SAB 128 Mk 1,5

0170-987 91.04

Bestillingsseddel for instruktionsbog

Mk 1,5 der er produceret ca. 89.10 –> 90.01 består af:

Kompressor:
SAB 128 Mk 1 med 4 P lejesystem, lodret indsugning og extern sugekontraventil.

Aggregat:
Mk 2 olieudskiller med 2 plane endebunde med integrerede fødder.

Send ordrebestemt rørdiagram, målskitse og selection af vibration dampers 4840-005 i udfyldt stand **sammen** med denne bestilling til trykkeriet! De vil blive indsat i instruktionsbogen som markeret nedenstående ved A, B, C.

Male drive _____ Female drive_____ Kølemiddel_____ Lb. nr. _____

Deres o/nr.: _____ Antal bøger:_____

Vort o/nr.: _____ Sprog: DA - EN - SP

Kendeord: _____ Indbundet ☐ Med huller ☐

Leverandør eller repræsentant: _____

Opstillingssted:_____

Sæt et kryds ved de leverede varianter

Styring	Ingen (klemmekasse/åben panel)		
	Relæstyring		
	PROSAB II		
Oliekøling	Vandkølet oliekøler	OWSG/OWCG	
	Kølemiddelkølet oliekøler	OOSI	
	Kølemiddelindsprøjtning i kompressor	HLI	
	Kølemiddelindsprøjtning i trykrør	BLI	
Kapacitets-indicering	Max./min. kontakter		
	Positionstransmitter		
Hovedventilsystem	Afgangsrør		

Instruktionsbog for PROSAB II bestilles separat med bestillingsseddel 0171-982.

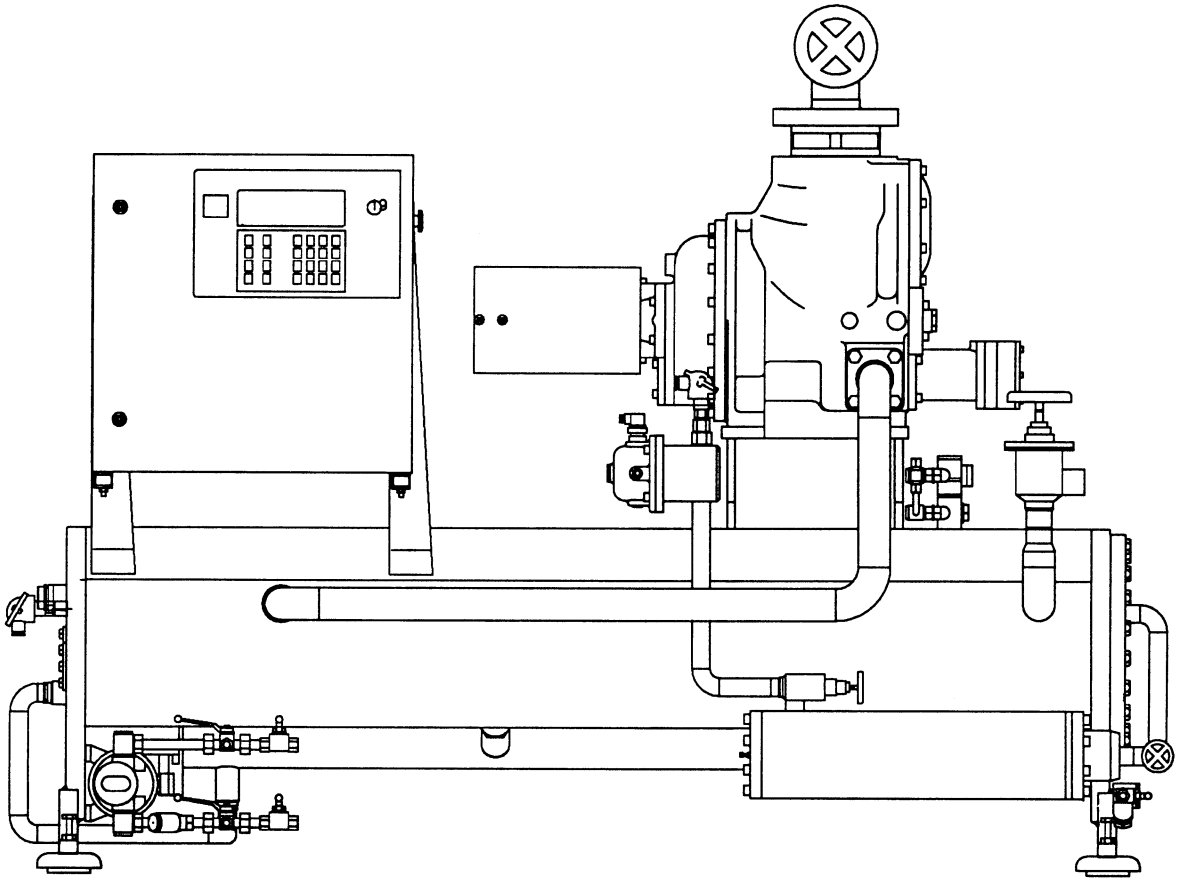
vend.....

Indhold:

Yderligere DANFOSS-instruktioner_____

Bestilt	Sendes	Forsendelse ☐ post ☐ m/anlæg ☐ Andet - - - - - - - - - - - - - - - - - -	Udført
Initialer		til -	Initialer
Bemærkninger:			

Instruction manual for screw compressor unit



nr. T0177035_0

SAB 128 Mk 1,5

90.10

0171-546-EN

Refrigerant: _____ Shop no. _____

Instruction manual for SAB 128 Mk 1.5

The screw compressor and unit may be fitted with different accessories, depending on their function and requirements.

Some of the variants are dealt with in this instruction manual, even though they do not form part of **your** particular unit.

In the following table, the variants included in the unit at the time of delivery are marked with an "x", the shop number being stated at the top of the page.

Controls	None (terminal box/open panel)		
	Relay		
	PROSAB II		
Oil cooling	Water-cooled oil cooler	OWSG/OWCG	
	Refrigerant-cooled oil cooler	OOSI	
	Refrigerant injection in compr.	HLI	
	Refrigerant injection in discharge pipe	BLI	
Capacity indication	Max./min. switches		
	Position transducer		

90.02

0171-500-EN

Preface

The purpose of this manual is to give the operating personnel a thorough knowledge of how to operate the compressor, and also to explain the following: operation and maintenance of the individual components, time between inspections, procedure for dismantling and reassembly of the compressor.

The manual also points out typical defects which may arise during operation, explaining likely causes, and indicating the steps which are necessary to correct such defects.

It is essential that the operating personnel are thoroughly aquainted with the contents of this manual, not only to ensure proper and efficient operation, but also because SABROE cannot accept any claims for damages during the guarantee period which are due to incorrect operation of the compressor.

Warning

If combustion engines are to be installed in the same room as refrigeration plant or pipes containing refrigerant, it is imperative that combustion air for the motor is taken from a point where refrigeration gas is **never** likely to be present – even if the gas accidentally escapes from the system.

If this warning is ignored, the lubricating oil from the combustion engine may mix with the refrigerant – resulting in corrosion or perhaps severely damaging the motor.

SABROE REFRIGERATION A/S

P.O. Box 1810, DK–8270 Højbjerg
Chr. X's Vej 201, Århus, Denmark

SABROE

Phone: +45 6 27 12 66
Telefax: +45 6 27 44 74
Teletex: 36 22 88
Telex: 6 87 40

Contents

0171-546-EN

90.09

0170-008-EN

First Aid for accidents with Ammonia

(Chemical formula: NH_3 – refrigerant no.: R717

- **General**

  Ammonia is not a cumulative poison. It has a distinctive, pungent odour that even at very low, harmless concentrations is detectable by most persons. Since ammonia is self-alarming, it serves at its own warning agent, so that no person will voluntarily remain in concentrations which are hazardous. Since ammonia is lighter than air, adequate ventilation is the best means of preventing an accumulation.

  Experience has shown that ammonia is extremely hard to ignite and under normal conditions is a very stable compound. Under extremely high, though limited concentrations, ammonia can form ignitable mixtures with air and oxygen, and should be treated with respect.

- **Basic rules for first aid**
  1. **Call a doctor immediately.**
  2. **Be prepared**: Keep an irrigation bottle readily available, containing 2.5% each of **borax** (natrium tetraborate) and **boric acid** (H_3BO_3) in **distilled** water.
  3. A shower bath or water tank should be available near all bulk installations of ammonia.
  4. When applying first aid, the persons assisting should be duly protected to avoid further injury.

- **Inhallation**
  1. Move affected personnel into fresh air immediately, and loosen clothing restricting breathing.
  2. **Call a doctor/ambulance with oxygen equipment immediately**
  3. Keep the patient still and warmly wrapped with blankets.
  4. If mouth and throat are burnt (freeze or acid burn), let the conscious patient drink water, taking small mouthfulls.
  5. If conscious and the mouth is not burnt, give hot, sweet tea or coffee (never feed an unconscious person).
  6. Oxygen may be administered, but **only** when authorized by a doctor.
  7. If breathing fails, apply artificial respiration.

- **Eye injuries from liquid splashes or concentrated vapour**
  1. Force the eyelids open and rinse eyes immediately with a solution of 2.5% each of borax and boric acid in distilled water (or pure running water), and continue for at least 30 minutes.
  2. **Call a doctor immediately.**

- **Skin burns from liquid splashes or concentrated vapour**
  1. Wash immediately with large quantities of water and continue for at least 15 minutes, removing contaminated clothing carefully while washing.
  2. **Call a doctor immediately.**
  3. After washing, apply wet compresses (solution of 2.5% each of borax and boric acid in distilled water) to affected areas until medical advice is available.

THERE CAN NEVER BE A PLANT THAT IS TOO SAFE.

SAFETY SHOULD BE A WAY OF LIFE

0170-008-EN

First aid for accidents with CFC/HCFC

(Chemical group: Chlorofluorocarbons -

refrigerant no.: R11 - R12 - R13 - R22 - R114 - R502, etc)

- **General**

  CFC/HCFC form colourless and invisible gasses which are heavier than air and smell faintly of chloroform at high concentrations only. They are non-toxic, non-inflammable, non-explosive and non-corrosive under normal operating conditions. When heated above approx. 300°C they break down into toxic, acid gas components, which are strongly irritating and aggessive to nose, eyes and skin and generally corrosive. Besides the obvious risk of unnoticeable, heavy gasses displacing the atmospheric oxygen, inhalation of larger concentrations may have an accumulating, anaesthetic effect which may not be immediately apparent. 24 hours medical observation is, therefore, recommended.

- **Basic rules for first aid**

  1. When moving affected persons from low-lying or poorly ventilated rooms where high gas concentrations are suspected, the rescuer must be wearing a lifeline, and be under continuous observation from an assistant outside the room.

  2. Adrenalin or similar heart stimuli must not be used.

- **Inhalation**

  1. Move affected person into fresh air immediately. Keep the patient still and warm and loosen clothing restricting breathing.
  2. If unconscious, call a doctor/ambulance with oxygen equipment immediately.
  3. Give artificial respiration until a doctor authorises other treatment.

- **Eye injuries**

  1. Force eyelids open and rinse with a 2% salt solution in distilled water (or pure running water) continuously for 10 minutes.
  2. Contact a doctor, or get the patient to a hospital immediately for medical advice.

- **Skin injuries – Freeze burns**

  1. Wash immediately with large quantities of luke warm water to reheat the skin. Continue for at least 15 minutes, removing contaminated clothing carefully while washing.
  2. Treat exactly like heat burns and seek medical advice.
  3. Avoid direct contact with contaminated oil/refrigerant mixtures from electrically burnt-out hermetic compressors.

THERE CAN NEVER BE A PLANT THAT IS TOO SAFE.
SAFETY SHOULD BE A WAY OF LIFE

90.04

0170-009-EN

Protecting the environment

Increasing industrialisation threatens our environment. It is therefore absolutely imperative that we protect nature against pollution.

To this end, many countries have passed legislation in an effort to reduce pollution and preserve the environment. These laws apply to all fields of industry, including refrigeration, and must be complied with.

Be especially careful with the following substances:

- refrigerants
- cooling media (brines etc)
- lubricating oils.

Refrigerants usually have a natural boiling point which lies a good deal below 0°C, this means that liquid refrigerants can be extremely harmful if they come into contact with skin or eyes.

High concentrations of refrigerant vapours are suffocating when they displace air, if high concentrations of refrigerant vapours are inhaled they attack the human nerve system.

When halogenated gasses come into contact with open flame or hot surfaces (over approx. 300°C) they decompose to produce poisonous chemicals, which have a very pungent odour which warns of their presence.

In high concentrations, R717 causes respiratory problems, and when ammonia vapour and air mix 15 to 28 vol. %, the combination is explosive and can be ignited by an electric spark or open flame.

Oil vapour in the ammonia vapour increases this risk significantly as the point of ignition falls below the mixture ratio stated.

Usually the strong smell of ammonia will give ample warning of its presence before concentrations become dangerous.

The following table shows the values for **refrigerant content in air**, measured in volume %. Certain countries may, however, have an official limit which differs from those stated.

		Halogenated refrigerant			Ammonia
		R 12	R 22	R 502	R 717
Chemical formula		CCl_2F_2	$CHClF_2$	$CHClF_2/C_2ClF_5$	NH_3
	Unit				
Time weighted average (TWA)	vol.%	0,1	0,1	0,1	0,005
Warning smell	vol.%	0,2			0,002

Furthermore

- If halogenated refrigerants are released directly to the atmosphere they will break down the ozone stratum in the stratosphere. The ozone stratum protects the earth from the ultra-violet rays of the sun. Halogenated refrigerants must, therefore, **never** be released to the atmosphere. Use a separate compressor to evacuate the refrigerant into

the plant's condenser/receiver or into separate refrigerant cylinders.

- Most halogenated refrigerants are miscible with oil. Oil drained from a refrigeration plant will often contain significant amounts of refrigerant. Therefore, reduce the pressure in the vessel or compressor as much as possible before draining the oil.
- Ammonia is easily absorbed by water: At 15°C, 1 litre of water can absorb approx. 0,5 kg liquid ammonia (or approx. 700 litres ammonia vapour).
- Even small amounts of ammonia in water (2-5 mg per litre) are enough to wreak havoc with marine life if allowed to pollute waterways and lakes..
- Ammonia is an alkaline which will damage plant life if released to the atmosphere in large quantities.

Refrigerant evacuated from a refrigerant plant must be charged in refrigerant cylinders intended for the specific refrigerant.

If the refrigerant is not to be reused, send it back to the supplier, or to an authorized institute for destruction.

Halogenated refrigerants must never be mixed. Likewise R717 must never be mixed with halogenated refrigerants.

Purging a refrigeration plant

If it is necessary to **purge** air from a refrigeration plant, make sure you observe the following:

- Refrigerants must not be released to the atmosphere.
- When purging an R717 plant, use an approved air purger. The purged air must pass through an open container of water so that any R717 refrigerant remaining can be absorbed. The water mixture must be sent to an authorized institute for destruction.
- Halogenated refrigerants can **not** be absorbed by water. An approved air purger must be fitted to the plant. This must be checked regularly using a leak detector.

Cooling media

Salt solutions (brines) of calcium chloride ($caCl_2$) or sodium chloride (NaCl) are often used.

During recent years alcohol, glycol and halogenated compounds have been used in brine production.

In general, all brines must be considered as harmful to nature and must be used with caution. Be very careful when charging or purging a refrigeration plant.

Never purge brines down a sewer or into the environment. The brine must be collected in suitable containers, clearly marked with the contents, and sent to an approved institute for destruction.

Lubricating oils

Refrigeration compressors are lubricated by one of the following oil types, depending on the refrigerant, plant type and operating conditions.

- mineral oil
- semi-synthetic oil
- alkyl benzene-based synthetic oil
- polyalphaolefine-based synthetic oil
- glycol-based synthetic oil.

When you change the oil in the compressor or drain oil from the refrigeration plant's vessels, always collect the used oil in containers marked "waste oil" and send them to an approved institute for destruction.

Note

This instruction provides general information. The owner of the refrigeration plant is responsible for ensuring that all by-laws are complied with.

Description of Compressor Type SAB 128

The SAB 128 compressor is a capacity regulated screw compressor with oil injection.

The two rotors are provided with an asymmetric 4 + 6 profile under SRM licence. At the suction end the rotors are provided with cylindrical roller bearings, while the bearings at the discharge end consist of a set of bearings to assimilate both axial and radial forces. The axial forces are equalized by rotating balance pistons mounted on the rotors.

The rotors are arranged to give a choice of either male or female drive. The unused shaft end is fitted with a closed cap.

When female drive is used, the capacity and the power consumption are increased by approx. 50% in relation to male drive.

The driving shaft is provided with a slide ring type shaft seal, consisting of a stationary cast iron ring with an O-ring seal against the shaft seal cover and a rotating spring-loaded carbon ring with a teflon seal against the shaft.

The capacity of the compressor can be continuously regulated from approx. 10% to 100% by a slide mounted underneath the rotors. At part load, the slide opens a number of oblique openings through which part of the suction gas is returned to the suction side before being compressed.

The pos. nos. below refer to the piping diagram, which is drawn to the specific order.

Slide movements are controlled by the regulating cylinder. When the regulating cylinder is connected to the oil pressure from from the oil separator (solenoid valve **pos. 70** open), the regulating slide moves to increase the capacity of the compressor.

When the solenoid valve **pos. 71** is opened while **pos. 70** is kept closed the regulating cylinder is connected to the suction pressure of the compressor. A built-in spring ejects the oil from the regulating cylinder, thereby moving the slide which regulates the compressor capacity to minimum.

Solenoid valves pos. 70 and pos. 71 must be connected electrically in such a way that only one can open at a time.

Pos. 70 is a so-called normally closed valve (closed when the coil is not energized).

Pos. 71 is a normally open valve (open when the coil is not energized), which will automatically minimize compressor capacity in the event of a power failure.

Key to Piping diagrams

Pilot and regulating controls (PROSAB control)

PT1	Pressure transducer (suction pressure)
PT2	Pressure transducer (discharge pressure)
PT3	Pressure transducer (oil pressure after oil filter)
PT4	Pressure transducer (oil pressure before oil filter)
TT5	Temperature transducer (discharge gas temperature)
TT6	Temperature transducer (oil temperature in flow control)
TT7	Temperature transducer (suction gas temperature)
GT8	Position transmitter (capacity slide)
PAZ10	Safety pressure cut-out (for TÜV, SDM and SA only)
FT18	Level switch

Pilot and regulating controls (relay control)

PAZ1	Low-pressure cut-out (only for classified systems)
PAZ2	High-pressure cut-out
PDAZ3	Differential pressure cut-out (pressure drop across oil filter)
T15	Thermometer (pressure gas temperature)
T16	Thermometer (oil temperature)
T17	Thermometer (suction gas temperature) - only if specially ordered
GT8	Position transmitter (capacity slide)
PDAZ11	Oil pressure difference pressure cut-out (oil pressure - suction pressure) - for classified systems only
TAZ12	Thermostat (oil temperature in manifold)
TAZ13	Thermostat (discharge gas temperature)
TC14	Thermostat (pilots solenoid valve pos. 82)
PI15	Suction pressure manometer
PI16	High-pressure manometer
PI18	Level switch

Pos.	Component description

Refrigerant system

20	Suction stop valve
21	Non-return valve with 2 mm pressure equalization nozzle in suction pipe
22	Flanged joint discharge pipe - compressor
23	Suction filter built into compressor
24	Service valve - air purge valve
25	Oil separator
26	Non-return valve in outlet pipe from oil separator
27	Stop and non-return valve in outlet pipe from oil separator
28	Safety valve for oil separator
29	Change-over valve for double safety valve Oil system

Oil system

30	Immersion heater in oil separator
31	Oil level indicators (2 pieces)
32	Oil cooler OOSI (refrigerant-cooled)
33	Oil cooler type B (water-cooled)
34	Stop valve for oil purging (oil side)
35	Stop valve for oil purging (refrigerant side)
36	Oil outlet branch to oil cooler/filter
37	Oil branch to pump suction end
38	Stop valve before oil filter
39	Oil filter with built-in non-return valve

40 Oil inlet from pump
41 Non-return valve built into oil filter
42 Stop valve after oil separator
43 Combined flow control and oil distributing manifold
44 Non-return valve in oil injection pipe
45 Nozzle in injection pipe, ø 3 mm (for R22 only)
46 Thermostatically-controlled 3-way valve for OOSI cooling
47 Service valve for oil drainage
48 Oil purge valve on oil filter
49 Thermostatic water valve for water-cooled oil cooler

Oil return from oil separator (for separator with fine separator only)

50 Stop valve
51 Oil filter
52 Nozzle
53 Oil level indicator
54 Stop valve
55 Oil separation element (fine separation)

Oil charging and prelubrication of bearings

60 Stop valve
61 Oil filter
62 Oil charging valve
63 Oil pump
64 Stop valve for air purging of pump
65 Stop valve
66 Non-return valve for oil charging
67 Solenoid valve (NC) - open during prelubrication
68 Stop valve

Capacity regulation

70 Solenoid valve (NC) - capacity regulation min. -> 100%
71 Solenoid valve (NC) - capacity regulation 100 -> min.%
72 Throttle valve for regulation of slide velocity

Oil cooling, HLI and BLI systems

80 Stop valve
81 Liquid refrigerant filter
82 Solenoid valve (NC)
TC83 Liquid injection valve TEAT
84 Stop valve

Compressor connections

90 Oil supply to bearings at discharge end
91 Oil supply to shaft seal and bearings at suction end
92 Oil injection in compressor
93 Oil return from capacity regulation and oil separator
94 Oil to and from regulating cylinder
95 Liquid supply for HLI cooling V_i 4.0
96 Liquid supply for HLI cooling V_i 2.6
97 Economizer connection

Economizer system type HESS

110 Stop valve
TC111 Thermostatic valve
112 Solenoid valve (NC)
113 Liquid filter
114 Stop valve
115 Stop valve for oil purge
116 Economizer vessel

Economizer system type EOSE

120 Stop valve
121 Non-return valve
122 Main valve
123 Solenoid valve (NC)
124 Stop valve for oil drainage
125 Safety valve
126 Float valve
127 Stop valve
128 Stop valve
129 Solenoid valve (NC)
130 Stop valve

131 Stop valve
132 Liquid filter

SVER type economizer system

140 Stop valve
141 Main valve
142 Pilot valve
143 Solenoid valve
144 Stop valve
145 Float valve
147 Liquid filter
148 Stop valve for oil purge
149 Non-return valve
150 Stop valve
151 Safety valve
152 Solenoid valve
153 Stop valve
154 Stop valve

Main valve system

160 Main valve
161 Pilot valve

NB: On units supplied without valves, the bracketed figures near the branches refer to the component numbers in this list. These components are to be fitted by the customer.

A

Description of the components

The component descriptions below have a pos. no. which is the same as that on the piping diagram. Some descriptions include drawings. Wherever a component comprises wearing parts or gaskets, the spare part numbers can be found in the unit spare parts list.

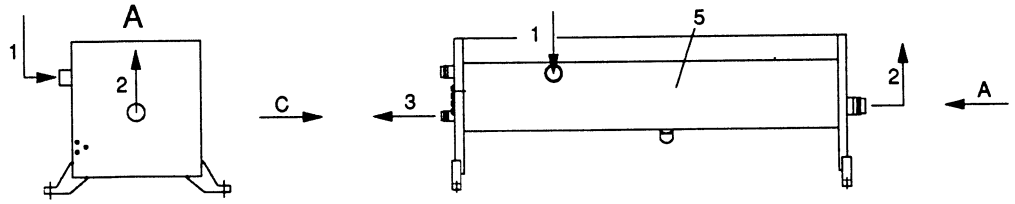
Oil separator, pos. 25

The oil separator on the compressor unit serves a number of purposes:

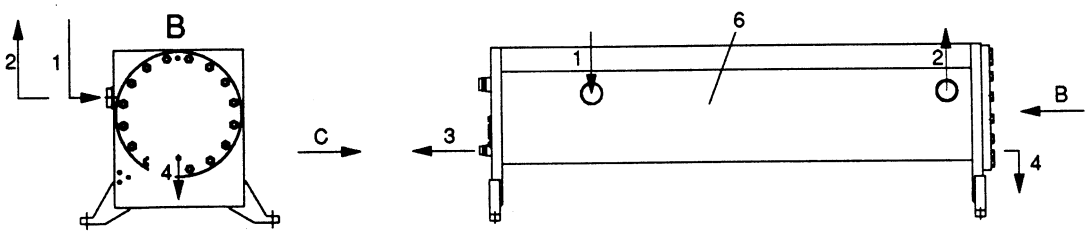
- It acts as oil receiver for the oil system, which lubricates and cools the screw compressor.
- It also forms the foundation for the electric motor and compressor. Figures 1 and 2 indicate what the connections are used for.
- Furthermore, the oil separator removes oil from the discharge gas that leaves the compressor. There are two different types of separator – the criteria for selection being the degree of separation required.

Fig. 1

Oil separator without special separation filter



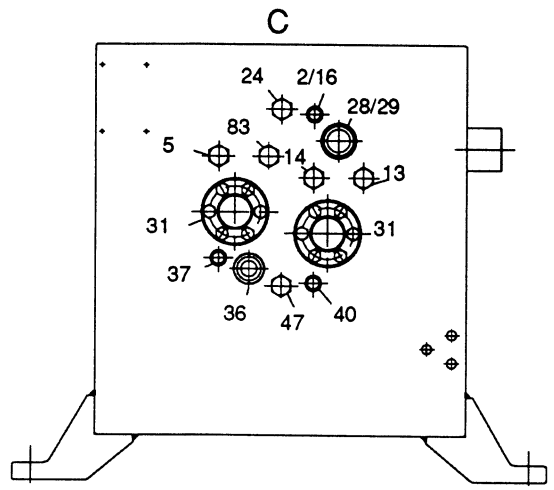
Oil separator with special separation filter



T0177036_0

Connection	Used for
1	Oil-refrigerant inlet
2	Refrigerant gas outlet
3	Oil for oil cooler
4	Oil from special separation filter

Fig. 2



No.	Used for
36	Oil outlet to oil cooler/oil filter
37	Oil outlet to oil pump (suction end)
31	Sight glass
	Discharge temp.nstr. panel = thermometer PROSAB II = PT100 sensor
24	Service valve
83	Discharge temp: Injection oil cooling = TEAT sensor
28/29	Safety valve, welding stub
2/16	Discharge pressure to instr.panel/PROSAB
13	Discharge temp. External oil cooler = KP81 sensor
	HLI/BLI injected oil cooling = KP79 sensor (only for units with instrument panel)
14	Discharge temp. Inject.oil cooling = KP77 sensor (only for units with instrument panel)
40	Oil inlet from oil pump to discharge end
47	Service valve

- **Oil separator without special separation filter**

  In this type of separator, the oil/gas mixture passes through a fine-meshed steel web which segregates the larger oil drops. The smaller oil drops pass through the filter together with the discharge gas and are carried to the condenser where they are dispersed into the plant.
  The degree of separation is typically lower than 250 ppm, depending on the operating conditions.

- **Oil separator with special separation filter**

  In this type of separator, the oil/gas mixture passes through a fine filter in addition to the steel mesh filter mentioned above. The fine filter intercepts the small oil drops remaining in the discharge gas.
  This type of oil separator usually separates to a degree of 25 ppm or even lower, depending on the operating conditions.

  The oil separator is characterized by a flange – as illustrated in the diagram. When this flange is dismantled, the special filter can be inspected and, if necessary, replaced.

  Oil caught in the special filter is led back to the suction side of the compressor through a filter pos. **51** and a nozzle pos. **52.**

  The oil level can be determined using the sight glasses in the flat end plate. During operation, the oil level **must** never fall below the middle of the lower sight glass. Conversely, the level of the oil must not be higher than the middle of the upper sight glass.

  The correct quantity of oil for the compressor unit is stated in table no. 4840-071. However, this does **not** include the oil circulating in the refrigerant system. This is particularly important with R22 plants with large quantities of refrigerant – allowance **must** be made for the oil dissolved in the refrigerant.

  Therefore, check the oil level during the initial period of operation, as this may drop quite rapidly until the oil contained in the refrigerant system has stabalized.

Crankcase heater

A 470 watt electric crankcase heater is built into the oil separator.

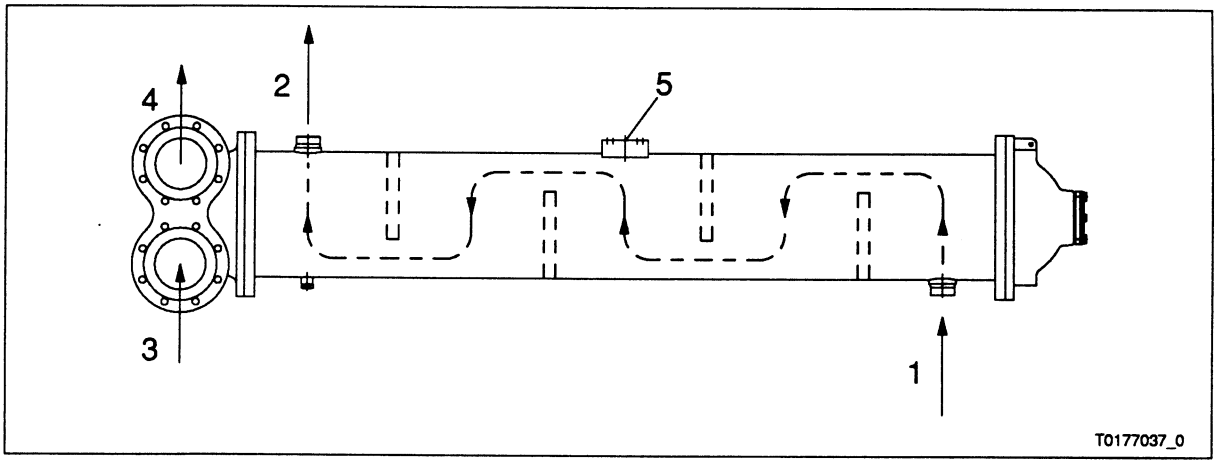
The purpose of this is to prevent the refrigerant condensing in the oil separator during standstill, and to ensure a certain minimum oil temperature before start- up. The crankcase heater must be activated at least 6-7 hours before starting the compressor up after a long standstill period.

The crankcase heater should be connected electrically so that it is activated at compressor standstill and deactivated when the compressor is running.

Note: *The crankcase heater must not be energized if the oil level is lower than the bottom sight glass.*

and must not be lower than 20°C. Please refer to the table for *Adjustment pressures and temperatures* inserted in the section *Preparation of compressor unit*, where the maximum oil temperature can be found. Refer also to oil recommendation "0170-104" regarding choice of oil.

