KKT KRAUS®
REFRIGERATION & AIR CONDITIONING

KKT-KRAUS
Kälte- und Klimatechnik GmbH
Industriestraße 23 a
D-91207 Lauf a. d. Pegnitz / Germany

Phone +49-9123 - 174 01
Fax +49-9123 - 174-174
E-mail kkt@kkt-kraus.com

Toll Free from US (866) 517 6867

REPRESENTED IN THE UNITED STATES BY:

SBT - Siemens Building Technologies

1000 Deerfield Parkway
Buffalo Grove
Illinois 60089-4513

Phone (847) 215-1000

E-mail n/a
Web : http://www.sbt.siemens.com

YOUR LOCAL SERVICE CONTRACTOR IS:

COMPANY NAME:

PHONE NUMBER:

FAX NUMBER:

H:\Siemens MED\KCC 215 L\03_Dokumente\Manual\KCC215-USA_Vers_10.doc

Contents **page**

1 General Remarks, Safety Warnings

Industrial cooler Type KCC 215-L-…

Manufacturer: KKT KRAUS KLIMATECHNIK GMBH
Industriestraße 23 a
D-91207 Lauf / Germany
Phone +49-9123-1 74 01
Fax +49-9123-8 24 56

After-sales: KKT KRAUS KLIMATECHNIK GMBH
After sales dept.
Industriestraße 23 a
D-91207 Lauf / Germany
Phone +49-9123-1 74 01
Fax +49-9123-8 24 56

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 Kraus GmbH 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-Kraus.
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-Kraus Service Partner.
- Maintenance must be carried out by properly trained personnel.
- Only genuine KKT-Kraus spare parts must be used.
- For KCC215-L-U/S: Ethylene 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-Kraus GmbH**

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! The cooling water must contain min. 35% to max. 38% ethylene glycol.
-Nominal static filling pressure when Chiller has been switched off: 1,5bar.
-Don`t handle valves while the Chiller is running

-**Ethylene 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.

Warranty void if manual removed from chiller.

Do not remove the Secure Digital Memory card from the CPU before the chiller is switched off!!!!!!

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 MASTER SWITCH !

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

2 General description

The chiller KCC215-L-U/S are fully assembled, factory inspected and tested, and suitable for fully-automated operation. The water ethylene 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 Siemens SPS. The settings on the governor is kept automatically within the limits that are possible for the given degree 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 a Frequency inverter for the condenser fan speed.
The chiller KCC215-L-U/S are fitted with low-pressure sensor as protection against freezing and excess temperature. With this, it is possible to set leaving water temperatures from +19°C to +22°C.

Ethylene 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 ethylene glycol!!!

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

Cooling block Type KCC 215-L-…

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-glycol mountings, additionally sound and rain-proofed using a galvanized cover-plate.

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

Laterally mounted capacitor heat-exchanger made of Cu-AL with covering galvanized framework, enameled fully in black.

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 coolant-collectors, 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-vaporizer of plumbed design. Heat-exchanger plates with optimized profile for safety coolant and built in expansion-valve.
Vaporizer 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 / ethylene-glycol entry, dirt absorber, 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, overflow valve with connection piece for computer terminal in cold water / AFN exit.

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

The temperature is controlled by a Siemens SPS actually temperature.

Additionally there is an connections to the MR for signals “run” and several faults

Condenser pressure control via pressure transmitter in the cooling circuit and frequency inverter, overload relay for system safety.

Internal cold water / ethylene-glycol (AFN) 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-glycol(AFN) 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 with a main switch, 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 master switch 5Q1 and the pump switch 14Q1 have been turned from “OFF” to “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 freezing of the evaporator if and when water volumes drop. The refrigerating machines switch on as soon as the fail-safe flow switch and control motor-protection pump is in order.

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 three hot gas by-pass valves.

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.

The refrigerant circuits which starts first is changed every week.

2.1.1 High-/Low- pressure control

The **high-pressure (HP) control** reacts to excess pressure of the magnitude of 19,2 bar by shutting off the compressors.

Causes of this include
- failure of condenser fans,
- high outdoor temperatures,
- a dirty condenser.

The compressor can only be put back in operation when the reset switch 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 control system consists of a Siemens SPS. The reference value is set at the works at 20°C for the outlet temperature. The sensor for the SPS 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. 25%, 50%, 75% of the machine’s refrigerating capacity.

Condenser pressure regulation

the condenser-pressure is regulated with help of the Frequency Inverter.
– see captions 4.5 “Frequency Inverter Settings” and 11.5 “Frequency Inverter”

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 KCC series are generally designed for a main supply of 480V 3Ph 60 Hz.

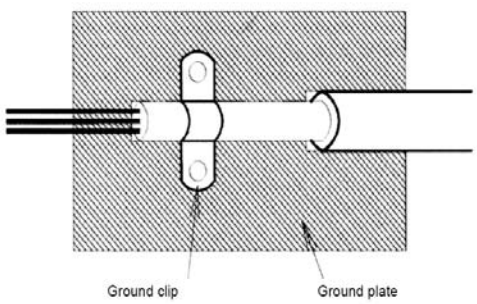
The connection L1, L2, L3, PE is performed via the terminal block in the switch cabinet.

The cooling block is switched on via the master switch .

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.

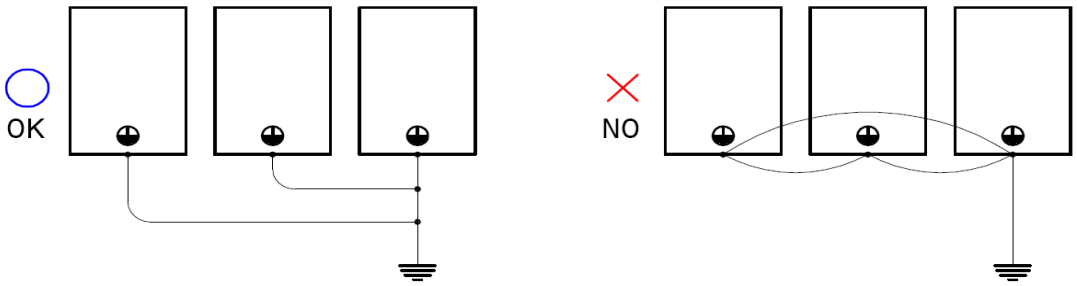
The width of the grounding wire must be min. 16mm² (AWG 6) or of the same width of the power supply.
The grounding must be an isolated ground and must connected on the ground terminal (X1) in the switch cabinet. The ground resistance must be less than 10 Ohm.

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 stands near an Avanto-Chiller KCC215-L-U/S)



3.3 Filling the unit with water-ethylene glycol-mixture

Fill with clean water (potable water quality) with Ethylene-glycol at the rate of min. 35% to max. 38%.
Open front panel and fill to a pressure of min.1,5 bar via the feed cock.
After filling, check all connections for leakage.
Don’t use propylene-glycol or automotive antifreeze
See also the enclosed Installing instruction

3.4 Draining air from the unit

The KCC 115 includes a closed water system.

If air get out of the system the water pressure dropes 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

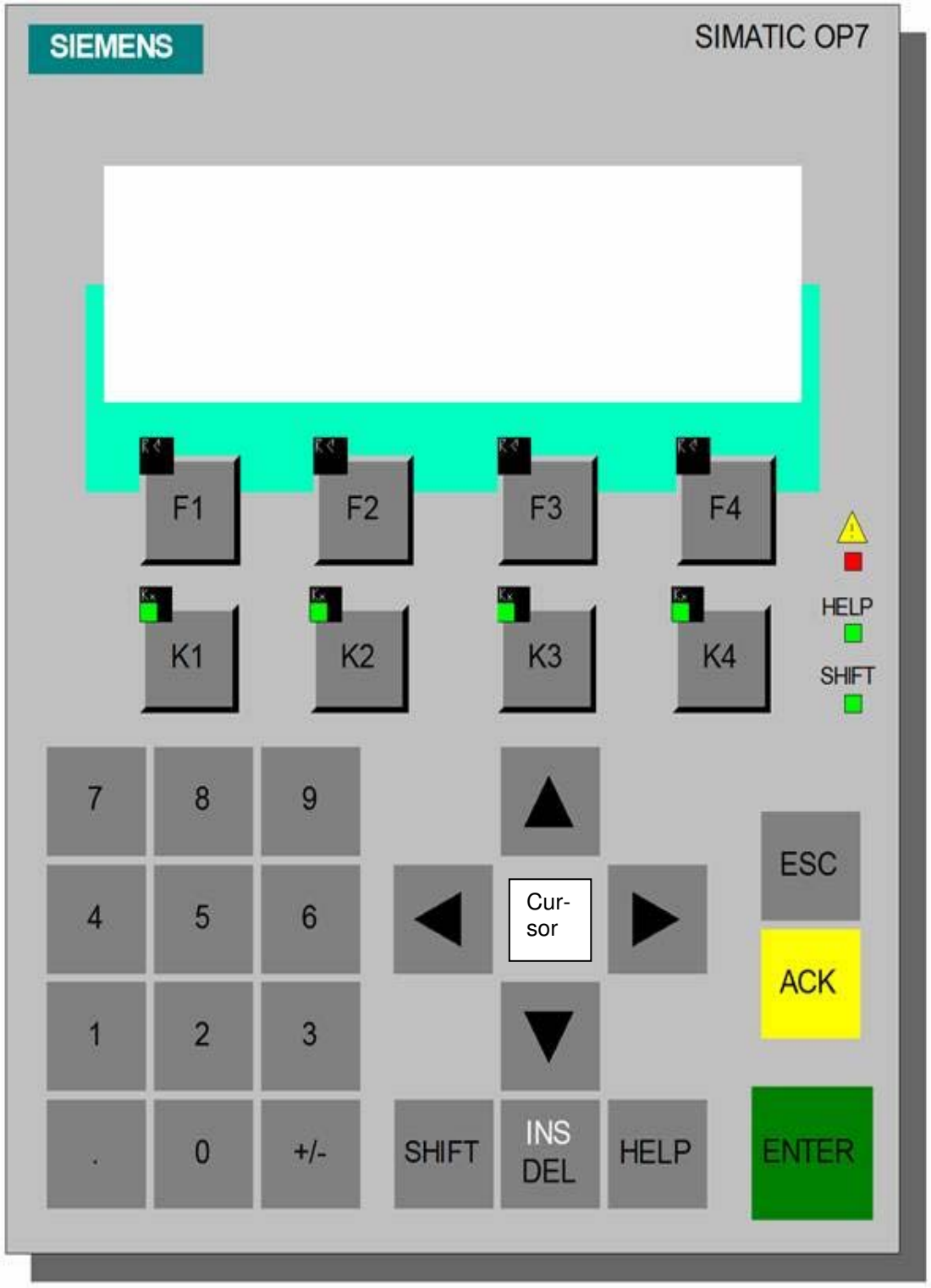
After all these steps, turn both switches to position "1". If all the prerequisites for operation have been met, the chiller will start after 1 minute.
In case of malfunctions: search for faults, take note of Chapter 9, TROUBLE SHOOTING, in this manual.
See also the enclosed Installing instruction

3.5 Setting the clock in the SPS (Siemens S7)

The following steps are to be used:

1. Switch on the main switch 5Q1
2. The control switch 14S1 into the switch cabinet must be switched on “Hand”.
3. Now the chiller is running autarc.
4. When the date and the clock on the display are wrong you can change it with following steps.
5. Press K4 bottom and a green light goes on
   Now you can change the data for 2 min during the green light is on.
6. Now press “shift” and then “cursor-up” or “cursor-down” for setting weekday. Close with “Enter”.
7. Press “shift” and then “cursor-right” for change the date.
8. Now set the correct date with the numbers. Close with “Enter”.
9. Now with “Cursor-down” for setting clock.
10. Set now the time and close with “Enter”.
11. Finally press F1. If the green light goes off during your setting pleas start again with step 5.

