**, in case of heavier loads use a suitable external relay.

15.1 Probes connection

Pressure probe (4 - 20 mA): respect the polarity. If using terminal ends be sure there are no bear parts which could cause short circuiting or introduce noise disturbance at high frequencies. To minimise the induced disturbances use shielded cables with the shield connected to earth.
Temperature probe: it is recommended to place the temperature probe away from direct air streams to correctly measure the temperature.

16. RS485 serial link

All models can be integrated into the monitoring and alarm system XJ500 using the TTL serial port. They use the standard ModBus RTU protocol, so they can be fitted in a system integrator using this protocol.
The controller has 2 serial addresses first one Ad1 for compressor section, second one Ad2 for fan section. To completely monitor both sections the values of the 2 addresses have to be different.
If the Ad2 parameters have the same value the status of the fans is not monitored.

17. Technical features

Housing: Self extinguishing ABS.
Case: Front panel 32x74 mm, depth 60mm ("C" format);
Mounting : "C" format panel mounting in a 29x71 mm panel cut-out
Protection: IP65.
Frontal protection: IP65 with frontal gasket mod RG-C model.
Connections: Removable terminal block 12 and 14 ways;
Power supply: 12Vac/dc ± 10%, 24Vac/dc ± 10%, 50-60Hz.
Power absorption: 5VA max.
Display: 3 digits red led and 4 digit orange led.
Inputs: 2 NTC probes, or 2 PTC probes and 2 4..20mA transducer.
Digital inputs: 5 free voltage
Relay outputs: 5 relay SPST 5(3)A, 250Vac
Open collector: alarm output: 12V, 40mA.
Analogue output: 4..20mA for fan control, trigger for fan control
Serial output : TTL standard **Communication protocol:** ModBus – RTU
Data storing: on the non-volatile memory (EEPROM).
Kind of action: 1B; **Pollution grade:** normal; **Software class:** A.
Operating temperature: 0÷60 °C.; **Storage temperature:** -25÷60 °C.
Relative humidity: 20-85% (no condensing)
Measuring range: NTC probe: -40÷110°C.
Resolution: 0,1 °C or 1°C; **Accuracy (ambient temp. 25°C):** ±0,7 °C ±1 digit

18. Alarm list

Usually alarm conditions are signalled by means of:
1. Activation of alarm output 0-12V
2. Buzzer activation
3. Message on proper display
4. Log of alarm: code and duration.

The table at paragraph 18.3

18.1 Types of alarms and signalling managed

18.1.1 A12: Configuration alarm

The following configuration parameters are checked after each modification.:

OA1 ÷ OA5	Outputs 1- 5 configuration
P2P	Second probe presence.
CtyP	Compressor type
dSEP	Dynamic set point enabling
AOP	Probe for analog output
tOP	Probe for triac output

When these parameters are set in wrong way an alarm message is generated:
the label A12 is shown on the upper display, while the lower display signals what wrong setting has created the error:
The following table contains the displayed messages:

Mess.	Errata	Corrige
nLod	Number of loads higher than loads available in the controller	• Check number of oAi set as load, this number has to be lower of equal to the number of relay of the controller.
cStP	Load (step) configuration error	• A relay oA(i) has been set as compressor without a previous relay oA(i-1) has been set as compressor. El oA1 = StP
AOP2	P2 probe not available for the 4÷20mA output	• P2 probe not available P2P =no. Enable the probe setting: P2P =yES • The second probe P2 is used to control the temperature of the engine of screw compressors. Check CtyP and set it different from Scr.
dSP2	P2 probe not available for the dynamic set point function	• P2 probe not available P2P =no. Enable the probe setting: P2P =yES • The second probe P2 is used to control the temperature of the engine of screw compressors. Check CtyP and set it different from Scr.
FAP2	P2 probe not available for fan regulation	• P2 probe not available P2P =no. Enable the probe setting: P2P =yES • The second probe P2 is used to control the temperature of the engine of screw compressors. Check CtyP and set it different from Scr.
CSP2	P2 probe not available for screw compressor	• Check CtyP and set it different from Scr.
P2CF	Wrong second probe configuration (El.: If Cty= Scr P2 ha to be PTC)	• Set P2P = yES and PbC2 = PTC

18.1.2 E0H, E0L Pressure switch alarm, suction and condensing sections

Terminals
Low pressure switch input: 9-10, high pressure switch input: HP.

Parameters
SEP: Low pressure switch polarity: It establishes if the input is activated by closing (SEP=cL) or by opening (SEP=oP) the terminals.
HPP: High pressure switch polarity: It establishes if the input is activated by closing (HPP=cL) or by opening (HPP=oP) the terminals.

Actions
Low pressure: every time the inputs are activated all the compressors are switched off. The instrument restart the standard operating mode when the input is disabled. If there are PEn activation in the PEi time, only manual resetting is allowed, by pressing the **DOWN** key for 3s or by turning off and on the instrument.

High pressure: every time the inputs are activated all the compressors are switched off and fans are switched on. The instrument restart the standard operating mode when the input is disabled. If there are PnF activation in the PiF time, only manual resetting is allowed, by pressing the **DOWN** key for 3s or by turning off and on the instrument.

18.1.3 EA1÷EA5: Compressors and fans safeties alarm.

Terminals
WARNING: THESE TERMINALS REQUIRE A FREE OF VOLTAGE CONNECTION.
The terminals (from 10, 11, 12, 13, 14+ ID5) really used depends on the number of loads. The protections regarding the compressors and fans are connected to these inputs. If one of these protections is enabling (E.I. for lack of oil or overheating, etc,) the corresponding load is turn off.

Parameters
ALIP: It establishes if the input is activated by closing (ALIP=cL) or by opening (ALIP=oP) the terminals.

Actions
Every time one input is activated the corresponding output is turned off.

Recovery
Recovery depends on **ALMr** parameter:
With **ALMr = no** The instrument restart the standard operating mode when the input is disabled.
With **ALMr = yES** manual recover for the alarms of compressors and fans. Push the **DOWN** key for 3s.

18.1.4 P1, P2: probe failure alarm

It is generated by failure in the probe P1 or P2.

If both compressors and fans are managed by the instrument
SPr: number of steps engaged with faulty probe. (0÷# oAi = cPr or StP) It's used only if CtyP=StP.
PoPr: capacity engaged with faulty probe (0÷255) It's used only if CtyP=dPo.
FPr: Number of fans engaged with faulty probe. (0÷# oAi = FAn)

If the second probe is used for dynamic set point
The function is disabled and only the standard set point is used.

If the second probe is used for analog output
The function is disabled, the value of the analog output is set in the SAo parameter.

Recovery
Automatic as soon as probe restarts working.

18.1.5 HA, LA, HA2, LA2High and low pressure (temperature) alarms

This alarm signals that the pressure (temperature) is out of limits established by parameters LAL and HAL for compressors and LAF –HAF for fans.
The tAo and AFd parameters set the delay between alarm condition and alarm signalling.
Action
The alarm is signalled with standard action. The outputs are unchanged.

18.2 Alarm muting

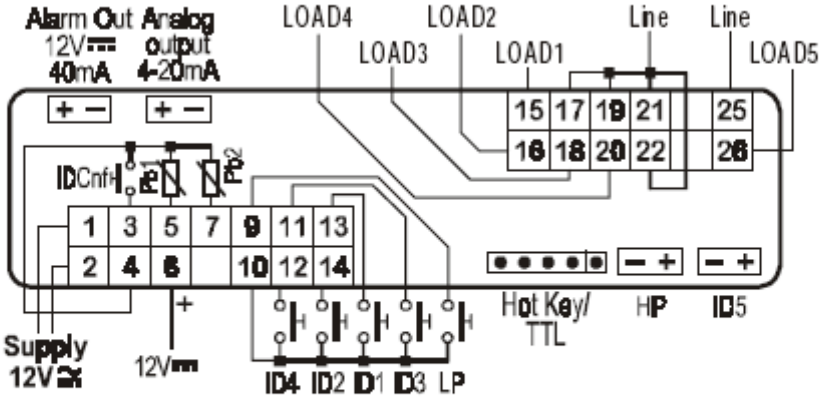
Press any buttons to silence the buzzer during an alarm condition.
Hold pressed for more than 3 seconds switch off the alarm relay during an alarm condition

18.3 Alarm conditions – summary table

Code	Description	Cause	Action	Reset
E0L	**Low pressure-switch alarm**	Low pressure switch input enabled	All compressors are turned off. Fans unchanged.	**Automatically** (if the number of activation are less than PEn in the PEi time) when the input is disable. - The compressors restarts working according to the working algorithm. **Manually** (if PEn activation happened in the PEi time) When the input is disable: a. hold pressed the **Restart**(DOWN)key for 3s or b. turn off and on the instrument.. - The compressors restarts working according to the working algorithm.
E0H	**High pressure switch alarm**	High pressure switch input enabled	- All compressors are turned off. - All fans are turned on.	**Automatically** (if the number of activation are less than PEn in the PEi time) when the input is disable. - Compressors and fans restart working according to the working algorithm. **Manually** (if PEn activation happened in the PEi time) When the input is disable: - hold pressed the **Restart**(DOWN) key for 3s or - turn off and on the instrument. Compressors and fans restarts working according to the working algorithm.
P1	**P1 probe failure alarm**	Probe failure or out of range	– The compressors are activated according to the SPr or PoPr parameters.	**Automatically** as soon as the probe restarts working.
P2	**P2 probe failure alarm**	Probe failure or out of range	– The fans are activated according to the FPr parameters.	**Automatically** as soon as the probe restarts working.

