

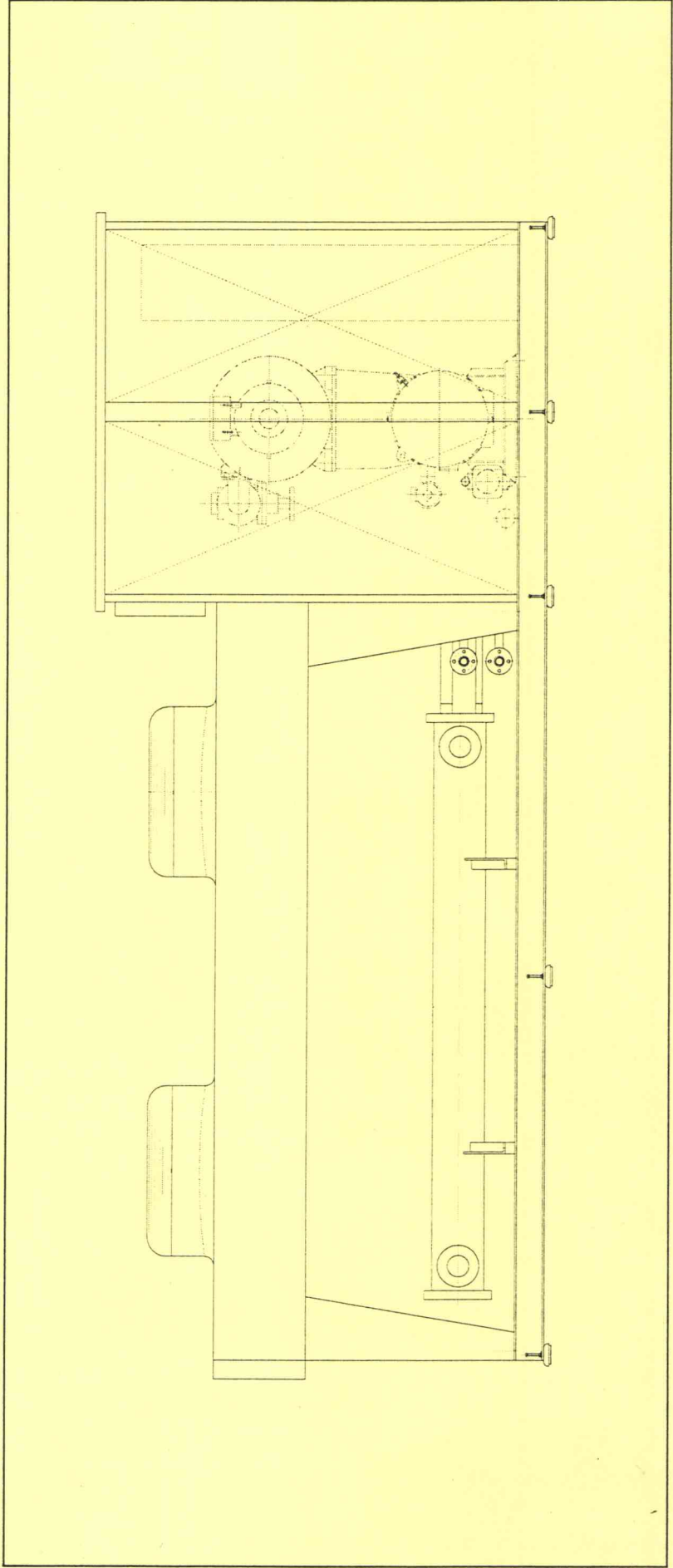


Refrigeration Division

Grasso

**Ammonia Liquid Chiller**  
**DX Series, Type LR 350 compact NH<sub>3</sub>, Project "KLENE"**

User Manual



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When operating, servicing and maintaining Grasso compressor units and chillers keep in mind, **in particular**, the following instructions taken from the standards, rules, ordinances and laws listed overleaf:

-  It is forbidden to weld or use open flames unless special safety instructions are observed.
-  Smoking is not allowed in the weather-protective cabin.
-  Escape routes must be free from obstacles.
-  Knowledge of the complete delivered documentation is a prerequisite for operating the equipment correctly and safely.
-  Any work on units and chillers may only be carried out by appropriately trained and instructed staff.
-  The refrigeration units must not be operated unless full functional and operational safety and reliability of all components, circuits (refrigerant and oil circuits, secondary refrigerant and cooling water circuits) and of the electrical switchgear is ensured.
-  The elements of the safety chain, the sensors and controllers shall be adjusted according to the designed values and must not be set out of operation, not in part either.

Adhere to the following standards, rules, ordinances and laws to ensure the safety and functionality of the *compressor units* and *chillers*:

- **Accident-Prevention Rule** including implementation regulations  
(VBG 20) Refrigeration plants, heat pumps and cooling equipment  
(VBG 121) Noise
- **DIN 8975**, Parts 1 to 9, Draft of Part 10  
Refrigeration plants - Safety principles for design, equipment , installation
- **DIN 2405** Pipes in refrigeration plants, marking
- **DIN 3158** Refrigerant fittings, safety specifications, testing, marking
- **VDI-Rules**
- **Ordinance on Pressure Vessels (DruckbehV)**
  - AD Instruction Sheets
  - Technical Rules on Pressure Vessels (TRB)
  - Technical Rules on Compressed Gases (TRG)
  - Technical Rules on Steam Boilers (TRD)
- **Instruction Sheets for Handling Ammonia**
- **Safety Data Sheet for Ammonia**
- **Ordinance on Hazardous Substances (GefStoffV)** including TRGS
- **Federal Emissions Control Act (BImSchG)**, 4. BImSchV
- **Ordinance on Failures (12. BImSchV)** including 1. Failure VwV
- **Water Resources Management Law (WHG)**, VAwS
- **Waste Disposal Law (AbfG)**
- **VDMA Unit Sheets**, particularly VDMA 24 243 and 24 169

The list of standards, rules etc. has been taken from Status Report No. 5 of Deutscher Kälte- und Klimatechnischer Verein "Sicherheit und Umweltschutz bei Ammoniak-Kälteanlagen (Safety and environmental protection in ammonia refrigeration plants)", November 1990, and fully applies to other refrigerants as well.

Grasso GmbH Refrigeration Technology is not liable for damage resulting from the operator's infringement of the mentioned rules or other laws and regulations binding at the respective place of installation.

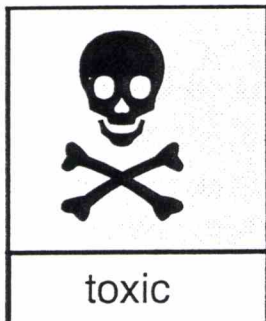
**OPERATING INSTRUCTIONS IN ACCORDANCE WITH §20 GEFSTOFFV (RULING OF DANGEROUS MATERIAL)**

**DANGEROUS MATERIAL**

**Ammonia (NH<sub>3</sub>)**

- Waterfree, gas, liquid and dissolved in water
- Group 2 in accordance with DIN 8975 - 1, molecular weight 17
- Density 0,7 kg/m<sup>3</sup> as a gas at 1 bar and 20°C, lighter than air
- Ammonia is situated in the closed circuit of the liquid chiller/ screw compressor package. In case of a havary ammonia is dissolved in water by using the absorption device or by using the jet of water.

**DANGER FOR PEOPLE AND ENVIRONMENT**



- A concentration  $\geq 25$  ppm is perceptible for the humid sense of smell;  
MAK-value - unhealthy from a limit value  $\geq 50$  ppm.
- Ammonia as a gas violent irritates and harms the eyes, has a penetrating smell and is toxic when it is inhaled.
- Liquid ammonia, ammonia as a gas in high concentrations and as a concentrated watery solution has a very corrosive effect to skin, mucous membranes and eyes.
- It's possible, that liquid ammonia kills the contacted skin by frost.
- Ammonia and air produce an explosionable mixture between 15...28 Vol.-%.

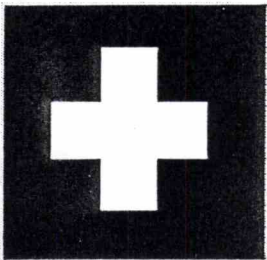
**PROTECTION MEASURES AND BEHAVIOUR REGULATIONS**

- The compressor unit/ liquid chiller must be operated only by trained and qualified staff.
- Interventions in the ammonia-circuit must be carried out only by experts in this field.
- The association with ammonia is only allowed by management confirmed persons.
- Regular informations have to carry out about the association with ammonia (with proof).
- The machine room ventilation has to be guaranteed.  
In case of ammonia smell in the machine room don't eat, drink and smoke there!
- The skin contact with liquid ammonia has to avoid absolute.
- A breath protection mask with ammonia filter has general to put on in case of working at the refrigerating plant.

### BEHAVIOUR IN CASE OF DANGER

- Please leave the machine room and set off the alarm if ammonia escapes out of the refrigerating plant.
- Put on please the breath protection mask with ammonia filter (colour: green).
- Rubber gloves, protection apron and protection boots have to use.
- Ammonia has to precipitate with a lot of water (spray water).  
Attention! Don't ignore the automatic start of the absorption device!
- Don't let out with ammonia enriched water into the sewerage system or public waters (WGK 2).

### FIRST AID



- The harmed person(s) has (have) to get away from the contaminated atmosphere into the open air.
- With ammonia contaminated clothes have to take off.
- Corroded parts of the body - mouth and eyes too - have to rinse out with water for about 20 minutes.
- Don't cover the relevant parts of the body with bandages, oil a.s.o., but protect them against frost.
- The harmed person(s) has (have) to get away into the hospital or to a doctor as soon as possible after rinsing off the relevant parts of the body.
- Medical treatment is immediate necessary, if ammonia was inhaled in great quantities and in case of corroded skin and eyes.

### APPROPRIATE DISPOSAL



Ammonia and its watery solution has to be disposed with special caution and responsibility.

The LR compact chiller series consists of 8 model types with established Grasso screw compressors and modules of the Chiller R Series.

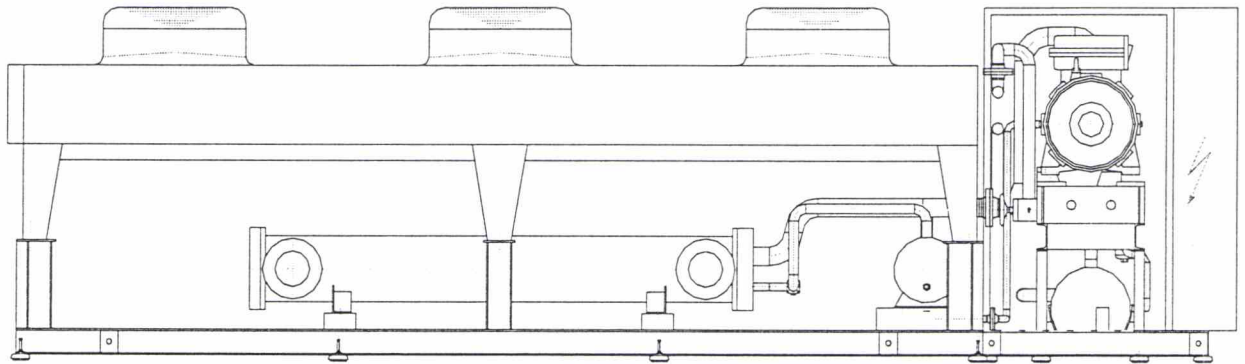
The working principle is the dry evaporation with shell and tube heat exchangers as evaporator and a mounted air cooled condenser.

The capacity range covers from 200 kW up to 800 kW regarding air conditioning application for manufacturing cold water.

The only used refrigerant is ammonia.

The LR compact chiller series requires low refrigerant charging quantities. So it guarantees highest safety and environmental standards.

The compact design provides the requirements for an outside installation. The refrigerant circuit is completely fitted, the chiller is completely wired and equipped with a control device, integrated into the low voltage system.



Chiller type	screw compressor	Nominal refrigerating capacity *) kW	Nominal motor output kW	Sound pressure level db (A) at 5m	Standard dimensions L, B, H in mm	Operating weight (kg)
LR 200	C	184	75	57	5500,2400,2300	3518
LR 250	D	216	75	57	5500,2400,2300	3905
LR 300	E	260	90	62	6530,2400,2300	4225
LR 350	G	306	110	62	6530,2400,2300	4504
LR 450	H	392	132	63	6750,2400,2300	5169
LR 500	L	462	160	63	8550,2400,2300	5822
LR 600	M	590	200	63	8850,2400,2300	7556
LR 800	N	764	250	63	10850,2400,2300	8241

\*) Water outlet - evaporator 6°C, Air inlet - condenser 32°C

*0,6 BHP  
12 m wh  
wh m<sup>3</sup>*  
10.06.99/ 0

**AMMONIA LIQUID CHILLER  
DX LR 350 COMPACT NH3, PROJECT "KLENE"**

**AMBIENT CONDITIONS**

• Ambient temperature	-15°C ... +40°C
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**MAXIMUM PERMISSIBLE OPERATING PRESSURES**

Refrigerant circuit	23 bar g.p.
Oil circuit	23 bar g.p.

**SETPOINTS OF SAFETY DEVICES FOR PROTECTION AGAINST INACCEPTABLE PRESSURES**

Pressure transducer discharge pressure shut-off pressure standard value	21 bar g.p.
Oil circuit monitoring with pressure transducers oil and discharge pressure shut-off differential pressure	≤ -2 bar
Suction pressure transducer shut-off pressure standard value	corresponding to $p_0 - 10 \text{ K}$

**SETPOINTS OF SAFETY DEVICES FOR PROTECTION AGAINST INACCEPTABLE TEMPERATURES**

Discharge temperature switching value	100 ± 5 °C
Oil temperature switching value	70 °C

**CONTROL SLIDE ADJUSTMENT TIMES**

Minimum adjustment time of control slide from MINIMUM to MAXIMUM	30s
from MAXIMUM to MINIMUM	30s
Recommended adjustment time from MINIMUM to MAXIMUM	60s
from MAXIMUM to MINIMUM	60s

Under start-up with cold oil conditions and at slight pressure differences between discharge pressure and suction pressure the adjustment times are longer than those under operating conditions.

**DISCHARGE TEMPERATURE**

**With oil cooler**

	t	t <sub>max</sub>
ammonia	$t \geq t_{oil} + 15 \text{ K}$	95°C

**With refrigerant injection**

	t
ammonia	50 + 5 °C

**SETPOINTS FOR OIL TEMPERATURE**

**Minimum viscosity of oil before entering the compressor  $v = 7cSt$**

Permissible range of oil temperature t <sub>oil</sub>	35-70°C
Recommended oil temperature t <sub>oil</sub>	60°C



Do not ignore viscosity decreasing by means of in oil soluted refrigerant.

**FIRST OIL CHARGING**

Chiller type	oil separator (diameter in mm)	oil charging (litre)
LR 350	508	90

**REFRIGERANT CHARGING**

Chiller type	Standard ammonia charging
LR 350	approx. 70 kg

**AUXILIARY AND CONTROL VOLTAGES**

Compressor driving motor	400 V, AC
Safety pressure limiter	230 V, AC
Solenoid valves for capacity control	230 V, AC
Monitoring devices for pressures, temperatures and volume flow	24 V, DC
Position transducer for control slide	24 V, DC
Solenoid valves refrigerant-expansion	24 V, AC
Solenoid valves release refrigerant-expansion	230 V, AC
Oil heater	400 V, 2 phases
Gehäuseheizung	230 V, AC
fan motor - housing	230 V, AC
fan motors - condenser	400 V, AC



## INTRODUCTION

Ammonia liquid chillers for dry evaporation (DX), Series LR compact, consists of the following main components:

1. Drive-line (screw compressor, driving motor, oil separator),
2. Evaporator,
3. Air-cooled condenser,
4. Low voltage system with control device,
5. Common base frame for all components.

Ammonia liquid chiller can be delivered in version LR for complete capacity range of model types 200 - 800 as standard ready for connecting, complete with pipes and wiring.

A heated and ventilated weather-protective cabine for the screw compressor is included into the scope of supply. The weather-protective cabine can be equipped with a sound vibration protection and with heaters on request. Thermostatic elements safe a minimum temperature inside the cabine.

## MODE OF OPERATION

Compressor sucks refrigerant gas out of evaporator and brought up to condensation pressure.

The refrigerant turns to liquid as it is cooled and ease about a solenoid valve directly into the evaporator. The solenoid valve is controlled by suction gas overheat.

The refrigerant evaporates by taking up heat (delivered by secondary refrigerant).

Oil is injected into the working chamber during screw compressor operation. Oil and refrigerant are separated again via the oil sparator on discharge side. Liquid refrigerant is injected into the screw compressor for reaching a discharge temperature, which is agree with the permissible oil temperature.

The oil passes through oil filter before it returns to the compressor.

In spite of high effective oil separation system oil reaches the chiller low pressure side. A special, by Grasso GmbH Refrigeration Technology used refrigerant soluble oil, makes the oil able to flowing so that it can be sucked from screw compressor again. This is the basis for a failure-free operation of evaporating system.

The screw compressors are fitted with continous capacity control by volume flow control (internal bypass) with a range of 15% - 100%.

## SHELL AND TUBE EVAPORATOR

- single- or double-tuned design, as water(glycole)cooler with tubes, gas-tight rolled-in into the tube plates
- in accordance with pressure vessel regulations, valid at the place of installation
- standard insulation, Armaflex type
- with ports for draining and venting

## HIGH PERFORMANCE CONDENSER

- air-cooled axial condenser, horizontal
- housing: galvanized steel plate, painted
- tubes out of galvanized steel with aluminium segments

## CONTROL DEVICE

In the standard design, the chillers are equipped with a standard SIMATIC S5-95U SPC. The SIMATIC controls the chiller operation.

A background illumination LCD display allows reading of all operating and fault messages as well as process variables. The display is operated via a robust keypad having 6 function and 24 system keys.

## LOW VOLTAGE SYSTEM

The low voltage system is completely wired with all necessary sensors and actuators as well as prepared for connecting the external incoming-feeder cable.

## SAFETY DEVICES AGAINST PRESSURE EXCEEDINGS

The screw compressor package is equipped with a safety pressure limiter (TÜV-application) and a pressure transducer, which prevent exceeding the discharge pressure limitation value (demand of UVV VBG 20).