Caution: Only when the green light of the “K4”-Bottom in on the changes are saved.

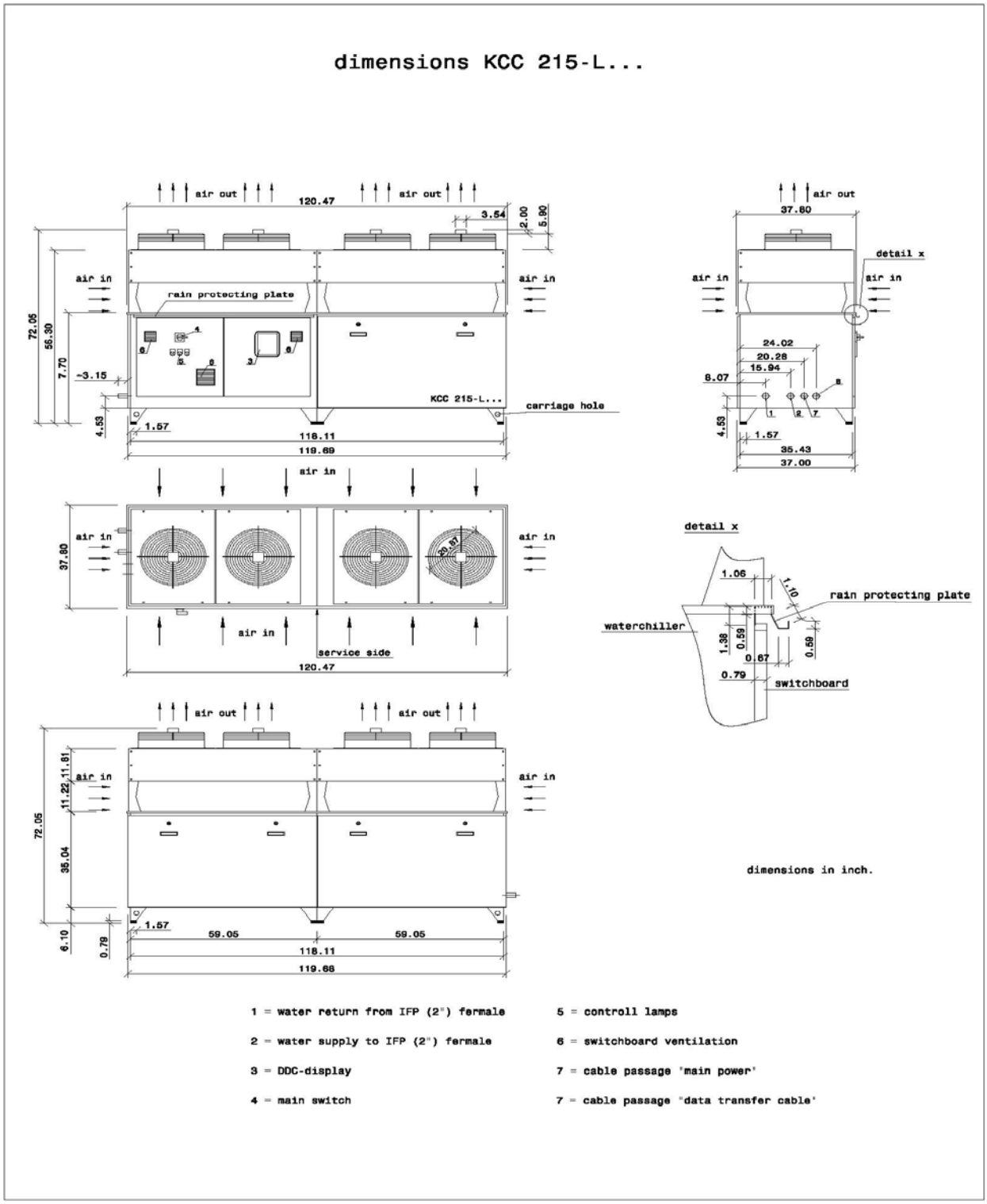

SIEMENS
SIMATIC OP7
F1
F2
F3
F4
K1
K2
K3
K4
HELP
SHIFT
7
8
9
4
5
6
1
2
3
.
0
+/-
Cur-
sor
SHIFT
INS
DEL
HELP
ESC
ACK
ENTER

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		19,2	bar
Water connection inlet		2“	G"female
Water connection outlet		2 “	G"female
Cold water temperature outlet	min.	19	°C
Cold water temperature outlet	max.	22	°C
Tolerance		±0,8	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		60,0	kW
Rated cold water outlet temperature		20	°C
Temperature of surroundings		48	°C
Main supply	380-480 V / 3Ph / 60 Hz		
Control voltage		24	VDc
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 KCC 215-L-…



4.3 Test report

Project number:_____ Type of plant:_____KCC 215 L-U/S_____

Project name:_____USA_____ Produce-No.:_____

Optical, mechanical, electric test

Housing and water fixtures

No.	Description	Yes	No	Remarks
1	Mechanical parts, housing, covering plates in perfect condition.			
2	All screws tested for tightness			
3	Colour as given			
4	Designations labelling on appliances, thermostats, pressure switches etc.			
5	Perfect door seals and locks			
6	Dirt – borings, insulation material			
7	All screw joints – water and refrigeration cycle – tightened up			
8				
9	**Labels inlet/outlet, Warning, Notice, Revision, Siemens Product, Ethylene and Manual**			

Switch box

No.	Description		Yes	No	Remarks
15	Correct complement of fuses, automatic cut-outs, bi-relays, protective motor switches				
16	Warning signs	external voltage, lightning bolt, supply line terminals			
17	Coverings VDE	bus-bar, master switch, control switch, power supply			
18	Lead-ins to switch box properly isolated				
19	Cable strain relievers affixed				
20	Cable signs				
21	Wiring diagrams in place in diagram pocket				
22					
23	Grounding o.k.				
24	Execution in accordance with wiring diagram				
25	Manual in place				

Refrigeration unit

No.	Description	Yes	No	Remarks
26	Pressure check performed see test report			
27	Test certificate issued			
28	Construction in accordance with refrigeration circuit diagram			
29	refrigeration circuit is dry			
30	All screw joints tightened up			

Performance test

No.	Description		Yes	No	Remarks
40	Emergency STOP control				
41	Performance test	Control system, fault alarms o.k., correct indicators			
42	LEDs and SPS display o.k.				
43	Safety chain o.k.				
44	Direction of rotation	pump			
		compressor			
		fan			
45	Performance test	HP pressure control			
		LP pressure control			
		Flow switches			
		Thermal contact			
		Over current trip			
		Hot-gas by-pass 1...X			
		expansion valve suction gas cooling			
46	Setting of	Protective motor switch			
		Over current trip 1...X			
		HP pressure control 1...X			
		LP pressure control1...X			
		Frequency inverter pressure control 1...X			
		Flow switches			
		Controller SPS Version No:			

4.4 Settings for coldness

Description						Remarks
High-pressure switch (SPS)	KM1		bar	_____	bar	
safety high pressure switch (pressostat)	KM1	19,2	bar		bar	
High-pressure-switch (SPS)	KM2		bar	_____	bar	
safety high pressure switch (pressostat)	KM2	19,2	bar		bar	
Low-pressure-switch (SPS)”off”	KM1	0,5	bar		bar	
Low-pressure-switch (SPS)”on”	KM1	1,0	bar		bar	
Low-pressure-switch (SPS)”off”	KM2	0,5	bar		bar	
Low-pressure-switch (SPS)”on”	KM2	1,0	bar		bar	
Condenser fan level I	1+2	11	bar		bar	
Condenser fan level I	3+4	11	bar		bar	
Total filling weight R134a	KM1	12	kg		kg	
Total filling weight R134a	KM2	12	kg		kg	
Safety valve	water	6,0	bar		bar	
Flow switch		0,6-1,0	m³/h		m³/h	
pressure expansion tank water		1,0	bar		bar	
Overflow valve water		6,0	bar		bar	

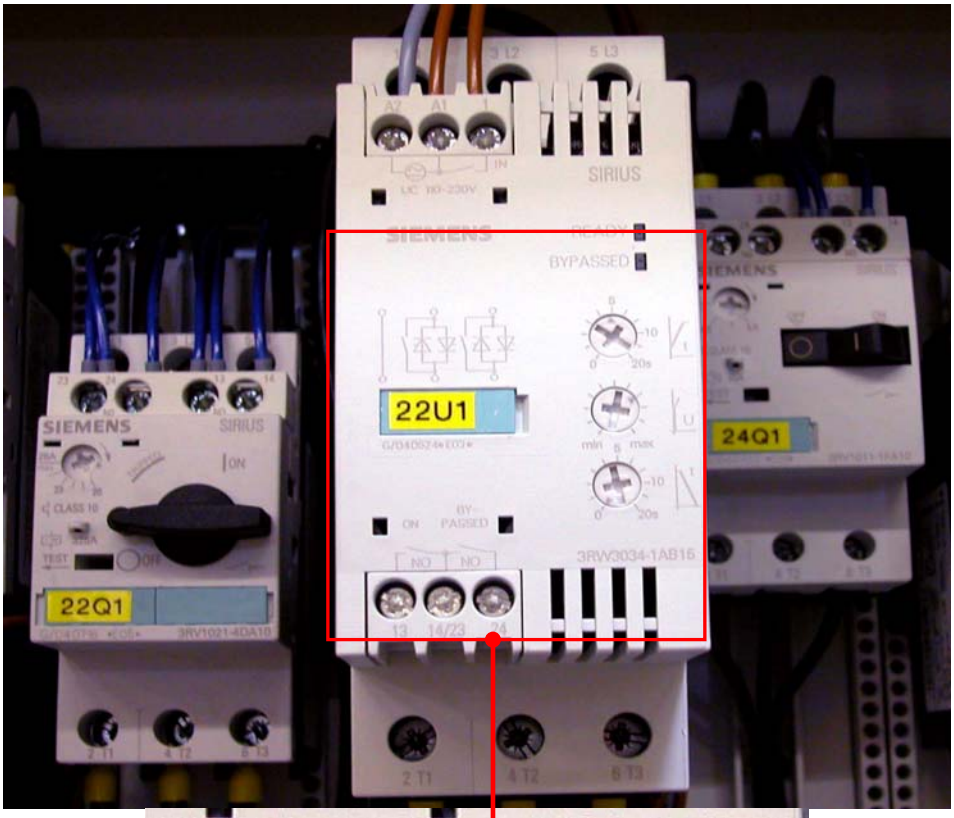
4.5 Temperature controller settings

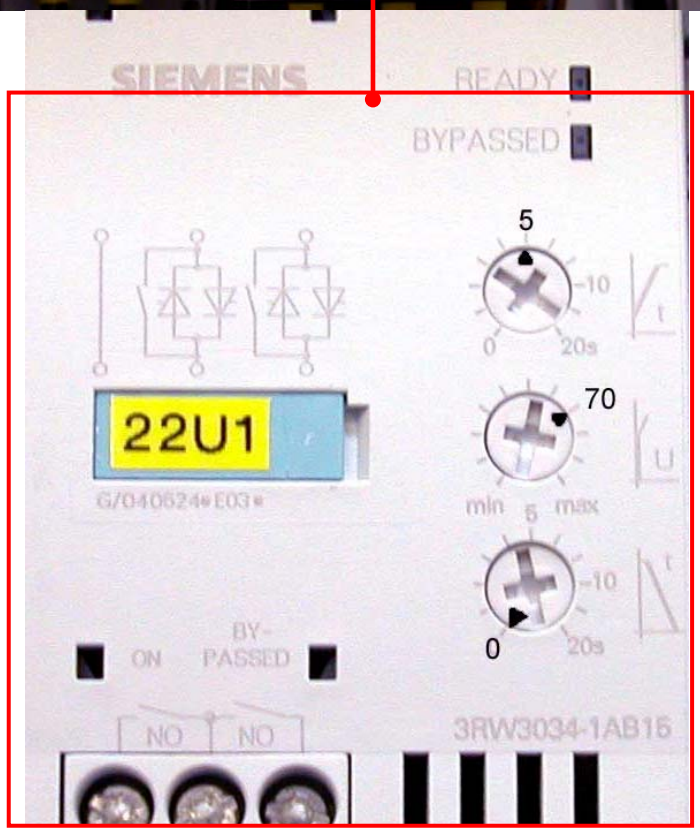
Software version reference is KCC215-1.1 actual: KCC215-__1.1_____