Code	Description	Cause	Action	Reset
EA1 EA2 EA3 EA4 EA5	**Load safeties alarm**	Safeties compressor/fan input activation. NOTE: with step compressors 1 input for each compressor has to be used.	– the corresponding load is turned off. (with step compressors all relays referred to the input are disabled).	Recovery depends on **ALMr** parameter: With **ALMr – no** The instrument restart the standard operating mode when the input is disabled. With **ALMr – yES** manual recover for the alarms of compressors and fans. Push the **DOWN** key for 3s.
LA	**Minimum pressure (temperature) alarm compressors section**	Suction pressure or temperature lower than SET_C-LAL value	– signalling only	**Automatically:** as soon as the pressure or temperature reaches the (Set_C-LAL+ differential) value. (differential – 0.3bar or 1°C)
LA2	**Minimum pressure (temperature) alarm fans section**	Condensing pressure or temperature lower than SET_F-LAL value	– signalling only	**Automatically:** as soon as the pressure or temperature reaches the (Set_F-LAL+ differential) value. (differential – 0.3bar or 1°C)
HA	**Maximum pressure (temperature) alarm compressors section**	Suction pressure or temperature higher than SET_C+HAL value	– signalling only	**Automatically:** as soon as the pressure or temperature reaches the (Set_C + HAL - differential) value. (differential – 0.3bar or 1°C)
HA2	**Maximum pressure (temperature) alarm fans section**	Condensing pressure or temperature higher than SET_F+HAL value	– signalling only	**Automatically:** as soon as the pressure or temperature reaches the (Set_F + HAL - differential) value. (differential – 0.3bar or 1°C)
A5	**Liquid level alarm**	Input enabled	– signalling only	**Automatically** as soon as the input is disabled
A14	**Load maintenance alarm**	A load has worked for the hour set in the SEr parameter	- signalling only	**Manually:** reset the running hour of the compressor (see par.**8 Running hours of loads**)

19. Wiring connections



Probe connections:
4-20mA probe: P1 = 5(-) – 6(+); P2 = 7(-) – 6(+);
PTC/NTC probe: P1 = 5 – 4; P2 = 7 – 4

NOTE: analog output is an option.

20. Parameters – Default values

Name	°C	°F	bar	PSI	Level	Description	Range
SEtc	-18,0	0	2,3	33	--	Set point for compressors	LSE ÷ HSE
SEtF	35,0	95	15,1	220	--	Set point for fans	LSF ÷ HSF
oA1	CPr	CPr	CPr	CPr	Pr2	Outputs 1 configuration	cPr / FAn / StP / ALr / LLn / nu
oA2	CPr	CPr	CPr	CPr	Pr2	Outputs 2 configuration	cPr / FAn / StP / ALr / LLn / nu
oA3	CPr	CPr	CPr	CPr	Pr2	Outputs 3 configuration	cPr / FAn / StP / ALr / LLn / nu
oA4	FAN	FAN	FAN	FAN	Pr2	Outputs 4 configuration	cPr / FAn / StP / ALr / LLn / nu
oA5	FAN	FAN	FAN	FAN	Pr2	Outputs 5 configuration	cPr / FAn / StP / ALr / LLn / nu
ctYP	SPo	SPo	SPo	SPo	Pr2	Compressor type	SPo / dPo / Scr
StP	CL	CL	CL	CL	Pr2	Valve outputs polarity	oP / cL
Pc1	20	20	20	20	Pr2	Power of compressor 1	0 ÷ 255
Pc2	20	20	20	20	Pr2	Power of compressor 2	0 ÷ 255
Pc3	20	20	20	20	Pr2	Power of compressor 3	0 ÷ 255
Pc4	20	20	20	20	Pr2	Power of compressor 4	0 ÷ 255
Pc5	20	20	20	20	Pr2	Power of compressor 4	0 ÷ 255
FtYP	404	404	404	404	Pr2	Freon Type	r22 / 404 / 507 / 134 / 717
rtY	db	db	db	db	Pr2	Type of regulation	db / Pb
StY	yES	yES	yES	yES	Pr2	Compressor rotation	no / YES
rot	yES	yES	yES	yES	Pr2	Fans rotation	no / YES
Pbc	Cur	Cur	Cur	Cur	Pr2	Probe 1 setting	cur / Ptc / ntc
PA04	0,5	7	0,5	7	Pr2	Adjustment of read out for the Probe at 4mA	0.0 bar o 0 PSI ÷ PA20
PA20	12,0	174	12,0	174	Pr2	Adjustment of read out for the Probe at 20mA	PA04 ÷ 51.0 bar o 750 PSI
cAL	0	0	0	0	Pr2	Probe 1 calibration	-12.0 ÷ 12.0 °C o bar / -20 ÷ 20 °F o PSI
P2P	yES	yES	yES	yES	Pr2	Second probe presence	no / YES
Pbc2	Cur	Cur	Cur	Cur	Pr2	Probe 2 setting	cur / Ptc / ntc
FA04	1	14	1	14	Pr2	Adjustment of read out for the Probe at 4mA	0.0 bar o 0 PSI ÷ FA20
FA20	31	450	31	450	Pr2	Adjustment of read out for the Probe at 20mA	FA04 ÷ 51.0 bar o 750 PSI
FcAL	0	0	0	0	Pr2	Probe 2 calibration	-12.0 ÷ 12.0 °C o bar / -20 ÷ 20 °F o PSI
SEP	CL	CL	CL	CL	Pr2	Low pressure switch input polarity	oP / cL
HPP	CL	CL	CL	CL	Pr2	High pressure switch input polarity	oP / cL
i1c	cL	cL	cL	cL	Pr2	Configurable digital input polarity	oP / cL
i1F	ES	ES	ES	ES	Pr2	Configurable digital input polarity functions	ES / oFF / LL
did	0	0	0	0	Pr2	Configurable digital input delay	0 ÷ 255 min.
ALiP	CL	CL	CL	CL	Pr2	Alarm input for compressors and fans polarity	oP / cL
ALMr	no	no	no	no	Pr2	Manual reset of alarms for compressors and fans	no / YES
dEu	°C	°F	bar	PSI	Pr2	Default measurement unit for displaying	bar / °C / PSI / °F

dixell	Operating instructions	cod. 1592001320

Name	°C	°F	bar	PSI	Level	Description	Range
rES	dE	in	dE	in	Pr2	Resolution for °C and bar	in / dE
rELP	rEL	rEL	rEL	rEL	Pr2	Pressure displaying	rEL / AbS
Pbd	4	8	0.5	7	Pr2	Proportional band or neutral zone width	> 0 ÷ 10.0 bar / 30.0 °C / 80 PSI / 50 °F
ESc	0	0	0	0	Pr2	Energy saving value for compressors	- + 20.0 bar / - + 50.0 °C / - + 300 PSI / - + 90 °F
onon	5	5	5	5	Pr2	Minimum time between 2 following switching ON of the same compressor	0 ÷ 255 min.
oFon	2	2	2	2	Pr2	Minimum time between the switching off of a compressor and the following switching on	0 ÷ 255 min.
don	0,3	0,3	0,3	0,3	Pr2	Time delay between the insertion of two different compressors	0 ÷ 99.5 min. (res. 10 sec.)
doF	0,1	0,1	0,1	0,1	Pr2	Time delay between switching off of two different compressors	0 ÷ 99.5 min. (res.10 sec.)
donF	0,3	0,3	0,3	0,3	Pr2	Minimum time a stage stays switched ON	0 ÷ 99.5 min. (res.10 sec.)
FdLY	no	no	no	no	Pr2	"don" delay enabled also for the first call	no / YES
FdLF	no	no	no	no	Pr2	doF" delay enabled also for the first switching off	no / YES
odo	20	20	20	20	Pr2	Regulation delay on start-up	0 ÷ 255 sec.
LSE	-40	-40	0,3	5	Pr2	Minimum set point for compressors	PA04 ÷ HSE
HSE	10	50	7,2	100	Pr2	Maximum set point for compressors	LSE ÷ PA20
Pb	4	8	2.0	24	Pr2	Proportional band or neutral zone width for fans	0.1÷10.0 bar / 30.0°C /80 PSI/ 50°F
ESF	0	0	0	0	Pr2	Energy saving value for fans	- + 20.0 bar / - + 50.0 °C / - + 300 PSI / - + 90 °F
Fon	15	15	15	15	Pr2	Time delay between the insertion of two different fans	0 ÷ 255 sec.
FoF	5	5	5	5	Pr2	Time delay between switching off of two different fans	0 ÷ 255 sec.
LSF	10	50	7,2	100	Pr2	Lower set for fans	PA04 ÷ HSF
HSF	60	140	27,8	404	Pr2	Higher set for fans	LSF ÷ PA20
PAo	30	30	30	30	Pr2	Alarm probe exclusion at power on	0 ÷ 255 min.
LAL	15,0	30	1,5	21	Pr1	Low pressure (temperature) alarm – compressor section	> 0 ÷ 30.0 bar / 100.0 °C / 430 PSI / 200 °F
HAL	20.0	40	2,5	46	Pr1	High pressure (temperature) alarm– compressor section	> 0 ÷ 30.0 bar / 100.0 °C / 430 PSI / 200 °F
tAo	15	15	15	15	Pr1	Low and High pressure (temperature) alarms delay– compressor section	0 ÷ 255 min.
SEr	999	999	999	999	Pr2	Service request	(0 = disable) 1 ÷ 999; res 10h
PEn	5	5	5	5	Pr2	Low pressure-switch intervention numbers	0 ÷ 15
PEi	15	15	15	15	Pr2	Pressure-switch interventions time	0 ÷ 255 min.
SPr	2	2	2	2	Pr2	Number of steps engaged with faulty probe	0 ÷ # compressors
PoPr	50	50	50	50	Pr2	Capacity engaged with faulty probe	0 ÷ 100 %
LAF	20	40	6,7	96	Pr1	Low pressure alarm – fans section	> 0 ÷ 30.0 bar / 100.0 °C / 430 PSI / 200 °F

