Manufacturer

ait-deutschland GmbH
Industriestraße 3
95359 Kasendorf
Germany

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

Representative in the US and Service Center

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

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

YOUR LOCAL SERVICE CONTRACTOR IS:

COMPANY NAME:

_____

PHONE NUMBER: FAX NUMBER:

_____

Contents page

1 General Remarks, Safety Warnings

Industrial cooler Type KSC 215-L- U/S

1.1 Industrial cooler Type KPC 212-L-U/S

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

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

Refrigerant **R134a**
Total filling weight **outdoor model 2 x 12,0 kg**
Permitted working pressure: 19 bar

1.2 Maintenance

The cooling block must be serviced at least twice a year by a Chiller company.

1.3 Warranty

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

- The initial start of the unit must be carried out by trained personnel from an Authorized KKT Service Partner.
- Maintenance must be carried out by properly trained personnel.
- Only genuine KKT spare parts must be used.
- For KSC215-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 chillers.**

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

1.4 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.

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

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

OBSERVE THE SAFETY RULES

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

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

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

Warranty void if manual removed from chiller.

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

2 General description

The chiller KSC215-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 KSC215-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 KSC 215-L- U/S

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

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

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

Compressors, cooling and cold-water/ethylene-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.

<u>Cooling-unit for fluid cooling, consisting of:</u>

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 one regulating solenoid valves for each circuit.

The supply temperature of the water circuit is controlled by a Siemens SPS.

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 have been turned from “OFF” to “ON”.

The pump main switch should 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 in case the plant has either a leak or insufficient water. A flow switch acts to prevent freezing of the evaporator when water volumes drop. The refrigerating machines switch on as soon as the safety sequence, 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 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 delay provides overload protection to the compressor.

The refrigerant circuits which starts first is changed after 24hours when the difference between the water return and supply is smaller than 0,7K for a dedicated time .

2.1.1 High-/Low- pressure control

The **high-pressure sensor** shut off the compressor via SPS if the pressure rises up to 18,9bar.
In series the second compressor will run.

If the sensory high pressure control is not in function a high pressure pressostat is installed.

The **high-pressure pressostat** reacts to excess pressure of the magnitude of 19,2 bar
by shutting off the compressor.

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 sensor** also switches off the compressor when the pressure sinks to 0,5 bar. The sensor is by-passed during start-up for 30 s.

Causes of this include
- defective Expansion valve,
- low outdoor temperatures,
- low level of refrigerant.

If the pressure rises to 1,0 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 solenoid valve. The setting is based on steady capacity regulating.

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 wiring diagram page 2.

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

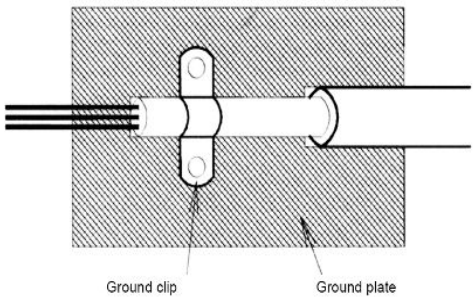
The connection L1, L2, L3, PE is performed via the terminal block X1 (power supply) in the switch cabinet.

The cooling block is switched on via the main switch 5Q1.

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.

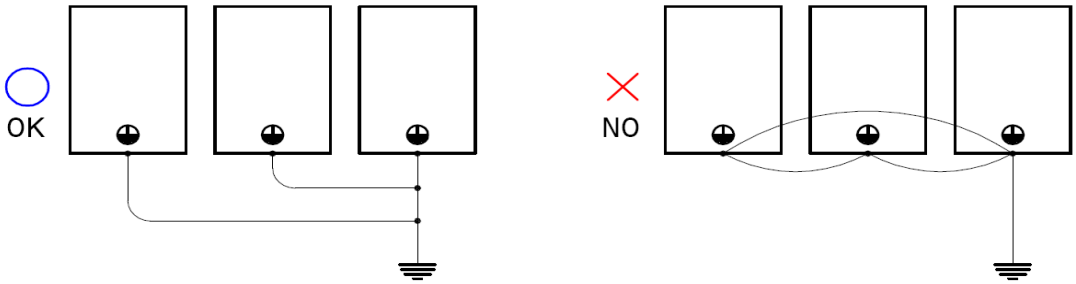
The width of the grounding wire must be min. 16mm² (AWG 6) or of the same width of the power supply. The grounding must be an isolated ground and must connected on the ground terminal (X1) in the switch cabinet. The ground resistance must be less than 10 Ohm.

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 KSC215-L-U/S)



3.3 Filling the unit with water-ethylene glycol-mixture

Water to be used (de-ionized water / destilled water / VE water / bartly de-ionized water)
This type of water has to be purchased and provided locally
Mix it with Ethylene-glycol at the rate of min. 35% to max. 38%.
Use ethylene-glycol of only one manufacturer.
(e.g.: DOWTHERM SR1-Dow Chemical, Safeflow EG-Clariant)
Do not mix two ore more different manufacturer for one water-ethylene-glycol circuit.
Open front panel and fill to a pressure of min.1,5 bar via the feed cock when the pump is off.
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 KSC 215 includes a closed water system.

If air get out of the system the water pressure drops down. If that happens you had to check the water pressure and if its to low you have to refill the water circuit.

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

After all these steps, turn the main switch in position "1". If all the prerequisites for operation have been met, the chiller will start at the latest 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 S73)

See also Installations Instructions cap. VIII SPS Settings

Setting the clock on the operation panel OP73

Remark: The function of the button F1, F2. F3 and F4 will shown above the buttons at the screen.

The following steps are to be used:

1. Switch on the main switch 5Q1
2. Now the chiller is running in autarc.
3. If the date and time displayed are incorrect, change them using the following steps.
4. If the display shows any failure please press back till the display looks like figure 2

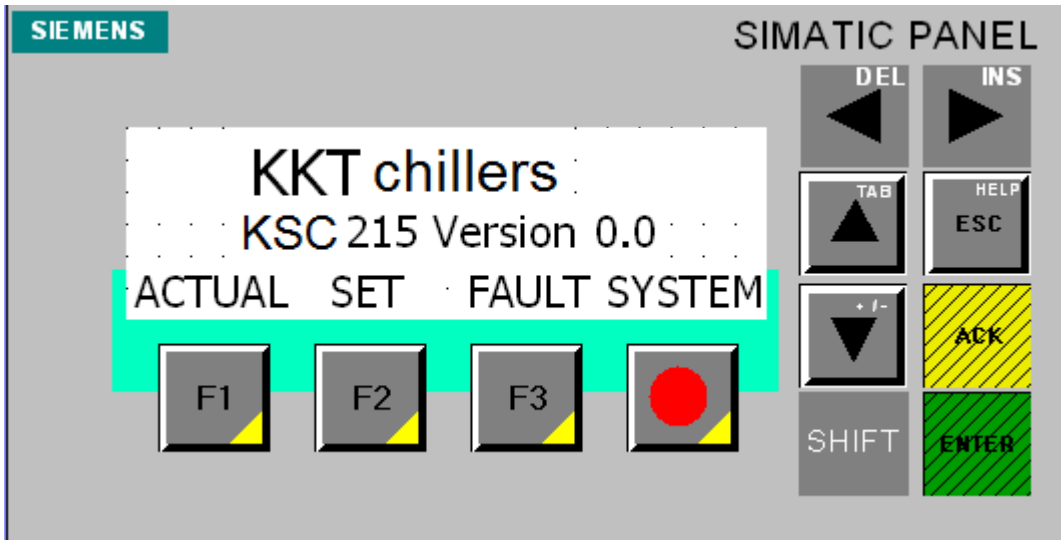
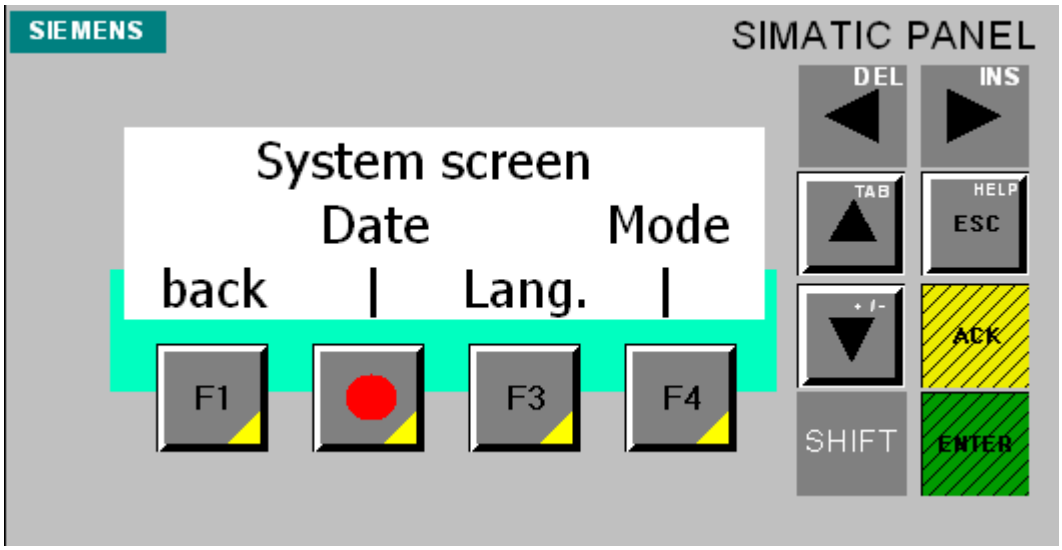
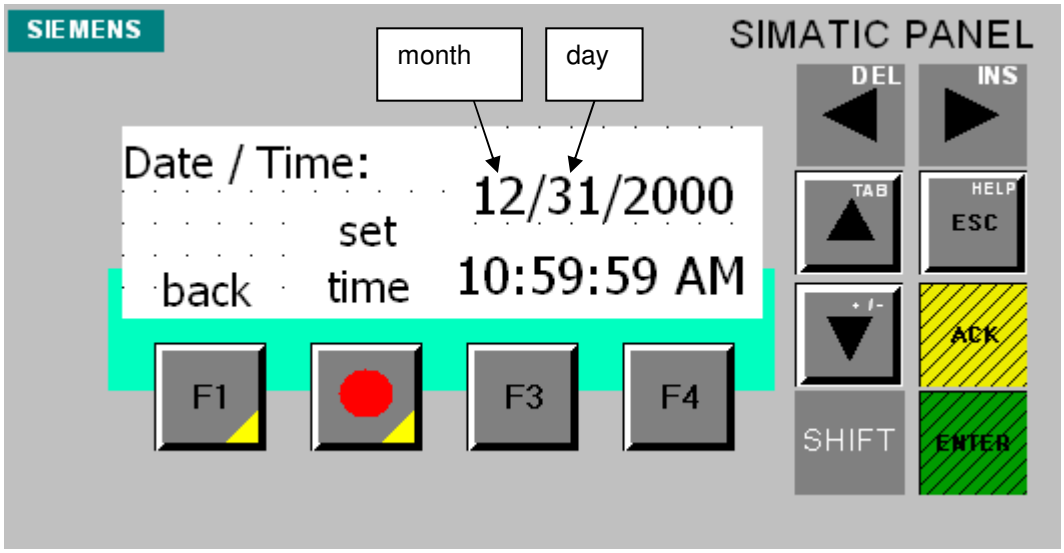


Abbildung 1 figure 2

5. Than press „F4“.



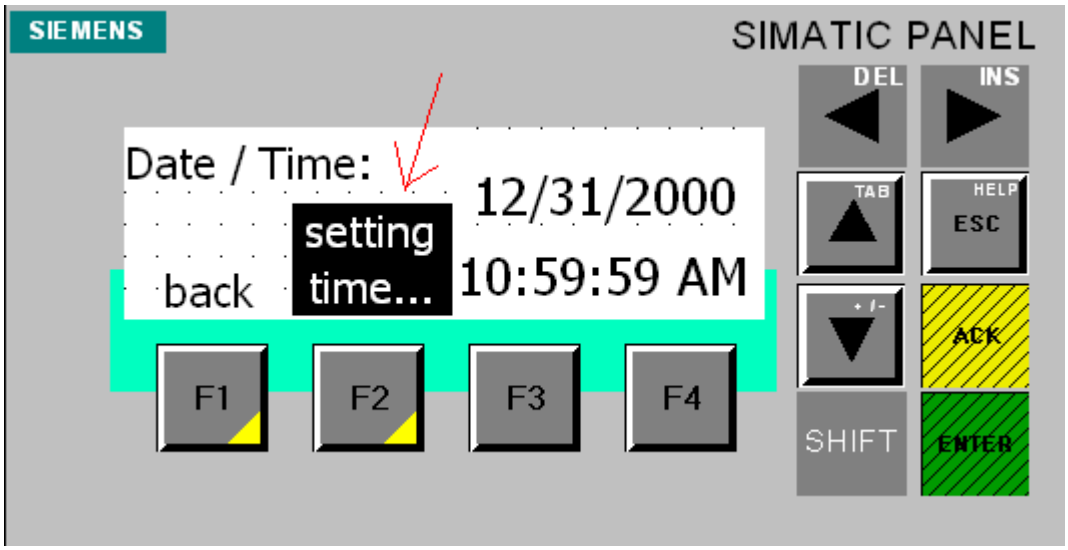
6. Than press „F2“



7. Press “Enter” and the “left arrow” and “right arrow” to set the cursor for change the values with the “up arrow”, “down arrow”. Close with “Enter”.

8. Than change the cursor with up arrow to the date.
   With left arrow” and “right arrow” change the possition of the cursor wihtin the date and with the “up arrow”, “down arrow” change the values. Close with “Enter”

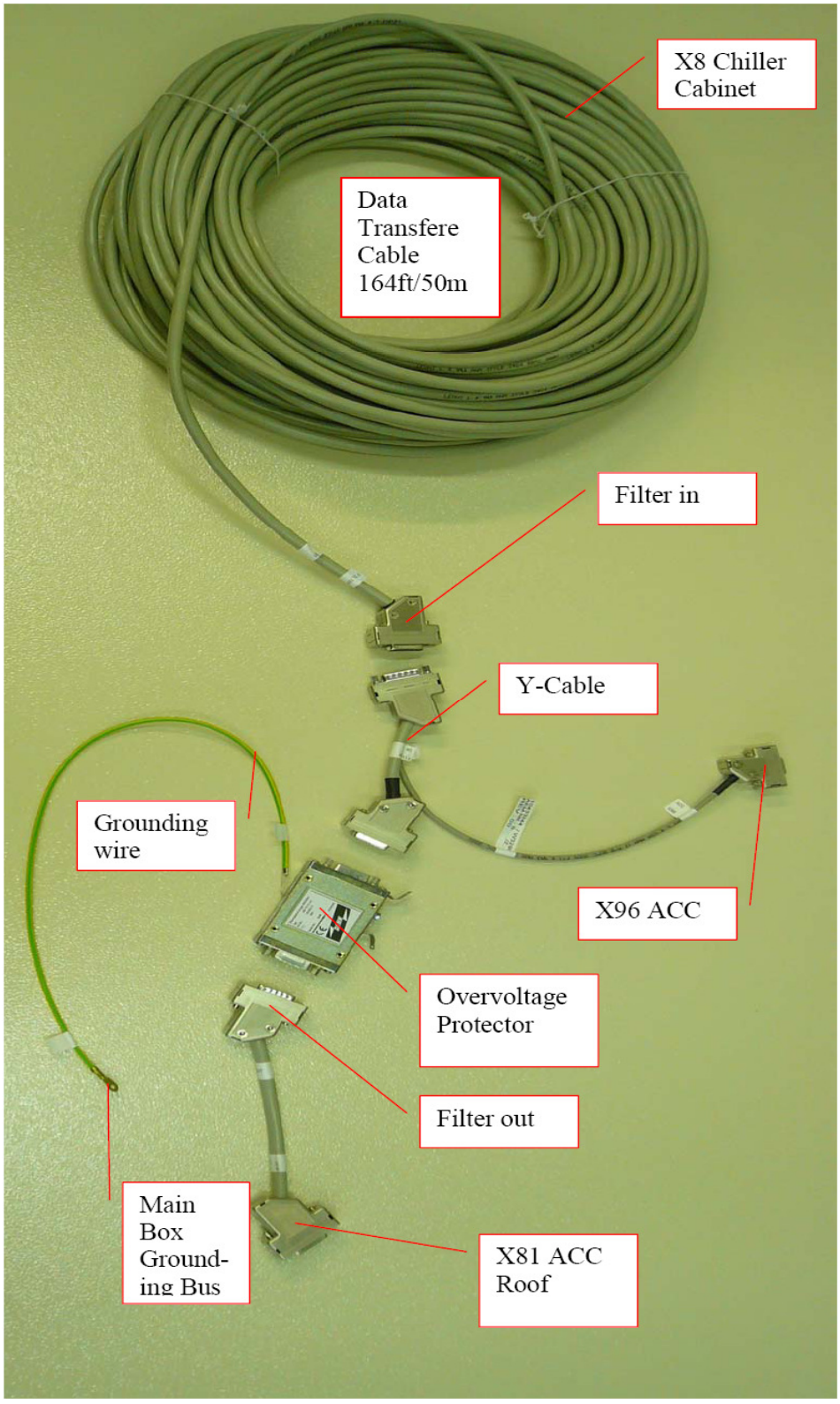
9. Press F2 for setting.The black sign show that the time will be set in the opertion panel.



10.With “Back” you go to System

11.With another “Back” you will go to the first picture.

3.6 Connecting the Data Cable

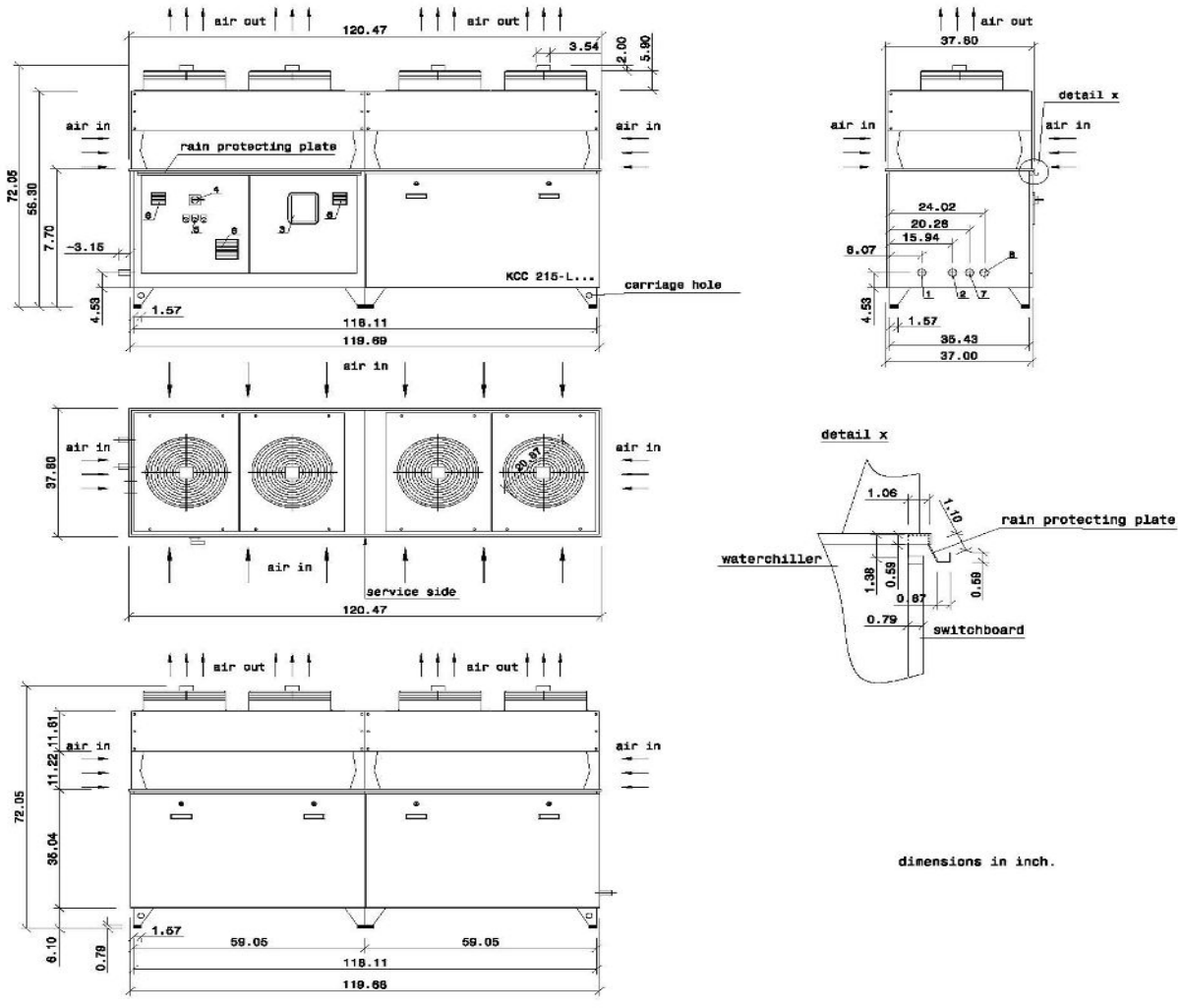


4 Technical Specifications

4.1 Data sheet

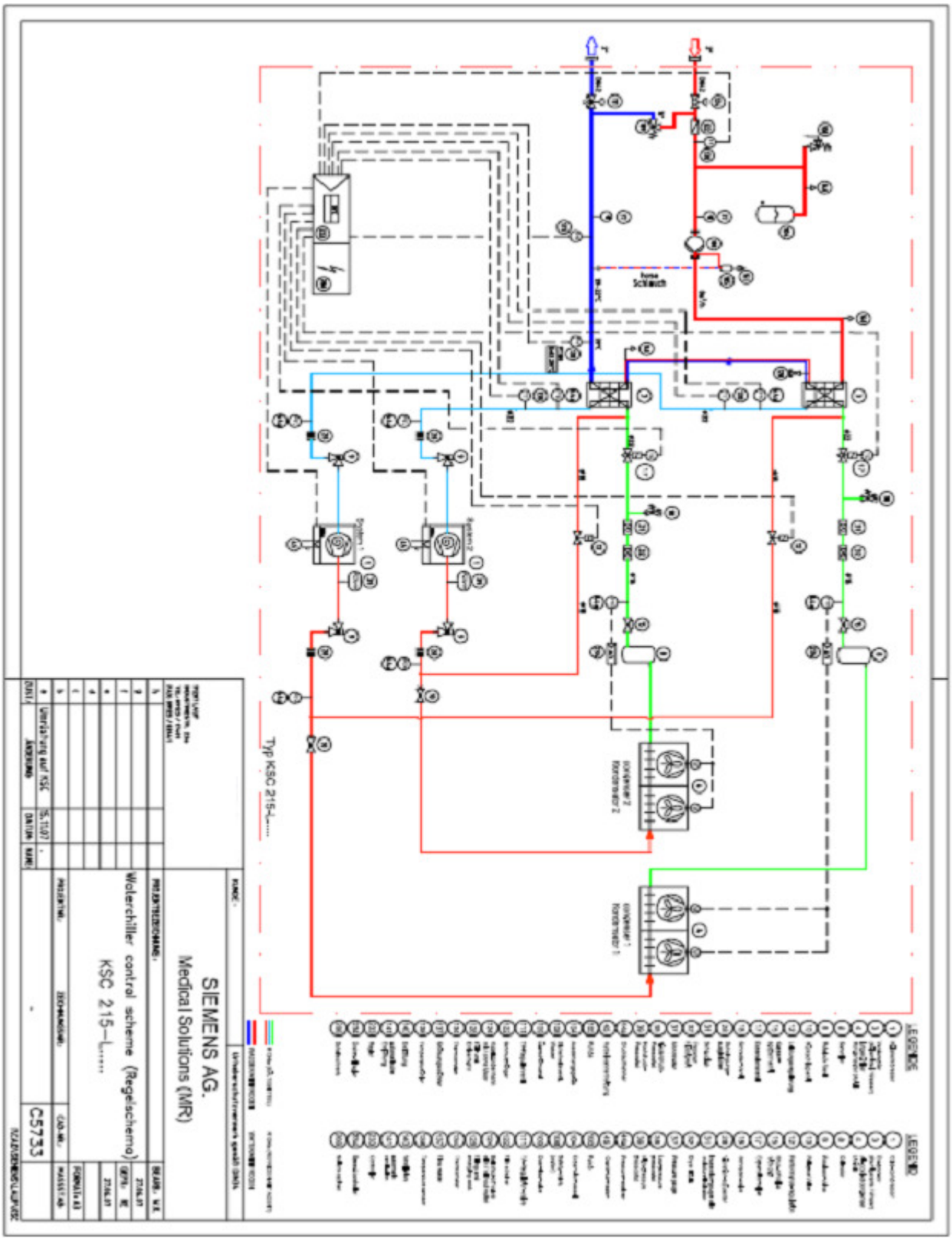
Model	Outdoor		
Dimensions	Depth	940	mm
	Breadth	3040	mm
	Height	1850	mm
Weight without refrigerant load	ca.	1070	kg
Weight with load	ca.	1100	kg
Shipping weight	ca.	1600	kg
Weight total refrigerant load		24,0	kg
CO2 equivalent		34,4	t CO2
Number of fans		4	
Quantity of air	2x	18000	m³/h
Refrigerant		R134a	
GWP		1430	
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		±0,5	K
Primary water pump type		CR 10- 05	
Rated water capacity	min.	7,8	m³/h
Rated water pressure		7,5	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	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 KSC 215-L- U/S



1 = water return from IFP (2') female
2 = water supply to IFP (2") female
3 = DDC-display
4 = main switch
5 = controll lamps
6 = switchboard ventilation
7 = cable passage 'main power'
7 = cable passage "data transfer cable'

4. 3 Water chiller control scheme



5 Transport

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

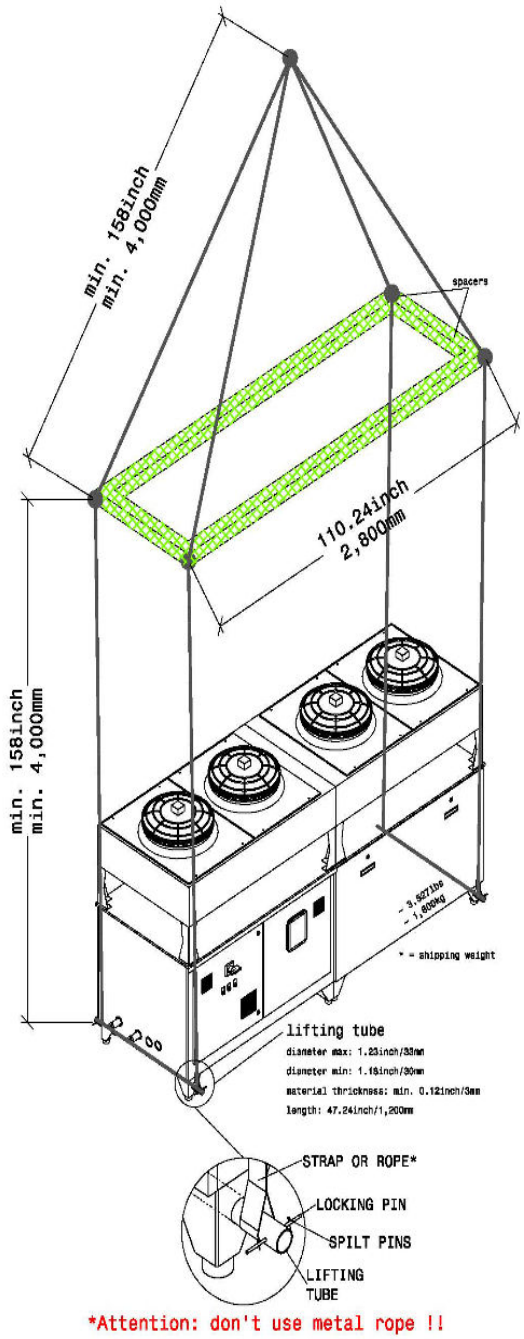
please ensure that the housing is not subjected to pressure at the sides.

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

The capacity of the lifting gear must be adequate to lift the load in question.

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

Weight and dimensions see “Data sheet”, chapter 4.1



6 Installing the chiller

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

(Weight with load: see technical specifications).

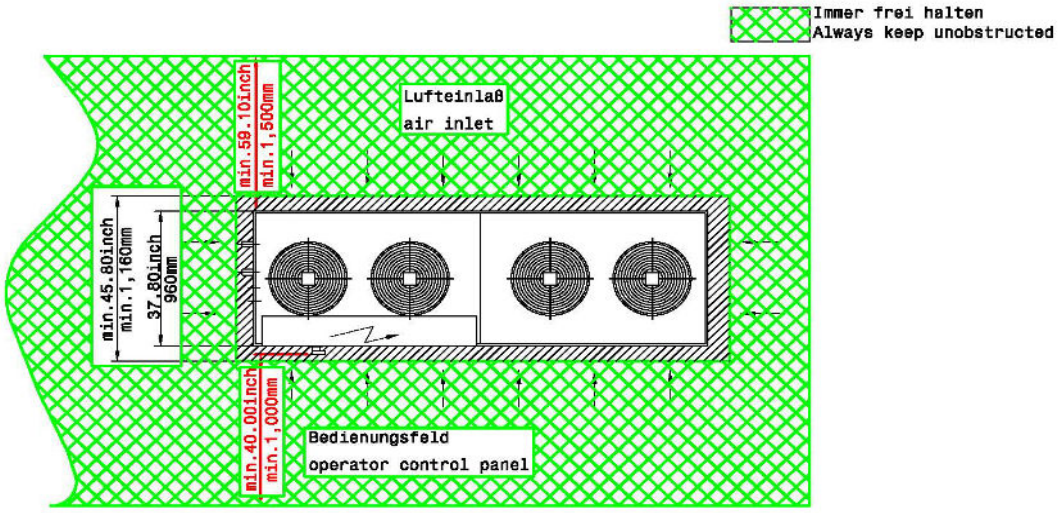
A distance should be kept free on all sides to allow sufficient access for operation and maintenance.