4.6 Electrical settings

Designation			Reference	Actual
Phase sequence relays	Asymmetry	5A1	10%	%
	Over voltage factor		1,1	
	Low voltage factor		0,9	
	Operation delay		5 s	s
Thermostat. Switch	Temperature heating	6B1	10 °C	°C
Thermostat. Switch	Temperature blower	6B2	40 °C	°C
Motor-protector	Pump	21Q1	5,8 A	A
Run-off delay	Pump		-- s	s
	Flow switch		45 s	s
Motor-protector	Compressor 1	22Q1	25,0 A	A
	Compressor 2	25Q1	25,0 A	A
Motor-protector	Control voltage 24VAC	5Q2	1,2A	A
Motor-protector	Control voltage 230VAC	5Q3	1,4A	A
Low-pressure cut-off delay	Compressor 1		60 s	s
	Compressor 2		60 s	s
Start Help	Compressor 1		45 s	s
	Compressor 2		45 s	s
Restart	Compressor 1		30 s	s
	Compressor 2		30 s	s
Motor protection condenser fan	V1 + V2	24Q1	4,8 A	A
Motor protection condenser fan	V3 + V4	27Q1	4,8 A	A

4.7 Soft Starter settings (optional)





4.8 Frequency Inverter settings

Main parameter settings – for further Parameter – see chapter “Frequnency Inverter”

Pa	Function - Parameter name	Adjustable Range	Reference	Customer-Setting
P1-03	Pressure reference - set point	0.0 ... 50.0bar	12,0 bar	
P1-04	Pressure sleep level	0.0 ... 30.0bar	10,5 bar	
P1-06	Pressure on-hysterese	0.0 ... 10.0bar	1,0 bar	
P2-01	Pressure level Summer/Summer start	5.0 ... 25.0bar	14 bar	
D2-02	Frequency reference lower limit		20,0 %	
E1-01	Input voltage setting		480 Volt	
E1-05	Max Voltage		480 Volt	
P1-05	Pressure sleep start delay time		0 sec	
U1-14	Software No. - Version	08016		
P3-01	Pressure Level “Winter”		4,0 bar	
B5-01	PI-Control-Mode Selection Mod.01 o.3		3	

4.9 Performance test

Order number:_____ Type:_____KCC 215 L-U/S_____

Order description:_____USA_____ Produce-No.:_____

Refrigerant circle: refrigerant R134a

Nr.	Description		Compressor 1	Compressor 2
1	Ambient temperature	te	°C	°C
2	Condensing temperature	tc	°C	°C
3	Hot gas temperature	tc	°C	°C
4	Liquid temperature	t2	°C	°C
5	Sub cooling	Δt	K	K
6	Evaporation temperature	tc	°C	°C
7	Suction gas temperature	tc1	°C	°C
8	Suction gas superheat	Δt	°K	°K

Water circuit: water – ethylene-glycol ___35-38_____ %

Nr.	description		reference		actual	
10	Cold water in	hot		°C		°C
11	Cold water out	cold	20+/-1	°C		°C
12	Rated water capacity		7,8	m³/h		m³/h
13	Density		1,06	Kg/ dm³		Kg/ dm³
14	Circle pressure		1,5+/-0,1	bar		bar
15	Cooling capacity		60+5	KW		KW

Amp ratings:

Amp Ratings are measured at following characteristically power supply data:

Power supply:_____480_____ Volt

Frequency:_____60_____ Hertz

No.	Part Name	Nominal Rate	Phase1	Phase 2	Phase3
16	pump	5,3 A	A	A	A
17	Compressor 1	25,6 A	A	A	A
18	Condenser fan 1+2 incl. FI	4,8 A	A	A	A
19	Compressor 2	25,6 A	A	A	A
20	Condenser fan 3+4 incl. FI	4,8 A	A	A	A
21	Output Trafo for 24 Volt	24,0 V	V	---------- V	---------- V
22	Output Trafo for 230 Volt	230,0 V	V	---------- V	---------- V
23	Supply circuit ampacity	A	A	A	A

All points of checklist 4.3 to 4.9 are checked.

Date:_____ Technician:_____ Sign:_____

Distributor:

Orginal: Projectmap
1. Kopie: _____
2. Kopie: _____

4.10 Unit card KCC 215 – L….

Produce-No.	date:
Proj.Nr.	project ingeneer:
Monteur:	date of manufacture:

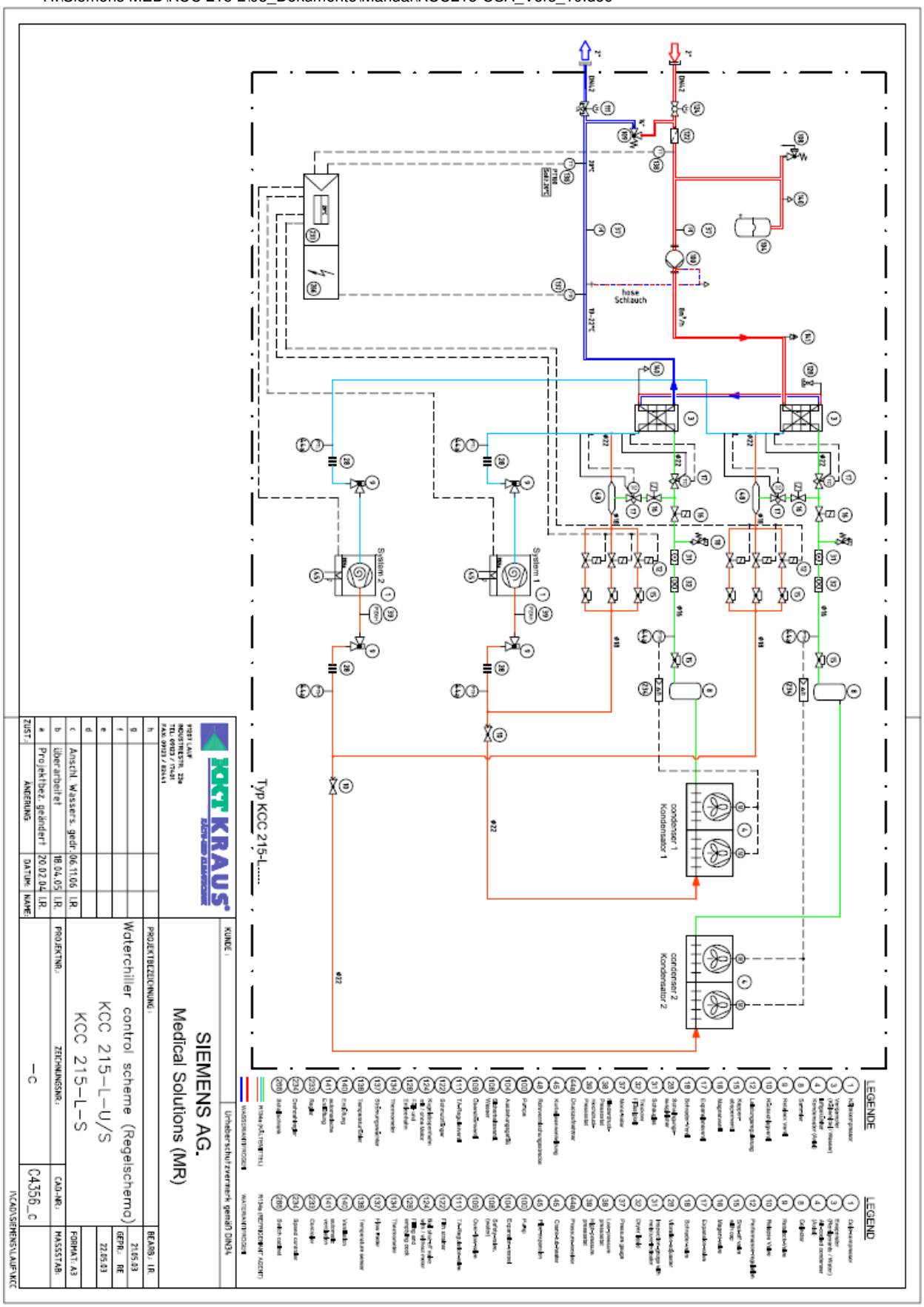
Maincomponentes

compressor	1	Copeland ZR 16 M3E	Ser.Nr.	_____
compressor	2	Copeland ZR 16 M3E	Ser.Nr.	_____
evaporator	1	GEA Ecoflex M25-60GLX	Ser-Nr.	_____
evaporator	2	GEA Ecoflex M25-60GLX	Ser.Nr.	_____
condenser	1	HTE VH24	Ser.Nr.	_____
condenser	2	HTE VH24	Ser.Nr.	_____
pump	1	Speck _____	Ser.Nr.	_____
			Ser.Nr.Motor	_____
Condenser fan	1	Ziehl Abbeg	Ser.Nr.	_____
Condenser fan	2	Ziehl Abbeg	Ser.Nr.	_____
Condenser fan	3	Ziehl Abbeg	Ser.Nr.	_____
Condenser fan	4	Ziehl Abbeg	Ser.Nr.	_____
Temperature controller	1	SPS Siemens	Ser.Nr.	_____
Frequency Inverter	1	Yaskawa	Ser.Nr.	_____
Frequency Inverter	2	Yaskawa	Ser.Nr.	_____

4.11 Water chiller control scheme

(see next page)

H:\Siemens MED\KCC 215 L\03_Dokumente\Manual\KCC215-USA_Vers_10.doc



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,

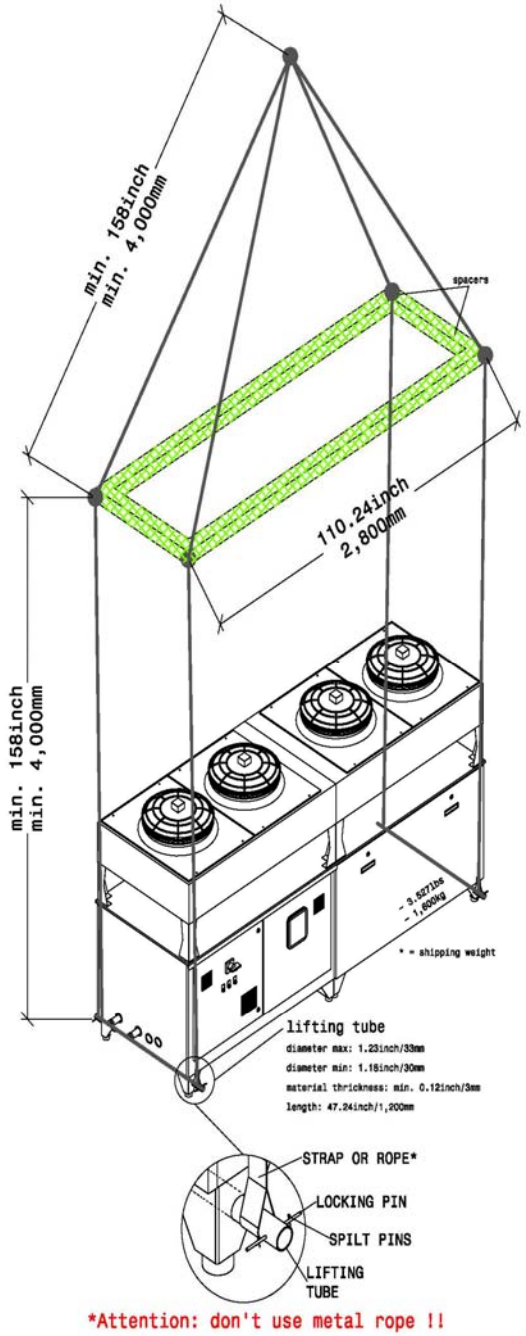
please ensure that the housing is not subjected to pressure at the sides.