dixell	Operating instructions	cod. 1592001320

Name	°C	°F	bar	PSI	Level	Description	Range
HAF	20	40	9,8	141	Pr1	High pressure alarm – fans section	> 0 ÷ 30.0 bar / 100.0 °C / 430 PSI / 200 °F
AFd	15	15	15	15	Pr1	Low and High pressure alarms delay – fans section	0 ÷ 255 min.
PnF	5	5	5	5	Pr2	High pressure-switch intervention numbers – fans section	0 ÷ 15
PiF	15	15	15	15	Pr2	Pressure-switch interventions time – fans section	0 ÷ 255 min.
FPr	2	2	2	2	Pr2	Number of fans engaged with faulty probe	0 ÷ # fans
dSEP	no	no	no	no	Pr2	Dynamic set point enabling	no / YES
dSES	100	100	100	100	Pr2	External temperature set point to start dynamic regulation	0.0 ÷ 150.0 °C / 32 ÷ 302 °F
dSEb	10	10	10	10	Pr2	External band width for dynamic set point	-50.0 ÷ 50.0 °C / -90 ÷ 90 °F
dSEd	0	0	0	0	Pr2	Set point differential for dynamic set point	- + 20.0 bar / - + 50.0 °C / - + 300 PSI / - + 90 °F
AOP	nP	nP	nP	nP	Pr2	Probe for analog output	nP(0) - P1(1) - P2(2)
LAO	0	0	0	0	Pr2	Start of scale for analog output	AOC=Pb : 0.0÷51.0(BAR) - 50.0÷150.0(°C) 0÷750(PSI) - 58÷302(°F);
UAO	1	1	1	1	Pr2	End of scale for analog output	AOC=Pb : 0.0÷51.0(BAR) - 50.0÷150.0(°C) 0÷750(PSI) - 58÷302(°F)
AOM	4	4	4	4	Pr2	Minimum value for analog output	4 ÷ 20
SAO	4	4	4	4	Pr2	Percentage of analog output in case of probe failure	0 ÷ 100 (%)
tbA	yES	yES	yES	yES	Pr2	Alarm relay silencing	no / YES
oFF	no	no	no	no	Pr2	Switching ON/OFF enabling from keyboard	no / YES
Ad1	1	1	1	1	Pr2	Compressors address	1 ÷ 247
Ad2	1	1	1	1	Pr2	Fans address)	1 ÷ 247
rEL	-	-	-		Pr1	Software release	readable only
Ptb	-	-	-		Pr1	Parameter table code	readable only
Pr2					Pr1	Password protected menu	readable only

Compressor parameters
Fans parameters
Common parameters

Dixell s.r.l.
Z.I. Via dell'Industria, 27 - 32010 Pieve d'Alpago (BL) ITALY
tel. +39 - 0437 - 98 33 - fax +39 - 0437 - 98 93 13
http://www.dixell.com E-mail: dixell@dixell.com

11.7 Pressure limiter and sensor

11.7.1 High-pressure switch

Monitors the condensation pressure and switches the compressor off before the max. permitted pressure of 19,0 bar has been reached.
Restarting the unit is only possible once the pressure has dropped and the reset button has been activated.

For this it is necessary< to remove the front panel.

Type ALCO PS2-C7A

11.7.2 Low-pressure switch

Monitors the evaporation temperature and switches off the compressor when it falls below the set value. (See technical specifications for standard setting). With this the condenser is protected. Moreover, this also prevents the evaporator from freezing.

The low pressure switch resets automatically once the pressure rises.

Type ALCO PS2-C7A

Pressure Controls Series PS2
Type C7A

Fig. 1a

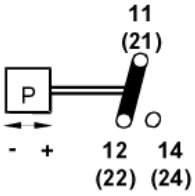


Fig. 1b

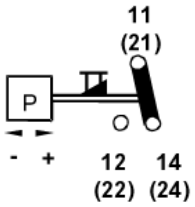
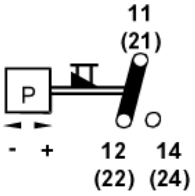


Fig. 1c



For application in refrigeration systems and heat pumps.

Technical data:

- Protection class: IP44 (IEC 529/EN 60529)
- Ambient temperature (housing): -50°C to +70°C
- Storage and transportation temperature: -50°C to +70°C
- Medium temperature: -50°C to 70°C
- Operating pressure: -0.9 bar to 31 bar
- Leakage test pressure: *see type code / pressure range*
- Vibration resistance: 4g (10...1000 Hz)
- Electrical rating
  - Heating load (AC1): 24 A / 230 V AC
  - Inductive load (AC15): 10 A / 230 V AC
  - Inductive load (DC13): 0.1 A / 230 V DC
    3 A / 24 V DC
  - Start-up (AC3): 144A / 230 V AC
  - Motor rating (FLA): 24 A / 230 V AC
  - Locked rotor (LRA): 144 A / 230 V AC
- Medium compatibility: HFC, HCFC, CFC
  not released for inflammable refrigerants
- Dimensions:
  width x height x depth (mm): 139 x 75 x 44
  without reset button, without pressure connector

Type code:

PS2 - ① ② ③ e.g. PS2-A 7 A

① Function

A = Both sides: automatic pressure control
B = Both sides: pressure cut out, external manual reset, TÜV/DIN 32733
C = Left: pressure limiter, automatic, TÜV/DIN 32733. Right: pressure cut out, external manual reset, TÜV/DIN 32733
G = Left: pressure cut out, external manual reset, internal manual reset, TÜV/DIN 32733
L = Left: automatic pressure control. Right: pressure control, extern. manual reset
M = Left: automatic pressure control. Right: convertible reset from R to A
R = Both sides: pressure control, external man. reset
S = Both sides: Safety pressure cut out, internal manual reset, TÜV/DIN32733
T = Left: pressure limiter, automatic, TÜV/DIN 32733. Right: safety pressure cut out, internal manual reset, TÜV/DIN32733.
U = Convertible from function ‘R’ to ‘A’
W = Both sides: pressure limiter, automatic, TÜV/DIN32733

NOTE: Manual reset versions in combination with the low pressure side of Pressure Range 7 or 9 have a low pressure manual reset function. Manual reset versions in combination with the high pressure side of Pressure Range 7, 8 or 9 have a high pressure manual reset function.

Pressure Controls Series PS2
Type C7A

Fig. 2

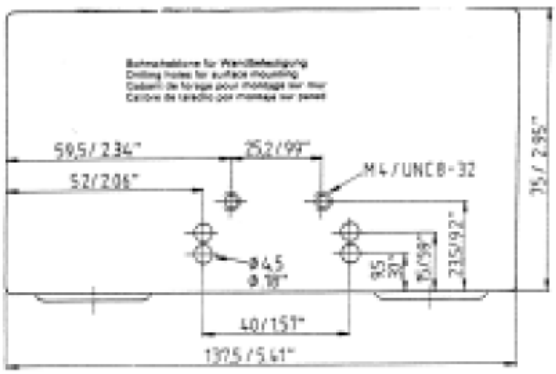
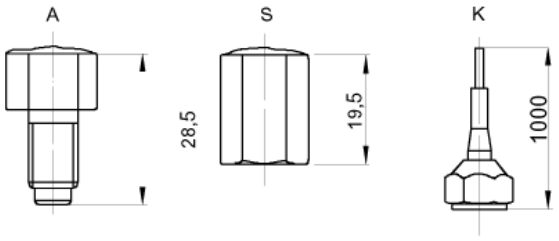


Fig. 3



② **Pressure range (leakage test pressure) left/right**

7 =	-0.75 … 3 bar (25 bar)	6 … 31 bar (36 bar)
8 =	6 … 31 bar (36 bar)	6 … 31 bar (36 bar)
9 =	-0.75 … 3 bar (13 bar)	6 … 31 bar (36 bar)

③ **Pressure connection**

A = 7/16"-20 UNF male;
C = R1/4 male, stainless steel with steel bellows
K = 1 m capillary tube with nut 7/16"-20 UNF, schrader valve opener
L = 1/4"-ODM solder with 1m capillary tube
U = 6 mm - ODF solder, 80 mm length
X = ¼" - ODF solder, 80 mm length
F = ¼-18 NPTF, stainless steel with steel bellows

Safety instructions:

- **Read installation instructions thoroughly. Failure to comply can result in device failure, system damage or personal injury.**
- **It is intended for use by persons having the appropriate knowledge and skill.**
- **Before opening any system make sure pressure in system is brought to and remains at atmospheric pressure.**
- **Ensure supply voltage and current of electric device match rating on PS2 name plate. Disconnect supply voltage from system and PS2 before installation or service.**
- **Do not exceed test pressure.**
- **Keep temperatures within nominal limits.**

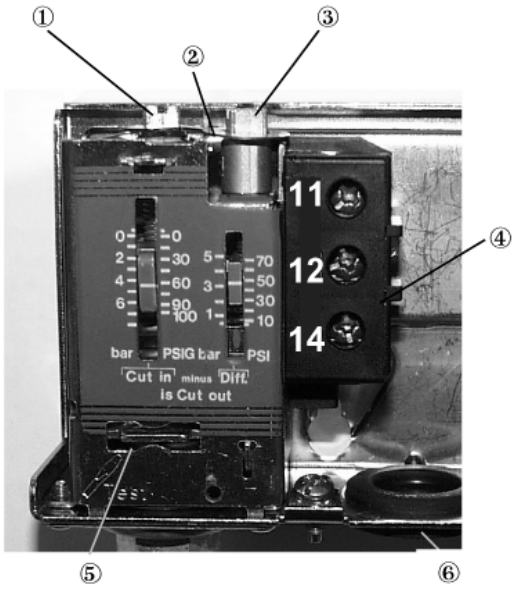
Function/Type of switch (Fig. 1):

Fig. 1a: Automatic reset function
Fig. 1b: Manual reset function for low pressure reset
Fig. 1c: Manual reset function for high pressure reset

- PS2 Pressure switches are equipped with two independent SPDT snap action contacts switching from 11-12 (21-22) to 11-14 (21-24) on rising and from 11-14 (21-24) to 11-12 (21-22) on falling pressure.
  Reaching the preset switch point on rising pressure, contact 11-12 (21-22) breaks while contact 11-14 (21-24) makes and vice versa on falling pressure.
- Terminal labels 11, 12 and 14 refer to the left side of the control and terminal labels 21, 22, 24 refer to the right side of the control.
- PS2 w. manual reset (high pressure/low pressure reset):
  Reaching the preset switching point contact 11-14 (21-24) breakes (low pressure switch) or contact 11-12 (21-22) makes (high pressure switch) and locks in this position.
  After the pressure rises or drops by a fixed differential the switch can be reset by pushing the reset button.
- PS2 with manual reset are “trip-free”.