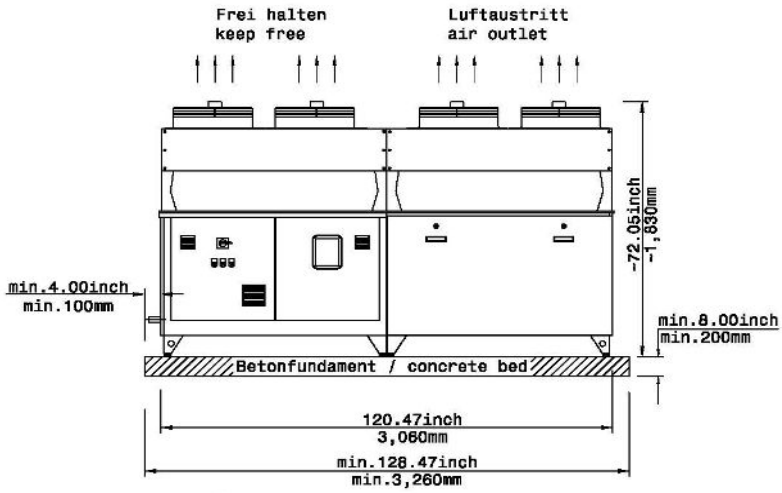
A space of 1,5 m must be left above the apparatus to ensure that air exhaust can leave freely.

Further details can be found in the following installation plans.

See also enclosed “ Installing Instruction “

waterchiller installation I





Maße für Betonfundamente, eventuell entsprechend den örtlichen Verhältnissen anpassen.

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

7 Notes on the water connections

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

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

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

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

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

See also enclosed “ Installing Instruction “

8 Power supply

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

The Type KSC 215 L-... must be run with fuses of no less than 60 in size.

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

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

See also 11.24 “Circuit Diagram”

9 TROUBLE SHOOTING

KIND OF TROUBLE	CAUSE	ELIMINATION
• malfunction of plant/system	1. power failure asymmetry, over voltage or low voltage	- check mains connection and asymmetry relay 5A1
	2. temperature sensor defective	- check sensor 15B1 clamp feeler and measure the resistance
	3. simatic 8N1, 8A1, 8A2, 8A3 and 8A4 malfunction	- check MMC-Card check power supply 24VDC 7U1and fuses 7F1 and 7F2
	4. chiller “not ok”	- check fuse 26F1 - data transfere cable - check overvoltage protection
• malfunction of pump 17M1	1. main switch 5Q1 not switched on 2. motor protector 17Q1 defective 3. fuse for control current defective 4. pump motor 17M1 defective 5. flow switch responded 10B1 6. shortage of water	- switch on main switch 5Q1 - replace motor protector 17Q1 - 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 17Q1 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 18M1 and 21M1 stops	1. Klixon/INT69 tripped 18A1 and 21A1	- Check Fuses 18Q1 and 21Q1 - wait until compressor cooled down; perhaps clean condenser or provide fresh air supply
	2. Klixon/INT69 18A1and 21A1defective	- replace Klixon/INT69

KIND OF TROUBLE	CAUSE	ELIMINATION
• malfunction of refrigerating machine	1. simatic stopped machine, return temperature too cold	- to check function, level down adjustments, wait until return temperature rised
• still malfunction of refrigerating machine	1. low pressure in refrigerant circuit - plant looses refrigerant - dryer in liquid pipe dirty - pressure relief valve defective - expansion valve 9Y1 and 16Y3 2. high pressure in refrigerant circuit - condenser dirty - fan defective - outside temperature too high - pressure sensor 20B1 and 23B1 for condenser control defective - Frequency inverter defective	 - find leak, seal, refill circuit - replace dryer - replace pressure relief valve - replace expansion valve - clean condenser - put right electric cause; check fuses 20Q1 and 23Q1 - spray condenser with water - replace pressostate - replace frequency inverter 20U1 and 23U1
• 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 2. not enough pressure of refrigerant circuit; refrigerant partly escaped; diminished pressure switch shut down compressor	- provide enough fresh air supply and fresh air removal; get rid of short-circuit across fresh air and exhaust air - find leak, seal, refill circuit
• not enough refrigeration power	1. air in water circuit 2. fallen below minimum water agitation quantity 3. not enough fresh air supply for condenser 4. not enough refrigerant in circuit	- vent system - design cross-section of water pipe right; perhaps open check valve in water circuit completely, increase pipe cross-section - provide enough fresh air supply and fresh air removal; get rid of short-circuit across fresh air and exhaust air - find leak, seal, refill circuit

9.1 Typical Failures

		[#####] = electrical item designation			
kind of failure	**plain text display**	**symptoms**	**possible cause**		**solution**
	fault safety high pressure refrig. circuit 1 or 2	compressor 1or 2 do not run	condensor refrig.circuit 1 or 2 dirty		clean condenser
safety high pressure 18B1 and 21B1			one or two condenser fans defective		
high pressure	fault high pressure refrig. Circuit 1 or 2	water becomes/is too hot	[20M1,20M2 or 23M1,23M2]		change fan [20M1,20M2 or23M1,23M2]
			one or two winding protector of condenser fans defective		change fan [20M1,20M2 or23M1,23M2]
			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 [20U1 oder 23U1]		change frequncy inverter [20U1 oder 23U1]
			pressure sensor defective [20B1 oder 23B1]		change pressure sensor [20B1 oder 23B1]
			contactor defective [13K3 oder 13K6]		change contactor [13K3 oder 13K6]
			safety high pressure switch defective [18B1,21B1]		change safety high pressure switch [18B1,21B2]
			pressure sensor defective [20B1 oder 23B1]		change pressure sensor [20B1 oder 23B1]
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 [20U1 oder 23U1]		check the controller of frequecy inverter
			expansion valve defective (closed) [9Y1 oder 16Y3]		change expansion solenoid valve[9Y1 or 16Y3]
			relais of expansion valve failure [18K2 oder 21K2]		change the relais of expansion valve[18K2 or 21K2]
			pressure sensor failure of condenser pressure control [20B1 oder 23B1]		change pressure sensor [20B1 or 23B1]
		ice between filter dryer an expansion valve	filter dryer blocked		change filter dryer
			pressure sensor defective [9B1 oder 9B3]		change pressure sensor 9B1 oder 9B3]
ambient temperature too low	ambient temperature too low	low pressure below 2 bar(29 PSI)	ambient temperature below -20°C (-4°F)		

		[#####] = electrical item designation		
kind of failure	**plain text display**	**symptoms**	**possible cause**	**solution**
compressor [18M1 oder 21M1]		compressor do not run	contactor [18K3 oder 21K3] or soft starter [18U1 oder 21U1] defective	change contactor [18K3 or 21K3] change soft starter [18U1 or 21U1]
		compressor do not run	Relais [13K2,13K5] defective	check and change relais [13K2,13K5]
compressor [18M1 oder 21M1]	motor protection compressor 1 or 2		overcurrent protector defective [18Q1 oder 21Q1]	change overcurrent protector [18Q1 oder 21Q1]
compressor [18M1 oder 21M1]	motor protection compressor 1 or 2		overcurrent protector switched off [18Q1 oder 21Q1]	check current and change the defective component
winding protection [18A1 oder 21A1]	winding protection compressor 1 or 2	compressor is very hot	winding protector INT 69 switched off [18A1 oder 21A1]	check INT 69 [18A1 oder 21A1]
winding protection [18A1 oder 21A1]	winding protection compressor 1 or 2	sunction line is too hot	winding protector INT 69 defective [18A1 oder 21A1]	change INT 69 [18A1 oder 21A1]
			Relais defekt [18K1,21K1]	check and change relais [18K1,21K1]
			sunction gas expansion valve defective	change sunction gas expansion valve
			solenoid vavle hot gas bypass defective	change solenoid valve hot gas bypass
pump [17M1]		pump do not run	contactor defective [17K1]	change contactor [17K1]
pump [17M1]	motor protection cold water pump		overcurrent protector switched off [17Q1]	check current and change the defective component
			flow switch [10B1]	check flow switch and change if necessary [10B1]
			Relais [13K1] defective	change relais [13K1]
flow	fault flow switch	pump do not run [17M1]	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)

[#####] = 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 [15B1,15B2]	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
			sensor temperature defective [9B1,9B2]	change temperature sensor
			condenser dirty	clean condensor
			one or two condenser fans defective [20M1,20M2 or 23M1,23M2]	change condensor fans [20M1,20M2 or 23M1,23M2]
			one or two winding protector of condenser fans defective	change condensor fans [20M1,20M2 or 23M1,23M2]
			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 [20U1 oder 23U1]	change Frequecy inverter [20U1 or 23U1]
			pressure sensor defective [20B1 oder 23B1]	change pressure sensor [20B1 or 23B1]
			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

		[####] = 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] switched 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 Chiller KSC215-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 (phase sequence or phase 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!!!!

Once the power 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 chillers Inspection Requirements Task List

Tasks List	Task List

<u>Control Cabinet</u>
• 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
	<u>CHILLER COMPRESSOR</u>
	• 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.

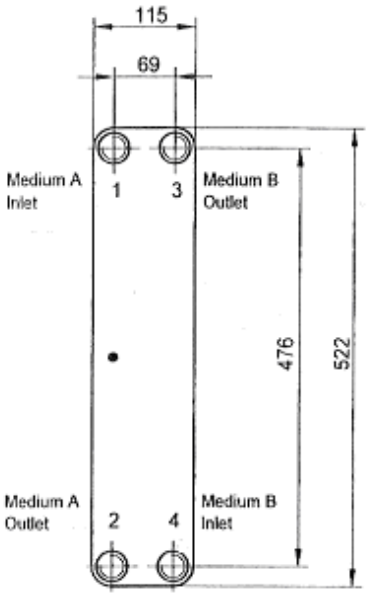
Test pressure

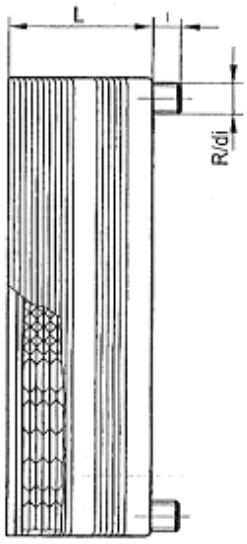
Water		24 bar
Refrigerant	R134a	37,5 bar

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).

Copeland Scroll — Single-Stage Hermetic Compliant SCROLL Motor-Compressor

11.2 Compressor

1 Safety instructions

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

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

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

You are strongly advised to follow these safety instructions.

1.1 Icon explanation

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

1.2 Safety statements

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

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

Single-Stage Hermetic Compliant SCROLL Motor-Compressor

1.3 General instructions

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

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

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

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

Copeland Scroll

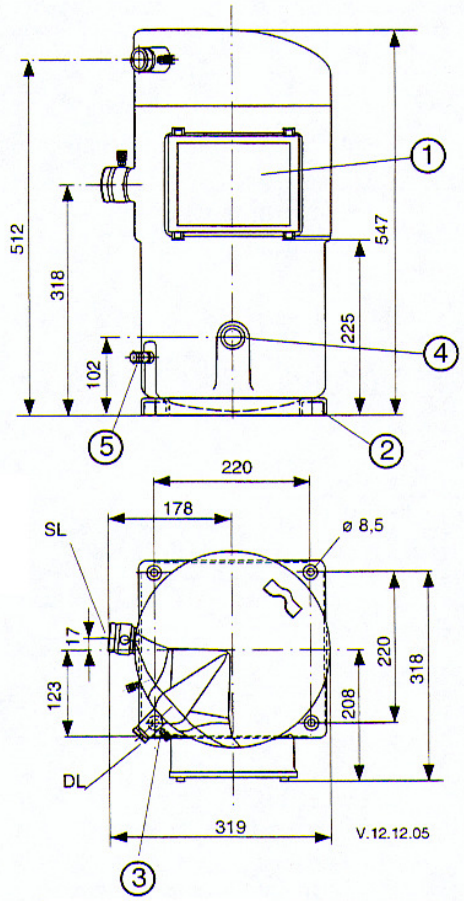
Single-Stage Hermetic Compliant SCROLL Motor-Compressor
Type ZR 16 M3E-TWD

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

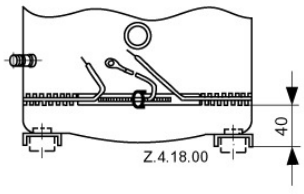
Introduction

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.

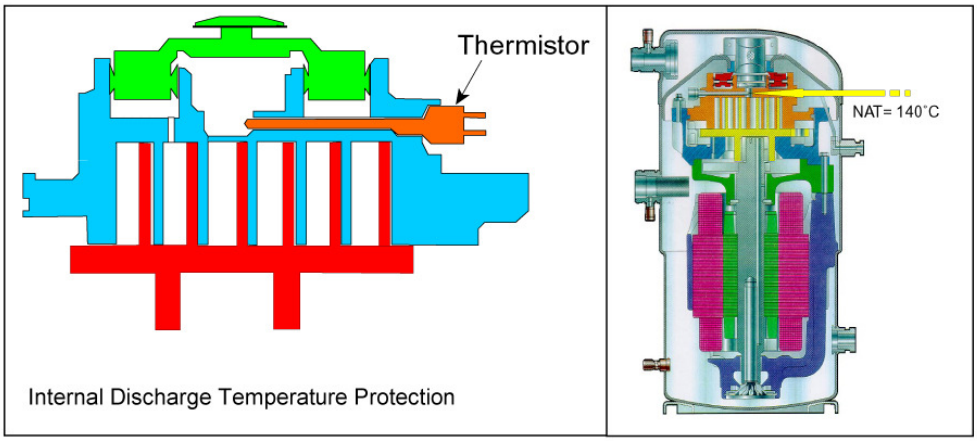
Minimum Run Time

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.

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

Discharge Temperature Protection

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



Internal Discharge Temperature Protection

Electronic Motor Protection

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

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

Module

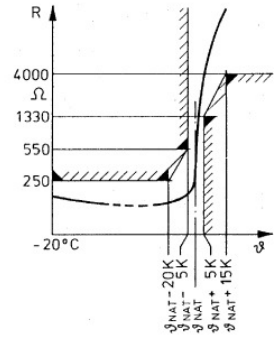
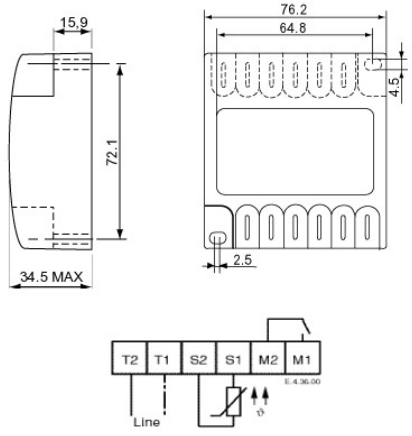


Fig. 6: Thermistor Resistance Curve

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.

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.

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!

2.4 Application range

2.4.1 Qualified refrigerants and oils

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

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

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

Table 1: Qualified refrigerants and oils

2.4.2 Application limits

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

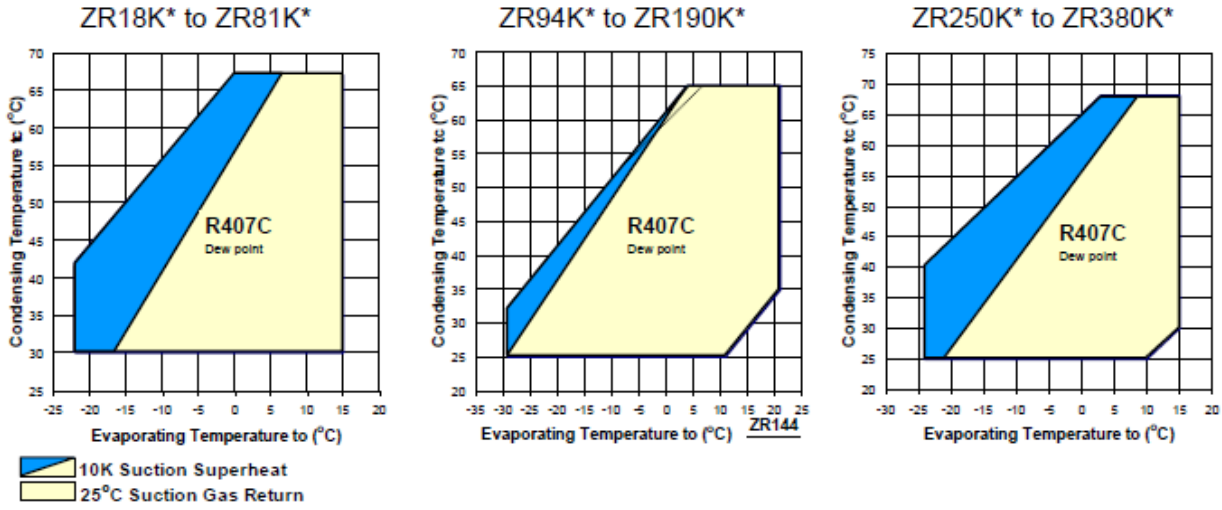


Figure 1: Application envelopes for compressors ZR18K* to ZR380K* with R407C

3 Installation

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

3.1 Compressor handling

3.1.1 Transport and storage

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

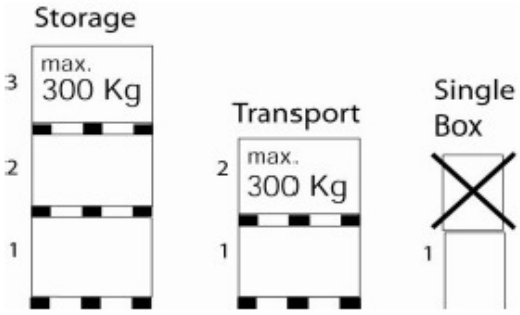


Figure 3

3.1.2 Positioning and securing

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

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

3.1.3 Installation location

Ensure the compressors are installed on a solid level base.

4 Electrical connection

4.1 General recommendations

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

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

4.2 Electrical installation

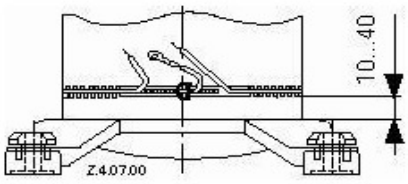
Crankcase heaters

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

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

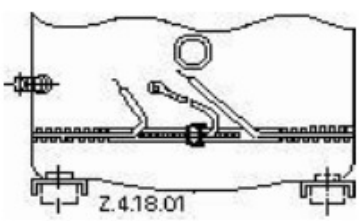
Model	Refrigerant charge limit
ZR18K*	2.7 kg
ZR22K* to ZR81K* / ZP24K* to ZP91K*	4.5 kg
ZR94K* to ZR190K* / ZP103K* to ZP182K*	7.0 kg
ZR250K* / ZP235K*	11.3 kg
ZR310K* to ZR380K* / ZP295K* to ZP385K*	13.6 kg
ZP485K*	16.0 kg

Table 3



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

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



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

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

Internal pressure relief valve

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

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

Discharge temperature protection

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

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

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

Figure 14: Advanced Scroll Temperature Protection (ASTP)

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

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

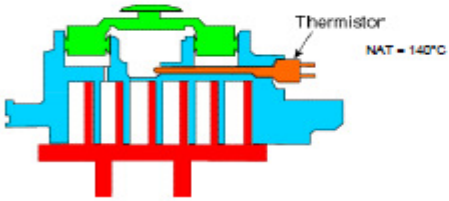
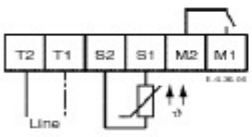


Figure 15: Internal discharge temperature sensor position

Motor protection

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

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



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

Figure 16: Wiring of the motor protection module

Module

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

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

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

Table 4: Protection module specifications INT69SC2

Protector functional check and failure detection

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

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

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

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

Checking the connection

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

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

Checking the compressor thermistor chain

Caution: Use maximum measuring voltage of 3V!

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

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

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

Checking the protection module

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

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

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

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

High-potential testing

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

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

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

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

5 Starting up & operation

Charging procedure

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

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

Copeland Scroll — Single-Stage Hermetic Compliant SCROLL Motor-Compressor
Type ZR xx KCE-TFD-650

Initial start-up

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

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

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

Rotation direction

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

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

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

Starting sound

During the very brief start-up, a clicking sound is audible, resulting from initial contacting of the spirals and is normal. Due to the design of the Copeland Scroll, the internal compression components always start unloaded even if system pressures are not balanced. In addition, since internal compressor pressures are always balanced at start-up, low-voltage starting characteristics are excellent for Copeland Scroll™ compressors.

Deep vacuum operation

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

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

Pump down cycle

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

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

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

Minimum run time

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

Shut-off sound

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

Copeland Scroll — Single-Stage Hermetic Compliant SCROLL Motor-Compressor
Type ZR xx KCE-TFD-650

Frequency

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

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

Oil level

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

Replacing a compressor

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

Compressor replacement

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

Start-up of a new or replacement compressor

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

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

Lubrication and oil removal

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

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

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

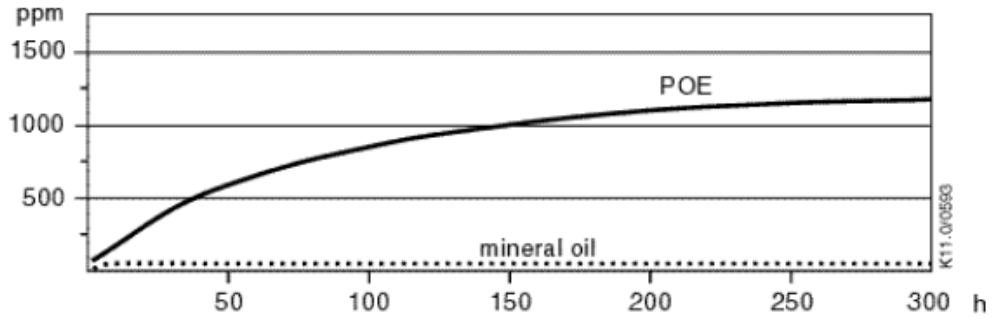


Figure 17: Absorption of moisture in ester oil in comparison to mineral oil in ppm by weight at 25°C and 50% relative humidity (h=hours)

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

Oil additives

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

11.3 Condenser

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

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

The fans are controlled by the Frequency Inverter.

The process heat is transmitted here to the surrounding air.

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

Fabr. H.T.E. Typ VH24

11.4 Fans

The axial flow-fans suck the surrounding air through the condenser package and blow the warm air out at the top. The chiller Type KSC215-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 ∆/Y switching.

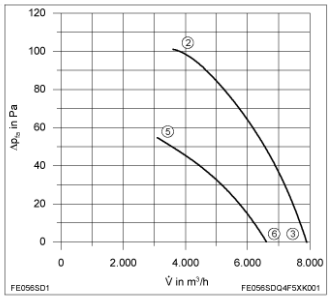


Fig. 3 FE056-SD_.4F._

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.

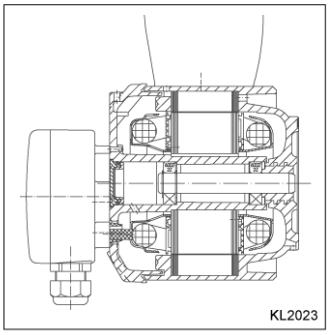
Motor protection
***IP54** in conformity with **DIN VDE 0470 part 1 (EN 60 529)** categorie 2*

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

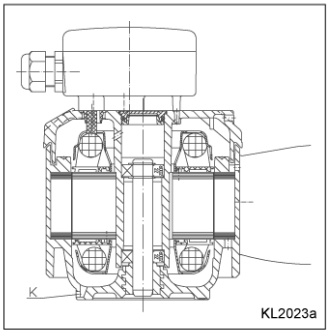
Bearing arrangement
*Deep-groove ball bearing **DIN 625**, closed at both sides, with high temperature grease for thermal class F including subzero temperature range down to -40 °C.*
Applications up to -60 °C upon request.

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

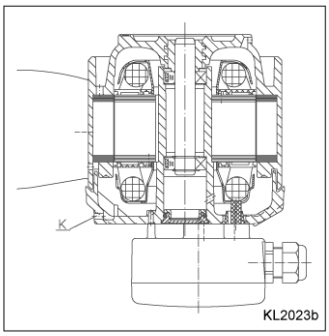
Condensation drain holes
The lower of the condensation drain holes „K“ must be open depending on whether mounting position Vo (rotor above) or Vu (rotor below) is used. With mounting position H, the condensate can escape via the gap between stator and rotor.



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

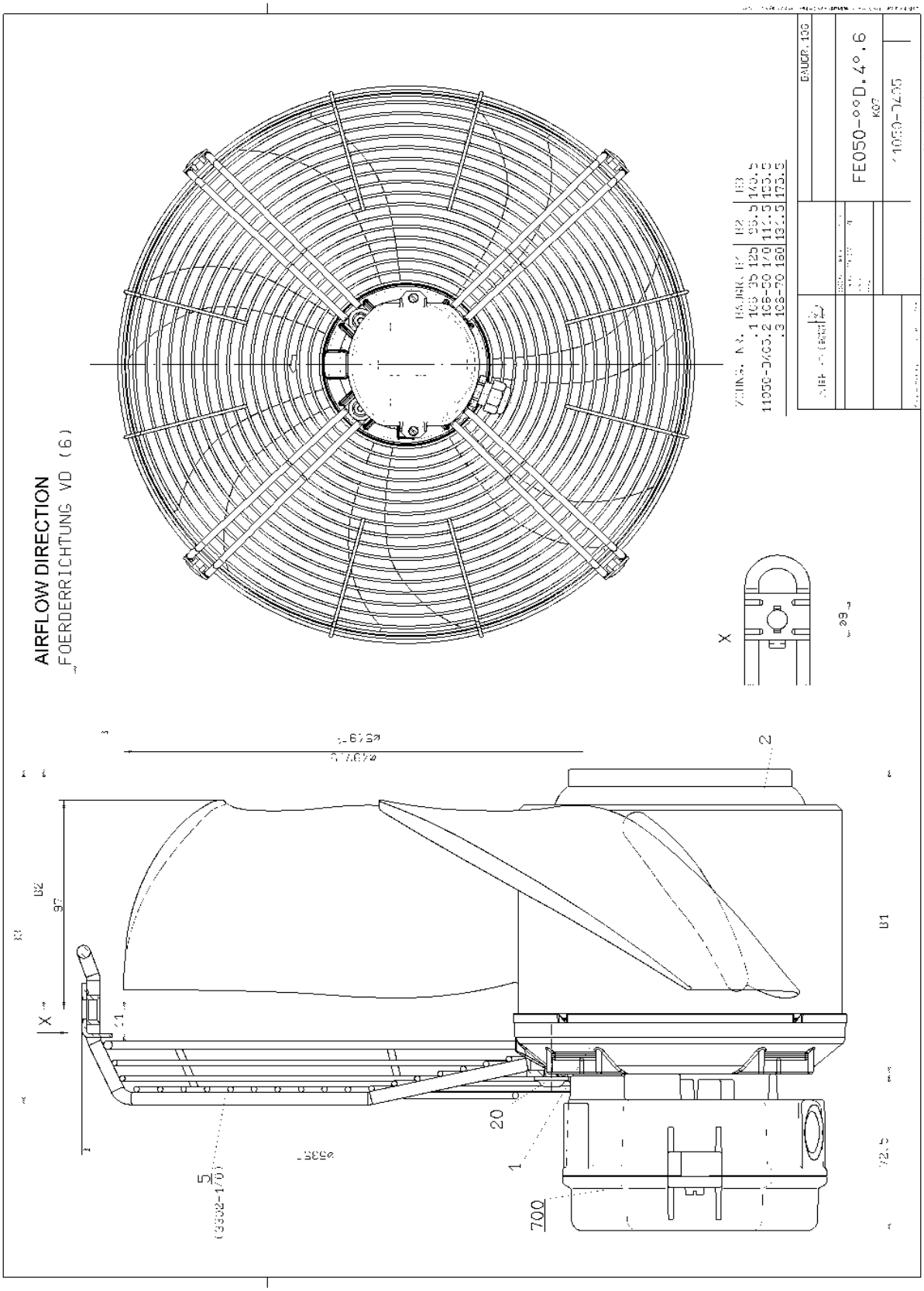
II free blowing fan mounted downstream of coil

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)
FE050-00D.40.6
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/m^3.*
- *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.

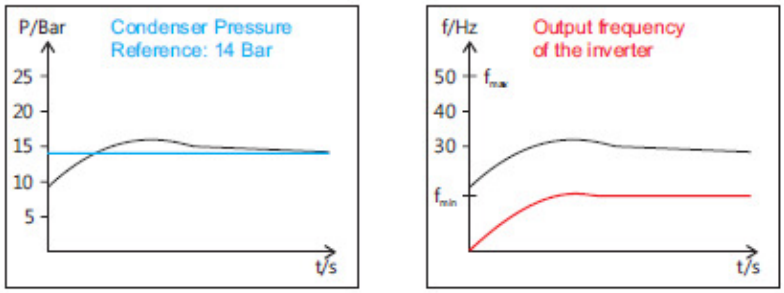
Maintenance, service

- *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.*

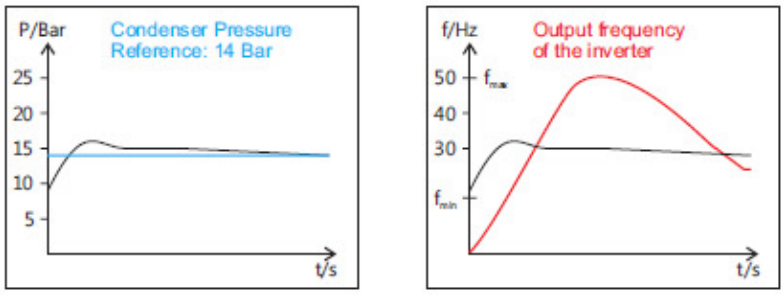
11.5 Frequency Inverter

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

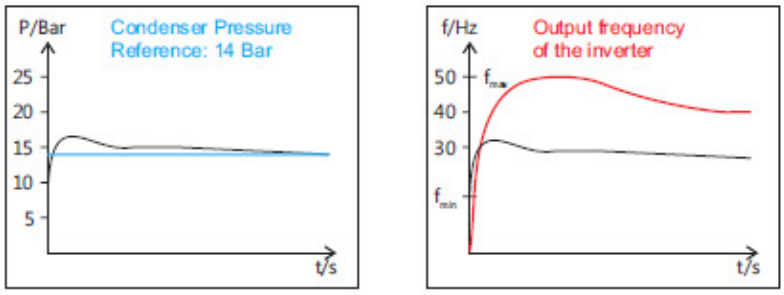
YASKAWA Mechatronics Solutions — Frequency Inverter YASKAWA E7–Series



Condenser "ON" at low ambient temperatures.