1. Water-cooled oil cooler, type OWSG/OWCB



No.	Used for
1	Hot oil inlet
2	Cooled oil outlet
3	Water inlet
4	Water outlet
5	Type plate

Construction

In principle, the oil cooler consists of a cylindrical shell with a steel tube nest inserted.

The cooler has oil inlet and outlet connections in the shell, whereas water inlet and outlet are in one of the end covers. The covers are made of cast iron.

The tube insert consists of two tube plates into which a number of tubes have been welded. The tubes are fitted with baffle plates, to prolong the passage of the oil through the cooler. Some of the oil thereby flows across the tubes, thus considerably improving the heat transfer from oil to cooling water.

The end covers on the cooler are designed to guide the water back and forth a number of times in order to prolong its passage through the piping.

The OWCB oil cooler features internal protection in piping and end covers in the form of a 200 my coating and corrosion plugs in the covers.

Application

The OWSG type oil cooler is designed for connection to a freshwater system incorporating anti-fouling and scaling measures. When operating with an evaporative cooling tower,

rust inhibitors and algicides must be added to the water.

The OWCB type oil cooler is used where the quality of the water cannot be guaranteed to be as satisfactory and constant as above

Cleaning

Fouling of the water side of the cooler will reduce the heat transfer coefficient, and thus the capacity of the cooler.It is therefore important that you inspect and clean the cooler regularly, according to the degree of purity of the cooling water available.

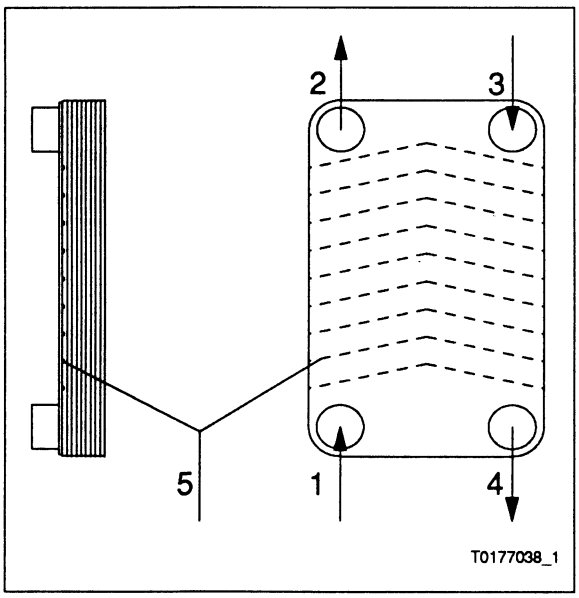
The OWSG oil cooler can be cleaned by removing the end cover without connections and drawing a bronze brush through the tubes. The inner pipe diameter is 8 mm. After brushing, rinse the tubes with pure water. Alternatively, ready-mixed inhibitive scouring acids can be used, with subsequent neutralization. Such agents must be designed for untreated steel tube heat exchangers. The chemical manufacturer's instructions **must** be followed to the letter!

The OWCG oil cooler must **not** be cleaned mechanically, as any impairment of the pipe coating may result in severe corrosive damage. Instead, an inhibited maximum 5% organic acid can be used for one hour at a maximum of 60°C. Finally the oil cooler should be flushed through with pure water.

Temperature regulation

The temperature of the oil is controlled by a water valve which regulates the water flow through the oil cooler in order to keep the temperature of the oil within the limits prescribed. The water valve sensor must be placed on the oil tube immediately after the cooler and the valve set to an oil outlet temperature of 50°C.

2. Water-cooler oil cooler, type B



No.	Used for
1	Hot oil inlet
2	Cooled oil outlet
3	Water inlet
4	Water outlet

Construction

The B-type oil cooler is a stainless steel plate heat exchanger. A V-pattern is moulded into each plate together with the inlet and outlet holes. The plate heat exchanger is assembled by turning the V-pattern upwards and downwards, alternately. All points of contact between the V-patterns are copper-welded. A supporting plate is soldered onto either side. Between the support plate fitted with connecting branches and the first heat-exchanger plate, a row of channels is visible. By means e.g. of a welding rod, make sure that the V-pattern faces upwards, preventing water from accumulating here. Owing to the principle of its design, the heat exchanger cannot be stripped down and must not be used in an R717 plant.

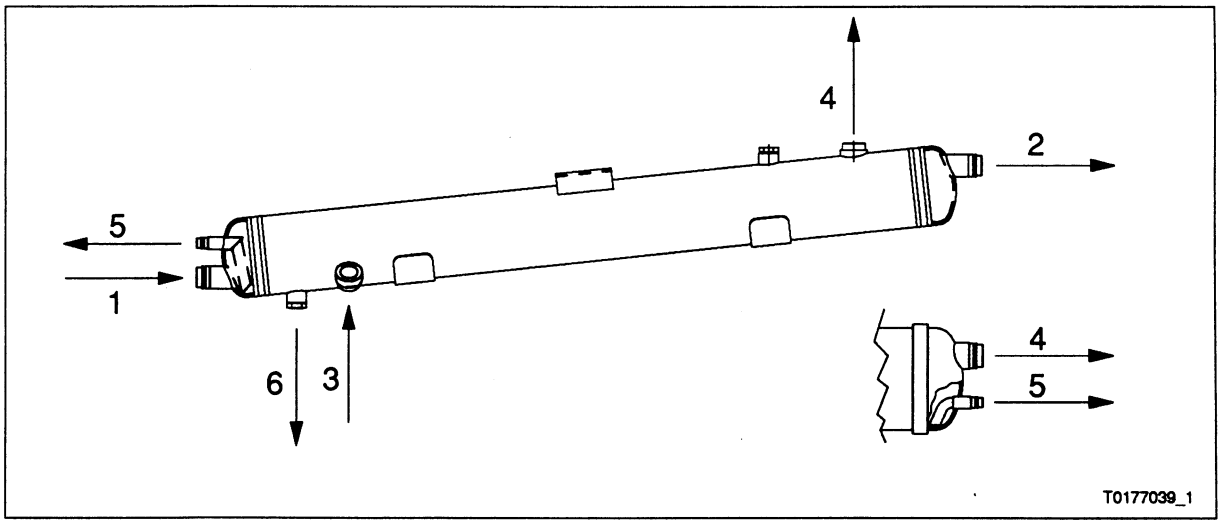
Application

The B-type oil cooler can only be used with freshwater as cooling agent.

Cleaning

Since the oil cooler cannot be dismantled, mechanical cleaning is not possible. We would therefore recommend that the water filter be fitted before the oil cooler. Cleaning can only be done with a cleaning fluid. The cleaning intervals for the cooling water side of the heat exchanger should be determined on the basis of the water's hardness and tendency to deposit scale. A 5% phosphoric acid or 5% oxalic acid solution can be used for cleaning purposes. Rinsing with plenty of pure water is then required to remove any remaining acid and dirt.

3. Refrigerant-cooled oil cooler, type OOSI



1	Oil inlet
2	Oil outlet
3	Refrigerant inlet
4	Refrigerant outlet

5	Oil draining (oil side)
6	Oil draining (oil side) – applies to R717 only

Construction

The oil cooler consists of a cylindrical shell with welded-on tube plates and a number of tubes welded in. Each of the two tube plates has an end plate welded on. The oil cooler is now an assembled, all-welded construction. The end plates are provided with welded branches for oil connection and drainage. The shell has

welded branches for refrigerant connection and for draining oil when operating with the R717.

Function

Oil flows through the tubes, which are designed for extremely efficient heat transfer between the oil and the tube walls.

Liquid refrigerant from the system receiver or a special priority vessel is admitted to the oil cooler to cool the oil. The liquid refrigerant partly evaporates on the outside of the tubes and the mixture of liquid and gas is piped to the condenser. The OOSI cooler may be placed on a gentle slant, with the oil and refrigerant outlets at the top end in order to make heat transfer particularly effective.

The receiver or the priority vessel is normally positioned above the oil cooler at a suitable height, thus ensuring an adequate supply of refrigerant by natural circulation. Alternatively, a pump can be used to effect refrigerant supply.

Cleaning

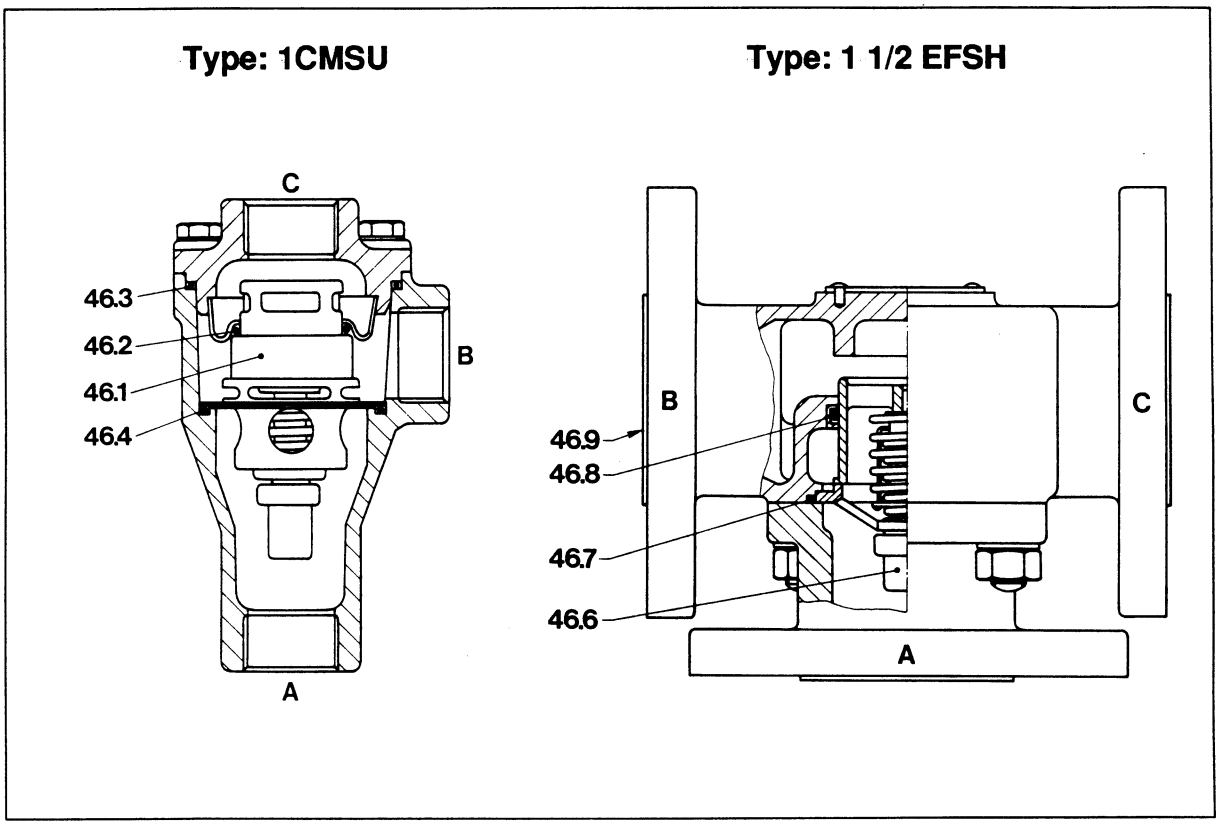
Since both the oil side and the refrigerant side of the oil cooler form part of closed systems, there will be no need for cleaning.

Temperature regulation

If there is any risk of the liquid refrigerant dropping below 15°C at any time, a temperature-regulating 3-way valve must be fitted to establish a bypass round the oil cooler. This will ensure that the oil temperature rises more quickly to a normal and stable level.

Depending on the size of compressor, one of the 3-way valves below should be used, connected as follows:

Port	Used for
A	Temperature-regulated oil to compressor
B	Hot oil from oil separator
C	Cooled oil from oil cooler



For SAB128 use 1 CMSU

Pos.	Description	No.
46.1	Thermostatic element	1365.004
46.2	O-ring ø32,92x3,53	1331.027
46.3	O-ring ø69,52x2,62	1331.145
46.4	O-ring ø59,99x2,62	1331.142

For SAB 163 use 1 1/2 EFSH

Pos.	Description	No.
46.6	Thermostatic element	1365.005
46.7	O-ring ø63,17x2,62	1331.144
46.8	O-ring ø44,04x3,53	1331.065
46.9	Gaskets, 3 pcs	2356.091

In standard execution, the thermostatic element regulates the oil temperature to 50°C. When the compressor unit is started, an oil temperature overshoot may occur before the 3-way valve has time to regulate the temperature. On compressor units with PROSAB control, this overshoot in oil temperature at compressor start-up is permissible for 5 minutes.

4. Refrigerant injection in discharge pipe BLI (Booster Liquid Injection)

Function

As the dry-saturated vapours are compressed from evaporator pressure to intermediate pressure, in the LP compressor of a two-stage system a considerable amount of heat is

generated. This must be dissipated in order to keep the gas and oil temperature at a suitable level. This is done by injecting liquid refrigerant from the receiver into the discharge pipe immediately after the LP compressor, controlled by a modulating injection valve. The liquid refrigerant will evaporate in the hot mixture of oil and discharge gas, thereby cooling the mixture. The size of the injection valve is chosen according to the refrigerant, intermediate pressure temperature, condensing temperature, and cooling requirement specified in the order. The thermocouple of the valve has a working range of 35-65°C.

Adjustment

The injection valve is factory-set to **opening temperature** at the mid-temperature range of the thermocouple.

Before starting the compressor up, the **opening temperature** of the injection valve must be set at:

Desired discharge gas temperature - 20°C

See *Table of adjustment values* and Danfoss instructions for setting of the injection valve.

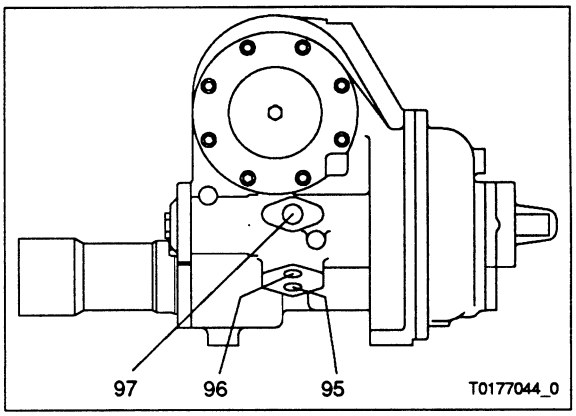
Adjust the valve more precisely once the installation is in stable operation.

In case of operation with BLI, a relatively large amount of foam may occur on the oil in the oil separator.

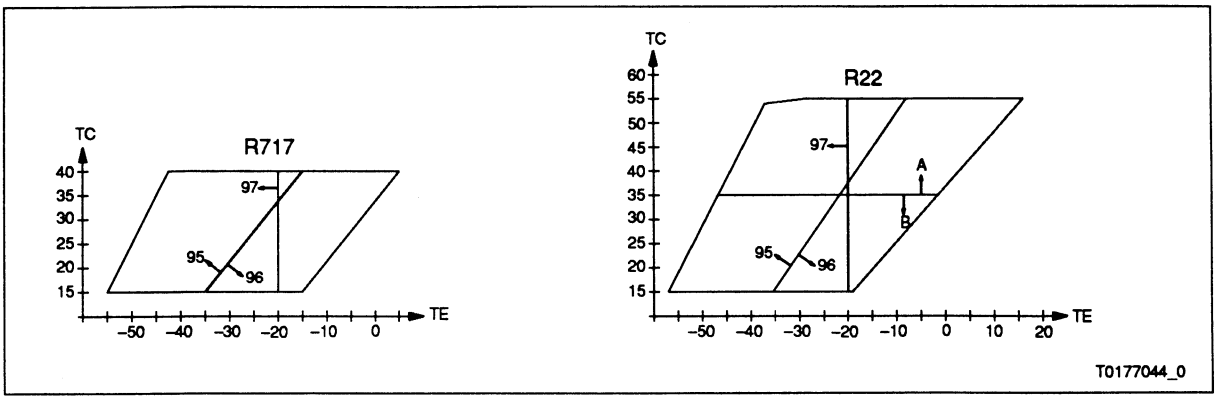
5. Refrigerant injection in compressor HLI (High-stage Liquid Injection)

Function

As the dry-saturated vapours are compressed from evaporator pressure to intermediate pressure, a considerable amount of heat is generated, which must be dissipated in order to keep the gas and oil temperature at a suitable level. This is done by injecting liquid refrigerant from the receiver into the compressor at a suitable stage in the compression process, controlled by a modulating injection valve. The liquid refrigerant will evaporate in the hot mixture of oil and refrigerant gas, thereby cooling the mixture. It is desirable to inject the liquid as late as possible for reasons of compressor power consumption. There are 2 different HLI connection ports, numbered 96 and 95 on the sketch below.



The size of the injection valve and the temperature range of the thermocouple are chosen according to the refrigerant, evaporating temperature, condensing temperature, and cooling requirement specified in the order. The following diagrams for R717 and R22, respectively, show which injection port to use as a function of evaporating and condensing temperature TE/TC.



If operating conditions change, for example owing to the season, and the operating point alternates between the range for use of connection port 95 and that for port 96, the letter should generally be used.

The thermocouple, which measures the discharge gas temperature above the oil bath in the oil separator, is supplied in 2 different versions with a working range of:

A: 35-65°C
B: 55-95°C

For refrigerant R717, always use an A-type sensor. For refrigerant R22, read the correct sensor type from the diagram TO177044.

An economizer can be connected to the compressor. An economizer is a heat exchanger which cools the liquid refrigerant from the receiver to the plant. A minor portion of the liquid evaporates and is sucked into compressor port no. 97; see drawing TO177044. The diagram shows the range in which it is permitted to use the economizer simultaneously with HLI cooling.

The liquid supply to the HLI system must be tapped from a point in the installation **always** certain to contain liquid refrigerant. This will ensure that the compressor is kept cooled at all times.

Adjustment

The injection valve is factory-set to opening temperature at the mid-temperature range of the thermocouple.

Before start-up of the compressor, the opening temperature of the injection vcalve must be set at:

Desired discharge gas temperature - 20°C

See *Table of adjustment values* and Danfoss instructions for setting the injection valve.

Fine-adjust the valve once the installation is in **stable** operation.

A thin layer of foam normally develops on the surface of the oil in the oil separator when operating with HLI. Vigorous foaming may be an indication of excessive liquid supply, in which case check that the temperature of the discharge gas is not too low in relation to the condensing temperature! See table of settings.
Safety and monitoring devices

Compressor units with relay control or terminal strip for remote control are normally equipped with the following instruments for safety and operating control, depending on the specific order.

Safety and monitoring devices

Compressor units with relay control or terminal strip for remote control are normally equipped with the following instruments for safety and operating control, depending on the specific order.

Safety devices

Pos. 28 Safety valve on oil separator with exhaust to the atmosphere. The exhaust line must be routed from the engine room out into the open air.

Pos. 43 Flow control in the oil distributor pipe. A spherical float with a permanent built-in magnet is able to actuate a reed switch in the float guide. The switch is wired up to a timing relay which will stop the compressor if the flow control chamber is not filled with oil within max. 10 secs. after start-up.

Pos. PAZ1 Pressure cut-out KP1, which stops the compressor in the event of the suction pressure falling below the set value. The pressure cut-out is not equipped with a reset, so the compressor starts again when the pressure has risen above the difference between the setpoints of the pressure cut-out.

Pos. PAZ2 High pressure cut-out KP5. The pressure cut-out is intended to safeguard the compressor against excessive discharge pressure.

Note: On units to be approved by TÜV, the KP5 is replaced by a pressure cut-out KP 7ABS which has been approved by TÜV. This high pressure cut-out will stop the compressor in the event of damage to the cut-out bellow or excessively high discharge pressure.

Pos. PDAZ 11 Differential oil pressure cut-out MP55. This pressure cut-out is designed to ensure sufficient lubricating pressure and oil pressure for capacity regulation. The pressure cut-out is equipped with a time lag of 45 secs. If the preset differential pressure has not been obtained by that time, the compressor will stop. The MP55 is equipped with manual reset.

Pos. PDAZ3 Differential pressure cut-out RT260 for oil filter control. If the pressure drop across the oil filter becomes excessive owing to dirt, the pressure cut-out will stop the compressor and a pilot lamp will light.

Pos. TAZ12 Thermostat KP79 with sensor in oil flow control. Designed to safeguard against excessive oil temperature.

Pos. TAZ13 Thermostat KP79 or KP81 with sensor in oil separator. Designed to safeguard against excessive discharge gas temperature.

Pos. TC14 Thermostat KP77 with sensor in oil separator. Designed to safeguard against too low discharge pipe temperature and hence too low oil temperature in connection with HLI and BLI oil cooling.

Please see section on setting of safety devices for various values.

Monitoring devices

Pos. PI15 Suction pressure gauge (evaporator pressure)

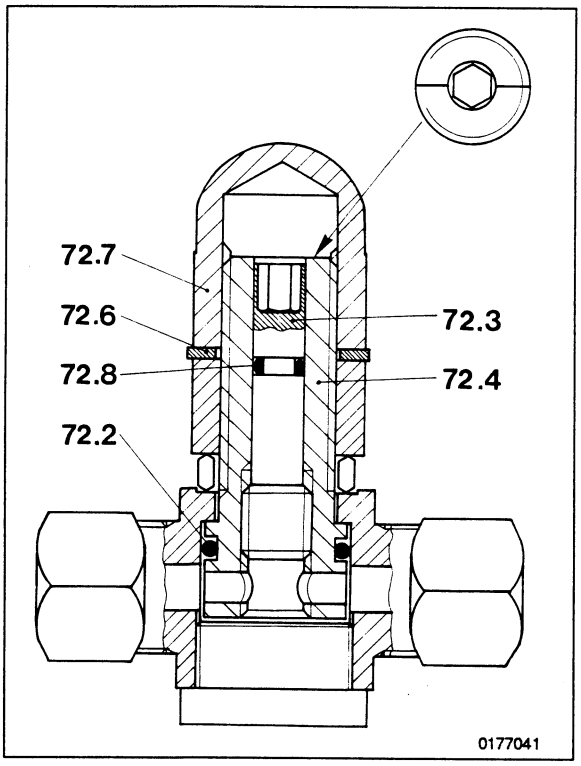
Pos. PI16 Discharge pressure gauge (condenser/intermediate pressure)

Pos. T15 Thermometer in oil separator (discharge gas temperature)

Pos. T16 Thermometer in oil flow control (oil temperature)

Pos. T17 Thermometer with sensor in suction pipe. Supplied as extra. Used to calculate superheat of the suction gas. Superheat is the temperature difference found by deducting the temperature read off the suction pressure gauge from the temperature read off the thermometer.

Throttle pos. 72



Pos.	Description	No.
72.2	O-ring ø15,54x2,62	1331.015
72.6	Gasket	2356.130
72.7	Cap	1434.001
72.8	O-ring ø4,47x1,78	1331.005

Construction

Valve housing, spindle, cap and connections are made of steel. Stem guide pos. 72.4, sealed by O-ring pos. 72.2, should be positioned so that the bore is located opposite the connections. This can be seen by a line at the top of the stem guide indicating the direction of the bore.

The spindle pos. 72.3 can be activated with a 6 mm Allen key. A cap nut pos. 72.7 with gasket pos. 72.6 is fitted for additional spindle protection. The connections are 10 mm cutting ring unions for pipe fitting.

Function

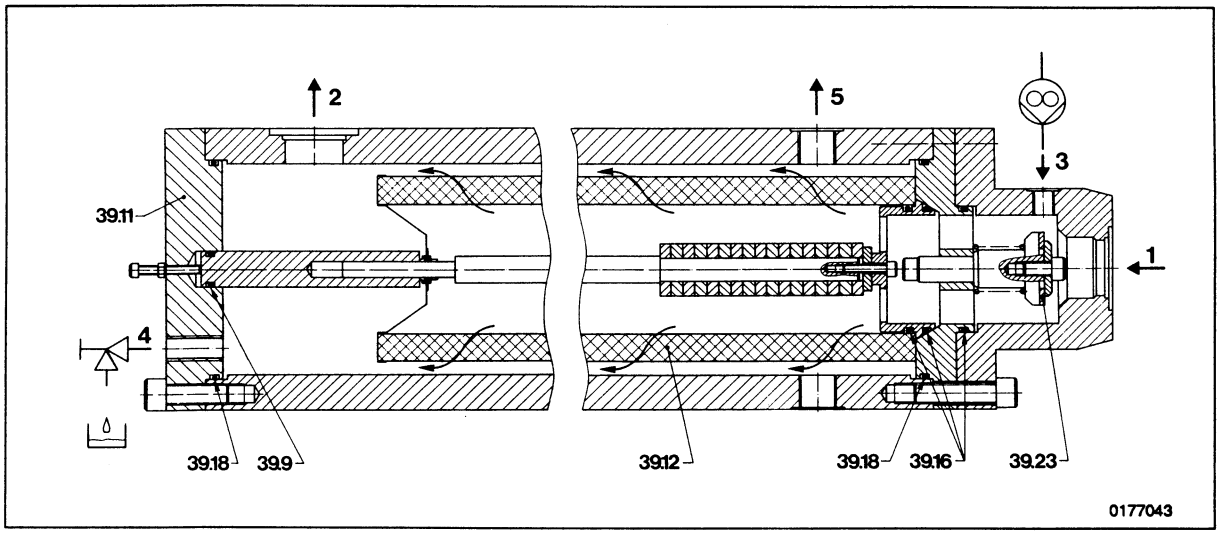
By adjusting the spindle pos. 72.3 to form a partial blockage of the bore, the valve will offer continuously adjustable resistance to the oil throughflow.

The throttle valve cannot serve as stop valve. The capacity slide on the compressor is actuated by oil pressure and a built-in spring. The velocity of the slide is regulated by the throttle valves. Turning the spindle pos. 72.3 clockwise causes the oil flow to be choked and the slide to move more slowly. Furthermore, the velocity of the slide depends on the electric controls. The solenoid valves which turn the oil flow on may be activated for short spells interrupted by breaks. The combination of activation, pause periods, and the position of the throttle valve determines the velocity of the slide.

Quite particularly on CFC and HCFC plants, the oil may contain a certain amount of refrigerant. In case of heat penetration from the compressor housing and possible pressure drop, the oil in the capacity slide cylinder may give off refrigerant in gas form. The cylinder activator then becomes a compressible mixture of oil and gas, which can sometimes provoke small jerks in the movements of the capacity slide. When the compressor capacity is to be changed from 100% to a lower percentage, the

slide may not move immediately when the capacity reduction solenoid valve is opened. The liberated gas must escape before the pressure drops sufficiently to enable the slide to move.

Oil filter pos. 39



Pos.	Description	No.
39.9	O-ring ø15,54 x 2,62	1331.015
39.12	Filter cartridge	1517.021
39.16	O-ring ø66,27 x 3,53	1331.072
39.18	P-ring ø117,07 x 3,53	1331.088
39.23	Gasket	2354.116

Oil filter pos. 39

The oil filter consists of a pipe with screw-retained covers. The end cover pos. 39.11 houses connection 4 (1/4" p.th.) for connecting an oil drainage system, and screw M5 with counternut for retention of the filter cartridge. The latter is made of compressed glass-fibre. The filter tissue is glued onto the end plate and supported by a perforated plate. Both this and the end plates are made of steel.

The access cover has a 1/4" threaded union for a prelubrication pump (if required) and a welded connection for oil supply as well as a built-in non-return valve with a teflon gasket. A magnetic rod is placed in the middle of the filter.

Function

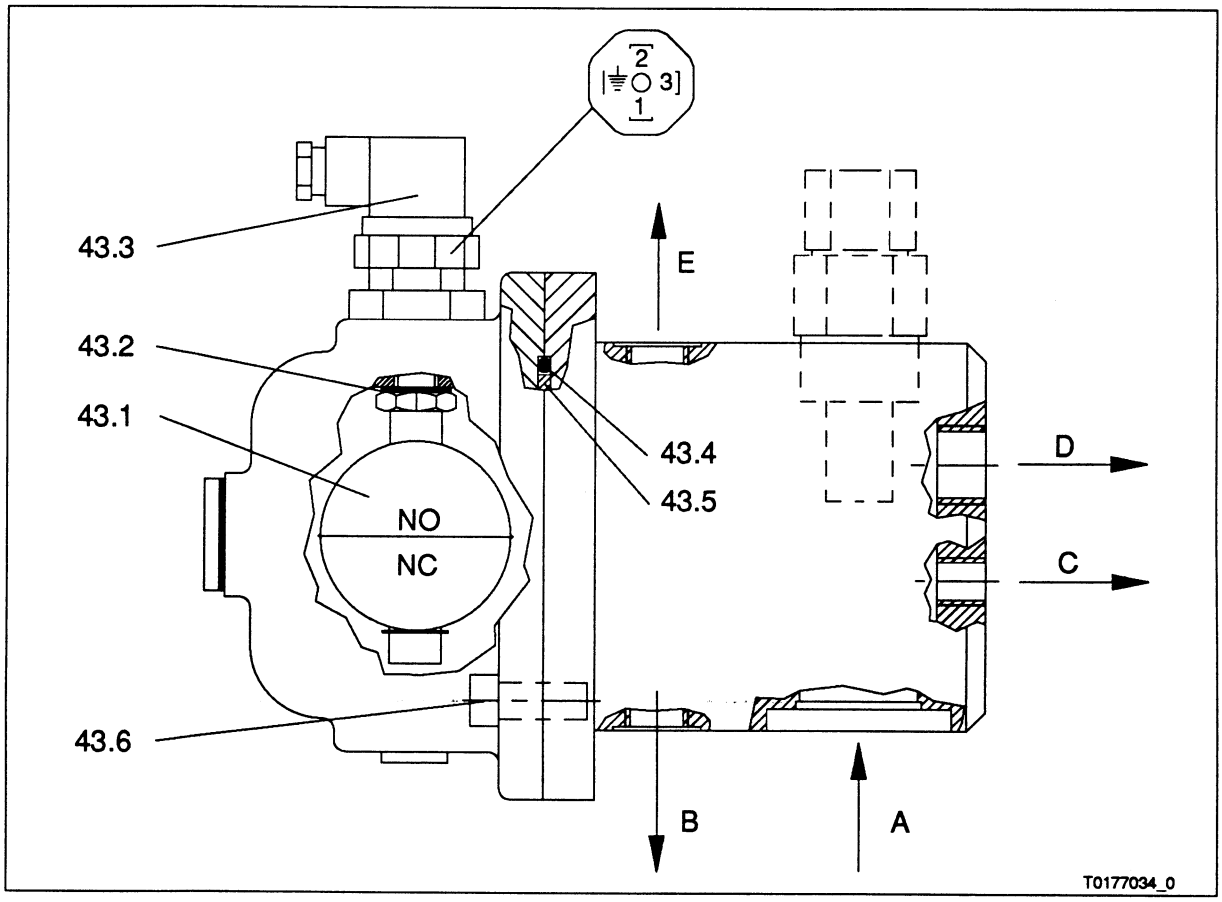
The oil flows from the connections 1/3 through the non-return valve and past the magnetic rod. The magnets must be mutually positioned with facing south poles and facing north poles. This ensures that magnetizable material is deposited on all the intermediate rings. The oil is purified further as it passes through the filter cartridge and leaves the filter at the welded connection 2. There will normally be equipment connected to measure the pressure loss across the oil filter and signal when the filter cartridge is clogged by dirt. The pressure loss must not exceed 1 bar. If the filter cartridge is not replaced and still clogged up, this may cause the filter tissue to burst. Thereby a large quantity of dirt will be

admitted direct onto the compressor bearings, with resultant damage.