The pressure relief valve prevents pressure exceeding higher than the permissible limitation value.

Safety valves with blow-off lines to the outside are installed according to the specific valid regulations.

## OIL HEATER

The oil heater is mounted into the oil separator because of possible temperatures lower than 15°C for outside installation. The combination of oil heater and heated weather-protective cabine guarantees the correct restart after a long still stand period.

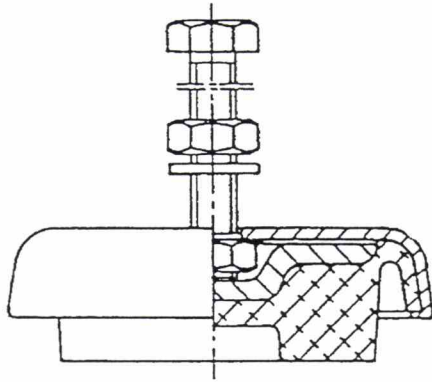
## CONNECTING FLANGES (EVAPORATOR)

*Standard for all chiller model types:*  
connecting flanges without mating flange

*Optional Equipment:*  
mating flanges

#### INSTALLATION WITH ANTI-VIBRATION MOUNTS

In this form of installation, the chiller is erected on vibration isolators which are bolted by screws to the chiller but not to the levelled concrete foundation.



*Isolator without foundation fixation*

The isolators retain their permanent resilience under design load. The levelling range is 20 mm. The chiller has a firm stand due to its design surface pressure and the resulting friction coefficient between isolator and foundation.

#### MISCELLANEOUS

The chillers are filled with dry nitrogen (0,2 bar gauge pressure).

Refrigerant and special type lubricating oil are included into the scope of supply.

Each chiller is delivered with an User Instruction containing the description of refrigerant circuit as well as the operating and maintenance instructions.

#### DRAWINGS AND CUSTOMER PARTS LIST

General drawing: 636126:14230.2

P+I diagram: 636125:14230.3

Customer parts list: RM219640

For Drawings and Customer parts list see special chapter of the „Technical Documentation“.

## 1. GENERAL INFORMATION

The DX chiller must be operated only by trained and qualified staff who are familiar with the contents of the user manual for Grasso ammonia DX chiller.

The safety regulations for the refrigeration plant must always be observed in order to prevent damage to the DX chiller and injury to the operating staff.

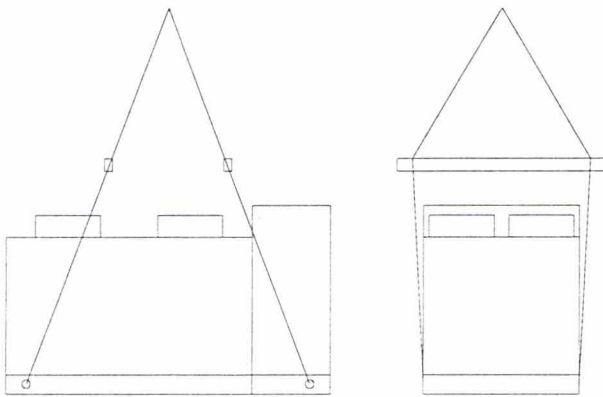
## 2. TRANSPORT AND STORAGE

Ammonia DX chiller are high-quality products which must be handled with due care. Protect the equipment from impacts and place it down carefully.

When transported by crane, the chiller must have the same position as in operation. Do not use attaching points other than those provided for this purpose.



A spreader bar is required for transport by crane. (for subdivided units as well)



It is forbidden to utilize fittings or pipes for attaching the chiller.

Position the chiller on the transport vehicle such that it is prevented from sliding and tilting. The competent staff member or the company is responsible for ensuring transport safety.

The storage area of chiller shall be plained and paved and secured against access of unauthorized persons. The chiller is to be protected against knocks and impacts.

Turn the shaft of the compressor at least every four weeks (approx. 10 revolutions).

At the same time, check the nitrogen filling and recharge to the specified overpressure of 2 bar, if required. Dry nitrogen with a residual moisture of  $\leq 300$  ppm is used for this purpose.

## 3. INSTALLATION

### Anti-vibration installation

The frame of the DX chiller shall be aligned with the levelling bolts until the coarse alignment (radial and angular misalignment  $\leq 0,25$  mm) at the coupling is attained again.

Before tightening the foundation bolts of isolators check, that the isolators are free over the spring (predominantly made of rubber) and not lie on the foundation.

## 4. ASSEMBLY

All pipes and electric cables must be connected so that no mechanical tension occurs.

### Connecting the pipes

Purge the nitrogen filling of the DX compact chiller by opening the vent valves before connecting the pipes.

Establish all pipe connections so that the transmission of thermal expansion and vibration to the DX chiller is limited as far as possible.

Flexible connection joints made of rubber can be used for water connections.

Provide all pipe connections with fixed points arranged immediately at the chiller.

Connect the following:

- cold water or brine, inlet and outlet are labeled

### Connecting the electric cables

- Connect the electric supply of power panel. See electric connection plan.

5. FIRST COMMISSIONING

The following procedures should be completed in the sequence in which they are described:

5.1. Pressure test; leakproofness test

Take the necessary safety measures before carrying out the compression test. The compression test is performed with dried, oil-free air and dry nitrogen.

To check the leakproofness an 3-hour compression test is carried out with dry air and dry nitrogen at an overpressure which should not be higher than the permissible operating overpressure of the chiller.

A pressure drop of 2 per cent is acceptable during the 3 hours, with variation in the ambient temperature having to be taken into consideration.

 Before starting the compression test remove or shut off control and regulating devices which could be damaged at the mentioned test pressure.

Enter the pressure in the pipes to be tested, the ambient temperature and the outside temperature measured in the shade in a report on the compression test every hour.

Reinstall any removed measuring, control and regulating devices after completion of the compression test if leakproofness of the chiller has been shown.

5.2. Drying, vacuum

After completion of the compression test the plant is evacuated and subjected to a vacuum test over a period of 6 hours.

The plant is evacuated to remove air and moisture.

The obtained vacuum may rise by a maximum of 5 torr within 6 h.

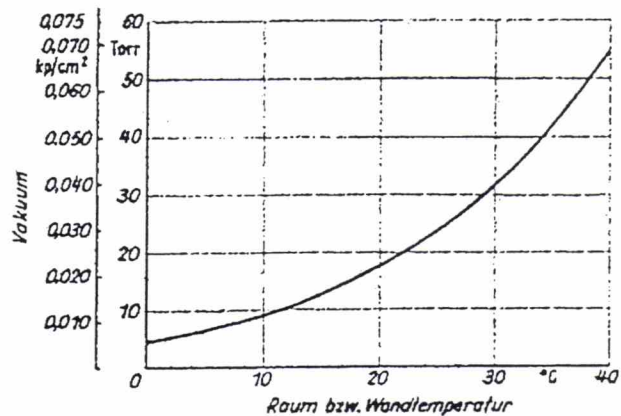


Fig. 1 Vacuum required for removing moisture from refrigeration plants

Shut the compressors off when the specified vacuum is attained; record the measured values hourly. Following the vacuum value, enter the machinery hall temperatures, the outside temperatures in the shade. The vacuum test must be followed by pressure compensation with NH<sub>3</sub>.

**5.3. Oil charging**

The vacuum present in the chiller before pressure compensation may be utilized for oil charging. After the pressure compensation and for refilling with oil a separate oil recharging pump is required.



Check the oil grade to be charged. See contract or project or Grasso recommendation.

Link the connection of the oil draining/oil charging shut-off valve (365) with the oil charging tank.

Shift the valves to the operating position before oil charging.

Open stop valve (365) until the oil level has reached at the top of the oblong sight glass in the oil separator.

Charge oil additionally via the service valve (135) in case of first oil charging. Close the stop valve (065) therefore!



The lubricating oils have a tendency to increased humidity admission by using selected components. Because of that the oil should come into contact with air for a short time only during charging the compressor. The contents of a opened drum has to use up during one working day. Close the drum between charging processes.

**5.4. Checking the failure monitoring**

1. Disconnect the incoming feeder of the compressor driving motor from the supply mains for checking the safety devices (e.g. remove LV/HBC fuse links).
2. First operate the built-in pressure transmitters, differential pressure switches and resistance thermometers by hand to test their function.
3. Then check the specified limiting values.
4. Switch compressor on.
5. "Failure - oil circuit monitoring" must be signalled after a starting delay of 20s.
6. Check the excitation of the solenoid valves of the adjusting device for capacity control in the MINIMUM direction.
7. Simulate the minimum end position of the control slide and check the switching function of main switch and star-delta contactor.
8. Check the switching function of the solenoid valves by actuating the pushbutton switches for capacity increase and capacity decrease:

1. capacity ↑	1. SV 1 and SV 4 are excited
2. capacity ↓	2. SV 2 and SV 3 are excited

11. Check the "failure - oil circuit monitoring". The compressor driving motor must switch off after 6s.
12. Adjust the rated current limiting control for the compressor driving motor.

**5.5. Checking the failure shutdown when the temperature is exceeded**

1. Put the resistance thermometer into an oil-bath and heat it.
2. Check the limiting values on the control display.

Limiting values:

discharge temperature	100 °C
oil temperature	70 °C

3. Check the failure indications on the compressor control device.
4. limiting values (see point 1).

**5.6. Checking the direction of rotation of the driving motor**



The coupling must not yet connect motor and compressor!

Secure the electric switchgear so as to prevent the compressor driving motor from being switched on accidentally.

With the control slide in the MIN or MAX position, it should be possible to rotate the compressor shaft easily and smoothly by hand. When checking the direction of rotation of the compressor driving motor pay attention to the conditions for switching the compressor on.



**As viewed in the direction of the shaft end, the the motor rotates in counterclockwise direction.**

The compressor driving motor is operated in star-delta connection for a short period in the operating mode "MANUAL". After that the compressor driving motor has to switch off.

If the direction of rotation of the motor is wrong, it should be corrected while the electric switchgear is secured to prevent the motor from being switched on accidentally. The motor must then idle for at least 1h.

The coupling protection must be in place during this running-in period as required in the labour safety regulations.

After checking the direction of rotation of the driving motor the coupling may be connected with the motor.

**5.7. Mounting the coupling**

The electric switchgear is then again secured to prevent it from being switched on accidentally. Mount the coupling, observe instructions of separate documentation.

The values for radial and angular deviations given in the coupling documentation must be checked and if necessary corrected.

**5.8. Checking the water circuits**

Check whether the cooling water pumps are running and the hand-operated shut-off fittings in the cooling water circuit are in their operating positions.

**5.9. Commissioning**

On completion of the above-mentioned work, the compressor unit can be commissioned in accordance with the operating instructions for the compressor control device.

1. Switch on the control voltage of the compressor control device.
2. Acknowledge failure indications.
3. Switch over to manual operation.
4. Switch on the unit.

**5.10. Checking the control slide adjustment times**

While the chiller is running, determine the adjustment times needed when the control slide is continually moved from the maximum end position to the minimum end position and back. For the automatic system to run smoothly, the adjustment times in either direction must be approximately the same.

Minimum adjustment time	30 sec.
Optimum adjustment time	60 sec.

The adjustment times are matched by means of throttle screws mounted on the solenoid valve plate.

Screwing inwards	Adjustment time ↑
Screwing outwards	Adjustment time ↓

**5.11. Adjusting the amount of injection oil and the oil temperature**

**Compressor units without refrigerant injection**

The amount of injection oil and the oil temperature directly influence the discharge temperature of the compressor. The amount of injection oil is adjusted under project conditions through the injection oil control valve.

- Standard values for discharge temperature

	t	t <sub>max</sub>
NH <sub>3</sub>	$t \geq t_{\text{öl}} + 15 \text{ K}$	95°C

**Compressor units with refrigerant injection**

The oil temperature is changed by setting the injection oil control valve. The more the shut-off valve is throttled, the more the oil temperature decreases. If the oil temperature becomes too low or reaches the lower range, the rated value for the discharge temperature should be set accordingly higher. When the oil circuit is adjusted for the first time, the injection oil control valve is opened by approx. 1/2 rotation.

The discharge temperature is then regulated to the value indicated in the „Technical Data“ by means of the thermostatic expansion valve.

- Standard values for discharge temperature

	t
NH <sub>3</sub>	50 + 5 °C

**6. NORMAL START-UP**

- Move the valves into the operating position.
- The oil level in the oil separator must be within the permissible range.
- The cooling water and cold water pumps have to be running.
- Start the compressor unit in accordance with the operating instructions of the compressor unit control device.

**7. ADJUSTING THE COMPRESSOR CAPACITY**

The capacity of the compressors can be adjusted independently automatically or controlled by hand.

Reducing the capacity causes an increase in the suction pressure and vice versa. When doing so check the ammeter to ensure that the driving motor is not overloaded. If the current input is too high, the rated current limiting control comes into operation. This means that the overloaded compressor adjusts itself towards MIN until the current input reaches an acceptable level. The capacity can then be adjusted again without restriction.

**8. TEMPORARY SHUT-DOWN**

If the compressor unit is shut down temporarily, the valves do not need to be operated; they remain in their operating positions. If there is a possibility of the temperature in the evaporator to rise above the cooling water temperature, the cooling water supply must be interrupted or the shut-off valve on the compressor suction side must be closed.

If it is possible that the temperature in the evaporator rises above the ambient temperature of the compressor unit, the compressor suction-side shut-off valve must be closed.

**9. SHUTTING DOWN FOR AN EXTENDED PERIOD**

- Switch off the compressor by hand or switch off the automatic operating system, if any, as specified in the operating instructions of the electric switchgear. Switch the compressor control device off.
- Shut off cold water supply.
- After a shut-down period of more than four weeks it is advisable to operate the SCU for a short time to supply the stuffing box of the compressor and the slide ring shaft seal of the oil pump with oil and to prevent the bearings from settling.
- The secondary refrigerant mustn't freeze during compressor standstill.

The Grasso Ammonia DX compact chillers can be operated under the most varied operation conditions within the given limits of application according to the requirements involved. The limits of application listed below are based on the operational principle of the Screw Compressor, thermodynamic relations, used vessels and safety devices and practical operating conditions. The appropriate Compressor model design (1-7) should be selected for the particular operating conditions.

Refrigerant				NH <sub>3</sub>
speed	n	min <sup>-1</sup>	min max	1450 3600
suction pressure	p <sub>0</sub>	bar (a)	min max	2,9 7,3
evaporation temp. with water as sec. refrigerant	t <sub>0</sub>	°C	min max	-1 + 15
evaporation temp. with frozen resistant sec. refrigerants	t <sub>0</sub>	°C	min max	- 18 + 15
min. suction superheat <sup>a)</sup>	t <sub>0h</sub>	K	min	5
condensing pressure	p	bar (a)	min max	10,0 20,3
condensing temperature	t	°C	min max	25 50
discharge temperature <sup>b)</sup>	t <sub>1</sub>	°C	min max	50 100
pressure ratio (p/p <sub>0</sub> ) <sup>c)</sup>	π	-	min	2
pressure difference (p - p <sub>0</sub> ) <sup>d)</sup>	Δp	bar	min	4

- a) Min. suction superheat at compressor inlet  $\Delta t_{0h} = t_{01} - t_0 = 3 \text{ K}$ .
- b) The minimum compressor discharge temperature  $t_1$  must be 25 K above condensing temperature  $t$  and in addition, 25 K above the oil temperature for supply to the bearings for compressors with journal bearings.
- c) Gas pulsation protection required for  $\pi \geq 8$  only.
- d) The given pressure difference ensures reliable compressor operation. Furthermore, allowance must be made for the pressure difference necessary for the control valves fitted in the refrigerating plant.

**COMMENTS:**

- When considering a particular case, all conditions given in the tables should be taken into consideration and adhered to.
- Should the given limit values be exceeded in any particular case, the manufacturer must be consulted.
- In addition to the application limits given in the tables, consider the operating conditions which must be observed for the corresponding type of compressor (e.g. start-up regime, oil pressure, oil quantity etc.).
- The oil temperature at the compressor inlet must be least 18°C.
- Ensure that the oil viscosity will be  $\geq 7 \text{ cSt}$  at  $n = 3000 \text{ rpm}$  and  $\geq 10 \text{ cSt}$  at  $n = 1500 \text{ rpm}$  for the oil supply to bearings.  
Take into account the drop in viscosity due to refrigerant dissolved in the oil!
- Economizer operation between the 100% and 85% control slide positions.

The given data refer to the operation conditions in a refrigeration or air conditioning installation.

While start-up of the unit it is only for a short time permitted to leave these conditions.



For Grasso Ammonia DX Chiller (dry evaporation) can be used fundamental refrigerant soluted oils only.

The minimum oil viscosity upstream of the compressor has to be  $\nu = 7cSt$  (take into account the drop of viscosity due to refrigerant dissolved in the oil).

Grasso recommends the following lubricating oils for refrigerant ammonia and dry evaporation:

Oil type		PGP-70 NH <sub>3</sub>	PGP-120 NH <sub>3</sub>	Triton GL 68
Manufacturer		Fuchs	Fuchs	DEA
Basis		Polyglykolöle + Additive		
Viscosity at 20°C	mm <sup>2</sup> /s	190	320	200
Viscosity at 40°C	mm <sup>2</sup> /s	73	118	68
Viscosity at 100°C	mm <sup>2</sup> /s	15	20	10,5
Viscosity index		189	200	k.A.
Pourpoint	°C	- 45	- 45	- 42
Flamepoint	°C	240	240	270
H <sub>2</sub> O-content	ppm	< 300	< 300	< 350
Thickness at 15°C	kg/m <sup>3</sup>	991	996	1010



The lubricating oils have a tendency to increased humidity admission because of using selected components. Round it the oils should be in contact with air for a short time only during charging the screw compressor. The content of a opened drum has to use up during one working day. Close the drum between charging processes.

Please consultate Grasso GmbH Refrigeration Technology in case of using other lubricating oils.

**1 GENERAL INFORMATION**

The DX Chiller must be serviced by appropriately trained operating staff only. These maintenance instructions shall be adhered to during all maintenance work. Moreover, all labour safety and fire prevention instructions and the technical safety rules for refrigeration plants must also be observed.