Condenser "ON" at normal ambient temperatures.

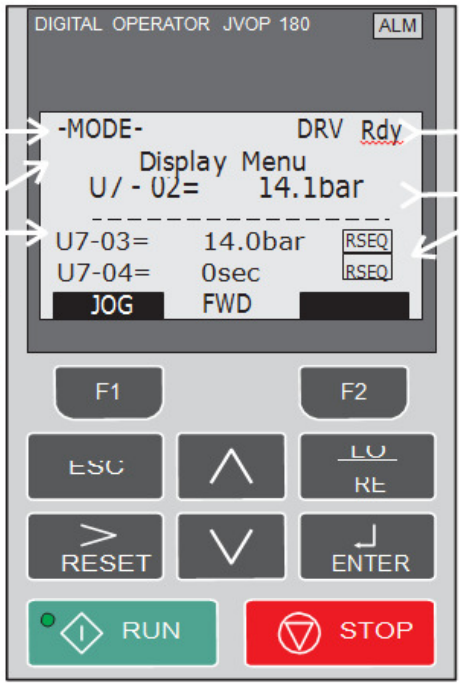


Condenser "ON" at high ambient temperatures.

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

YASKAWA Mechatronics Solutions — Frequency Inverter YASKAWA E7–Series

Digital Operator Display



Text display

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

Line 2 Text description of the parameter indicated in line 2

Line 4 Pressure setpoint in Bar

Pressing the UP/DOWN keys changes the mode:
> Drive mode “DRV”
> Quick Programming mode
> Advanced Program mode
> Modified Constants
> Auto-Tuning

UP - Key
Selects user numbers
Increments setting values

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

LO/RE — **LOCAL/REMOTE** - Key
LO: Operation via Operator
RE: Operation via terminals

F1 — **Function key 1**
Function is depending on the menu that is currently displayed

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

Line 1 Right Corner Rdy is lit: Rdy = Ready

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

Line 5 Displays the ON Timer

Pressing the ENTER Key is used to get access to 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

ENTER

DOWN - Key
Selects user constant numbers
Decrements setting values

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

ESC

Function key 2
Function is depending on the menu that is currently displayed

F2

STOP - Key
Stops inverter operation with the operator

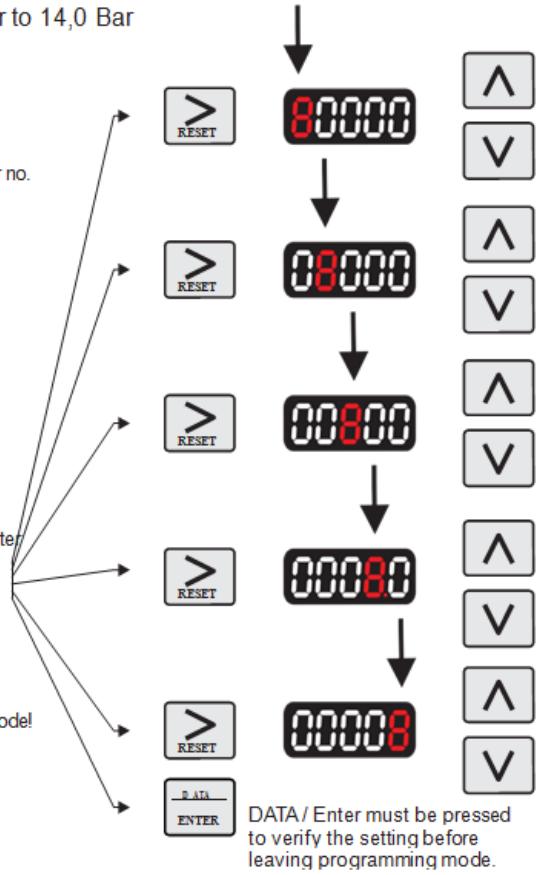
STOP

YASKAWA Mechatronics Solutions — Frequency Inverter YASKAWA E7–Series

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:
∧	Programming Mode — Enables Access to all Parameter
ENTER	The left character ("P") of the parameter no. is blinking.
∨	P1-01 minTransducer — P1-01 is blinking Parametergroup P1 is now active.
RESET	P1-01 minTransmitter — P1-01 is blinking Parametergroup P1 is now active.
RESET	P1-01 minTransmitter — P1-01 is blinking Parametergroup P1 is now active.
∧	P1-03 minTransmitter — 2x — P1-03 is blinking Parameter P1-03 is now selected.
ENTER	P1-03 Pressure reference — 12.0 is blinking (default value) P1-03 displays the value of this parameter (e.g. pressure reference in "Bar")
RESET	The value can be changed by pressing the increment, decrement or shift key as per the example.
	14.0 Pressure-reference — Reference has been changed. To start the inverter it is neccessary to select the "Drive" menu.
ENTER	P1 - 03 14.0 Bar New pressure reference — The V1000 will not start in programm-mode!
00End	**Programming is confirmed and the new value becomes active**



DATA / Enter must be pressed to verify the setting before leaving programming mode.

YASKAWA Mechatronics Solutions

Frequency Inverter YASKAWA E7–Series

Short discription of the most useful parameters.

Para-meter No.:	Default value:	Range: min.	Range: max.	Change during Operation Yes/No	Manual Page:	Parameter name:	Parameter MENU: PROGRAMMING — Select Parameter group with UP / DOWN key. Changes to the individual parameter (RESET). Selects parameter (UP / DOWN).
P1-01	0	0	9999	N	CASE	Parameter name:	
P1-01	1	0	1	N	CASE	Condensing Program	Mode: 1sets the inverter into Condensing mode; Changes: P1-01=0.0; P1-02=30.0; P1-03=14.0; P1-04=13.0; P1-05=2.0
A1-03	0	0	3330	N	P. 100	Initialize to factory settings	Mode: 2220 sets the inverter back to factory settings.
b1-01	5	0	5	N	P. 104	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. 106	Operation method selection	Set the run command input method: 0=Operator; 1=Terminals; 2,3=Comms; 5=Case-Software (Auto-Switch-Off)
b5-01	1	0	3	N	P. 120	PI control mode selection	Mode: 0=Disabled (Off); 1=Enabled (On)
b5-02	1.0	000	2500	Y	P. 120	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	80	00	3600	Y	P. 120	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. 121	PI-Output characteristic	PI output characteristic : 0=output is positive; 1=output is negative (Reference increases --> output frequency increases)
C1-01	50	00	6000	Y	P. 127	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	150	0	100	N	P. 138	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. 146	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. 146	V/Hz - pattern selection	Mode 6 = 60Hz, Variable torque Mode 5 = 50Hz, Variable torque
E2-01	44	05	108	N	P. 149	Motor rated current	These values will become the reference values for motor pro-tection, torque limits and torque control.
h3-10	b	0	b	N	P. 182	Function Analog Input A2	Mode “b” fixes analogue Input A2 as a reference source of the PI control.
L2-01	2	0	2	Y	P. 190	Momentary Power loss behavior	In mode “2” the V1000 will not trip because of undervoltage, once power is back the drive will continue to run.
L5-01	10	0	10	Y	P. 201	Number of Auto-Restarts	Automatically restarts after a supply fault occurs. The counter is reset, once normal operation has continued for 10 Minutes.
P1-01	00	-1000	1000	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=4mA)
P1-02	300	-1000	1000	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=20mA)
P1-03	140	-1000	1000	N	CASE	Pressure reference	Determines the pressure level setpoint of the condenser. Pressure level unit is “Bar”.
P1-04	130	-500	500	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.I
P1-05	20	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	05	00	100	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	00	3000	N	CASE	Pressure start delay time	Determines a delay time for the re-start function in P01-06.
P3-02	160	50	500	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.
P3-03	800	000	2500	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.
P3-04	05	00	3600	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.
P3-05	250	00	600	Y	CASE	“Summer” start time	Determines the time after power on where as “Summer” PI-control is active.
P3-06	40	000	1500	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.
P3-07	10	000	2500	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.
P3-08	50	00	3600	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.
P3-08	50	00	6000	Y	CASE	“Winter” start time	Determines the time after power on where as “Winter” PI-control is active.

YASKAWA Mechatronics Solutions

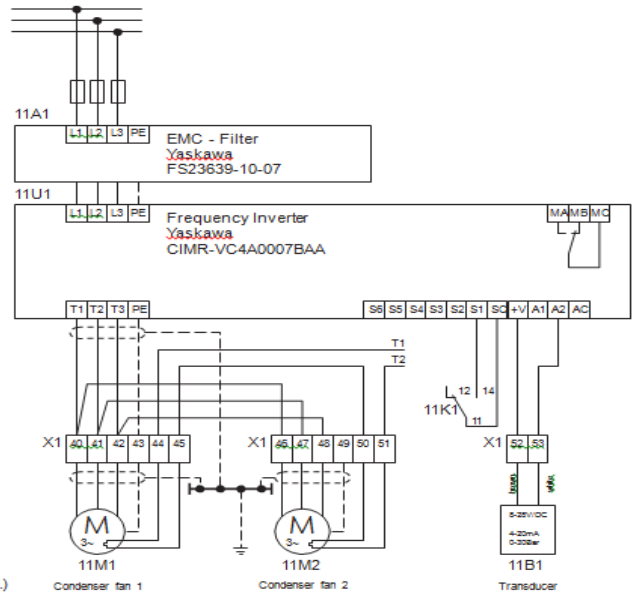
Frequency Inverter YASKAWA E7–Series

Technical Data

Frequency inverter: Yaskawa CIMR-VC4A0007BAA

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 @ 50°C
Rated output capacity:	4 kVA
Rated output current:	5,5 A
Max. output current:	8,2 A
Max. output frequency:	400 Hz
Control characteristics	
Control method:	Sine wave PWM
Speed control 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:	150% 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:	6, free programmable
Digital Outputs:	3 free programmable (1xRelay, 2 open coll.)
Analogue Inputs:	2, 0-10 V and 4-20 mA free programmable
Analogue Outputs:	1, 0-10 V free programmable
Digital Operator	
Optional LCD Display:	Textdisplay, 5-lines; 9 keys
Environment	
Ambient operating temperature:	-10 - +40°C at rated load -10 - +60°C ati 80% rated load = 4 A -20 - + 60°C

Standard-wiring



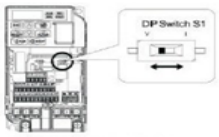


Figure 3.25 DIP Switch S1

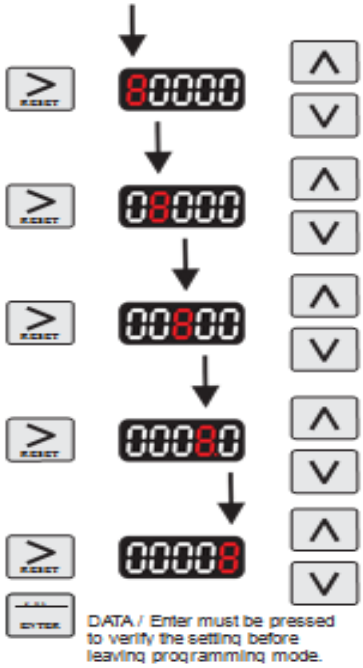
S1: DIP-Switch 1.2:
I = Analogue Input A2 4-20mA
(I = Default)
V = Analogue Input A2 0-10V

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:
Programming Mode	Enables Access to all Parameter
	The left character ("P") of the parameter no. is blinking.
P1-01	P1-01 is blinking
min.transducer	Parametergroup P1 is now active.
P1-01	P1-01 is blinking
min.transmitter	Parametergroup P1 is now active.
P1-01	P1-01 is blinking
min.transmitter	Parametergroup P1 is now active.
P1-03	P1-03 is blinking
min.transmitter	Parameter P1-03 is now selected.
P1-03	12,0 is blinking (default value)
Pressure reference	P1-03 displays the value of this parameter (e.g. pressure reference in "Bar")
	The value can be changed by pressing the increment, decrement or shift key as per the example.
14.0	Reference has been changed.
Pressure-reference	To start the inverter it is neccessary to select the "Drive" menu.
P1 - 03 14.0 Bar	The V1000 will not start in programm-mode!
New pressure reference	
Programming is confirmed and the new value becomes active	

2x



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

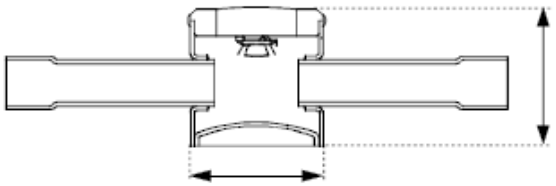
Refrigerant	Liquid Temperature °C	Moisture content in mg Water per kg refrigerant (ppm) blue dry	violet	purple Caution	red Caution – wet
R22	25 38 52	25 35 50	40 65 90	80 130 185	145 205 290
R404A / R507	25 38 52	15 25 45	33 50 60	60 110 140	120 150 180
R134a	25 38 52	20 35 50	35 55 85	90 120 150	130 160 190
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

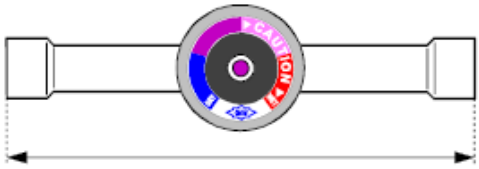
Filter drier should be changed

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.

Expansion valve and Hot Gas Bypaß Valve

SIEMENS **4714**

Refrigerant Valves PN 40 MVL661...

for safety refrigerants

- One valve type for expansion, hot-gas and suction throttle applications
- Hermetically sealed
- Selectable standard interface DC 0/2...10 V or DC 0/4...20 mA
- High resolution and control accuracy
- Precise positioning control and position feedback signal
- Short positioning time (< 1 s)
- Closed when deenergized
- Robust and maintenance-free
- Five valve sizes with k_{vs} values from 0.25 to 12 m³/h

Use

The MVL661... refrigerant valve is designed for modulating control of refrigerant circuits including chillers and heat pumps. It is suitable for use in expansion, hot-gas and suction throttle applications, and for use with organic safety refrigerants (R22, R134a, R404A, R407C, R410A, R507, etc.) and R744 (CO_2).

CE2N4714en
08.06.2005

Building Technologies
HVAC Products

Type summary

Type reference	DN	k_{vs} [m³/h]	Q_0 E [kW]	Q_0 H [kW]	Q_0 D [kW]
MVL661.15-0.4	15	0,40	47	9,2	1,7
MVL661.15-1.0	15	1,0	117	23	4,2
MVL661.20-2.5	20	2,5	293	57	10
MVL661.25-6.3	25	6,3	737	144	26
MVL661.32-12	32	12	[1]	[1]	50

[1] MVL661.32-12.0 is only approved for suction throttle applications

k_{vs} Nominal flow rate of refrigerant through the fully open valve (H_{100}) at a differential pressure of 100 kPa (1 bar) to VDI 2173
The k_{vs} values and the Q_0 refrigeration capacities can be reduced to 63 % if required, refer to page 4 «k_{vs} reduction »
Q_0 E Refrigeration capacity in expansion applications
Q_0 H Refrigeration capacity in hot-gas bypass applications
Q_0 D Refrigeration capacity in suction throttle applications and Δp = 0.5 bar
Q_0 With R407C at t_0 = 0 °C, t_c = 40 °C

The pressure drop across evaporator and condenser is assumed to be 0.3 bar each, and 1.6 bar upstream of the evaporator (e.g. spider).
The capacities specified are based on superheating by 6 K and subcooling by 2 K.

The refrigeration capacity for various refrigerants and operating conditions can be calculated for the 3 types of application using the tables at the end of this Data Sheet. For accurate valve sizing, the valve selection program «Refrigeration VASP» is recommended.

Ordering

Valve body and magnetic actuator form one integral unit and cannot be separated. When ordering, please give quantity, product name and type reference.

Example: 1 refrigerant valve MVL661.15-0.4

Replacement electronics ASR61: Should the valve's electronics become faulty, the entire electronics housing is to be replaced by spare part ASR61, which is supplied complete with Mounting Instructions (74 319 0270 0).

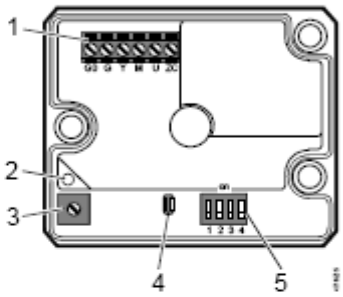
Function / mechanical design

Features and benefits

- 4 selectable standard signals for setpoint and measured value
- DIP switch to reduce the k_{vs} value to 63 % of the nominal value
- Potentiometer for adjustment of minimum stroke for suction throttle applications
- Automatic stroke calibration
- Forced control input for "Valve closed" or "Valve fully open"
- LED for indicating the operating state

The MVL661... can be driven by Siemens or third-party controllers that deliver a DC 0/2...10 V or DC 0/4...20 mA output signal.
For optimum control performance, we recommend a 4-wire connection between controller and valve. When operating on DC voltage, a 4-wire connection is **mandatory!**
The valve stroke is proportional to the control signal.

Operator controls and indicators in the electronics housing



1 Connection terminals
2 LED for indication of operating state
3 Minimal stroke setting potentiometer Rv
4 Autocalibration
5 DIP switches for mode control

Override control

3 modes of operation are possible with override input (ZC):

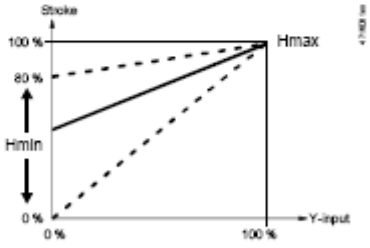
- **No function**: ZC contact not wired; the valve stroke is determined by control signal Y
- **Valve forced fully open**: ZC connected directly to G (AC 24 V or DC 24)
- **Valve forced closed**: ZC connected directly to G0

See also «Connection terminals» on page 8.

Signal priority

Of the possible input signals, override control signal ZC has the highest priority. If ZC is open, the valve stroke is determined by input Y and the potentiometer setting.

Minimum stroke setting

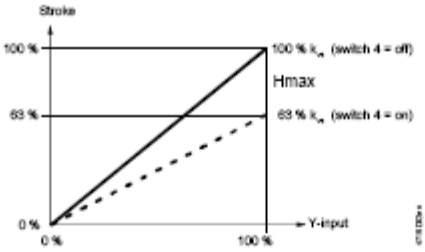


In the case of the suction throttle valve, it is essential that a minimum stroke limit be maintained to ensure compressor cooling and efficient oil return. This can be achieved with a reinjection valve, a bypass line across the valve, or a guaranteed minimum opening of the valve. The minimum stroke can be defined via the controller and control signal Y, or it can be set directly with potentiometer Rv.

The factory setting is zero (mechanical stop in counterclockwise direction, CCW). The minimum stroke can be set by turning the potentiometer clockwise to a maximum of 80 % k_{vs} .

Under no circumstances must potentiometer Rv be used to limit the stroke on expansion applications. It must be possible to close the valve fully.

k_{vs} reduction



When k_{vs} reduction (DIP switch 4 in position on) the stroke will be limited to 63 % mechanical stroke. 63 % of full stroke then corresponds to an input / output signal of 10 V.
If, in addition, the stroke is limited to 80 %, for example, the minimum stroke will be 0.63 x 0.8 = 0.50 of full stroke.

Autocalibration

The printed circuit board of the MVF661... has a slot to facilitate calibration. To make the calibration, insert a screwdriver in the slot so that the contacts inside are connected. As a result, the valve will be fully closed and then fully opened.
Calibration matches the electronics to the valve's mechanism.

MVF661... refrigerant valves are supplied fully calibrated.

When is calibration required?
After replacement of the electronics (ASR61), when the red LED is lit, or when the valve (valve seat) is leaking.

Configuration of DIP switches

Switch	Value	off (factory setting)	on
1	Positioning signal Y	[V]	[mA]
2	Positioning range Y and U	0...10 V 0...20 mA	2...10 V 4...20 mA
3	Position feedback U	[V]	[mA]
4	Flow k_{vs}	100 % k_{vs}	63 % k_{vs}

Switch 2	Function of connection terminal			
	Y (positioning signal) Switch 1		U (position feedback) Switch 3	
	off	on	off	on
off	0...10 V	0...20 mA	0...10 V	0...20 mA
on	2...10 V	4...20 mA	2...10 V	4...20 mA

Indication of operating state

LED	State	Function	Action
LED green	Steady on	• Operation	Automatic mode; everything ok
	Flashing	• Calibration in progress	Wait until calibration is terminated (LED stops flashing)
LED red	Steady on	• Calibration error • Internal error	Start stroke calibration again (short-circuit contacts via slot in PCB) Replace electronics
	Flashing	• Mains fault	Check mains power supply (e.g. outside the frequency or voltage range)
LED	Off	• No power supply • Faulty electronics	Check mains power supply, check wiring Replace electronics

Engineering notes

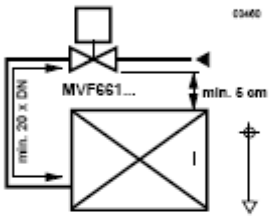
Depending on the application, it may be necessary to observe additional installation instructions and fit appropriate safety devices (e.g. pressostats, full motor protection, etc.).

Warning ⚠ In order not to damage the seal inside the valve insert, the plant must be vented on the low-pressure side after the pressure test has been made (valve port AB), or the valve must be fully open during the pressure test and during venting (power supply connected and positioning signal at maximum or forced opening by G → ZC).

Expansion application

To prevent formation of flash gas on expansion applications, the velocity of the refrigerant in the fluid pipe may not exceed 1 m/s. To assure this, the diameter of the fluid pipe must be greater than the nominal size of the valve, using reducing pieces for making the connections to the valve.
A filter / dryer must be mounted upstream of the expansion valve.

Recommendation



Laboratory measurements reveal that control performance improves when the refrigerant valve is installed so that it is higher than the evaporator (min. 50 mm).
Allow a settling path of at least 0.5 m or 20 x DN between valve and distributor.

This is a general recommendation for expansion valves.

The valve is not explosion-proof.
It is not approved for use with ammonia (NH3, R717).

Sizing

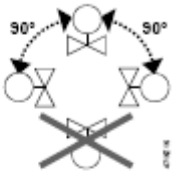
For straightforward valve sizing, refer to the tables for the relevant application (from page 9).
For accurate valve sizing, we recommend to make use of the valve sizing software «Refrigeration VASP».

Notes

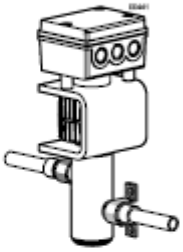
The refrigeration capacity Q_0 is calculated by multiplying the mass flow by the specific enthalpy differential found in the h, log p-chart for the relevant refrigerant. To help determine the refrigeration capacity more easily, a selection chart is provided for each application (page 9 and following). With direct or indirect hot-gas bypass applications, the enthalpy differential of Q_c (the condenser capacity) must also be taken into account when calculating the refrigeration capacity.
If the evaporating and / or condensing temperatures are between the values shown in the tables, the refrigeration capacity can be determined with reasonable accuracy by linear interpolation (refer to the application examples on page 9 and following).
At the operating conditions given in the tables, the permissible differential pressure Δp_{max} (25 bar) across the valve is within the admissible range for these valves.
If the evaporating temperature is raised by 1 K, the refrigeration capacity increases by about 3 %. If, by contrast, subcooling is increased by 1 K, the refrigeration capacity increases by about 1 to 2 % (this applies only to subcooling down to approximately 8 K).

Mounting notes

The valve should be mounted and commissioned by qualified staff. The same applies to the replacement electronics and the configuration of the controller (e.g. SAPHIR or PolyCool).



- The refrigerant valve can be mounted at any angle from upright to horizontal, but must not be suspended below the horizontal
- Pipework should be arranged such that the valve is not located at a low point in the plant where oil can collect
- Pipes should be fixed so that there is no pressure on the valve connections (vibration can lead to burst pipes)
- The valve must not be fitted with the help of its bracket
- The valve body and the connected pipework should be lagged
- The actuator must not be lagged
- Before soldering the valve into the pipework, check that the direction of flow is correct
- To avoid dirt and the formation of scale (oxide), inert gas is recommended for soldering
- During soldering, cool the valve with a wet cloth, for example, to ensure that it does not become too hot
- The pipes must be soldered with care. The flame must be large enough to ensure that soldering joints are heated quickly and that the valve itself does not become too hot. The flame should be directed away from the valve



The valve is supplied complete with Mounting Instructions 74 319 0232 0.

Maintenance

The refrigerant valve is maintenance-free.

Repair

The valve can not be repaired. It has to be replaced as a complete unit.

Disposal

The actuator contains electrical and electronic components and must not be disposed of together with domestic waste.

Legislation may demand special handling of certain components, or it may be sensible from an ecological point of view

Current local legislation must be observed.

Warranty

Application-specific technical data must be observed.
If specified limits are not observed, Siemens Building Technologies / HVAC Products will nor assume any responsibility.

Technical data

Functional actuator data

Power supply

- AC 24 V

Extra low-voltage only (SELV, PELV)		
Operating voltage		AC 24 V ± 20 %
Frequency		45...65 Hz
Typical power consumption	P_{med}	12 W
	Standby	< 1 W (valve closed)
Rated apparent power	S_{NA}	22 VA (for selecting the transformer)
Required fuse		1.6...4 A (slow)

• DC 24 V	Operating voltage	DC 20...30 V
	Current draw	0.5 A / 2 A (max.)
Input	Control signal Y	DC 0/2...10 V or DC 0/4...20 mA
	Impedance DC 0/2...10 V	100 kΩ / 5nF
	Impedance DC 0 / 4...20 mA	240 Ω / 5nF
	Forced control	
	Input impedance	22 kΩ
	Close valve (ZC connected to G0)	< AC 1 V; < DC 0.8 V
	Open valve (ZC connected to G)	> AC 6 V; > DC 5 V
	No function (ZC not wired)	Positioning signal Y active
Output	Position feedback signal Voltage	DC 0/2...10 V; load resistance ≥ 500 Ω
	Current	DC 0/4...20 mA; load resistance ≤ 500 Ω
Product data	PN class	PN 40 to EN 1333
	Permissible pressure p_S	4.0 MPa (40 bar) [1]
	Max. differential pressure Δp_{max}	2.5 MPa (25 bar) DN32: 200 kPa (2 bar)
	Leakage rate (internally across seat)	max. 0.002 % k_{vs} or max. 1 Nl/h gas at Δp = 4 bar (must not be used for safety shutoff functions)
	Permissible media	organic refrigerants (R22, R134a, R404A, R407C, R410A, R507 etc.) and R744 (CO_2); not suited for ammonia (R717)
	Medium temperature	–40...120 °C; max. 140 °C for 10 min
	External seal	hermetically sealed (fully welded, no static or dynamic seals)
	Valve characteristic (stroke, k_v)	linear (to VDI / VDE 2173)
	Stroke resolution $\Delta H/H_{100}$	1 : 1000 (H = stroke)
	Mode of operation	modulating
	Position when deenergized	closed
	Orientation [2]	upright to horizontal
	Positioning time	< 1 s
Materials	Valve body and parts	steel / CrNi steel
	Seat / piston	CrNi steel / brass
	Sealing disk	PTFE
Pipe connections	Sleeves	internally soldered, CrNi steel
Electrical connections	Cable entry glands	3 x ∅ 20.5 mm (for M20)
	Min. cross-sectional area of cable	0.75 mm²
	Max. cable length	65 m with 1.5 mm² cable (copper)
	between transformator / power supply	110 m with 2.5 mm² cable (copper)
	and valve	160 m with 4.0 mm² cable (copper)
Dimensions and weight	Dimensions	refer to «Dimensions»
	Weight	refer to «Dimensions»
Norms and standards	Protection standard	IP 65 to IEC 529
	Conformity	meets the requirements for CE marking UL listed for UL 873 C-UL certified to Canadian Standard C22.2 No. 24 C-Tick N 474 PED 97/23/EC: pressure bearing equipment Art. 1, Par. 2.1.4 / Art. 3, Par. 3 DN32: fluid group 2 only

AC + DC: immunity	Industrial IEC 61000-6-2 [3]
AC: emission	Residential IEC 61000-6-3
DC: emission	CISPR 22, Klasse B
HF interference immunity	IEC 1000-4-3; IEC 1000-4-6 (10 V/m)
HF interference emission	EN 55022, CISPR 22, Klasse B
Vibration [4]	IEC 68-2-6 (5 g acceleration, 10-150 Hz, 2.5 h) (5 g horizontal, max. 2 g upright)

[1] On the basis of DIN 3230-3 tested with 1.5 x operating pressure (60 bar)

[2] At 45 °C < T_{amb} < 55 °C and 80 °C < T_{med} < 120 °C the valve must be installed on its side to avoid shortening the service life of the valve electronics

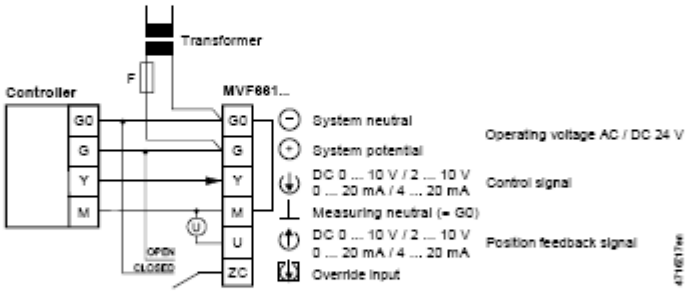
[3] Transformer 160 VA (e.g. Siemens 4AM 3842-4TN00-0EA0)

[4] In conjunction with severely vibrating plant, use only highly flexible stranded wires

General environmental conditions

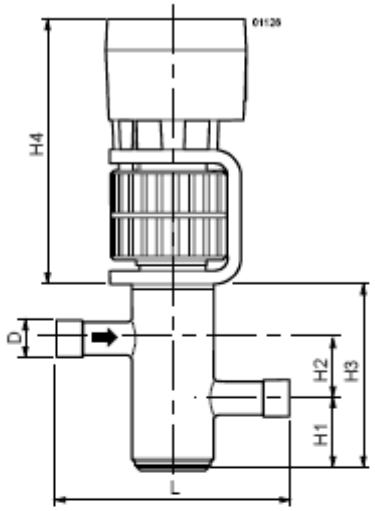
	Operation IEC 721-3-3	Transport IEC 721-3-2	Storage IEC 721-3-1
Climatic conditions	Class 3K6	Class 2K3	Class 1K3
Temperature	–25...55 °C	–25...70 °C	–5...45 °C
Humidity	10...100 % r. h.	< 95 % r. h.	5...95 % r. h.