Changing the filter cartridge

When the filter cartridge needs replacing, shut off the oil filter after the compressor unit has been stopped. The pressure in the oil filter is equalized to atmospheric pressure at connection 5. The oil is then drained at 4. The cover pos. 39.11 is removed and the filter cartridge taken out complete with magnetic rod. Before fitting a new filter cartridge, make sure to clean the magnetic rod. Dirty oil may have run from the inside of the filter cartridge out into the filter housing during dismantling. The filter house **must be thoroughly cleaned** before inserting a new filter cartridge. Do not use cloths which produce fluff and fibres when applied. Before fitting the cover pos. 39.11, loosen centre screw M5 a few turns. After fitting the filter cartridge and cover, tighten the centre screw to a torque of 2 Nm, thereby securing the filter cartridge, and tighten the counternut.

Flow control pos. 43



Pos.	Description	No.
43.1	Float switch	1553.024
43.2	Gasket ø 19/15	2356.124
43.3	Plug	1554.001
43.4	O-ring ø88,49x3,53	1331.079
43.5	Plate	3446.276
43.6	Screw M10 x 30	1413.372

Installation of electric wires in plug 43.3:

Terminal	Wire colour
1	Brun
2	Hvid

Port	Connect to:
A	Oil inlet
B	Bearings at pressure end
C	Capacity regulation
D	Rotor lubrication and lubricating pressure control valve
E	Shaft seal

The float control consists of a cast iron cover and a machine-tooled steel cover. The two covers are joined by screws and sealed with an O-ring. Unused connections are plugged and sealed with gaskets.

The cast iron cover has a built-in level switch consisting of a stem with an electrical switch sensitive to magnetism (reed switch) and a float with a built-in ring magnet. The steel casing is used for oil pressure transmission, oil temperature measuring and oil supply to the compressor, etc.

Before welding of any admission pipes, the flow control must be disassembled so that O-ring 43.4 is not destroyed by the heat.

Function

The oil flows from the oil separator to the flow control, via cooling and filtering if installed. From here it is distributed to the compressor's lubricating points. If the oil supply is sufficient, the float control fills and the float ball and magnet are lifted. The ball must face as shown on the sketch. When the float ball is lifted to reach its topmost position, the normally open reed switch will close to indicate sufficient oil supply. If not, the controls are designed to stop the compressor before damage occurs.

Oil pump pos. 63

The primary function of the pump is to ensure lubrication of bearings and shaft seal before the compressor starts.

When the compressor start button is actuated, only the oil pump starts; after 60 secs. a timing relay will start the compressor motor and stop the oil pump. On booster units, however, the pump will continue to operate. The setting of the timing relay must not exceed the duration for which the compressor is known not to be filled with oil before starting.

Furthermore, the pump is used for oil charging. (See section about compressor operation.)

Installing the compressor unit

The following is a schematic description of the operations to be performed when installing a compressor unit.

1. Aligning the compressor unit with the foundation.
2. Connecting electricity, refrigerant and possibly also cooling water supplies.
3. Adjusting safety devices.
4. Aligning the coupling.
5. Mounting of coupling guard.
6. Evacuating the compressor unit.
7. Oil charging.
   In order to ensure compressor and motor a

long life as well as noise and vibration-free operation, it is necessary to align the compressor unit and coupling with utmost care. Misalignment of the compressor unit or coupling may produce stresses and vibrations which can be transmitted to the compressor bearings and thus cause major damage.

Vibrations may be caused by the following:

Distortion between compressor unit and foundation.
Distortion between compressor and base frame.
Distortion between motor and base frame
Strains from pipe connections between compressor and installation.
Incorrect alignment of coupling between compressor and motor.
Untruth in compressor or motor shafts.
Untruth in coupling.
Defective balancing of coupling.
Unbalance in compressor and motor.

The person installing the unit is responsible for the points up to and including aligning the coupling. The other points must be checked by the compressor or motor manufacturer prior to delivery.

The following sections deals with each point for which the fitter is responsible.

1.0 Alignment of unit with foundation

When mounting the unit on the foundation or the engine floor, care must be taken to stand it equally on all supports without stresses.

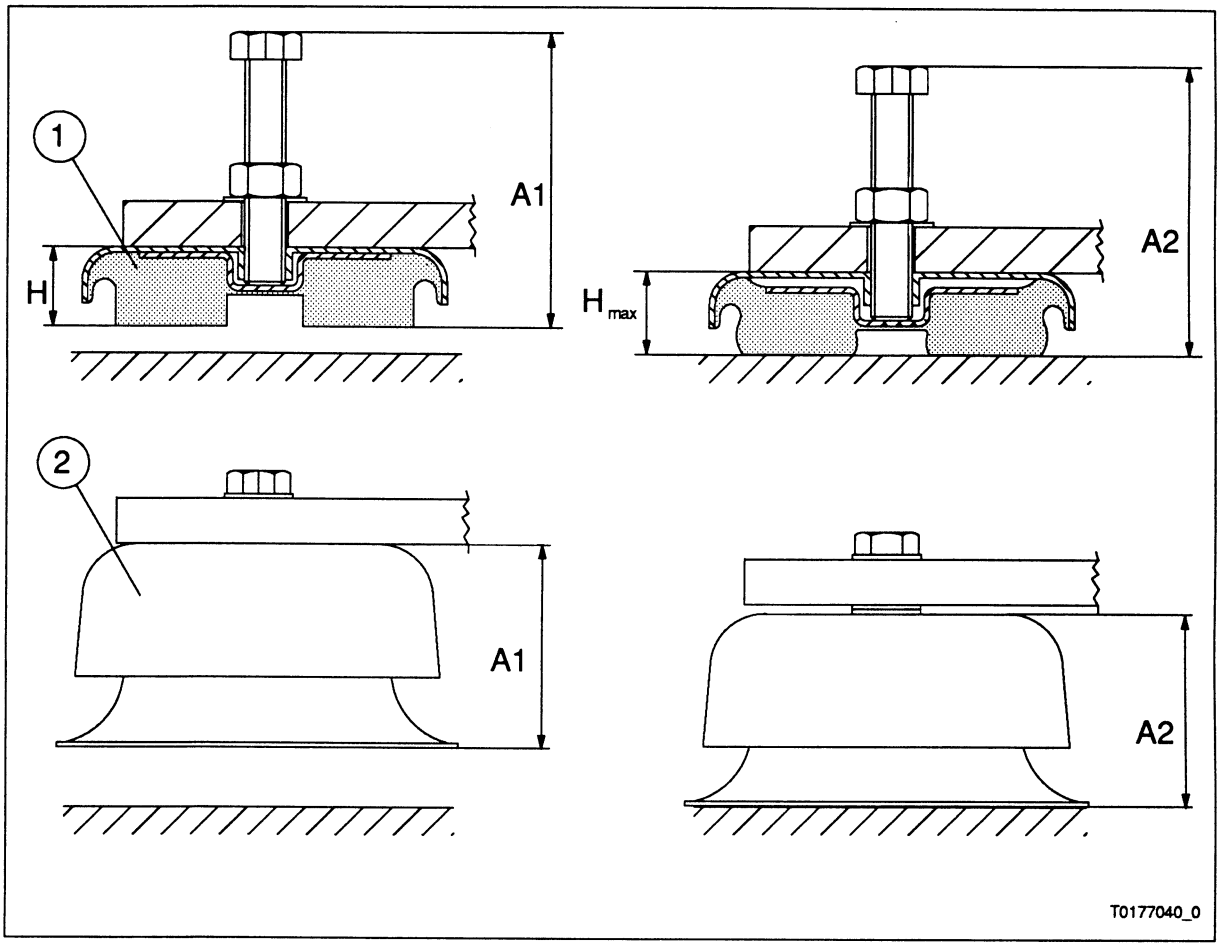
The unit can be mounted in the following ways:

- on vibration dampers
- direct on foundation (with foundation bolts)

In both cases the unit must be aligned **before** fitting the connecting pipes to the installation.

0171-546-EN

1.01 Fitting the vibration dampers



Depending on whether the compressor unit is destined for use on land or at sea, the vibration dampers shown at the top or the bottom of drawing T0177040 are included in the supply.

The purpose of the vibration dampers is to attenuate the propagation of vibrations from the compressor unit to the foundation. In addition, the marine vibration dampers serve to cushion vibrations from the foundation to the compressor unit, at the same time securing the unit on its foundation.

It is imperative that the vibration dampers be placed correctly, as shown in the completed drawing forwarded to the customer or the distributor. This drawing is valid only for the unit in question.

The vibration dampers supplied are marked with a code, for instance LM6-60. LM6 indicates the size; 60 indicates the rubber hardness and expresses thereby the bearing strength and damping ability.

When using vibration dampers, the machine room floor is assumed to have the necessary bearing strength and to be level, so that the adjustment of the vibration dampers can be kept within the adjusting measurements stated on the drawing submitted.

In order for the individual vibration damper to cushion properly, a sufficient load must be imposed. A1 and H should be measured without load and A2 with load.

	Industrial type ①	Marine type ②
Flexion A1-A2	min 0,8	min 3,0
Height adjustment	H_{max} = H+12	with discs supplied as shown

The flexion of a damper is adjusted by increasing or decreasing the load in relation to the other supports. The foot can be raised by screwing the adjusting rod down or by inserting more discs between damper and foot (marine type), thereby increasing the load and hence also the flexion.

Once the installation has cooled down, check during operation that the flexion of the dampers is still correct.

1.02 Fitting directly onto the foundation

When mounting direct on a foundation with embedded iron, check carefully that all 4 legs are stable. Alternatively, shims must be used in order to avoid distortion of the compressor unit.

1.1 Alignment of compressor with base-frame

Since the compressor stands on a three-point fixture, there is no danger of distorting the compressor housing.

Verify that all the screws are properly tightened.

1.2 Alignment of motor with base-frame

Check that the motor feet make full contact with the milled-off contact faces of the base frame. Check that all surfaces are clean and free of burrs.

Perform this check with the fixing bolts loosened. If slip occurs at one or more resting surfaces, line up before tightening the bolts. If unaligned, there is a risk that the motor may be subjected to stresses which will damage the bearings.

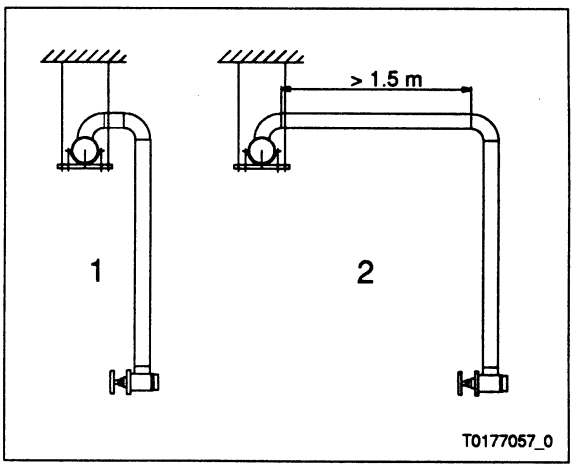
Coupling alignment is also made considerably easier if there is no distortion between the electric motor and the foundation.

2.0 Making various connections

Connect the compressor unit to refrigerant and electricity supplies as well as to cooling water, if applicable. Pipings subject to sizeable temperature fluctuations must be laid so as to allow deflection at appropriate points. This will ensure that excessive forces are not transmitted e.g. to the suction connection on the compressor. Secured pipes may give rise to very large strains, for instance when the temperature changes from installation temperature to evaporating temperature.

Once the installation has cooled down, the vibration dampers on the compressor unit should be checked for correct flexion.

Shown below is a rigid, and therefore unacceptable, piping (1) and a more flexible one (2).



3.0 Adjustment of safety equipment (for compressor units with relay-based controls)

The safety equipment fitted is not supplied correctly adjusted. The correct settings for pressure cut-outs and thermostats depend on the refrigerant, oil cooling principle, and form and condition of operating. The relevant values are found in the table below. The safety equipment must be adjusted **before the first start-up!**

With the coupling separator dismantled, check that the direction of rotation on the compressor motor is correct, as shown by the cast arrow on the suction cover above the axle journal.

If there is an oil pump, check that the direction of rotation follows that shown by the arrow on the pump.

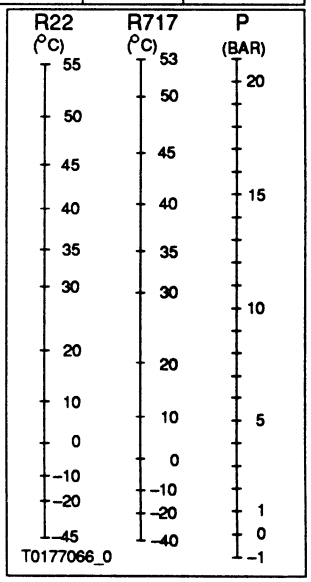
	Parameter/point	Device	Type	Limit/ unit	Oil cooler			
					OWSG OWCG B/OOSI	HLI R717	HLI R22	BLI
Safety equipment	Oil temperature	Thermostat	KP79	max/°C	60	–	–	–
	Discharge gas temp.	Thermostat	KP79/KP81	max/°C	100	60	TC+35	60
Control equipment	Discharge gas temp. for TEAT valve			Set point/ °C	–	50	TC+30	50
	Oil separator temp.	Thermometer		max/°C	100	55	TC+35	55
	Oil separator temp.	Thermometer		min/°C	TC+5	TC+5	TC+5	TC+5
	Oil temp. before compressor			max/°C min/°C	55 20	– –	– –	– –
	Start of compressor cooling. Solenoid valve activated through discharge gas temp.	Thermostat	KP77	°C	–	TC+5	TC+5	TC+5
					Condensing temperature °C R717/R22			
					–> 0	20 –> 30	30 –> 40	40–>53/55
Safety equipment	Oil separator with 25 bar design pressure	Safety valve ③		Opening pres. Bar	25	25	25	25
	Discharge pressure ① for units with 25 Bar safety valve	Pressurestat	KP5/KP5A/ KP7ABS/ KP7BS	max/Bar	5/6.5	14	19/18	23
	Oil separator with 18 Bar design pressure	Safety valve ③		Opening pres. Bar	18	18	18	18
	Disch. pressure ① for units with 18 Bar Safety valve	Pressurestat	KP5/KP5A/ KP7ABS/ KP7BS	max/Bar	5/6.5	14	16	16
	Suction pressure ②	Pressurestat	KP1	min/Bar	④ P(TE-5)	P(TE-5)	P(TE-5)	P(TE-5)
	Lubricating pressure for compressor	Differential pressurestat	MP55/ MP55A	min/Bar	1	2.5	2.5	2.5
	Differential pressure accross oil filter	Diff. pressurestat	RT260A	max/Bar	0.5	1.0	1.0	1.0

① Read the type plate on the oil separator to check the design pressure and read the opening pressure stamped on the safety valve. Set pressurestats to the value stated in the table for the relevant condensing pressure – this must not be more than 2 bar below the opening pressure for the safety valve!

② The compressor must not operate at a differential pressure between inlet and outlet pressure higher than 20 Bar. Read the pressure gauges on the compressor unit and calculate the pressure difference or read the saturation pressures from the above graph for evaporator and condenser temperatures and calculate the pressure difference.

③ The safety valve is factory-set and sealed. This setting must not be altered.

④ P(TE-5) denotes the pressure for temperature TE-5 read from the refrigerant graph.



TC = Condensing temperature
TE = Evaporating temperature
OWSG/ OWCG/B = Water-cooled oil cooler
OOSI = Refrigerant-cooled oil cooler
HLI = Refrigerant injection in compressor (High-stage Liquid Injection)
BLI = Refrigerant injection in discharge pipe after compressor (Booster Liquid Injection)

4.0 Alignment of coupling between compressor and motor:

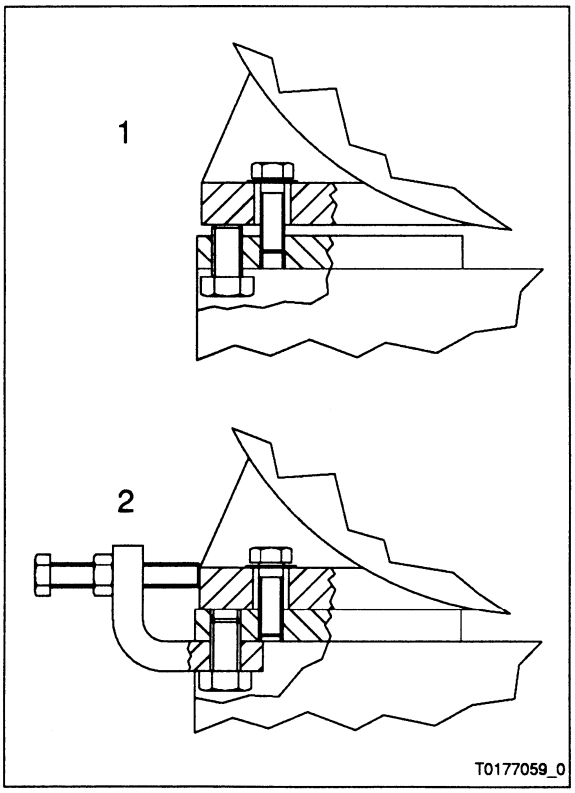
Final alignment of compressor and motor can be performed once the suction and pressure pipes have been connected to the unit.

Auxiliary tools for alignment of coupling

4 clamps with adjusting screws are supplied with each unit, together with 4 sets of shims. Each set consists of:

Qty	Thickness (mm)
1	3,0
2	1,0
3	0,25
2	0,15
2	0,10

Large motors can be lifted by the screws supplied, as shown on sketch 1 below, for insertion of shims. The clamps shown in sketch 2 are used for lateral displacement of the motor.



It is recommended to use SABROE's measuring jig and feeler-gauge set for alignment of coupling.

Mounting of coupling parts:

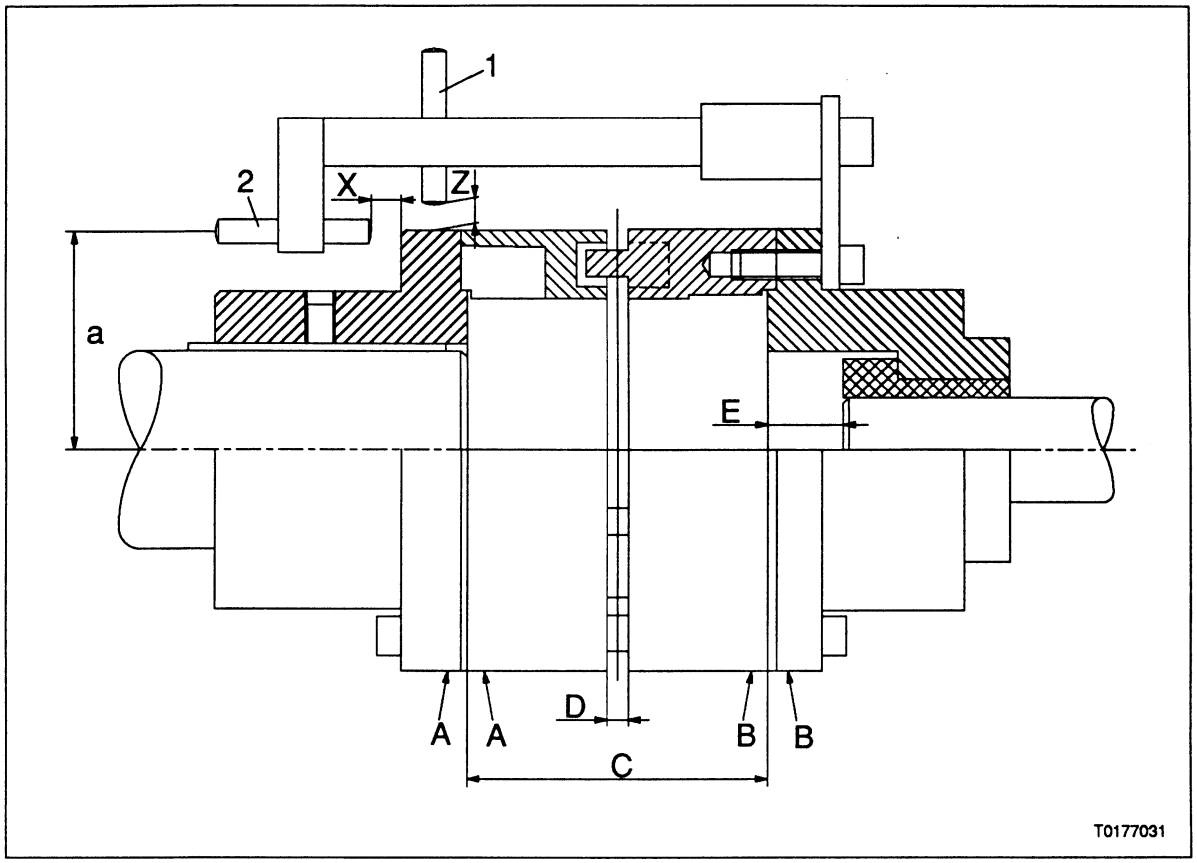
Before mounting the coupling hub, clean the compressor shaft, coupling hub and spacer bushing and smear them with a non-acidic oil. The coupling hub and spacer bushing should be mounted at distance E from the axle journal to the hub end face. Tighten the screws on the spacer bushing evenly and retighten them one by one in a circle (not by cross-tightening) at a torque of 8 Nm. The bushing will expand and secure the coupling hub.

During a transition period, the compressor may come with a conical axle journal. The coupling part for such compressors is supplied with a conical bore.

It is advisable to squeeze on the coupling hub for the motor by means of a threaded rod with a nut and tightening bar. If the coupling hub is forced on, bearing damage may occur. Secure the coupling hub to the axle journal with a pin screw and tongue/groove connection. If the coupling is supplied unbored because the motor type is not known at the time of delivery, the coupling hub and separator must be balanced as per VDI 2060 Q 6.3 to a maximum of 3600 rpm without tongue but with pin screw. Hub and separators must be marked for correct orientation.

Hub and separators which have been balanced by SABROE are marked in succession. This is indicated on drawing T0177031 by A-A and B-B. Separators must not be swapped or turned as compared to the markings!

Tighten the lateral adjustment screws for the motor by hand so as to provide a lateral fixation during alignment.

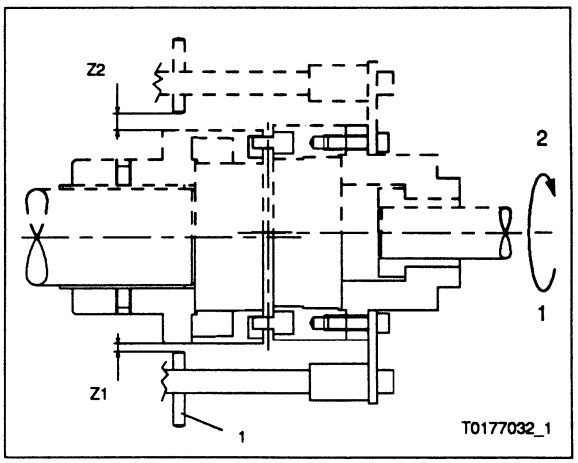


Coupling type	C (mm)	D (mm)	E (mm)	Max. dimensional variation at	
				pin 1	pin 2
H 148	100 -> 101	7 -> 8	25	0,10	0,10

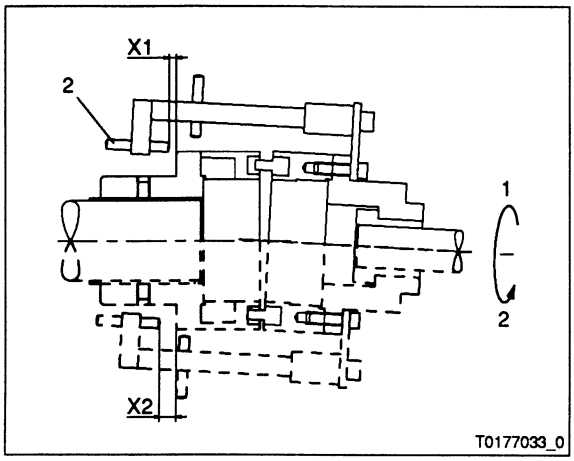
In principle, alignment involves manoeuvering the motor so as to form the shaft into an extension of the compressor shaft.

By means of the measuring jig and a feeler-gauge set, the correct information can be obtained for positioning the shims at the correct points underneath the motor. Rotate the coupling parts 180° simultaneously with the measuring jig, motor and compressor and perform the measurements at the same spot on the coupling surface.

Using pin 1, measure possible staggers between centre lines. See sketch T0177032.



Using pin 2, measure possible angle error between centre shafts. See sketch T0177033.



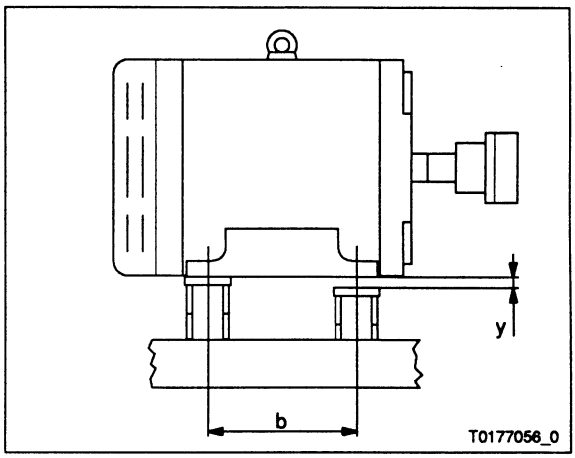
Fit the intermediate parts without the rubber cartridge inserted. Check that the compressor is secured to the base frame.

Alignment is easy if the following instructions are followed strictly.

Parallel shafts in a horizontal plane

1. Turn the coupling so that the measuring jig is in the upper position.
2. Guide the measuring pin (pos. 2) towards the coupling part using a 1 mm feeler gauge and fix the pin. Remove the feeler gauge.
3. Turn the coupling 180°. Motor and compressor go together. Measure with feeler gauges how much the distance from the measuring pin to the coupling part has changed. This change x = x2 – x1.
4. Measure distance "b" between the feet of the motor as shown on sketch T0177056. Measure distance "a" from pin 2 to central motor shaft.
5. Insert shims of thickness "y" either under both front feet or both rear feet, tilting the motor at the end desired. Shim thickness is calculated using the following formula:

$$y = x \times \frac{b}{2a}$$



6. After fixing the motor bolts, repeat the measurement and compare the result with the table values.

Parallel displacement for correct centre height

1. Turn the coupling so that the adjusting jig faces down.
2. Guide measuring pin "1" towards the coupling part using a 1 mm feeler gauge and fix the pin. Remove the feeler gauge.
3. Turn the coupling 180° and measure the increase in distance using feeler gauges. The increase z = z2 – z1.
4. Lift the motor by placing shims with thickness z/2 **underneath all four feet.**
5. After fixing the motor, repeat the measurement and compare the result with the table values.

Parallel shafts in the vertical plane

1. Turn the coupling so that the measuring jig faces horizontally out to one side.
2. Guide adjusting pin "1" towards the coupling using a 1 mm feeler gauge. Fix the pins and remove the feeler gauges.

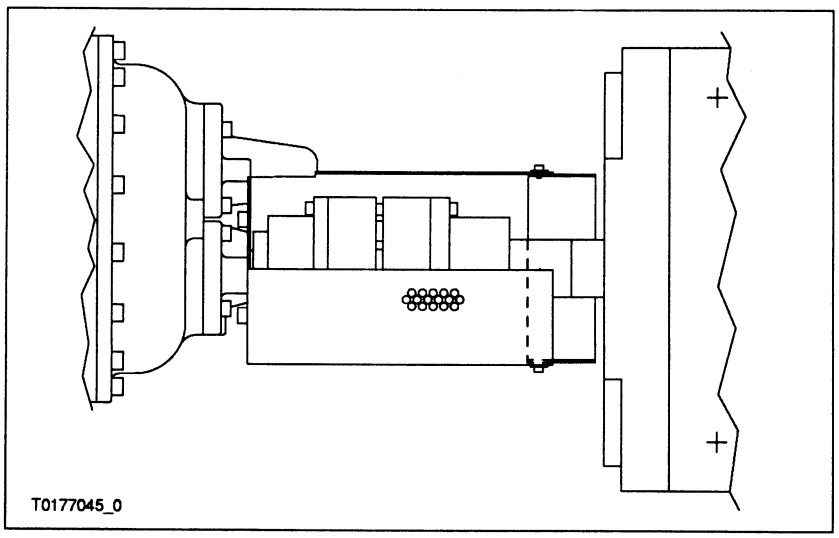
3. Turn the coupling as close to 180° as is possible for the cap cover and using the feeler gauge measure the deviations from one millimeter at both pins.

4. Moving and turning the motor sideways towards the adjusting screws and repeating this measurement, set the motor in accordance with the table. Remember that the motor must be secured during each measurement.

Final mounting

1. Tighten the foundation bolts on the motor.
2. Dismantle the intermediate parts, insert the rubber cartridge and mount the intermediate parts with the balancing marks correctly oriented.
3. Check distance **C** or **D**.
4. Dismount the adjusting jig and tighten the screw to the correct torque.
5. Fit the coupling guard.

5.0 Coupling guard



Once alignment of the coupling has been correctly performed, mount the two halves of the coupling guard on the adapter plate which is secured to the shaft seal cover on the compressor. Shift the plate shell, which is positioned inside the coupling guards, far enough towards the drive motor that it makes access to rotating parts **impossible**. On certain motor sizes, the shell must be shifted so far that it is held only by two screws. The other two are then superfluous.

6.0 Evacuating the compressor unit

Evacuation of the compressor unit serves a twofold purpose:

1. Air and other gases which are not condensable should be eliminated. These gases increase the condensing pressure and hence the compressor's power consumption.