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.

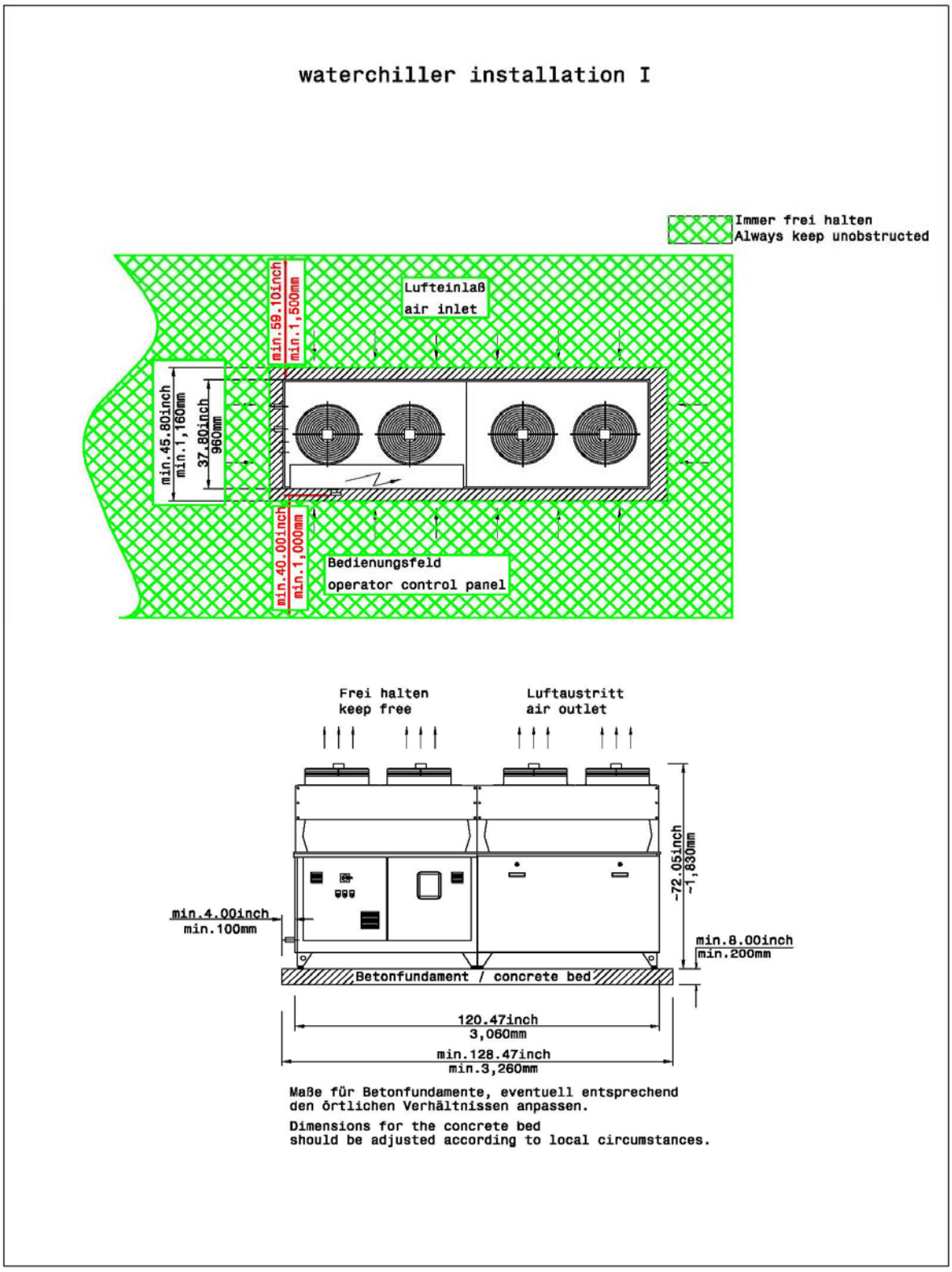
(Weight with load: see technical specifications).

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
Immer frei halten
Always keep unobstructed
Lufteinlaß
air inlet
min.59.10inch
min.1,500mm
min.45.80inch
min.1,160mm
37.80inch
960mm
min.40.00inch
min.1,000mm
Bedienungsfeld
operator control panel
Frei halten
keep free
Luftaustritt
air outlet
72.05inch
1,830mm
min.4.00inch
min.100mm
min.8.00inch
min.200mm
Betonfundament / concrete bed
120.47inch
3,060mm
min.128.47inch
min.3,260mm
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 KCC series and the IFP of 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.

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 KCC 215 L-… must be run with fuses of no less than 63 in size.

The supply voltage must be 380-480V / 3ph /50-60 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”

H:\Siemens MED\KCC 215 L\03_Dokumente\Manual\KCC215-USA_Vers_10.doc

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 5A1
	2. temperature sensor defective	- check sensor 9B1 clamp feeler and measure the resistance
	3. simatic 8N1, 8A1, 8A2 and 8A3 malfunction	- check MMC-Card check power supply 24VDC 7U1and fuses 7F1 and 7F2
	4. chiller “not ok”	- check fuse 28F1 - data transfere cable - check overvoltage protection
• malfunction of pump 21M1	1. main switch 5Q1 not switched on 2. control switch 14S1 on 'OFF' 3. main fuse 21Q1 defective 4. fuse for control current defective 5. pump motor 5M1 defective 6. flow switch responded 11B1 7. shortage of water	- switch on main switch 5Q1 - switch control switch to 'AUTO' 14S1 - replace fuse 21Q1 - replace fuse - replace complete pump - check water flow - check system pressure, clean strainer
• leaking slide seal (a leaking slide seal is: when on the buttom of the pump is permanent a puddle)	1. air on top of pump 2. dirt in the watercircuit	- check the air vent on top of pump, change pump - flush and clean the watercircuit, refill with new 35-38vol% water ethylene glycol mixture
• still malfunction of pump	3. overload trip 21Q1 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 22M1 and 25M1 stops	1. Klixon/INT69 tripped 22A1 and 25A1	- Check Fuses 22Q1 and 25Q1 - wait until compressor cooled down; perhaps clean condenser or provide fresh air supply
	2. Klixon/INT69 22A1and 25A1defective	- replace Klixon/INT69
• malfunction of refrigerating machine	1. simatic 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 23Y1 and 26Y1 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 24Q1 and 27Q1
	- outside temperature too high	- spray condenser with water
	- pressure sensor 24B1 and 27B1 for condenser control defective	- replace pressostate
	- Frequency inverter defective	- replace frequency inverter 24U1 and 27U1
• 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
•		-

H:\Siemens MED\KCC 215 L\03_Dokumente\Manual\KCC215-USA_Vers_10.doc

9.1 Typical Vailures

		[#####] = electrical item designation		
kind of failure	**plain text display**	**symptoms**	**possible cause**	**solution**
safety high pressure	fault safety high pressure refrig. circuit 1 or 2	compressor 1or 2 do not run	condensor refrig.circuit 1 or 2 dirty	clean condenser
high pressure	fault high pressure refrig. Circuit 1 or 2	water becomes/is too hot	one or two condenser fans defective [24M1,24M2 or 27M1,27M2]	change fan [24M1,24M2 or27M1,27M2]
			one or two winding protector of condenser fans defective	change fan [24M1,24M2 or27M1,27M2]
			one or two winding protector of condenser fans switched off	check isolation and current and change the defective component
	fault frequency inverter condenser fan refrig. circuit 1 or 2		Frequecy inverter defective [24U1 oder 27U1]	change frequncy inverter [24U1 oder 27U1]
			pressure sensor defective [24B1 oder 27B1]	change pressure sensor [24B1 oder 27B1]
			contactor defective [22K3 oder 25K3]	change contactor [22K3 oder 25K3]
			safety high pressure switch defective [12B1,13B1]	change safety high pressure switch [12B1,13B2]
			pressure sensor defective [9B5 oder 9B7]	change pressure sensor [9B5 oder 9B7]
ambient temperature too high	ambient temperature too high	high pressure over 19bar(275.6PSI)	ambient temperature over 48°C (118.4°F)	
low pressure	fault low pressure refrig.circuit 1 or 2	compressor do not run	failing of refrigerant of cause leakage	seek and seal the leakage, refill refrigerant
		water becomes/is too hot		
			condenser pressure control defective [24U1 oder 27U1]	check the controller of frequecy inverter
			liquid solenoid valve defective (closed) [23Y1 oder 26Y1]	change the liquid solenoid valve[23Y1 or 26Y1]
			relais of liquid solenoid valve failure [16K3 oder 16K8]	change the relais of the liquid solenoid valve[16K3 or 16K8]
			pressure sensor failure of condenser pressure control [24B1 oder 27B1]	change pressure sensor [24B1 or 27B1]
		ice between filter dryer an expansion valve	filter dryer blocked	change filter dryer
			pressure sensor defective [9B4 oder 9B6]	change pressure sensor 9B4 oder 9B6]
ambient temperature too low	ambient temperature too low	low pressure below 2 bar(29 PSI)	ambient temperature below -20°C (-4°F)	

H:\Siemens MED\KCC 215 L\03_Dokumente\Manual\KCC215-USA_Vers_10.doc

KKT KRAUS KÄLTE-UND KLIMATECHNIK

[#####] = electrical item designation

kind of failure	plain text display	symptoms	possible cause	solution
compressor [22M1 oder 25M1]		compressor do not run	contactor [22K3 oder 25K3] or soft starter [22U1 oder 25U1] defective	change contactor [22K3 or 25K3] change soft starter [22U1 or 25U1]
		compressor do not run	Relais [16K2,16K7] defective	check and change relais [16K2,16K7]
compressor [22M1 oder 25M1]	motor protection compressor 1 or 2		overcurrent protector defective [22Q1 oder 25Q1]	change overcurrent protector [22Q1 oder 25Q1]
compressor [22M1 oder 25M1]	motor protection compressor 1 or 2		overcurrent protector switched off [22Q1 oder 25Q1]	check current and change the defective component
winding protection [22A1 oder 25A1]	winding protection compressor 1 or 2	compressor is very hot	winding protector INT 69 switched off [22A1 oder 25A1]	check INT 69 [22A1 oder 25A1]
winding protection [22A1 oder 25A1]	winding protection compressor 1 or 2	suction line is too hot	winding protector INT 69 defective [22A1 oder 25A1]	change INT 69 [22A1 oder 25A1]
			Relais defekt [17K6,18K1]	check and change relais [16K2,16K7]
			suction gas expansion valve defective	change sunction gas expansion valve
			solenoid vavle hot gas bypass defective	change solenoid valve hot gas bypass
pump [21M1]		pump do not run	contactor defective [21K1]	change contactor [21K1]
pump [21M1]	motor protection cold water pump		overcurrent protector switched off [21Q1]	check current and change the defective component
			flow switch [11B1]	check flow switch and change if necessary [11B1]
			Relais [16K1] defective	change relais [16K1]
			control switch off [14S1]	control switch "hand"
flow	fault flow switch	pump do not run [21M1]	dirt trap blocked	clean the dirt trap
			solenoid valve on IFP (transfere station) defective	check the IFP (trasfere panel)
			air in water circuit	vent and refill water circuit
			water pressure too low	refill water circuit up to 1.5 bar(21.75PSI)