Connection terminals



Dimensions

Dimensions in mm



Type reference	DN	D [inch]	L [mm]	H1 [mm]	H2 [mm]	H3 [mm]	H4 [mm]	T [mm]	M [kg]
MVL661.15-0.4	15	5/8"	140	44	36	113	160	103	4.4
MVL661.15-1.0	15	5/8"	140	44	36	113	160	103	4.4
MVL661.20-2.5	20	7/8"	150	41	41	119	160	103	4.5
MVL661.25-6.3	25	1 1/8"	160	40	47	126	160	103	4.6
MVL661.32-12	32	1 3/8"	190	43	54	142	160	103	6.1

DN Nominal size
D Pipe connections [inch]
T Depth
M Weight including packaging [kg]

Valve sizing with correction factor

The applications and tables on the following pages are designed for help with selecting the valves. To select the correct valve, the following data is required:

- **Application**
  - Expansion (starting on page 10)
  - Hot-gas (starting on page 13)
  - Suction throttle (starting on page 15)
- **Refrigerant type**
- **Evaporating temperature t_0 [°C]**
- **Condensing temperature t_c [°C]**
- **Refrigeration capacity Q_0 [kW]**

To calculate the nominal capacity, use the following formula:

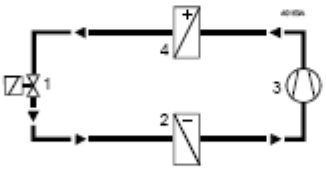
- **k_{vs} [m³/h] = Q_0 [kW] / K...*** * K... for expansion = KE; for hot-gas = KH; for suction throttle = KS
- The theoretical k_v value for the nominal refrigeration capacity of the plant should not be less than 50 % of the k_{vs} value of the selected valve
- For accurate valve sizing, the valve selection program «Refrigeration VASP» is recommended

The application examples on the following pages deal with the principles only. They do not include installation-specific details such as safety elements, refrigerant collectors, etc.

Use of the MVL661... as an expansion valve

- Typical control range 20...100 %.
- Increased capacity through better use of the evaporator
- The use of two or more compressors or compressor stages significantly increases efficiency with low loads
- Especially suitable for fluctuating condensing and evaporating pressures

Capacity optimization



Electronic superheat control is achieved by using additional control equipment (e.g. PolyCool).

Application example

Refrigerant R407C; Q_0 = 205 kW; t_0 = –5 °C; t_c = 35 °C
The correct k_{vs} value for the MVL661... valve needs to be determined.

The important section of table KE for R407C (see page 12) is the area around the working point. The correction factor KE relevant to the working point should be determined by linear interpolation from the four guide values.

Note on interpolation

In practice, the KE, KH or KS value can be estimated because the theoretical k_{vs}-value ascertained will be rounded off by up to 30 % to one of the ten available k_{vs}-values. So you can proceed directly with Step 4.

Step 1: For t_c = 35, calculate the value for t_o = –10 between values 20 and 40 in the table; result: **112**
Step 2: For t_c = 35, calculate the value for t_o = 0 between values 20 and 40 in the table; result: **109**
Step 3: For t_o = –5, calculate the value for t_c = 35 between correction factors 112 and 109; calculated in steps 1 and 2; result: **111**
Step 4: Calculate the theoretical k_{vs} value; result: **1.85 m³/h**
Step 5: Select the valve; the valve closest to the theoretical k_{vs} value is the **MVL661.20-2.5**
Step 6: Check that the theoretical k_{vs} value is not less than 50 % of the nominal k_{vs} value

KE-R407C	t_o = –10 °C	t_o = 0 °C
t_c = 20 °C	**108**	**85**
t_c = 35 °C	*112*	*109*
t_c = 40 °C	**113**	**117**

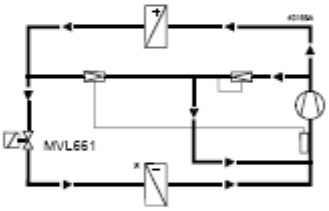
Interpolation at	t_c = 35 °C
108 + [(113 – 108) x (35- 20) / (40 - 20)]	112
85 + [(117 - 85) x (35 - 20) / (40 - 20)]	109

Interpolation at	t_o = -5 °C
112 +[(109 - 112) x (-5 - 0) / (-10 - 0)]	111

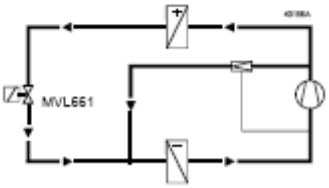
k_v theoretical = 205 kW / 111 = 1.85 m³/h
Valve MVL661.20-2.5 is suitable, since: 1.85 m³/h / 2.5 m³/h x 100 % = 74 % (> 50 %)

Capacity control

a) Refrigerant valve MVL661... for capacity control of a dry expansion evaporator. Suction pressure and temperature are monitored with a mechanical capacity controller and reinjection valve.
- Typical control range 0...100 %
- Energy-efficient operation with low loads
- Ideal control of temperature and dehumidification



b) Refrigerant valve MVL661... for capacity control of a chiller.
- Typical control range 10...100 %
- Energy-efficient operation with low loads
- Allows wide adjustment of condensing and evaporating temperatures
- Ideal for use with plate heat exchangers
- Very high degree of frost protection



Note: A larger valve may be required for low load operation than is needed for full load conditions. To ensure that the selected valve will not be too small for low loads, sizing should take account of both possibilities.

Correction table KE
Expansion valve

$t_c \setminus t_e$	R22 -40	-30	-20	-10	0	10
00	82	68	37			
20	101	104	107	105	81	18
40	108	111	114	118	120	123
60	104	108	112	116	119	122

$t_c \setminus t_e$	R134a -40	-30	-20	-10	0	10
00	27					
20	71	74	77	66	43	
40	74	78	81	85	89	92
60	67	72	76	81	85	89

$t_c \setminus t_e$	R744 -40	-30	-20	-10	0	10
-20	226	149				
00	262	264	241	166		
20	245	247	247	246	213	

$t_c \setminus t_e$	R290 -40	-30	-20	-10	0	10
00	83	67	22			
20	104	109	113	107	80	
40	105	110	115	120	125	130
60	93	99	105	111	116	122

$t_c \setminus t_e$	R401A -40	-30	-20	-10	0	10
00	31					
20	80	83	85	72	46	
40	87	90	94	97	101	102
60	85	89	94	98	102	106

$t_c \setminus t_e$	R402A -40	-30	-20	-10	0	10
00	73	69	50			
20	77	81	85	88	74	35
40	71	75	80	84	88	91
60	50	55	60	65	69	74

$t_c \setminus t_e$	R404A -40	-30	-20	-10	0	10
00	69	63	44			
20	70	74	78	81	68	30
40	61	65	70	74	78	81
60	36	41	46	51	55	59

$t_c \setminus t_e$	R407A -40	-30	-20	-10	0	10
00	79	67	40			
20	91	95	98	102	82	30
40	89	94	98	102	106	110
60	72	77	82	87	92	96

$t_c \setminus t_e$	R407B -40	-30	-20	-10	0	10
00	72	66	45			
20	77	80	84	88	75	34
40	69	74	78	83	87	91
60	46	51	56	61	66	70

$t_c \setminus t_e$	R407C -40	-30	-20	-10	0	10
00	79	65	31			
20	98	101	105	108	85	21
40	100	104	109	113	117	121
60	87	93	98	103	108	113

$t_c \setminus t_e$	R410A -40	-30	-20	-10	0	10
00	116	117	91	12		
20	125	130	133	137	120	69
40	119	124	129	133	137	140
60	90	96	101	106	110	114

$t_c \setminus t_e$	R410B -40	-30	-20	-10	0	10
00	112	112	87	11		
20	122	126	129	132	115	66
40	119	124	128	131	134	137
60	98	103	108	112	115	118

$t_c \setminus t_e$	R507 -40	-30	-20	-10	0	10
00	72	66	47			
20	78	81	83	86	71	33
40	74	78	81	84	87	90
60	53	57	61	64	68	71

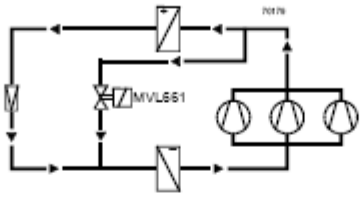
$t_c \setminus t_e$	R1270 -40	-30	-20	-10	0	10
00	109	93	59			
20	122	126	130	129	101	31
40	122	127	133	138	142	147
60	108	115	121	127	132	136

- With superheat = 6 K — With subcooling = 2 K — Δp upstream of evaporator = 1.6 bar
- Δp condenser = 0.3 bar — Δp evaporator = 0.3 bar

Use of the MVL661... as a hot-gas valve

The control valve throttles the capacity of a compressor stage. The hot gas passes directly to the evaporator, thus permitting capacity control in the range from 100 % down to approximately 0 %.

Indirect hot-gas bypass application



Suitable for use in large refrigeration systems in air conditioning plant, to prevent unacceptable temperature fluctuations between the compressor stages.

Application example

With low loads, the evaporating and condensing pressures can fluctuate depending on the type of pressure control. In such cases, evaporating pressure increases and condensing pressure decreases. Due to the reduction in differential pressure across the fully open valve, the volumetric flow rate will drop – the valve is undersized. This is why the effective pressures must be taken into account when sizing the valve for low loads.

Refrigerant R507; 3 compressor stages; Q_0 = 75 kW; t_0 = 4 °C; t_c = 40 °C
Part load Q_0 per stage = 28 kW; t_0 = 4 °C; t_c = 23 °C

KH-R507	t_0 = 0 °C	t_0 = 10 °C
t_c = 2 °C	**14.4**	**9.0**
t_c = 23 °C	*15.6*	*11.0*
t_c = 40 °C	**22.4**	**22.0**

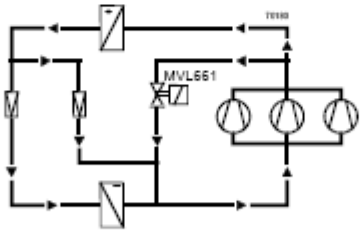
Interpolation at	t_c = 23 °C
14.4 + [(22.4 – 14.4) x (23 - 20) / (40 - 20)]	15.6
9.0 + [(22.0 – 9.0) x (23 - 20) / (40 - 20)]	11.0

Interpolation at	t_0 = 4 °C
15.6 + [(11.0 – 15.6) x (4 - 0) / (10 - 0)]	13.8

k_{vs} theoretical = 28 kW / 13.8 = 2.03 m^3/h
Valve MVL661.20-2.5 is suitable, since: 2.03 m^3/h / 2.5 m^3/h x 100 % = 81 % (> 50 %)

Direct hot-gas bypass application

The control valve throttles the capacity of one compressor stage. The gas is fed to the suction side of the compressor and then cooled using a reinjection valve. Capacity control ranges from 100 % down to approximately 10 %.



Suitable for large refrigeration systems in air conditioning applications with several compressors or compressor stages, and where the evaporator and compressor are some distance apart (attention must be paid to the oil return).

Correction table KH
Hot-gas valve

$t_c \setminus t_o$	R22 -40	-30	-20	-10	0	10
00	8.9	8.4	6.3			
20	15.3	15.1	14.8	14.6	13.2	6.5
40	24.2	23.7	23.2	22.8	22.4	22.1
60	35.7	34.7	33.8	33.0	32.3	31.7

$t_c \setminus t_o$	R134a -40	-30	-20	-10	0	10
00	4.5					
20	9.8	9.6	9.5	9.2	7.4	
40	15.9	15.6	15.3	15.1	14.9	14.7
60	23.8	23.2	22.7	22.3	21.9	21.6

$t_c \setminus t_o$	R744 -40	-30	-20	-10	0	10
-20	38.1	30.5				
00	60.9	59.8	58.1	47.1		
20	87.3	84.9	82.5	80.2	76.1	

$t_c \setminus t_o$	R290 -40	-30	-20	-10	0	10
00	10.9	10.0	6.5			
20	18.0	17.7	17.4	17.1	15.0	
40	27.3	26.7	26.2	25.8	25.4	25.1
60	38.2	37.2	36.4	35.7	35.1	34.5

$t_c \setminus t_o$	R401A -40	-30	-20	-10	0	10
00	4.7					
20	10.2	10.0	9.9	9.5	7.6	
40	16.9	16.6	16.2	16.0	15.8	15.6
60	25.9	25.2	24.6	24.1	23.7	23.3

$t_c \setminus t_o$	R402A -40	-30	-20	-10	0	10
00	9.7	9.5	8.3			
20	15.9	15.7	15.4	15.2	14.5	9.3
40	23.7	23.2	22.7	22.4	22.0	21.7
60	31.5	30.7	29.9	29.2	28.7	28.1

$t_c \setminus t_o$	R404A -40	-30	-20	-10	0	10
00	9.4	9.2	7.8			
20	15.2	15.0	14.8	14.6	13.9	8.6
40	22.3	21.8	21.5	21.1	20.9	20.6
60	28.8	28.0	27.4	26.8	26.4	25.9

$t_c \setminus t_o$	R407A -40	-30	-20	-10	0	10
00	8.9	8.6	6.7			
20	15.7	15.4	15.2	15.0	14.1	8.0
40	24.9	24.4	23.9	23.5	23.1	22.8
60	35.9	34.9	34.0	33.2	32.6	32.0

$t_c \setminus t_o$	R407B -40	-30	-20	-10	0	10
00	9.0	8.6	7.4			
20	15.3	15.1	14.8	14.7	14.0	8.8
40	23.3	22.8	22.4	22.0	21.7	21.5
60	31.6	30.7	30.0	29.3	28.8	28.3

$t_c \setminus t_o$	R407C -40	-30	-20	-10	0	10
00	8.6	8.1	5.9			
20	15.3	15.0	14.8	14.6	13.6	7.0
40	24.7	24.2	23.7	23.3	22.9	22.6
60	36.3	35.3	34.4	33.6	33.0	32.4

$t_c \setminus t_o$	R410A -40	-30	-20	-10	0	10
00	14.5	14.3	13.2	6.2		
20	24.2	23.7	23.3	23.0	22.1	15.9
40	36.8	35.9	35.1	34.4	33.7	33.1
60	50.0	48.5	47.2	46.0	44.9	43.8

$t_c \setminus t_o$	R410B -40	-30	-20	-10	0	10
00	14.3	14.1	12.9	6.1		
20	23.8	23.3	22.9	22.5	21.6	15.5
40	36.5	35.6	34.7	33.9	33.2	32.5
60	50.7	49.1	47.7	46.4	45.2	44.0

$t_c \setminus t_o$	R507 -40	-30	-20	-10	0	10
00	9.8	9.5	8.1			
20	16.1	15.8	15.5	15.3	14.4	9.0
40	24.5	23.8	23.3	22.8	22.4	22.0
60	33.1	31.8	30.7	29.8	29.0	28.3

$t_c \setminus t_o$	R1270 -40	-30	-20	-10	0	10
00	13.5	13.0	10.3			
20	22.0	21.6	21.2	20.9	19.0	9.9
40	33.0	32.2	31.6	31.1	30.6	30.1
60	46.1	44.8	43.8	42.8	41.9	41.2

- With superheat = 6 K — With subcooling = 2 K — Δp upstream of evaporator = 1.6 bar
- Δp condenser = 0.3 bar — Δp evaporator = 0.3 bar

11.10 Liquid receiver

Liquid receiver GBV 3 (vertical)

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

11.11 Primary water pump

Fully installed and plumbed-in water pump Type **Grundfos CR10-5** (see technical specifications and appendix).

The pump is assembled with an 3,0kW Motor from the manufacturer VEM.
(see technical specifications item 11.12.1).

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.

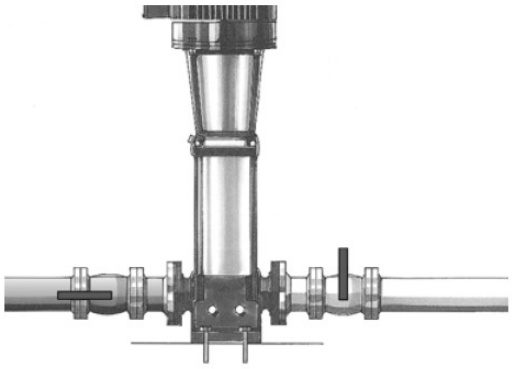
It is essential that the pump is filled with the cooling medium and de-aerated before it is started.

Operating instructions CR
Multistage centrifugal pumps

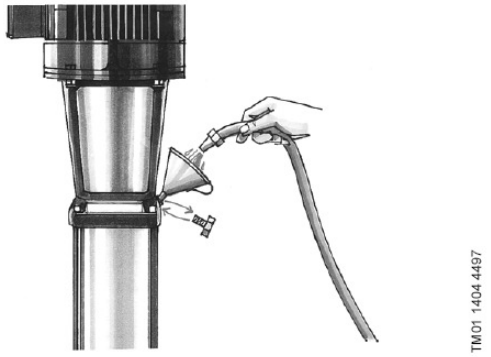
1.General
Grundfos GmbH, Schlüterstraße 33, 40699 Erkrath, Germany
Series CR

Start-up

1

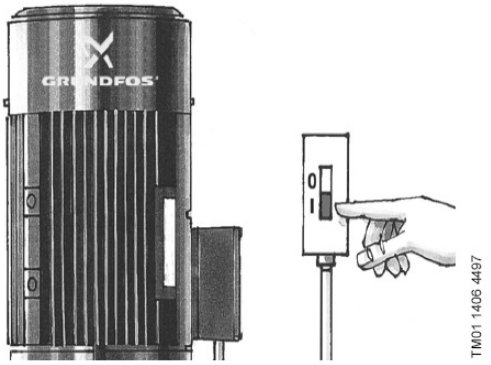


2

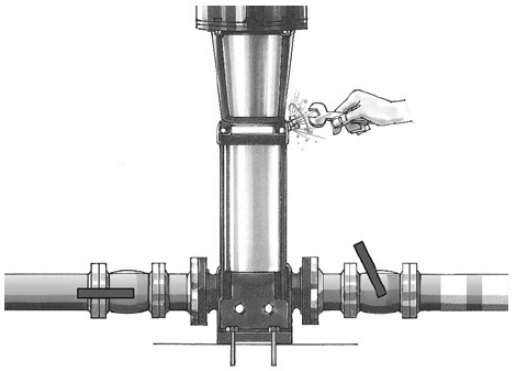


3

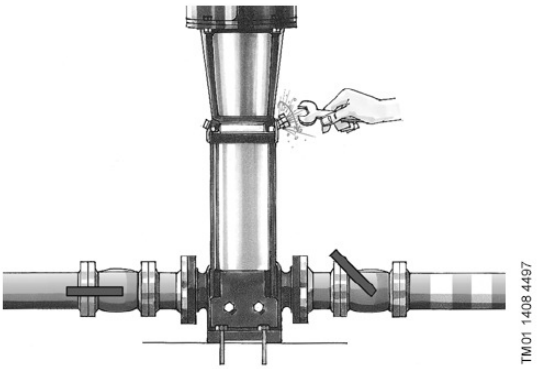
4



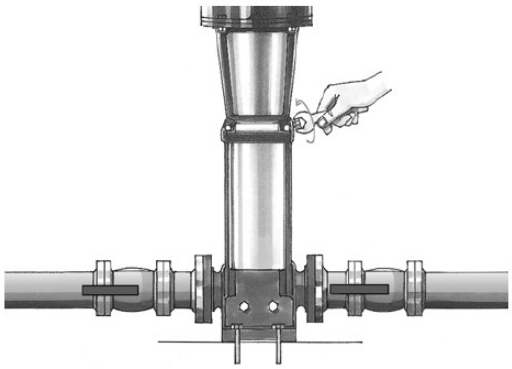
5



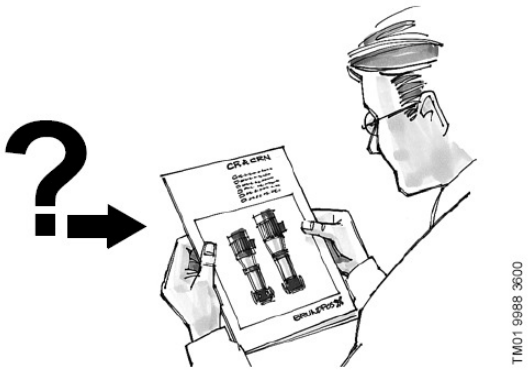
6



7



8



(GB) Start-up

1 Close the isolating valve on the discharge side of the pump and open the isolating valve on the suction side.	**2** Remove the priming plug from the pump head and slowly fill the pump with liquid. Replace the priming plug and tighten securely.
3 See the correct direction of rotation of the pump on the motor fan cover.	**4** Start the pump and check the direction of rotation.
5 Vent the pump by means of the vent valve in the pump head. At the same time, open the discharge isolating valve a little.	**6** Continue to vent the pump. At the same time, open the discharge isolating valve a little more.
7 Close the vent valve when a steady stream of liquid runs out of it. Completely open the discharge isolating valve.	**8** For further information, see page 20.

(D) Inbetriebnahme

1 Das druckseitige Absperrventil schließen und das saugseitige Absperrventil öffnen.	**2** Einfüllstopfen demontieren und Pumpe langsam auffüllen. Einfüllstopfen wieder einschrauben und fest anziehen.
3 Siehe richtige Drehrichtung auf der Lüfterhaube des Motors.	**4** Pumpe einschalten und Drehrichtung der Pumpe prüfen.
5 Pumpe über Entlüftungsventil im Kopfstück der Pumpe entlüften. Gleichzeitig das druckseitige Absperrventil ein wenig öffnen.	**6** Die Entlüftungsvorgehensweise fortsetzen. Gleichzeitig das druckseitige Absperrventil ein bisschen mehr öffnen.
7 Entlüftungsventil schließen, wenn das Medium aus dem Ventil herausläuft. Das druckseitige Absperrventil ganz öffnen.	**8** Für weitere Informationen, siehe Seite 27.

(F) Mise en route

1 Fermer la vanne d'isolement du côté refoulement et ouvrir la vanne d'isolement du côté aspiration de la pompe.	**2** Démonter le bouchon d'amorçage de la tête de pompe et amorcer lentement la pompe. Remettre en place le bouchon d'amorçage.
3 Voir le sens correct de rotation de la pompe sur le capot du ventilateur du moteur.	**4** Démarrer la pompe et vérifier son sens de rotation.
5 Purger la pompe par la vis de purge située dans la tête de pompe. Ouvrir simultanément légèrement la vanne d'isolement du côté refoulement.	**6** Continuer à purger la pompe. Ouvrir simultanément un peu plus la vanne d'isolement du côté refoulement.
7 Fermer la vis de purge lorsqu'un filet d'eau homogène s'écoule. Ouvrir entièrement la vanne d'isolement du côté refoulement.	**8** Pour plus d'informations, voir page 33.

(I) Avviamento

1 Chiudere la valvola di intercettazione sul lato di mandata della pompa e aprire quella sul lato di aspirazione.	**2** Rimuovere il tappo di adescamento dalla testa pompa e versare lentamente il liquido nella pompa. Reinserire il tappo e chiuderlo accuratamente.
3 Osservare il corretto senso di rotazione della pompa sul coperchio della ventola motore.	**4** Avviare la pompa e controllare il senso di rotazione.
5 Sfiatare la pompa per mezzo della valvola di sfiato sulla testa pompa. Contemporaneamente, aprire leggermente la valvola di mandata.	**6** Continuare a sfiatare la pompa, continuando contemporaneamente ad aprire la valvola di mandata.
7 Chiudere la valvola di sfiato quando fuoriesce un flusso di liquido costante. Aprire completamente la valvola di mandata.	**8** Per ulteriori informazioni vedere pagina 39.

CONTENTS

Warning

Prior to installation, read these installation and operating instructions. Installation and operation must comply with local regulations and accepted codes of good practice.

1. Symbols used in this document

Warning

If these safety instructions are not observed, it may result in personal injury!

Caution ***If these safety instructions are not observed, it may result in malfunction or damage to the equipment!***

Note ***Notes or instructions that make the job easier and ensure safe operation.***

2. Handling

Warning

Do not use the lifting eyes of the motors of the CR, CRI, CRN 1s, 1, 3, 5, 10, 15 and 20 pumps for lifting the entire pump.

When lifting the entire pump with motor, follow these instructions:

- Lift CR, CRI, CRN 1s, 1, 3, 5, 10, 15 and 20 pumps fitted with Grundfos MG motors in the pump head by means of straps or the like.
- Lift CR, CRN 32, 45, 64, 90, 120 and 150 fitted with Grundfos MG motors up to and including 11 kW by means of the eye nut fitted to the pump head.
- Lift CR, CRN 32, 45, 64, 90, 120 and 150 fitted with Siemens motors of 15 kW and up by means of the eye bolts fitted to the motor flange.
- For CR, CRI and CRN pumps fitted with other motor makes than those mentioned above, we recommend that you lift the pump in the pump head by means of straps.

3. Type designation

3.1 Type key for CR, CRI, CRN 1s, 1, 3, 5, 10, 15 and 20

Example	CR	3-	10	X-	X-	X-	X-	XXXX
Pump range: CR, CRI, CRN								
Nominal flow rate in m^3/h								
Number of impellers								
Code for pump version								
Code for pipework connection								
Code for materials								
Code for rubber pump parts								
Code for shaft seal								

3.2 Type key for CR, CRN 32, 45, 64, 90, 120 and 150

Example	CR	32-	2	1-	X-	X-	X-	X-	XXXX
Pump range: CR, CRN									
Nominal flow rate in m^3/h									
Number of stages									
Number of impellers with reduced diameter									
Code for pump version									
Code for pipework connection									
Code for materials									
Code for rubber pump parts									
Code for shaft seal									

4. Applications

Grundfos multistage in-line centrifugal pumps, types CR, CRI and CRN, are designed for a wide range of applications.

CR, CRI, CRN

CR, CRI CRN pumps are suitable for liquid transfer, circulation and pressure boosting of cold or hot clean liquids.

CRN

Use CRN pumps in systems where all parts in contact with the liquid are made of high-grade stainless steel.

Pumped liquids

Thin, clean, non-explosive liquids, not containing solid particles or fibres. The liquid must not attack the pump materials chemically.

When pumping liquids with a density and/or viscosity higher than that of water, use motors with correspondingly higher outputs, if required.

5. Technical data

5.1 Ambient temperature and altitude

Motor power [kW]	Motor make	Motor efficiency class	Maximum ambient temperature [° C]	Maximum altitude above sea level [m]
0.37-0.75	Grundfos MG	EFF 2	+40	1000
1.1-11	Grundfos MG	EFF 1	+60	3500
15-75	Siemens	EFF 1	+55	2750

If the ambient temperature exceeds the above temperature values or the pump is installed at an altitude exceeding the above altitude values, the motor must not be fully loaded due to the risk of overheating. Overheating may result from excessive ambient temperatures or the low density and consequently low cooling effect of the air.

In such cases, it may be necessary to use a motor with a higher rated output.

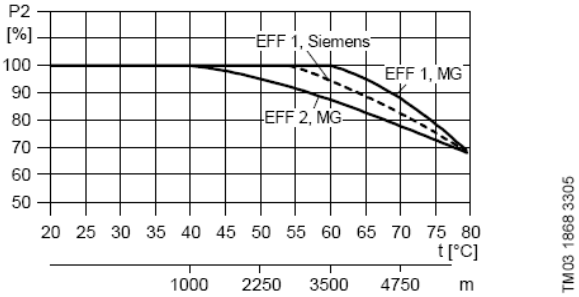


Fig. 1 Motor output depends on temperature/altitude

Example

Figure 1 shows that the load of an EFF 1 motor in an ambient temperature of 70 °C must not be loaded more than 89 % of the rated output. If the pump is installed 4750 metres above sea level, the motor must not be loaded more than 89 % of the rated output.

In cases where both the maximum temperature and the maximum altitude are exceeded, the derating factors must be multiplied (0.89 x 0.89 = 0.79).

5.2 Liquid temperature

The table on page 173 states the relationship between liquid temperature range and maximum permissible operating pressu

Note ***The maximum permissible operating pressure and liquid temperature ranges apply to the pur only.***

5.3 Maximum permissible operating pressure and liquid temperature for the shaft seal

Note ***The diagram below applies to clean water and water containing anti-freeze liquids.***

CR, CRI, CRN 1s to 20 and CR, CRN 32 to 150

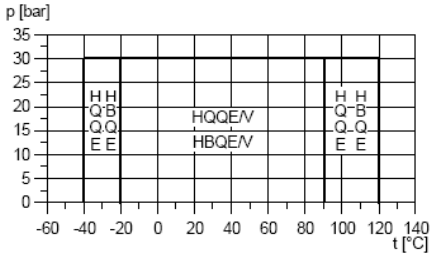


Fig. 2 Maximum permissible operating pressure and liquic temperature

CRI and CRN pumps using a type H shaft seal with EPDM rubb parts, HxxE, can be cleaned in place (CIP) with liquids up to 150 °C for maximum 15 minutes.

Note ***The pumping of liquids above +120 °C may res in periodical noise and reduced pump life.***

CR, CRI, CRN pumps are not suitable for the pumping of liquic above 120 °C for long periods.

5.4 Minimum inlet pressure

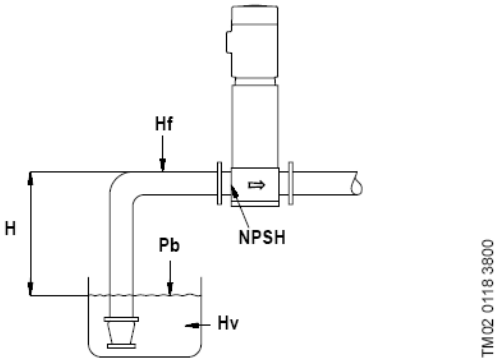


Fig. 3 Schematic view of open system with a CR pump

The maximum suction lift “H” in metres head can be calculated as follows:

$H = p_b \times 10.2 - NPSH - H_f - H_v - H_s$

p_b = Barometric pressure in bar. (Barometric pressure can be set to 1 bar.) In closed systems, p_b indicates the system pressure in bar.