2. Water in gas and liquid phase must be removed. There must be no free water. Water in the compressor unit and plant gives rise

to corrosion. The presence of water and air also decomposes the lubricating oil.

Connect the vacuum pump to service valve pos. 24 on the oil separator. At an ambient temperature of 20°C the compressor unit should not be evacuated in less than a couple of hours. At lower ambient temperatures such as for example +5°C, the evacuation time should be considerably extended. If suction is too fast, any water in liquid form will freeze to ice and can only be removed **very** slowly. Evacuate to 4-5 mm Hg.

Keep the compressor unit evacuated, for instance overnight, to check for proper sealing.

With refrigerants particularly sensitive to moisture, such as R12, it may be necessary to replenish with nitrogen and re-evacuate.

Afterwards, fill up with refrigerant to a pressure above atmospheric pressure.

7.0 Oil charging

Top the compressor unit up with oil using the manually controlled oil pump.

Close valve pos. 60 and connect valve pos. 62 via a suction hose to a newly-opened oil tank. Open valve pos. 64 and activate the oil pump until the oil pump and pipe system are filled with oil. Stop the pump. Close valve pos. 64 and open valve pos. 65, subsequently replenishing the oil until it becomes visible in the upper oil level sight glass

Do not use oil from containers which have been open for any length of time, as the oil absorbs moisture from the air.

See table 4840-007 for the quantity of oil.

Compressor unit operation

Initial start-up

Follow the points below:

- Check the oil level and the oil temperature (the heating element has been connected for 6-7 hours)
- Check that internal valves are open for correct compressor function. Open the discharge stop valve.
- Open the suction stop valve a few turns. If fitted with some device to ensure the accumulation of lubricating pressure, open the suction stop valve completely.
- Check that the capacity slide is set to minimum on the capacity indicator.
- Activate the oil cooling system, if any.
- Activate the start function for manual operation. The prelubrication pump will operate for 45 seconds before the compressor starts. Consecutive sequences of prelubrication must not be run unless the compressor is rotating, as the compressor may otherwise overfill with oil.
- Open the suction stop valve slowly when the difference between the inlet and outlet pressure on the compressor is greater than 2.5 bar at high-pressure operation and 1.0 bar in booster mode.
- Increase compressor capacity and follow the oil and pressure pipe temperature, suction and discharge pressure, motor current consumption and oil level in the oil separator.
- Do not leave the compressor unit for the first hour!

Start-up after standstill without control voltage

- Check the oil level and the oil temperature (the heating element has been connected for 6-7 hours).
- Open the pressure check valve.
- Open the suction stop valve a few turns. If fitted with some device to ensure the accumulation of lubricating pressure, open the suction stop valve completely.
- Check that the capacity slide is set to minimum on the capacity indicator.
- Activate the oil cooling system, if any.
- Activate the start function. Open the suction stop valve slowly if throttling is done manually.
- Do not leave the compressor unit for the first quarter of an hour!

Stopping for standstill with control voltage

- Reduce compressor capacity to a minimum.
- Stop the compressor.
- Observe to check that the compressor does not run in slow reverse for more than a few minutes.
- Open the water supply to any water-cooled oil cooler, unless controlled by automatic gear.

Stopping for standstill without control voltage

- Carry out the procedure described under *Stopping for standstill with control voltage.*
- Close the discharge stop valve.
- Cut the power supply on the control panel.

0171-546-EN

Routine checks

In order to check the state of the compressor unit and cooling plant, it is recommended that as a minimum the following data are noted in the operating log:

Suction pressure (bar)
Suction temperature (°C)
Discharge pressure (bar)
Discharge gas temperature (°C)
Oil temperature (°C)
Oil level in relation to sightglass
Current consumption (amps)
Number of hours

Stopping for a lengthy standstill

- Carry out the procedure described under *Stopping for standstill with control voltage*".
- Close the suction and discharge stop valves.

If, however, the unit is located in an exposed place where the temperature of the surroundings may drop below 0°C, the cooling water must be drained from the oil cooler, where water-cooled.

Complete protection of the machine during a longer period of standstill must also include protection of all external brightwork such as e.g. shaft end and coupling.

Checking safety equipment

Note: *The procedure below requires the presence of qualified personnel able to measure the control voltage at the control panel!*

The aim of the procedure below is to check the function of the safety equipment and the control system on compressor units with relay-based controls. This is to ensure operating safety and the safety of the surroundings.

Not every compressor unit is equipped with all the components mentioned below.

1. Suction pressure cut-out KP1

Operating the compressor unit under normal running conditions, throttle the suction stop valve, thereby simulating a drop in evaporator pressure. The compressor must then stop on reaching the set pressure of the suction pressure cut-out.

2. Discharge pressure cut-out KP5

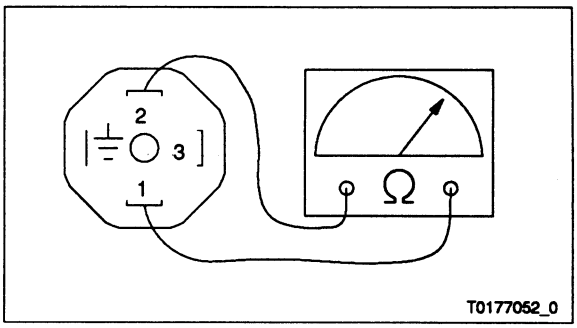
With the compressor unit in operation, throttle the discharge stop valve very carefully. As you throttle, keep an eye on the discharge pressure gauge. Exercise extreme caution, particularly if there is a slight difference between the setting of the pressure cut-out and the safety valve's opening pressure.

The compressor must stop on reaching the set pressure of the cut-out. See table for set pressure.

Afterwards, reset the pressure cut-out manually.

3. Flow control

Dismount the plug on the flow control after stopping the compressor.



Measure the resistance between terminals 1 and 2 with an ohmmeter as shown in drawing TO177052.

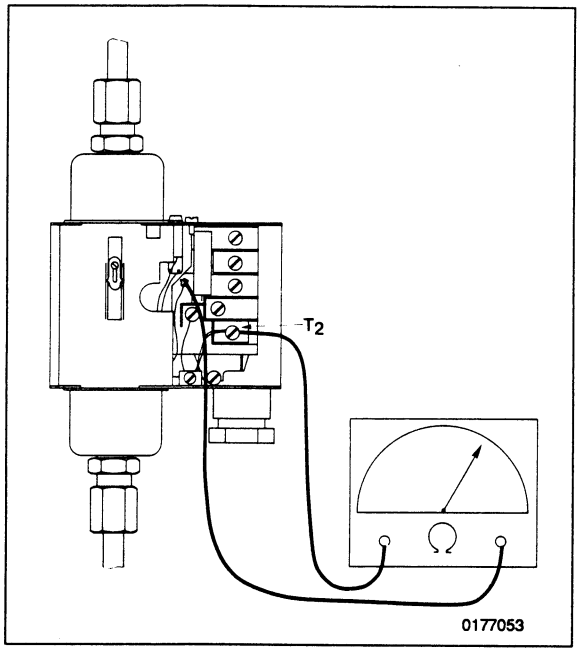
The resistance must be infinite, indicating an open switch!

Keep an eye on the ohmmeter as the compressor starts up. When the oil lifts the float ball in the flow control, the switch will close and the resistance drop to 0 ohm. This shows that the flow control is functioning. After 10 seconds, the control should stop the compressor unit owing to the lack of a flow signal.

Remount the plug on the flow control.

4. Differential lubricating pressure cut-out MP55

Shut the control voltage off on the electric panel and dismount the cover frome the differential pressure cut-out MP55.



Measure the resistance between T2 and the soldering point indicated on drawing 0177053. The resistance must be infinite, indicating that the switch set is open due to lack of lubricating pressure. Remove the ohmmeter. Start the compressor unit and check that the pilot lamp lights up. After a few minutes of normal operation, push the test-plate down with an insulated screwdriver and keep it there. The controls must stop the compressor after approx. 45 seconds owing to the simulated low lubricating pressure. Refit the cover.

5. Thermostats

Place the sensors on the thermostats in an oil or water bath which can be heated up. Check that the compressor is stopped at the temperatures specified in the table.

6. Oil filter differential pressure cut-out RT260

With the compressor unit operating normally, use a voltmeter to measure the voltage from terminal 1 in differential pressure cut-out RT 260 to the 0 volt terminal on the electric panel. There must be control voltage between the two. Throttle at stop valve pos. 42 after the oil filter to simulate an increase in pressure loss. This must be done within 10-20 seconds. When the pressure loss across the "oil filter" exceeds the set pressure, the contact in RT 260 switches off and the voltage on the voltmeter will drop to 0 volts. The control must stop the compressor instantly.

7. Safety valves

As the safety valves "blow off" into the open when activated, they should **not** be tested on the compressor unit. Their opening pressure must be checked with a special device.

0171-546-EN

Service schedules for the for SAB 128

As the screw compressors contain virtually only rotating parts, the periods between service inspections are quite extensive.

The most critical period for a plant is the time immediately following initial set-up. During plant installation, it is practically impossible to prevent impurities entering piping and vessels. Such impurities will be drawn by the compressor into the suction filter, which will intercept large dirt particles. Small particles will pass through the suction filter into the oil separator, to be kept suspended in the oil in the separator; this is the reason why the oil should be purified or changed after just 500 hours of operation - the lubricity of the oil has not diminished after such a short time, it simply requires thorough purification.

Purification of the oil can be done through a 3my filter in a closed system. During the purification process, the oil must not be exposed to the oxygen and moisture in the air.

Impurities in the oil may necessitate replacing the oil filter insert shortly after the initial start-up.

Providing pressures and temperatures are kept within the limits prescribed, filters are kept clean and periodical inspections are carried out as directed below, the compressor will enjoy a long and efficient service life.

Periodical inspections

1) Every day:

1.1 External inspection and checking for signs of leakage.

1.2 Checking of oil level in oil reservoir.

1.3 Checking of pressures and temperatures.

1.4 Checking for abnormal vibrations or noise.

1.5 Logging of operating data.

2) After 50 hours' operation:

2.1 Remove the filter bag from the suction filter.

3) After 200 hours' operation:

3.1 Clean the suction filter on the compressor.

3.2 Take an oil sample; if highly discoloured and contaminated, change or purify the oil even at this stage.

3.3 Check the oil filter insert, pos. 34.

3.4 Clean oil filters pos. 51 and 61.

3.5 Check the coupling.

3.6 Check the tightening of screws and nuts.

4) After 500 hours' operation:

4.1 Clean the suction filter on the compressor.

4.2 Change or purify the oil through a 3 my filter.

Note: During oil drainage, switch off power supply to heating element in oil reservoir.

4.3 Check the oil filter insert, pos. 34.

4.4 Clean oil filters pos. 51 and 61.

4.5 Check the alignment of the coupling.

5) After 2500 hours' operation:

5.1 Clean the suction filter on the compressor.

5.2 Take an oil sample; change or purify the oil if still contaminated.

5.3 Check the oil filter insert, pos. 39.

5.4 Clean oil filters pos. 51 and 56.

5.5 Check the coupling and alignment, and inspect the rubber element. Add talcum powder when re-fitting.

5.6 Check the function of pressure cut-outs and thermostats (see separate instructions).

6) After 10,000 hours' operation:

6.1 Clean the suction filter on the compressor.

6.2 Change the oil filter insert, pos. 34.

6.3 Clean oil filters pos. 51 and 56.

6.4 Check the coupling and alignment, and inspect the rubber element. Add talcum powder when re-fitting.

6.5 Check the function of pressure cut-outs and thermostats (see separate instructions).

6.6 Change the oil on the compressor unit. It may be possible to reuse the oil after filtering through a 3 my filter. This, however, is conditional on an oil sample being submitted to the oil supplier for laboratory testing. If the oil company approves the lubricity of the oil, it can be reused after filtering in a closed circuit system.

7) After 30,000 hours' operation:

7.1 Complete overhaul of the compressor, including changing all gaskets; inspecting and evaluating whether bearings need replacing, now the compressor is open anyway for inspection of rotors and regulating system.

7.2 Overhaul and clean the compressor motor.

Note: The motor manufacturer's prescriptions as to service schedules must be observed.

7.3 Change the oil filter insert.

7.4 Replace the compressor oil with fresh, new oil.

7.5 Change the rubber element on the coupling and use talcum powder when mounting.

7.6 Check the coupling.

7.7 Check the function of pressure cut-outs and thermostats.

This inspection service should be performed after every 30,000 operating hours.

For every further 10,000 hours of operation, inspection as mentioned under point 5 should be carried out.

Service

Preparations before servicing the compressor

The pos. numbers in this section refer to the piping diagram.

Before dismantling any part of the compressor unit for inspection or repair, the pressure must be reduced to atmospheric.

Stop the compressor after setting the capacity regulation to minimum.

When the compressor has stopped, the pressure in the unit will automatically be equalized to the suction pressure.

If only the oil filter insert pos. 39 needs replacing, the pressure should only be equalized to the evaporator pressure, after which the filter should be isolated by means of valves pos. 38 and 42. Instructions for changing the filter insert are included in the oil filter description.

Close discharge and suction stop valves.

On an R717 plant, the remaining pressure from evaporator to atmospheric pressure can be purged into a bucket of water. In the case of a CFC and HCFC plant, the refrigerant must be sucked out using an evacuating compressor.

Heating element pos. 30 must be connected until the pressure has been fully equalized, as the heater is instrumental in boiling off refrigerant from the oil.

Note: If CFC or HCFC gases escape, air the room thoroughly. Otherwise the gas, which is heavier than air, will hover above the floor and displace the oxygen. Also make sure that there is no naked flame in the room, as the combusted gas can give off phosgene gas, which is **extremely** toxic.

The compressor unit is then ready for inspection and any necessary repairs.

Dismantling and assembling

In this section, the pos. numbers refer to the sectional drawing of the compressor.

Repair work on the compressor must be carried out by skilled and thoroughly trained personnel who know the order in which to dismantle and assemble all compressor parts.

This instruction describes how to dismantle and re-assemble the compressor completely. How-ever, dismantling to this extent will not be necessary in all case.

When dismantling, mark the parts to ensure that they are replaced in the same position as before.

This instruction also describes how to use the tool kit which can be purchased separately.

If the torque moments for screws and bolts are not specified consult table no. 124079.

Partial dismantling and inspection can be undertaken without removing the compressor from the base frame, but it must be removed when carrying out a complete inspection.

The procedure for dismantling and handling any of the parts mentioned in this instruction must be carefully followed in order to avoid the risk of serious damage.

Study the instructions carefully before beginning to work.

As O-ring gaskets have a tendency to expand when exposed to oil and refrigerant, we would advise that you have have an extra set of gaskets on hand before commencing work.

Tools

Apart from the tools mentioned in the table of tools, a metal plate is needed on which to place the compressor during work.

Place the compressor so that there is ample space around it, and make sure that the area is clean and free of dust.

Removing various accessories

Before starting work on the compressor, the power supply to the compressor motor must be switched off and precautions taken to ensure that the compressor cannot be started inadvertently. This is best done by removing the motor fuses.

Dismantle the following parts from the compressor:

1) Coupling linking compressor and motor.

2) Flanges connecting the discharge and suction sides of the compressor.

3) Oil tubes connected to the compressor.

   Note: *These pipes may contain oil. They should therefore be loosened carefully to allow any such oil to be collected.*

   Once removed, these oil pipes must be stored in a clean environment and so as to avoid damage before re-assembling.

4) Electrical connections to min./max. switches and position transducer, where supplied.

Oil drainage

Most of the remaining oil can be drained off the compressor – while suspended in the crane – by removing the threaded plugs pos. 1 D on the underside at the suction and discharge ends, respectively.

However, a little oil will still remain in the compressor, so a plentiful supply of clean cloths should always be kept at hand with which to keep the work area clean.

Note: *Never use twist or other materials that fluff.*

Dismantling sequence

The following table indicates a possible sequence for dismantling:

Parts to be dismantled	Sequence
Suction filter	1
Shaft seal	2
Regulating cylinder	3
Capacity slide	4
Bearing cover at discharge end	5
Bearing cover at suction end	6
Roller bearing at suction end	7
Rotors	8
Bearings at discharge end	9

Work up to and including point 5 can be carried out step by step while the compressor is on the base frame.

Points 6 to 9 are carried out with the compressor removed from the base frame.

The individual points are described below.

Suction filter pos. 3 A

The compressor is equipped with a suction filter built into the compressor housing above the rotors.

The purpose of the filter is to collect the dirt which inevitably comes from the evaporators and the piping system.

Cleaning the suction filter

If the difference between the suction pressure and evaporator pressure on the compressor increases, it may be caused by clogging in the suction filter. Check, however, that all suction valves are completely open!

If the suction filter is not cleaned, the pressure drop across the filter may be great enough to burst the filter, which will result in all the accumulated dirt being forced through the compressor in one go.

Remove cover pos. 2 A. Hold on to the filter when unscrewing locking screw pos. 3 B to release the filter.

The filter can then be eased out of the compressor housing.

Note: *Take care that no dirt enters the compressor when the filter is removed.*

Clean the filter in an oil solvent and blow-dry it clean with compressed air. During cleaning, check to see whether the soldered joints are intact and if the wire mesh is ruptured. Make sure the filter is clean and dry before re-inserting.

If the filter contained a great deal of dirt when last cleaned, the cleaning process should be repeated after a further 500 hours (approx.) of operation.

Afterwards, it will be necessary to clean the suction filter only when the plant is dismantled for inspection.

Shaft seal pos. 8 A

The shaft seal, of the slide-ring type, consists of a lapped cast-iron ring with an O-ring (the stationary part) and a carbon ring (also lapped) with a teflon sealing ring and a spring retainer with springs (the rotating part).

Be extremely careful with the lapped slide surfaces. Even the slightest scratch will cause the shaft seal to leak.

When dismantling the shaft seal, remove the shaft seal cover first. If the cover is jammed so tight that it cannot be removed by hand, it can be eased off by placing two steel pins, dia. 8 x 40, in the threaded holes designed for attaching the coupling guard. The cover can be forced off by screwing two of the cover screws into the threaded holes with no through-going thread.

The stationary part of the shaft seal, which is prevented from rotating by a pin pos. 5 D, comes off with the cover. The slide ring can be tapped out carefully with a gudgeon from the "outer" side of the cover. The rotating part of the shaft seal can be drawn out by hand.

The shaft seal forms a complete unit. If defective, all parts must be replaced.

A new shaft seal in the original packing is equipped with 3 pin screws. These must not be used and should be thrown away.

When the shaft seal has been taken out, the balance piston pos. 7 A can be removed to allow inspection of the bearings. Two threaded holes M4 are bored into the balance piston to facilitate extraction.

Regulating cylinder pos. 17 A

The compressor capacity is regulated by the slide, pos. 16 A, which exposes or closes a number of oblong and oblique holes, cast into the compressor casing and linking the rotor bores to the suction side. This enables some of the gas drawn in to escape from compression between the rotors and to return to the suction side.

The position of the slide, and hence the compressor capacity, can be read off a scale on the end of the regulating cylinder.

An eccentric is mounted inside the indicator housing. This activates either a max. or a min. switch (optional extras) when the slide is in extreme positions.

Warning:

Never remove the guide pin pos. 20 A while the spring pos. 15 E is still mounted. There are still some 30 kilograms of spring force even though the slide is in the minimum

capacity position. On the assembly drawing, the plug has been drawn as if it were vertical. In reality, it is located horizontally opposite the discharge pipe.

Remove the cover for indicator pos. 19 J to-gether with O-ring and indicator glass. Remove indicator housing 19 A before loosening screw 19 F, which holds the indicating dial in place. Withold the indicating dial while loosening screw 19 F. This will protect guide pin pos. 16 B, which would otherwise have to take the entire torque of the screw.

Remove the regulating cylinder cover 19 A. As the spring is still compressed, the screws 18 H must be loosened alternately until the slide is stopped by guide pin 20 A.

Dismount the regulating cylinder.

The piston and piston ring can now be inspected.

Press the regulating slide back slightly towards the spring to permit removal of guide pin pos. 20 A. The regulating slide can now be drawn out.

Bearing covers at discharge end

Take off the bearing covers at discharge end pos. 14 A and remove the inner covers pos. 12 A and 12 B by means of a screw in the free threaded hole M8. Inspect O-rings pos. 12 D and 12 C.

Bearing covers at suction end

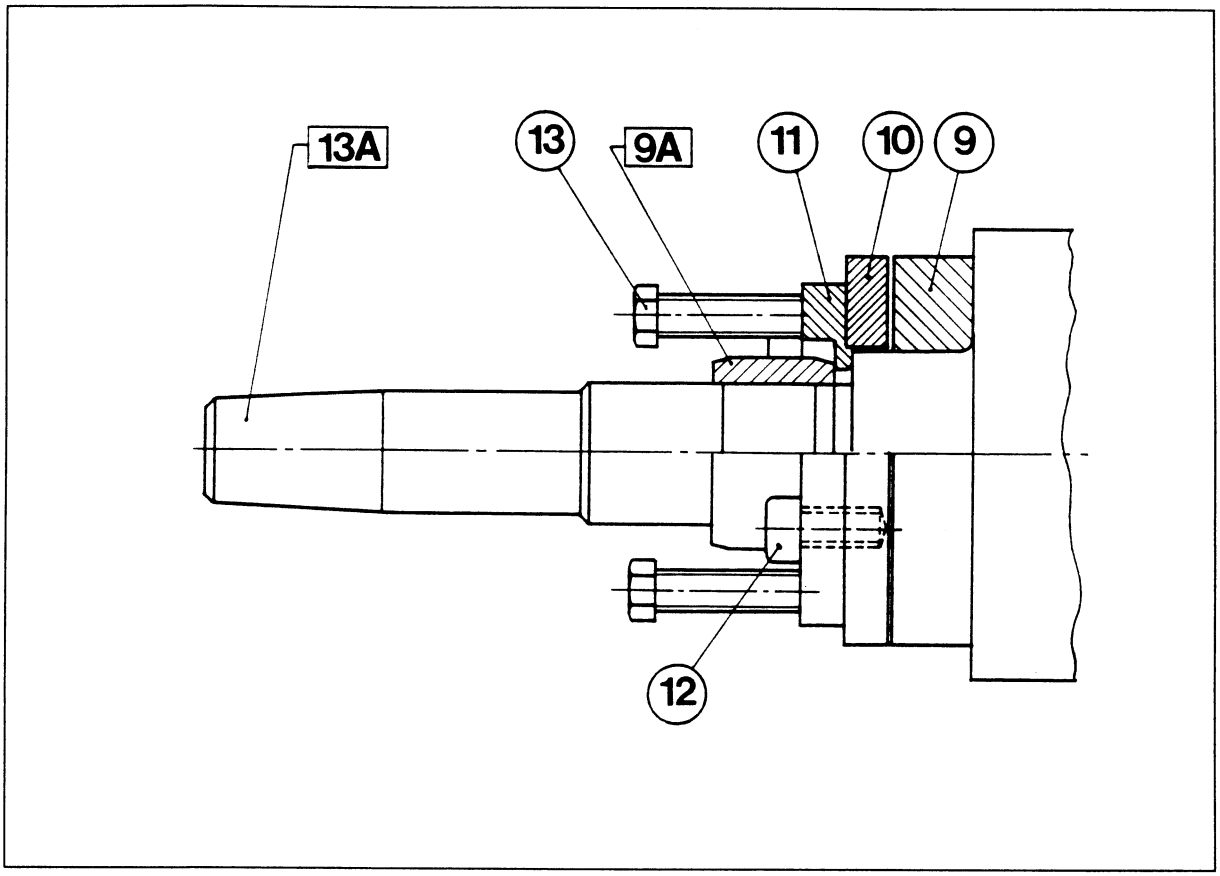
Before dismantling the bearing cover at the suction end, the cap cover 6 A, shaft seal 5 A and spring housing cover 15 A must be removed. Remove also balance piston pos. 7 A.

Knock out the two guide pins pos. 4 D.

The cover can now be pulled out over the two axle journals. Use a crane, preferably, and avoid damaging the face of the shaft!

The outer ring of the roller bearings can now be carefully tapped out - from the inside of the cover - with a thin dowel through the two 8.8 mm holes.

Remove the driving pin pos. 13 B. The inner ring of the roller bearings can now be pulled off the shafts by means of the tool shown in the sketch below.



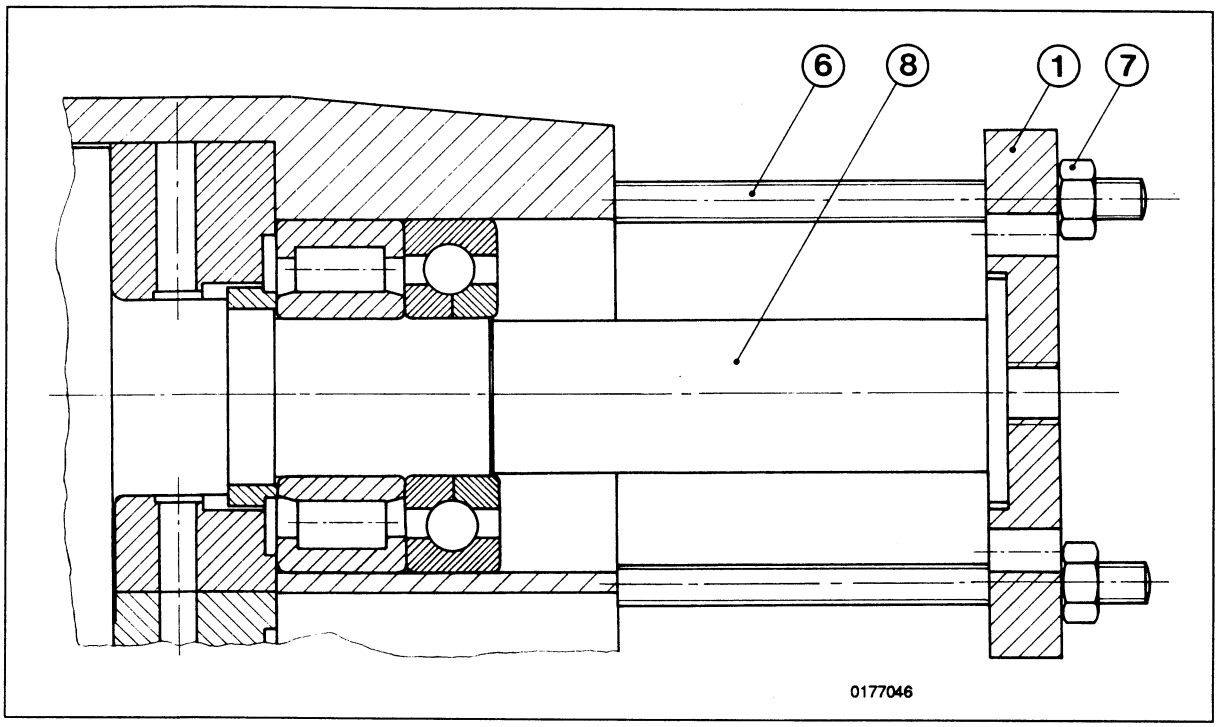
Withdrawing the rotors

Push the rotors out using the tool as shown in the following sketch.

Screw the four long threaded journals from the tool set into the threaded holes used for securing of the cover, pos. 14 A.

Be careful to tighten all four nuts alternately so as to avoid any distortion of pressure.

The dismantled bearings should be replaced with a new bearing pack, which also includes the spacer ring. This spacer ring is calibrated exactly to the two bearings with which it is packed.



Mounting

Carefully clean all parts before re-assembling. Examine the parts for damage and wear. Replace damaged or worn parts with new ones. Examine all gasket rings to see if they can be re-used. If in doubt, replace them.

Before remounting, lubricate all parts, including screws, with pure and new refrigerator oil. Areas where the inner rings for the ball and roller bearings are to be fitted must be greased with molybdenum disulphide (molycote) or graphite grease before fitting of the rings.

Rotor housing

Check that plugs with gaskets have been inserted. Check the contact face of the discharge ports for dirt and burrs.

Discharge ports

The discharge ports should be checked particularly carefully for burrs, marks or dirt on the surfaces facing the rotors.

Push the ports into place in the rotor housing and secure them with screws pos. 1 G, steel gasket 1 H under the head.

Insertion of rotors

At the suction end, the rotors are marked with either one or two numbers. The marked lobes must engage, otherwise problems may occur!

It is essential that male and female rotors are placed in correct relation to each other, as indicated on the blue sectional drawing, and as cast in the bearing cover at the suction end.

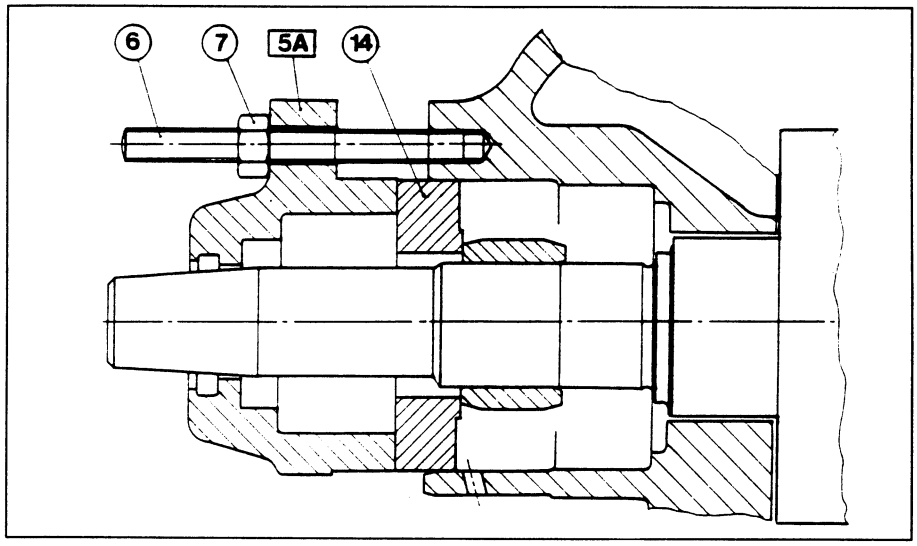
Bearing cover at suction end

Lift the cover 4A carefully in over the shaft journals and tighten gently with 2 screws until the guide pins pos. 4 D are driven in, then tighten the screws. Two screws are enough, as the cover must be dismantled again once the bearings are in place.

Fitting the inner rings at the suction end

The inner rings of the bearings should be pressed into place using the shaft seal cover

pos. 5 A and the tools shown in the following drawing.