H:\Siemens MED\KCC 215 L\03_Dokumente\Manual\KCC215-USA_Vers_10.doc

		[#####] = electrical item designation		
kind of failure	**plain text display**	**symptoms**	**possible cause**	**solution**
water temperature		water supply too cold	DDC defective	check the DDC
			solenoid valve hot gas bypass defective	change the solenoid valve hot gas bypass
			Relais solenoid vavle defective [16K4,16K5,17K1,17K2,14K4,17K5]	check relais and change if necessary [16K4,16K5,17K1,17K2,14K4,17K5]
			temperature sensor defective [9B1,9B2]	change temperature sensor
water temperature		water supply too hot	DDC defective	check DDC
			solenoid valve hot gas bypass defective	change the solenoid valve hot gas bypass
			Relais solenoid vavle defective [16K4,16K5,17K1,17K2,14K4,17K5]	check relais and change if necessary [16K4,16K5,17K1,17K2,14K4,17K5]
			sensor temperature defective [9B1,9B2]	change temperature sensor
			condenser dirty	clean condensor
			one or two condenser fans defective [24M1,24M2 or 27M1,27M2]	change condensor fans [24M1,24M2 or 27M1,27M2]
			one or two winding protector of condenser fans defective	change condensor fans [24M1,24M2 or 27M1,27M2]
			one or two winding protector of condenser fans switched off	check isolation and current and change the defective component
	fault frequency inverter condenser fan reffrig. circuit 1 or 2		Frequecy inverter defective [24U1 oder 27U1]	change Frequecy inverter [24U1 or 27U1]
			pressure sensor defective [24B1 oder 27B1]	change pressure sensor [24B1 or 27B1]
			compressor 1 or 2 failure	see compressor
			high pressure	see high pressure
			low pressure	see low pressure
no display	no disply available	Chiller do not run	display defective	change display
			control fuse switched off [5F1, 5F2]	check current and change the defective component
fuse 24V [7F1,7F2]	"automatic fuse fault 24V"		fuse 24V transformer [5Q2]	check current and change the defective component

H:\Siemens MED\KCC 215 L\03_Dokumente\Manual\KCC215-USA_Vers_10.doc

KKT KRAUS KÄLTE-UND KLIMATECHNIK

		[#####] = electrical item designation		
kind of failure	**plain text display**	**symptoms**	**possible cause**	**solution**
asymetrie relais [5A1]	"fault sequence relais"	Chiller do not run	power supply phase wrong	check power supply and change two phases if necessary
			power supply overvoltage or low voltage	
			power supply one or more phase failure	
			asymetrie relais defective [5A1]	change asymetrie relais [5A1]
Simatic failure	no disply available	Chiller do not run	display failure	change display
		red sign on siematic shines	hardware failure	change hardware
fuse 24V [7F1,7F2]	no disply available		control fuse switched off [7F1,7F2]	check current and change the defective component
			fuse 24V transformer [5Q2]	check current and change the defective component
failure on MR control monitor Siemens		display "Chiller not ok"	data transfere cable not connected	connected the cable shown in the installation manual
			overvoltage protector not connected	connected overcurrent protector shown in the installation manual
			fuse [28F1] swiched off	check current and change the defective component
fuse 230V [5F1]	"automatic fuse fault 230V"	only DDC is ok. Compressor, pump an fans do not run	fuse [5F1] defective	change fuse [5F1]
			overcurrent protector defective [5Q3]	change overcurrent protector [5Q3]
			overcurrent protector switched off [5Q3]	check current
emergency stop	"emergency stop"	chiller do not run	emergency stop button switched if mounted	

9.2 Explanations about the automatic restart of the AVANTO Chiller

KCC215-L-...

The following power failure situations are considered:

1. Main switch: On => Off => On
2. Mains supply: ok => power failure => power returns

9.2.1 Main switch: On => Off => On

When switching the main switch off and on again, the operator's display shows the a failure message called „phase sequence“ (blinking) and at the electrical cabinet the green and the red indicator lamps are blinking to indicate this failure. After a start-up time of around 20 sec., the chiller will restart automatically and the life bit is on again. The red indicator lamp blinking goes off again and the green lamp continues blinking to indicate that **in the past in this situation a power failure / interruption occurred.**

The chiller restarts automatically!!!!

In case the chiller does not restart automatically, the failure is still pending!

9.2.2 Mains supply: ok => power failure => power returns

Once power returns after a failure, the screen also displays the error message „phase sequence“ and the green indicator lamp at the electrical cabinet blinks to indicate that a failure **had occurred**.

The chiller restarts automatically!!!!

If the power supply is not within the limit values set at the phase sequence relay (overvoltage exceeds 528V(440V), undervoltage remains/falls under 432V(360V), asymmetry larger than 10%), the failure is still existing. Due to the failure, the red indicator lamp at the electrical cabinet is blinking to show that a **failure is pending** and the chiller does not restart.

Once the voltage supply has stabilized again, the **chiller restarts automatically** after a start-up time of around 20 secs**,** the red indicator lamp goes off, the life bit is on again, the green indicator lamp saying that a failure **was pending** is still blinking and at the display the failure message „phase sequence“ remains visible.

In case the chiller does not restart automatically, the failure is still pending or another failure exists!

To set off the failure message at the operator's display, press the „ACK-button“ at the display unit.

The blinking green or red indicator lamp at the electrical cabinet becomes permanent (green lamp) or goes off (red lamp), if the „black RESET-button“ at the electrical cabinet is actuated.

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.

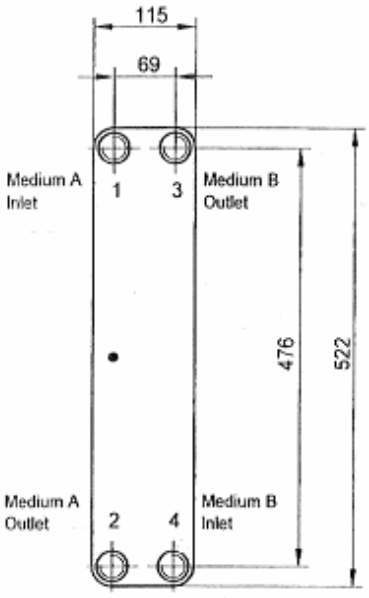
Type-tested helium test at10 – 8 bar.

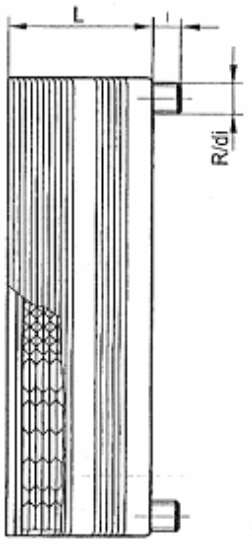
Test pressure Water 24 bar
Refrigerant R134a 37,5 bar

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

Copeland Scroll

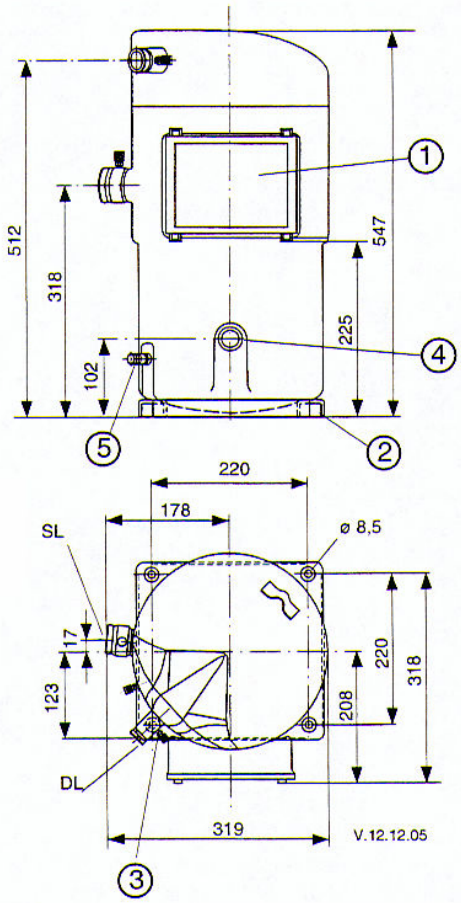
Single-Stage Hermetic Compliant SCROLL Motor-Compressor
Type ZR 16 M3E-TWD

Data Sheet

max. working pressures	ISO 5149		
high- / low-pressure	28,0	/ 17,0	bar
nominal speed (50 Hz / 60 Hz)	2900	/ 3500	min^{-1}
displacement, theor. (50 Hz / 60 Hz)	35,6	/ 43,0	m^3/h
lubrication by oil-pump			
oil charge	4,0	l	
grade of oil (ester)	Mobil EAL Arctic 22 CC		
	ICI Emkarate RL32 CF		
enclosure class	IP 54 (IEC 34)		
internal motor protection	ELECTRONIC		
weight (net / gross)	103	/ 110	kg

SL suction spud	1 3/4" - 12 Rotalock
DL discharge spud	1 1/4" - 12 Rotalock
1 terminal box	
2 rubber grommet	
3 non-return valve	
4 sight glass	
5 oil level adjustment valve	

Volt (±10%)	~	Hz	Connection	Locked Rotor Current (A)	Max. Operating Current (A)	Motor Code
380 - 420	3	50	Y	151 - 167	25,6	TWD
460	3	60	Y	158	25,6	TWD



Accessories

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

Single-Stage Hermetic Compliant SCROLL Motor-Compressor Type ZR 16 M3E-TWD

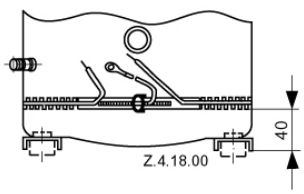
Introduction

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*

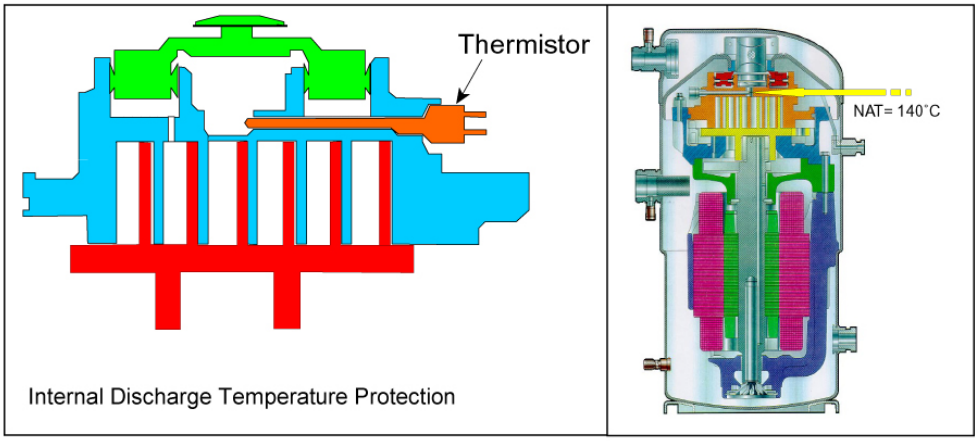
A crankcase heater is needed to drive out excessive amounts of refrigerant that have migrated into the shell during standstill periods and no accumulator is piped to provide free liquid drainage during the off cycle.

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.