NPSH = Net Positive Suction Head in metres head (to be read from the NPSH curve on page 171 at the highest flow the pump will be delivering).

H_f = Friction loss in suction pipe in metres head at the highest flow the pump will be delivering.

H_v = Vapour pressure in metres head, see fig. E on page 176. t_m = Liquid temperature.

H_s = Safety margin = minimum 0.5 metres head.

If the calculated “H” is positive, the pump can operate at a suction lift of maximum “H” metres head.

If the calculated “H” is negative, an inlet pressure of minimum “H” metres head is required. There must be a pressure equal to the calculated “H” during operation.

Example

p_b = 1 bar.
Pump type: CR 15, 50 Hz.
Flow rate: 15 m^3/h.
NPSH (from page 171): 1.1 metres head.
H_f = 3.0 metres head.
Liquid temperature: +60 °C.
H_v (from fig. E, page 176): 2.1 metres head.

$H = p_b \times 10.2 - NPSH - H_f - H_v - H_s$ [metres head].

$H = 1 \times 10.2 - 1.1 - 3.0 - 2.1 - 0.5 =$ **2.7 metres head**.

This means that the pump can operate at a suction lift of maximum 2.7 metres head.

Pressure calculated in bar: 2.7 x 0.0981 = 0.265 bar.
Pressure calculated in kPa: 2.7 x 9.81 = 26.5 kPa.

5.5 Maximum inlet pressure

The table on page 174 states the maximum permissible inlet pressure. However, the actual inlet pressure + pressure when the pump is running against a closed valve must always be lower than the *5.3 Maximum permissible operating pressure and liquid temperature for the shaft seal*.

The pumps are pressure-tested at a pressure of 1.5 times the values stated on page 174.

5.6 Minimum flow rate

Due to the risk of overheating, do **not** use the pump at flows below the minimum flow rate.
The curves below show the minimum flow rate as a percentage the nominal flow rate in relation to the liquid temperature.
– – – – = air-cooled top.

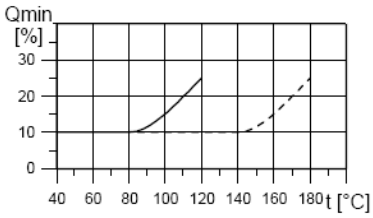


Fig. 4 Minimum flow rate

Caution ***Never operate the pump against a closed discharge valve.***

5.7 Electrical data

See motor nameplate.

5.8 Frequency of starts and stops

Motor sizes	Maximum number of starts per hour
≤3 kW	200
4 to 30 kW	100
37 to 55 kW	75
75 kW	50

5.9 Dimensions and weights

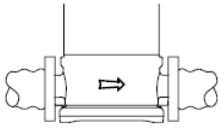
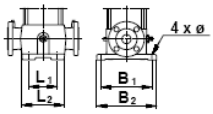
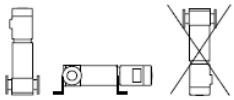
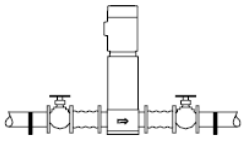
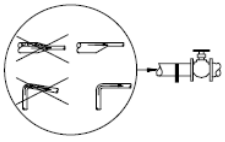
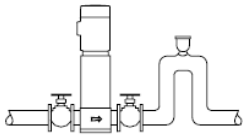
Dimensions: See fig. C, page 175.
Weights: See label on the packing.

5.10 Sound pressure level

See fig. D, page 176.

6. Installation

The pump must be secured to a horizontal, plane and solid foundation by bolts through the holes in the base plate. When installing the pump, follow the procedure below in order to avoid damaging the pump.

Step	Action
1  TM02 0013 3800	Arrows on the pump base show the direction of flow of liquid through the pump.
2  TM00 2256 3393	This information is stated on page 175: • port-to-port lengths • dimensions of the base • pipework connections • diameter and position of foundation bolts.
3  TM01 1241 4097	The pump can be installed vertically or horizontally. However, the motor must neither fall below the horizontal plane nor be installed upside down. Ensure that an adequate supply of cool air reaches the motor cooling fan. Pumps with motors above 4 kW must be motor supported.
4  TM02 0116 3800	To minimize possible noise from the pump, we advise you to fit expansion joints on either side of the pump and anti-vibration mountings between foundation and pump. Fit isolating valves on either side of the pump to avoid draining the system if the pump needs to be removed for cleaning, repair or replacement. Always protect the pump against backflow by means of a non-return valve (foot valve).
5  TM02 0114 3800	Install the pipes so that air locks do not occur, especially on the suction side of the pump.
6  TM02 0115 3800	Fit a vacuum valve close to the pump if the installation has one of these characteristics: • The discharge pipe slopes downwards away from the pump. • There is a risk of siphon effect. • Protection against backflow of unclean liquids is needed.

6.1 Outdoor installation

When installed outdoors, it is recommended to provide the motor with a rain cover. It is also recommended to open one of the drain holes in the motor flange on motor sizes of 1.5 kW and up.

7. Electrical connection

The electrical connection should be carried out by an authorized electrician in accordance with local regulations.

Warning

Before removing the terminal box cover and before removing/dismantling the pump, make sure that the electricity supply has been switched off.

Connect the pump to an external mains switch with a minimum contact gap of 3 mm in all poles.

The operating voltage and frequency are marked on the motor nameplate. Make sure that the motor is suitable for the electricity supply on which it will be used.

Single-phase Grundfos motors incorporate a thermal switch and require no additional motor protection.

Three-phase motors must be connected to a motor-protective circuit breaker.

The terminal box can be turned to four positions, in 90 ° steps. Follow this procedure:

1. If necessary, remove the coupling guards. Do not remove the coupling.
2. Remove the bolts securing the motor to the pump.
3. Turn the motor to the required position.
4. Replace and tighten the bolts.
5. Replace the coupling guards.

Carry out the electrical connection as shown in the diagram inside the terminal box cover.

7.1 Frequency converter operation

Motors supplied by Grundfos

All three-phase motors supplied by Grundfos can be connected to a frequency converter. The frequency converter must be set to variable torque.

Depending on the frequency converter type, this may cause increased acoustic noise from the motor. Furthermore, it may cause the motor to be exposed to detrimental voltage peaks.

Caution ***Grundfos motors, types MG 71 and MG 80, for supply voltages up to and including 440 V without phase insulation (see motor nameplate), must be protected against voltage peaks above 650 V (peak value) between the supply terminals.***

We recommend to protect all other motors against voltage peaks higher than 1200 V by 2000 V/µsec.

The above disturbances, i.e. both increased acoustic noise and detrimental voltage peaks, can be eliminated by fitting an LC filter between the frequency converter and the motor.

For further information, please contact the frequency converter or motor supplier.

Other motor makes than those supplied by Grundfos

Please contact Grundfos or the motor manufacturer.

8. Start-up

Caution ***Do not start the pump until it has been filled with liquid and vented. If the pump runs dry, the pump bearings and the shaft seal may be damaged.***

Warning

Pay attention to the direction of the vent hole and take care to ensure that the escaping water does not cause injury to persons or damage to the motor or other components.
In hot-water installations, pay special attention to the risk of injury caused by scalding hot water.

Follow the instructions on page 3.

CR, CRI, CRN 1s to 5

For these pumps, we advise you to open the bypass valve during start-up, see fig. 5 for bypass valve location. The bypass valve connects the suction and discharge sides of the pump, thus making the filling procedure easier. Close the bypass valve again when the operation is stable.

When pumping liquids containing air, we advise you to leave the bypass valve open if the operating pressure is lower than 6 bar.

Close the bypass valve if the operating pressure constantly exceeds 6 bar. Otherwise the material at the opening will be worn because of the high liquid velocity.

9. Maintenance

Warning

Before starting work on the pump, make sure that all power supplies to the pump have been switched off and that they cannot be accidentally switched on.

Pump bearings and shaft seal are maintenance-free.

Motor bearings

Motors not fitted with grease nipples are maintenance-free.

Motors fitted with grease nipples should be lubricated with a high-temperature, lithium-based grease. See the instructions on the fan cover.

In the case of seasonal operation (motor is idle for more than 6 months of the year), we recommend you to grease the motor when the pump is taken out of operation.

10. Frost protection

Pumps which are not being used during periods of frost should b drained to avoid damage.

Drain the pump by loosening the vent screw in the pump head and by removing the drain plug from the base.

Warning

Pay attention to the direction of the vent hole ar take care to ensure that the escaping water doe not cause injury to persons or damage to the motor or other components.
In hot-water installations, pay special attention the risk of injury caused by scalding hot water.

Do not tighten the vent screw and replace the drain plug until th pump is to be used again.

CR, CRI, CRN 1s to 5

Before replacing the drain plug in the base, screw the bypass valve out against the stop. See fig. 5.

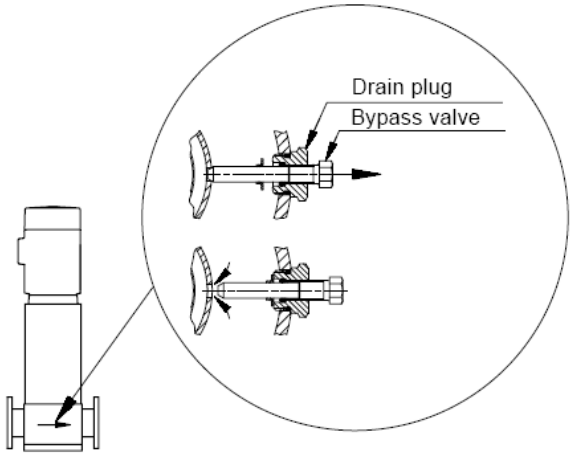


Fig. 5 Location of drain plug and bypass valve

Fit the drain plug by tightening the large union nut followed by th bypass valve.

11. Service

Note ***If a pump has been used for a liquid which is toxic or injurious to health, the pump will be classified as contaminated.***

If Grundfos is requested to service the pump, Grundfos must be contacted with details about the pumped liquid, etc. *before* the pump is returned for service. Otherwise Grundfos can refuse to accept the pump for service.

Possible costs of returning the pump are to be paid by the customer.

However, any application for service (no matter to whom it may be made) must include details about the pumped liquid if the pump has been used for liquids which are toxic or injurious to health.

11.1 Service kits

Service kits for CR, CRI and CRN, see **www.grundfos.com** (WebCAPS), WinCAPS or Service Kit Catalogue.

12. Fault finding chart

Warning

Before removing the terminal box cover and before removing/dismantling the pump, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

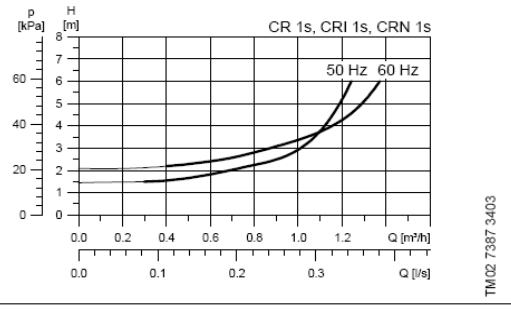
Fault	Cause	Remedy
1. Motor does not run when started.	a) Supply failure.	Connect the electricity supply.
	b) Fuses are blown.	Replace fuses.
	c) Motor-protective circuit breaker has tripped out.	Reactivate the motor-protective circuit breaker.
	d) Thermal protection has tripped out.	Reactivate the thermal protection.
	e) Main contacts in motor-protective circuit breaker are not making contact or the coil is faulty.	Replace contacts or magnetic coil.
	f) Control circuit is defective.	Repair the control circuit.
	g) Motor is defective.	Replace the motor.
2. Motor-protective circuit breaker trips out immediately when supply is switched on.	a) One fuse/automatic circuit breaker is blown.	Replace the fuse/cut in the circuit breaker.
	b) Contacts in motor-protective circuit breaker are faulty.	Replace motor-protective circuit breaker contacts.
	c) Cable connection is loose or faulty.	Fasten or replace the cable connection.
	d) Motor winding is defective.	Replace the motor.
	e) Pump mechanically blocked.	Remove the mechanical blocking of the pump.
	f) Motor-protective circuit breaker setting is too low..	Set the motor-protective circuit breaker correctly.
3. Motor-protective circuit breaker trips out occasionally.	g) Motor-protective circuit breaker setting is too low.	Set the motor-protective circuit breaker correctly.
	h) Low voltage at peak times.	Check the electricity supply.
4. Motor-protective circuit breaker has not tripped out but the pump does not run.	a) Check 1 a), b), d), e) and f).	
5. Pump performance not constant.	a) Pump inlet pressure is too low (cavitation).	Check the suction conditions.
	b) Suction pipe/pump partly blocked by impurities.	Clean the suction pipe/pump.
	c) Pump draws in air.	Check the suction conditions.
6. Pump runs but gives no water.	a) Suction pipe/pump blocked by impurities.	Clean the suction pipe/pump.
	b) Foot or non-return valve blocked in closed position.	Repair the foot or non-return valve.
	c) Leakage in suction pipe.	Repair the suction pipe.
	d) Air in suction pipe or pump.	Check the suction conditions.
	e) Motor runs in the wrong direction of rotation.	Change the direction of rotation of the motor.
7. Pump runs backwards when switched off.	a) Leakage in suction pipe.	Repair the suction pipe.
	b) Foot or non-return valve defective.	Repair the foot or non-return valve.
8. Leakage in shaft seal.	a) Shaft seal is defective.	Replace the shaft seal.
9. Noise.	a) Cavitation.	Check the suction conditions.
	b) Pump does not rotate freely (frictional resistance) because of incorrect pump shaft position.	Adjust the pump shaft. Follow the procedure in fig. F, G or H at the end of these instructions.
	c) Frequency converter operation.	See section *7.1 Frequency converter operation*.

13. Disposal

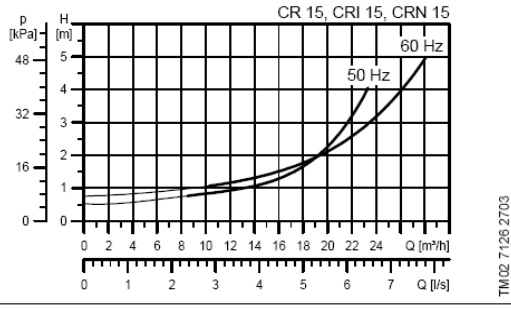
This product or parts of it must be disposed of in an environmentally sound way:

1. Use the public or private waste collection service.
2. If this is not possible, contact the nearest Grundfos company or service workshop.

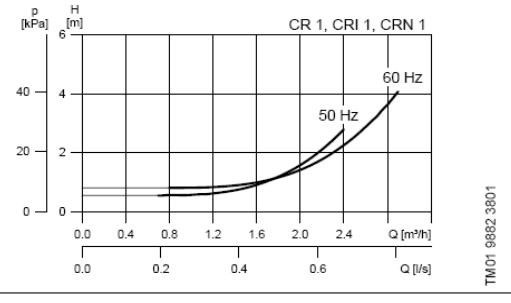
NPSH



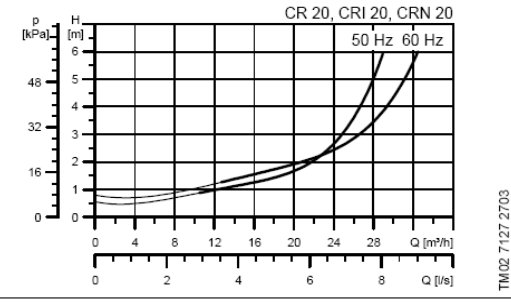
TM02 7387 3403



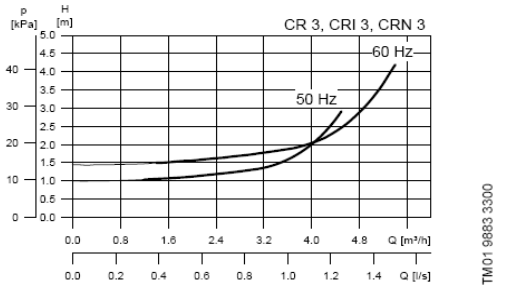
TM02 7126 2703



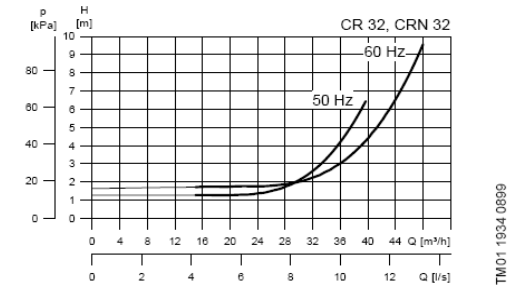
TM01 9882 3801



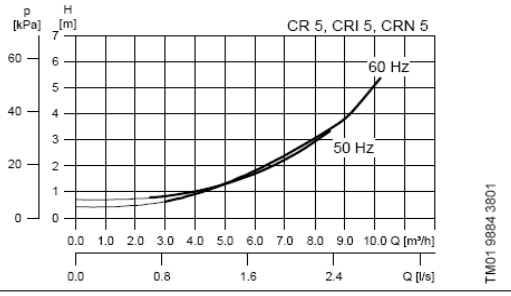
TM02 7127 2703



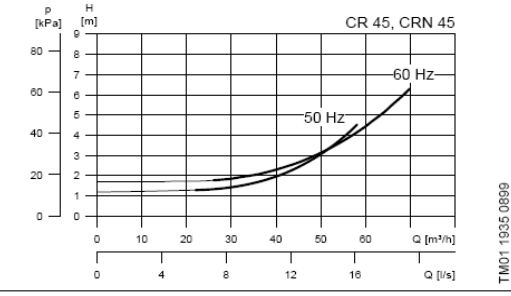
TM01 9883 3300



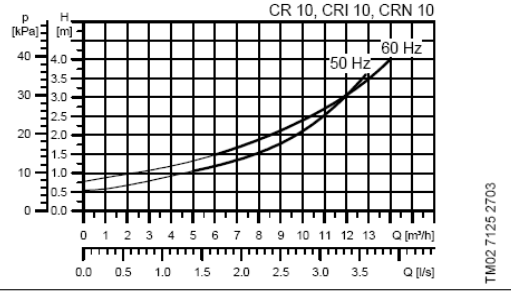
TM01 1934 0899



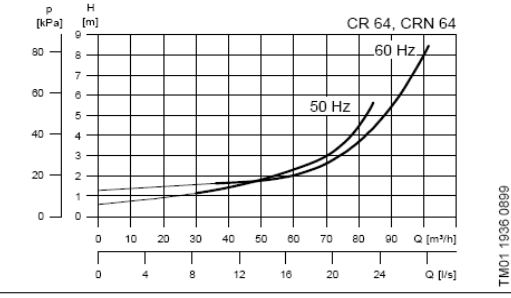
TM01 9884 3801



TM01 1935 0899



TM02 7125 2703



TM01 1936 0899

Fig. A

Maximum permissible operating pressure / liquid temperature range:

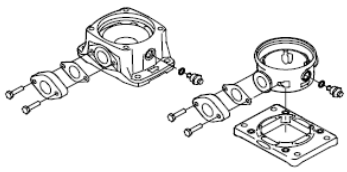
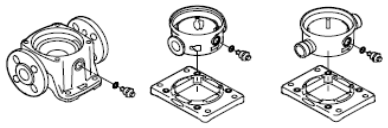
			Oval		PJE - CLAMP - CA - UNION DIN - FGJ	
						
			Operating pressure	**Liquid temperature range**	**Operating pressure**	**Liquid temperature range**
50 Hz	CR, CRI, CRN 1s		16 bar	–20 °C to +120 °C	25 bar	–20 °C to +120 °C
	CR(E), CRI(E), CRN(E) 1		16 bar	–20 °C to +120 °C	25 bar	–20 °C to +120 °C
	CR(E), CRI(E), CRN(E) 3		16 bar	–20 °C to +120 °C	25 bar	–20 °C to +120 °C
	CR(E), CRI(E), CRN(E) 5		16 bar	–20 °C to +120 °C	25 bar	–20 °C to +120 °C
	CR(E), CRI(E) 10-1	→ 10-16	16 bar	–20 °C to +120 °C	16 bar	–20 °C to +120 °C
	CR(E), CRI(E) 10-17	→ 10-22	-	-	25 bar	–20 °C to +120 °C
	CRN(E) 10		-	-	25 bar	–20 °C to +120 °C
	CR(E), CRI(E) 15-1	→ 15-7	10 bar	–20 °C to +120 °C	-	-
	CR(E), CRI(E) 15-1	→ 15-10	-	-	16 bar	–20 °C to +120 °C
	CR(E), CRI(E) 15-12	→ 15-17	-	-	25 bar	–20 °C to +120 °C
	CRN(E) 15		-	-	25 bar	–20 °C to +120 °C
	CR(E), CRI(E) 20-1	→ 20-7	10 bar	–20 °C to +120 °C	-	-
	CR(E), CRI(E) 20-1	→ 20-10	-	-	16 bar	–20 °C to +120 °C
	CR(E), CRI(E) 20-12	→ 20-17	-	-	25 bar	–20 °C to +120 °C
	CRN(E) 20		-	-	25 bar	–20 °C to +120 °C
	CR(E), CRN(E) 32-1-1	→ 32-7	-	-	16 bar	–30 °C to +120 °C
	CR(E), CRN(E) 32-8-2	→ 32-14	-	-	30 bar	–30 °C to +120 °C
	CR(E), CRN(E) 45-1-1	→ 45-5	-	-	16 bar	–30 °C to +120 °C
	CR(E), CRN(E) 45-6-2	→ 45-11	-	-	30 bar	–30 °C to +120 °C
	CR, CRN 45-12-2	→ 45-13-2	-	-	33 bar	–30 °C to +120 °C
	CR(E), CRN(E) 64-1-1	→ 64-5	-	-	16 bar	–30 °C to +120 °C
	CR, CRN 64-6-2	→ 64-8-1	-	-	30 bar	–30 °C to +120 °C
	CR(E), CRN(E) 90-1-1	→ 90-4	-	-	16 bar	–30 °C to +120 °C
	CR, CRN 90-5-2	→ 90-6	-	-	30 bar	–30 °C to +120 °C
	CR, CRN 120		-	-	30 bar	–30 °C to +120 °C
	CR, CRN 150		-	-	30 bar	–30 °C to +120 °C
60 Hz	CR, CRI, CRN 1s		16 bar	–20 °C to +120 °C	25 bar	–20 °C to +120 °C
	CR, CRI, CRN 1		16 bar	–20 °C to +120 °C	25 bar	–20 °C to +120 °C
	CR, CRI, CRN 3		16 bar	–20 °C to +120 °C	25 bar	–20 °C to +120 °C
	CR, CRI, CRN 5		16 bar	–20 °C to +120 °C	25 bar	–20 °C to +120 °C
	CR, CRI, CRN 10-1	→ 10-10	16 bar	–20 °C to +120 °C	16 bar	–20 °C to +120 °C
	CR, CRI, CRN 10-12	→ 10-17			25 bar	–20 °C to +120 °C
	CR 15-1	→ 15-5	10 bar	–20 °C to +120 °C		
	CR, CRI, CRN 15-1	→ 15-8			16 bar	–20 °C to +120 °C
	CR, CRI, CRN 15-9	→ 15-12			25 bar	–20 °C to +120 °C
	CR 20-1	→ 20-5	10 bar	–20 °C to +120 °C		
	CR, CRI, CRN 20-1	→ 20-7			16 bar	–20 °C to +120 °C
	CR, CRI, CRN 20-8	→ 20-10			25 bar	–20 °C to +120 °C
	CR, CRN 32-1-1	→ 32-5			16 bar	–30 °C to +120 °C
	CR, CRN 32-6-2	→ 32-10-2			30 bar	–30 °C to +120 °C
	CR, CRN 45-1-1	→ 45-4			16 bar	–30 °C to +120 °C
	CR, CRN 45-5-2	→ 45-7			30 bar	–30 °C to +120 °C
	CR, CRN 64-1-1	→ 64-3			16 bar	–30 °C to +120 °C
	CR, CRN 64-4-2	→ 64-5-2			30 bar	–30 °C to +120 °C
	CR, CRN 90-1-1	→ 90-3			16 bar	–30 °C to +120 °C
	CR, CRN 90-4-2				30 bar	–30 °C to +120 °C
	CR, CRN 120				30 bar	–30 °C to +120 °C
	CR, CRN 150				30 bar	–30 °C to +120 °C

Fig. B

Maximum inlet pressure for CR, CRI and CRN:

50 Hz		60 Hz	
CR, CRI, CRN 1s			
CR, CRI, CRN 1s-2 → CR, CRI, CRN 1s-36	10 bar	CR, CRI, CRN 1s-2 → CR, CRI, CRN 1s-27	10 bar
CR, CRI, CRN 1			
CR, CRI, CRN 1-2 → CR, CRI, CRN 1-36	10 bar	CR, CRI, CRN 1-2 → CR, CRI, CRN 1-25 CR, CRI, CRN 1-27	10 bar 15 bar
CR, CRI, CRN 3			
CR, CRI, CRN 3-2 → CR, CRI, CRN 3-29 CR, CRI, CRN 3-31 → CR, CRI, CRN 3-36	10 bar 15 bar	CR, CRI, CRN 3-2 → CR, CRI, CRN 3-15 CR, CRI, CRN 3-17 → CR, CRI, CRN 3-25	10 bar 15 bar
CR, CRI, CRN 5			
CR, CRI, CRN 5-2 → CR, CRI, CRN 5-16 CR, CRI, CRN 5-18 → CR, CRI, CRN 5-36	10 bar 15 bar	CR, CRI, CRN 5-2 → CR, CRI, CRN 5-9 CR, CRI, CRN 5-10 → CR, CRI, CRN 5-24	10 bar 15 bar
CR, CRI, CRN 10			
CR, CRI, CRN 10-1 → CR, CRI, CRN 10-6 CR, CRI, CRN 10-7 → CR, CRI, CRN 10-22	8 bar 10 bar	CR, CRI, CRN 10-1 → CR, CRI, CRN 10-5 CR, CRI, CRN 10-6 → CR, CRI, CRN 10-17	8 bar 10 bar
CR, CRI, CRN 15			
CR, CRI, CRN 15-1 → CR, CRI, CRN 15-3 CR, CRI, CRN 15-4 → CR, CRI, CRN 15-17	8 bar 10 bar	CR, CRI, CRN 15-1 → CR, CRI, CRN 15-2 CR, CRI, CRN 15-3 → CR, CRI, CRN 15-12	8 bar 10 bar
CR, CRI, CRN 20			
CR, CRI, CRN 20-1 → CR, CRI, CRN 20-3 CR, CRI, CRN 20-4 → CR, CRI, CRN 20-17	8 bar 10 bar	CR, CRI, CRN 20-1 CR, CRI, CRN 20-2 → CR, CRI, CRN 20-10	8 bar 10 bar
CR, CRN 32			
CR, CRN 32-1-1 → CR, CRN 32-4 CR, CRN 32-5-2 → CR, CRN 32-10 CR, CRN 32-11-2 → CR, CRN 32-14	4 bar 10 bar 15 bar	CR, CRN 32-1-1 → CR, CRN 32-2 CR, CRN 32-3-2 → CR, CRN 32-6 CR, CRN 32-7-2 → CR, CRN 32-10-2	4 bar 10 bar 15 bar
CR, CRN 45			
CR, CRN 45-1-1 → CR, CRN 45-2 CR, CRN 45-3-2 → CR, CRN 45-5 CR, CRN 45-6-2 → CR, CRN 45-13-2	4 bar 10 bar 15 bar	CR, CRN 45-1-1 → CR, CRN 45-1 CR, CRN 45-2-2 → CR, CRN 45-3 CR, CRN 45-4-2 → CR, CRN 45-7	4 bar 10 bar 15 bar
CR, CRN 64			
CR, CRN 64-1-1 → CR, CRN 64-2-2 CR, CRN 64-2-1 → CR, CRN 64-4-2 CR, CRN 64-4-1 → CR, CRN 64-8-1	4 bar 10 bar 15 bar	CR, CRN 64-1-1 CR, CRN 64-1 → CR, CRN 64-2-1 CR, CRN 64-2 → CR, CRN 64-5-2	4 bar 10 bar 15 bar
CR, CRN 90			
CR, CRN 90-1-1 → CR, CRN 90-1 CR, CRN 90-2-2 → CR, CRN 90-3-2 CR, CRN 90-3 → CR, CRN 90-6	4 bar 10 bar 15 bar	CR, CRN 90-1-1 → CR, CRN 90-2-2 CR, CRN 90-2-1 → CR, CRN 90-4-2	10 bar 15 bar
CR, CRN 120			
CR, CRN 120-1 → CR, CRN 120-2-1 CR, CRN 120-2 → CR, CRN 120-5-1 CR, CRN 120-6-1 → CR, CRN 120-7	10 bar 15 bar 20 bar	CR, CRN 120-1 CR, CRN 120-2-2 → CR, CRN 120-3-1 CR, CRN 120-4-2 → CR, CRN 120-5-1	10 bar 15 bar 20 bar
CR, CRN 150			
CR, CRN 150-1-1 → CR, CRN 150-1 CR, CRN 150-2-1 → CR, CRN 150-4-1 CR, CRN 150-5-2 → CR, CRN 150-6	10 bar 15 bar 20 bar	CR, CRN 150-1-1 CR, CRN 150-1 → CR, CRN 150-2 CR, CRN 150-3-2 → CR, CRN 150-4-1	10 bar 15 bar 20 bar