If repairs are necessary, contact the service department of **Grasso GmbH Refrigeration Technology**.



Perform all maintenance work carefully to keep the SCU in good working order. Guarantee claims will be rejected if the customer failed to follow the Maintenance Instructions.

Pay attention to maintenance checklist !!!

**2 SERVICE SCHEDULE**

Checking of	Frequency			Remarks
	every 24-72h	weekly	monthly	
Suction temperatur	●			superheat must not be lower than 3 K
Discharge temperature	●			superheat must not be lower than 25 K, maximum final compression temperature 100°C
Oil temperature	●			see Technical Data, the viscosity shall not be lower than 7 cSt at 3000 rpm
Oil pressure	●			the oil pressure must be at least 1 bar above the final compression pressure, a faulty oil pressure may be caused by a clogged oil filter
Discharge pressure	●			compare with design value, determine the superheat on the discharge side by comparison with the final compression temperature
Oil level in oil separator	●			check the oil level in the sight glass; if it is below the bottom third of the sight glass, recharge oil
Oil heater			●	upon standstill of the SCU the heater, if any, must start operating automatically; if the thermostatic cutout disconnects the heater, this may be caused lack of oil
Adjustment of safety devices			●	compare setpoints in Technical Data
Capacity control		●		solenoid valves must switch audibly when the capacity is adjusted; check in operating mode „MANUAL“
Expansion valves	●			solenoid valves must switch audibly
Number of operating hours		●		see Maintenance schedule for necessary maintenance work

3 MAINTENANCE SCHEDULE

Maintenance work	Operating hours						
	72 h	200 h	5000 h	10000 h	15000 h	20000 h	25000 h
Empty oil reservoir rotary seal	•						
Replacement of oil filter		•	•	•	•	•	•
Suction filter cleaning		•	•	•	•	•	•
Oil change			•	•	•	•	•
Coupling maintenance		•	•	•	•	•	•
Shell and tube heat exchanger			•	•	•	•	•
Expansion valves		•	•	•	•	•	•

As the maintenance intervals given in the table can be shortened by influences not conditioned by the machine, it is recommended to inspect the unit, including the wear parts of the compressor and filters, yearly.

4 MAINTENANCE WORK

4.1 Replacement of suction filter

1. Set the chiller out of operation.
2. Suck refrigerant after pressure compensation between HP and LP sides (take into account the safety regulations).
3. Screw off housing cover.
4. Remove suction filter element.
5. In case of intense connection between O-ring and suction filter element can be used a suitable device to get it out. With it a nut is used, welded on suction filter element.
6. Clean suction filter element, wash with appropriate fat-dissolving cleaning agent followed by blowing off with compressed air.
7. Replace O ring on suction filter element and reinsert suction filter element.
8. Replace O ring on cover, close cover reliably.
9. Evacuate the SCP using a vacuum pump.
10. Pull in refrigerant.
11. Check all components for leakproofness.



**Note!**

Since the compressor is not protected against coarse dirt particles during maintenance work on the suction filter, special care is necessary in addition to the usual cleanliness required while carrying such work.

## 4.2 Oil change

### Note:

Aged oil features an increasing loss of lubricity so that all rotating components of the compressor are endangered. The filter elements become prematurely clogged and must be cleaned and replaced at shorter intervals.

### Maintenance work:

Take oil samples for analysis and comparison of the data with those of fresh oil at regular intervals. Examine the colouration of the oil visually and evaluate the degree of contamination.

### Changing the oil:

1. The SCU must be run for at least half an hour to reach its operating temperature before the oil can be changed.
2. First shut down the compressor as described in the Operating Instructions.
3. Wait for pressure compensation between HP and LP sides. Otherwise the pressure can be reduced by opening the vent valve on the suction filter and then disposing of the refrigerant as specified by law
4. Drain waste oil through the oil draining/oil charging valves and dispose (Note: hazardous waste!). Then close valve and draw off refrigerant again until about atmospheric pressure is reached.
5. Otherwise depressurize the SCU by opening the vent valve - suction filter, taking into account the safety rules for refrigeration plants.
6. Open the drain plugs on oil cooler and oil separator to discharge the residual oil. Then reclose the drain plugs reliably.
7. Replace or clean the filter elements of oil filter and suction filter (see oil filter change and suction filter change).
8. Evacuate the SCP using a vacuum pump.
9. Draw in refrigerant.
10. Check all components for leakproofness. Charge oil and start the SCU as specified in the Operating Instructions.



### NOTES ON OIL CHANGE INTERVALS:

The degree to which oil in refrigeration plants has aged must be checked by analysis and comparison of the data with those of fresh oil. Oil ageing can also be judged from the darkening of the oil colour and the deposits found in the oil filters. If the degree of ageing cannot be assessed reliably by laboratory analysis and the results of visual examination, it is advisable to change the oil at the following intervals (see Maintenance schedule).



**Change oil in SCUs using ammonia as refrigerant after every 5000 operating hours or after 1 year at the latest.**

## 4.3 Oil filter replacement

1. For oil filter replacement for screw compressors type C, D, E, G see corresponding user manuals. For oil filter replacement of the other screw compressor types see as follows:
2. When the oil filter is heavily contaminated it may be necessary to replace it even if this is not provided according to the normal maintenance schedule.
3. Close stop valve before and after oil filter.
4. Compensate pressure with atmospheric pressure.
5. Drain oil.
6. Remove cover.
7. Withdraw oil filter element and dispose in due manner if it is heavily contaminated.
8. Carefully insert a new oil filter element.
9. Close cover.
10. Open stop valves before and after oil filter.
11. Vent oil filter through the vent valve after completion of the pressure compensation.

## 4.4 Coupling maintenance

1. Place the DX Chiller out of operation.
2. Secure the electric motor to prevent that is switched on accidentally.
3. Subject the lamination packages to a visual examination.
4. Check the tightening torques of the fitting screws.
5. Check the alignment of the electric motor and correct it according to the Steel Lamination Coupling Documentation, if required.

**FUNCTION**

**Oil separator for refrigerant-unsoluble oils, e.g. ammonia and Shell Clavus**

The refrigerant-oil mixture is fed to the front part of the horizontal oil separator where a combined agglomerator/demister takes over the first stage of oil separation. This front oil separator part also acts as oil receiver.

The fine separation of the aerosol-type oil portion from the refrigerant takes place in the rear part of the oil separator by means of changeable oil fine separation cartridges. The oil separated in the fine separation section of the oil separator is returned to the compressor (connection port M) via an orifice plate.

**Oil separator for refrigerant-soluble oils, e.g. R22 or R134a with Shell Clavus**

When R22 is employed as refrigerant, the use of cartridges for fine oil separation is not required. The hole oil return to additional injection is not applicable. The oil is only separated by the combined agglomerator/ demister, for oil fine separation is used a special demister type.

**MAINTENANCE**

The oil fine separation cartridges should be replaced at the latest after 2000 hours of operation or after three years. An earlier replacement is required if an increased amount of oil is splashed (oil is recharged at unusually short intervals).

**CONSTRUCTION**

Item	Designation
1	refrigerant inlet
2	refrigerant outlet
3	agglomerator/ demister (not shown in fig.1)
4	oil fine separation cartridge
5	gap for mounting
6	oil level indicator
7	level switch connection
8	oil heater connection
9	oil outlet to oil cooler
10	main oil return out from oil fine separation section

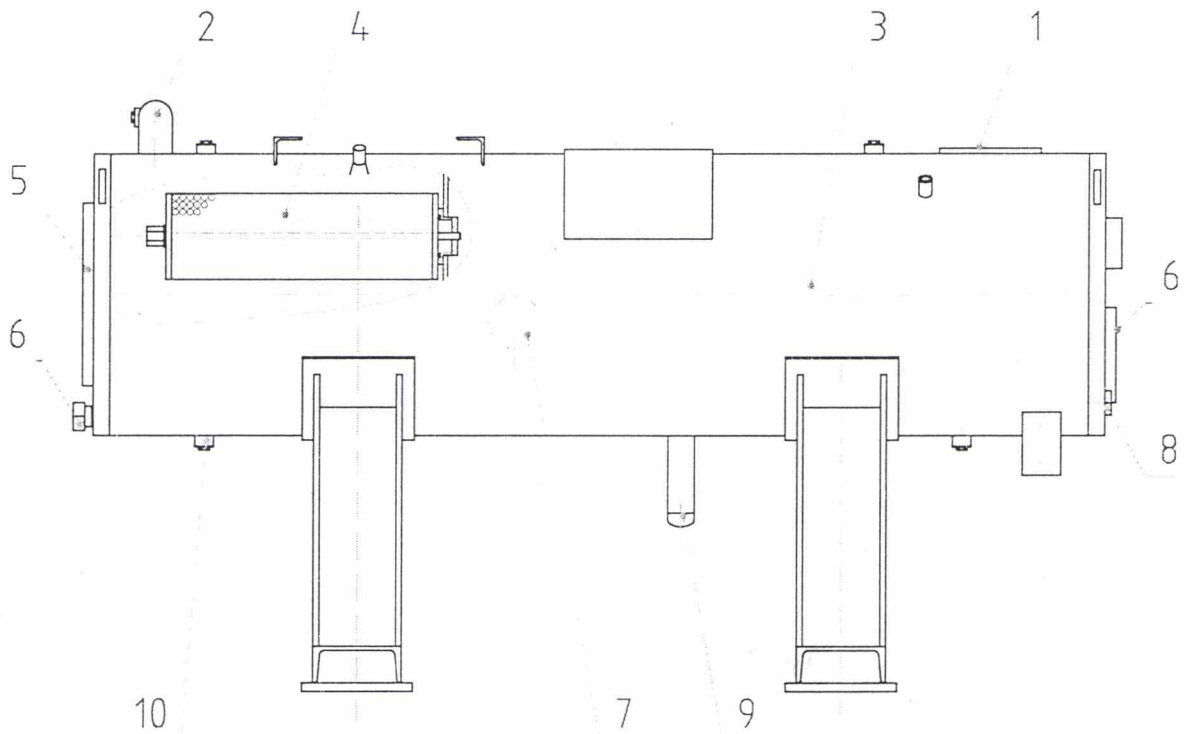


Fig. 1 Horizontal oil separator for screw compressor packages SMALL Series

**EQUIPMENT OF THE SCP**

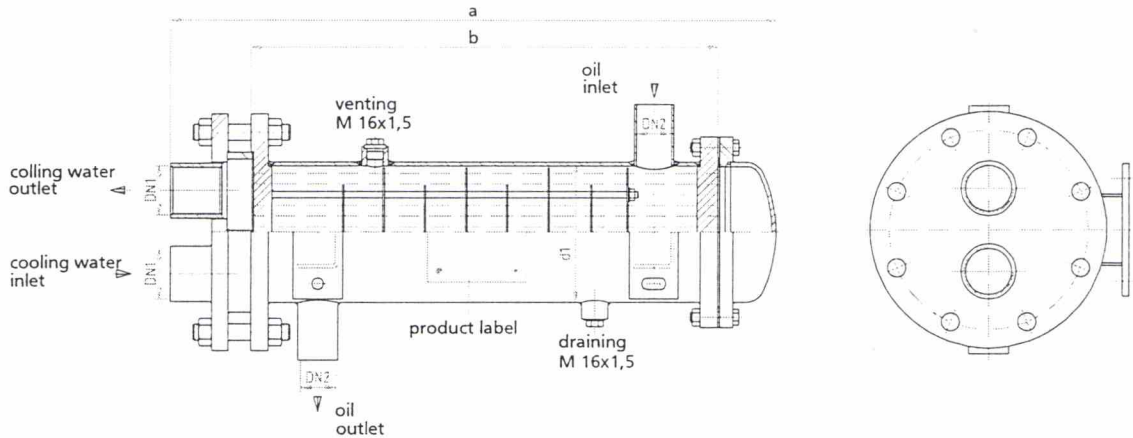
SCP type	∅ oil separator (mm)	Number of oil fine separation cartridges *
CA	508	1 - 3
DA	508	1 - 3
EA	508	1 - 3
GA	508	1 - 3

\* Depending on compressor type and operating conditions. For refrigerant-unsoluble oils only.

**SPARE PARTS**

Item	Spare part	Ident. N°
4	Oil fine separation cartridge	362698013
-	O ring, oil fine separation cartridge 65x5	762925123
11	O ring, gap for mounting 230x5	762925159
1	O ring, refrigerant inlet 100x5	762925132
-	O ring, refrigerant outlet, compressor side for C,D 80x5	762925128
-	O ring, refrigerant outlet, compressor side for 100x5	762925132

**SCREW COMPRESSOR PACKAGES**



Type			80 / 700	80 / 1000	100 / 1000	100 / 1250	100 / 1400
exchange area	A	m <sup>2</sup>	0,7	1,0	2,1	2,6	2,9
oil cooling capacity	R22	kW	5	10	24	40	42
oil cooling capacity	NH <sub>3</sub> <sup>1)</sup>	kW	7	15	37	58	62
	NH <sub>3</sub> <sup>2)</sup>	kW	12	25	55	75	88
max. water flow rate		m <sup>3</sup> /h	4,0	4,0	9,0	9,0	9,0
pressure losses, water side		bar	0,40	0,42	0,47	0,54	0,59
diameter		mm	80	80	100	100	100
total length	a	mm	845	1145	1150	1400	1550
tube length	b	mm	700	1000	1000	1250	1400
oil in- and outlet		DN 2	40	40	40	40	40
water in- and outlet		DN 1	1"	1"	1,25"	1,25"	1,25"
volumen oil side		l	2,5	3,5	5,6	7,0	7,9
weight		kg	26	30	40	45	48
Ident number			362598877	362598878	362598879	362598880	362598881

Type			150/1500	200/1000	200/1500	250/1750	250/2250
exchange area	A	m <sup>2</sup>	6,2	8,7	13,1	16,4	21,1
oil cooling capacity	R22	kW	70	105	166	210	250
oil cooling capacity	NH <sub>3</sub> <sup>1)</sup>	kW	104	148	235	300	370
	NH <sub>3</sub> <sup>2)</sup>	kW	150	220	320	400	440
max. water flow rate		m <sup>3</sup> /h	16	32	32	54	54
pressure losses, water side		bar	0,52	0,38	0,46	0,44	0,56
diameter		mm	150	200	200	250	250
total length	a	mm	1665	1203	1703	1968	2468
tube length	b	mm	1500	1000	1500	1750	2250
oil in- and outlet		DN 2	50	50	50	65	65
water in- and outlet		DN 1	2"	2,5"	2,5"	3"	3"
volumen oil side		l	19,4	20,2	30,3	52	66,9
weight		kg	108	136	172	285	343
Ident number							

**TECHNICAL SPECIFICATIONS**

**Water side - non corrosive water**

water inlet ≤ 30°C  
 operating pressure 10 bar  
 operating temperature max. 70°C

$$\text{water - outlet} = \text{water - inlet} + \frac{0,833 \times \text{oil cooling capacity (kW)}}{\text{water volume (m}^3/\text{h)}}$$

**Oil side**

	NH <sub>3</sub> <sup>1)</sup>	NH <sub>3</sub> <sup>2)</sup>	R22
oil inlet	80 °C	90°C	85°C
oil outlet	50 °C	60°C	45°C

operating pressure 23 bar  
 operating temperature max. 105°C

For technical specifications of oil cooler, please use the programme AEL.WKG.