Pressure Controls Series PS2
Type C7A

Fig. 4



① Range spindle / Bereichsspindel
② Lockplate / Sicherungsblech
③ Differential spindle / Differenzspindel
④ Electrical terminals / Elektrische Anschlussklemmen
⑤ Check-out lever / Testhebel
⑥ Cable entry grommet / Kabeldurchführung

Fig. 5a

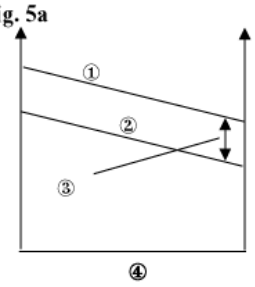
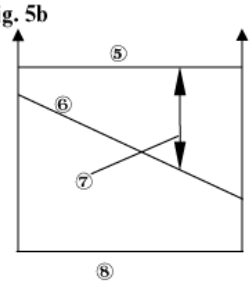


Fig. 5b



① Upper setpoint / Oberer Schaltpunkt
② Lower setpoint / Unterer Schaltpunkt
③ Differential = constant / Differenz = konstant
④Turning range spindle / Drehungen der Bereichsschraube

⑤ Upper setpoint / Oberer Schaltpunkt
⑥ Lower setpoint / Unterer Schaltpunkt
⑦ Differential = variable / Differenz = variabel
⑧ Turning differential spindle / Drehungen der Differenzspindel

Mounting (Fig. 2):
- PS 2 controls may be installed by using a mounting plate or as a wall-mounted device against a flat surface.
- Use universal thread M4 or UNC8-32 mounting holes for installation via mounting plate
- Use the standard mounting holes at the backside for wall mounting.
- Use mounting screws supplied with control
- Mounting screws must not penetrate control backside by more than 8 mm to ensure proper operation
- PS2 can be installed in any direction except upside-down
- **In order to achieve protection class IP44, the following instructions must be observed:**
  - ❖ Cover must be closed and cover screw fastened
  - ❖ Control must be mounted against a flat surface so that all openings on the housing backside are fully covered

Mounting direction:
Any direction except upside down

Pressure connection (Fig. 3):
- Connection of the pressure side depends on the exact model / pressure connector.
- Connectors A, C, F and S: Do not apply torsional load to pressure connnector; use second spanner to counter-balance torque when tightening pressure connection.
- Connector A: high pressure versions (pressure range ‘5’) are equipped with a snubber to dampen pulsations.
- When connecting PS2 to the hot gas line of a refrigeration system, a pipe, capillary or flexible tube of at least 80 mm shall be used to allow sufficient temperature drop between refrigeration line and pressure switch bellows.
- K-type connectors: Use copper gasket supplied with control.

Electrical connection (Fig. 4):
- **Note: Comply with local electrical regulations when conducting electrical wiring.** Wire size must match the electrical load connected to the switch contacts.
- Feed cables through rubber grommet at switch bottom.
- Optionally, the rubber grommet may be replaced by a standard PG 13.5 cable gland.
- Connect wires to terminals 1, 2 and 4. by taking into account switch functions as shown in Fig.s 1a to 1c.
- Fasten terminal screws with torque 1.2 Nm.
- For electronic applications with low electrical loads (voltage ≤24 V and current <50 mA) gold plated contacts are recommended.

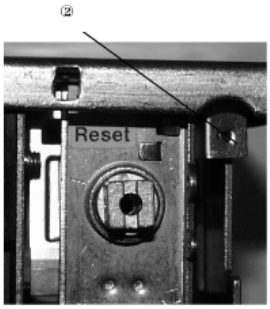
Setpoint adjustment (Fig. 4, Fig. 5):
- PS2 pressure switches come with individually adjustable range and differential depending on the exact model.
- Manual reset switches always have a fixed differential.
- Use a flat screw driver or a ¼” refrigeration (square)

Pressure Controls Series PS2
Type C7A

Fig. 6a

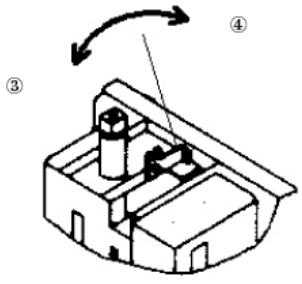
① Reset button for external reset /
Rückstellknopf bei externer Handrückstellung

Fig. 6b



② Reset button for internal reset /
Rückstellknopf bei interner Handrückstellung

Fig 6c



③ Universal reset toggle: position manual reset / Konvertierbarer Reset in Position: Handrücktellung
④ Universal reset toggle: automatic reset / Konvertierbarer Reset in Position: automatische Rückstellung

wrench to adjust setpoints as described below.

- Adjust upper setpoint using the range spindle.
- Adjust lower setpoint by turning the differential spindle.
- **Upper setpoint – Differential = Lower setpoint**
- A separate gauge must be used for exact adjustment of the setpoints. The integrated display scale can only be used for obtaining approximate settings.
- Refer to the ALCO catalogue for standard factory settings.

Manual reset / Universal reset (Fig. 6)

- Manual reset (external): Press the reset button as indicated by Fig. 6a.
- Manual reset (internal): Remove the housing cover and press the reset button as indicated by Fig. 6b
- Note that the reset is 'trip-free', i.e. reset is only possible if the pressure has reached its reset treshold.
- Universal reset: Remove the cover and change the universal toggle to the desired position (manual reset or auto reset) as indicated by Fig. 6c.

Check-out lever (Fig. 4)

- Use the check-out lever to manually override the electrical contact position for testing out the system
- Use the check-out lever on low pressure switches to manually override the electrical contact position for evacuating the refrigeration system

Standards

- DIN 32733 / EN 12263: specific models
- Low Voltage Directive 73/23/EWG; 93/68/EWG; EN 60947-1; EN 60947-5-1
- UL/CSA: all models (pending)

11.7.3 Pressure sensor for VFD

11.8 Sight glass

Moisture Liquid Indicator
AMI – 1SS5

General information and technical data:

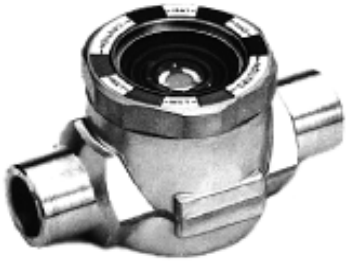
The **AMI** series of Moisture Indicators are designed to monitor the moisture content within the liquid line of a Refrigeration system. When the liquid line is empty, circles may be seen in the glass. However, when the liquid refrigerant touches the glass, the circles disappear indicating the system is fully charged.

- Maximum working pressure: 35 bar,
- Medium temperature : -40 to 100 °C
- Compatibility :

Refrigerants: R22, R404A, R507, R134a, R407C, R502, and R12. Not suitable for R11 or Ammonia.

Oils: Mineral, Alkyl benzene and ester lubricants.

- For further information, see technical data sheet.



AMI – 1SS

Type	Order-No.	Connection mm	Connection inch	Configuration
AMI - 1 SS 5	805 716	16	5/8	Female Solder x Female Solder ODF x ODF

Safety instructions:

- **Read installation instructions thoroughly. Failure to comply can result in device failure, system damage or personal injury.**
- **It is intended for use by persons having the appropriate knowledge and skill. Before attempting to install the indicator, make sure pressure in system is brought to and remains at atmospheric pressure.**
- **Do not release any refrigerant into the atmosphere.**
- **Do not use on any other fluid media without prior approval of Alco Controls. Use of fluids not listed could result in chemical deterioration of components.**

Mounting location:

- AMI is bi-directional and may be installed in any position which allows visual access to the indicator window itself.
- The Moisture indicator is normally located after the filter drier and before the solenoid valve.

Installation:

- Do not remove seal caps until ready for installation.
- The seal caps should be removed with care to avoid damaging the extension tube connections.
- To avoid oxidization, it is advised to purge the system with an inert gas such as nitrogen while brazing.
- **Do not exceed the maximum temperature of 100°C.**
- The lens assembly on “SS” models should be removed before brazing. Do not exceed 8 Nm (70 inch lbs) when reassembling to avoid damaging the ”O” ring seal.
- When brazing, direct the flame away from the main body. If in doubt about temperature, use wet rags or other suitable heat protection (see Fig. 1).
- To avoid overheating it is advised to make the joint at one end and cool the AMI completely before repeating the procedure on the other end connection.
- Test for leakage on connections after completion of installation.

Warning: **Failure to do so could result in loss of refrigerant.**

Refrigerant	Liquid Temperature °C	blue dry	violet	purple Caution	red Caution - wet
R 134a	25	20	35	90	130
	38	35	55	120	160
	52	50	85	150	190

11.9 Filter drier

Filter drier ADK 165

General information and technical data:
ADK/BFK Liquid line filter-driers are for new installation or after service.

- Maximum working pressure : 34 bar
- Maximum proof pressure : 34 bar
- Compatibility : CFCs, HCFCs, HFCs, mineral, Alkyl benzene and ester lubricants
- For further information, see technical data sheet.

Safety instructions:

- **Read installation instructions thoroughly. Failure to comply can result in device failure, system damage or personal injury.**
- **It is intended for use by persons having the appropriate knowledge and skill. Before attempting to install the filter-drier make sure pressure in system is brought to and remains at atmospheric pressure.**
- **Do not release any refrigerant into the atmosphere.**
- **Do not use on any other fluid media without prior approval of Alco Controls. Use of fluids not listed could result in chemical deterioration of the desiccant in filter-drier.**
- **In a severely contaminated system, avoid breathing acid vapours and avoid contact with the skin from contaminated refrigerant / lubricants. Failure to do so could result in skin injury.**

Operation:

- After leakage test, start system and after sufficient running time, check colour of moisture indicator for moisture level. We recommend the use of ALCO moisture indicators. The colour calibration of ALCO moisture indicators provide a positive and precise indication of the system's moisture condition.
- In systems with excessive moisture it may be necessary to replace filter-drier for several times in order to bring moisture in the system to a safe level.