Pressing the outer rings into the suction end

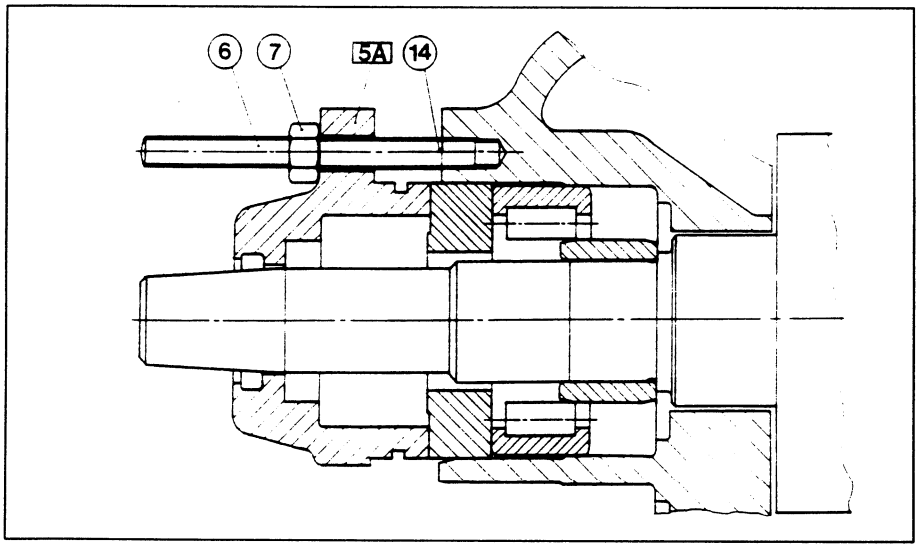
The outer ring on the roller bearing can be pressed in using the tool shown on the drawing below.

When both bearings pos. 9 A are fitted, take off the entire suction cover pos. 4 A in order to fit the driving pin pos. 13B. Remember to mount it on the shaft where the shaft seal will be fitted.

Refit the suction cover and tighten the screws to the prescribed torque.

Press the balance piston, pos. 7 A, into place.

Remember to lubricate the shaft with grease.

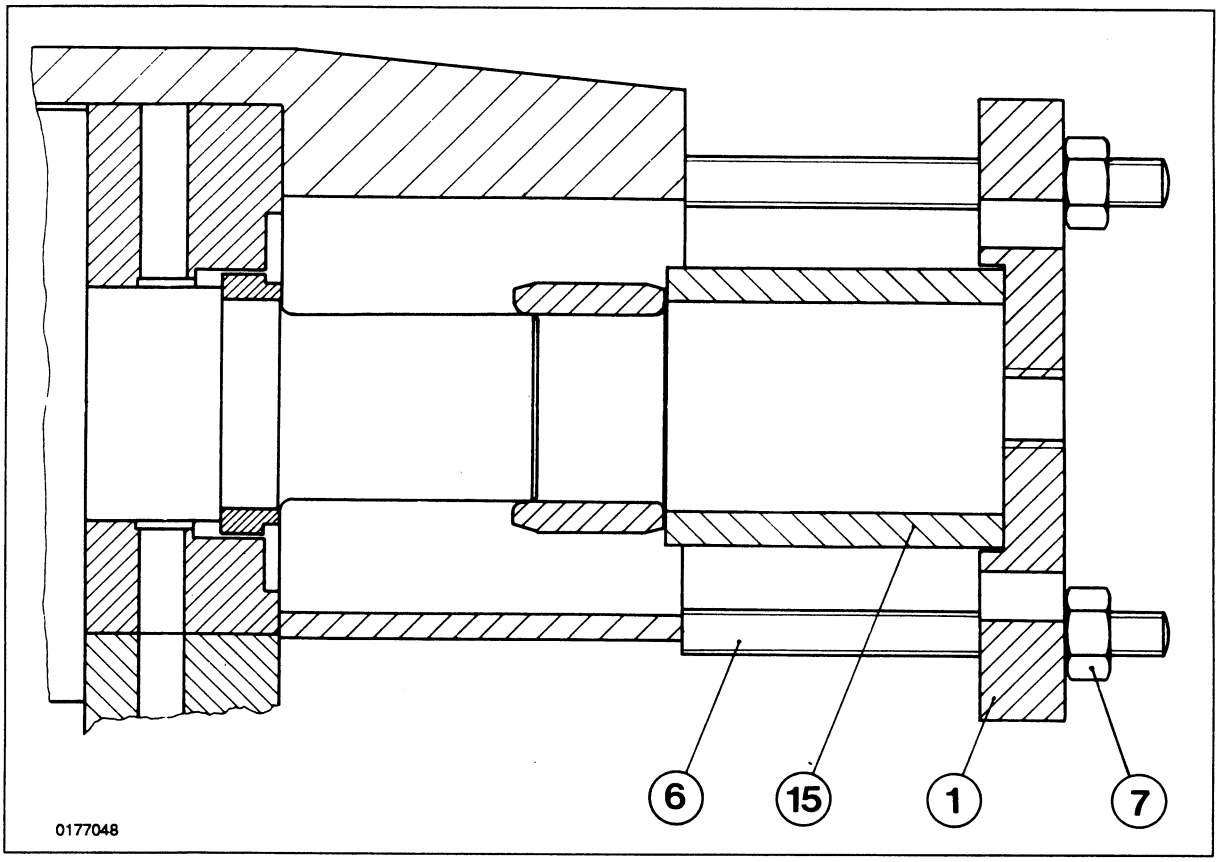


Bearings at discharge end

The shaft ends should be greased.

Mount the spacer ring included in the bearing pack so that it is positioned as shown in the sketch. The spacer ring is individually matched to the bearings pack and must **not be swapped!**

The tool for pressing the inner rings home is illustrated below.



Press the inner ring of the roller bearing onto the axle journal until it touches the spacer ring.

The outer ring with roller bearing rollers can be virtually pressed into place using the inner cover pos. 12. A gentle tap with a soft punch will push it the rest of the way.

The ball bearing, which is divided into two parts, is marked with a cross on both the outer and one of the inner rings. These marks must face outwards!

The innermost inner ring of the ball bearing should be pressed into place using the same tool as for the inner ring of the roller bearing.

The outer ring - with balls - of the ball bearing can be positioned manually. The outer inner ring of the ball bearing can be pressed onto the shaft using the same tool as for the roller bearing inner ring.

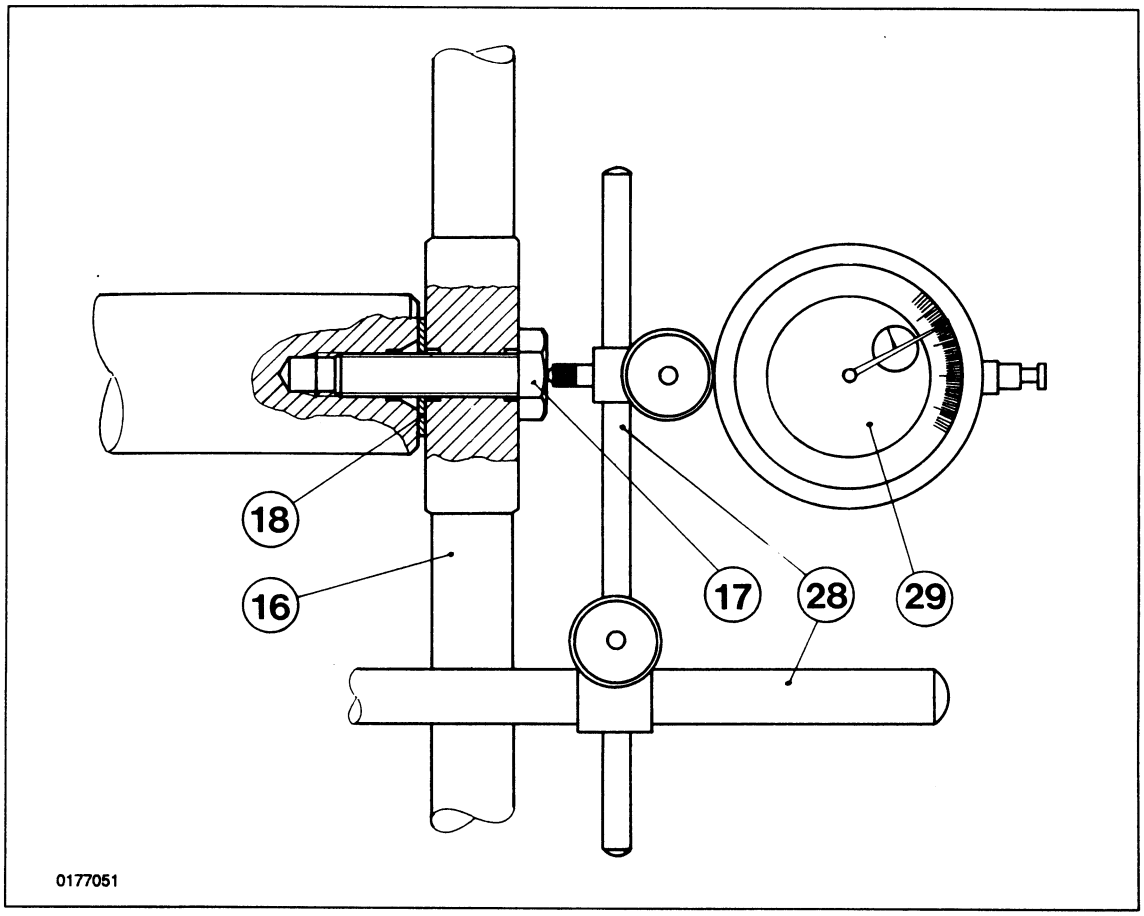
To tighten the disc pos. 13 C, fit handle 16 from the tool set onto the opposite end of the rotor. Tighten screw 13 D to the prescribed torque with a counter-purchase on handle 16.

Measuring to check the position of the rotors

When measuring, ensure that gap "A" between rotor end and discharge port cannot be reduced to less than 0.05 mm.

This check must be carried out before mounting the inner cover pos. 12, in the following way: Mount the handle from the tool set onto the rotor to be examined. Secure the handle using screw 17.

Place a dial meter with the feeler on the screw head, as shown on drawing 0177051 below.



Push the rotor right up to the outlet port and set the dial meter to 0. Then draw the rotor as far as possible in the opposite direction. The reading on the meter is the value A max.

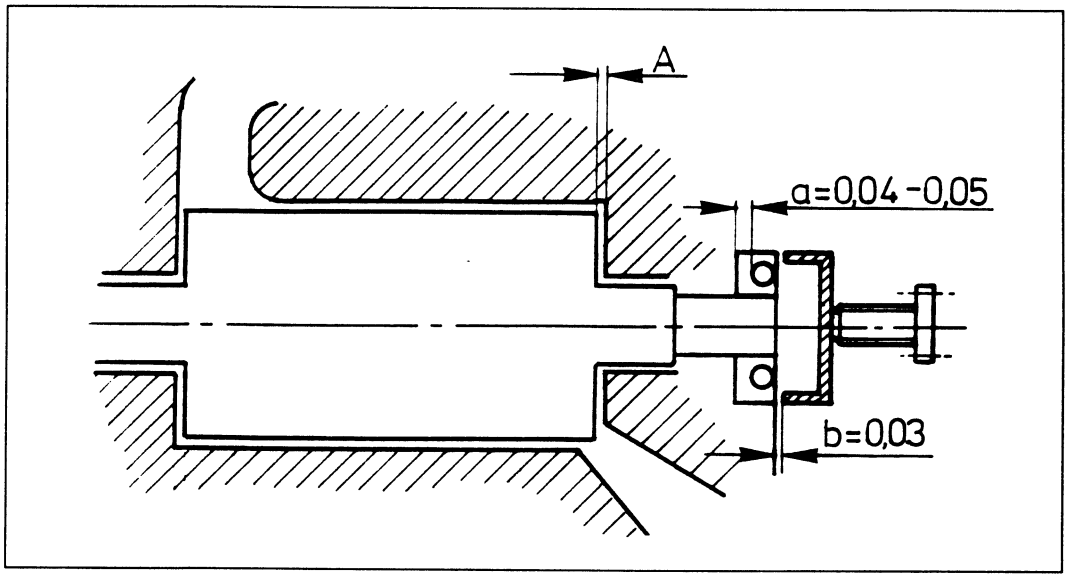
Using regulating screw 14 C, press the outer rings of the bearings together and right up to the outlet port (b = 0).

Measure the to-and-fro movement of the rotor with the dial meter. The meter reading corresponds to the built-in clearance "a", typically 0.04-0.05 mm on new bearings.

Now press back the inner cover 0.03 mm so as to release the outer ring of the ball bearing. This is done by loosening adjusting screw pos. 14 C sufficiently to move the rotor back and forth by "a" + 0.03 mm.

$$A = A\ max \times (a + 0.03)$$

It must not be possible to reduce "A" to less than 0.05 mm. Secure the adjusting screw using pin screws 14 D.



Capacity slide and cylinder

Fit sealing ring pos. 16 C on the piston and secure with screws pos. 16 E. The sealing ring must be placed as shown on the drawing, i.e. with the opening pointing towards the compressor. Remember to fit the pin pos. 16 B in the piston before mounting and tightening the ring pos. 16 D.

The pin 16 B must be positioned with the flat end facing down into the twisted flute in spindle 18 C.

Position the regulating slide pos. 16A and secure with the guide pin pos. 20 A placed on the side of the compressor housing and not as shown on the drawing.

Draw the piston out a little to facilitate fitting the cylinder, which is then pushed into place and secured with screws pos. 17 C.

Check whether the slide moves back and forth freely. If the slide sticks at any point, loosen screws pos. 17 C and move the slide to and fro, then retighten the screws.

Cover for regulating cylinder

Fit sealing ring pos. 18 D onto the spindle pos. 18 C.

The ring should be fitted with the opening facing towards the cylinder. Fit the ball bearing pos. 18 E on the spindle and secure with the locking ring. The ball bearing and the spindle must then be inserted in the cover and secured with a locking ring pos. 18 G. Mount the cover on the cylinder with the two M10 threaded holes placed above each other.

Eccentric disc and indicator dial

Assemble the parts using the two pipe pins.

The eccentric disc must be positioned so that the screw hole in the indicator dial centers with the bore in the eccentric disc.

Once assembled, the eccentric disc and indicator should be fastened to the shaft. The

indicator should point to the left, approx. 13 degrees below horizontal when the slide is in minimum position.

When tightening the screw, the indicator dial should be held to relieve the pin pos. 16 B.

Housing for capacity indication

The housing should be positioned so that the two 16 mm holes are located slightly below the centre line in both sides.

Capacity scale pos. 19 G

Insert the glass into the cover pos. 19 J with the O-ring outermost.

The cover must be mounted so that the two holes align with the two 16 mm holes in the housing.

Before final tightening, verify that the slide is in minimum position.

Fix the glass so that the arrow points to minimum position.

Cover with spring guide

Fit the spring pos. 15 E over the spring guide pos. 15 B, then put the complete assembly into place. Take care not to damage the O-ring as a fairly strong pressure is necessary to ensure that the screws catch the thread.

Balance piston at suction end

Place the balance piston onto the chosen drive rotor so that the pin pos. 5 D slots into the groove.

Shaft seal

Mount the stationary part of the shaft seal – the cast iron ring – in the shaft seal cover with the O-ring fitted. The pin pos. 5 D must fit into the hole on the cast iron ring.

Insert the rotating part of the shaft seal over the shaft so that pin pos. 7 B fits into the hole on the spring retainer of the shaft seal.

The correct hole is the hole with no spring in. Be careful not to damage the lapped slide surfaces!

Note: *The three pointed screws inserted in a new shaft seal must not be used to secure the shaft seal to the shaft. Throw them away!*

Shaft seal cover

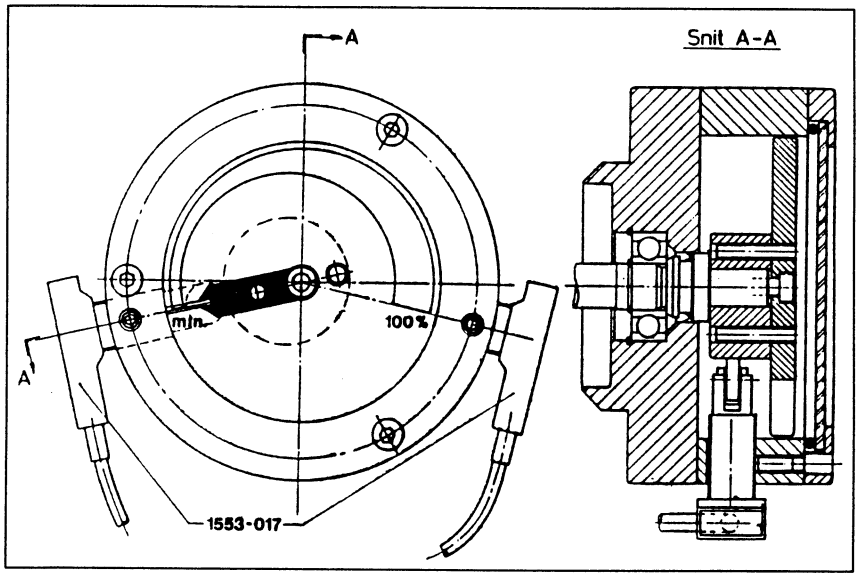
Plug the one of the threaded holes which will not be used for oil drainage.

Slide the oil throw ring pos. 13 F over the shaft so that it faces the oil drainage groove in the shaft seal cover.

Capacity indicator and limit switches

The compressor is equipped with a mechanical capacity indicator and in some cases with limit switches. On request, it can also be equipped with a position transducer for remote indication of compressor capacity.

Capacity indicator with limit switches



The compressor capacity can be read directly on the compressor by means of the mechanical indicator pos. 19 D.

A milled groove in the spindle, pos. 18 C, turns the spindle and hence the indicator dial, as the slide pos. 16 A moves back and forth.

At the end of the spindle in the indicator housing under the indicator dial is mounted an eccentric which on turning can activate a set of micro-switches. These will signal when the capacity slide reaches its extreme positions.

Adjusting limit switches

The limit switches are mounted in holes drilled in the side of the indicator housing and secured with a locking screw.

Tighten the indicator dial with eccentric to the spindle pos. 18 C, with the regulating slide in minimum position. The indicator should now point towards the centre of the hole, where the minimum switch is to be mounted.

Now tighten the minimum switch in a position where the switch is just on.

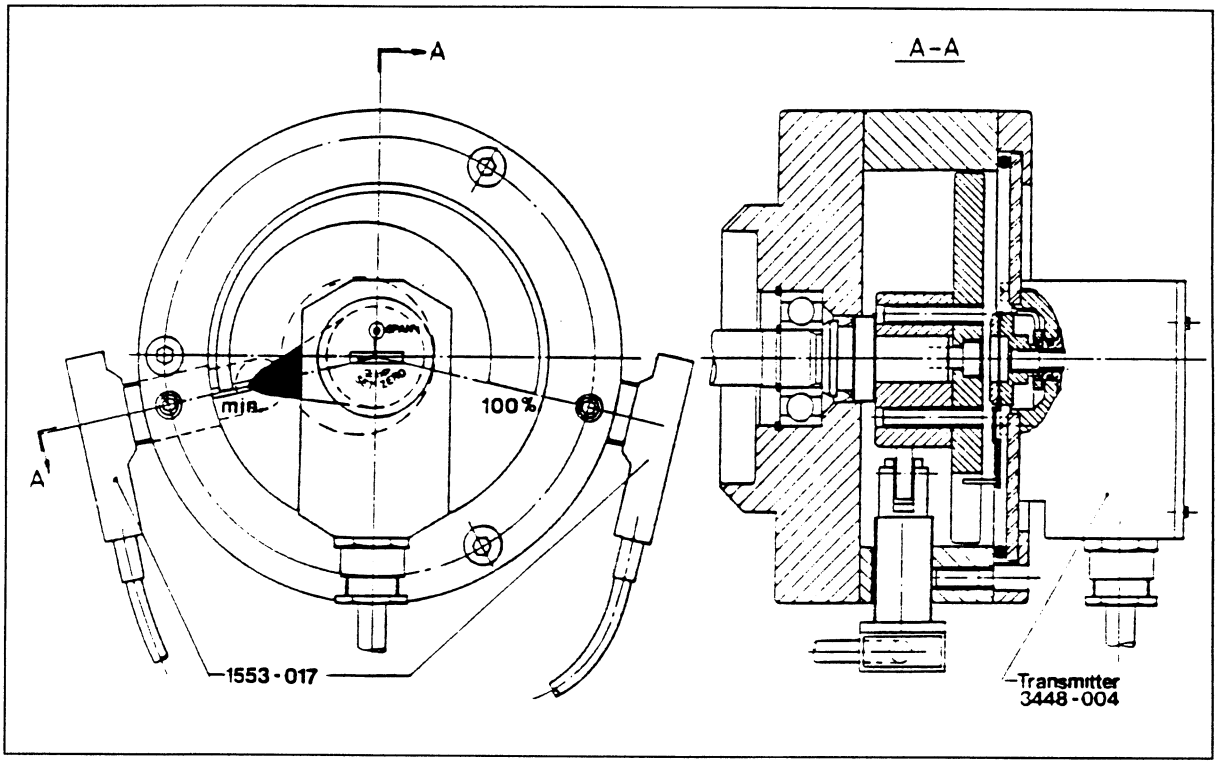
Tighten the maximum switch so that it is just on when the regulating slide is in maximum position.

It must be impossible to start the compressor unless the minimum switch has been activated, thereby signalling that the compressor is at minimum capacity.

The maximum switch can be used to give start signal for extra compressor capacity.

0171-546-EN

Position transducer



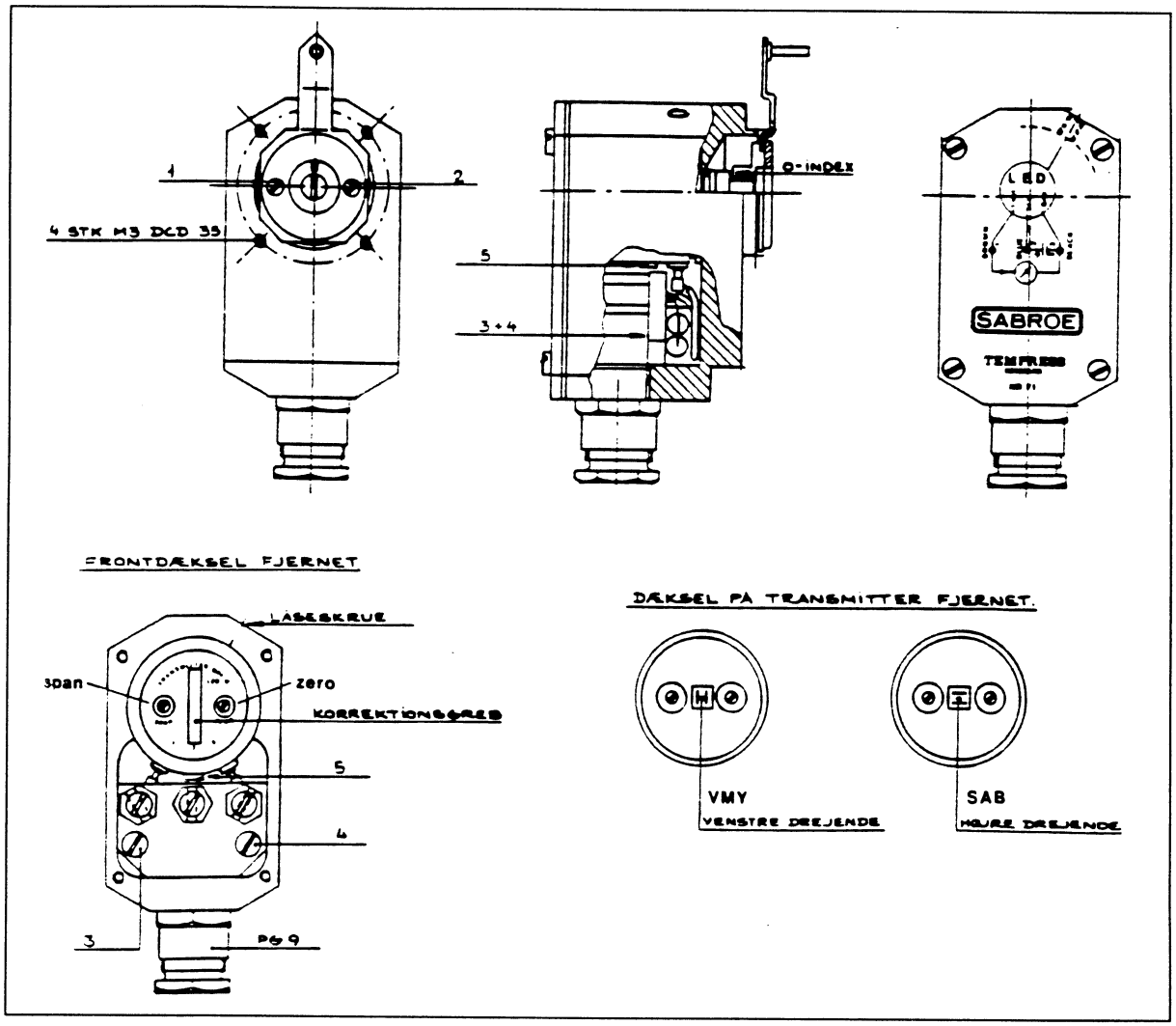
Mounting transducer

1. Adjust the compressor to 0 capacity on the indicator.
2. Place the two 0-index marks on the transducer opposite each other.
3. Loosen screws 1 and 2. Turn the indicator so that the position of the driving pin corresponds roughly to the position of the driving hole on the capacity dial. Then tighten screws 1 and 2.
4. Mount the glass with transducer so that the pin engages with the hole in the capacity dial.
5. If the indicator instrument or the PROSAB II does not indicate 0, minor 0-corrections can be made by adjusting the "zero" setting. Major 0-corrections should be made by loosening the lock screw and turning the cylindrical housing with the correction handle.
6. Set the compressor on 100% capacity.
7. Correct any incorrect indication on the instrument or PROSAB II by means of the "span" setting.

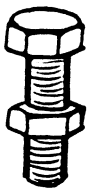
Dismounting of cover and transducer

1. Dismantle screws 3 and 4 and lift out the terminal strip.
2. Using a screwdriver through the cable grommet, loosen screw 5 and remove the cover on the instrument.

0171-546-EN

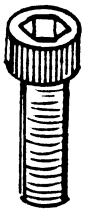

1
2
4 STK M3 DCD 35
O-INDEX
5
3+4
LED
SABROE
FRONTDÆKSEL FJERNET
LÅSESKRUE
span
zero
KORREKTIONSSKRUE
5
4
3
PG 9
DÆKSEL PÅ TRANSMITTER FJERNET
VMY
VENSTRE DREJENDE
SAB
HØJRE DREJENDE

TORQUE VALUES FOR SCREWS AND BOLTS



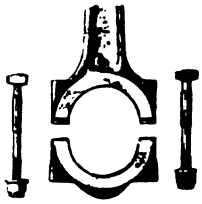
Metric thread (ISO 8.8)

M	4	5	6	8	10	12	14	16	18	20	22	24	27
Kpm	0.28	0.53	0.94	2.2	4.1	7.0	11	15	23	30	38	52	68
ft lbf.	2.1	3.9	6.8	16	30	50	80	110	170	220	270	370	490
Nm	2.7	5.2	9.2	22	40	69	108	147	225	295	375	510	670



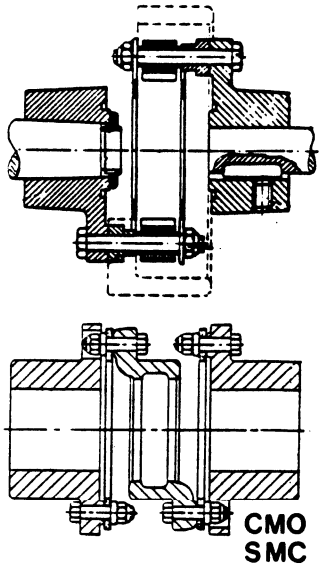
Metric thread (ISO 12.9)

M	4	5	6	8	10	12	14	16	18	20	22	24	27
Kpm	0.42	0.78	1.4	3.2	6.1	10	16	23	34	44	55	76	100
ft lbf.	3.0	5.7	10	23	44	75	120	160	240	320	400	550	720
Nm	4.1	7.6	14	31	60	98	157	225	335	430	540	745	980



Connecting rod bolts

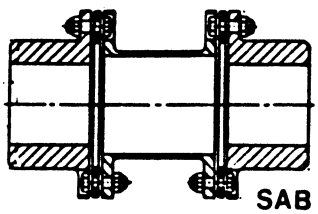
	CMO	SMC 65	SMC 100	SMC 180
UNF	5/16"	5/16"	3/8"	5/8"
Kpm	2.1	2.8	4.4	17
ft lbf.	15	20	32	130
Nm	20	27	43	167



CMO
SMC

Coupling bolts (Metalastik - coupling)

Compressor		Coupling type	Thread	Torque values		
				Kpm	ft lbf.	Nm
CMO - TCMO		21/544	5/8" UNF	16	120	157
SMC TSMC	65	21/544	5/8" UNF	16	120	157
	100	21/510	5/8" UNF	16	120	157
		21/674	3/4" UNF	22	160	216
		21/786	1" UNF	50	360	490
	180	21/928	1" UNF	50	360	490



SAB 128
SAB 163

Coupling bolts (Thomas Rex - coupling)

Compressor		Coupling type	Thread	Torque values		
				Kpm	ft lbf.	Nm
CMO - TCMO		AMR 225	5/16" UNF	3.5	25	34
SAB 128		52/225				
SAB 163		52/262				
SMC TSMC	104-108	AMR 312 S	7/16" UNF	8.7	63	85
	112-116	AMR 350 S	1/2" UNF	13	95	128
	186-188	AMR 450 S	11/16" UNF	28	200	275

96.04

0170-150-EN

Selecting lubricating oil for SABROE compressors

On establishing the area diagrams for the selection of lubricating oils for refrigeration compressors, **general** conditions concerning lubrication of compressors and oils in the plant components have been considered. When selecting oils, however, **specific plant conditions** must be taken into consideration and **agreed upon with the oil companies**. For the selection, use the area diagrams on the following pages (see the example).

The SABROE code number consists of letters referring to the oil types in the following table, as well as oil's ISO VG no., indicating its viscosity at +40°C.

96.04

0170-150-EN

Code design.	Oil types
M	Mineral oil
A	Synthetic oil based on Alkylbenzene
MA	Mixture of M and A oils
P	Synthetic oils based on polyalphaolefin
AP	Mixture of A and P oils
MP	Mixture of M and P oils
E	Synthetic ester-based lubricants
G	Synthetic oil based on polyglycol

Once you have selected the best suited oil on the basis of the oil recommendation diagrams and tables as well as determined the SABROE-code number, **the List of Oil Companies** will help you to select the correct oil from the oil company that you decide to deal with.