**CONSTRUCTION MATERIALS**

finned tubes	6 x 0,5mm up to diameter 200 mm high grade steel 1.4301 10 x 1mm for diameter 250 mm high grade steel 1.4571
tube plate	high grade steel 1.4301
end covers	steel
tube shell	steel

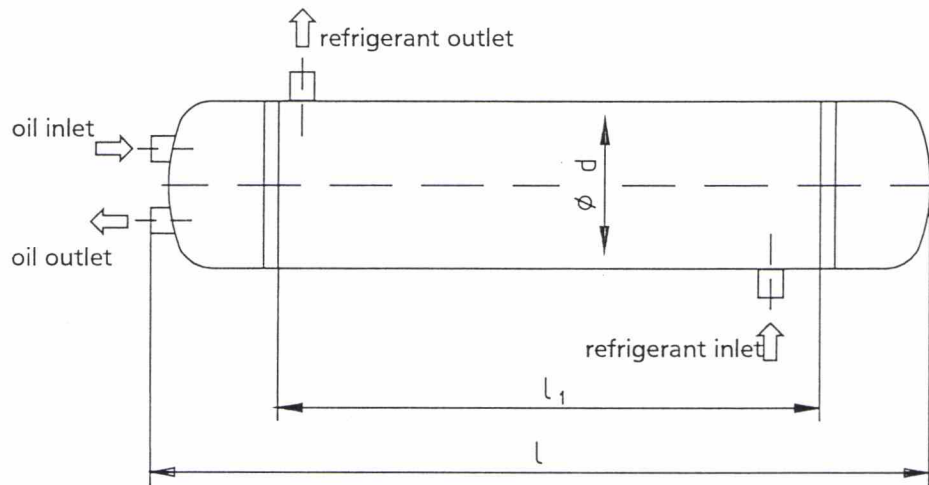
**APPLICATION**

all types of units

**APPROVAL**

- Work's acceptance for diameters 80 mm and 100 mm (TÜV is not necessary)
- TÜV, Stoomwezen
- TÜV-Austria, AEEF, UDT





Type		150-1000	200-1500	200-2000	250-2000	300-1500	350-1500	350-2000	400-1500	400-2000
exchange area	m <sup>2</sup>	1,1	3,9	5,2	9,9	11,3	14,8	19,7	19,0	25,3
oil cooling capacity	R22 kW	-	10	35	70	-	115	160	-	215
oil cooling capacity	<sup>1</sup> NH <sub>3</sub> kW	6	25	40	80	-	100	130	-	230
	<sup>2</sup> NH <sub>3</sub> kW	10	45	75	140	160	215	270	-	350
diameter	d mm	150	200	200	250	300	350	350	400	400
total length	l mm	1200	1700	2200	2200	1700	1700	2200	1700	2200
tube length	l <sub>1</sub> mm	1000	1500	2000	2000	1500	1500	2000	1500	2000
oil in- and outlet	DN	32	40	40	40	50	50	50	50	50
refrigerant inlet	DN	32	40	50	50	65	65	65	80	80
refrigerant outlet	DN	40	50	65	65	80	80	80	100	100
volume refrigerant side	l	13	34	45	67	67	80	107	107	142
volume oil side	l	4	13	18	32	38	50	64		
weight	kg	43	130	160	247	270	310	390		
ident no.	362598...	...535	...536	...537	...538	...539	...540	...541	...542	...543

**TECHNICAL SPECIFICATIONS**

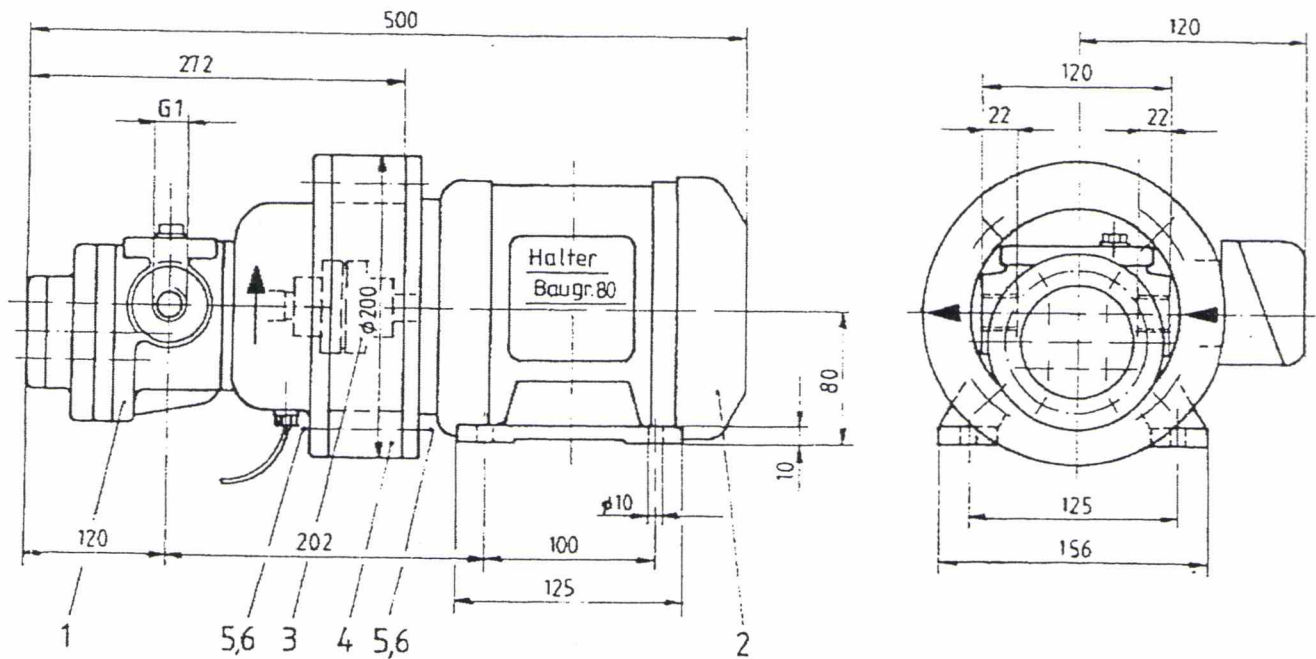
condensing temperature max. +40°C for NH<sub>3</sub>  
max. +35°C for R22

oil side	NH <sub>3</sub> <sup>1)</sup>	NH <sub>3</sub> <sup>2)</sup>	R22
oil inlet	80°C	90°C	85°C
oil outlet	50°C	60°C	45°C

operating temperature tubular space (oil) / shell space (refrigerant) : max. 110°C / max. 60°C  
operating pressure tubular space / shell space : 23 bar

**CONSTRUCTION MATERIALS**

tubes: 16 x 1,5mm, welded into the tube plates  
material: carbon-steel with internal vortex inducing fins  
tube bundle: welded into the shell with end covers and connections as a complete unit,  
material: carbon-steel  
application: for all SCP-types, especially for ramified thermosyphon systems with several SCP  
approval: TÜV  
other possible certificates: GL, LRS, ABS, DNV



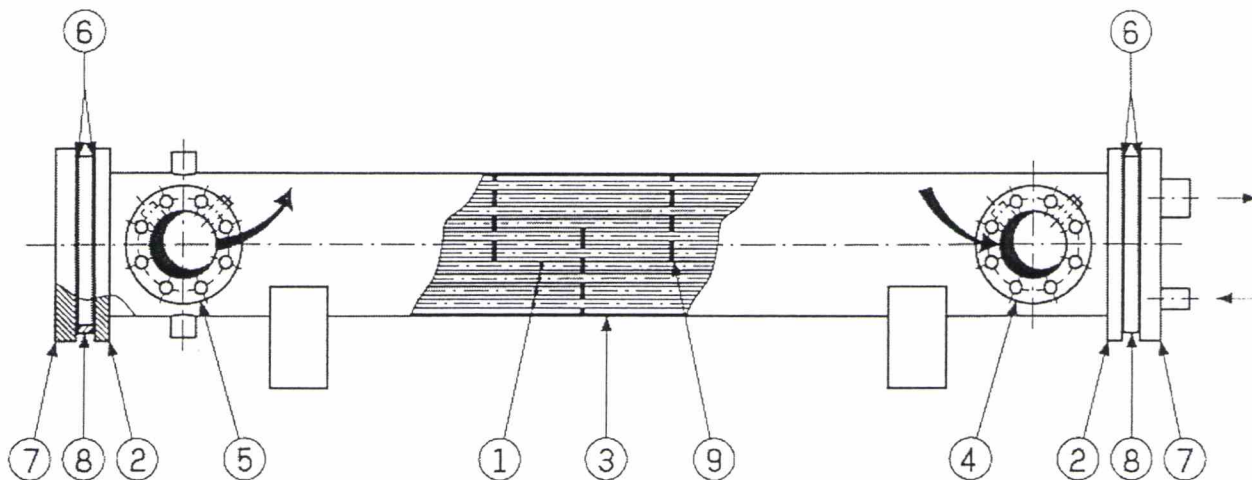
**MODEL TYPE F**

Design type pump with latern, coupling, motor and mating flanges

delivered liquid	lubricating oil with ammonia, R22 or R134a
volume flow	approx. 22,5 l/min
operating pressure	max. 25 bar, $\Delta p = 6$ bar
suction(-)/supply(+)height	max. 19 bar
drive motor/ direction of rotation	above/ left
viscosity	10-300 mm <sup>2</sup> /s
operating temperature	35 ... 100 °C
shaft sealing	special type shaft seal
bearings	journal bearing
safety valve	without
power requirement	0,95 kW

**THREE-PHASE A.C.MOTOR**

design type	90 S
speed	1410 1/min
model type	V1
capacity	1,1 kW
voltage	400 V, 50 Hz
class of protection	IP 54



#### CONSTRUCTION

- 1 **Bundle of high performance tubes** secured by expansion over 2 steel endplates (2).
- 2 **steel endplates**
- 3 **steel shell**, fitted with:
  - 4, 5 **Inlet/ Outlet pipings** of the outside tube circuit. Those pipes are themselves equipped with:
    - 1/2" socket for the antifrost and regulation sensors mounting
    - 1" socket for the flowswitch mounting
    - 3/4" sockets for draining and event of the outside tubes circuit
    - Support feet
  - 6 **Set of flat gaskets** between:
  - 7 **Headers** and
  - 8 **Spacers** spacers and endplates.  
Note:  
on the front tape are fixed the inlet and outlet pipes of the fridge circuit.
  - 9 **Anticorrosion baffles**.

#### CODIFICATION

FYH	Shell and tube evaporator
273	Shell outside diameter (mm)
30	Shell length (dm)
4	Number of passes inside tubes
B	Baffles type

#### OPERATING LIMITS

##### Inside tubes: Refrigerant

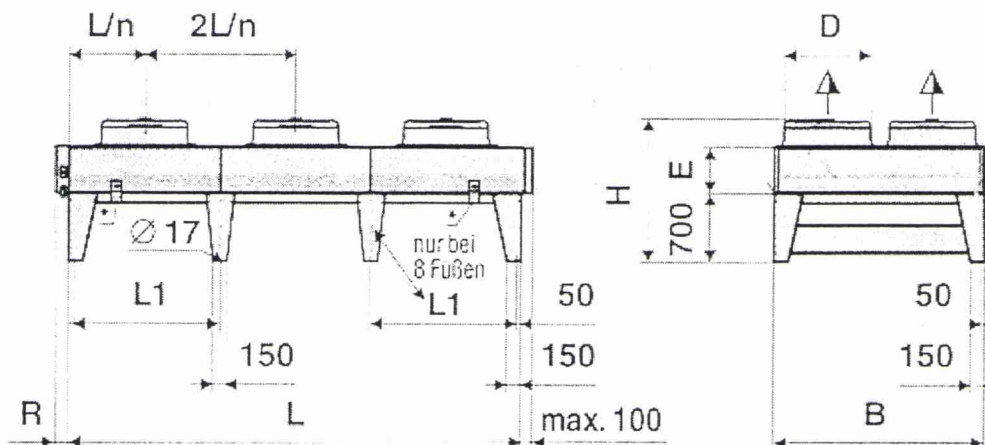
$T_{min}/T_{max}$	- 25 / 50 °C
$P_c$	17,0 bar
$P_e$	22,1 bar

##### Outside tubes: warm fluid

$T_{min}/T_{max}$	- 10 / 50 °C
$P_c$	10,0 bar
$P_e$	13,0 bar

#### DRYEX MULTITUBULAR EVAPORATORS

... guarantee the perfect integration in medium and large duty cooling units.



\* Transpor device can be disassembled  
n = number of fans  
D = 630 mm  
F = 260 mm

#### CONDENSER COIL

Coil tubes do not contact the end sheets. Complete coil is supported by special rods. This principle reduces the risc of tube fracture.

Galvanized steel tube  $\varnothing$  12 mm with a spacing of 50x25 mm staggered. Fins made of high grade aluminium with a fin spacing of 2,4 mm.

#### CASING

Galvanized steel sheet, painted to RAL 7032

#### FANS

Low noise level axial fans with maintenance free motors with protection class IP 54, three-phase current 400/3/50, according to DIN 40050.

Construction: Insulation material class F, admissible ambient temperature  $-25$  up to  $+55^{\circ}\text{C}$ .

All fans generally available as 2-speed fans ( $\Delta$ -Y-changeover) as well as suitable for various speed control.

In case of higher air temperatures and varying air resistance the power input will change.

The integrated thermo contacts (thermistors) must be used as motor protection.

High speed  $\Delta$ , low sopeed Y.

#### GENERAL REMARK

The axial condensers are designed for outdoor operation with no external pressure drops being considered. In case of long periods of non-operation the motors must be operated every month for 2-4 hours.

#### NOMINAL CAPACITIES

The nominal capacities refer to a condensation temperature  $t_c = 40^{\circ}\text{C}$ , at an air inlet temperature  $t_{ie} = 25^{\circ}\text{C}$ , temperature difference  $\Delta t = 15\text{K}$ , at geodetic height NN, ratings are for refrigerant ammonia.

#### TYPE CODE

AGVH 091 C /2x2 N(D)

AGV condenser with axial fans  
H horizontal  
091 fan  
C module of model  
2x2 number of fans  
N standard design

#### CHARACTERISTICS

		$\Delta$	Y
Nominal capacity at $\Delta t = 15\text{K}$	kW	917,2	781,0
Air flow	$\text{m}^3/\text{h}$	227800	181400
Motor capacity	W	3600	2500
Motor current (at 400V)	A	7,20	4,30
Motor speed n	$\text{min}^{-1}$	890	700



### ANWENDUNGSGEBIETE

Rippenrohr-Heizkörper dienen der Beheizung und als Frostschutz Räumlichkeiten, die normalerweise nicht mit einer Heizung ausgestattet sind, wie z.B.

- Wetterschutzhauben
- Elektrische Schaltanlagen,
- Wasserversorgungsanlagen,
- Außenräume,
- Werkstätten,
- Arbeitsplätze.

### AUFBAU

- Beripptes Rohr mit 2 Fußstützen
- 1, 2 oder 3 Edelstahl-Heizschlangen  $\varnothing$  8,4 mm
- Haube aus Stahl, glanzverzinkt
- Oberfläche: Stahl lackiert oder Edelstahl

### TECHNISCHE DATEN

- Ausführung: 230 V AC
- Leistung: 1000 W
- Schutzart IP 65
- Kabelverschraubung Pg 11 mit Zugentlastung
- Rohrlänge: 500 mm

### TEMPERATUR

Rippentemperatur: ca. 160°C

### AUFSTELLUNG

Waagrecht auf Böden, an Wänden oder in Nischen.  
Keine Gegenstände auf die Heizkörper legen. Vorsicht bei Verkleidungen! (Bildung von Wärmestau!)

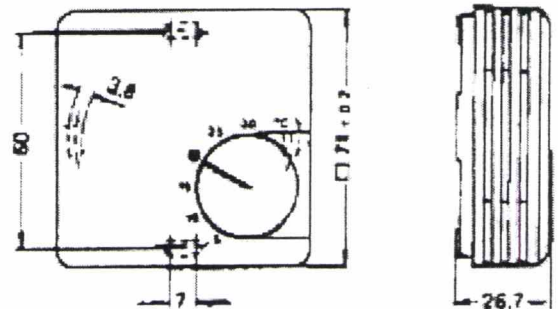
Senkrecht nur bei geringen Leistungen (z.B. Rohrlänge 1000 mm, 1000 W) mit unten liegendem elektrischen Anschluß möglich.

Sollten die Rippenrohre an Stellen eingebaut werden, wo eine Verletzungsgefahr besteht, wird empfohlen, einen Edelstahl-Schutzkorb anzubringen.

04.09.97/ 0

### REGELUNG

durch Raumtemperaturregler IP 30



Der Raumtemperaturregler IP 30 wird zur automatischen Konstanthaltung von Lufttemperaturen in Verbindung mit der o.g. Raumheizung verwendet.

Der Raumtemperaturregler besteht aus einem Bimetall-Regler mit 1-poligem Umschaltkontakt und einem Kunststoffgehäuse.

### Elektrischer Anschluß des Raumtemperaturreglers

- Direkte Schaltung - Zwischenschaltung eines Schützes erst ab einer Leistung von 2000 W erforderlich.

### Technische Daten des Raumtemperaturreglers

Schutzart:	IP 30
Schaltelement:	1-poliger Umschalter
Schaltdifferenz:	0,5 K
Schaltleistung:	10 A
Spannung:	230 V AC
Regelbereich:	- 20°C bis + 30°C

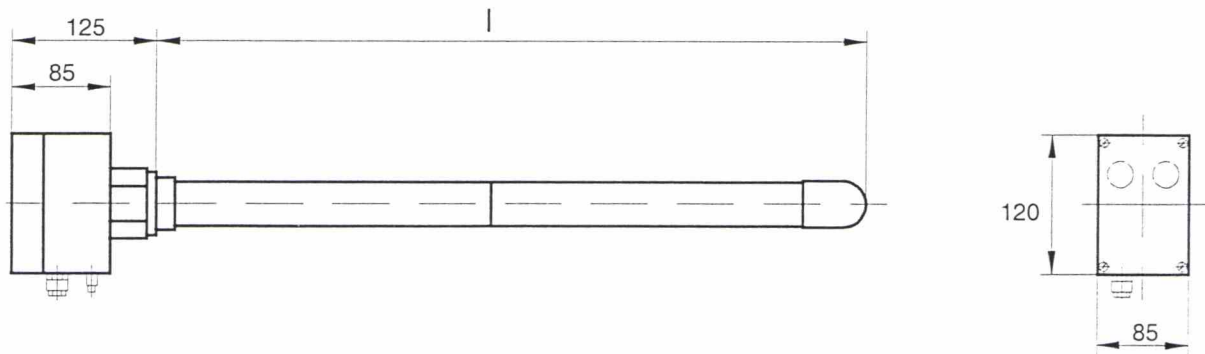


Fig.: screw-in heater element standard execution

screw-in heater element type	Ident No.	heating capacity [kW]	rated current [A]	fitting length l [mm]	weight [kg]
C/Th/STB/RR/3/R1 <sup>1</sup> / <sub>2</sub> -K-2 315-400-1000	677398153	1,0	2,5	315	1,2
C/Th/STB/RR/3/R1 <sup>1</sup> / <sub>2</sub> -K-2 380-400-1200	677398154	1,2	3	380	1,5
C/Th/STB/RR/3/R1 <sup>1</sup> / <sub>2</sub> -K-2 465-400-1500	677398155	1,5	3,8	465	2,0
C/Th/STB/RR/3/R1 <sup>1</sup> / <sub>2</sub> -K-2 600-400-2000	677398156	2,0	5	600	2,3
C/Th/STB/RR/3/R1 <sup>1</sup> / <sub>2</sub> -K-2 700-400-2200	677398157	2,2	5,5	700	2,5
C/Th/STB/RR/3/R1 <sup>1</sup> / <sub>2</sub> -K-2 790-400-2500	677398158	2,5	6,3	790	2,8
C/Th/STB/RR/3/R1 <sup>1</sup> / <sub>2</sub> -K-2 860-400-3000	677398159	3,0	7,5	860	3,1

connection thread : 1<sup>1</sup>/<sub>2</sub>" „whitworth“-tube thread, conical

sealing : teflon band

voltage : 400V AC; 2ph; 50Hz

temperature limiter : 150°C, responds to surface temperature

temperature controller : 0 - 120°C, factory adjusted on 60°C

Explosionproof elements are available on request (by named the ex-class).