Fig. C

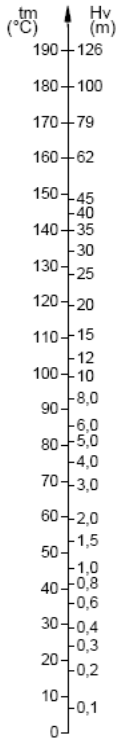
Pump Type	Oval				PJE				CLAMP - FlexiClamp				UNION				DIN - FGJ							
	TM00 2251 3393				TM00 2252 3393				TM00 2253 3393				TM00 2254 3393				TM00 2255 3393				TM00 2256 3393			
	L [mm]	H [mm]	D [Rp]		L [mm]	H [mm]	D [mm]		L [mm]	H [mm]	D [mm]		L [mm]	H [mm]	D [G]		L [mm]	H [mm]	DN		L_1 [mm]	L_2 [mm]	B_1 [mm]	B_2 [mm]	ø [mm]
CR 1s	160	50	1														250	75	25/32		100	145	180	220	13
CRI, CRN 1s					210	50	42.2		162	50	30		228	50	2		250	75	25/32		100	150	180	220	13
CR 1	160	50	1														250	75	25/32		100	145	180	220	13
CRI, CRN 1					210	50	42.2		162	50	30		228	50	2		250	75	25/32		100	150	180	220	13
CR 3	160	50	1														250	75	25/32		100	145	180	220	13
CRI, CRN 3					210	50	42.2		162	50	30		228	50	2		250	75	25/32		100	150	180	220	13
CR 5	160	50	1¼														250	75	25/32		100	145	180	220	13
CRI, CRN 5					210	50	42.2		162	50	30		228	50	2		250	75	25/32		100	150	180	220	13
CR 10	200	80	1½														280	80	40		130	178	215	256	13.5
CRI, CRN 10					261	80	60.1		202	80	50						280	80	40		130	200	215	248	13
CR 15	200	80	2														300	90	50		130	176	215	256	13.5
CRI, CRN 15					261	90	60.1		202	90	50						300	90	50		130	200	215	248	13
CR 20	200	80	2														300	90	50		130	176	215	256	13.5
CRI, CRN 20					261	90	60.1		202	90	50						300	90	50		130	200	215	248	13
CR 32																	320	105	65		170	223	240	298	14
CRN 32																	320	105	65		170	226	240	298	14
CR 45																	365	140	80		190	248	266	331	14
CRN 45																	365	140	80		190	251	266	331	14
CR 64																	365	140	100		190	248	266	331	14
CRN 64																	365	140	100		190	251	266	331	14
CR 90																	380	140	100		199	261	280	348	14
CRN 90																	380	140	100		199	261	280	348	14
CR 120																	380	180	125		275	344	380	472	18
CRN 120																	380	180	125		275	344	380	472	18
CR 150																	380	180	125		275	344	380	472	18
CRN 150																	380	180	125		275	344	380	472	18

Fig. D

Airborne noise emitted by pumps with motors fitted by Grundfos:

Motor [kW]	50 Hz	60 Hz
	$\bar{L}_{pA}$ [dB(A)]	$\bar{L}_{pA}$ [dB(A)]
0.37	53	58
0.55	53	56
0.75	53	57
1.1	55	60
1.5	59	65
2.2	61	66
3.0	58	63
4.0	65	69
5.5	63	68
7.5	68	73
11	70	75
15	63	67
18.5	63	67
22	67	71
30	71	75
37	71	75
45	71	75
55	71	75
75	73	77

Fig. E

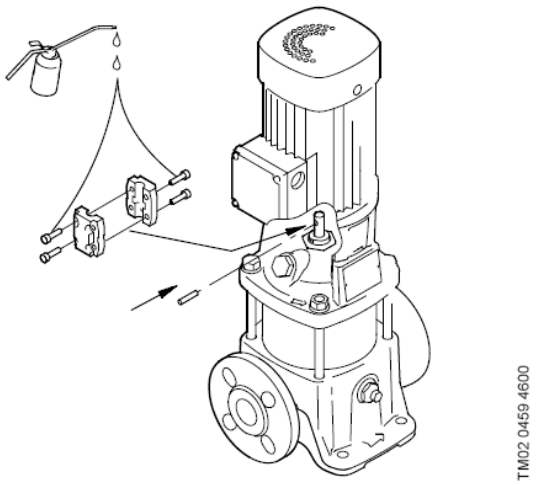


TM02 7445 3503

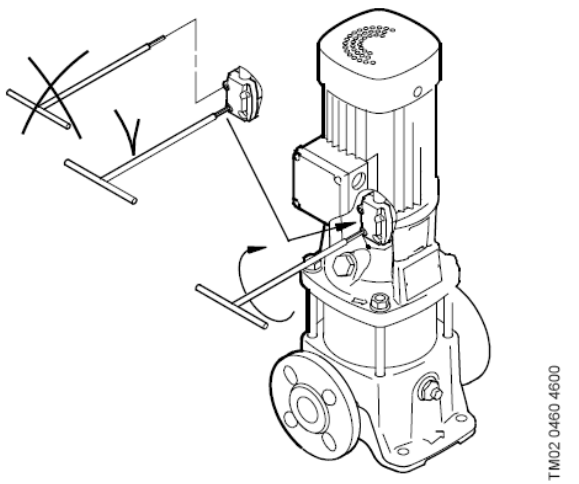
CR, CRI, CRN 1s, 1, 3 and 5

Fig. F

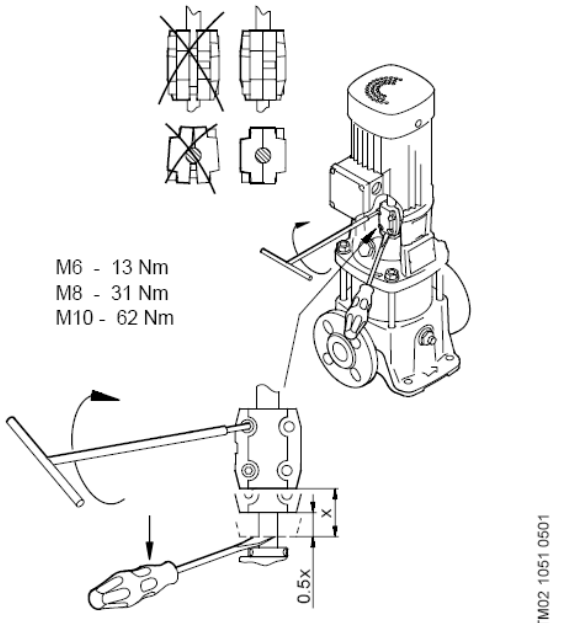
A



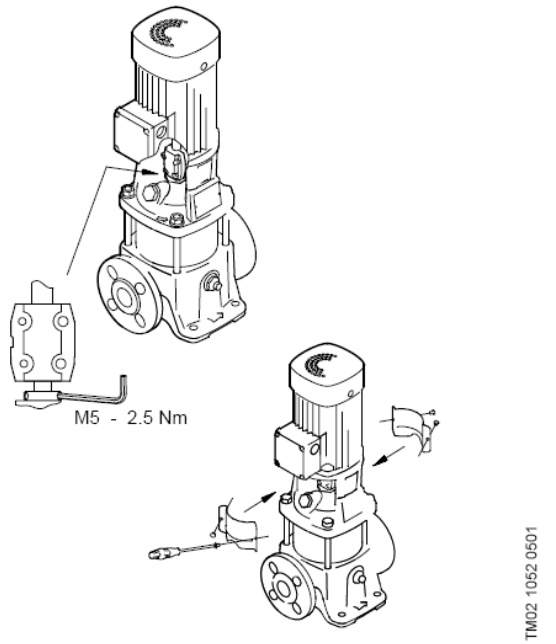
B



C



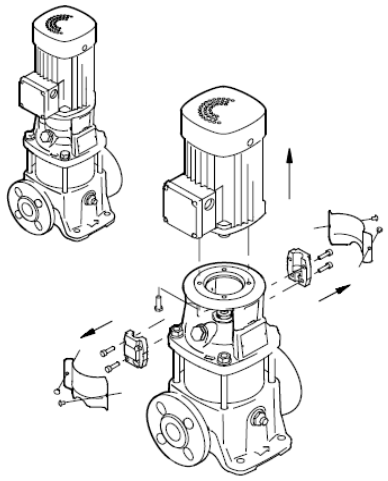
D



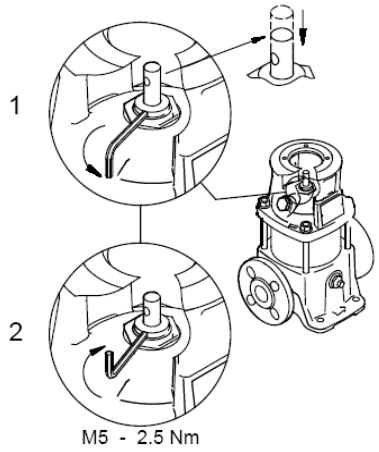
CR, CRI, CRN 10, 15 and 20

Fig. G

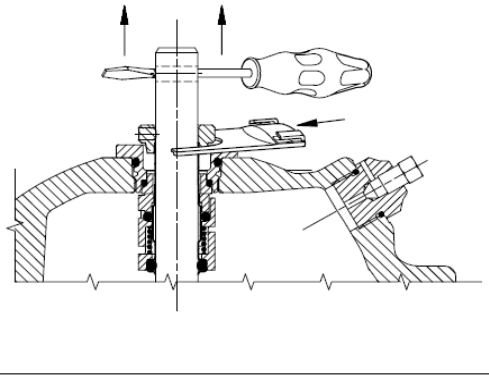
A



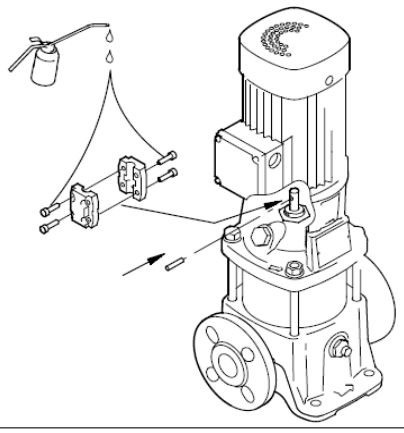
B



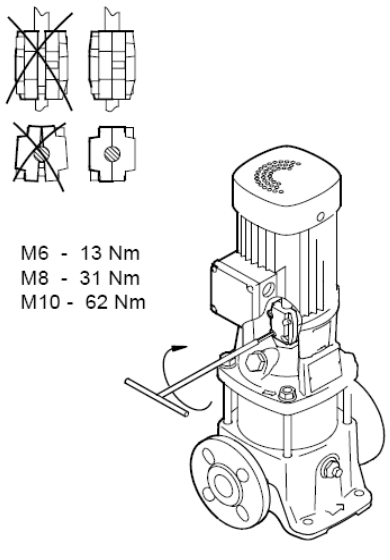
C



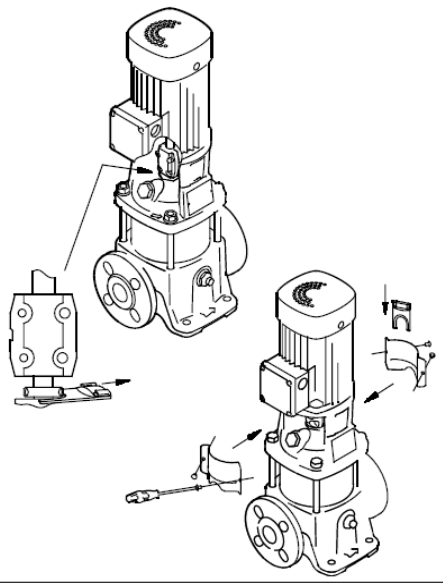
D



E



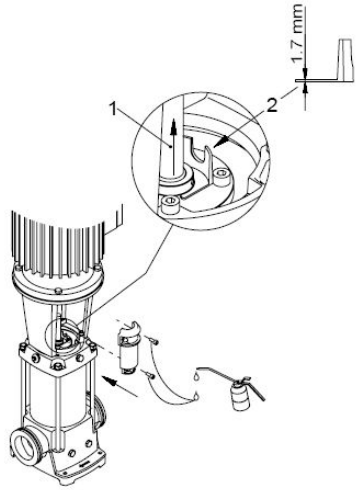
F



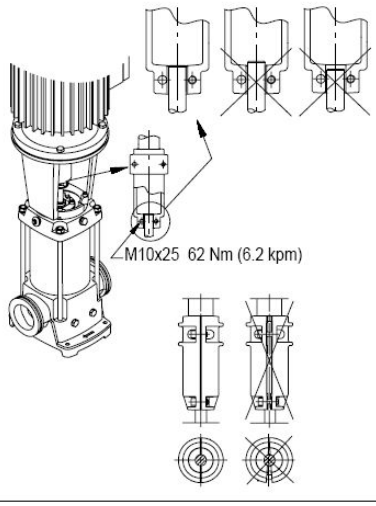
CR, CRN 32, 45, 64, 90

Fig. H

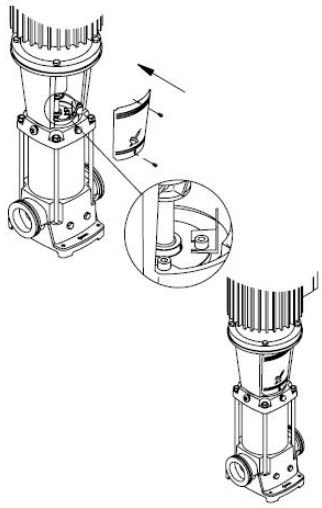
A



B

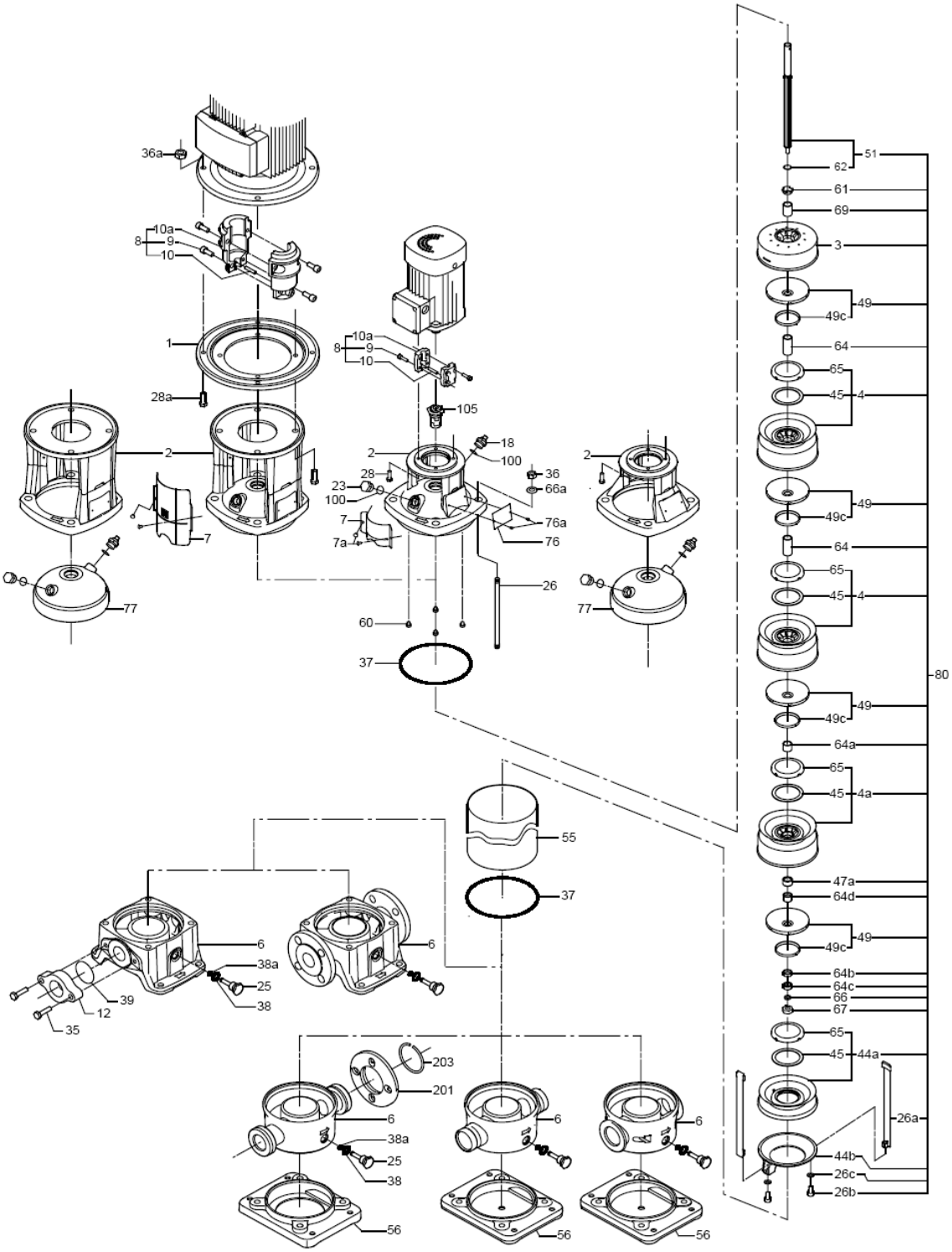


C



Pos. no.	Description					
	GB	D	F	I	E	P
1	Adapter flange	Zwischenflansch	Bride d'adaptation	Flangie adattatrici	Brida acoplamiento	Flange do adaptador
1a	Motor stool	Laterne	Lanterne moteur	Lanterna del motore	Acoplamiento	Adaptador do motor
2	Pump head	Kopfstück	Tête de pompe	Testa pompa	Cabezal bomba	Cabeça da bomba
3	Chamber, top	Oberste Kammer	Chambre supérieure	Camera superiore	Cámara superior	Câmara superior
3a	Chamber without neck ring	Kammer ohne Spaltring	Chambre sans bague d'étanchéité	Camera senza collarino	Cámara sin anillo de junta	Câmara sem aro
4	Chamber complete	Kammer komplett	Chambre complète	Camera completa	Cámara completa	Câmara completa
4a	Chamber with bearing ring	Kammer mit Lagerring	Chambre avec bague de palier	Camera con cuscinetto	Cámara con anillo cojinete	Câmara com casquilho
5a	Chamber complete	Kammer komplett	Chambre complète	Camera completa	Cámara completa	Câmara completa
6	Base	Fußstück	Pied de pompe	Base	Base	Base
6a	Stop pin	Sperrzapfen	Goupille d'arrêt	Molla di arresto	Pasador tope	Pino
6d	Guide plate for base	Führungsplatte für Fußstück	Plaque pour pied de pompe	Guida per basamento	Placa guía para base	Prato-guia da base
6g	Bearing ring	Lagerring	Joint de palier	Cuscinetto	Anillo cojinete	Casquilho
7	Coupling guard	Schutzschirm	Protège-accouplement	Giunti di protezione	Protector acoplamiento	Protecção do acoplamento
7a	Screw	Schraube	Vis	Vite	Tornillo	Parafuso
8	Coupling complete	Kupplung komplett	Accouplement complet	Giunto completo	Acoplamiento completo	Acoplamento completo
9	Screw	Schraube	Vis	Vite	Tornillo	Parafuso
10	Shaft pin	Zylinderstift	Goupille cylindrique	Molla albero	Pasador eje	Pino do veio
18	Air vent screw	Entlüftungsschraube	Vis de purge	Vite della ventola	Tornillo purga aire	Parafuso de purga
19	Pipe plug	Stopfen	Bouchon	Tappo	Tapón tubería	Bujão da tubagem
21	Plug	Stopfen	Bouchon	Tappo	Tapón	Bujão da tubagem
23	Plug	Stopfen	Bouchon	Tappo	Tapón	Bujão da tubagem
25	Drain plug	Entleerungsstopfen	Bouchon de vidange	Tappo spurgo	Tapón purga	Bujão de drenagem
26	Staybolt	Stehbolzen	Goujon	Tiranti	Espárrago sujeción	Perno
26a	Strap	Spannband	Tirant d'assemblage	Tirante	Tirante	Tirante
26b	Screw	Schraube	Vis	Vite	Tornillo	Parafuso
26c	Washer	Unterlegscheibe	Rondelle	Rondella	Arandela	Anilha
28	Screw	Schraube	Vis	Vite	Tornillo	Parafuso
28a	Screw	Schraube	Vis	Vite	Tornillo	Parafuso
31	Screw	Schraube	Vis	Vite	Tornillo	Parafuso
32a	Washer	Unterlegscheibe	Rondelle	Rondella	Arandela	Anilha
35	Screw	Schraube	Vis	Vite	Tornillo	Parafuso
36	Nut	Mutter	Ecrou	Dado	Tuerca	Fêmea
36a	Nut	Mutter	Ecrou	Dado	Tuerca	Fêmea
37	O-ring/gasket	O-Ring/Dichtung	Joint/bague	O ring/guranizione	Junta tórica/junta	O-ring/junta
38	O-ring	O-Ring	Joint	O ring	Junta tórica	O-ring
38a	O-ring	O-Ring	Joint	O ring	Junta tórica	O-ring
44	Inlet part complete	Einlaufteil komplett	Partie aspiration complète	Parte interna completa	Parte aspiración completa	Aspiração completa
45	Neck ring	Spaltring	Bague d'étanchéité	Collarino	Anillo tope	Aro
45a	Neck ring complete	Spaltring komplett	Bague d'étanchéité complète	Colalrino completo	Anillo tope completo	Aro completo
47	Bearing ring	Lagerring	Bague de palier	Cuscinetto	Anillo cojinete	Casquilho
47a	Bearing with driver	Lager mit Mitnehmer	Bague de palier avec driver	Cuscinetto con guida	Cojinete con engranaje	Casquilho com guia
47b	Bearing ring, rotating	Lagerring, rotierend	Bague de palier tournante	Cuscinetto rotante	Anillo cojinete giratorio	Casquilho rotativo
47c	Bush	Buchse	Douille	Boccola	Manguito	Manga
47d	Retaining ring	Haltering	Bague de blocage	Anello di arresto	Anillo cierre	Retentor
47e	Retaining ring	Haltering	Bague de blocage	Anello di arresto	Anillo cierre	Retentor
48	Split cone nut	Mutter für Klemmbuchse	Ecrou de cône de serrage	Dado bussola conica	Tuerca casquillo cónico	Fêmea cónica
49	Impeller	Laufrad	Roue	Girante	Impulsor	Impulsor
49a	Impeller	Laufrad	Roue	Girante	Impulsor	Impulsor
49b	Split cone	Klemmbuchse	Cône de serrage	Bussola conica	Casquillo cónico	Casquilho cónico
49c	Wear ring	Verschleißring	Bague d'usure	Anello di usura	Anillo desgaste	Aro de desgaste
51	Pump shaft	Pumpenwelle	Arbre de pompe	Albero pompa	Eje bomba	Veio
55	Outer sleeve	Mantel	Chemise	Camicia esterna	Camisa exterior	Camisa exterior
56	Base plate	Grundplatte	Plaque de base	Basamento	Placa base	Base
56a	Base plate	Grundplatte	Plaque de base	Basamento	Placa base	Base
56c	Screw	Schraube	Vis	Vite	Tornillo	Parafuso
56d	Washer	Unterlegscheibe	Rondelle	Rondella	Arandela	Anilha
57	O-ring	O-Ring	Joint	O ring	Junta tórica	O-ring
58	Seal carrier	Halter für Wellen-abdichtung	Toc d'entraînement	Porta tenuta	Soporte cierre	Suporte do empanque
58a	Screw	Schraube	Vis	Vite	Tornillo	Parafuso
60	Spring	Feder	Ressort	Molla	Muelle	Mola
61	Seal driver	Mitnehmer	Toc d'entrainement	Guida guarnizione	Guía de cierre	Batente do espaçador
62	Stop ring	Stopring	Bague d'arrêt	Anello di arresto	anillo de tope	Mola de encosto
64	Spacing pipe	Distanzhülse	Douille d'entretoise	Tubo distanziale	Casquillo espaciador	Espaçador
64a	Spacing pipe	Distanzhülse	Douille d'entretoise	Tubo distanziale	Casquillo espaciador	Espaçador
64c	Clamp, splined	Spannstück, Vielnut	Pièce de serrage	Giunto	Casquillo ranurado	Casquilho escatelado
64d	Spacing pipe	Distanzhülse	Douille entretoise	Tubo distanziale	Casquillo espaciador	Espaçador
65	Neck ring retainer	Halter für Spaltring	Support pour bague d'étanchéité	Fermo per collarino	Retén anillo junta	Retentor do aro
66	Washer	Unterlegscheibe	Rondelle	Rondella	Arandela	Anilha
66a	Washer	Unterlegscheibe	Rondelle	Rondella	Arandela	Anilha
66b	Lock washer	Sicherungsblech	Rondelle de blocage	Blocco per rondella	Arandela cierre	Anilha retentora
67	Nut/Screw	Mutter/Schraube	Ecrou/Vis	Dado/Vite	Tuerca/Tornillo	Fêmea/Parafuso
69	Spacing pipe	Distanzhülse	Douille entretoise	Tubo distanziale	Casquillo espaciador	Espaçador
76	Nameplate set	Schildersatz	Plaque d'identification	Targhetta	Juego placa identificación	Chapa de identificação
100	O-ring	O-Ring	Joint	O ring	Junta tórica	O-ring
105	Shaft seal	Wellenabdichtung	Garniture mécanique	Tenuta meccanica	Cierre	Empanque mecânico
201	Flange	Flansch	Bride	Flangia	Brida	Flange
203	Retaining ring	Haltering	Bague de blocage	Blocca flangia	Anillo cierre	Anel retentor

CR, CRI, CRN 10, 15 and 20



11.11.1 Motor of pump

Id.-Nr. VEM 68 238 01/12.05

VEM motors GmbH

VEM motors GmbH
Carl-Friedrich-Gauß-Str. 1
D 38855 Wernigerode
Postfach 101252
D 38842 Wernigerode
Tel.: ++49(0)3943/680
Fax: ++49(0)3943/682440
www.vem-group.com

VEM motors Thurm GmbH

VEM motors Thurm GmbH
Äußere Dresdener Str. 35
D 08060 Zwickau
Postfach 200329
D 08003 Zwickau
Tel.: ++49(0)375427 0
Fax: ++49(0)375427383

Montage-, Bedienungs- und Wartungsanleitung
Drehstrom-Asynchronmotoren mit Käfigläufer
und mit Schleifringläufer, Normalausführung — deutsch

Installation, operating and maintenance instructions
Three phase asynchronous motors with squirrel cage rotor
and slip ring rotor, standard design — englisch

Instructions de montage, d'utilisation et d'entretien
Moteurs asynchrones triphasés rotor à cage
et rotor à bagues, version standard — französisch

Instrucciones de montaje, de servicio y de mantenimiento
Motores asíncronos trifásicos con rotor de jaula
y de anillos, ejecución normal — spanisch

Instrução de montagem, de serviço e de manutenção
Motores trifásicos assíncronos com rotor de gaiola e
com rotor com anéis colectores, modelo normal — portugiesisch

Istruzioni per il montaggio, l'uso e la manutenzione
Motori asincroni trifase con rotore a gabbia
e con rotore a collettore, versione standard — italienisch

Montage-, bedienings- en onderhoudshandleiding
Asynchrone draaistroommotoren met kortsluitanker
en met sleepringanker, normale uitvoering — niederländisch

Installation, Operating and Maintenance Instructions
Three Phase Asynchronous Motors with Squirrel Cage Rotor, Standard Design

1. General
To prevent damage to motors and the driven equipment the procedures laid down in the Operating and Maintenance Instructions must be followed. Especially to avoid risk of injury, the separately enclosed Safety Regulations must be adhered to strictly.
Since for reasons of clarity the Operating and Maintenance Instructions cannot contain specific information with regard to all conceivable special applications and areas with special requirements, the user himself has to make appropriate protection arrangements during the installation process.

2. Description
The motors have been manufactured in accordance with IEC 34-1, DIN EN 60034-1, DIN VDE 0530 and other appropriate DIN standards. Motors can also be supplied to comply with special regulations (e.g. Classification Regulations, Regulations for Explosion Protection). Separate additional instructions apply for the following motor versions:
Roller table motors, motors in explosion protected design
The details on the relevant Order Confirmation constitute the scope of supply.

3. Degree of Protection
The degree of protection of the motors is indicated on their rating plate. The degree of protection of additional devices fitted to the motor can be different than the degree of protection of the motor. This needs to be taken into consideration during the installation of the motors. If motors are installed in the open (Degree of Protection ≥ IP 44), they should be protected against direct effects of the climate (freezing of the fan due to direct fall of rain, snow and formation of ice).

4. Type of Construction
The type of construction of the motors is indicated on the rating plate. The motors can be used in different types of construction only with permission of the manufacturer and if necessary after modification carried out in accordance with the manufacturer's instructions. Especially with types of construction with vertical shaft the user has to ensure that foreign particles cannot fall into the fan cowl.

5. Transport & Storage
If possible the motors should only be stored in closed and dry rooms. Outdoor storage under cover is permitted for a short time only and requires adequate protection against all harmful effects of the climate. The motors also have to be protected against mechanical damage. Never transport or store the motors resting on their fan cowls. The eye bolts of the motors together with appropriate lifting tackle must be used for transport. The eye bolts are intended for the lifting of the motors only, without any additional parts such as bed plates, gears etc. If eye bolts are removed after installation, the tapped holes must be blanked off permanently according to the Protection Standard.

6. Removal of the Transport Safety Device
On motors with transport safety device (roller bearing), the hexagon head screw provided for the fastening of the transport safety device is to be loosened and taken off together with the transport safety device. Subsequently the bearing cover bolt packed in a bag inside the terminal box is to be screwed into the bearing cover. If it is necessary for the motor type the bag will also contain a lock washer that is to be placed onto the bearing end shield bolt before screwing it into the bearing cover.