We would like to point out, however, that the mentioned oils are listed following the recommendations of the oil companies and that the oil companies alone are responsible for both oil qualities and their applicability.

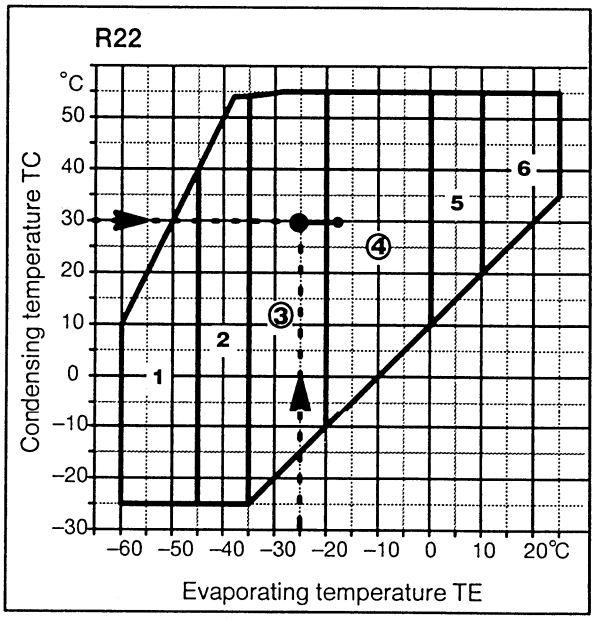
In case you experience problems with the oil in the compressor or in the refrigeration plant, you should contact the oil supplier directly.

On determining the SABROE code no. first use the oil recommendation diagram, in which the current operation is inserted as shown in the following example:

Example (screw compressors):

Refrigerant: R22
Condensing temp. **TC +30°C**
Evaporating temp. **TE –25°C**

Please, observe whether the compressor and the plant have to change their operating conditions from time to time, f.inst. by running at different evaporating temperatures TE, or if, due to seasonal changes, they must run at higher or lower condensing temperatures TC.



0170-150-EN

By plotting TC and TE into the oil diagram the example requires a **group 3** oil, or if the TE at times changes to, f.inst. –18°C, a **group 3 or group 4** oil must be applied.

SABROE code no	Area no						Max oil temp.		
							Condensing temp.		
	1	2	3	4	5	6	35°C	45°C	55°C
M68			•	•			+50	+50	
M100				•	•		+50	+50	+50
M150					•		+55	+55	+50
MA68		•	•	•			+50	+50	+50
MA100			◆	◆	•		+55	+55	+70
A68	◆	◆	◆	◆			+50	+50	-
A100	▲	▲	◆	◆	◆		+55	+55	+50
A150	◆	◆	◆	◆	◆		+75	+75	+70
AP68		◆	◆	◆	◆		+65	+60	+55
AP100		◆	◆	◆	◆		+70	+65	+60
P68				◆	◆		+65	+65	+60
P100				◆	▲	◆	+70	+70	+65
P150					◆	▲	+75	+75	+70
P220					•	◆	-	+80	+80

By looking at the oil recommendation table you will find the **SABROE code no.** which is covered by the one or several group nos that you have selected. In the above example SABROE code no A100 has been selected.

On determining the SABROE code no you should consider the **three signature designations** (useable, appropriate and very appropriate) described below the table.

At the same time you should pay attention to the permissible max. oil temperatures, stated to the right in the table and referring to the oil cooling system and TC on the compressor and unit.

Using the SABROE code no. you now select the desired oil in the **List on Oil Companies.**

The same selecting procedure is used in the case of reciprocating compressors. See the oil recommendation diagrams and table for reciprocating compressors. In case a plant has both screw- and reciprocating compressor and the recommendation indicates the use of different oil types, please contact SABROE.

Oil changing on SABROE compressors:

Concerning SABROE compressors you should not change to another oil make or type without consulting the oil company. It is also not advisable to top up the compressors with another oil than the one specified for that particular plant and already charged on the compressor.

In both cases the result may be operating problems in the refrigeration plant and wear in the compressors, which may be due to the incompatibility of different oil types or because oil residue has been left in the compressor, in the oil separator and in the plant.

The dissolved oil residue can block filters and moving parts in the compressor.

Further, a possible oil change to another oil type or make is only allowed to take place in connection with a thorough **evacuation** and drainage of the refrigeration plant of any old oil and a cleaning of both compressor and oil separator (contact SABROE and the Oil Company).

Only oil from the original package should be used, and both make and type must be in compliance with the specification for that particular plant.

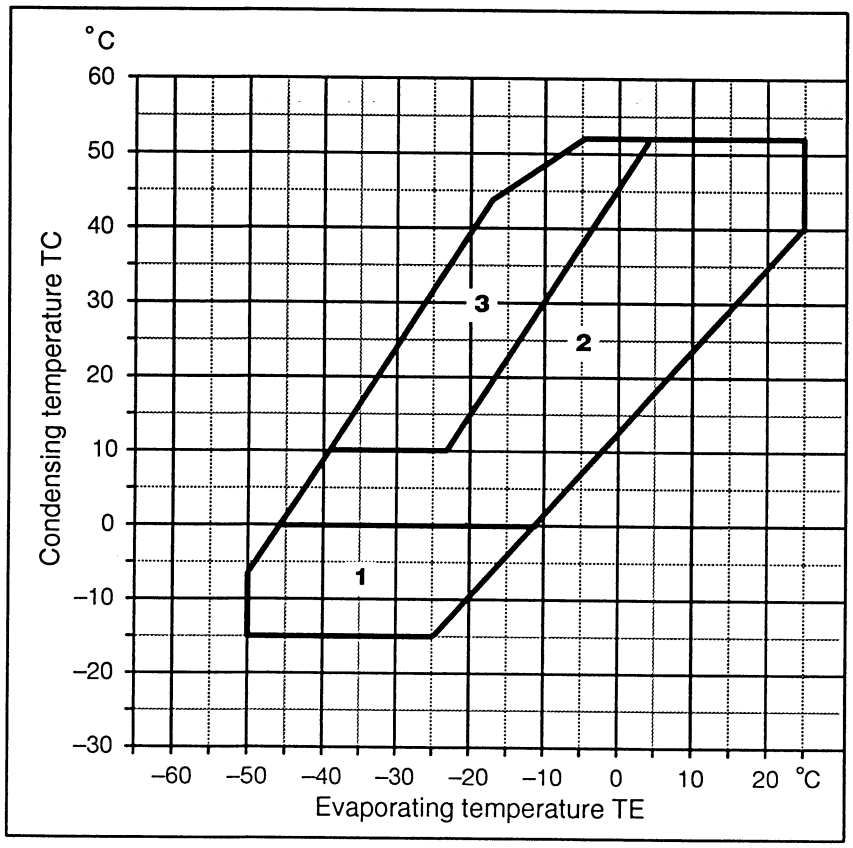
Keep the original package airtight during its storage in order to prevent any humidity from the air from being absorbed by the oil.

Consequently, purchase oil in cans corresponding to the amount used for one or, at the most, two charges. Make sure that the cans that have not been completely emptied are stored in a warm place.

A list on the recommended intervals for oil changes can be found in the compressor instruction manual.

0170-150-EN

R717
Oil recommendation
one-stage reciprocating compressors

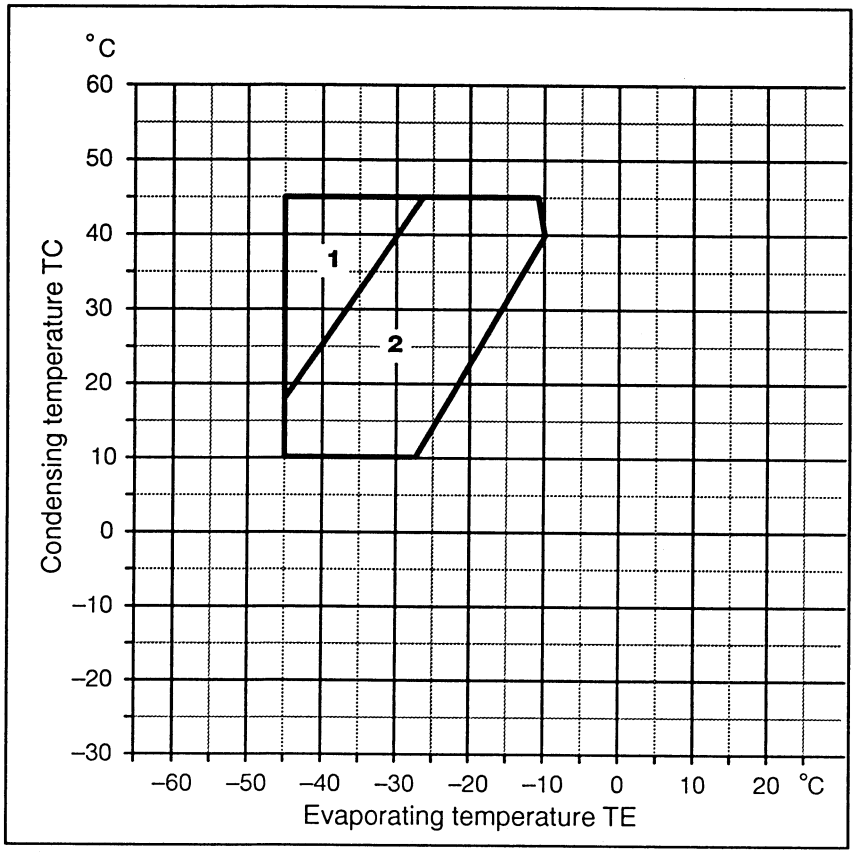


SABROE code no	Area no 1	2	3
M46	●		
M46-68	◆	●	
M68	◆	◆	◆
MA46	●		
MA46-68	◆	●	
MA68	◆	◆	◆
A46	●		
A46-68	◆	●	
A68	◆	◆	◆
AP46	●		
AP68	◆	◆	◆
AP100	◆	◆	◆
P68	▲	▲	▲
P100	◆	◆	◆

● = useable ◆ = appropriate ▲= very appropriate

- suitable viscosity at low temperatures in the evaporating system.
- suitable viscosity in the lubricating system with compressor and unit at stand-still and in operation.
- lower oil carry-over
- longer life of oil (P-oils)

0170-150-EN



R717

Oil recommendation two-stage reciprocating compressors

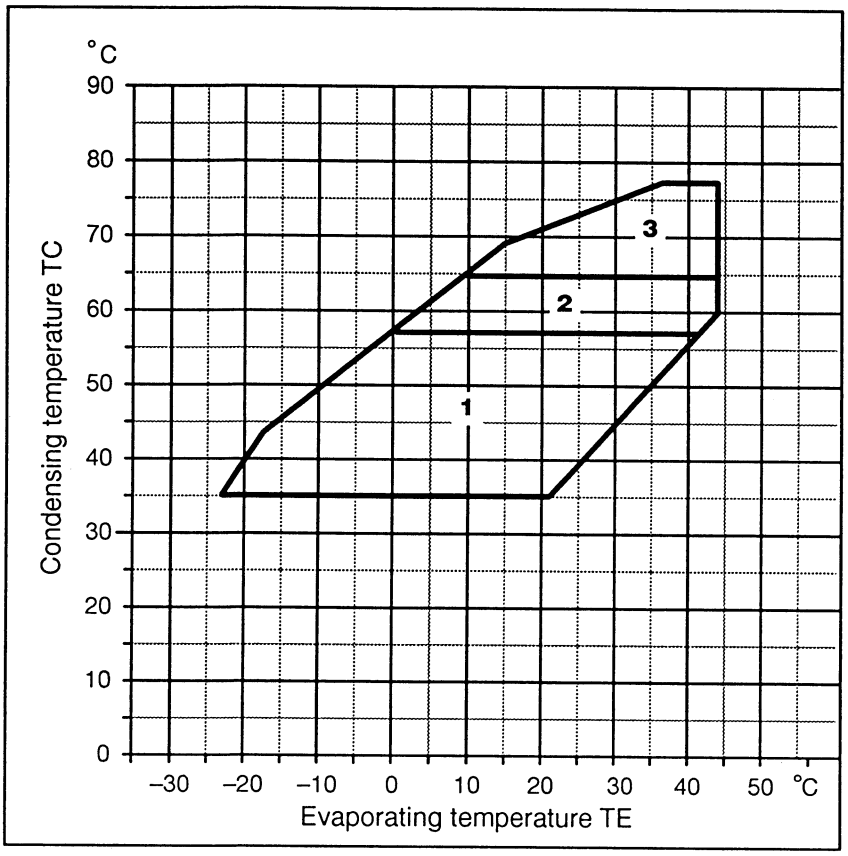
SABROE code no	Area no 1	Area no 2
M46-68 M68	 ◆	● ◆
MA46-68 MA68	 ◆	● ◆
A46-68 A68	 ◆	● ◆
AP68 AP100	◆ ◆	◆ ◆
P68 P100	▲ ◆	▲ ◆

● = useable ◆ = appropriate ▲= very appropriate

- suitable viscosity at low temperatures in the evaporating system.
- suitable viscosity in the lubricating system with compressor and unit at stand-still and in operation.
- lower oil carry-over
- longer life of oil (P-oils)

0170-150-EN

R717
Oil recommendation HPO & HPC reciprocating compressors



SABROE code no	Area no 1	2	3
P100	▲	◆	
P150		▲	◆
P220			▲

● = useable ◆ = appropriate ▲= very appropriate

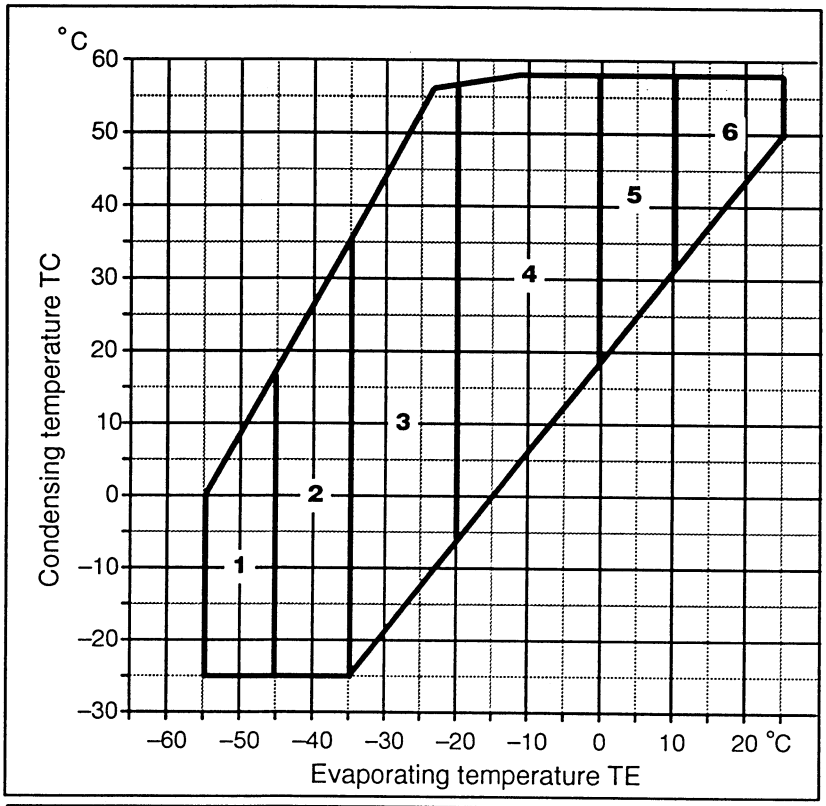
- suitable viscosity at low temperatures in the evaporating system.
- suitable viscosity in the lubricating system with compressor and unit at stand-still and in operation.
- lower oil carry-over
- longer life of oil (P-oils)

0170-150-EN

R22

Oil recommendation

one-stage reciprocating compressors



SABROE code no	Area no 1	2	3	4	5	6
M46			●			
M46-68			◆			
M68			◆	◆	●	
M100				◆	●	
MA46		●	●			
MA46-68		●	◆			
MA68		◆	◆	◆	●	
MA100			●	◆	●	
A46	●	●	●			
A46-68	◆	◆	◆			
A68	▲	▲	▲	▲	◆	
A100	▲	▲	▲	▲	◆	
A150			●	◆	◆	
AP46		●	●	●	●	
AP68		◆	◆	▲	▲	
AP100		◆	◆	▲	▲	
P68				◆	▲	
P100				◆	▲	▲

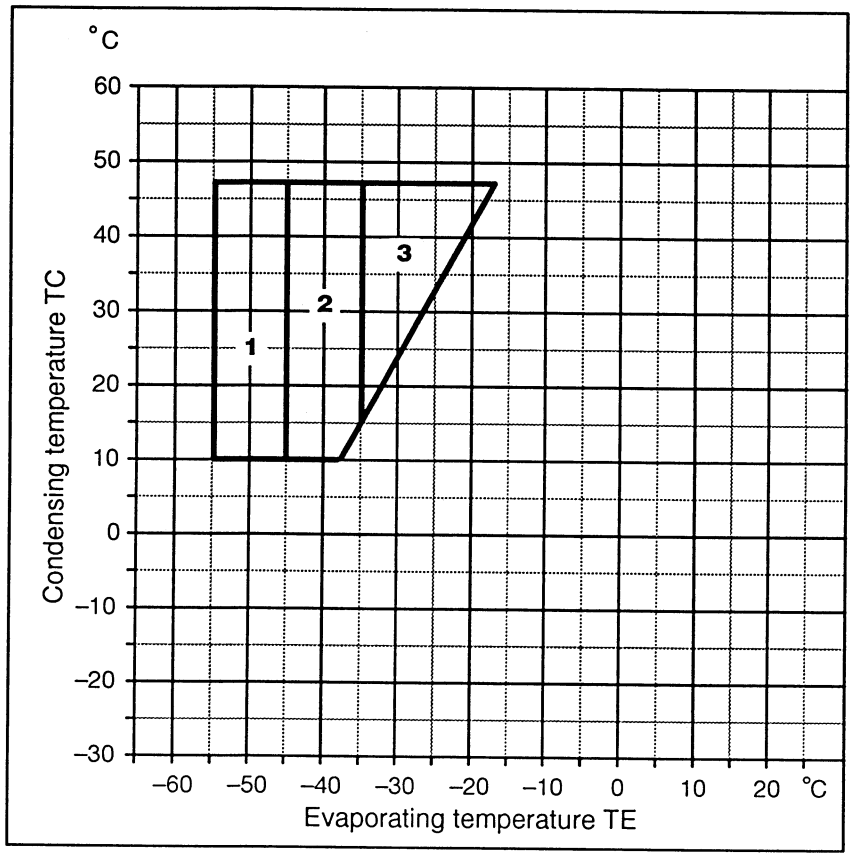
● = useable ◆ = appropriate ▲= very appropriate

- suitable miscibility with refrigerant at low temperatures.
- suitable viscosity at low temperatures in the evaporating system.
- suitable viscosity in the lubricating system with compressor and unit at stand-still and in operation.
- lower oil carry-over
- longer life of oil (P-oils)

0170-150-EN

R22

Oil recommendation two-stage reciprocating compressors



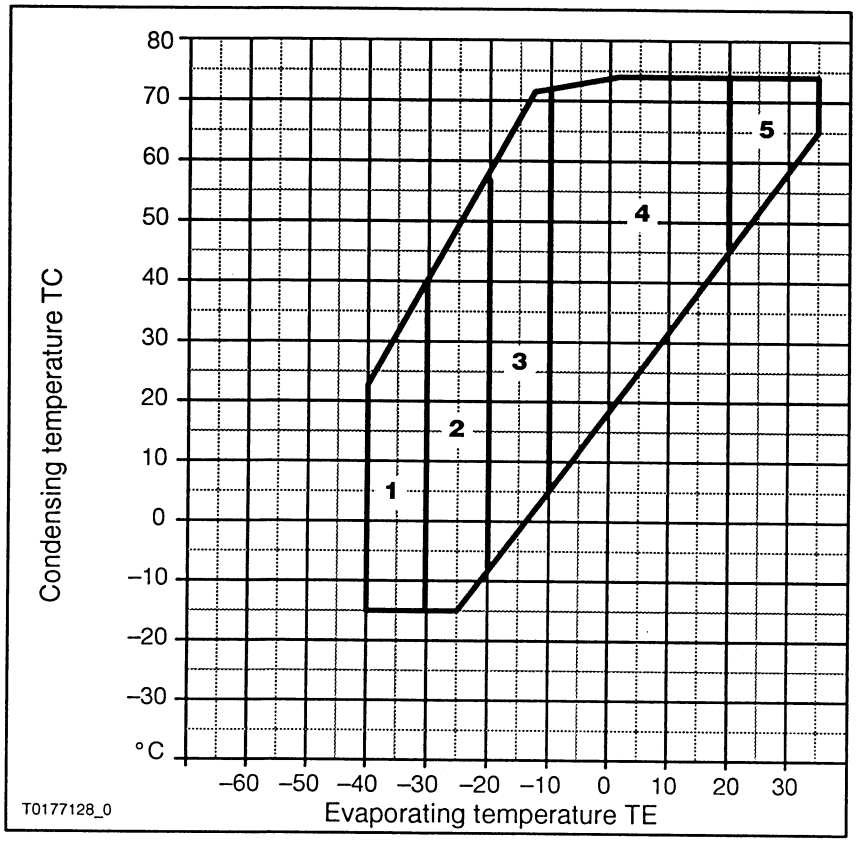
SABROE code no	Area no 1	2	3
M46			●
M46-68			◆
M68			◆
MA46		●	●
MA46-68		●	◆
MA68		◆	◆
MA100			●
A46	●	●	●
A46-68	◆	◆	◆
A68	▲	▲	▲
A100	▲	▲	▲
A150			●
AP46		●	●
AP68		◆	◆
AP100		◆	◆

● = useable ◆ = appropriate ▲= very appropriate

- suitable miscibility with refrigerant at low temperatures.
- suitable viscosity at low temperatures in the evaporating system.
- suitable viscosity in the lubricating system with compressor and unit at stand-still and in operation.
- lower oil carry-over
- longer life of oil (P-oils)

0170-150-EN

R134a
Oil recommendation
one-stage reciprocating compressors



SABROE code no	Area no 1	2	3	4	5
E 46	◆				
E 68	▲	◆	◆	●	
E100		▲	▲	◆	●
E150			◆	▲	◆
E220				◆	▲

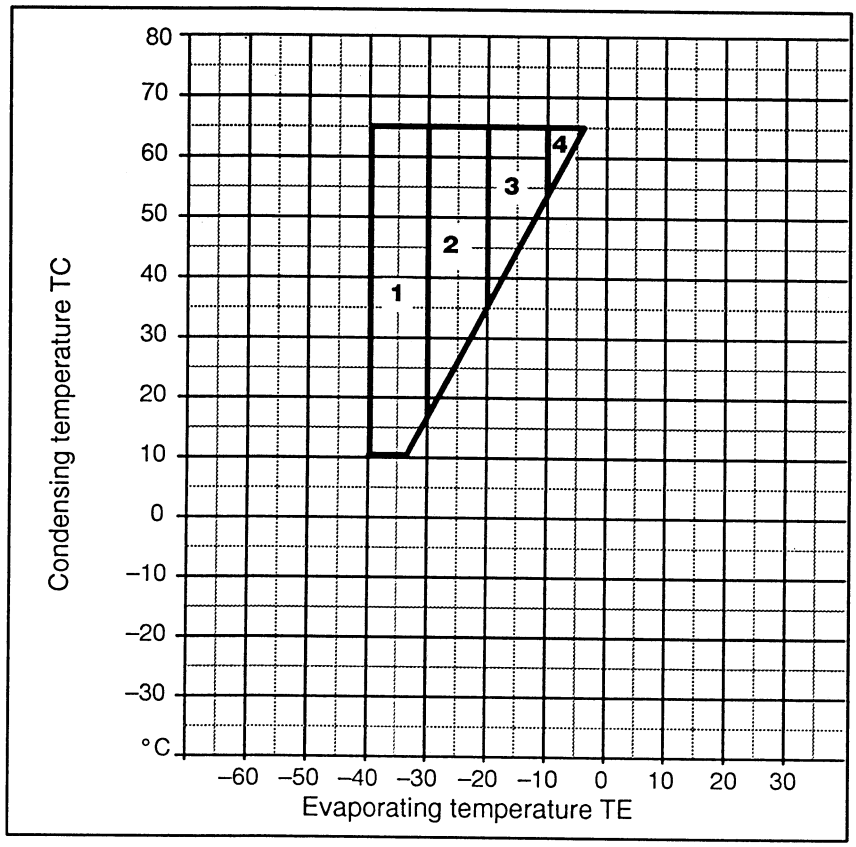
● – useable ◆ = appropriate ▲= very appropriate

- suitable miscibility with refrigerant at low temperatures.
- suitable viscosity at low temperatures in the evaporating system.
- suitable viscosity in the lubricating system with compressor and unit at stand-still and in operation.
- lower oil carry-over
- longer life of oil (P-oils)

0170-150-EN

R134a

Oil recommendation two-stage reciprocating compressors



SABROE code no	Area no 1	2	3	4
E 46	◆			
E 68	▲	◆	◆	•
E100		▲	▲	◆
E150			◆	▲
E220				◆

• – usable ◆ – appropriate ▲= very appropriate

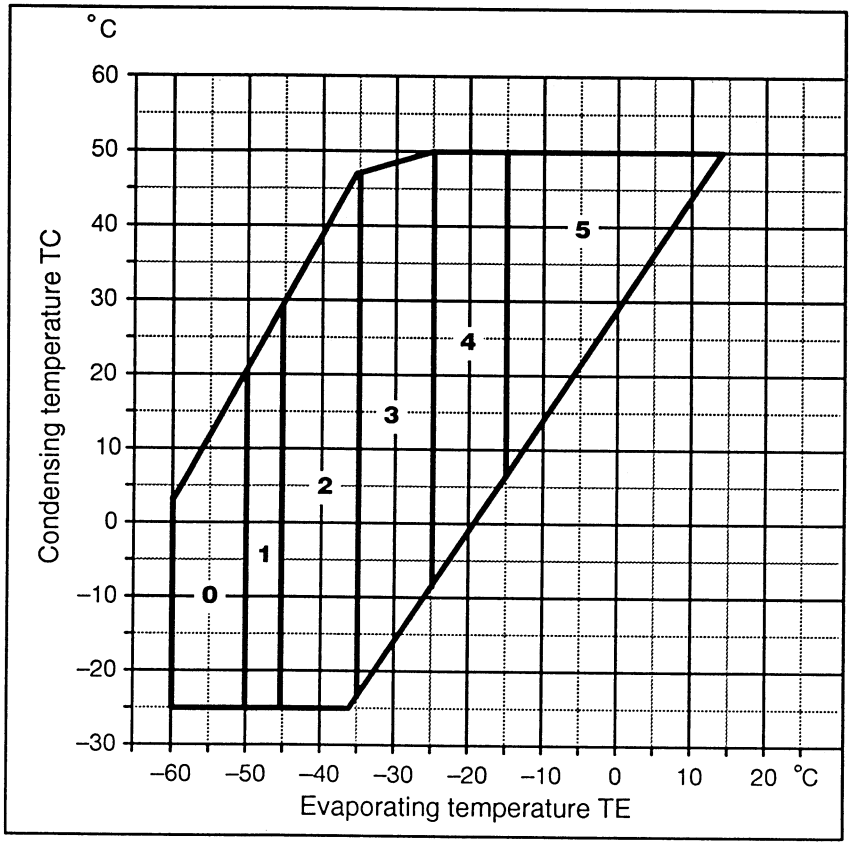
- suitable miscibility with refrigerant at low temperatures.
- suitable viscosity at low temperatures in the evaporating system.
- suitable viscosity in the lubricating system with compressor and unit at stand-still and in operation.
- lower oil carry-over
- longer life of oil (P-oils)

0170-150-EN

R404A/R507

Oil recommendation

one-stage reciprocating compressors



SABROE code no	Area no 1	2	3	4	5
E 32	▲	● ◆	◆		
E 46		◆	▲	◆	●
E 68		▲	◆	▲	◆
E100			▲	◆	▲
E150			◆		◆
E220					

Area O: Not fully miscible (two phase area), special oil return procedure required.