SCP-type	∅ oil separat.	heating capacity oil heater (kW)
<b>single-stage</b>		
C, D, E, G	508	1,0
H, L, P	508	1,5
RB, SB	508	1,5
	711	2,2
RK, SK	711	2,2
VB, YB, ZB	508	1,5
	711	2,2
	813	2,5
VK, YK, ZK	813	2,5
αB	711	2,2
	813	2,5
	1016	3,0
αK	1016	3,0
<b>two-stage</b>		
HE, HN, LE, LN, PE, PN	508	1,2
RE, RN, SE, SN	711	1,5
VE, VN, YE, YN, ZE, ZN	711	1,5

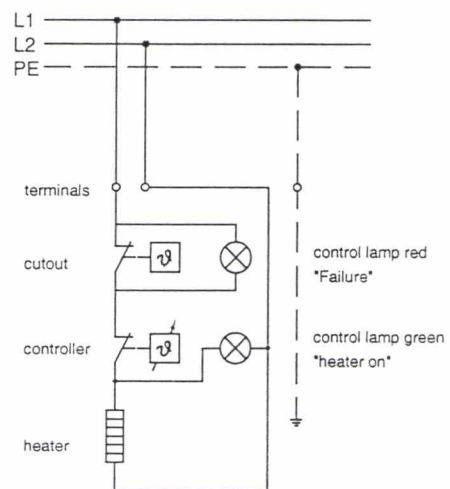
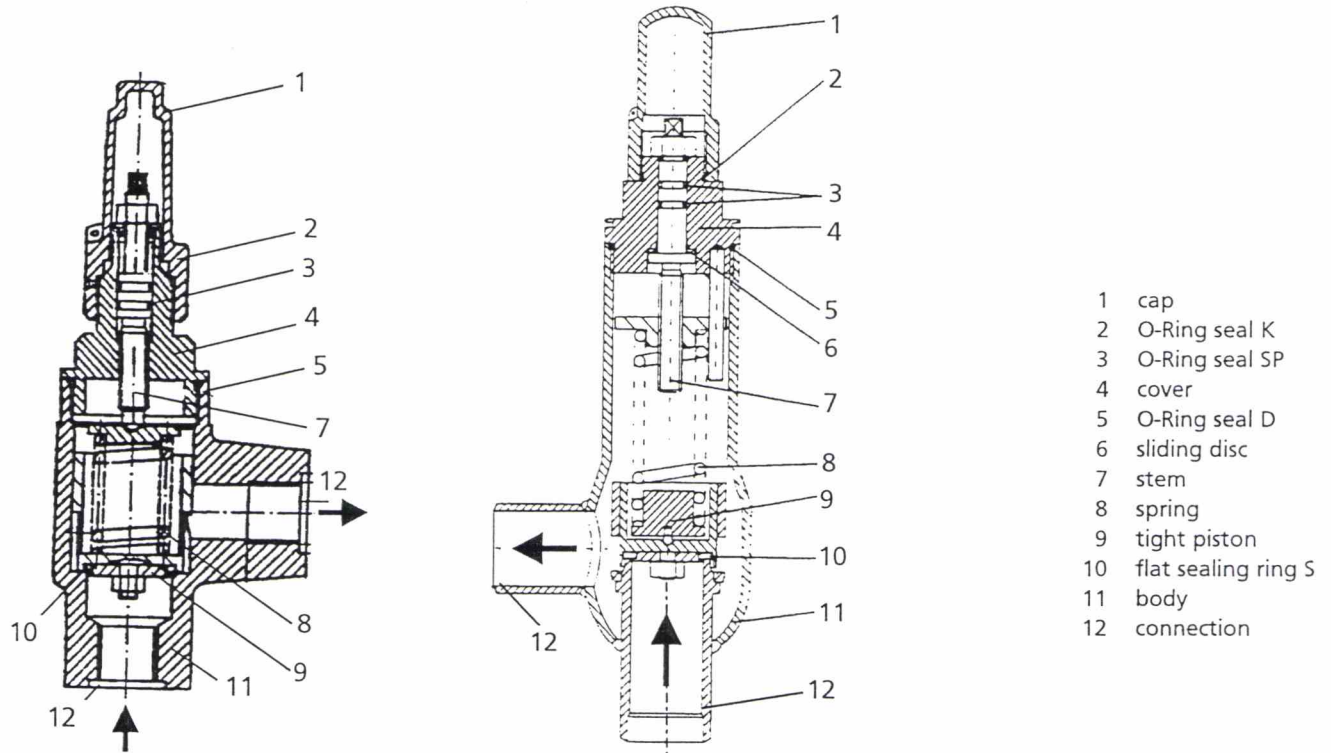


Fig.: electric connection

NB 20

NB 25, 32



- 1 cap
- 2 O-Ring seal K
- 3 O-Ring seal SP
- 4 cover
- 5 O-Ring seal D
- 6 sliding disc
- 7 stem
- 8 spring
- 9 tight piston
- 10 flat sealing ring S
- 11 body
- 12 connection

**APPLICATION**

Oil pressure control valve is an automatically working controlling device, that regulates the pressure difference and maintains it at a constant level within the oil circulation of refrigerant screw compressor units.

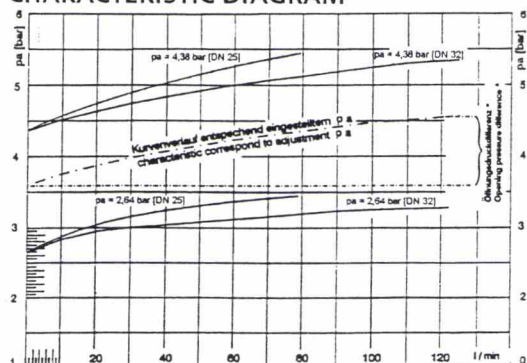
**CHARACTERISTICS**

- Operating mediums: lubricating oils for ammonia and freons
- Sealing: < 5 g refrigerant/ year
- Mounting position: vertically, horizontally
- Testing: acc. DIN 3158, AD-test report
- Resistance: 1,3 x PB (100%)
- Sealing: PB (100%)
- Setting value:  $p_e$  (100%)

**PARAMETERS**

NB	20	25	32
min. flow area [mm <sup>2</sup> ]	491		707
adjustables	2 up to 6		
pickup pressure $p_a$ [bar]	2 up to 6		
presettes pressure $p_a$ [bar]	2+0,5	3+0,5	
flanged connection	-	x	x
Male coupling G 1/2"	x	-	
PN 40 DIN flange/ screwed joint 501598...	216	214	205
PN 40 AWP flange 501598...	-	217	215

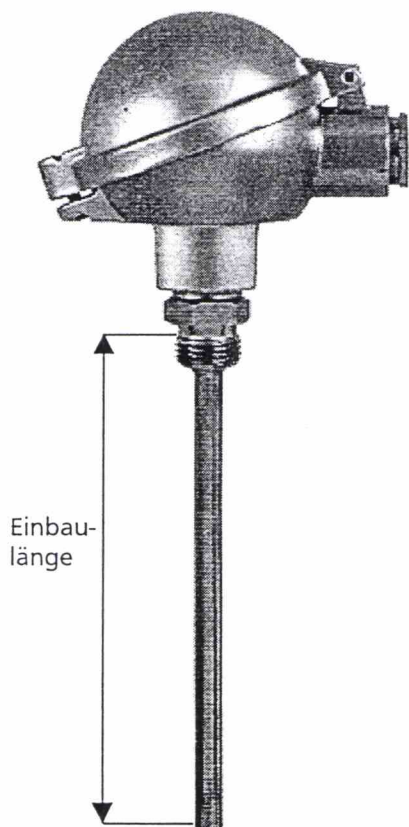
**CHARACTERISTIC DIAGRAM**



Measured:

- Oil pump: 200 l/min
- Oil temperature: +20°C ± 7K
- Oil type: XK 57 with R22

EINSCHRAUBWIDERSTANDSTHERMOMETER



Einschraubwiderstandsthermometer ohne Halsrohr und mit austauschbarem Meßeinsatz dienen zur Temperaturmessung in Verdichtern, Druckbehältern und Rohrleitungen. Sie werden direkt ohne zusätzliches Tauchrohr eingeschraubt.

**Achtung !**

Das komplette Einschraubwiderstandsthermometer nur in drucklosem Zustand des Verdichters bzw. des Behälters oder der Rohrleitung heraus-schrauben. Besteht keine Möglichkeit zum Absperrern, kann der Meßeinsatz durch Öffnen des Anschlußkopfes demontiert und ggf. ausgetauscht werden.

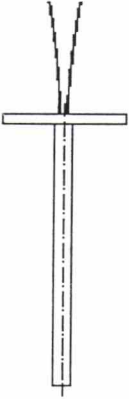
Temperaturtransmitter und Meßeinsatz sind separat ohne Druckausgleich austauschbar.

AUFBAU UND TECHNISCHE DATEN

Anschlußkopf:	Form BSZ, drehbar mit Feststellschrauben
Meßeinsatz:	Ø 4 mm auswechselbar
Schutzrohr:	6 x 0,75 mm, rost- und säurebeständiger Niro-Stahl
Halsrohr:	ohne
Einschraubgewinde:	M12x1,5 mit O-Ringkontur
Dichtung:	O-Ring 15x2 Ident-Nr. 762925234
Temperaturtransmitter:	T 20 auswechselbar
Potentiometer:	versiegelt
Temperaturbereich:	- 60°C bis 140°C
Meßumformer:	4 ... 20 mA
Schaltung:	2-Leiter
max. Mediendruck:	35 bar
Grenzabweichung:	DIN IEC 751 Klasse B
Einbaulänge	30/ 60/ 90/ 120 mm
Standardausführung:	geschlossen schwingungsfest
Ex-Ausführung	geschlossen schwingungsfest EEx ia/ib IIC T6 NAMUR NE24 PTB-Bescheinigung

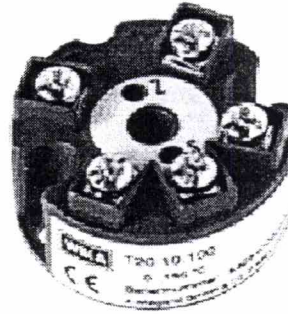


MEßEINSATZ PT 100



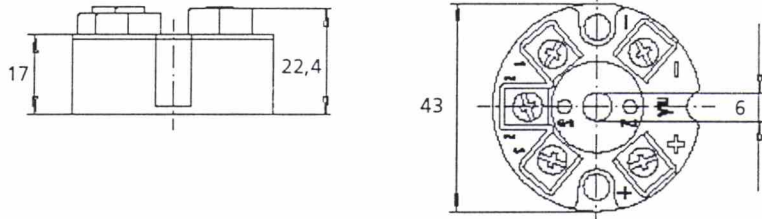
- Meßeinsatz ohne Klemmsockel
- vorbereitet zur Transmittermontage
- für Einbaulängen 30, 60, 90, 120 mm

TEMPERATURTRANSMITTER TYP T 20

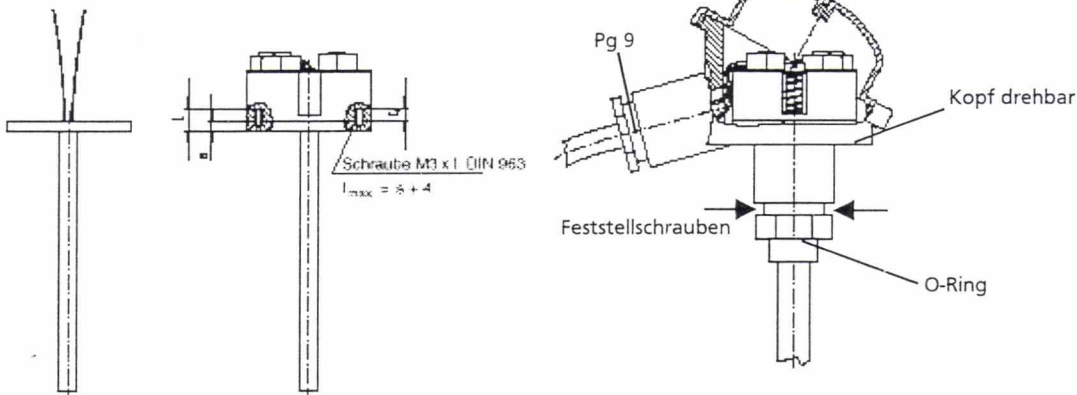


Eingang:	für Pt 100
Temperaturbereich:	- 60/ +140°C
Analogausgang:	4 ... 20 mA, 2-Leiter
Schaltung:	fester Meßbereich
Fehlersignalisierung:	bei Fühlerbruch/ Fühlerkurzschluß
Potentiometer:	versiegelt
bei Ex-Schutz:	eigensicher EEx ia/ib IIC T4/T5/T6 CE-Zeichen

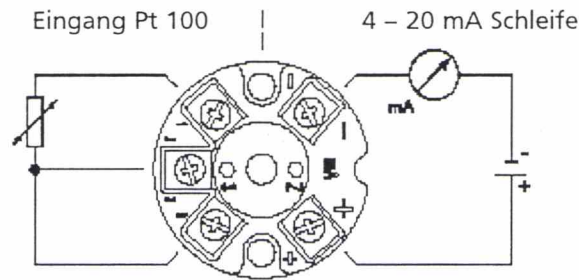
Abmessungen in mm



MONTAGE

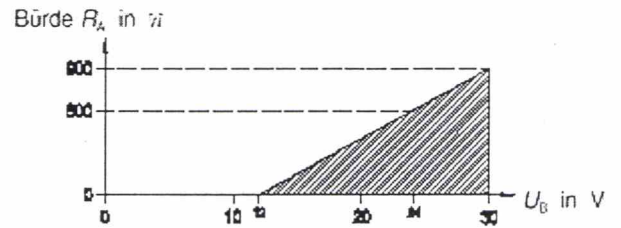


**BELEGUNG DER ANSCHLUßKLEMMEN**



**BÜRDENDIAGRAMM**

Die zulässige Bürde hängt ab von der Spannung der Schleifenversorgung.



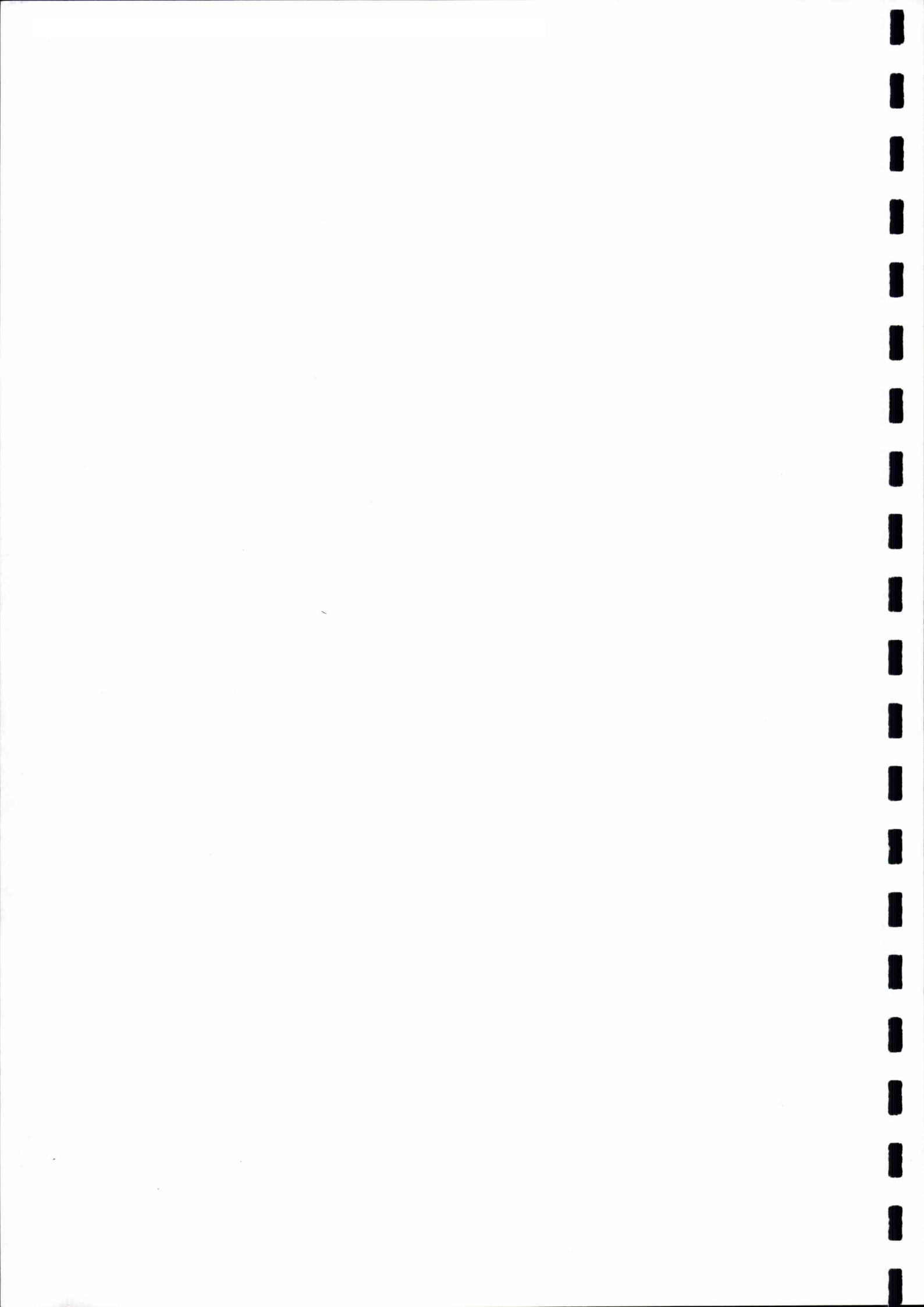
**STANDARDAUSFÜHRUNG, IDENT-NUMMERN**

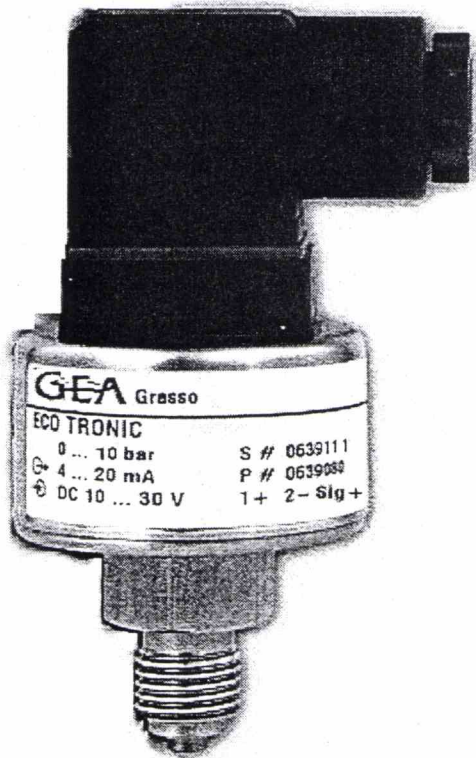
Einbaulänge	Einschraubwiderstands-thermometer (komplett)	Meßeinsatz (Ersatzteil)	Temperaturtransmitter T20 (Ersatzteil)
30 mm	630498243WI	630498117WI	630498242WI
60 mm	630498246WI	630498118WI	630498242WI
90 mm	630498249WI	630498119WI	630498242WI
120 mm	630498252WI	630498120WI	630498242WI

**Ex-AUSFÜHRUNG, IDENT-NUMMERN**

Einbaulänge	Einschraubwiderstands-thermometer (komplett)	Meßeinsatz (Ersatzteil)	Temperaturtransmitter T20 (Ersatzteil)
30 mm	630498243EX	630498117EX	630498242EX
60 mm	630498246EX	630498118EX	630498242EX
90 mm	630498249EX	630498119EX	630498242EX
120 mm	630498252EX	630498120EX	630498242EX

Ex-Ausführung mit PTB-Bescheinigung





- Max. pressure control precision by high developed sensor technology
- Energy saving by exact power control, for example suction pressure control
- Compatibility with all refrigerant types incl. ammonia, advantages for stocking
- Integrated current controller; pressure transducer can be provided by any electric supply within fixed limits.
- Effective protection against moisture allows mounting raw conditions, for example in suction line even if the pressure transducer is iced up.
- Design protects against mechanical influences as impulse load, vibration and pressure peak values.
- Calibration is not required. Sensor technology guarantees retaining of manufacturers presettings, independent of ambient temperature and atmospheric pressure changes. This is important for low-pressure control in refrigerating and air conditioning systems.
- High insensitivity to electromagnetic influences.