ADK

Type ADK	Order No.	Connection Flare/SAE	
		mm	inch
165	003 620	16	5/8

Size	Water adsorption capacity (gram) Liquid Temperature		Acid Adsorption Capacity (gram)
	24°C R134a	52°C R134a	
ADK16	23,0	20,8	4,5

Service hints:

- On field installed systems or retrofit, the use of ADK/BFK Filter Driers with the companion ALCO BTAS or ASD/ASF suction line filter drier/filter is recommended.
- For system clean-up after burn-out, we recommend installing an oversized filter-drier. To provide positive compressor protection, add an ALCO ASD or BTAS filter-drier in suction line.
- Always install a new filter-drier when existing ones become saturated with moisture and foreign materials.

Caution: Do not attempt to dry out a used filter-drier.

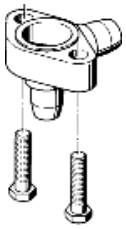
11.10 Thermo-Expansion valves

Thermo-Expansion Valve
TCLE 750 MW

Series	R 134a Type	R 134a Nom. Cap. kW	Orifice	Power Assembly
TCLE	750 MW	32,0	X 22440-B7B	XB1019...1 B

TCLE

Angle Style Type	Angle Style Order No.	Connections mm Solder ODF	for Valve Series
A 576 - MM	803 239	16 x 22	TCLE



Angle Style Flange

11.11 Solenoid valves

Hot gas

2-Way Solenoid Valves
200 RB

Type		Order-No.	Connection Solder/ODF mm	Solder/ODF inch	Flare/SAE mm	Flare/SAE inch	Nominal Capacity Q_n (kW) Liquid R 134a	Hot Gas R 134a
200 RB 3	T3	801 239	10	3/8			6,6	3,0
200 RB 4	T3	801 190		3/8			15,5	7,1
200 RB 6	T5	801 186	16	5/8			27,3	12,5

Type		Order-No.	kv-Value m^3/h	Vp min. bar	Coil Type
200 RB 3	T3	801 239	0,4	0,00	ASC
200 RB 4	T3	801 190	0,9	0,05	
200 RB 6	T5	801 186	1,6		

Liquid

2-Way Solenoid Valves
240 RA

11.12 Liquid receiver

Liquid receiver GBV 3 (vertical)

Volume	Dimensions mm						Type ZU434/1: ● = ja ○ = nein	Inspection glasses	Position of SG	Brazed connections		Weight
										Inlet	Outlet	
l	D	L	B	B1	E	F				Ø mm	Ø mm	kg
3	125	360	-	100	9	30	m	-	-	12	12	6

11.13 Primary water pump

Fully installed and plumbed-in water pump Type **Speck IN-V 10 - 50** (see technical specifications and appendix).

The pump is switched on by turning the master switch to position "Auto"/”Hand” and the control switch for the pump likewise to position "Auto"/”Hand”!.

The water is kept in constant circulation. The water pump is interlocked with the compressor, i.e. cooling is unable to take place if the pump is not on.

It is essential that the pump is filled with the cooling medium and de-aerated before it is started.

Operating instructions IN-E / IN-V/ IN-E-S / IN-V-S /
IN-E-H-S / E
Multistage centrifugal pumps

1.General
Speck Pumpen Verkaufsgesellschaft Karl Speck GmbH & Co., Lauf
Series IN-V
Country of origin: EU

1.2 Fields of Application Multistage centrifugal pumps of the Series IN-E / IN-V / IN-E-S and E are especially suitable for the fields of application described below:

1.3 Technical Data
Starting currents and noise levels

P (kW)	**0,37**	**0,55**	**0,75**	**1,1**	**1,5**	**2,2**	**3,0**
I_A / I_N (three-phase)	4,4	4,7	5,5	5,9	6,3	6,8	7,2
I_A / I_N (single-phase)	2,7	2,8	2,8	2,8	3,0	3,0	-
Noise level dB (A) at 2850 rpm	61	62	66	68	70	70	70
Noise level dB (A) at 1425 rpm	-	54	54	55	56	56	56

P (kW)	**4,0**	**5,5**	**7,5**	**11,0**	**15,0**	**18,5**	**22,0**
I_A / I_N (three-phase)	7,0	7,9	7,7	6,0	7,5	7,5	7,5
Noise level dB (A) at	73	73	74	80	81	82	90

2850 rpm							
Noise level dB (A) at 1425 rpm	58	63	65	68	-	-	-

Other motor data like voltages, maximal power input, frequency, insulation class and speed are indicated on the motor rating plate.

2.Safety

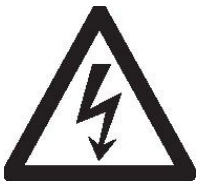
The Operation Manual contains basic instructions which must be obeyed during mounting, operation and maintenance. Therefore, the Operation Manual should be carefully read before installation and start-up by the person in charge of the installation as well as by all other technical personnel/operators and should at all times be available at the installation site.

It is important that not only all general safety measures appearing under the above heading „Safety“ should be adhered to but also all other, specialized safety instructions appearing under different headings, e.g. when used by private customers.

2.1 Symbols for Safety Instructions in the Operation Manual

All safety warnings contained in the Operation Manual which, when ignored, may constitute danger for humans, are marked with general danger symbols.

Safety symbol according to DIN 4844 - W 9;
in case of electrical hazards they are specially marked with



Safety symbol according to DIN 4844 - W 8.
For safety warnings which, when ignored, may constitute a hazard for the machine and its functions, the word CAUTION
is added.

Symbols directly attached to the machine like e.g.

- arrow denoting the direction of rotation
- type plate
- symbol for fluid connections
– pump number must be heeded and kept legible at all times.

2.2 Personnel Qualification and Training All operation, inspection and installation personnel must be qualified for these jobs. Scope of responsibility, competency and the supervision of the personnel must be clearly

defined by the operator. If the personnel is not fully qualified, they must be properly trained and instructed. If necessary and if required, the manufacturer/deliverer may train customer personnel. Furthermore, the operator must make sure that the contents of the Operation Manual is fully understood by the personnel.

2.3 Dangers and Hazards resulting from Non-Compliance with Safety Warnings Non-compliance with safety warnings may constitute a hazard for persons as well as for the environment and the machine. Non-compliance with safety warnings may void any guarantees or claims for damages.

Here are a few examples where non-compliance may entail the following hazards:
Failure of important functions of the machine/plant
Failure of manufacturer-recommended servicing and maintenance procedures
Hazards to human beings through electrical, mechanical or chemical reaction
Danger to the environment through leakage of hazardous substances

2.4 Safety-orientated operation Safety warnings contained in this Operation Manual, all existing national rules and regulations for the prevention of accidents as well as any internal work or operational safety precautions by the operator must be complied with.

2.5 General Safety Warnings for the User/Operator
If hot or cold machine parts should present a hazard, such parts must be protected against accidental contact.

Protective devices for moving parts (e.g. couplings) must never be removed
while the machine is in operation.

Leakages (e.g. of the mechanical seal) of hazardous substances (e.g. explosive, toxic, hot) must be drained off in such a way that any danger to persons and the environment is prevented. All pertinent rules and regulations must be
obeyed.

Danger through electrical energy must be avoided (for details see safety rules
established by VDE and the local utilities.)

2.6 Safety warnings for Maintenance, Inspection and Installation Work

The operator shall be responsible for all maintenance, inspection and installation work to be performed by authorized and qualified technical personnel thoroughly acquainted with the Operation Manual.

Basically, any work on the machine should only be performed when the machine is shut down. The proper procedure for shutting down the engine described in the Operation Manual must be adhered to unconditionally.

Pumps or aggregates which are used to pump hazardous substances must be
decontaminated.

Immediately after the work is completed, all safety and protective devices must be reattached or activated, respectively.
Before restarting the machine, all points (!!) contained in the chapter „Initial start-up“ should be observed.

2.7 Unauthorized Alterations or Modifications and the Manufacturing of Spare Parts

Alterations/Modifications or changes in the machine's design require the prior consent by the manufacturer. Original spare parts and accessories authorized by the manufacturer enhance the machine's safety. Using other spare parts may void any liability for consequential damages on the part of the manufacturer.

2.8 Unauthorized Operation

The operational safety of the machine can only be guaranteed whenever it is operated in accordance with Section 1 – General – of the Operation Manual. The limiting values stated in the data sheets must never be exceeded.
Cited Standards/Norms and other Documentation
DIN 4844 Part 1 Safety marking; Safety symbol W 8
Supplement 13

DIN 4844 Part 1 Safety marking; Safety symbol W 9
Supplement 14

3. Transportation and Intermediate Storage

When transporting the pump, suitable packaging must be provided for. Prolonged intermediate storage in an environment with high humidity level and strongly varying temperatures should be avoided.
Condensation may affect windings and metal parts. This will void the warranty.

4. Range of Operation

CAUTION
Ambient temperature: up to max. 50°C
Temperature of pumping media
IN-E / IN-V / IN-E-S / IN-V-S: -15°C - max. 120°C
Medium temperature E: -15°C - max. 50°C

max. inlet height/ The pressure at the suction end must at least exceed
the max. suction lift steam pressure of the liquid by the NPSH-value + 0.5 m
safety margin.
For special calculations, please, contact us.
max. inlet height: Actual gravity feed pressure + zero flow height should be lower than the maximal permissible operational pressure
(25 bar) = 2500 kPa. See technical documentation.

5. Assembly

CAUTION

The pump is installed with the shaft in vertical position. Ample air flow at the motor fan must be guaranteed. Arrows on the base plate show the direction of medium flow.
The measurements of the base plate are stated in the prospects.