7. Installation and Fitting

Since during normal operation of electric motors, temperatures in excess of 100 °C can occur on their surface, any contact with them must be prevented if the motors are installed in accessible areas. Because of this temperature sensitive parts must never be fitted to them or have contact with them. In types of construction IM B14 and IM B34 it must be ensured that the maximum usable screw depth specified in the catalogue is not exceeded, otherwise the winding will be damaged.
Vent holes must be kept free and the minimum distances stated in the dimensional drawings must be maintained so that the flow of cooling air is not obstructed. Care must be taken that the discharged warmed up cooling medium is not sucked up again.
The key in the shaft end is secured by the shaft protective sleeve for transport and storage only. Because of the danger that the key may be thrown aside, a start-up or a trial run with the key protected by the shaft sleeve only is strictly forbidden.
Transmission components (such as couplings, pinions or belt pulleys) should be drawn onto the shaft by means of pull-on devices or by heating-up the part to be drawn onto the shaft. For the purpose of drawing the transmission components onto the shaft, the shaft ends are provided with tapped centering holes according to DIN 332 Part 2. Transmission components must never be driven onto the shaft using hammer blows because the shaft, the bearings and other components of the motor could be damaged.
All components that are to be fitted to the shaft end must be balanced dynamically according to the balancing system of the motor (full or half key). The rotors of the motor are balanced with half key; this is indicated by letter H after the serial number on the rating plate. Motors with letter F after the serial number are balanced with full key. If possible the motors are to be installed in such a way that they are free from vibrations. With precision balanced motors special instructions are to be followed. When the installation is completed the user must ensure protection of movable parts and safety of operation.
Direct coupling to the driven machine requires a particularly accurate alignment. The shafts of both machines must be in alignment. The shaft height is to be adjusted to that of the driven machine using appropriate shims.
Belt drives put a lot of stress on the motor because of relatively high radial forces. When dimensioning belt drives, apart from the instructions and calculation programmes issued by the manufacturers of the belts, it must be ensured that the radial force permissible at the shaft end of the motor as stated in our data is never exceeded by the pull and pre-tensioning of the belt. When pre-tensioning the belt during installation the instructions of the belt manufacturers must be strictly adhered to.

The threaded holes of the flange types listed in the table are through holes (type IMB14, IMB34).
To avoid damage to the winding overhang of the motor winding, **observe the maximum permissible tap depths in conformity with the following table**.

Flange type to DIN 42948	Flange type to DIN EN 50347	Tap depth (mm)
C80	FT65	8
C90	FT75	8
C105	FT85	8.5
C120	FT100	8.5
C140	FT115	10
C160	FT130	10
C200	FT165	12
C250	FT215	13

If a motor of type IMB34 without flanged attachments is used, the user has to take appropriate **measures** at the through holes **to maintain the specified degree of protection.**

8. Insulation Check & Replacement of Grease / Bearings

When the motor is first commissioned and especially after extended storage, the insulation resistance of the winding is to be measured to earth and between phases. The check must take place using the rated voltage, but at least 500 V. During and immediately after the measurements dangerous voltages are present at the terminals. Therefore never touch the terminals and follow the operating instructions of the insulation resistance meter closely! Depending on the rated voltage U_N, the following minimum values must be maintained with a winding temperature of 25 °C :

Rated Power P_N kW	Insulation Resistance referred to Rated Voltage kΩ/V
$1 < P_N \leq 10$	6.3
$10 < P_N \leq 100$	4
$100 < P_N$	2.5

If the minimum values are lower, the winding must be dried properly until the insulation resistance corresponds to the required value.
When the motor is commissioned after a prolonged period of storage inspect the bearing grease visually and replace it if hardening and other irregularities occur. If the motors are to be commissioned by the manufacturer after more than three years following their delivery then the bearing grease must always be replaced. With motors fitted with covered or sealed bearings the bearings must always be replaced with new bearings of the same type after a storage period of four years.

9. Commissioning

Please follow the Safety Regulations closely. All work is to be carried out only when there is no voltage on the motor. The installation must be carried out according to the valid regulations by qualified skilled personnel. Initially the mains conditions (voltage and frequency) must be compared with the data on the rating plate of the motor. The dimensions of the connecting cables must be adjusted in line with the rated currents of the motor.

The connection points of the motor are marked in accordance with DIN VDE 0530 Part 8. In Section 19 of these instructions the most common circuit diagrams for three phase motors in basic design are provided, according to which the connection will be implemented. For all other versions, the special circuit diagrams are glued to the inside of the terminal box cover or placed in the terminal box. An additional terminal box can be provided for the connection of auxiliary and protection devices (e.g. anti-condensation heaters); the same regulations apply as for the main terminal box.

Always start the motors with an over-current protection device that is set in accordance with the relevant nominal values of the motor (≈1,05 I_{nom}). Otherwise warranty claims with respect to damaged windings become void. Before the motor is connected for the first time it is recommended to check the insulation resistances between winding and earth and between phases (see Section 8). After prolonged storage it is absolutely essential that the insulation resistance is measured. Before coupling the motor to the driven machine, check the direction of rotation of the motor to prevent possible damage being caused to the driven machine. If the mains supply with the phase sequence L1, L2 and L3 is to be wired to the connection points U, V, W, the motor is rotating clockwise looking at the shaft end. The direction of rotation can be changed by swapping the connections between 2 phases. For the permissible tightening torques for the terminal board bolts refer to the table below:

Terminal board	Connecting Bolt Thread	Permissible Tightening Torque in Nm
16 A	M4	1.2 + 0.5
25 A	M5	2.5 ± 0.5
63 A	M6	4 ± 1
100 A	M8	7.5 ± 1.5
200 A	M10	12.5 ± 2.5
400 A	M12	20 ± 4
630 A	M16 / M20	30 ± 4 / 52 ± 4

Before closing the terminal box make absolutely sure that:

- the connection has been made in accordance with the wiring diagram
- all terminal box connections are tightened
- all minimum values of air paths are maintained (larger than 8 mm up to 500 V, larger than 10 mm up to 750 V, larger than 14 mm up to 1000 V)
- the interior of the terminal box is clean and free from foreign particles
- unused cable entries are blanked off and the threaded plugs with seals are tightened
- the seal in the terminal box cover is clean and tightly glued and all sealing surfaces are in the correct state to ensure that the relevant degree of protection is maintained.

Before starting up the motor check that all safety regulations are strictly adhered to, that the machine is correctly installed and aligned, that all fixing parts and earthing connections are tightened, that the auxiliary and additional devices are functionally and correctly connected and if a second shaft end is fitted that the key is secured against being thrown aside.

If possible the motor is to be connected without load. If the motor is running smoothly and without any abnormal noises, the load of the driven machine is to be applied onto the motor. When the motor is started up it is recommended to monitor the current consumption if the motor is loaded with its driven machine so that any possible overloads and asymmetries occurring in the mains can be recognised immediately. The starter must always be in the starting position during starting. With slip ring motors the correct running of the brushes must be monitored. They must be absolutely spark-free. Please always observe the Safety Regulations during operation of the motor and when switching it off.

If a motor in type of mounting IM B34 is used without flanged components, the user must take suitable measures at the though bore holes to maintain the respective degree of protection.

10. Maintenance

You are once again referred to the Safety Regulations, in particular to isolation, to securing against reconnection, to checking whether all components connected to a voltage source are in dead state. If it is necessary to disconnect the motor from the mains for maintenance work particular care must be taken to ensure that any possibly existing auxiliary circuits (e.g. anti-condensation heaters, forced ventilators, brakes) are also disconnected from the mains.

If the motor is to be dismantled during maintenance work, the sealing compound on the centering shoulders is to be removed. When re-assembling the motor these need to be re-sealed using a suitable motor sealing compound. Existing copper sealing washers must always be refitted.

11. Bearings and Lubrication

The anti-friction bearings of the motors in standard design are filled with anti-friction bearing grease in the factory (or with sealed bearings by the bearing manufacturer) according to DIN 51825 in compliance with the table below:

Type series	Lubricating grease according to DIN 51825	Lubricating Grease Base
All Squirrel Cage motors IEC/DIN 56 – 132T Progressive standard 56 - 100	Asonic GLY 32 or Multemp SRL	Lithium base
All Squirrel Cage motors IEC/DIN 132 – 355 and Progressive standard 112 – 315	KE2R-40	Polyurethane base
Forced Ventilated motors		
Brake motors		
Slip ring motors IEC/DIN and Progressive Standard		
Marine Motors for on board ship		

Under normal load and climatic conditions, the quality of grease guarantees an operation of the motor for approx. 10,000 service hours with two pole design and 20,000 service hours with multipole design. If not otherwise agreed the grease of anti-friction bearing must never be refilled during this period. However, the condition of the grease should be checked occasionally even before this time limit. The indicated number of service hours is only valid for operation at rated speed. If during operation of the motor via an inverter the nominal speed is exceeded then the regreasing period reduces approximately in the opposite ratio to the increase in the motor speed.

Regrease the bearings only after a thorough cleaning using suitable solvents. The same type of grease must be used. When replacing the grease only the equivalent types specified by the motor manufacturer can be used. Please bear in mind that the bearings should only be filled up to about 2/3 of their free space. A complete filling of the bearings and bearing covers with grease leads to increased bearing temperature and therefore to increased wear.

The regreasing of bearings with regreasing facility is carried out at the grease nipple when the motor is running using the grease quantity required for the respective motor. For the re-greasing intervals please refer to the table below:

Frame Size	Two pole design	Four and multipole design
112 to 280	2,000 hrs.	4,000 hrs.
315	2,000 hrs.	4,000 hrs.
355	2,000 hrs.	3,000 hrs.

The quantities of grease required for the re-greasing are stated in the below table (Please note that for the first re-greasing approx. twice the amount of grease is required because the grease lubrication pipes are still empty). The used grease is collected in the grease chamber of the external bearing cap. After approx. 5 re-greasings this old grease should be removed, e.g. as part of inspection work.

Series Progressive standard Frame Size	Overall length Number of poles	Quantity of grease in cm³ D-end	ND-end	Series IEC/DIN Frame Size	Overall length Number of poles	Quantity of grease in cm3 D-end	ND-end
112	all	10	10		LX2, M2	23	20
132	all	17	17	160	L4, 6, 8	23	20
160	all	23	20		M2	23	23
	2	23	23	180	M4, L6, 8	23	20
180	≥4	31	31		L4	23	23
	2	31	31		L2	-	-
200	≥4	35	31	200	LX2	31	31
225	2	35	35		L4, 6, 8 LX 6	31	23
	≥4	41	35		M2	31	31
250	2	41	41	225	M4, 6, 8 S4, 8	35	31
	≥4	52	41		M2	35	35
	2	52	52	250	M4, 6, 8	41	35
280	≥4	57	52		2	41	41
	S2	57	52	280	≥4	52	41
315	M2	57	57		2	52	52
VL	S4, 6, 8	64	52		≥4	57	52
	M4, 6, 8	78	57		MX2 VL	57	52

Series Progressive standard Frame Size	Overall length Number of poles	Quantity of grease in cm³ D-end	ND-end	Series IEC/DIN Frame Size	Overall length Number of poles	Quantity of grease in cm3 D-end	ND-end
355	2	57	57	315	MY2 VL	57	57
	4	90	57		MX4, 6, 8 VL	64	52
	6,8	90	57		MY4, 6, 8 VL	78	57

12. Slipring Contact System
The slipring contact system is to be inspected at regular intervals. It is advisable to check the slip rings 2 – 3 times immediately after commissioning, at intervals of approx. 50 operating hours. Subsequently regular maintenance is to be carried out at intervals that depend on the relevant operating conditions. A thin layer of patina should be formed on the surface of the slip rings. Generally such patina layer is formed after an operation of between 100 to 500 hours. If intensive scoring or burnt spots on the slip ring surface occur they must be removed immediately either by cleaning or if necessary by re-machining. If slight scoring appears it is not necessary to re-machine. The pressure of the carbon brushes must be checked. It should be between 18.5 kPa and 24 kPa. When replacing the brushes the same type of brush must always be used. New carbon brushes must be bedded-in. With box type brush holders care must be taken to ensure that the carbon brushes do not jam due to contamination. The carbon brushes wear naturally and the abrasion can amount to 3 - 5 mm per 1,000 hours of operation.

13. Draining of condensation water
On installation sites where formation of dew and thus occurrence of condensation water can be expected inside the motor, the accumulated condensation water has to be drained at regular intervals through the opening at the lowest point of the end shield. Subsequently the opening must be closed up again.

14. Cleaning
So that the effects of cooling air are not interfered with, all parts of the motor must be cleaned at regular intervals. In the majority of cases it is sufficient to clean the machine with compressed air that is free from water and oil. Especially the vent holes and the spaces between the ribs must be kept clean. The dust generated by natural wear and deposited in the interior of the motor or in the slip ring space must be removed at regular intervals. It is recommended to include the electric motors in the regular routine inspections of the driven machine.

15. Motors with Thermal Winding Protection
A continuity test of the thermistor sensor circuit using a test lamp, a hand generator and such like is strictly prohibited because this would destroy the sensors immediately. If it becomes necessary to verify the cold resistance of the sensor circuit (at approx. 20°C) then the measuring voltage must never exceed 2.5 V DC. It is recommended to carry out the measurement using a Wheatstone bridge with a 4.5 V DC supply voltage. The cold resistance of the sensor circuit must never exceed 810 Ohms; a measurement of the hot resistance is not necessary. With motors that are fitted with thermal winding protection, care must be taken that when the thermal winding protection responds and after the cooling down of the motor, no hazards can occur due to spurious automatic reconnection.

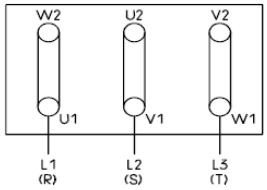
16. Warranty, Repair, Spare Parts
Unless expressly agreed otherwise only our contractual workshops are permitted to carry out repairs during the warranty period. Other repairs that may potentially be required can also be carried out by skilled personnel in these workshops. Details about Customer Service network can be obtained from the manufacturer on request. The spare parts are listed in Section 20 of these Operating & Maintenance Instructions. Maintenance carried out appropriately (provided it is as described in Section “Maintenance”) does not constitute a breach of warranty provisions. The contractual warranty liability on the part of the manufacturer is not prejudiced by this.

17. Electromagnetic Compatibility
The motors, as non-independently working unit, have been checked with regard to their conformity with the EMC Standards. It is the responsibility of the equipment operator to ensure by suitable measures that the apparatus or plant in their entirety comply with the relevant electromagnetic compatibility standards.

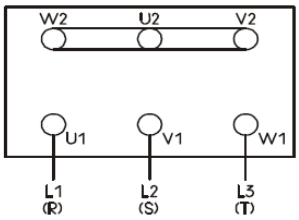
18. Trouble Shooting
General mechanical and electrical faults are to be rectified according to the Schedule in Section 21. All Safety Regulations must be strictly observed when rectifying faults.

19. Klemmenplattenschaltungen, Terminal board circuits, Connexions de la plaque à bornes, Klemplaatschakelingen, Forbindelsesdiagramm

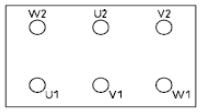
Käfigläufer mit einer Drehzahl:
Δ niedrige Spannung
single speed squirrel cage motors:
Δ low voltage
Rotor à cage à une vitesse de rotation:
Δ tension basse
Kortsluitanker met één toerental:
Δ lage spanning
Kortslutningsmotor med eet omdrejningstal:
Δ lav spænding



Käfigläufer mit einer Drehzahl:
Y hohe Spannung
single speed squirrel cage motors:
Y high voltage
Rotor à cage à une vitesse de rotation:
Y tension élevée
Kortsluitanker met één toerental:
Y hoge spanning
Kortslutningsmotor med eet omdrejningstal:
Y høj spænding

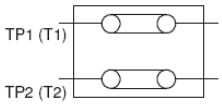


Sterndreieckschalteranschluß:
bei Sterndreieckschalter ohne Brücken anschluss nach Schema des Schalters
Star-delta switch connection:
For star-delta switch without bridges, connection as per to the switch scheme
Connexion du commutateur étoile-triangle:
Dans le cas des commutateurs étoile- triangle sans ponts, connexion suivant le schéma du commutateur
Sterdriehoek-aansluiting:
Bij sterdriehoekschakelaars zonder brug volgt aansluiting overeen-komstig het schema van de schakelaar
Stjernetrekantkoblingstilslutning:
ved tilslutning af Y/ Δ omskifter foretages tilslutning i henhold til omskifterens diagram



Motor mit thermischem Wicklungsschutz
Klemmenplattenschaltung wie oben
Motor with thermal winding protection Terminal board connection as above
Moteur avec protection thermique de l'enroulement
Connexion de la plaque à bornes comme ci-dessus
Motor met thermische wikkelingsbeveiliging
Klemmenbord aansluiting zoals boven
Motor med termisk viklingsbeskyttelse
Forbindelsesdiagram som ovenstående

vom Motor
from the motor
du moteur
van motor
fra motor



Anschluss des Auslösegerätes
connection of the tripping device
Connexion du déclencheur
Aansluting van uitschakel apparatuur
tilslutning af relæ

Der Anschluss erfolgt nach dem Anschlussschema des Auslösegerätes
The connection will be implemented as per the connecting diagram of the tripping device
La connexion se fait suivant le schéma de connexion du déclencheur
Aansluiting vindt plaats overeenkomstig het aansluitschema van de uitschakel apparatuur tilslutningen foretages i henhold til relæts diagram

---

Schleifringläufermotor
Δ niedrige Spannung
Slip ring motor
Δ low voltage
Moteur avec rotor à bagues
Δ tension basse
Sleepringankermotor
Δ lage spanning
Slæberingsmotor
Δ lav spænding

Y hohe Spannung

Y high voltage

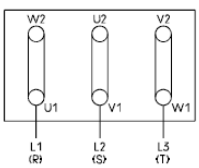
Y tension élevée

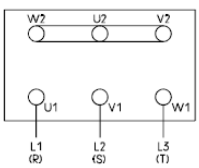
Y hoge spanning

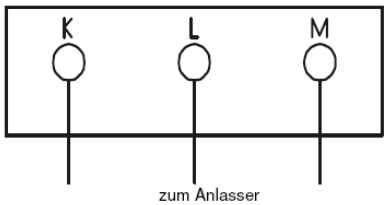
Y høj spænding

Läufer, Rotor
Läuferanschluss je nach Typ an Läuferklemmen oder Bürstenhalter
Rotor connection according to type either via terminals or via brush holder
Connexion du rotor suivant le type aux borne du rotor ou au porte-balais
Rotoraansluiting afhankelijk van type aan rotorklem of borstelhouder
Rotortilslutning foretages afhængig af type, enten til rotorklemmer eller børsteholder

Ständer, Stator





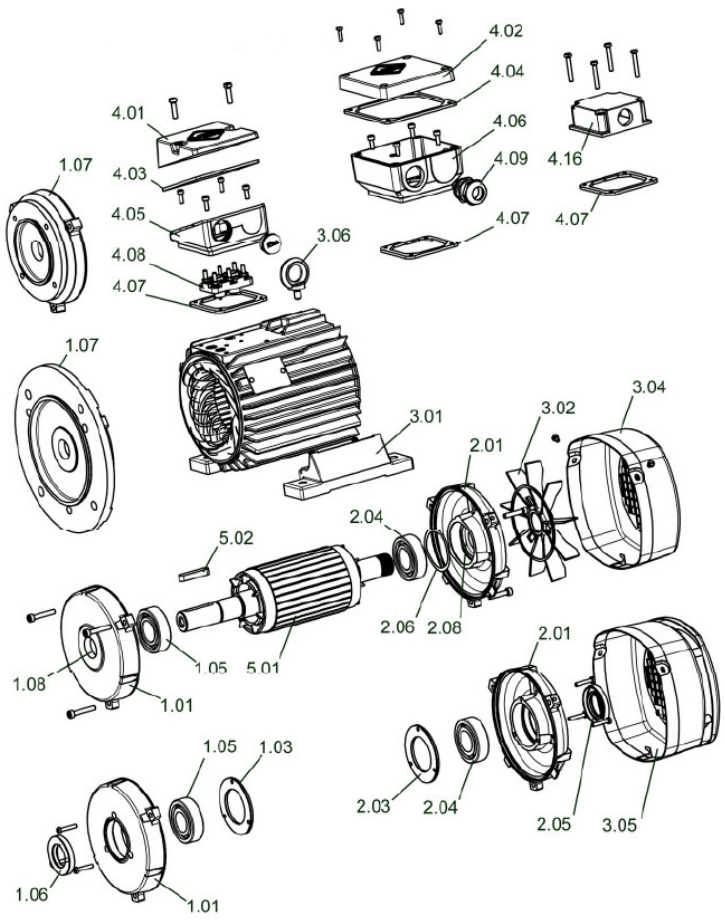


zum Anlasser
to the starter
vers le démarreur
naar aanloopinrichting
til starteren

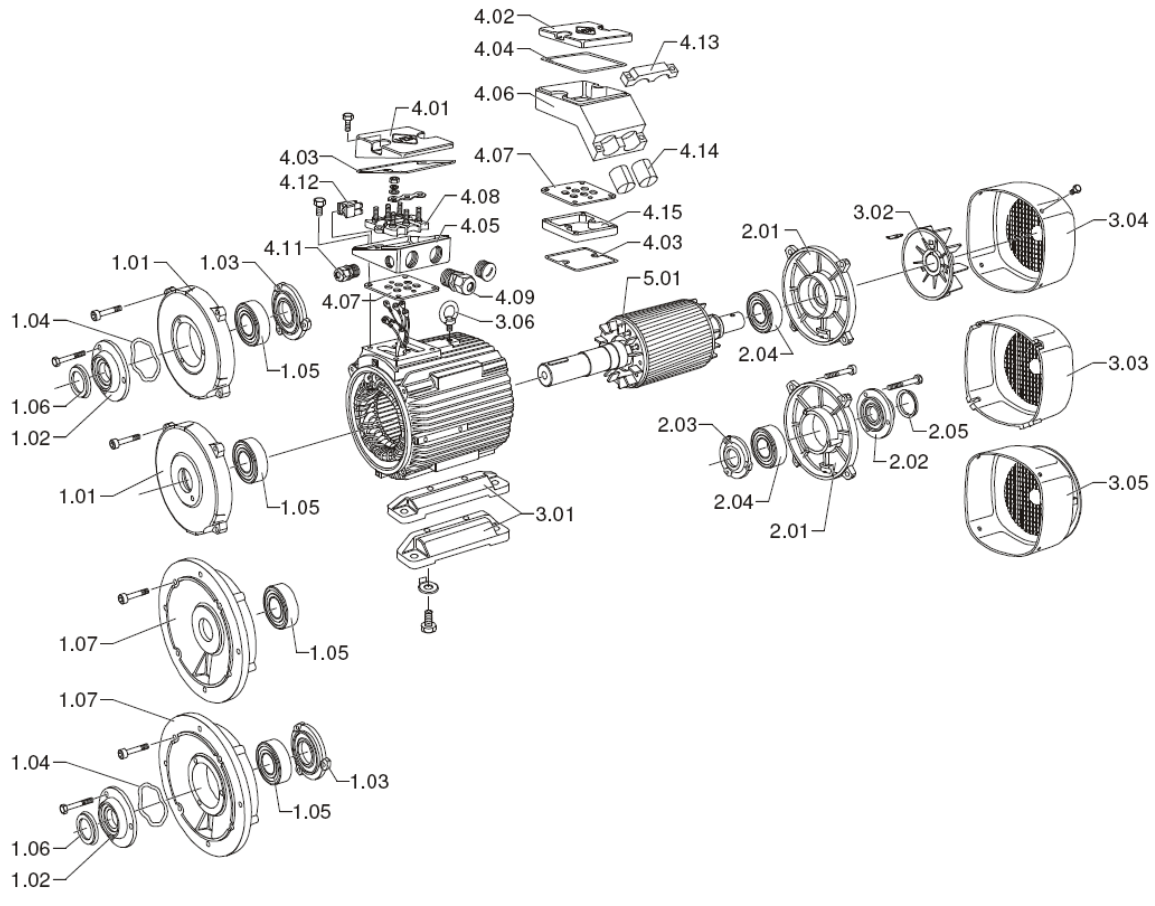
20. Aufbau der Motoren, Construction of the motor, Composition des moteurs

Kennzahl	Bezeichnung	Designation	Désignation
1.01	Lagerschild D-Seite	End shield Drive-end	Flasque côté D
1.02	Lagerdeckel, D-Seite, außen	Bearing cover, Drive-end, external	Couvre-roulement, côté D, extérieur
1.03	Lagerdeckel, D-Seite, innen	Bearing cover, Drive-end, internal	Couvre-roulement, côté D, intérieur
1.04	Tellerfeder / Wellfeder, D-Seite, nicht bei Rollenlagern	Disc spring / wave washer, Drive-end, not for roller bearings	Rondelle à plateau/ élastique (n'existe pas pour roulements à rouleaux
1.05	Wälzlager D-Seite	Antifriction bearing, Drive-end	Roulement, côté D
1.06	V-Ring D-Seite	V-type rotary seal, Drive-end	Joint V, côté D
1.07	Flanschlagerschild	Flange end shield	Flasque à bride
1.08	Filzring D-Seite	Felt ring, Drive-end	Bague de feutre, côté D
2.01	Lagerschild N-Seite	End shield Non-drive end	Flasque côté N
2.02	Lagerdeckel, N-Seite, außen	Bearing cover, Non-drive end, external	Couvre-roulement, côté N, extérieur
2.03	Lagerdeckel, N-Seite, innen	Bearing cover, Non-drive end, internal	Couvre-roulement, côté N, intérieur
2.04	Wälzlager N-Seite	Antifriction bearing, Non-drive end	Roulement, côté N
2.05	V-Ring N-Seite	V-type rotary seal, Non-drive end	Joint V, côté N
2.06	Wellfeder N-Seite (oder D-Seite)	Wave washer, Non-drive end (or Drive-end)	Rondelle élastique, côté N (ou côté D)
2.08	Filzring N-Seite	Felt ring, Non-drive end	Bague de feutre, côté N
3.01	1 Paar Motorfüße	1 pair of motor feet	1 paire de pattes
3.02	Lüfter	Fan	Ventilateur
3.03	Lüfterhaube, Kunststoff	Fan cowl, plastic	Capot de ventilateur, plastique
3.04	Lüfterhaube, Stahlblech	Fan cowl, sheet steel	Capot de ventilateur, tôle d'acier
3.05	Lüfterhaube mit Schutzdach	Fan cowl with canopy	Capot de ventilateur avec abri
3.06	Ringschraube	Lifting eye bolt	Œillet de levage
4.01/4.02	Klemmenkastendeckel	Terminal box cover	Couvercle de boîte à bornes
4.03/4.04	Dichtung Klemmenkastendeckel	Terminal box cover gasket	Joint de couvercle de boîte à bornes
4.05/4.06	Klemmenkastenunterteil	Terminal box base	Partie inférieure de boîte à bornes
4.07	Dichtung Klemmenkastenunterteil	Terminal box base gasket	Joint embase de boîte à bornes
4.08	Klemmenplatte	Terminal plate	Plaque à bornes
4.09	Kabeleinführung	Cable gland	Entrée de câble
4.10	Verschlussschraube	Screw plug for gland opening	Fermeture
4.11	Kabeleinführung für thermischen Wicklungsschutz	Cable gland for thermal winding protection	Entrée de la protection thermique
4.12	Anschluss für therm. Wicklungsschutz	Terminal for thermal winding protection	Borne pour protection thermique
4.13	Schelle	Clamp	Collier
4.14	Verschlußstücken	Sealing components	Bouchons
4.15	Zwischenplatte	Adapter plate	Plaque intermédiaire
4.16	Flacher Anschlußkasten	Flat terminal box	Boîte de connexion plate
4.17	Normalienbeutel	Standard parts bag	Sachet de barrettes
5.01	Läufer, komplett	Rotor, complete	Rotor, complet
6.01	Schleuderscheibe, D-Seite	Grease thrower ring, Drive-end	Disque centrifuge côté D
6.02	Schleuderscheibe, N-Seite	Grease thrower ring, Non-drive end	Disque centrifuge côté N
6.03	Labyrinthbuchse, D- u. N-Seite	Labyrinth gland, Drive- and Non-drive end	Douille à labyrinthe côté D et N
6.04	Leitscheibe, D-Seite	Guide disc, Drive-end	Disque guide côté D
6.05	Leitscheibe, N-Seite	Guide disc, Non-drive end	Disque guide côté N
7.01	Schleifringläufer mit Schleifringen	Slip ring rotor with slip rings	Rotor a bagues avec jeu de bagues
8.01	Bürstenhalter	Brush holder	Porte-balais
8.02	Bürstenträgerplatte mit Bürstenbolzen	Brush carrier plate with brush rod	Plaque porte-balais avec axe de balais
8.03	Schutzdeckel für Schleifringraum	Protective cover slip ring compartment	Couvercle de protection pour le logement des bagues collectrices
8.04	Dichtung für Schutzdeckel	Gasket for protective cover	Joint pour le couvercle de protection
8.05	Deckel für Lüfterhaube	Cover for fan cowl	Couvercle pour le capot de ventilateur
9.01	Klemmenkastendeckel für Läuferklemmenkasten	Terminal box cover for rotor terminal box	Couvercle de la boîte à bornes du rotor
9.02	Dichtung Klemmenkastendeckel für Läuferklemmenkasten	Gasket for terminal box cover for rotor terminal box	Joint du couvercle de la boîte à bornes du rotor
9.03	Klemmenplatte für Läuferanschluss	Terminal board for rotor connection	Plaque à bornes du rotor
9.04	Klemmenkastenunterteil für Läuferanschluss	Terminal box base for rotor connection	Embase de la boîte à bornes du rotor
9.05	Kabeleinführung für Läuferanschluss	Cable gland for rotor connection	Entrée du câble pour le raccordement du rotor
9.06	Zwischenflansch für Läuferklemmenkasten	Adapter flange for rotor terminal box	Bride intermédiaire pour la boîte à bornes du rotor
9.07	Verschlussschraube für Läuferanschluss	Screw plug for rotor connection	Vis de fermeture pour le raccordement du rotor