**CHARACTERISTICS**

Linearity	$\pm 0,2 \% \text{ FS} \pm 0,5\% \text{BFSL}$
Repeatability and hysteresis	$\pm 0,1 \% \text{ FS}$
Ambient temperature sensitivity	$< 0,04 \% \text{ FS} / ^\circ \text{C}$ (zero point) $< 0,04 \% / ^\circ \text{C}$ (sensitivity)
Long term stability	0,3 % FS/year

**ELECTRICAL PARAMETERS**

Power supply voltage	10 – 30 V DC, polarity protection, Pinconfiguration + = Pin 1 - = Pin 2 reserve voltage protection, over-voltage protection and short-circuit protection
Current	< 5 mA
Standard output signal	4 – 20 mA, two-wire connection current limitation max. 23 mA (35 bar g.p. max)
response time (10...90%)	$\leq 5 \text{ ms}$
Max. cable impedance	$(\text{Power supply voltage} - 10) / 0,03 (\Omega)$
HF Interference	10 V/m, 150 KHz – 1 GHz: < 0,5 % FS
Elektrostatic discharging	IEC 801-2 cl. 3
Insulation	> 100 M $\Omega$ , for 500 V DC
C E – mark	fault emission acc. EN 50081-1 and 2 fault immission, immunity acc. EN 50082-1 (IEC 801) Conformity declaration
Electrical connection	plug DIN 43650 right-angle plug IP 65/ IP 67 Pg9

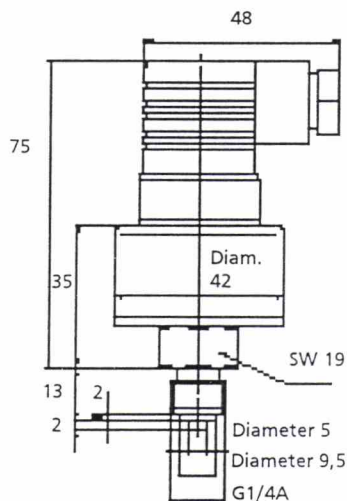
**OTHER PARAMETERS**

Material	stainless steel, housing and medium-contacted material constant against all fluorided refrigerants/ ammonia and lubricating oils
Degree of protection	IP 65 (with DIN – right-angle plug DIN 43650 Pg9) acc. IEC 529
Pressure port	G 1/4 " DIN 3852-E with laminated, refrigerant-resistant sealing
Sealing	0 ... 35 bar abs.

Ambient temperatures	operation: -60 up to + 110 °C compensated range: -30°C up to +80°C -30°C up to +40°C for pressure transducer ≤ 13 bar a ±0°C up to +80°C for pressure transducer > 13 bar a transport / storing: -30 up to +100 °C
Weight	0,15 kg
Vibration (IEC 68-2-6)	15 g
Impulse load (IEC 68-2-6)	500 g

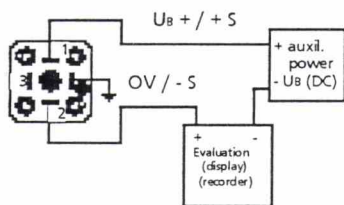
**RIGHT-ANGLE PLUG**

Dimensions (mm)



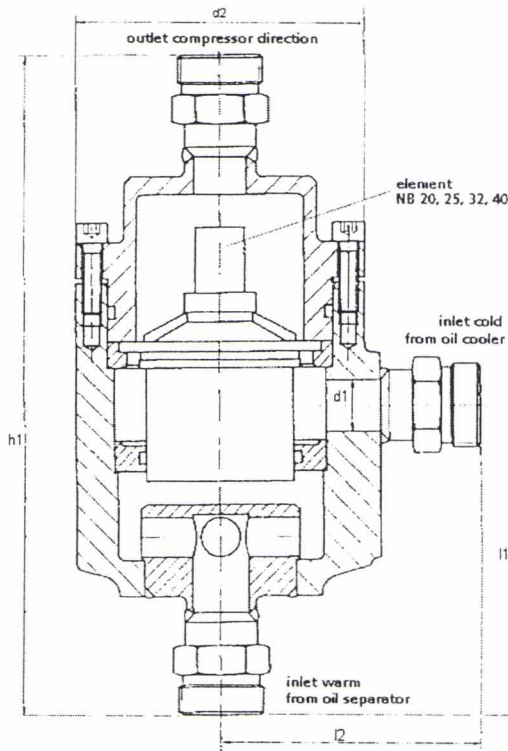
**ELEKTRICAL CONNECTION**

Two-wire system

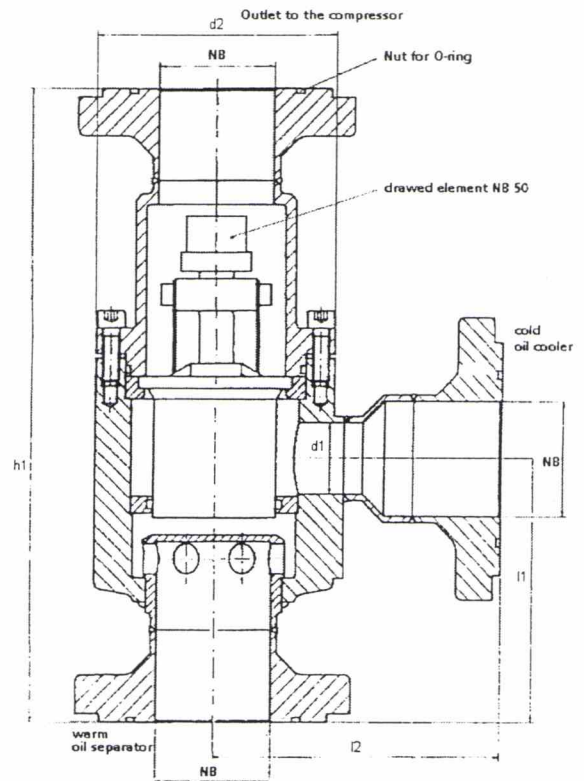


**IDENT-NUMBERS**

Type	Pressure Range	Ident-Number
ECO TRONIC 7	0 ... 7 bar abs.	632198021WI
ECO TRONIC 13	0 ... 13 bar abs.	632198034WI
ECO TRONIC 21	0 ... 21 bar abs.	632198022WI
ECO TRONIC 25	0 ... 25 bar abs.	632198125WI
ECO TRONIC 32	0 ... 32 bar abs.	632198035WI

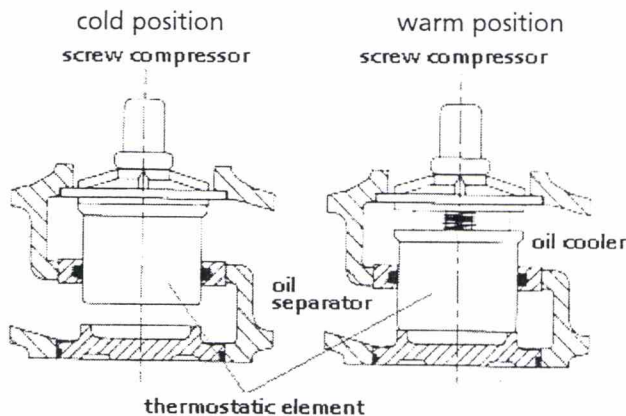


Temperature controller NB 20-40



Temperature controller NB 50

**OPERATION**



**PRINCIPAL DIMENSIONS AND DATA**

NB	l1 (mm)	l2 (mm)	h1 (mm)	d1 (mm)	d2 (mm)	weight (kg)
20	94	81	201	16	90	4,4
25	101	88	215	22	90	4,8
32	115	116	236	22	90	7,1
40	109,5	112,5	225	22	90	7,1
50	123	138	296	34	114	13,8

**TEMPERATURE RANGE:** 38 - 46 °C  
others on request

Thermostatic 3-Way-Valve for application in Screw Compressor Packages:

- Automatic control of lubricating oil temperatures
- Precise operation, high-grade quality
- Thermosensitive sensors
- Full range of temperatures

The temperature controllers have an operating band of approx 9°C from the point of opening to full open. The function of the thermosensitive sensors is unaffected by system pressures.

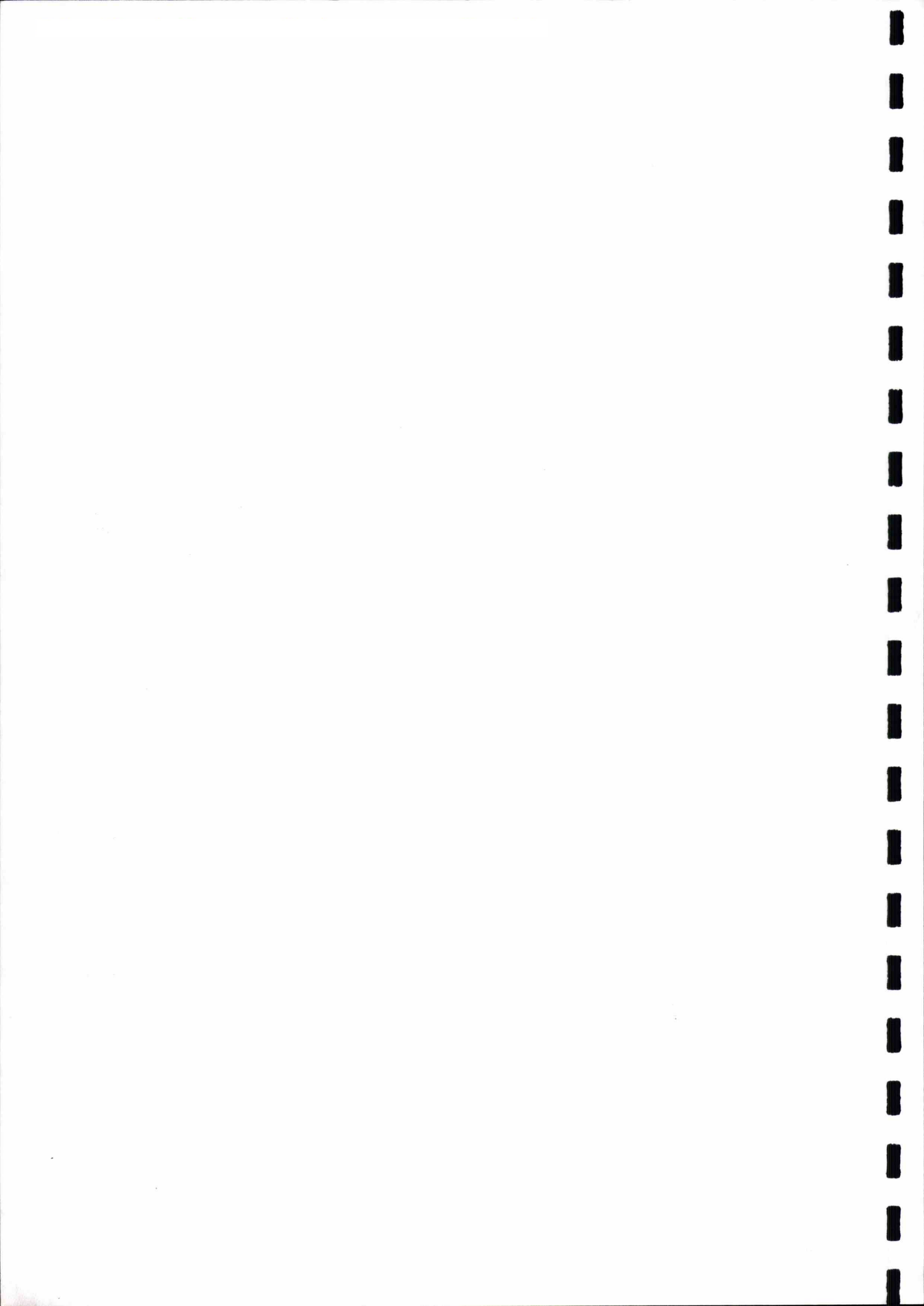
The standard application is the above depicted welding construction. Cast iron and other materials can be delivered to special order.

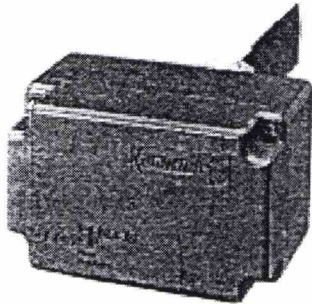
The sealing of the modulating valve is designed to ensure that the internal passages are leak free resulting in rapid warm-up of the engine to its optimum operating temperature and the maintaining of that temperature even at light power loadings.

The temperature controller works maintenance-free. All types are easy to handle because of low weight.

The valve insert (thermostatic element) has to select according operating conditions.

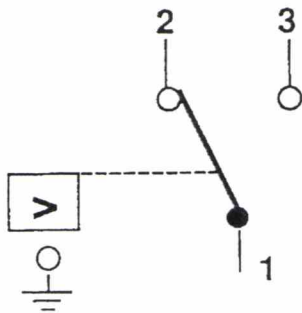
DN 20	DN 25	DN 32	DN 40	DN 50
637698168				637698158





The flow switch type F61TB-9100 is used in lines to control the liquid flow. The flow switch should block lines and protect the refrigeration plant in case of flow interruption.

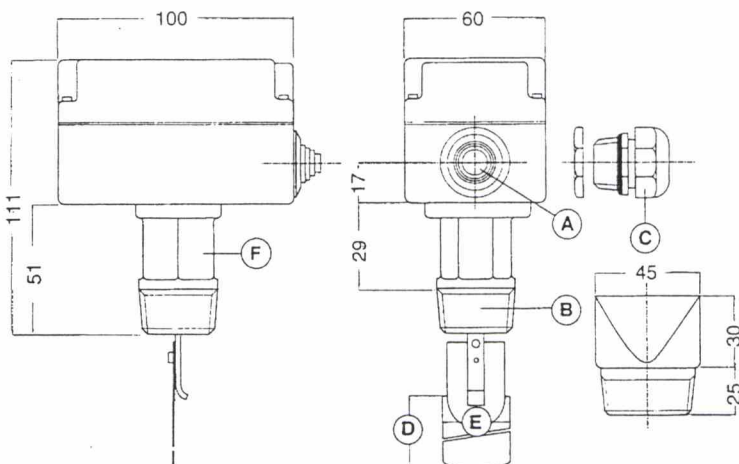
**Contact function**



- 1-3 close if flow increase (flow exists)
- 1-2 close if flow decrease (switch-off)

**Attention!**

If you use the device without cover have a look at current leaded parts!



**MATERIAL**

Housing/ cover	polycarbonat
Flow switch body	brass
Innenteile	brass, phosphorus bronze, brass nickeled
Paddel	phosphorus bronze / high-grade steel

**TECHNICAL DATA**

Standard, protective	IP 67
Medium pressure, max.	1 MPa
Medium temperature, min.	-30°C
Medium temperature, max.	with cover: 85°C at 20°C ambient temperature
	Medium temperature (max.) decreases at increased ambient - temperatures. The temperature at switching contact must be lower than +55°C!

Ambient temperature min./max.

-40/ +55°C  
Avoid a ice-shaping into the housing/ corrugated tube by combination of low ambient temperature and (low) medium temperature!

Switching capacity  
switch-off value

15(8) A; 220 V  
NB 100 < 8,5 m<sup>3</sup>/h  
NB 125 < 13 m<sup>3</sup>/h  
NB 150 < 17 m<sup>3</sup>/h  
NB 200 < 47 m<sup>3</sup>/h

Weight

0,55 kg

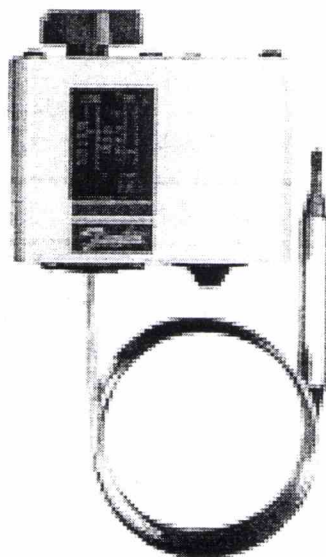
Order no. (spare part)

502898009

A	22,3 mm	
B	1-11	1/2" NPT
C	PG	IP 67
F	30 mm	hexag.
Nom. size (tube)	dim. D	dim. E
1"	35 mm	25 mm
2"	61 mm	29 mm
3"	90 mm	29 mm
6"	174 mm	29 mm







KP Thermostate sind temperaturgesteuerte elektrische Schalter. Ein KP-Thermostat hat einen einpoligen (SPDT) Wechselschalter.