6. Electrical Connection

CAUTION

The electrical connection must be performed by a licensed electrician in accordance with the local rules and regulations of the electric company and/or the VDE. Make sure that the electrical data shown on the rating plate match the actual power supply. All motors must be connected to a motor protection switch.
The terminal box can be turned 90°. For that purpose, remove the coupling guard (Item 681) and the hex nuts (Item 901.1). Disassembling the coupling is not necessary. Now the motor can be turned to the desired position. Reattach the touch guard. Start pump only when completely filled and deaerated. Perform electrical connection in strict accordance with the wiring diagram inside the terminal box.

7. Initial Start-up

7.1 Filling up

CAUTION

The pump should only be started when fully primed and deaerated. In closed or open systems where there is primary pressure (pressure bias) on the suction side of the pump, the shut-off valve should be closed and the screw plug (Item 903.1) in the pump's headpiece removed. The shut-off valve in the suction line is then opened slowly until the liquid to be pumped exits from the filling orifice.
The screw is attached again and tightened securely. The shut-off valves are now fully opened.
In open systems, where the liquid level is below the pump, also the suction line must be filled and deaerated before start-up. In that case, the socket screw (Item 914) in the base and the screw plug in the headpiece (Item 903.1) must be removed. By removing the socket screw (Item 914), a connection is provided between the suction and pressure chambers within the pump, so that during the filling process both chambers are filled simultaneously.
Filling is done from above through the filling orifice. The socket screw (Item 914) should only be replaced after the pump is completely filled (during the filling process, the drain orifice should be closed).
The screw plug (Item 903.1) must be attached again and the shut-off valves opened again.

Checking the Direction of Rotation
CAUTION
The correct direction of rotation is indicated by arrows on the headpiece of the pump. When looking from the motor towards the pump, the motor should run clockwise.

7.3 Switching frequency

CAUTION

- Motors smaller than 4 kW: max. 100 switching cycles per hour
- Other motors: max. 20 switching cycles per hour

(Depending on operational conditions, above data may be subject to change.)

8. Maintenance

CAUTION

The bearings and the shaft seal require no maintenance. Motors without grease nipples require no maintenance. Motors with grease nipples may be lubricated with lithium-based grease. (Recommended: SKF-C3).

9.Protection against frost

CAUTION

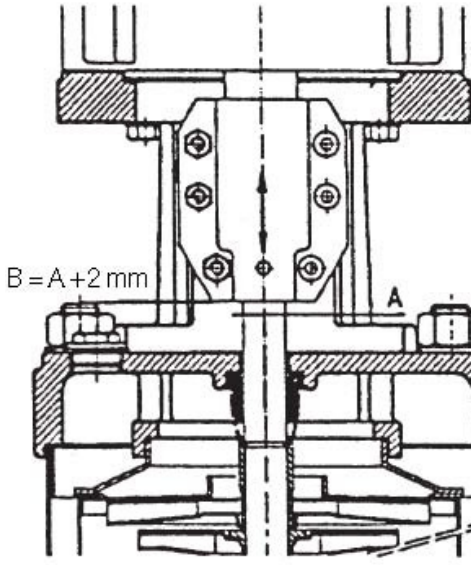
If there is danger of frost during prolonged idle periods, the pump must be drained completely. For this purpose, the shut-off valves on both sides of the pump are closed and the screw plug in the headpiece (Item 903.1) and the inbus plug in the base (Item 914) are removed. The plugs for the pipelines are replaced only after the pump has been restarted.

10. Motor Assembly

CAUTION

1. Make sure that both coupling halves are clean and not damaged (remove any impurities like paint etc.)
2. Place the coupling pin into the orifice in the shaft provided therefore. Then slide the two coupling halves over the pin and hand-tighten the two coupling bolts firmly.
3. Place the motor onto the motor lantern (If necessary, remove shaft key at the motor).
4. The pump shaft has an axial play of approx. 4 mm.

The correct position of the hydraulics package is in the exact centre of the axial play. This is why the hydraulics package - before tightening the coupling bolts - should be lifted by 2 mm and then locked in position.
With motors above 7.5 kW which must be equipped with a locating-type bearing, make sure that the motor shaft fits into the couplings when not under load (Otherwise the motor shaft might be lifted out of its bearings).



A: shortest shaft length

B: correct shaft length

5. Coupling bolts should be tightened uniformly and cross-wise.
   The permissible torque should be determined by means of torque wrench.

Torque M 6 : 16 Nm
M 8 : 30 Nm
M 10 : 70 Nm

The faces of the steel couplings abut against each other. The grey cast iron couplings, when correctly assembled, show a gap of equal size on both sides.

11. Troubleshooting

Type of malfunction:	Possible source of trouble
1. Motor will not start when switched on:	a. Power connection faulty. b. Fuse blown. c. Motor cutout switch tripped. d. Circuit breaker contacts or coil defective. e. Control safety device defective.
2. Motor cutout switch immediately trips, when motor is switched on:	a. Fuse blown (one phase missing). b. Motor cutout switch defective. c. Cable connection loose or defective. d. Motor winding defective. e. Motor cutout switch set too low. f. Solid matter is blocking impellers.
3. Motor cutout trips sometimes:	a. Motor cutout switch set too low. b. Inconstant power supply. c. Line voltage sometimes too low.
4. Motor cutout switch is on but pump will not run:	a. Check items 1, a, b, d, e.
5. Pump’s performance unstable:	a. Suction line too small. b. Suction line partly clogged. c. Pump is pulling air.
6. Pump is running, however, does not deliver:	a. Suction line clogged. b. Foot or check valve blocked. c. Leaking suction line. d. Air in suction line. e. Wrong direction of rotation. f. Shut-off valve closed.
7. After switching pump off, it rotates in the wrong direction	a. Leaking suction line. b. Foot or check valve defective. c. Foot valve blocked in open position.
8. Noise and/or vibration:	a. Inlet height insufficient. (Cavitation). b. Motor or pump bearing defective.

9. Noise and/or leakage's in the mechanical seal:	a. Mechanical seal defective. b. Axial play of pump set incorrectly.

12. General Information

CAUTION

• Shut-off valves must be installed in front of and behind the pump. This eliminates the necessity of draining the pump every time for maintenance, repair, shutdown or replacement work.

- Whenever pumps must be installed in the vicinity of living rooms, we recommend vibration dampers at the suction and pressure sides of the pump as well as between pump and foundation.

• We would like to point out expressly that tensions in the piping must never be allowed to affect the pump. Thus the pump should be installed in such a way that any tension probably caused by temperature variations cannot adversely affect the functioning of the pump. When installing pipelines, these should be relieved of any tension in front and behind the pump.

- In installations where pumps may be forced to work against closed shut-off valves etc., a bypass line should be installed. (Permissible minimum rate of flow = 10 % of the rated pump capacity).
- Whenever a pump is integrated into a system it is mandatory that the operational conditions affecting the pump should be determined first. (E.g. minimal size of a suction vessel, protection against dry running, pressure surges, simultaneous intake of air, draining the pump because of lifting forces etc.).

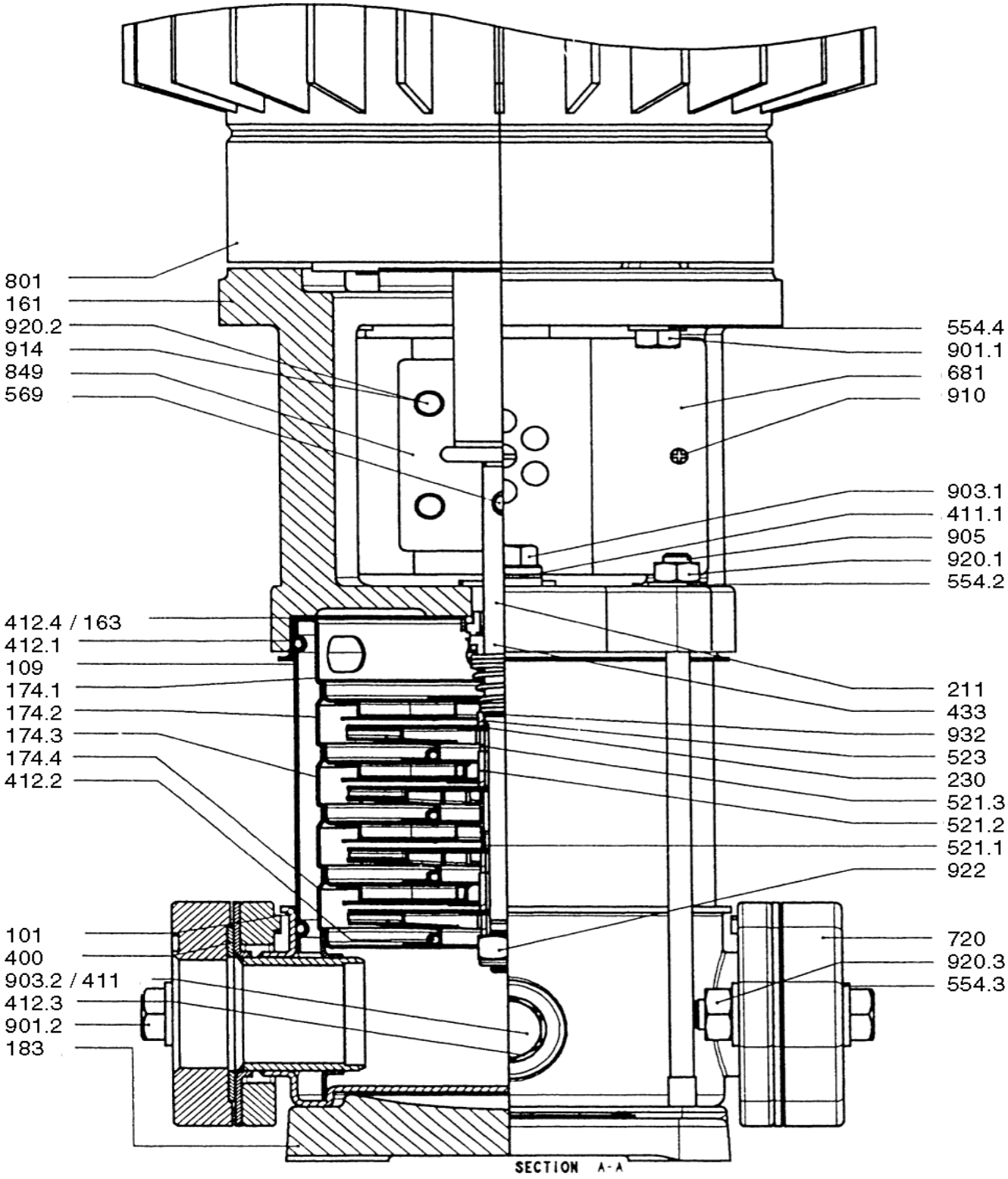
13. Warranty

The warranty is valid for one year from the date delivery, i.e. during that period of time we agree to replace components with manufacturing defects without charge whenever the pump is sent to our plant, freight paid. Exceptions are wear-and-tear parts (e.g. mechanical seals and bearings). **Important:** The warranty does not cover damages caused by improper use or abuse (i.e. dry running, connecting lines which are not strain or pressure-relieved, or incorrect working point). In warranty cases, the pump must be returned unopened. That is the only possibility to arrive at an objective and complete determination of the cause of the malfunction. Opening or disassembling the pump will void any warranty.