Copeland Scroll

Single-Stage Hermetic Compliant SCROLL Motor-Compressor
Type ZR 16 M3E-TWD

Module

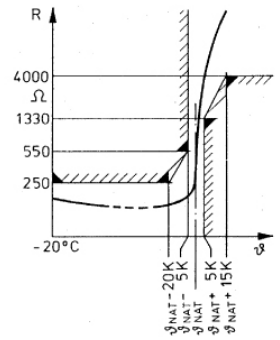
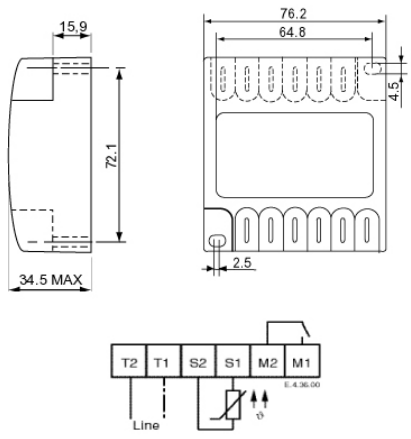


Fig. 6: Thermistor Resistance Curve

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.

Copeland Scroll

Single-Stage Hermetic Compliant SCROLL Motor-Compressor
Type ZR 16 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.

Copeland Scroll

Single-Stage Hermetic Compliant SCROLL Motor-Compressor
Type ZR 16 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!

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.

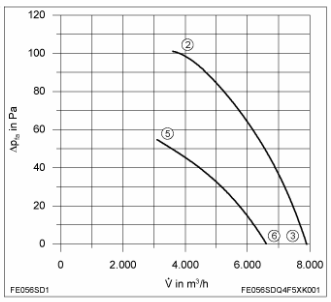


Fig. 3 FE056-SD_.4F._

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.

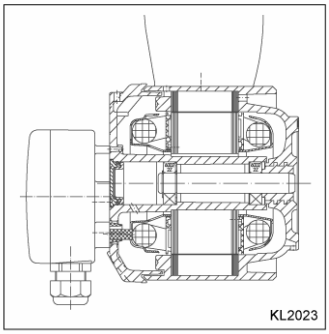
Motor protection
***IP54** in conformity with **DIN VDE 0470 part 1 (EN 60 529)** categorie 2*

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

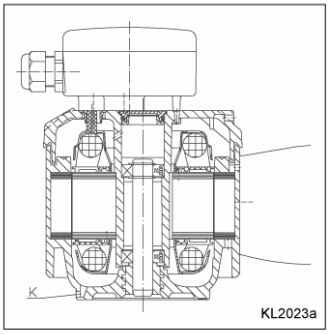
Bearing arrangement
*Deep-groove ball bearing **DIN 625**, closed at both sides, with high temperature grease for thermal class F including subzero temperature range down to -40 °C.*
Applications up to -60 °C upon request.

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

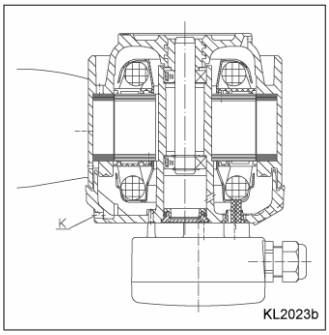
Condensation drain holes
The lower of the condensation drain holes „K“ must be open depending on whether mounting position Vo (rotor above) or Vu (rotor below) is used. With mounting position H, the condensate can escape via the gap between stator and rotor.



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 <u>both</u> 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

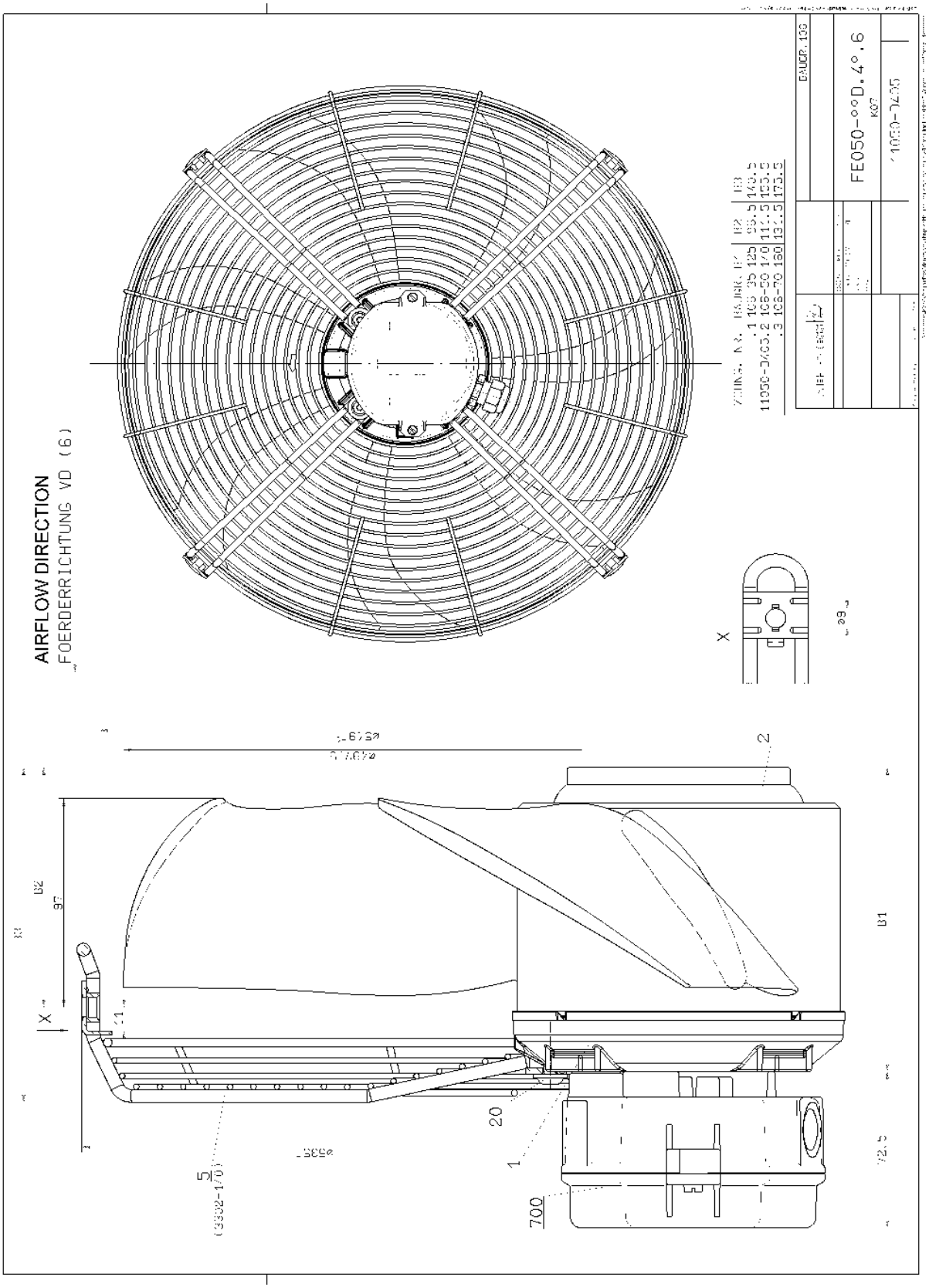
II free blowing fan mounted downstream of coil

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-
X
20
1
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.*

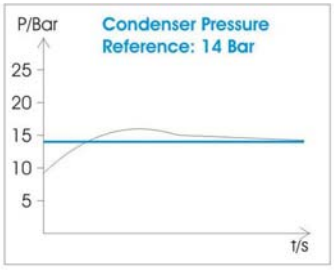
11.5 Frequency Inverter

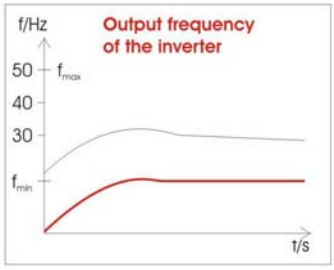
The Frequency Inverter controls the speed of the condenser fans to get a constant pressure of refrigerant gas.

YASKAWA Mechatronics Solutions

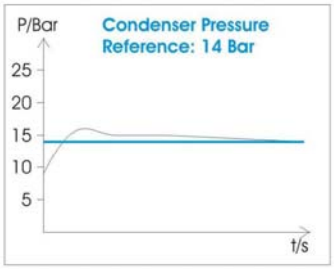
Frequency Inverter YASKAWA E7–Series

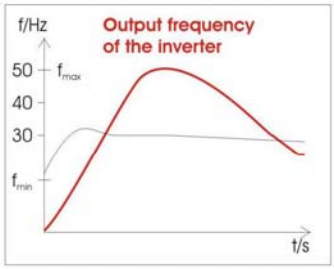
Shot Menu
Software for
Condenser fan application



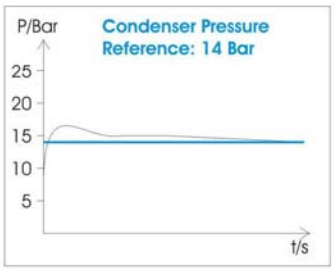


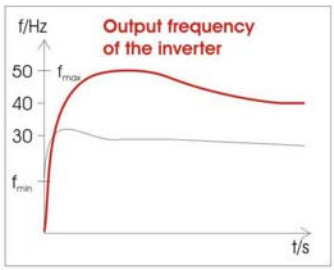
Condenser “ON” at low ambient temperatures.





Condenser “ON” at normal ambient temperatures.





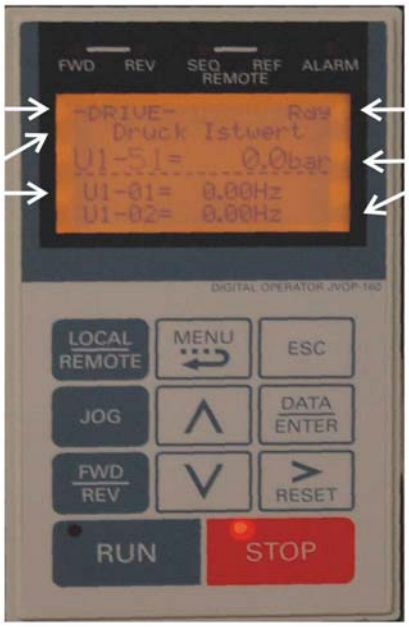
Condenser “ON” at high ambient temperatures.

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

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

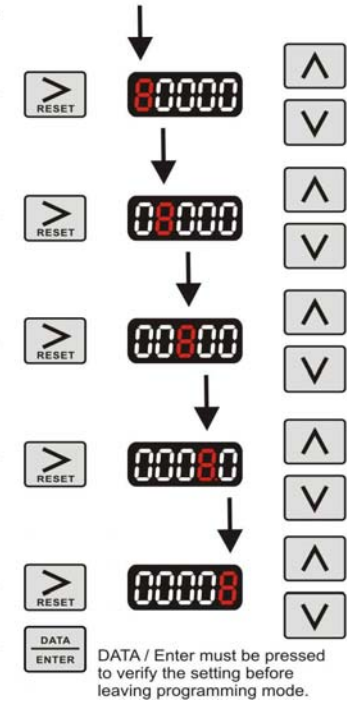
RUN — **RUN** - Key
Starts the inverter via Operator

STOP — **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.
RESET — 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 necessary 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.



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.
A1-03	0	0	9999	N	P. 5.43		RESET Changes to the individual parameter; ∧ ∨ Selects parameter
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	60.0	Y	CASE	“Winter” start time	Determines the time after power on where as “Winter” PI-control is active.