● = useable ◆ – appropriate ▲– very appropriate

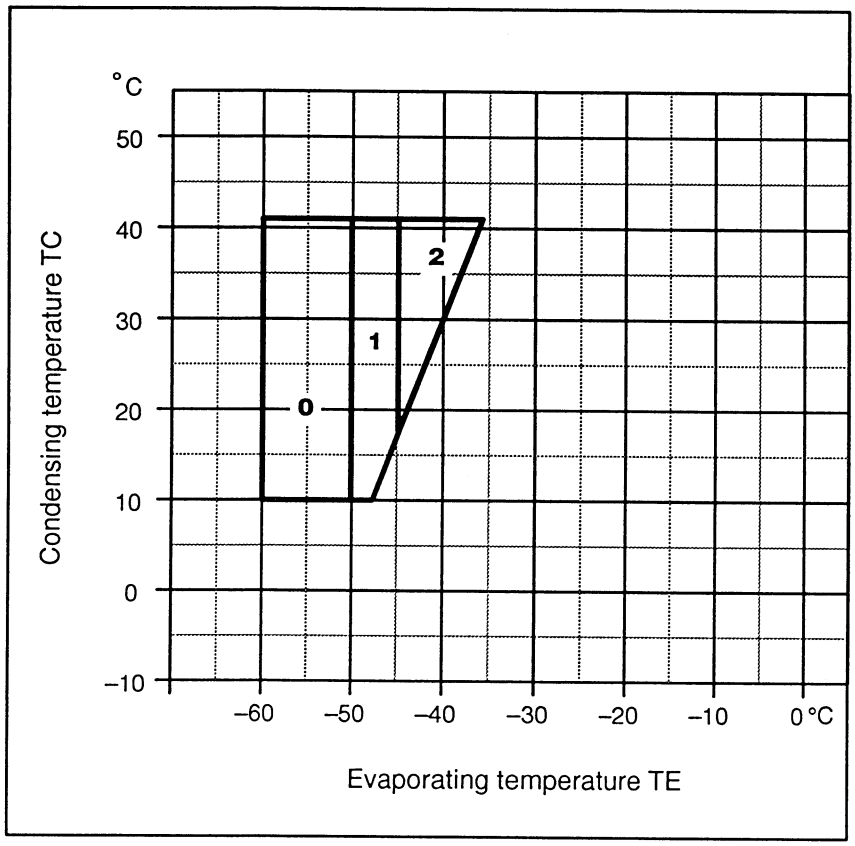
- suitable miscibility with refrigerant at low temperatures.
- suitable viscosity at low temperatures in the evaporating system.
- suitable viscosity in the lubricating system with compressor and unit at stand-still and in operation.
- lower oil carry-over
- longer life of oil (P-oils)

0170-150-EN

R404A/R507

Oil recommendation

two-stage reciprocating compressors



SABROE code no	Area no 1	Area no 2
E 32	▲	●
E 46		◆
E 68		▲

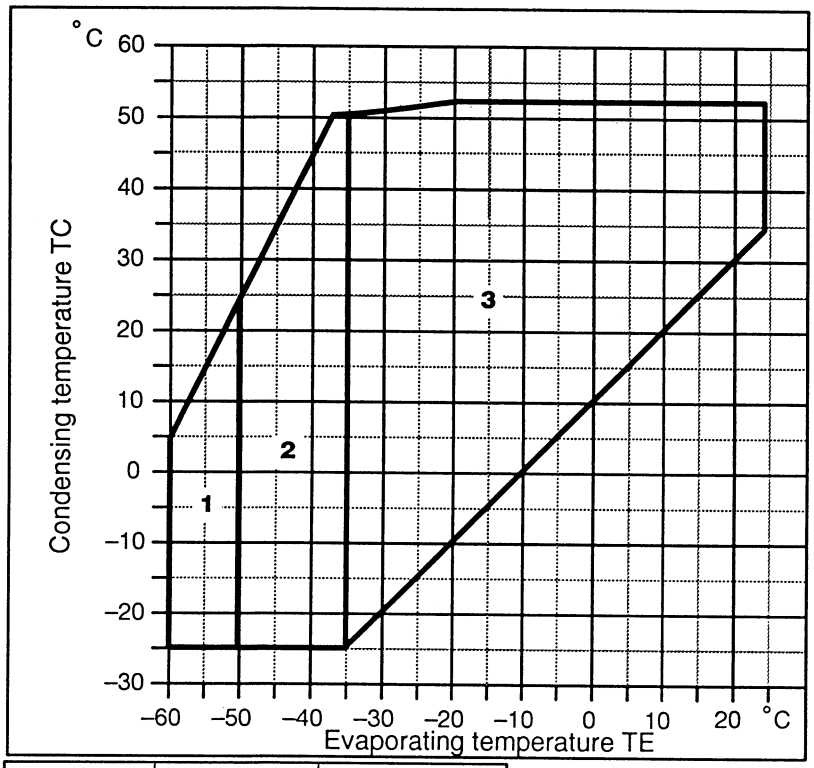
Area O: Not fully miscible (two phase area), special oil return procedure required.

● = useable ◆ = appropriate ▲= very appropriate

- suitable miscibility with refrigerant at low temperatures.
- suitable viscosity at low temperatures in the evaporating system.
- suitable viscosity in the lubricating system with compressor and unit at stand-still and in operation.
- lower oil carry-over
- longer life of oil (P-oils)

0170-150-EN

R717
Oil recommendation
Screw compressors



SABROE code no	Area no 1	2	3	Max oil temp. °C
M46-68		●	●	50
M68		●	◆	50
M100			◆	55
M150				
MA46-68		●	●	50
MA68		◆	◆	50
MA100			◆	55
A46-68		●	●	50
A68		●	●	50
A100			●	55
A150				
AP46		●	●	50
AP68	◆	◆	◆	55
AP100		◆	◆	60
P68	▲	▲	▲	60
P100		◆	◆	60
P150				
P220				
MP 46		●	●	60

● – useable ◆ – appropriate ▲– very appropriate

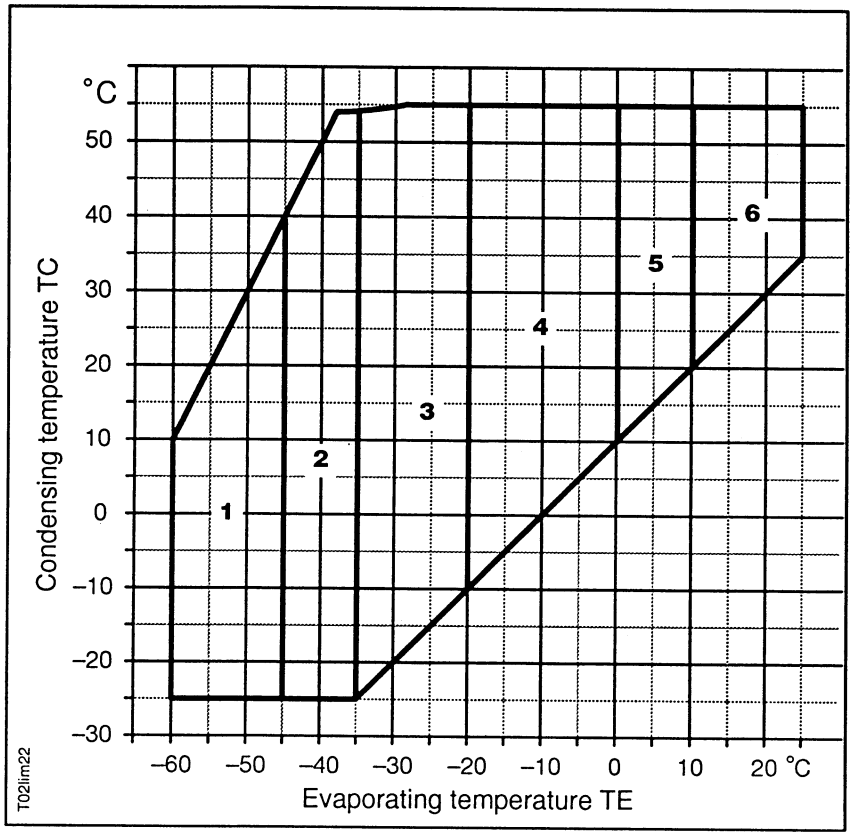
- suitable miscibility with refrigerant at low temperatures.
- suitable viscosity at low temperatures in the evaporating system.
- suitable viscosity in the lubricating system with compressor and unit at stand-still and in operation
- lower oil carry-over
- longer life of oil (P-oils)

0170-150-EN

R22

Oil recommendation

Screw compressors



SABROE code no	Area no						Max oil temp.		
	1	2	3	4	5	6	Condensing temp. 35°C	45°C	55°C
M68			●	●			+50	+50	
M100				●	●		+50	+50	+50
M150					●		+55	+55	+50
MA68		●	●	●			+50	+50	+50
MA100			◆	◆	●		+55	+55	+70
A68	◆	◆	◆	◆			+50	+50	–
A100	▲	▲	▲	▲	◆		+55	+55	+50
A150	◆	◆	◆	◆	◆		+75	+75	+70
AP68		◆	◆	◆	◆		+65	+60	+55
AP100		◆	◆	◆	◆		+70	+65	+60
P68				◆	◆		+65	+65	+60
P100				◆	▲	◆	+70	+70	+65
P150					◆	▲	+75	+75	+70
P220					●	◆	–	+80	+80

● – useable ◆ – appropriate ▲– very appropriate

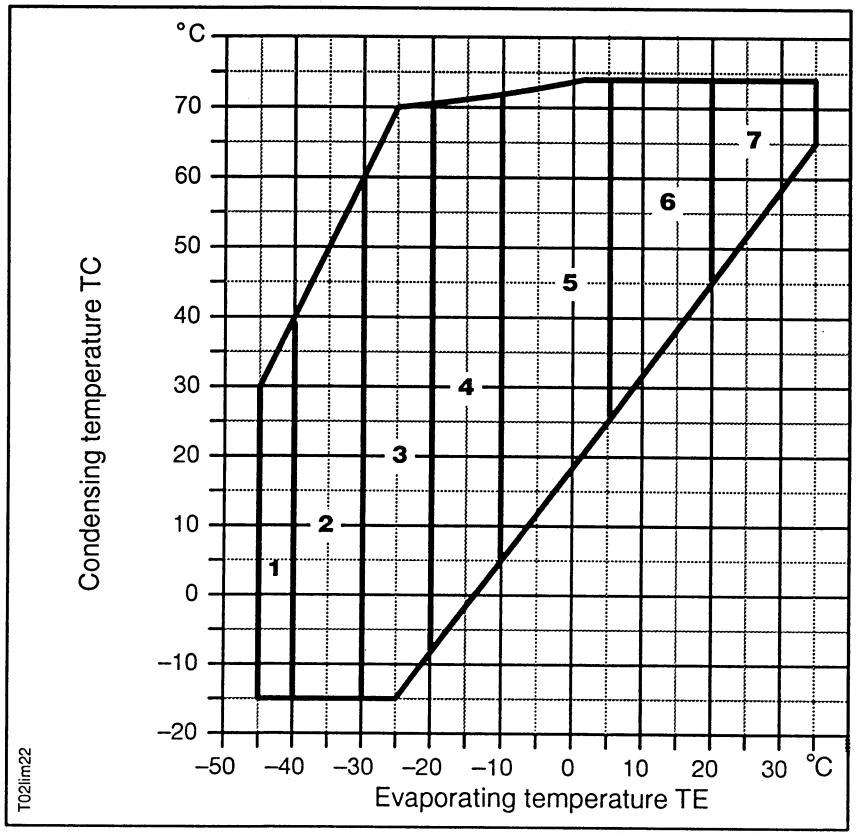
- suitable miscibility with refrigerant at low temperatures.
- suitable viscosity at low temperatures in the evaporating system.
- suitable viscosity in the lubricating system with compressor and unit at stand-still and in operation.
- lower oil carry-over
- longer life of oil (P-oils)

0170-150-EN

R134a

Oil recommendation

Screw compressors



SABROE code no	Area no							Max oil temp. Condensing temp.		
	1	2	3	4	5	6	7	40°C	60°C	75°C
E32	▲							+50	+45	–
E46		◆						+55	+50	–
E68		▲	◆	◆	◆			+65	+60	–
E100			▲	▲	▲	●		+70	+65	+60
E150				◆	◆	◆		+75	+70	+65
E220					●	▲	◆	+80	+75	+70
E320						◆	▲	–	+80	+75

● = useable ◆ = appropriate ▲= very appropriate

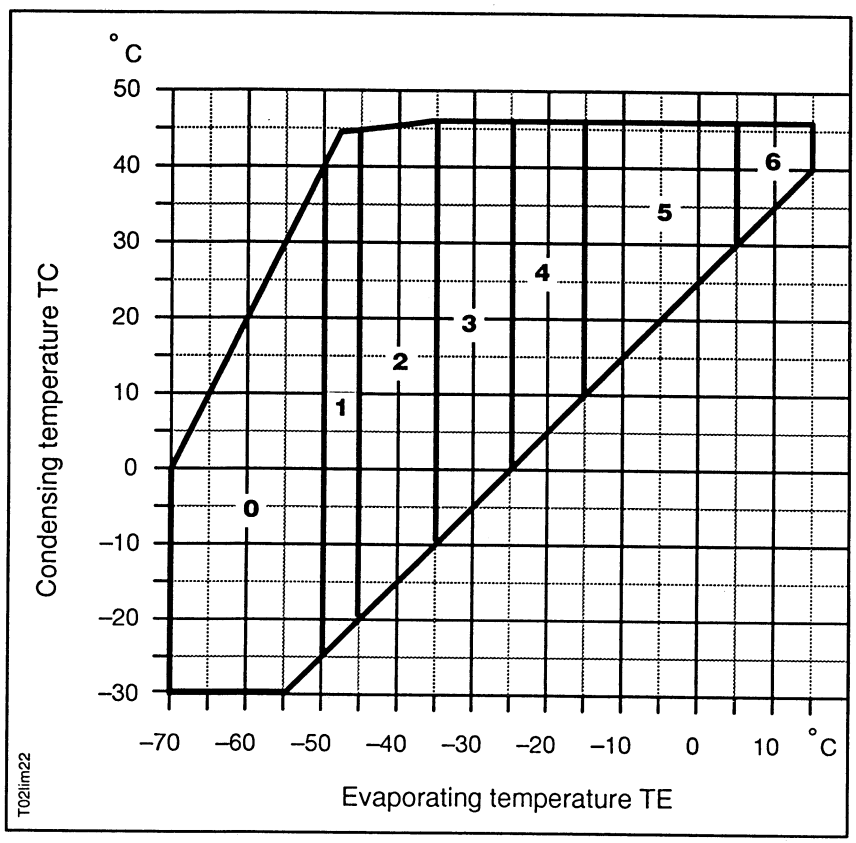
- suitable miscibility with refrigerant at low temperatures.
- suitable viscosity at low temperatures in the evaporating system.
- suitable viscosity in the lubricating system with compressor and unit at stand-still and in operation.
- lower oil carry-over
- longer life of oil (P-oils)

0170-150-EN

R404A/R507

Oil recommendation

Screw compressors



SABROE code no	Area no						Max oil temp.	
	1	2	3	4	5	6	Condensing temp. 35°C	45°C
E32	▲	●					+45	+45
E46		◆	◆				+50	+50
E68		▲	▲	◆	●		+55	+55
E100			◆	▲	◆	●	+60	+60
E150				◆	▲	◆	+70	+70
E220					◆	▲	+75	+75

Area O: not fully miscible (two phase area), special oil return procedure required.

● = useable ◆ = appropriate ▲= very appropriate

- suitable miscibility with refrigerant at low temperatures.
- suitable viscosity at low temperatures in the evaporating system.
- suitable viscosity in the lubricating system with compressor and unit at stand-still and in operation.
- lower oil carry-over
- longer life of oil (P-oils)

0170-150-EN

Oils recommended by SABROE for refrigeration compressors **No. 1**
HCFC & R717

Oil company	SABROE code no * See notes	Name of oil	
Avia	M 46	Avia	FC 46
	M 68	Avia	FC 68
	M 100	Avia	FC 100
BP	M 46	Energol	LPT 46
	M 46-68	Energol	LPT-F 46
	M 68	Energol	LPT 68
	A 46	Enersyn	LPS 46
	A 68	Enersyn	LPS 68
	A 100	Enersyn	LPS 100
	P 68	Enersyn	LPS-PO 68
	G 220	Enersyn	LPS-PO 100
Caltex	M 46	Capella	WF 46
	M 68	Capella	WF 68
	M 100	Capella	WF 100
Castrol	M 46-68	Icematic	99
	M 46-68	Icematic	299
	A 68	Icematic	2284
	A 100	Icematic	2285
	P 68	Icematic	2294
Chevron (UK: Gulf Oil)	P 68	Ammonia Refrigeration Oil	
	M 68	Refrigeration Oil	WF
	M 46	Eskimo	RC 46
	M 68	Eskimo	RC 68
	M 68	(Gulf: Eskimo 68)	
Chevron Oronite	A 46	Zerol	250
	A 68	Zerol	350
	A 100	Zerol	500
CPI Engineering Services Inc.	M 68	CP	1009-68
	P 68	CP	4600-68
	E 100	CP	4214-100
	E 150	CP	4214-150
	E 320	CP	4214-320
	G 100	CP	412-100

ISO VG No
Oil type

Oil company	SABROE code no * See notes	Name of oil	
DEA	M 46	Triton	WF 46
	M 68	Triton	WF 68
	MA 46	Triton	MS 46
	MA 68	Triton	MS 68
	A 150	Triton	S 150
	P 68	Triton	A 68
	P 220	Triton	A 220
	G 68*	Triton	GL 68
Elf/ Lub Marine 1)	M 46	Elfrima	NH 46
	M 68	Elfrima	NH 68
	M 46	Elfrima	FR 46
	M 46-68	Elfrima Friga 1)	FR 68 2
	M100	Elfrima	FR 100
	M 150	Elfrima	FR 150
	MP 46	Barelf	NBT 46
	A 46-68	Barelf	AL 55
	A 100	Barelf Primeria 1)	AL 100 SG 100
Esso/Exxon	M 46	Zerice	46
	M 68	Zerice (Zero-mar)	68
	A 46	Zerice	S 46
	A 68	Zerice	S 68
	A 100	Zerice	S 100
	P 68	Zero-pol	S 68
	P 220	Zero-pol	S 220
Fuchs	M 46	Reniso	KS 46
	M 68	Reniso	KC 68
	M 100	Reniso	KES 100
	MA 46	Reniso	KMH 46
	A 46	Reniso	SP 46
	A 68	Reniso	SP 68
	A 100	Reniso	SP 100
	G 68*	Reniso	PG 68
	A 68*	Reniso	PGP 70
	G 120-150	Reniso	PGP120

ISO VG No
Oil type

* Ammonia soluble lubricant.

0170-150-EN

Oils recommended by SABROE for refrigeration compressors **No. 2**
HCFC & R717

Oil company	SABROE code no * See notes	Name of oil
Hüls	P 68	Anderol RCF-P68
Hydro - Texaco	M 46	Capella WF 46
	M 68	Capella WF 68
	M 100	Capella WF 100
	A 46	Refrigeration Oil Low Temp46
	A 68	Refrigeration Oil Low Temp68
	A 100	Refrigeration Oil Low Temp00
	P 68	Capella A 68
	P 220	Capella A 220
Ipiranga	M 46	Ipigel 46
	M 46	Ipigel 46-P
	M 68	Ipigel 68
Kuwait Petroleum	M 68	Q8 Stravinsky C
	AP 68	Q8 Stravinsky 68
Mobil		Gargoyle
	M 68	Arctic 300 *
	A 68	Arctic SHC 426
	A 100	Arctic SHC 427
	P 68	Arctic SHC 226
	P 100	Arctic SHC 228
	P 220	Arctic SHC 230
	P 320-460	Arctic SHC 234
Petrobrás Distribuidora	M 46-68	Lubrax Industrial CP-60RH
	MA 46	Lubrax Industrial CP-46RF
	MA 68	Lubrax industrual CP-68RF
	MA 100	Lubrax industrual CP-100RF
Petro-Canada	M46-68	Reflo 68 A

Oil company	SABROE code no * See notes	Name of oil
Shell	M 46	Clavus Oil 46
	M 68	Clavus Oil 68
	M 46	Clavus Oil G 46
	M 68	Clavus Oil G 68
	M 100	Clavus Oil G 100
	MA 46	SD Refrigerator Oil
	A 68	V-Oil 7054
Statoil	M 46	Fridge Way 46
	M 68	Fridge Way 68
	A 46	Fridge Way S 46
	A 68	Fridge Way S 68
	A 100	Comp Way S 100
Sun oil	M 46	Suniso 3 1/2 GS
	M 46-68	Suniso 4 GS
	M 46-68	Suniso 4 SA
	M 100	Suniso 5 G
	M 150	Suniso 6 GS

* Approved for HCFC only

0170-150-EN

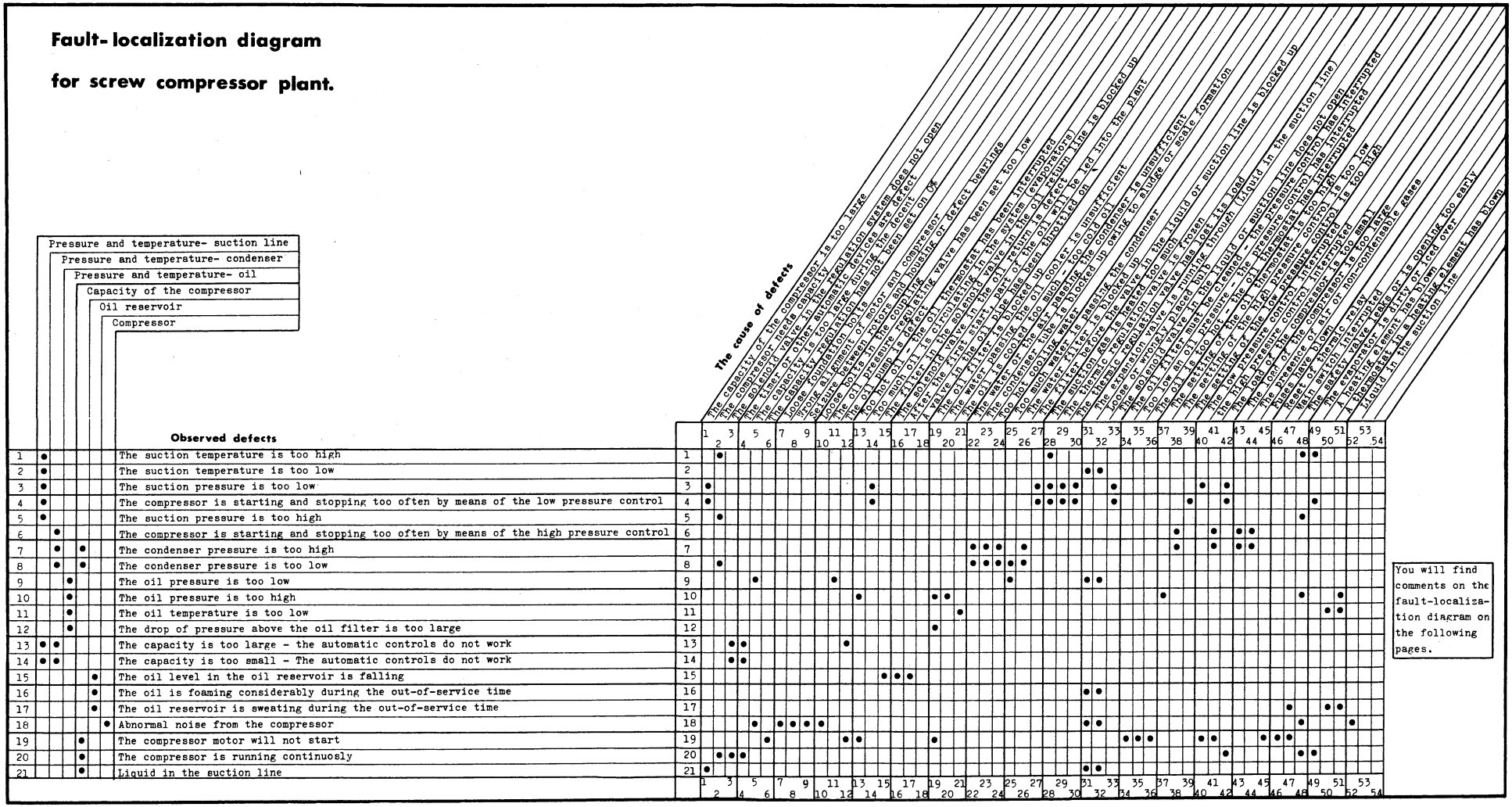
Oils recommended by SABROE for refrigeration compressors **No. 3**
HFC

Oil company	SABROE code no	Name of oil	
BP	E46	Enersyn	MP-S46
Castrol	E68	Icematic	SW 68
	E100	Icematic	SW 100
	E150	Icematic	SW 150
	E220	Icematic	SW 220
Caltex	E46-68	Aurora	SE 55
	E68-100	Aurora	SEZ 80
	E100-150	Aurora	SEZ 120
	E150-220	Aurora	SEZ 170
CPI Engineering Services Inc	E32	Solest ®	32
	E68	Solest ®	68
	E100-150	Solest ®	120
	E220	Solest ®	220
DEA	E46-68	Triton	SE 55
	E68-100	Triton	SEZ 80
	E100-150	Triton	SE 120
	E150-220	Triton	SE 170
ELF	E32	Planetelf	ACD 32
	E46	Planetelf	ACD 46
	E68	Planetelf	ACD 68
	E68	Planetelf	ACD 68 M
	E100	Planetelf	ACD 100
	E100	Planetelf	ACD 100 LT
	E220	Planetelf	ACD 220
Fuchs	E46-68	Reniso	E46
	E68	Reniso	E68
	E100	Reniso	E100
	E220	Reniso	E220
Hydro - Texaco	E32	Capella	HFC 32
	E46	Capella	HFC 46
	E68	Capella	HFC 68
	E100	Capella	HFC 100
	E220	Capella	HFC 220

Oil company	SABROE code no	Name of oil	
Hüls	E100	Anderol	RCF-E-100
	E150	Anderol	RCF-E-170
ICI	E32	Emkarate	R 32 S
	E46	Emkarate	RL 46 S
	E68	Emkarate	RL 68 S
	E100	Emkarate	RL 100 S
	E150	Emkarate	RL 150 S
	E32	Emkarate	RL 32 H
	E46	Emkarate	RL 46 H
	E68	Emkarate	RL 68 H
	E220	Emkarate	RL 220 H
Lubrisol	E46	Lubrikuhl	ISO - 46
	E68	Lubrikuhl	ISO - 68
	E100	Lubrikuhl	ISO - 100
	E220	Lubrikuhl	ISO - 220
Mobil	E46	Arctic	EAL 46
	E68	Arctic	EAL 68
	E100	Arctic	EAL 100
Shell	E32	Clavus Oil	R 32
	E46	Clavus Oil	R 46
	E68	Clavus Oil	R 68
	E100	Clavus Oil	R 100
Sun Oil	E 46	Suniso	SL 46
	E 68	Suniso	SL 68
	E 100	Suniso	SL 100

Fault-localization diagram

for screw compressor plant.



9.72 0171-626-EN

COMMENTS ON THE FAULT-LOCALIZATION DIAGRAM

1 TOO HIGH SUCTION TEMPERATURE

1.2	Lacking capacity	Increase the capacity
1.28	Too large overheating on the suction gas	Examine and regulate the thermic valves of the evaporators
1.48	The safety valve leaks or is opening too early	Control the condenser pressure and adjust or repair the safety valve

2 TOO LOW SUCTION TEMPERATURE

2.31	Liquid in the suction line	Regulate the expansion valves or the float valves
2.32	Loose or wrongly placed bulb	Control whether the bulbs have a good contact with the suction pipe, and whether the placing is correct

3 TOO LOW SUCTION PRESSURE

3.1	The capacity is too large	Reduce the capacity of the compressor
3.14	Too much oil in the evaporators	Drain off the oil from the evaporators
3.27	The filter in the liquid line is blocked up	Examine and clean the filters in the liquid lines
3.28	Too large overheating on the suction gas	Regulate the expansion valves
3.29	Freezing in the thermic expansion valve	Thaw out the thermic expansion valve by means of hot, wet rags and let the liquid from the receiver pass through the drier-filter Note: You must never add methanol to the system in order to avoid freezing as this might occasion corrosion and chemical attacks in the compressor etc.