14. Spare parts list for IN-V-(S)

Part #	Description
101	pump housing
109	stage casing
161	casing cover with lantern
163	discharge cover
174.1	upper diffuser
174.2	diffuser
174.3	diffuser
174.4	diffuser
189	bottom plate
211	shaft
230	impeller
400	gasket
411	gasket
411.1	gasket
412.1	o-ring
412.2	o-ring
412.3	o-ring
412.4	o-ring
433	mechanical seal
521.1	sleeve, short
521.2	sleeve, long
521.3	sleeve, stainless steel
523	shaft sleeve
554.2	washer
554.3	washer
554.4	washer
569	coupling pin
681	coupling guard
720	flange
801	motor
849	coupling
901.1	hex bolt
901.2	hex bolt
903.1	threaded plug
903.2	threaded plug
905	tie bolt
910	bolt
914	socket head screw
920.1	hex nut
920.2	hex nut
920.3	hex nut

922	impeller nut
932	retaining ring


801
161
920.2
914
849
569
554.4
901.1
681
910
903.1
411.1
905
920.1
554.2
412.4 / 163
412.1
109
174.1
174.2
174.3
174.4
412.2
211
433
932
523
230
521.3
521.2
521.1
922
101
400
903.2 / 411
412.3
901.2
183
720
920.3
554.3
SECTION A-A

11.14 Air vent

Honeywell Braukmann	Automatic Air Vent with integral shutoff valve E121

E121 Automatic air vent

The E121 air vent is a reliable automatic venting device and is suitable for venting air or gas from heating systems or heat process installations.
For hot water heating systems, radiators, wall- and ceiling-mounted air heaters, air collection vessels, pipe work circuits, boilers and air separators.
Not suitable for mineral oil or liquids with mineral-oil based additives.

Materials	Brass housing and lid, high-grade plastic float, heat-resistant elastomer seal components
Medium type	water or water-glycol mixture according to VDI 2035
Max. media temperature	110 °C
Static pressure	PN10
Port connection type	external threads
Additional description	With fitted Z 121 A shut-off valve cleaning or replacement of the seal and inner components can be carried out without draining the system.

Product description	Type
Standard version, connection size R 3/8	**E121-3/8A**

Service parts

Description	Additional Product Type
Shut-off valve	**Z121-3/8**

Honeywell
Braukmann

Automatic Air Vent with integral shutoff and leak protection
E121

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

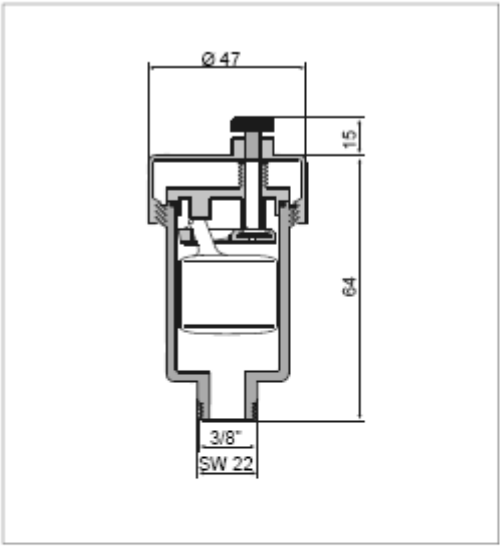
Operating temperature	max. 110 °C
Operating pressure	max. 10 bar
Connection sizes	R ⅜" or R ½ "

5. Accessories

Z 121 - ⅜	shutoff valve ⅜"
Z 121 - ½	shutoff valve ½"

Honeywell
Braukmann

Automatic Air Vent with integral shutoff and leak protection
E121



Function

Inside the automatic air vent there is a float which operates a lever according to the water level. When there is no water in the housing, then the float opens the valve. Air can therefore be vented from the heating system during filling. When the heating system has been filled, the inflowing water closes the valve and the vent is shut off. Water usually contains oxygen which bubbles off during operation of the system and collects at the highest point. The automatic air vent must therefore be fitted at the air collection position (highest point on a boiler or pipework circuit).

Versions

E121-3/8A = Standard version, Connection size R 3/8"
E121-1/2A = Standard version, Connection size R 1/2"

Accessories

Shutoff valve

Brass housing, high-grade temperature-resistant synthetic material inner components, hot-water-resistant elastomer seal ring — Z121-3/8A

11.15 Safety valve

Diaphragm safety relief valve
531 series ¾" - 1"

Diaphragm safety relief valve for potable water systems, with female-female connections.

Factory set at: 6 bar.

Maximum opening pressure: +10%.

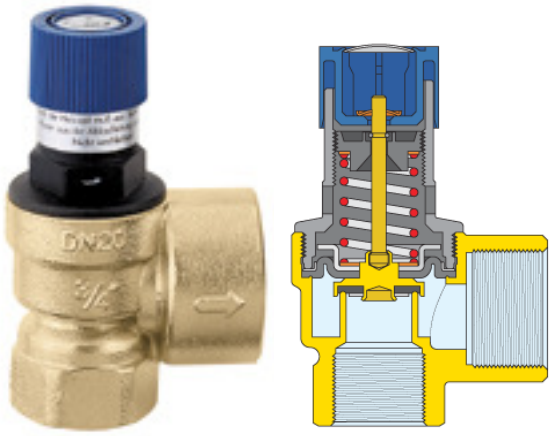
Minimum reseating pressure: -20%.

Maximum temperature: 100°C.

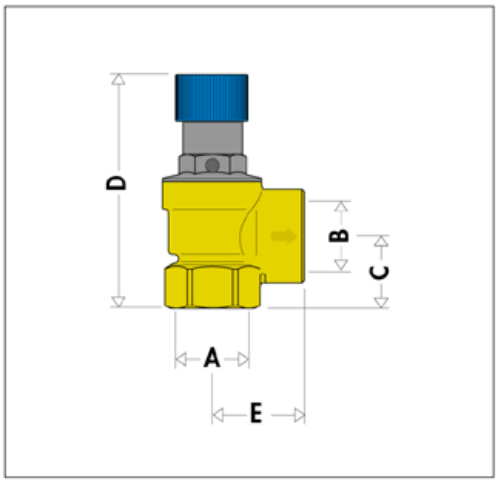
Brass body.

Diaphragm and seal in EPDM.

Cover and handle in glass reinforced nylon.



531



A	B	C	D	E
3/4"	1"	30	92	40,5
1"	1 1/4"	38	144	48
1 1/4"	1 1/2"	44	185	57,5

11.16 Expansion vessel

Flamco | **Expansion Vessel Airfix A 35**

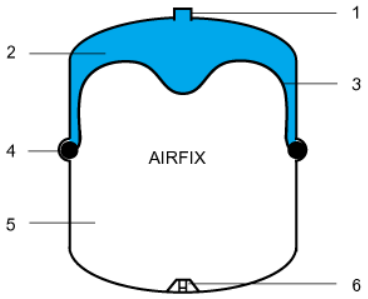
For use on hot and cold water supplies including pump control, unvented HWS systems and water boosting sets.

The Flexcon clench ring construction allows the water section to be coated before assembly.

The inside and outside of these expansion vessels are corrosion resistant coated, both on the water side and the gas side.

SPECIFICATION

Capacity:	35 litre
Maximum Working Pressure:	8 bar
Maximum Operating Temperature:	70 °C (343K).
Diaphragm:	Flexible rubber with rolling action.
Clamp Ring:	Separate, zinc plated.
Certification:	WRC listed and approved



1. System connection.
2. Water from system.
3. Diaphragm.
4. Clamp ring clamps diaphragm between the two vessel halves.
5. Gas charge.
6. Gas filler valve.

The inside and outside of the Airfix expansion vessels have a corrosion resistant coating on both the water and gas side of the vessel, with the exception of the 2 and 4 litres. This makes the Airfix vessel fully corrosion resistant. The plastic coating is resistant to 70°C and does not impart any odour. colour or taste to the water.

Maintenance and servicing

The Airfix A expansion vessel is maintenance-free. If local laws and regulations require the initial pressure to be checked regularly, this should be done. If water has been lost via the safety valve, the initial pressure may be too low. This can only be checked by first depressurizing the system. Shut off the cold water feed pipe and drain the boiler until the pressure is 0 bar. Check the initial pressure (see under "Commissioning"). If the initial pressure is too low, it should be raised with compressed air. Take care that the pressure does not exceed the maximum operating pressure. If it is no longer possible to set the correct initial pressure, the membrane may be leaking; in that case, the entire vessel should be replaced.