Die Schalterstellung ist von der Thermostateinstellung und der Fühlertemperatur abhängig.

KP-Thermostate werden in den Steuerstromkreisen von Gleichstrommotoren oder großen Wechselstrommotoren installiert.

KP hat ein Kontaktsystem mit Schnappfunktion. Das Wellrohr bewegt sich daher nur dann, wenn der Ein- bzw. Ausschaltwert erreicht wird.

#### VORTEILE

- Lasergeschweißte Wellenroherelemente bedeuten erhöhte Betriebssicherheit
- Robuste und kompakte Konstruktion
- Hohe Kontaktbelastung
- Vibrationssicherheit von 4 g im Bereich von 0 - 1000 Hz
- Ultrakurze Prellzeiten
- Universelle Anwendung
- Fühlertyp E3 (Ø 9,5 x 85 mm, zyl. Fühler) mit Adsorptionsfüllung
- Normalausführung mit Wechselschalter (umgekehrte Schalterfunktion oder Anschluß an ein Signal möglich)
- Montagefreundlich
- Hohe mechanische und elektrische Lebensdauer

#### TECHNISCHE DATEN

Umgebungstemperatur: + 20°C ... + 60°C

Differenz  $\Delta T$ :

bei niedrigster Temperatureinstellung K: 3,5 ... 10

bei niedrigster Temperatureinstellung K: 3,5 ... 10

Reset: automatisch

Max. Fühlertemperatur: 130 °C

Kapillarrohrlänge: 2 m

Schalter: einpoliger Wechselschalter

Kabeldurchführung: Kunststoff für Kabeldurchmesser von 6 bis 14 mm

Kabelverschraubung: Pg 13,5 oder Pg 16

Schutzart: IP 33 gemäß IEC 529

#### ADSORPTIONSFÜLLUNG

Elementfüllung teils aus einem überhitzten Gas, teils aus einem festen Stoff mit großer Adsorptionsoberfläche. Da der feste Stoff im Fühler konzentriert ist, wird dieser immer der temperaturregelnde Teil des thermostatischen Elementes sein. Es kann daher unberücksichtigt bleiben, ob der Fühler kälter oder wärmer als der übrige Teil des thermostatischen Elementes wird.

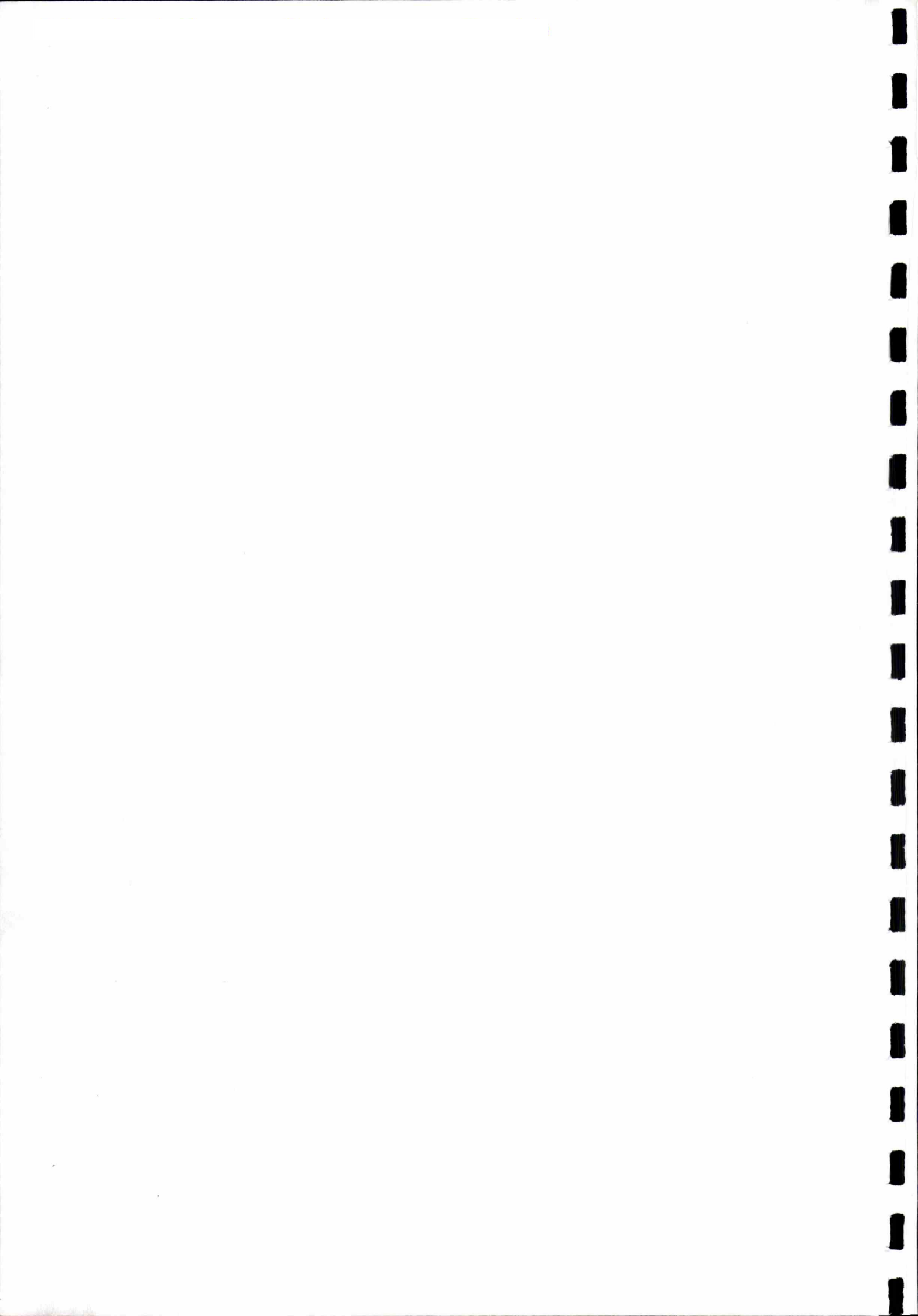
#### EINSTELLUNG

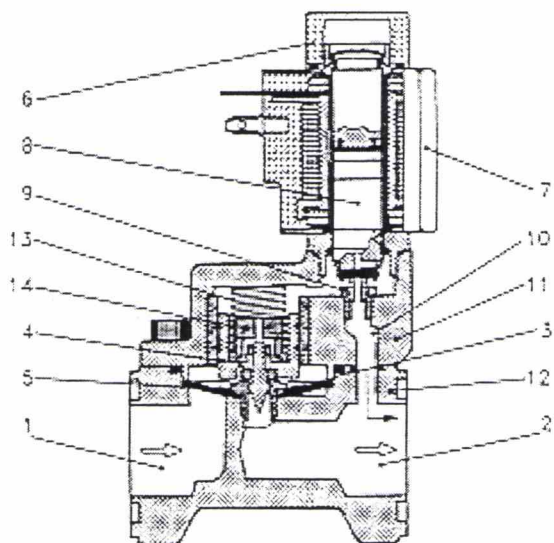
Die obere Ansprechtemperatur an der Bereichsskala einstellen.

Differenz an der "DIFF"-Skala einstellen.

Die Temperatureinstellung der Bereichsskala entspricht dann der Temperatur, bei der der Verdichter bei steigender Temperatur einschaltet. Nach dem Abfallen der Temperatur entsprechend der Differenzeinstellung wird der Verdichter abgeschaltet.

Es ist zu beachten, daß die Differenz von der Bereichseinstellung abhängig ist. Die Differenzskala darf deshalb nur als Richtlinie verwendet werden. Wenn der Verdichter bei niedrigen Einstellungen der Abschalttemperatur nicht abschaltet, ist zu prüfen, ob eine zu große Differenz eingestellt ist.





- 1 Inlet
- 2 Outlet
- 3 Nozzle
- 4 Piston, complete mounted
- 5 Filter
- 6 Cap
- 7 Coil
- 8 Armature
- 9 Pilot nozzle
- 10 Nozzle drain
- 11 Cover out of GGG 40.3 Cast iron
- 12 Valve seat out of GGG 40.3 Cast iron
- 13 Spring
- 14 Insert element

#### ADVANTAGES

- Integrated expansion- and solenoid valve functions
- Wide-ranging control area (10 - 100% of declared)
- Integrated Filter element
- Without hysteresis
- Changeable nozzle

#### TECHNICAL INFORMATION

Supply Voltage: 24V AC, 230 V DC  
or 100 V DC  
Supplied by AKC-controller or  
by an other controller type.

Coil Voltage  
Tolerance: +10%/ -15%

Power 24V AC: 40 VA  
Consumption: 230 V DC: 18 W  
During switching on: 55 VA

Working Principle: PBM (Pulse duration  
modulation)

Sequence  
Duration: 6 Seconds

Performance: 25 up to 100 kW (R22)  
125 up to 500 kW (R717)

Controlling  
Range: 10 - 100% of  
Performance range

Valve Material: Cast iron GGG 40.3

Connecting Ports: Flanges

Medium temperature: -50 up to +60°C

Ambient temperature: -50 up to +50°C

Leak above valve seat: < 0,02% of Kv

MOPD: 22 bar

Max. Working Pressure  
(MWP): 28 bar

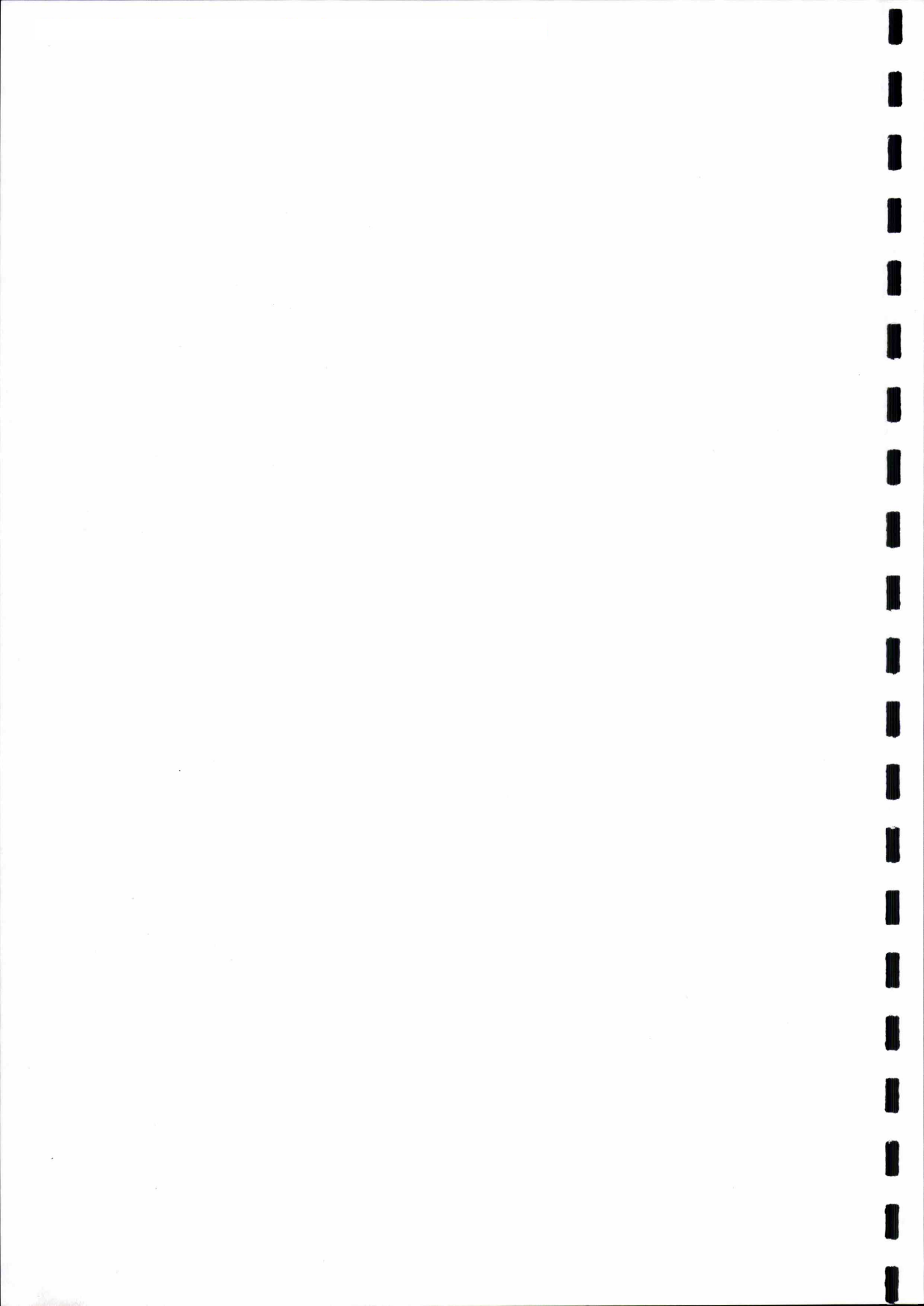
Test Pressure: 36 bar

Main Nozzle: changeable

Filter element: 100 µm, changeable

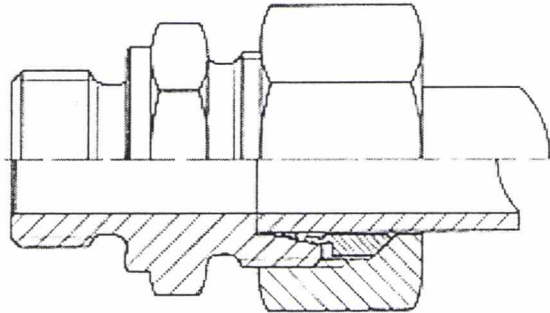
Weight: 2,0 kg (without coil)

Protective  
Standard: depending on coil type  
Max. IP 67 (IEC 529)



Für Verschraubung nach DIN 2353  
Bohrungsform W DIN 3861 (24° Konus)  
(ISO 8434, Teil 1)

For couplings to DIN 2353  
Type of part end W DIN 3861 (24° cone)  
(ISO 8434, part 1)



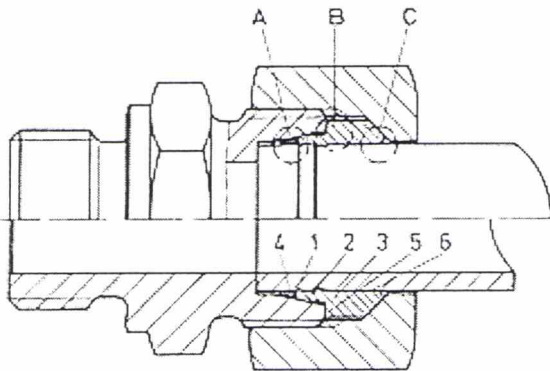
Vor dem Anzug der  
Überwurfmutter  
Before tightening the nut

Der BELLZET-WD-Ring vereinigt die Vorzüge des BELLZET-Zweikantenringes mit denen der elastischen Dichtung. Der zusätzliche Dichtring besteht aus Kunststoff (PTFE).

The BELLZET-WD-Ring combines the advantages of the BELLZET double-bite ring with those of the elastic seal. The additional sealing ring is made of plastic.

- A Vorderer Bereich: Kaltverfestigung, metallische Dichtung und Feindichtung durch zusätzlichen Dichtring.
- B Mittlerer Bereich: Anzugsbegrenzung, kein Ausbeulen.
- C Hinterer Bereich: Optimale Rohreinspannung, keine Rohreinschnürung, schwingungsdämpfend.

- A Front area: Strain hardening, metallic seal and fine seal by means of additional sealing ring.
- B Central area: Tightening limitation, no beating out.
- C Rear area: Optimum pipe clamping, no pipe necking, vibration-damping-



Nach dem Anzug der  
Überwurfmutter  
After tightening the nut

Nach Anzug der Überwurfmutter sind die Schneidkanten 1 und 2 in die Rohrwand eingedrungen und halten das Rohr in der Verschraubung fest. Die Schneidenform ist so ausgebildet, daß bestmögliche Kraftaufnahme und -verteilung erreicht werden. Der Teil 3 des BELLZET-WD-Ringes hat sich zwischen Innenkonus und Rohrwand verkeilt und bewirkt so eine metallische Abdichtung. Durch die Feindichtwirkung des zusätzlichen Dichtelementes 4 wird mit hoher Sicherheit Leakagefreiheit auch bei Druckstößen, Temperaturschwankungen und Vibrationen erreicht.

After tightening the nut, the cutting edges 1 and 2 have penetrated the pipe wall and firmly retain the pipe in the coupling. The cutting edge shape is such that optimum take-up and distribution of force is obtained. Part 3 of the BELLZET-WD-ring has wedged between inner cone and pipe wall and thus produces a metallic seal. By virtue of the fine sealing action of the additional sealing element 4, positive freedom from leakage is achieved, even in the case of pressure surges, temperature fluctuations and vibration.

Die Anschlagfläche 5 liegt nach vollendetem Anzug der Überwurfmutter an der Stirnfläche des Stutzens an. Durch das hierdurch spürbar steil ansteigende Anzugsdrehmoment werden Über- und Untermontagen wirkungsvoll verhindert.

After tightening of the nut is complete, the stop face 5 rests on the end face of the coupling body. The resultant sharply increasing tightening torque fully prevents over- and under-fitting.

Teil 6 legt sich fest um das Rohr, wodurch Schwingungen gedämpft werden und nicht an die Rohreinschnitte 1 und 2 gelangen können.

Part 6 locates firmly around the pipe, as a result of which vibration is damped and cannot reach the pipe indentations 1 and 2.