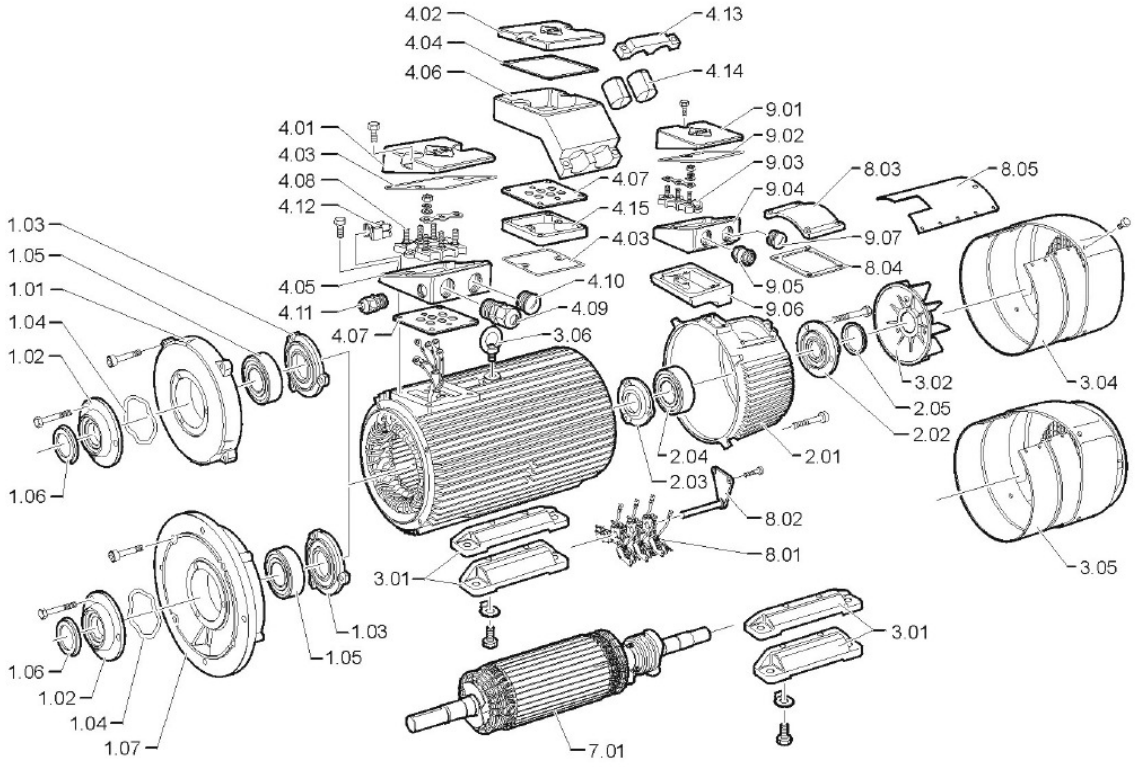
Drehstrom-Asynchronmotor mit Käfigläufer, Grundausführung K2.R 56 – 132T
(Beispiel, gelieferte Ausführung kann in Details abweichen)
Three phase asynchronous motor with squirrel cage rotor / basic version K2.R 56 – 132T
(example, delivered version may differ in details)
Moteur asynchrone triphasé avec rotor à cage / version de base K2.R 56 – 132T
(exemple, la version livrée peut légèrement différer)
Motor asíncrono trifásico con rotor de jaula / ejecución básica K2.R 56 – 132T
(Ejemplo, determinadas ejecuciones pueden diferir en detalles)
Motor trifásico assíncrono com rotor de gaiola/ modelo de base K2.R 56 – 132T
(exemplo, o modelo fornecido pode diferir em detalhes)
Motore asincrono trifase con rotore a gabbia / versione K2.R 56 – 132T
(Esempio, la versione fornita può differenziasi in particolari)
Asynchrone draaistroommotor met kortsluitanker/ standaarduitvoering K2.R 56 – 132T
(Voorbeeld, bepaalde details van de geleverde uitvoering kunnen afwijken)
Trefaset-asynkronmotor med kortslutningsrotor / grundudførelse K2.R 56 – 132T
(eksempel, leveret udførelse kan afvige i detaljer)
Kortsluten trefas asynkronmotor / grundutförande K2.R 56 – 132T
(exempel, levererat utförande kan avvika i vissa detaljer)
Trefase kortslutnings asynkronmotor / basisversjon K2.R 56 – 132T
(Eksempel, levert modell kan avvike i enkelte detaljer)
Oikosulkumoottori, jossa häkkikäämitys / perusmalli K2.R 56 – 132T
(Esimerkki, toimitettu malli voi poiketa yksityiskohdiltaan)
Трёхфазный асинхронный двигатель с короткозамкнутым ротором / основное исполнение K2.R 56 – 132T
(пример, поставляемое исполнение может отклоняться в деталях)
Ασύγχρονος τριφασικός κινητήρας με βραχυκυκλωμένο ρότορα / Βασική Έκδοση K2.R 56 – 132T (παράδειγμα, η παραδοτέα έκδοση μπορεί να παρουσιάζει διαφορές σε λεπτομέρειες)
" محرك ثلاثي الأطوار – غير تزامني بعضو دوار قفصي / بالتجهيزات الأساسية K2.R 56–132T "
(على سبيل المثال، يمكن أن يكون النوع الذي تم توريده، مختلفا في أجزائه التفصيلية)



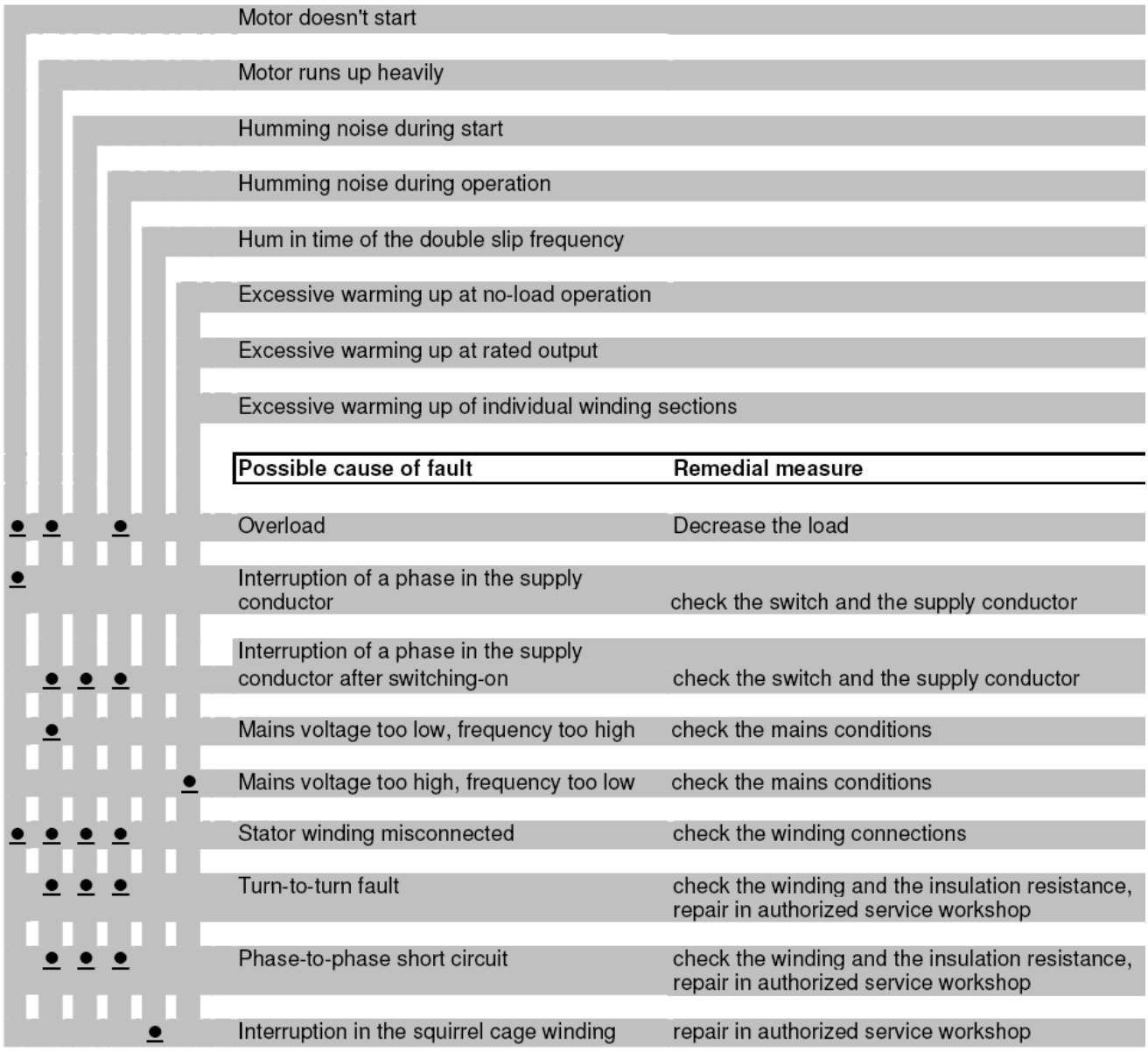
Drehstrom-Asynchronmotor / Grundausführung K1.R / K2.R 112 - 355
(Beispiel, gelieferte Ausführung kann in Details abweichen)
Three phase asynchronous motor / basic version K1.R / K2.R 112 - 355
(example, delivered version may differ in details)
Moteur asynchrone triphasé avec rotor à cage / version de base K1.R / K2.R
(exemple, la version livrée peut légèrement différer)
Motor asíncrono trifásico con rotor de jaula / ejecución básica K1.R / K2.R 132 - 355
(Ejemplo, determinadas ejecuciones pueden diferir en detalles)
Motor trifásico assíncrono com rotor de gaiola / modelo de base K1.R /K2.R 132 – 355
(exemplo, o modelo fornecido pode diferir em detalhes)
Motore asincrono trifase con rotore a gabbia / versione base K1.R / K2.R 132 - 355
(Esempio, la versione fornita può differenziasi in particolari)
Asynchrone draaistroommotor met kortsluitanker / basisuitvoering K1.R / K2.R
(voorbeeld, bepaalde deteils van de geleverde uitvoering kunnen afwijken)
Trefaset-asynkronmotor med kortslutningrotor / grundudførelse K1.R / K2.R 132 - 355
(eksempel, leveret udførelse kan afvige i detaljer)
Kortsluten trefas asynkronmotor / grundutförande K1.R / K2.R 132 - 355
(exempel, levererat utförande kan avvika i vissa detaljer)
Trefase kortslutnings asynkronmotor / basisversjon K1.R / K2.R 132 - 355
(Eksempel, levert modell kan avvike i enkelte detaljer)
Oikosulkumoottori, jossa häkkikäämitys / perusmalli K1.R / K2.R 132 - 355
(Esimerkki, toimitettu malli voi poiketa yksityiskohdiltaan)
Трёхфазный асинхронный двигатель с короткозамкнутым ротором / основное исполнение K1.R / K2.R 132 - 355 (пример, поставляемое исполнение может отклоняться в деталях)
Ασύγχρονος τριφασικός κινητήρας με βραχυκυκλωμένο ρότορα / Βασική Έκδοση K1.R / K2.R 132 - 355 (παράδειγμα, η παραδοτέα έκδοση μπορεί να παρουσιάζει διαφορές σε λεπτομέρειες)
" محرك ثلاثي الأطوار – غير تزامني بعضو دوار قفصي / بالتجهيزات الأساسية 355 – 132 K2.R /K1.R "
(على سبيل المثال، يمكن أن يكون النوع الذي تم توريده ، مختلفا في أجزائه التفصيلية)



Drehstrom-Asynchronmotor mit Schleifringläufer / Grundausführung S11R / SPER / S11H / SPEH
(Beispiel, gelieferte Ausführung kann in Details abweichen)
Three-phase asynchronous motor with slip ring rotor / basic version S11R / SPER, S11H /SPEH
(example, delivered version may differ in details)
Moteur asynchrone triphasé avec rotor a bagues / version de base S11R / SPER / S11H /SPEH
(exemple, la version livrée peut légèrement différer)
Motor asíncrono trifásico con rotor de anillos collectores / ejecución básica S11R / SPER, S11H / SPEH
(Ejemplo, determinadas ejecuciones pueden diferir en detalles)
Motor trifásico assíncrono com rotor com anéis colectores / modelo de base S11R / SPER, S11H /SPEH
(exemplo, o modelo fornecido pode diferir em detalhes)
Motore asincrono trifase con rotore ad anello collettore / versione base S11R / SPER, S11H / SPEH
(Esempio, la versione fornita può differenziasi in particolari)
Asynchrone draaistroommotor met sleepringanker / standaarduitvoering S11R / SPER, S11H / SPEH
(voorbeeld, bepaalde details van de geleverde uitvoering kunnen afwijken)
Trefaset-asynkronmotor med slæberingsrotor / grundudførelse S11R / SPER, S11H, SPEH
(eksempel, leveret udførelse kan afvige i detaljer)
Släpringade trefas asynkronmotor / grundutförande S11R/SPER, S11H/SPEH
(exempel, levererat utförande kan avvika i vissa detaljer)
Trefase asynkron sleperingmotor / basisversjon S11R/SPER, S11H/SPEH
(Eksempel, levert modell kan avvike i enkelte detaljer)
Oikosulkumoottori, jossa liukurengasroottori / perusmalli S11R/SPER, S11H/SPEH
(Esimerkki, toimitettu malli voi poiketa yksityiskohdiltaan)
Трёхфазный асинхронный двигатель с фазным ротором /
основное исполнение S11R / SPER, S11H / SPEH
(пример, поставляемое исполнение может отклоняться в деталях)
Ασύγχρονος τριφασικός κινητήρας με δρομείς δακτυλίου / Βασική Έκδοση S11R / SPER, S11H / SPEH (παράδειγμα, η παραδοτέα έκδοση μπορεί να παρουσιάζει διαφορές σε λεπτομέρειες)
" محرك ثلاثي الأطوار – غير تزامني بعضو دوار قفصي / بالتجهيزات الأساسيةSPEH / S11H SPER, / S11R"
(على سبيل المثال، يمكن أن يكون النوع الذي تم توريده، مختلفا في أجزائه التفصيلية)



21. Trouble shooting
21.1 Electrical Faults



Possible cause of fault	Remedial measure
Overload	Decrease the load
Interruption of a phase in the supply conductor	check the switch and the supply conductor
Interruption of a phase in the supply conductor after switching-on	check the switch and the supply conductor
Mains voltage too low, frequency too high	check the mains conditions
Mains voltage too high, frequency too low	check the mains conditions
Stator winding misconnected	check the winding connections
Turn-to-turn fault	check the winding and the insulation resistance, repair in authorized service workshop
Phase-to-phase short circuit	check the winding and the insulation resistance, repair in authorized service workshop
Interruption in the squirrel cage winding	repair in authorized service workshop

21. 2 Mechanical Faults

Dragging noise	Excessive warming up	Strong vibrations	Bearing warming up excessively	Bearing noises	Possible cause of fault	Remedial measure
●	●		●		Rotary parts are dragging	Determine the cause, re-align parts
	●				Air supply reduced	Check the ventilation passages
		●			Unbalance of the rotor	Take rotor off, re-balance it
		●			Rotor not circular, shaft deformed	Take rotor off, co-ordinate further measures with the manufacturer
		●			Imperfect alignment	Align motor & driven machine, check the coupling
		●			Unbalance of the coupled machine	Re-balance coupled machine
		●			Shocks from the coupled machine	Check the coupled machine
		●			Irregularities from the gear	Check and repair the gear
		●			Resonance with the foundation	Stiffen the foundation after consultation
		●			Changes in the foundation	Determine the cause, eliminate it and re-align the machine
			●		Too much grease in the bearing	Remove excess grease
			●		Coolant temperature higher than 40 °C	Regrease bearing with suitable grease
			●		V-type rotary seal or gamma ring are dragging	Replace V-type rotary seal or gamma ring, maintain the prescribed installation clearance
			●	●	Lubrication insufficient	Lubricate according to instructions
			●	●	Bearing is corroded	Replace bearing
			●	●	Bearing clearance too small	Use bearing with larger bearing clearance
				●	Bearing clearance too large	Use bearing with smaller bearing clearance
				●	Chatter marks in the bearing track	Replace bearing
				●	Standstill marks	Replace bearing
				●	Cylindrical roller bearing operated at low load	Change the bearing according to manufacturer's instructions
			●		Coupling pushes or pulls	Re-align motor & driven machine
			●		Belt tension too high	Adjust the belt tension according to instructions
			●	●	Bearing not aligned or stressed	Check the bearing bore, consult the manufacturer

11.12 Air vent

Honeywell Braukmann	Automatic Air Vent with integral shutoff valve E121

E121 Automatic air vent

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

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

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

Service parts

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

Honeywell
Braukmann

Automatic Air Vent with integral shutoff and leak protection
E121

1. Installation

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

1.1 Assembly

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

2. Maintenance

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

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

3. Range of application

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

4. Technical Data

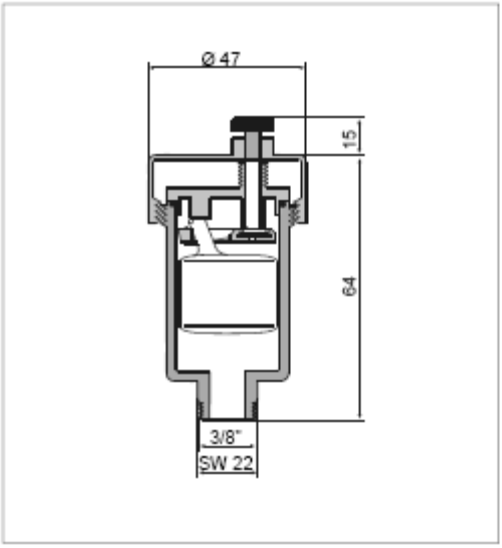
Operating temperature	max. 110 °C
Operating pressure	max. 10 bar
Connection sizes	R ³/₈" or R ¹/₂ "

5. Accessories

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

Honeywell
Braukmann

Automatic Air Vent with integral shutoff and leak protection
E121



Function

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

Versions

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

Accessories

Shutoff valve

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

11.13 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%.

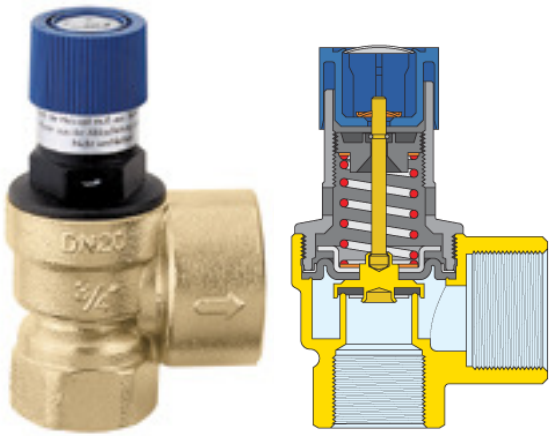
Minimum reseating pressure: -20%.

Maximum temperature: 100°C.

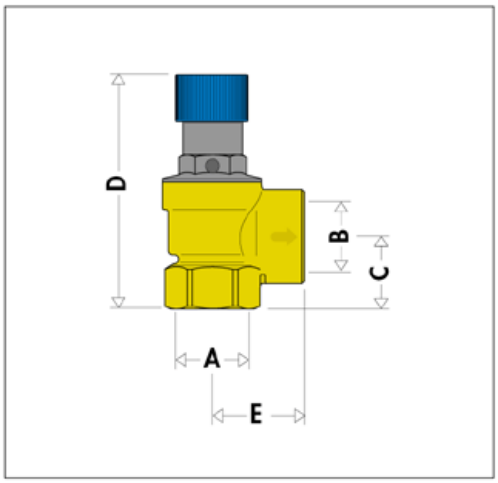
Brass body.

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

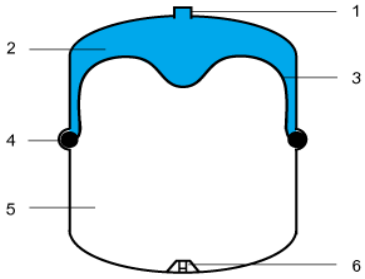
11.14 Expansion vessel

Flamco — Expansion Vessel Flexcon Top A 35

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

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

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



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.

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

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.

11.15 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

11.16 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

11.17 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).

11.18 Overflow valve

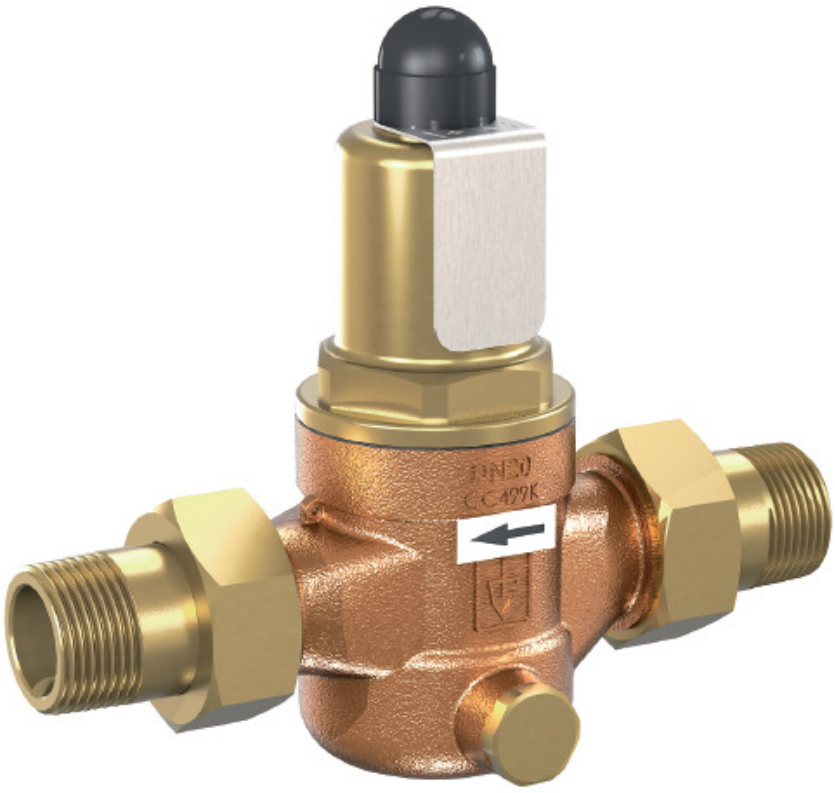
Überström-/Regelventile aus Rotguss

Typ 630
für Flüssigkeiten und gasförmige Medien

Overflow/pressure control valves made of gunmetal

Type 630
for liquids and gaseous media

CE



Anforderungen:
- DGR 97/23/EG Kategorie I

Anschluss: G 1/2", 3/4", 1", 1 1/4", 1 1/2", 2"
Einstelldruck: 0,5 - 10 bar

Beschreibung und Leistungstabelle auf der Rückseite.
Technische Daten auf Seite 4.52.

Approvals:
- PED 97/23/EC category I

Connection: G 1/2", 3/4", 1", 1 1/4", 1 1/2", 2"
Pressure range: 0.5 - 10 bar

For description and capacity chart see reverse side of this page. For technical data please see page 4.52.

Überström-/Regelventile aus Rotguss

Typ 630

In Durchgangsform, mit Federbelastung.
Völlig geschlossene, gasdichte Ausführung, unter Betriebsbedingungen einstellbar, ohne dass Medium in die Umgebung austritt.
Verschraubungen aus Rotguss / Messing mit Rohrgewinde nach DIN EN 10226.
Hohe Durchflussleistungen bei kleinen Druckdifferenzen aufgrund der Membransteuerung.

Standard mit EPDM-Dichtung aus zugelassenen Materialien gemäß Trinkwasserverordnung.
Für Wasser, neutrale Flüssigkeiten, ölfreie Pressluft und neutrale Gase
- Mediumstemperatur bis 95 °C

FKM (Viton)-Dichtungen (Typ 630 V)
Für nicht neutrale Medien, z. B. Öl, Benzin, Kerosin oder ölhaltige Pressluft
- Mediumstemperatur bis 200 °C

Typ 630 V gegen Mehrpreis erhältlich.

Einstellbereiche:
0,5 bis 2 bar
1,5 bis 6 bar
5,5 bis 10 bar

Bei Bestellung bitte Einstellbereich oder gewünschten Einstelldruck angeben.
Verplombung gegen Mehrpreis erhältlich.

Zubehör:
Manometer zur Druckeinstellung
- siehe Kapitel 8, Manometer Typ 36, 39, 40

Ersatzteile:
Ventileinsatz mit Ventilsitz

Einbau:
Der Überströmregler wird spannungsfrei in Pfeilrichtung im Rohrleitungssystem eingebaut.
Die Einbaulage ist beliebig.
Vor Einbau ist das Rohrleitungssystem zu säubern.

Overflow/pressure control valves made of gunmetal

Type 630

Straightway form, spring-loaded. Completely closed gastight version, can be adjusted under operating conditions without media escaping into the atmosphere.
Union joints made of gunmetal/brass with male threads according to DIN EN 10226.
High flow rates with small pressure differences due to diaphragm control.

Standard with EPDM seal made of approved materials according to the prevailing drinking water directive.
For water, neutral liquids, oil-free compressed air and neutral gases
- Medium temperature up to 95 °C

FKM (Viton) seals (Type 630 V)
For non-neutral media, e.g. oil, petrol, kerosene or compressed air containing oil
- Medium temperature up to 200 °C

Type 630 V available at a surcharge.

Ranges of adjustment:
0.5 to 2 bar
1.5 to 6 bar
5.5 to 10 bar

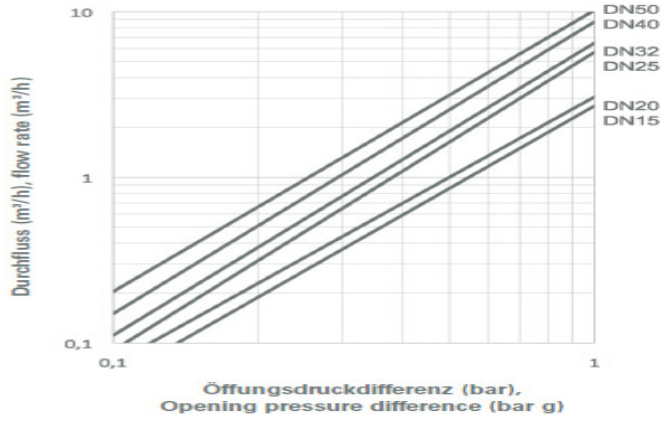
Please state range of adjustment or required set pressure when placing your order.
Available set and sealed against surcharge.

Accessories:
Pressure gauge for pressure setting
- see chapter 8, pressure gauges type 36, 39, 40

Spare parts:
Valve insert with valve seat

Installation:
The overflow valve is fitted in the pipe system stress-free in the direction of the arrow.
Any installation position is possible.
Purge pipe system prior to installation.

Durchflussleistungen (Wasser) Typ 630, flow rates (water) type 630

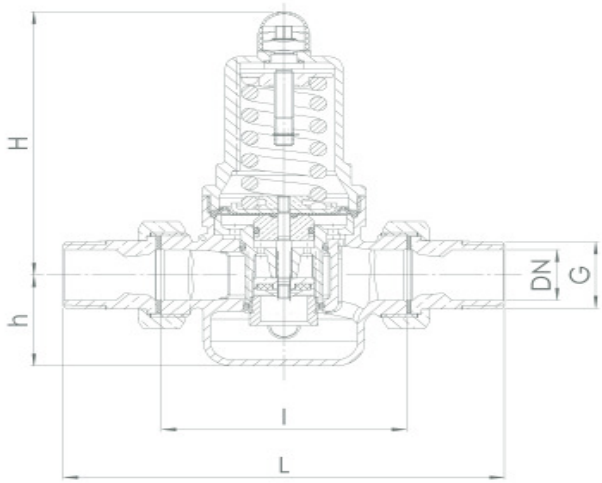


4.51

630: Anschluss, Einbaumaße, Einstellbereiche
630: Connection, installation dimensions, ranges of adjustment

Nennweite nominal diameter	DN	15	20	25	32	40	50
Anschluss connection	G	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
Einstellbereiche ranges of adjustment	bar bar(g)	0,5-2 1,5-6 5,5-10	0,5-2 1,5-6 5,5-10	0,5-2 1,5-6 5,5-10	0,5-2 1,5-6 5,5-10	0,5-2 1,5-6 5,5-10	0,5-2 1,5-6 5,5-10
Einbaumaße in mm installation dimensions in mm	L l H h	142 80 102 33	158 90 102 33	180 100 130 45	193 105 130 45	226 130 165 70	252 140 165 70
Kv-Wert für Wasser kv value for water	m³/h	2,5	3	5,5	6	9,5	10
Gewicht, weight	kg	1,2	1,4	2,5	2,7	5,5	6

630

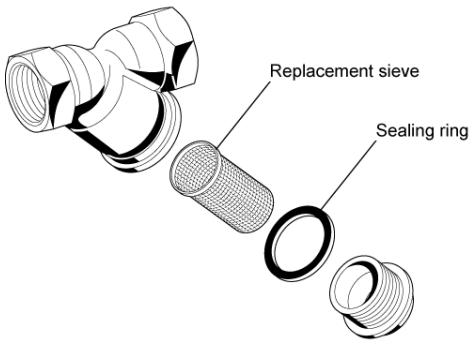


Werkstoffe • Materials

Bauteil, component	Werkstoff, material	DIN EN	ASTM / AISI
Gehäuse, body	Rotguss, gunmetal	CC499K	UNS C83600
Innenteile, internal parts	Rotguss, gunmetal	CC499K	UNS C83600
	Messing, brass	CW614N	UNS C37700
	Edelstahl, stainless steel	1.4571	AISI 316 Ti
Druckfeder, pressure spring	Federstahl, spring steel	1.1200	-

11.19 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!

11.19.1 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 Display OP73 in the switch cabinet. For the purpose of external evaluation of the error signal, the collective alarm message is connected via data cable and overvoltage protection to the Operation Panel of the MRI (See also circuit diagram)

11.20 Switch cabinet

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

For parts see circuit diagram.

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

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

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

12 Safety notes

12.1 Notes for refrigerant

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

First-aid measures

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

Measures for fire-fighting

- Suitable extinguishing agent: Product that does not burn itself. Coordinate extinguishing measures to surrounding fire. Cool containers by spraying with water.
- Special dangers from the material, its combustion products or emerging gases: Dangerous gases and vapours build during pyrolysis.
- Special protective equipment for fire fighting: Independent breathing apparatus and acid-resistant protective suit with deployment in the immediate vicinity.

- Further information: The effect of fire can cause bursting or exploding of the container. Flammable gas-air mixture possible under certain conditions.

Measures upon accidental release

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

Handling and storage

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

Personal protective gear

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

General safety and hygiene measures

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

12.2 Instructions regarding machine oil

First aid measures

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

Fire-fighting measures

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

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

Measures for unintentional release

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

Personal safety equipment

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

Handling and storage

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

13 Circuit diagram

Circuit diagram see the next pages or in switch cabinet