Commissioning

The initial pressure of the Airfix A expansion vessel should correspond to the pressure in the potable water system, i.e. it should be 0.2 bar higher than the minimum water pipe pressure at the expansion vessel. This ensures that the vessel is completely emptied by pressure before mains water flows to the boiler.
The initial pressure is shown on the vessel's sticker. The correct initial pressure is set by releasing nitrogen. To lower the initial pressure, proceed as follows: pull off the cap on the bottom of the expansion vessel from the filling valve. Remove the plug and push the internal valve in slightly to cause nitrogen to be released. Measure the pressure in the expansion vessel at regular intervals in order to set the correct value. Re-insert the plug and screw it in tightly to prevent leakage. Then push the cap onto the plug. Correct fitting is indicated by an audible click.

11.17 Manometers

Manometers in the water circuit

These allow the pressure values of the pumps and the cooling medium system to be checked.

Min. System pressure	suction end	pump	1,0 bar
Max. System pressure	delivery end	pump	8,0 bar
Differential pressure	pump approx		7,0 bar

11.18 Flow switch

Monitors the water flow volume through the evaporator and shuts the device down completely if the min. water quantity is reached.

Fabr.: Sika VHS07M2KKTKR01

11.19 Flow control valve

TA HYDRONICS

STAD: Balancing, pre-setting, measuring, shut-off, draining

Pressure class: PN 20

Temperature:

Max. working temperature: 120°C
Min. working temperature: -20°C

Material:

The valves are made of AMETAL ® .
Seat seal: Stem with EPDM O-ring
Spindle seal: EPDM O-ring
Handwheel: Polyamide

AMETAL ®is the dezincification resistant alloy of TA.

➡ = Flow direction

Marking:

Body: PN 20/150, DN and inch size.

Handwheel: Valve type and DN.

Setting STAD

Setting of a valve for a particular pressure drop, e g corresponding to 2.3 turns on the graph, is carried out as follows:

1. Close the valve fully (Fig 1).
2. Open the valve 2.3 turns (Fig. 2).
3. Using a 3 mm Allen key, turn the inner spindle clockwise until stop.
4. The valve is now set.

Fig. 1. Valve closed

Fig. 2. The valve is set at 2.3

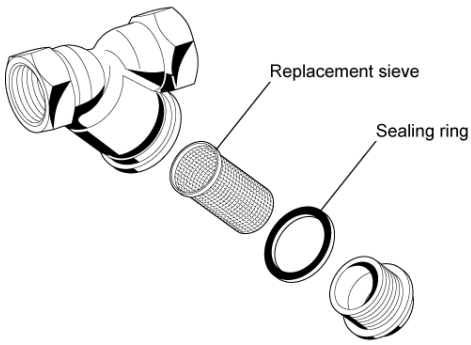
Fig. 3. Fully open valve

To check the setting: Close the valve, the indicator shows 0.0.

Open it to the stop position.
The indicator then shows the set value, in this case 2.3 (Fig. 2).

11.20 Dirt trap

The dirt trap in form of Y-Strainer is fully installed (see 4.10 in Water chiller control scheme (122)) and protects the evaporator from dirt.
As a matter of principle the plant is to be operated with clean water. With that regular servicing of the filter is unnecessary.



	Operation	Interval	Carried out by
Inspection	Inspection of the location and water tightness of sieve insert and seal ring	According to operating conditions	User or specialist
Inspection and Maintenance	Cleaning or if necessary replacement of sieve Cleaning and if necessary replacement of the sealing ring	According to operating conditions	User or specialist

Caution! Work on electric and refrigerant circuits should only be performed by qualified operatives. Observe the safety rules!

11.21 Remote control 24 V DC control panel

See Circuit Diagram

11.21.1 Collective alarm

The red warning lamp in the door of the switch cabinet lights up when one of the safety sensors has been triggered. The cause of the error can be identified more exactly by means of the LEDs in the switch cabinet. For the purpose of external evaluation of the error signal, the collective alarm message can be accessed, potential-free, from the terminal. (See also circuit diagram)

11.22 Switch cabinet

The switch cabinet is fully installed, connected and complies with the technical requirements of the VDE 0113.

For parts see circuit diagram.

The unit is switched on by means of the master switch.

When the master switch is turned to Pos. 1 the water pump is started and, should the thermostat require cooling, the compressor is turned on.

In order to prevent the compressor from being switched on for short intervals, the time-delay relay hinders the start procedure. After the time has passed by and the compressor has been at a standstill, i.e. after a pause of approx. 1 minute, the refrigeration process will commence immediately if the thermostat has switched it on.

12 Safety notes

12.1 Notes for refrigerant

R 134a	R 407C	R 404A
1,1,1,2 Tetraflourethane F3C-CH2F ≥99 %	1,1,1,2 Tetraflourethane F3C-CH2F 52 % Pentafluorethane F3C- CHF2 25 % Difluormethane CH2F2 23 %	1,1,1 Trifluorethane F3C- CH3 52 % Pentafluorethane F3C- CHF2 44 % 1,1,1,2 Tetraflourethane F3C-CH2F 4 %
Possible dangers Pyrolysis in poisonous and corrosive products:		
Hydrogen fluoride, fluorphosgene	Hydrogen fluoride, fluorphosgene possible in traces	Hydrogen fluoride, carbon dioxide, fluorphosgene possible in traces
Discharged gas: Emerging liquid can cause freezing		

First-aid measures

- After inhalation: Bring the afflicted person into fresh air and position them comfortably while protecting yourself. Call doctor. Commence mouth-to-mouth resuscitation if breathing has stopped.
- After skin contact: First leave the caked clothing on the skin. Rinse the cold-damaged areas with lukewarm (never hot) water. Do not rub! Cover sterilely. Seek medical treatment.
- After contact with eyes: With splashed eyes, rinse out at least 15 minutes with clean water or eyewash solution. Consult an ophthalmologist.
- After ingestion: Ingestion is not considered a potential means of exposure (gas).
- Notes for the doctor: Do not administer catecholamine or adrenaline-ephedrine medications.

Measures for fire-fighting

- Suitable extinguishing agent: Product that does not burn itself. Coordinate extinguishing measures to surrounding fire. Cool containers by spraying with water.
- Special dangers from the material, its combustion products or emerging gases: Dangerous gases and vapours build during pyrolysis.
- Special protective equipment for fire fighting: Independent breathing apparatus and acid-resistant protective suit with deployment in the immediate vicinity.
- Further information: The effect of fire can cause bursting or exploding of the container. Flammable gas-air mixture possible under certain conditions.

Measures upon accidental release

- Environmental protective measures: Do not allow to penetrate into the environment if possible.
- Procedure for cleaning: Allow product to evaporate
- Further information: Avoid allowing the product to get into the drain or closed spaces.

Handling and storage

- Handling: Protection against fire and explosion: Heating leads to increased pressure and risk of bursting. Cool endangered containers with water. Open containers slowly and carefully.
- Storage: Containers can be stored outside. Provide sufficient ventilation in closed rooms. Avoid strong sources of heat – danger of bursting. Keep containers tightly closed. Storage class: 2A

Personal protective gear

- Respiratory protection: Omitted with sufficient ventilation. Independent breathing apparatus within closed spaces, with insufficient oxygen supply, with considerable or uncontrollable release. Only use respiratory protection in accordance with international / national norms. Only use insulating devices, no filter devices.
- Protective gloves: Chemical-resistance protective gloves. Recommended material: Polyvinylalcohol.
- Protective eyewear: Close-fitting protective eyewear.

General safety and hygiene measures

- Do not inhale vapours/aerosols.
- Do not eat, drink or smoke while working.

12.2 Instructions regarding machine oil

First aid measures

- After inhalation: While protecting yourself, take the affected person to where there is fresh air and keep them calm. Fetch a doctor.
- After skin contact: Remove contaminated, soaked clothing. Wash down skin with water. If symptoms occur, seek medical attention.
- After eye contact: Rinse with eyelids held open for at least 10 minutes using clean water or an eyewash solution. Seek the advice on an eye specialist.
- After swallowing: Do not induce vomiting. Rinse mouth with water and drink two glasses of water. Seek the advice of a doctor.
- Instructions for the doctor: Symptomatic treatment and supportive therapy as indicated.

Fire-fighting measures

Minimal fire risk. Product only ignites at very high temperatures.

- Suitable extinguishing materials: Adapt to the environment. Carbon dioxide, powder and foam extinguishers. Use water only with caution in order to avoid any potentially severe generation of vapours.
- Particular hazards from the material, its combustion products or any gases issuing from it: Irritating vapours can be released in the event of thermal decomposition.
- Special safety equipment for fighting fires: Respiratory equipment independent of circulating air and acid-resistant protective suit for use in close proximity.
- Further information: The effect of fire can lead to the container bursting or exploding. Ignitable gas/air mixtures are possible under certain conditions.

Measures for unintentional release

- Environmental measures: Do not allow to enter the drainage system or any bodies of water. Absorb with sand, earth or other similarly absorbent material. Fill a container for correct waste disposal.
- Cleaning procedure: Clean contaminated areas with water.
- Further information: Inform the police or authorities in charge in the event of penetration into bodies of water or the drainage system.

Personal safety equipment

- Respiratory protection: Unnecessary if there is sufficient ventilation. Respiratory equipment independent of circulating air for use within enclosed rooms, with insufficient oxygen supply, with considerable or uncontrollable release. Only use respiratory protection according to international/national norms. Only use insulation devices, no filter devices.
- Hand protection: Safety gloves. Recommended material: Nitrile rubber.
- Eye protection: Tight-fitting protective goggles.

Handling and storage

- Handling: Avoid longer periods of skin contact. Avoid inhalation of high mist concentrations. Avoid inhalation of high vapour concentrations.
- Storage: Suitable material for packing drum: Mild steel. Securely seal unused containers to prevent penetration by moisture. Keep away from strong oxidising agents.

13 Circuit diagram

Circuit diagram see the next pages or in switch cabinet