**DIREKTMONTAGE IM VERSCHRAUBUNGSSTUTZEN**

1. Überwurfmutter, BELLZET-WD-Ring und Kunststoff-Dichtelement auf das Rohr schieben. Das Rohrende in den Verschraubungsstutzen stecken.
2. Noch im Umlauf befindliche nicht gleitbeschichtete Stutzen und Muttern sind einzuölen. Bei Neubestellung kein Einölen mehr notwendig.
3. Weiche Rohre (Kupfer, Aluminium, dünnwandige Stahlrohre) sollten zur sicheren Montage mit einer Verstärkungshülse versehen werden.
4. Überwurfmutter bis zur fühlbaren Anlage von Hand auf Stutzen schrauben.
5. Rohr fest gegen Anschlag im Stutzen drücken - **sonst Fehlmontage** - dabei die Überwurfmutter bis zum deutlich spürbaren Kraftanstieg, um ca. 1 bis 1 1/2 Umdrehungen anziehen.
6. Kontrolle.  
Überwurfmutter lösen und zurückschieben und kontrollieren, ob der Spalt zwischen Stutzen und BELLZET-WD-Ring geschlossen ist.

**CONNECTING SLEEVE MOUNTING**

Push the nut, the BELLZET-WD-Ring and the plastic sealing ring on the tube. Stick the end of tube in the connecting sleeve.

Circulating sleeves and nuts without slide-coating have to lubricated.  
Lubricating is not necessary for new ordered parts.

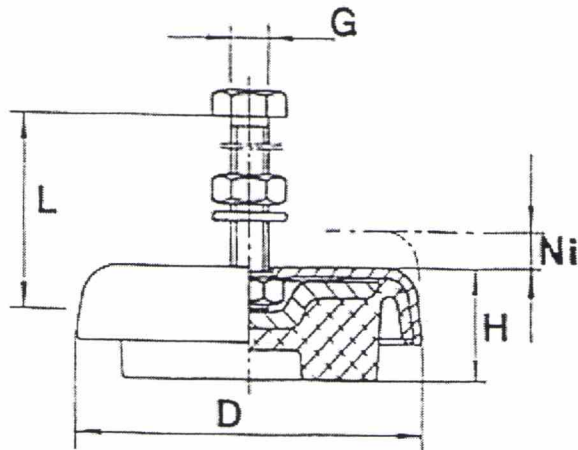
Non-rigid tubes (copper, aluminium, thin-walled steel tubes) should be equipped with a reinforced sleeve for mounting safety.

Screw the nut manually light onto the sleeve.

Press the tube securely on the top of the sleeve (otherwise mounting failure!).  
Tight the nut up to the feelable power increasing, for approx. 1 or 1 1/2 rotations.

Check.  
Work the nut loose, pull it back and check, if the gap between sleeve and BELLZET-WD-Ring is closed.

**STANDARD DESIGN**



**Characteristics**

Type LM (dimensions in mm)	1-11	3-11 3-25	3-33
Diameter	D	80	120
Height	H	25	37   32
Thread	G	M10	M12
Screw length	L	80	90
max. mounting foot thickness		43	44
Levelling height	Ni	15	20
Weight	kg	0,4	1,1

**Load per element**

Type	LM 1-11	LM 3-11	LM 3-25	LM 3-33
(kg)	480	650	900	1200
Ident	763398043	763398044	763398045	763398046

**DESIGN**

- elastomer - metal - connection
- compact design
- integrated levelling system

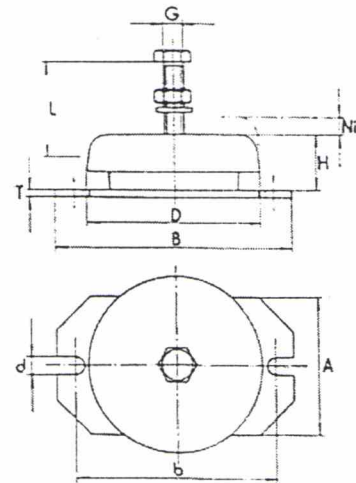
**CHARACTERISTICS**

- active and passive arrangements
- anti-vibration mounting, impulse absorption
- structure-borne noise insulation
- installation without holding point on foundation
- broadband loading range
- natural frequency (stat.) 12Hz – 20Hz
- fine thread

**VARIANTS**

- parts out of galvanized metal
- parts out of stainless steel
- elastomer – special quality

**SPECIAL DESIGN BOTTOM PLATE BA TYPE**



**Characteristics**

Type LM (dimensions in mm)	1-11	3-11 3-25	3-33
Width	A	158	
Length	B	90	
Thickness	T	10	
Distance between hole centres	b	140	
Bore hole	d	13	
Weight	kg	2	

**LEVELLING**

- levelling range max. 5 – 30 mm

**MATERIAL**

- elastomer piece in CR-quality with high angular flexibility, resistant to ageing and oil
- outer cap out of St W 23 or GG
- yellow enamelled metal surface
- forged clamping plate
- screw M10/ M12 acc. DIN 933, quality 8.8 zinc-coated



**Attention!**

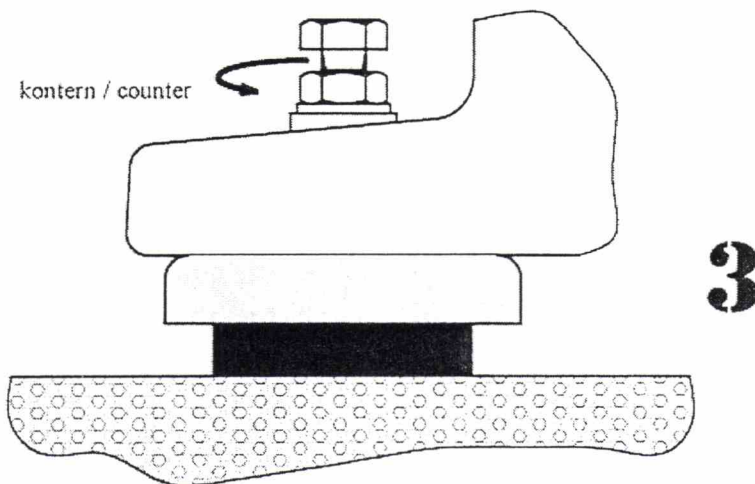
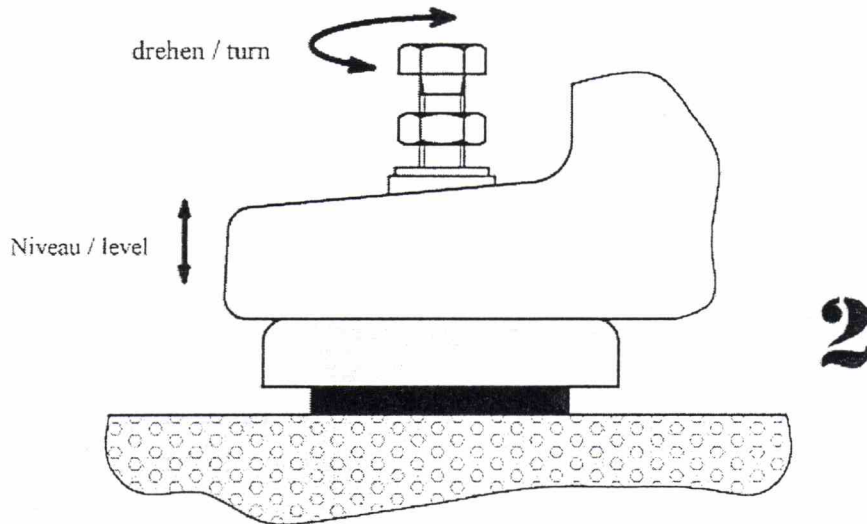
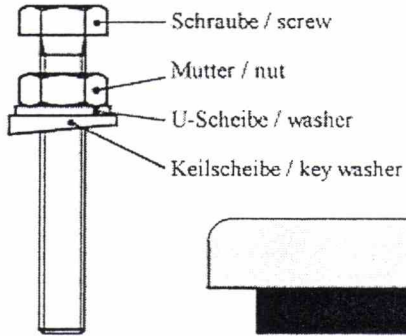
The combination of level mount elements and U-type profile is equipped 1 wedge-disc for each element.

Type LM	1-11	3-11 3-25	3-33
thread size	M10	M12	
4-disc (wedge disc) acc. DIN 434	Ø 11	Ø 13	
Ident	542711002	542711003	



INSTALLATION INSTRUCTION

Reihenfolge beachten!  
Pay attention to assembly!



**FUNCTION**

Insulation of objects the operating temperature of which is less than the ambient temperature.

- Avoidance of dew water generation
- Limitation of moisture absorption by diffusion to a minimum
- Reduction of energy losses
- Observance of prescribed operating temperatures
- Physiological harmlessness
- Chemical stability
- Corrosion protection
- Easy processability
- fire-protection requirements

**PRODUCT PROFILE**

**Description:** Highly flexible, closed-cell insulating material having a high water vapour and diffusion resistance and a low caloric conductivity

**Material:** Foam material based on synthetic rubber (elastomer)

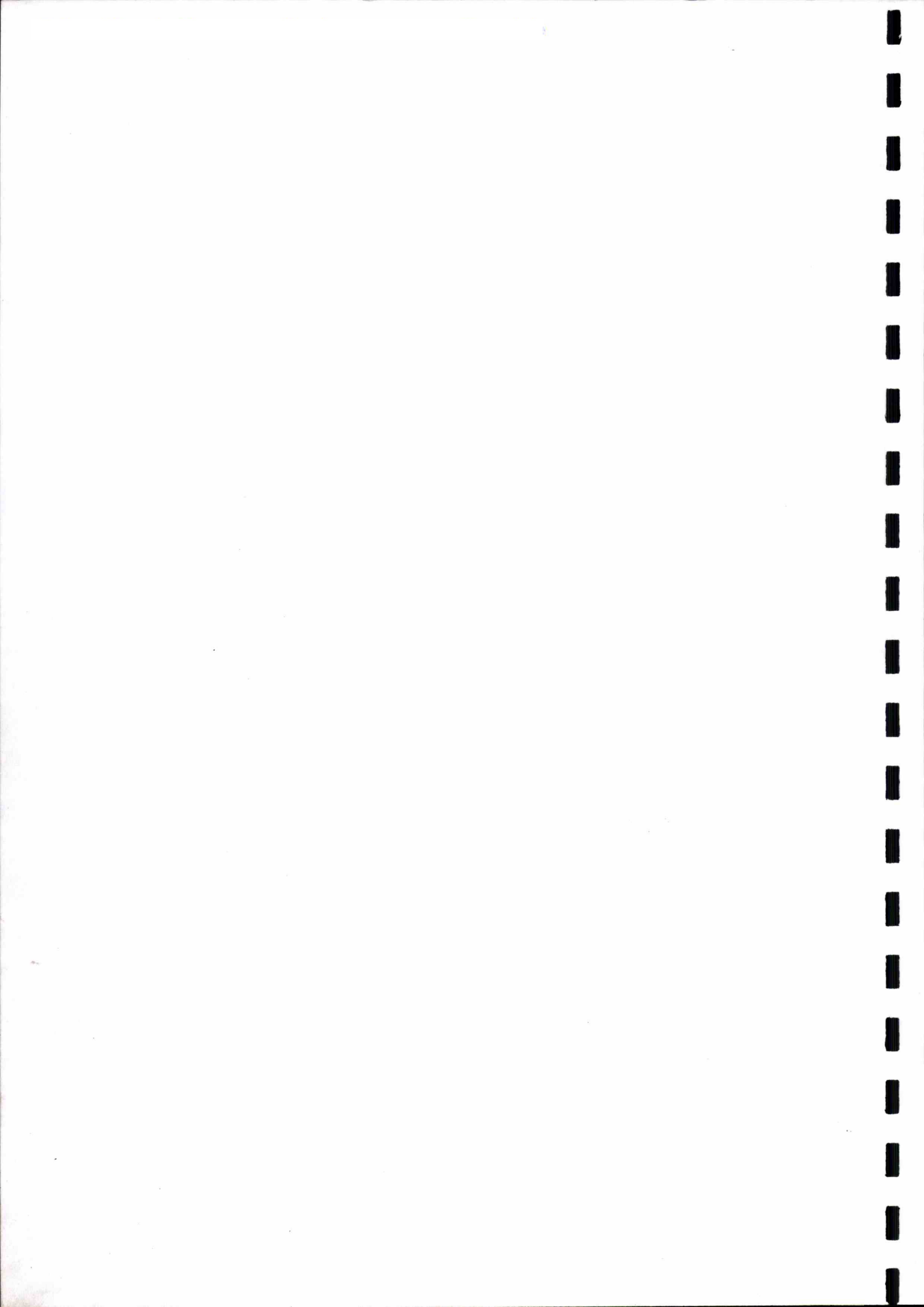
**Manufacture:** Extrusion process followed by curing

**Appearance:** Surface: foam skin, smooth  
Cutting areas: porous  
Colour: black

**Application:** Insulation of pipelines, fittings, air channels, containers and the like in technical and industrial refrigerating and air-conditioning equipment

**TECHNICAL SPECIFICATION**

Application range:	(Temperature limits) Max. media temperature + 105°C Min. media temperature - 40°C
<ul style="list-style-type: none"> <li>▪ Caloric conductivity <math>\lambda</math> according to DIN 52612/13 at different average temperatures and</li> <li>▪ Vapour diffusion according to DIN 52615 on request</li> </ul>	
Fire behaviour:	hardly inflammable (according to DIN 4102-B1)  normally inflammable (according to DIN 4102-B2)
Practical fire behaviour:	self-extinguishing, non-dripping, does not conduct flames
fire resistance of components:	Tests according to DIN 4102, Part 11  Wall leadthrough up to R 90 Ceiling leadthrough up to R 120
Noise protection:	DIN 4109  Reduction of body noise transmission  Insulating effect up to 30 dB(A)
Health aspects:	No adverse smell or taste effects, suitable for applications in the foodstuff industry  Basis: synthetic rubber. No asbestos components
Weather stability:	Open outside laying possible using an Armafinish protective paint
Stability against building material /chemicals:	Usual building material: very good Chemicals: on request



**MODULAR STANDARD - PLC (PROGRAMMABLE LOGIC CONTROL)**

<b>Manufacturer</b>	Siemens	
<b>Type</b>	Simatic S5 - 95 U	
<b>General</b>	<p>Freely programmable controllers, that may be adapted to specific SC requirements. The number of analogue and binary inputs and outputs can be varied by selecting the appropriate components. Programming is carried out using defined and tested software modules that are created and organized by Grasso. Changes in these software modules are <b>not</b> permissible, as a rule.</p> <p>Package control organization:</p> <ol style="list-style-type: none"> <li>1. Ensuring unit safety by monitoring of pressure and temperatures.</li> <li>2. Running a fail-safe startup and shutdown routine.</li> <li>3. Screw compressor capacity control using a control slide (volume flow control of the suction flow), either manually or automatically.</li> <li>4. Automatic refrigerant injection into the evaporator.</li> </ol>	
<b>Specifications</b>	<p><b>Model type:</b> Standard housing with an engineered modular PLC configuration and a standard terminal.</p> <p><b>Power supply:</b> 115/ 230 V AC 50/ 60 Hz</p> <p><b>Control and display unit:</b> Controls are installed in the door of the housing and labelled. The terminal has a 4-line text display. All analogue process data are displayed at the terminal. Texts can be displayed in various languages.</p> <p><b>Parameterization:</b> Process parameters are parameterized, after having entered a password, from the controls at the terminal to adapt the controller to the process.</p> <p><b>Behaviour after power return:</b> Return to the state prior to power failure.</p> <p><b>Elapsed-time meter:</b> Available software function.</p>	
<b>Inputs</b>	<p>Modular structure of I/O peripherals. All process variables can be processed in analogue mode.</p> <p>Sensor inputs are designed for standardized input signals (4-20mA; 0-10V). Custom-built variants are available (<b>extra cost !</b>).</p>	
<b>Outputs</b>	<p>Modular structure of I/O peripherals.</p> <p>Custom-built variants are available (<b>extra cost !</b>).</p>	
<b>Application</b>	No maritime or airborne applications.	
<b>Controlled variable</b>	<p>One process temperature in °C (Standard - temperature of secondary refrigerant)</p> <p>Controlled by a three-position controller.</p> <p>Set point and neutral zone can be parameterized.</p>	
<b>Set point adjustment</b>	Setpoints can be adjusted through the unit controller or a higher-level master control.	

<b>Start-up modes</b>	MANUAL	SC unit/ chiller is switched ON / OFF manually, independently of the refrigerating demand.	
	AUTO	SC unit/ chiller is switched ON / OFF automatically depending on local refrigerating demand.	
<b>Operating modes</b>	MANUAL	Manual key-operated capacity control (the control slide is shifted manually).	
	AUTO	Automatic setpoint-dependent capacity control (the control slide is shifted automatically).	
<b>Control modes</b>	LOCAL	SC unit/ chiller can be operate independently (no master control).	
	CENTRAL	SC unit/ chiller is controlled by master control only.	
<b>Fault messages</b>	Each fault is displayed as an on-line message and stored in a histogram buffer. A fault log printer can be connected.		
<b>Sequential control</b>	Simple sequential routine without hours run balancing available by interconnecting several S 5 - 95 U units.		
	Sequential control with hours run balancing and an optimized sequence can be achieved by using a master control via a SINEC L2 interface.		
	Sequential control among individual chiller controllers without a master control can be achieved using a SINEC L2 interface with L2 bus coupling.		
<b>Communication</b>  via <b>BUS-coupling</b>	<b>with a higher level control (master control)</b>		
	All status messages and all analogue data sent via a SINEC - L2 interface can also be sent to a higher-level master control using a SINEC-L2 interface.		
	Up to 32 SCP/ chiller controls can be connected to a higher-level master control using this method.		
via <b>floating contacts</b>	To higher-level control:	Status messages	Chiller/ SCP ready Chiller/ SCP fault. The control slide position may be passed on as an analogue signal using a buffer amplifier.
	From higher-level control:	Status messages	Chiller/ SCP ON/ OFF Fault acknowledgement Increase/ reduce SC capacity
<b>Bus coupling</b>	SINEC - L1 SINEC - L2		
<b>Documentation</b>	Hardware descriptions	German, English, French	
	Circuit diagrams	German, according to DIN	
	User manual	German	