YASKAWA Mechatronics Solutions

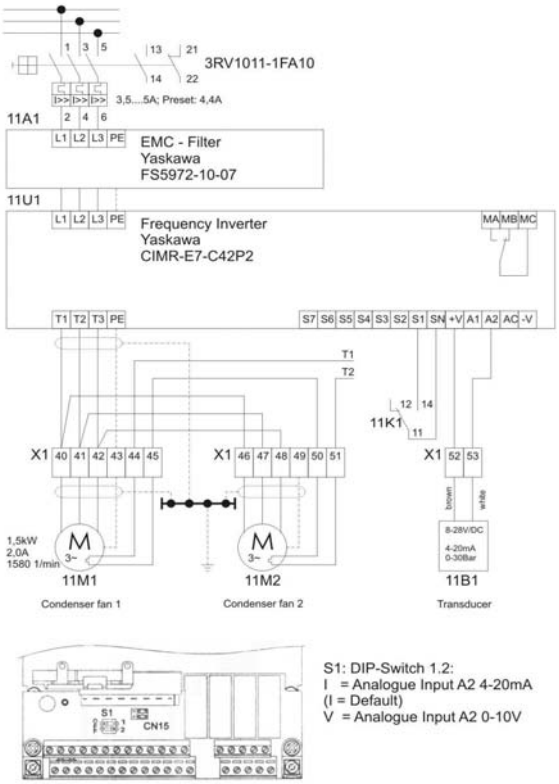
Frequency Inverter YASKAWA E7–Series

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:
00000001		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:
00000001		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 Programmable Logic Controller PLC

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 PLC shows the actual readings of the initial medium temperature.

The reference value is shown by pressing the reset button.

11.7 High -Pressure limiter

High-pressure switch

Monitors the condensation pressure and switches the compressor off before the max. permitted pressure of 19,2 bar has been reached.
Restarting the unit is only possible once the pressure has dropped and the reset button has been activated.

Type ALCO PS3-B6S

11.8 Sight glass

ALCO CONTROLS	MIA Moisture Indicator Technical Data	Document Nr.: A3.5.023/E 2 replacement for: A3.5.023/E 1 Date: 23.09.1998

Moisture Indicator with "true hermetic" design

Traditional Moisture Indicators have been brass based products which require the use of gaskets to establish the seal between the body and the glass. The MIA series utilises pioneering manufactures techniques to provide a fully hermetic product without the use of any gaskets.

Features

- Fully hermetic
- Corrosion free stainless steel body
- Crystal Indicator element for long lifetime and reliability
- Easily determination of moisture content
- Sensitive indicator with calibrated four colours
- Large clear viewing area
- Lightweight (only 60g MIA M06/014)
- ODF extended tube configurations suitable for all commercial applications
- For R 22, R407C, R 134a, R 404A & R507 together with Mineral- and POE oils
- Eliminates the need of "wet ragging" during installation

MIA
Moisture Indicator

Description

As the use of advanced and alternative refrigerants increase, the need for reducing the effects of global warming also increase.

By using pioneering manufacturing techniques, Alco Controls has developed the MIA series which is the first truly hermetic Moisture Indicator, creating a new standard within the industry.

Design

Utilising one continuous process, the glass viewing section and copper extension tubes are fused to the stainless steel body creating a fully hermetic seal. Furthermore by using advanced materials, the MIA becomes free from corrosion whilst having the benefits of becoming lightweight when compared to traditional brass based products. The MIA series also takes advantage of the different thermal conductivity between Stainless steel and copper. Thus under normal circumstances, the MIA can be brazed into a system without the need of "wet ragging". A feature such admired by the industry for saving installation time and costs.

Indicator

Where many products in the market use insensitive paper indicators, Alco has retained the long established moisture indicator used in the existing AMI series because of its known advantages. This guarantees system performance by providing a sensitive and durable monitoring of the systems moisture content, enabling the indicator to react to minimum moisture level of 50 ppm specified by leading compressor manufacturers.

With the new designed reference colour scale it has become easier to determine all moisture levels by matching the element colour with the four colours on the reference label.

The crystal indicator element is chemically engineered for long life accuracy and reliability. It is highly resistant to damage by free water or motor burnout contaminants and has proved to be more durable than traditional paper type indicators. It is therefore not necessary to exchange the indicator after exchange of filter drier.

The element gradually changes colour in relation to changes of the systems moisture content as indicated in the table.

Determining the Moisture Content with the Color Code

Refrigerant	Liquid Temperature °C	Moisture content in mg Water per kg refrigerant (ppm) blue dry	violet	purple Caution	red Caution – wet
R22	25 38 52	25 35 50	40 65 90	80 130 185	145 205 290
R404A / R507	25 38 52	15 25 45	33 50 60	60 110 140	120 150 180
R134a	25 38 52	20 35 50	35 55 85	90 120 150	130 160 190
R407C	25 38 52	26 40 64	42 68 109	94 144 230	151 232 371
R410A	25 38 52	30 55 75	50 85 120	110 190 270	165 290 420

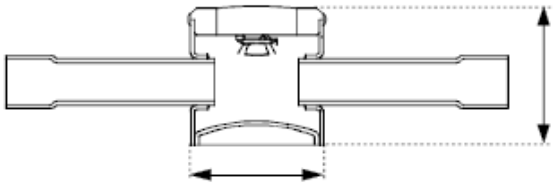
Filter drier should be changed

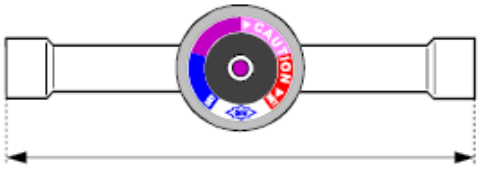
H:\Siemens MED\KCC 215 L\03_Dokumente\Manual\KCC215-USA_Vers_10.doc

ALCO CONTROLS	**MIA** **Moisture Indicator**	Document Nr.: A3.5.023/E 2 replacement for A3.5.023/E 1 Date: 23.09.1998

Selection and Dimensions (not to scale)

Type	Part Code	for tube outside Ø	Height A (mm)	Length B (mm)	Weight (g)
MIA 014	805 851	1/4"	25,5	98,0	60
MIA 038	805 852	3/8"	35,5	109,0	80
MIA 012	805 853	1/2"	35,5	113,0	90
MIA 058	805 854	5/8"	35,5	108,5	95
MIA M06	805 846	6 mm	25,5	98,0	60
MIA M10	805 847	10 mm	35,5	109,0	80
MIA M12	805 848	12 mm	35,5	113,0	90
MIA M16	805 854	16 mm	35,5	108,5	95





Technical Data

Maximum working pressure	35 bar
Burst pressure	175 bar
Medium compatibility	CFC, CHFC, HFC Mineral-, Alkyl Benzene and POE oils (not released for use with caustic, poisonous or flammable substances)
Operating temperature	-40 to 100°C

Installation location	in any position
Connections	ODF extended copper tubes, solder connections only
External leakage (100%-production tested with Helium- Spectrometer)	<3g / yr ($1{,}8 \times 10^{-5}$ cc/sec)
Pressure drop	negligible

In **Europe** please contact
ALCO CONTROLS DIVISION
Emerson Electric GmbH & Co
Postfach 1251 / Heerstraße 111
D-71332 Waiblingen /Germany
Phone ...49-7151-509-0 / Fax ...49-7151-509-200
In **Asia / Pacific** please contact
ALCO CONTROLS DIVISION
Emerson Electric Company
5B, Pioneer Building, 213 Wai Yip Street
Kwun Tong, Hong Kong.
Phone: (852) 2342-6663
Fax.: (852) 2866-7376

In **North and South America** please contact:
ALCO CONTROLS DIVISION
Emerson Electric Company
P.O. Box 411400,
St. Louis, Mo 63141 / USA
Phone: (314) 569-4666 / Fax.: (314) 567-2101
Your ALCO CONTROLS representative:

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.

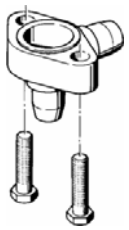
11.10 Thermo-Expansion valves

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

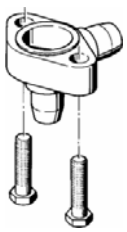


Angle Style Flange

Liquid Injection Valve LCLE 3,5

Series	Nominal Capacity Q_n kW R 134a	Orifice	Connections Flange C 501 – 7 Solder/ODF mm	Power Assembly
LCLE 3,5 *	9,3	X 22440-B3,5B	12 x 16	XB1019...2B

LCLE



Angle Style Flange

11.11 Solenoid valves

Hot gas

2-Way Solenoid Valves
200 RB

Type	Order-No.	Connection Solder/ODF mm	Connection Solder/ODF inch	Connection Flare/SAE mm	Connection Flare/SAE inch	Nominal Capacity Q_n (kW) Liquid R 134a	Nominal Capacity Q_n (kW) 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

GÜNTNER

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 2850 rpm	73	73	74	80	81	82	90
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

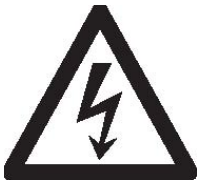
The Operation Manual contains basic instructions which must be obeyed during mounting, operation and maintenance. Therefore, the Operation Manual should be carefully read before installation and start-up by the person in charge of the installation as well as by all other technical personnel/operators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

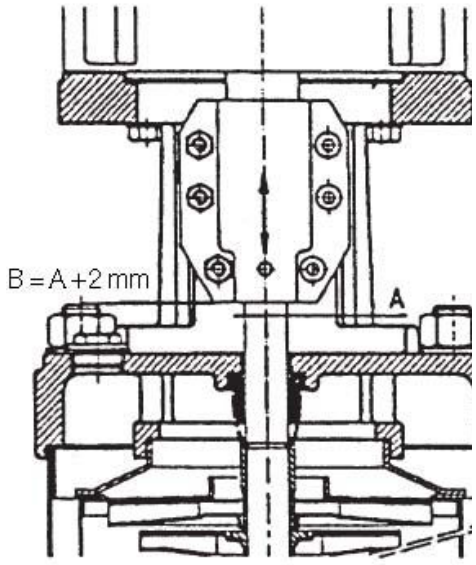
If there is danger of frost during prolonged idle periods, the pump must be drained completely. For this purpose, the shut-off valves on both sides of the pump are closed and the screw plug in the headpiece (Item 903.1) and the inbus plug in the base (Item 914) are removed. The plugs for the pipelines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

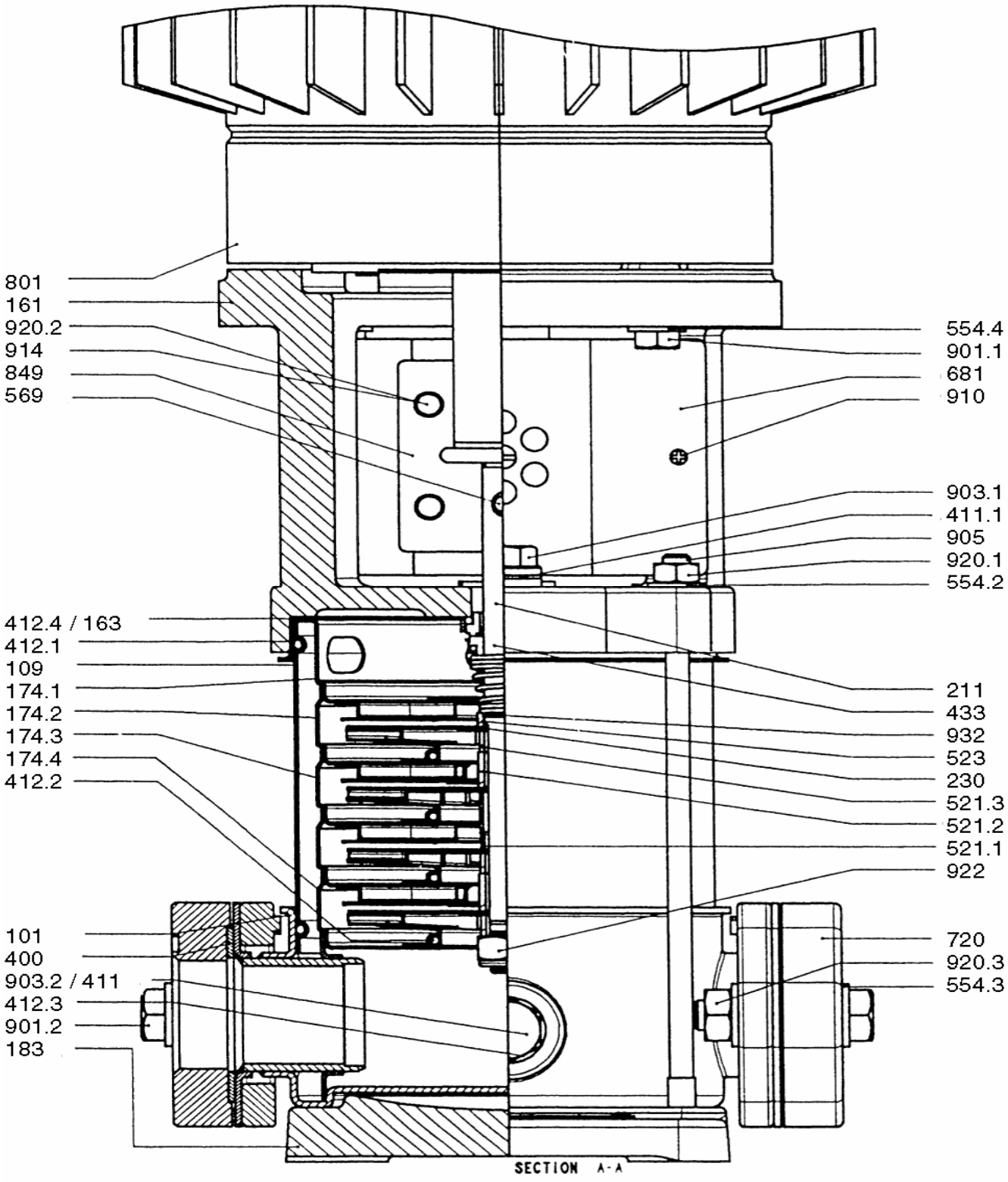
- In installations where pumps may be forced to work against closed shut-off valves etc., a bypass line should be installed. (Permissible minimum rate of flow = 10 % of the rated pump capacity).
- Whenever a pump is integrated into a system it is mandatory that the operational conditions affecting the 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 and leak protection EA122-AA**

1. Installation

It is necessary during installation to observe codes of good practice, to comply with local requirements and to follow the installation instructions. The installation location should be protected against frost and be easily accessible.

1.1. Assembly

1. Screw in the automatic air vent at the highest point of the boiler or circuit in the heating system using a seal material (PTFE or hemp).
   - Use an open-ended wrench and screw in tightly.
2. Ensure that the cap of the leak protection is fully screwed down onto the lid.
3. Set the automatic air vent in the open position by turning the housing until the ❍ symbol corresponds with the line on the connection piece.
4. Fill system.

2. Method of Operation

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). The closing force of the float valve is very small and therefore water-borne dirt can prevent the valve fully closing, which results in the valve dripping slightly. Expanding discs are built into the valve to prevent this dripping occurring. These discs expand when wet and then shut off a secondary valve, thereby preventing leakage.

3. Inspection and Maintenance

The automatic air vent must be regularly inspected because the function can be affected by the presence of collected dirt.

1. Close the automatic air vent by turning the housing until the symbol ● corresponds with the line on the connection piece.
2. Unscrew the cover and remove complete with the float.
3. Clean all parts carefully or if necessary replace with spare part No. 0900577 and then reassemble.
4. Check whether the cap of the leak protector is fully screwed down on the cover.

4. Range of Application

Hot water heating systems, radiators, wall and ceiling-mounted air heaters, air collection vessels, pipe circuits, boilers and air separators.
Not suitable for mineral oil or liquids with mineral-oil based additives.

5. Technical Data

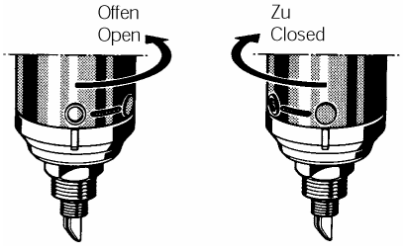
Operating temperature:	max. 110 °C
Operating pressure:	max.6.0 bar
Connection sizes:	R 1/8" + 3/8" or R 1/4" + 3/8"

6. Options

EA 122 - AA = Connection sizes R 1/8" + 3/8"
EA 122 - BA = Connection sizes R 1/4" + 3/8"

7. Service Parts

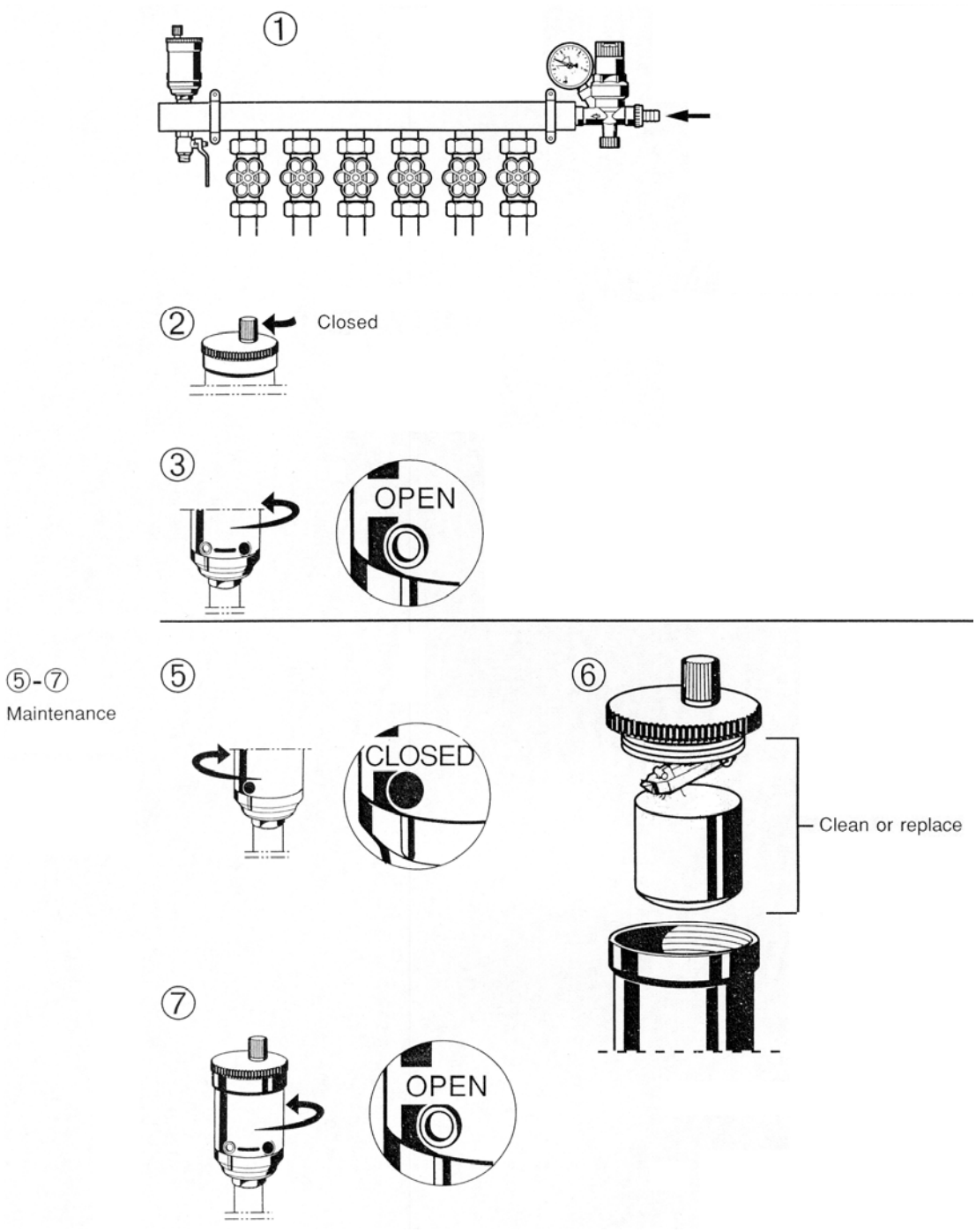
Cover complete with float Part No. 0900577
Leak protection discs complete (Pack of 5) Part No. 0900761



Honeywell Braukmann

Automatic Air Vent with integral shutoff and leak protection EA122

Operation



11.15 Safety valve

CALEFFI

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%.

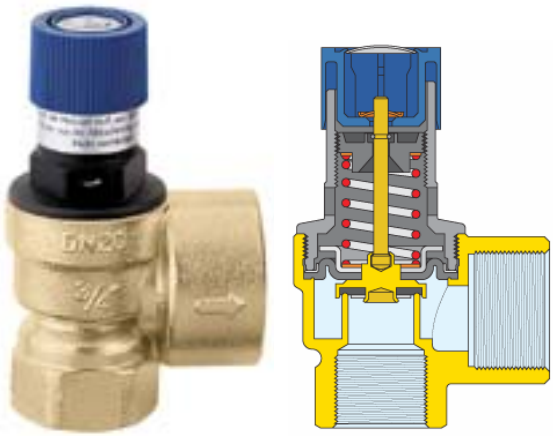
Minimum reseating pressure: -20%.

Maximum temperature: 100°C.

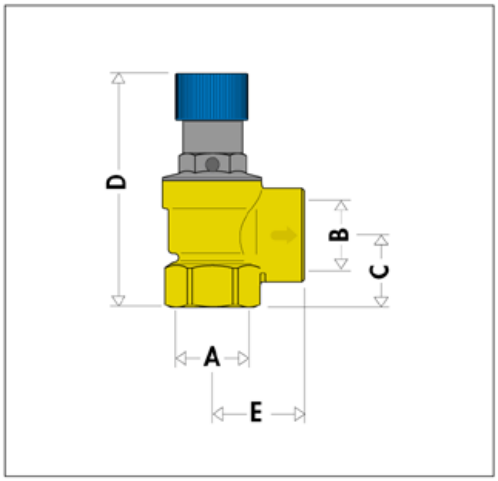
Brass body.

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 18

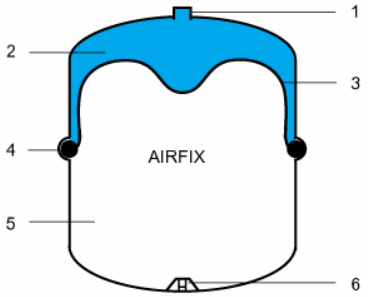
For use on hot and cold water supplies including pump control, unvented HWS systems and water boosting sets.

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	5,0 bar
Differential pressure	pump approx		2,5 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

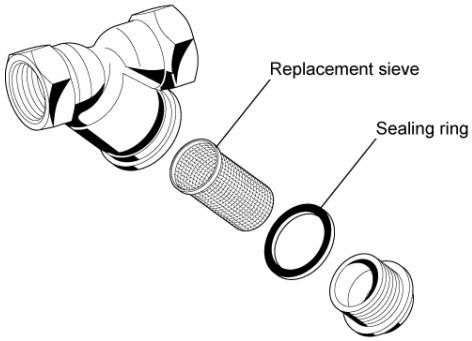
To check the setting: Close the valve, the indicator shows 0.0.

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

11.20 Overflow valve

11.21 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!

11.22 Remote control 24 V DC control panel

See Circuit Diagram

11.22.1 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)

11.23 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.

11.24 Circuit diagram

Circuit diagram see the next pages or in switch cabinet