TOO LOW SUCTION PRESSURE

3.30	The thermic expansion valve has lost the load	The valve does not open - replace the valve
3.33	The solenoid valve in the liquid or suction line does not open	The coil may be blown - replace the coil
3.42	The load of the plant is too small	Put more refrigerant liquid into the plant

4 THE COMPRESSOR STARTS AND STOPS TOO OFTEN BY MEANS OF LOW PRESSURE CONTROL

4.1	See point 3.1	
4.14	See point 3.14	
4.27	See point 3.27	
4.28	See point 3.28	
4.29	See point 3.29	
4.30	See point 3.30	
4.33	See point 3.33	
4.39	The low pressure control is set too high	Adjust the pressure control
4.42	See point 3.42	
4.49	The evaporator is dirty or iced over	Clean or defrost the evaporator

5 TOO HIGH SUCTION PRESSURE

5.2	The compressor is lacking capacity	Regulate the capacity of the compressor
5.48	The safety valve leaks or is opening too early	Adjust or repair the valve

6 THE COMPRESSOR STARTS AND STOPS TOO OFTEN BY MEANS OF HIGH PRESSURE CONTROL

	See under point 7	

7 TOO HIGH CONDENSER PRESSURE

7.22	The water or the air passing the condenser is unsufficient	Regulate the water inlet or clean the condenser
7.23	The condenser pipe blocked up owing to sludge or scale formation	Clean the condenser pipe
7.24	Too hot cooling water	Procure colder cooling water or reduce the capacity of the compressor
7.26	The water filter blocked up	Clean the water filter
7.38	The high pressure control has been set too low	Adjust the pressure control
7.43	Too much load in the plant	Drain off liquid into an empty reservoir
7.44	Air or non-condensable gases in the system	Blow out the air by means of the condenser

8 TOO LOW CONDENSER PRESSURE

8.2	The compressor is lacking capacity	Control whether the capacity of the compressor corresponds to the load of the plant. Regulate the inlet of water into the condenser
8.25	Too much water is passing the condenser	Adjust the water inlet

9 TOO LOW OIL PRESSURE

9.5	Too large capacity during the descent	Too large a capacity during the descent might cause that liquid is sucked into the suction line. This liquid might have the oil in the oil reservoir foam violently so that the oil pressure will fall and the machine stop. Before the machine is started again it must be examined whether there is liquid in the oil reservoir. This liquid must be boiled out by means of the heating element or by heating the oil reservoir with hot water or steam. The plant must consequently be descended with reduced capacity.
9.11	The oil pressure regulator is set too low	When delivered from the factory the regulator is adjusted at the prescribed 2,5 kp/cm, however, it must be controlled during the operation
9.31	The expansion valve is running through (liquid in the suction line)	See comments under point 9.5
9.32	Loose or wrongly placed bulb	A loose bulb on the expansion valve might occasion that liquid is running into the suction line - see, moreover, the comments under point 9.5

10 TOO HIGH OIL TEMPERATURE

10.13	Thermostat interrupted	The thermostat shall interrupt at 60°C. The reason why the oil has become too hot must be found under the following points
10.18	A valve in the oil system has been throttled on	Control whether all the valves are open
10.20	The water or the liquid refrigerant passing the oil cooler is unsufficient	Examine whether the valves are open, or whether the water filter or the oil cooler must be cleaned
10.48	The safety valve leaks or is opening too early	Adjust or repair the valve
10.51	Thermostat in heating element	Examine whether the thermostat can interrupt at 60°C

11 TOO LOW OIL TEMPERATURE

11.21	The oil is cooled too violently	Regulate the oil cooling
11.50	The heating element in the oil reservoir is defect	Replace the heating element
11.51	The thermostat in the heating element is defect	Replace the thermostat

12 TOO LARGE PRESSURE DROP ABOVE THE OIL FILTER

12.19	The oil filter is blocked up	Clean the filter in trichloride and blow through with air

13 TOO LARGE CAPACITY - THE AUTOMATIC DEVICES DO NOT WORK

13.3	The solenoid valve of the regulating system does not open	Defect solenoid valve - replace valve or coil
13.4	Timer or other automatic devices are defect	Replace or repair
13.12	Auxiliary pump defect	When the compressor is stopping the auxiliary pump shall set the capacity regulation on 0% capacity so that the compressor is ready to start again.
		Examine whether the pump is provided with current or whether the pump or the motor is defect

14 TOO SMALL CAPACITY - THE AUTOMATIC DEVICES DO NOT WORK

14.3	See point 13.3	
14.4	See point 13.4	

15 THE OIL LEVEL IS FALLING IN THE OIL RESERVOIR

15.15	The filter for the solenoid valve in the oil return is blocked up	Clean the filter
15.16	The solenoid valve in the oil return is defect	The oil return pipe must be hot during the operation
15.17	During the start part of the oil will be led into the plant	Especially in freon plants part of the oil will be circulating in the plant.
		When the plant in balancing, oil must be refilled if necessary

16 THE OIL IS FOAMING VIOLENTLY DURING THE OUT-OF-SERVICE TIME

16.31	The expansion valve is running through (liquid in the suction line)	Examine expansion valves and float valves
16.32	Loose or wrongly placed bulb	Examine the placing of the bulb

17 THE OIL RESERVOIR IS SWEATING DURING THE OUT-OF-SERVICE TIME

17.47	The main switch interrupted	If the compressor is stopped, and the current cut off by means of the main switch, possible liquid refrigerant in the oil reservoir will evaporate. As the heating element of the oil reservoir is also cut off, the heat for the evaporation must be taken from the surroundings. The oil will consequently become very cold and must be heated before the re-start.
17.50	The heating element blown	See point 17.47
17.51	Thermostat in heating element defect	See point 17.47

18 ABNORMAL NOISE FROM THE COMPRESSOR

If the compressor is producing an abnormal noise, it must be stopped, and the reason herefor be found so that the compressor may be repaired before re-start

18.5	Too large capacity during the descent	Too large capacity during the descent may cause that liquid is sucked into the suction line to the compressor. Consequently it is recommended to operate with reduced capacity during the descent
18.7	Loose foundation bolts	Tighten up the bolts
18.8	Wrong alignment of motor and compressor	Adjust the alignment
18.9	Seizure between rotors. Seizure between rotors and housing. Defect bearings	The compressor must not be started. It must be opened and repaired
18.10	Loose bolts in coupling	Stop the compressor and tighten up the bolts
18.31	Liquid in the suction line	Examine and adjust valves running through
18.32	Loose or wrongly placed bulb	Examine the placing of the bulb
18.48	The safety valve is opening	Examine the blow pressure of the safety valve

19 THE COMPRESSOR MOTOR WILL NOT START

19.6	The capacity regulation has not been set on 0%	See under the points 13.3 - 13.4 and 13.12
19.12	The auxiliary pump is defect	See under point 13.12
19.13	Too high oil temperature	See under point 10
19.19	The oil filter blocked up	Clean the oil filter - reset the pressure control
19.34	The oil differential pressure control interrupted	Clean the oil filter - reset the pressure control
19.35	Too low oil pressure	See under point 9
19.36	Too hot oil	See under point 10

THE COMPRESSOR MOTOR WILL NOT START

19.40	Low pressure control has interrupted	The compressor will start again when the suction pressure has risen so much that the pressure control is activated again - See moreover point 3
19.41	High pressure control has interrupted	See under point 7
19.45	Fuses have blown	Examine the reason herefor and replace fuses
19.46	Thermic relay has interrupted	Examine the reason for the overloading
19.47	Main switch interrupted	Close the circuit

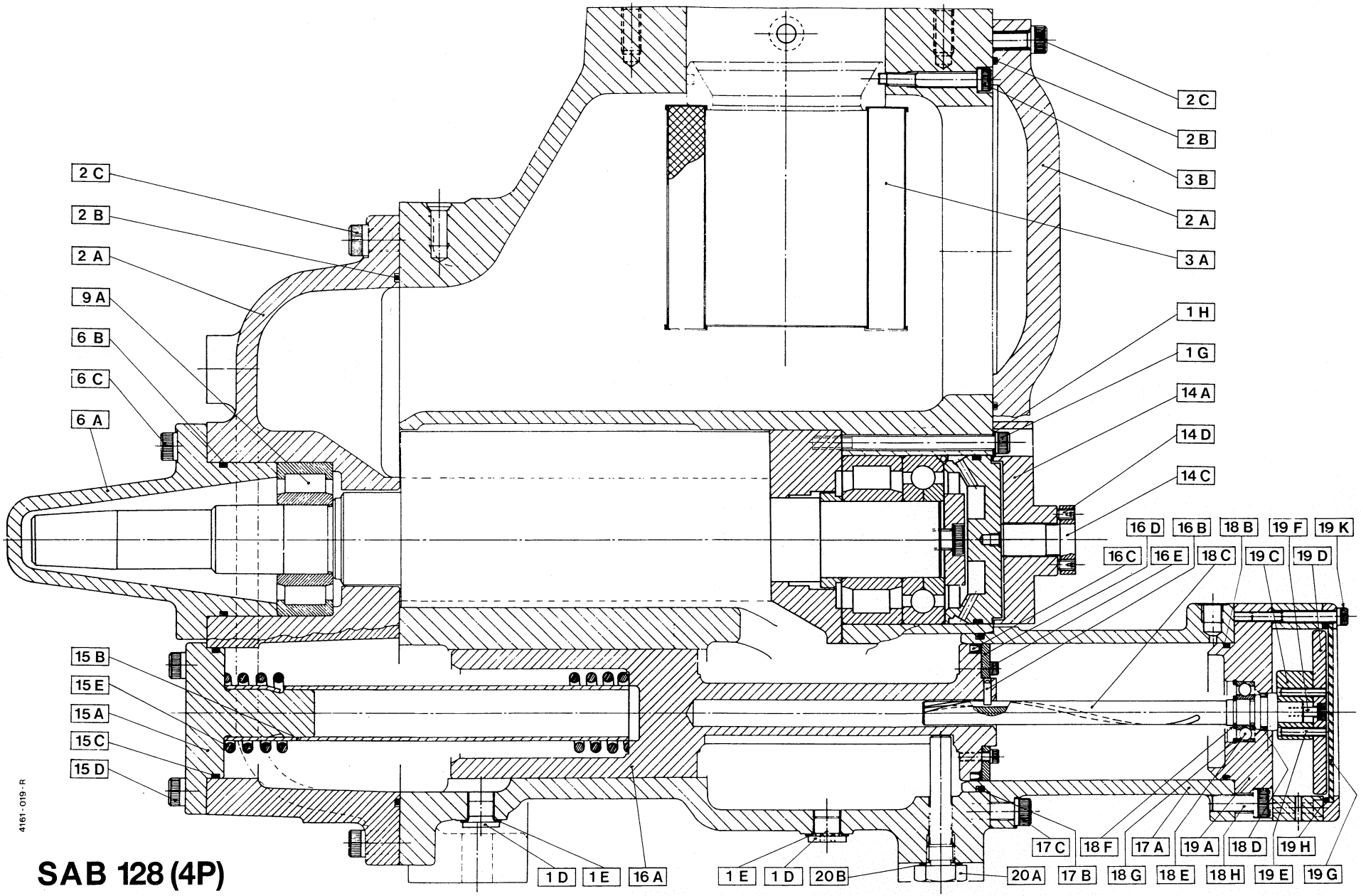
20 THE COMPRESSOR IS RUNNING CONTINUOUSLY

20.2	The compressor is lacking capacity	See under point 14
20.3	The solenoid valve in the capacity regulation system is not opening	See under point 13.3
20.4	Timer or other automatic devices defect	See under point 13.4
20.42	The plant has too small load	Fill liquid refrigerant to the plant
20.48	The safety valve leaks or is opening too early	See point 10.48
20.49	The evaporators are dirty or iced over	Clean or defrost the evaporators

21 LIQUID IN THE SUCTION LINE

21.1	The capacity of the compressor is too large	Reduce the capacity
21.31	The expansion valve is running through	Adjust the expansion valve
21.32	Loose or wrongly placed bulb for expansion valve	Examine the placing of the bulb and adjust

0661 - 780

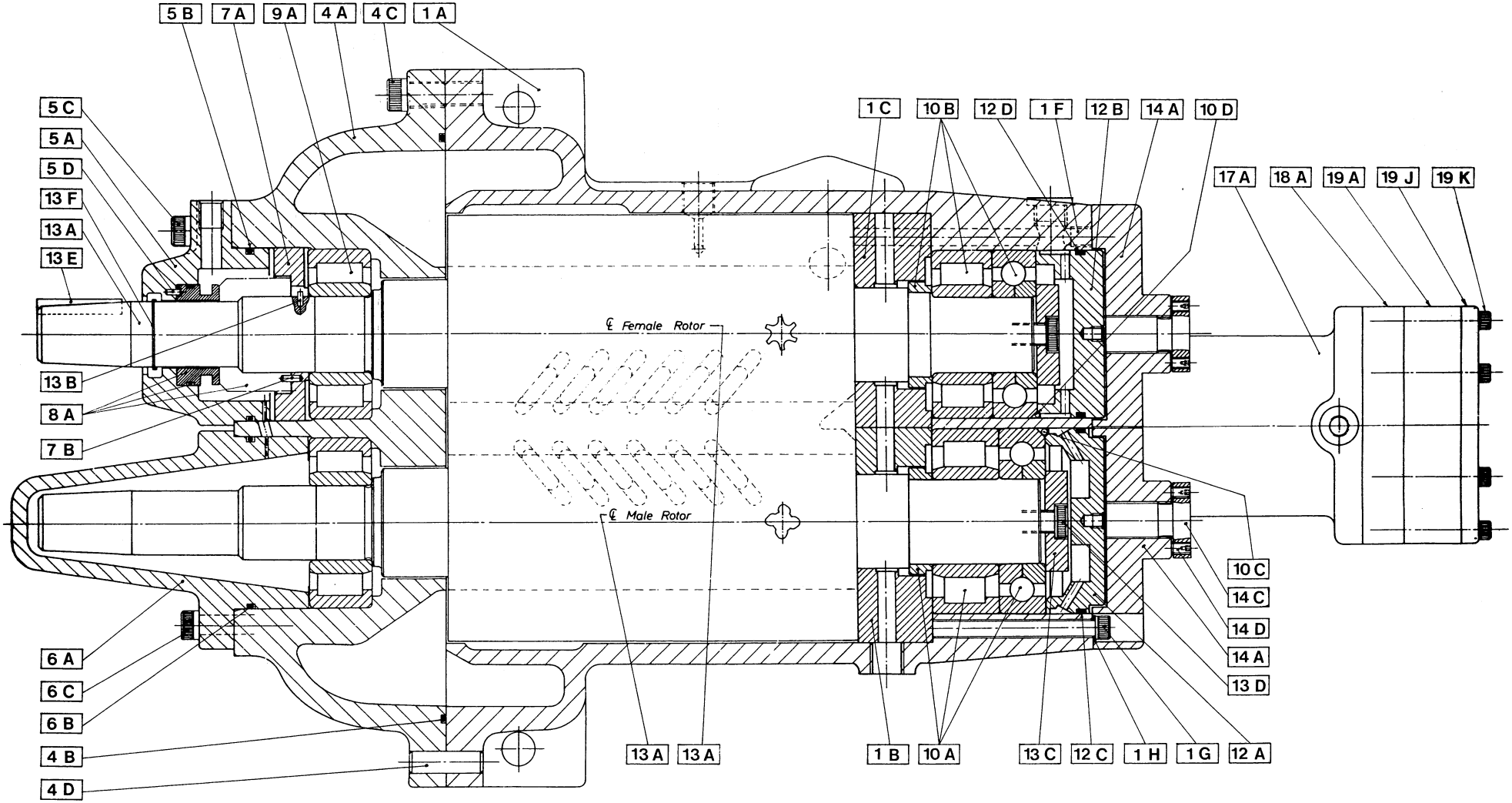


4161-019-R

SAB 128 (4P)

88.04

0661 - 780



4161 - 019 - R

SAB 128 (4P)

(List of parts 0661 - 781

88.05

0661-781-EN

Spare Parts for SAB 128 (4P) Model 1988

Matching drawing: 0661-780

Pos.	Designation	Supply for Pos.	No.	Part no.
	Complete compressor block SAB 128-4P. Vi 2.6			4161-018
	Complete compressor block SAB 128-4P. Vi 4.0			4161-019
	Compressor frame			
1A	Compressor frame		1	3011-001
1B-1	Discharge port (female) Vi 2.6	1A	1	3031-010
1B-2	Discharge port (male) Vi 2.6	1A	1	3031-009
1C-1	Discharge port (female) Vi 4.0	1A	1	3031-012
1C-2	Discharge port (male) Vi 4.0	1A	1	3031-011
1D	Threaded plug with collar 3/8"	1A	4	1343-026
1E	Gasket for plug ø 24/18 x 1.5	1D	4	2356-128
1F	Threaded plug 1/8"	1A	2	1343-140
1G	Socket cap screw M8 x 100	1B-1C	8	1413-369
1H	Gasket for screw ø 13/8 x 2 (steel)	1G	8	2351-028
	Cover for suction filter			
2A	Cover	1A	1	3013-029
2B	O-ring ø 196.46 x 3.5	2B	1	1331-106
2C	Socket cap screw M10/35	2A	8	1413-373
	Suction filter			
3A	Suction filter complete	1A	1	4521-024
3B	Locking screw	3A	1	2111-114
	Bearing cover at suction end			
4A	Bearing cover	1A	1	3013-021
4B	O-ring ø 304.39 x 3.5	4A	1	1331-112
4C	Socket cap screw M12 x 40	4A	16	1413-388
4D	Cylindrical pin ø 12 x 40	1A	2	1445-084
	Shaft seal cover			
5A	Shaft seal cover	4A	1	3013-024
5B	O-ring ø 85.3 x 3.5	5A	1	1331-078
5C	Socket cap screw M10 x 30	5A	4	1413-372
5D	Driving pin ø 4 x 8	5A	1	1446-019
5E	Hose connection 1/4"	5A	1	1345-143
5F	Plastic hose 3/16" x 300 mm	5E	1	1241-190
5G	Threaded plug 1/4"	5A	1	1343-025
5H	Gasket ø 20/13 x 1.5	5G	1	2356-125
	Cap cover			
6A	Cap cover	4A	1	3013-025
6B	O-ring ø 85.3 x 3.5	6A	1	1331-078
6C	Socket cap screw M10 x 30	6A	4	1413-372
	Balance piston in suction end			
7A	Balance piston	4A	1	3025-007
7B	Driving pin ø 4 x 8	7A	1	1446-019

Pos.	Designation	Supply for Pos.	No.	Part no.
	Shaft seal			
8A	Shaft seal complete with o-ring	13A	1	1377-009
8B	O-ring	8A	1	1331-033
	Bearing at suction end			
9A	Radial roller bearing NU 2308 E	13A	2	1513-016
	Bearings at discharge end			
10A	Set of bearings (male)	1A	1	3021-015
10B	Set of bearings (female)	1A	1	3021-016
10C	Retaining pin (male)	10A	1	3021-012
10D	Retaining pin (female)	10B	1	3021-017
	Thrust cover at discharge end			
12A	Thrust cover (male)	1A	1	3013-046
12B	Thrust cover (female)	1A	1	3013-047
12C	O-ring ø 85,32 x 3,5 (male)	12A	1	1331-078
12D	O-ring ø 91,67 x 3,5 (female)	12B	1	1331-080
	Rotors			
13A	Rotor set	1A	1	3024-003
13B	Driving pin ø 4 x 8	1A	4	1446-019
13C	Thrust washer	13A	2	3021-004
13D	Socket cap screw M12 x 25 DIN 7984	13C	2	1413-020
13E	Key 10 x 8 x 45	13A	1	2123-014
13F	Splash ring	13A	1	1437-217
	Bearing cover at discharge end			
14A	Bearing cover	1A	2	3013-014
14B	Socket cap screw M10 x 40	14A	6	1413-374
14C	Adjusting screw	14A	2	2111-122
14D	Pointed screw M6 x 10	14C	4	1413-231
	Cover for capacity regulating slide			
15A	Cover	4A	1	3013-023
15B	Spring retainer	15A	1	3043-013
15C	O-ring ø 66,27 x 3,5	15A	1	1331-072
15D	Socket cap screw M10 x 25	15A	4	1413-371
15E	Spring ø 41/6 x 425	15B	1	2144-029
	Capacity regulating slide			
16A	Regulating slide	4A	1	3043-014
16B	Cylindrical pin ø 6 x 16	16A	1	1445-076
16C	Sealing ring for piston ø 80	16A	1	1331-519
16D	Retaining ring for piston	16A	1	3043-012
16E	Socket cap screw M5 x 12 (self locking)	16D	4	1413-328

Pos.	Designation	Supply for Pos.	No.	Part no.
	Capacity regulating cylinder			
17A	Cylinder	4A	1	3043-011
17B	O-ring ø 85,3 x 3,5	17A	1	1331-078
17C	Socket cap screw M10 x 30	17A	4	1413-372
	Cover for capacity regulating cylinder			
18A	Cover	17A	1	3013-022
18B	O-ring ø 72,6 x 3,5	18A	1	1331-074
18C	Spindle axle for capacity indication	17A	1	3045-023
18D	Sealing ring for spindle axle	18C	1	1331-502
18E	Radial ball bearing SKF 6202	18C	1	1511-012
18F	Circlip for saft ø 14	18C	1	1437-206
18G	Circlip for bore ø 35	18A	1	1437-148
18H	Socket cap screw M10 x 25	18A	4	1413-371
	Capacity indicator			
19A	Housing for capacity indicator	17A	1	3045-024
19B	Socket cap screw M6 x 30	19A	3	1413-343
19C	Eccentric ring	18C	1	3045-025
19D	Indicating dial	18C	1	3045-026
19E	Spring dowel sleeve ø 5 x 26	19C	2	1446-022
19F	Socket cap screw M5 x 16	19D	1	1413-331
19G	Glass for capacity indicator ø 100	19J	1	1226-018
19H	O-ring ø 98,02 x 3,5	19J	1	1331-081
19J	Cover for capacity indicator	19A	1	3045-021
19H	Socket cap screw M6 x 45	19J	3	1413-346
19L	Pointed screw for micro-switch	19A	2	
	Dowel pin for regulating slide			
20A	Dowel pin	1A	1	3045-022
20B	Gasket ø 24/18 x 1,5	20A	1	2356-128
	Economizer inlet			
21A	Blind plug	1A	1	3013-027
21B	O-ring ø 40.87 x 3.5	21C	1	1331-064
21C	Blind flange	1A	1	3013-026
21D	Socket cap screw M12 x 30	21C	2	1413-386
	S.O.C. inlet			
22A	Blind plug	1A	2	3013-002
22B	O-ring ø 18.5 x 2.62	22C	2	1331-017
22C	Blind flange	1A	1	3013-001
22D	Socket cap screw M12 x 30	22C	4	1413-386

88.05

0661-782-EN

Spare Parts Set for SAB 128 (4P) Model 1988

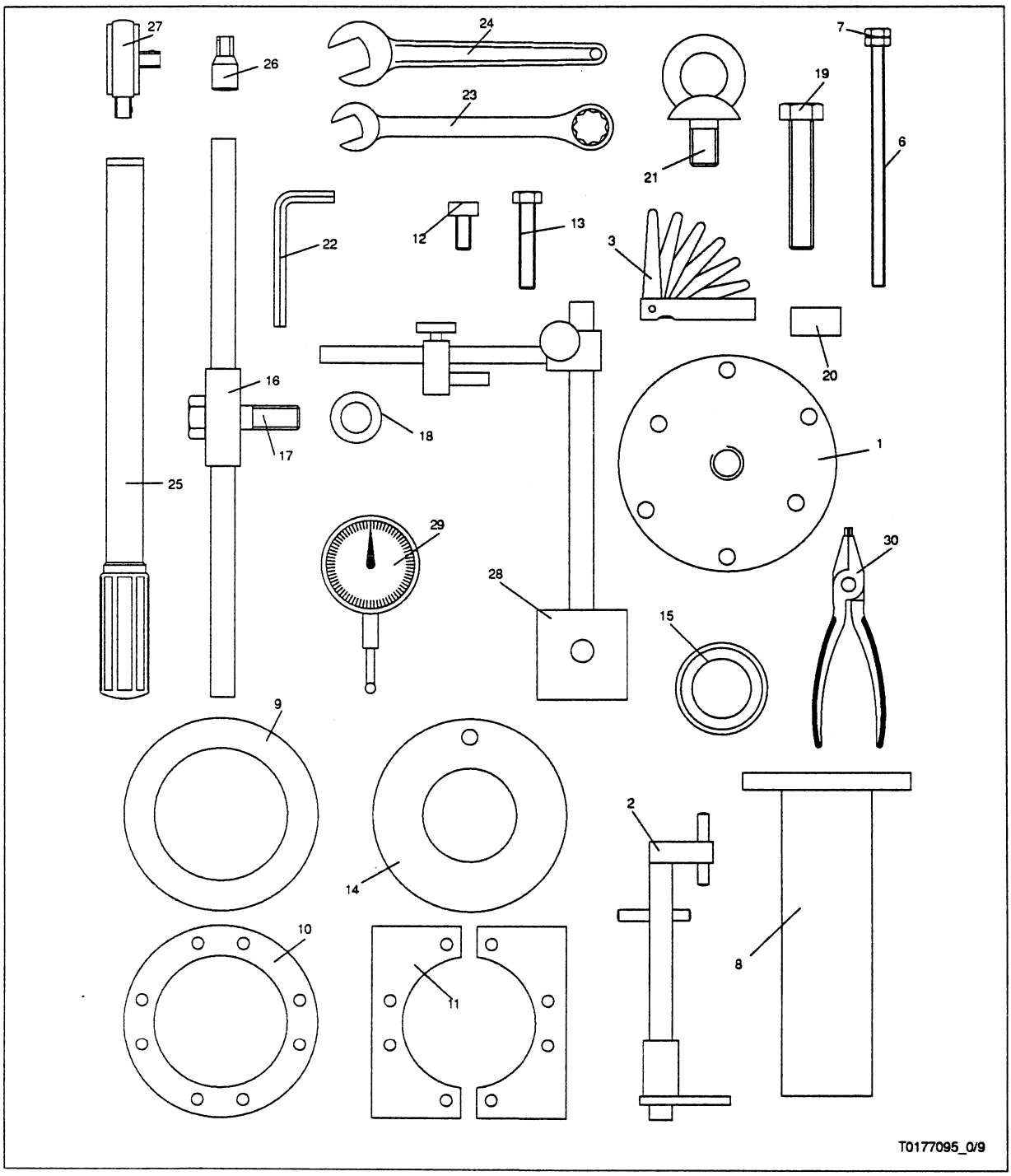
Matching drawing: 0661-780

Pos.	Designation	No.	Part no.
	Spare parts set no. 1 (normal set)		3084-007
1E	Gasket ø 24/18 x 1.5	5	2356-128
1H	Gasket for screw ø 13/8 x 2 (steel)	8	2351-028
2B	O-ring ø 196.44 x 3.5	1	1331-106
4B	O-ring ø 304.39 x 3.5	1	1331-112
5B	O-ring ø 85.32 x 3.5	5	1331-078
5H	Gasket ø 20/13 x 1.5	1	2356-125
6B	See pos. 5 B		
12C	See pos. 5B		
12D	O-ring ø 91.67 x 3.5	1	1331-080
15C	O-ring ø 66.27 x 3.5	1	1331-072
16C	Sealing ring for piston	1	1331-519
16E	Socket cap screw M5 x 12	4	1413-328
17B	See pos. 5B		
18B	O-ring ø 72.62 x 3.5	1	1331-074
18D	Sealing ring for spindle	1	1331-502
19H	O-ring ø 98.02 x 3.5	1	1331-081
21B	O-ring 40.87 x 3.5	2	1331-064
22B	O-ring ø 18.72 x 2.67	2	1331-017
	Spare parts set no. 2 (extended set)		3084-008
	Spare parts set no. 1	1	3084-007
8A	Shaft seal	1	1377-009
9A	Radial roller bearings NU2308E	2	1513-016
10A	Bearing set (male)	1	3021-015
10B	Bearing set (female)	1	3021-016
13D	Socket cap screw M12 x 25	2	1413-020
18E	Radial roller bearing SKF 6202	1	1511-012
	Spare parts set no. 3 (certificate set)		3084-009
	Spare parts set no. 2	1	3084-008
1G	Socket cap screw M8 x 100	3	1413-369
2C	Socket cap screw M10 x 35	3	1413-373
4C	Socket cap screw M12 x 40	6	1413-388
4D	Cylindrical pin ø 12 x 40	2	1445-084
5C	Socket cap screw M10 x 30	4	1413-372
5D	Driving pin ø 4 x 8	3	1446-019
6C	See pos. 5C		
7A	Balance piston	1	3025-007
7B	See pos 5D		
13B	See pos 5D		
13F	Splash ring	1	1437-217
15D	Socket cap screw M10 x 25	3	1413-371
16B	Cylindrical pin ø 6 x 16	1	1445-076
17C	See pos 5C		
18F	Circlip for shaft	1	1437-206
18G	Circlip for bore	1	1437-148
18H	See pos 15D		
19B	Socket cap screw M6 x 30	1	1413-343
19E	Driving pin ø5 x 26	2	1446-022
19F	Socket cap screw M5 x 16	1	1413-331
19K	Socket cap screw M6 x 45	1	1413-346

92.05

0661-783-EN

Tools for compressor types
SAB 128 (4 P) (1988 model)
and SAB 128 Mk 2 (after 89.10)



0661-783-EN

Normal set = A401
Extended set = A402
Tool for aligning the coupling = B401

Pos.	Designation	Part no.	A401	B402	B401
1 –1	Puller for coupling and bearings	3083–060	1	1	
2 –1	Alignment device	3183–104			1
3 –1	Feeler gauge	1622-050			1
6 –1	Threaded pin M 10 x 160	2112–129	4	4	
7 –1	Nut M 10	1432–064	4	4	
8 –1	Tools for drawing out the rotors	3083–063	1	1	
9 –1	Thrust ring for the puller	3083–043	1	1	
10 –1	Ring for the puller	3083–042	1	1	
11 –1	Puller for bearing rings	3083–041	2	2	
12 –1	Socket cap screw M 10 x 25	1413–371	4	4	
13 –1	Hexagon head screw M 10 x 55	1424–197	4	4	
14 –1	Tools for fitting the bearings	3083–062	1	1	
15 –1	Tools for fitting the bearings	3083–061	1	1	
16 –1	Handle for fitting the rotor	3083–007	1	1	
17 –1	Hexagon head screw M 10 x 40 with flat head	2111–117	1	1	
18 –1	Aluminium washer ø 25/10 x 1.5	2356–129	1	1	
19 –1	Hexagon head screw M 16 x 130	1424–271	1	1	
20 –1	Thrust washer, tools for coupling	3083–002	1	1	
21 –1	Eye bolt M 12	1427–150	3	3	
22 –1	Allen key for socket cap screw 10 mm	1612–401		1	
–2	" " " " " " 8 mm	1612–399		1	
–3	" " " " " " 6 mm	1612–398		1	
–4	" " " " " " 5 mm	1612–397		1	
–5	" " " " " " 4 mm	1612–396		1	
–6	" " " " " " 3 mm	1612–395		1	

Pos.	Designation	Part no.	A	B	C
23 –1	Combination spanner 27 mm	1612–280		1	
23 –2	" " 24 mm	1612–279		1	
23 –3	" " 19 mm	1612–277		1	
23 –4	" " 17 mm	1612–276		1	
24 –1	Open spanner 36 mm			1	
25 –1	Torque wrench 1.5 - 9 Kpm			1	
26 –1	Hexagon bit adaptor 1/2" - 10 mm			1	
26 –2	Hexagon bit adaptor 1/2" – 8 mm			1	
27 –1	Converter for torque wrench			1	
28 –1	Magnetic Fixture for dial indicator			1	
29 –1	Dial indicator			1	
30 –1	Retaining ring plier J 2			1	
30 –2	Retaining ring plier A 1			1	

Vægt (Excl. motor, kølemiddel, olie og vand)
Weight (Excl. motor, refrigerant, oil and water)

Oliekøler Oil cooler	Olieudskiller Oil separator Kg.	Kompr. Compr. Kg.	Armaturer Compont. Kg.	Oliekøler Oil cooler Kg.	Aggr. total Unit totaly Kg.
OOSI 1614	OHU 3015: 250	200	210	95	755
	3019: 275				780
	4015: 475				980
	4019: 515				1020
OOSI 2114	OHU 3015: 250			150	810
	3019: 275				835
	4015: 475				1035
	4019: 515				1075
OWSG 1615	OHU 3015: 250			120	780
	3019: 275				805
	4015: 475				1005
	4019: 515				1045
OWSG 2115	OHU 3015: 250			185	845
	3019: 275				870
	4015: 475				1070
	4019: 515				1110
B 35 - 10,16,24 32	OHU 3015: 250			15	675
	3019:275				700
	4015:475				900
	4019:515				940
HLI / BLI	OHU 3015: 250			20	680
	3019:275				705
	4015: 475				905
	4019: 515				945

	Econom. HESS kg.
HESS 131746	64
HESS 161736	103
HESS 211726	166

Oliefyldning (oliestand midt på øverste skueglas under drift)
Oil charge (oil level, at running conditions, in the middle of the top sight glass)

Oliekøler Oil cooler	Olieudskiller Oil separator L	Oliefilter Oil filter L	Kompr. Compr. L	Oliekøler Oil cooler L	Div. rør Div. pipes L	Aggregat total Unit totaly
OOSI 1614	OHU 3015 : 49	6	3	8	4	70
	3019 : 44					65
	4015 : 62					83
	4019 : 52					73
OOSI 2114	OHU 3015 : 49			15		77
	3019 : 44					72
	4015 : 62					90
	4019 : 52					80
OWSG 1615	OHU 3015 : 49			17		79
	3019 : 44					74
	4015 : 62					92
	4019 : 52					82
OWSG 2115	OHU 3015 : 49			28		90
	3019 : 44					85
	4015 : 62					103
	4019 : 52					93
B 35 -10, 16, 24, 32	OHU 3015 : 49			1		63
	3019 : 44					58
	4015 : 62					76
	4019 : 52					66
HLI BLI	OHU 3015 : 49			0		62
	3019 : 44					57
	4015 : 62					75
	4019 : 52					65

Shipping volume (incl. motor IEC 315 M)

Aggregat med olieudskiller : Unit with oil separator : OHU 3015	OHU 3019	Aggregat med olieudskiller : Unit with oil separator : OHU 4015	OHU 4019
M^3	M^3	M^3	M^3
5,8	6,2	6,1	6,6

REV	ECN	DESCRIPTION	DATE	AFD	INIT	SIGN	AFD	INIT	SIGN	AFD	INIT	SIGN	RELEASED FOR	MF
0			890807	UFF	TPH									X
				PRODUCT RESPONSIBLE			PRODUCTION METHODS			QUALITY ASSURANCE				

MASTER REV | REPLACES REV | REPLACED BY REV

WORKMANSHIP AND TOLERANCES IN ACCORDANCE WITH SABROE MANUFACTURING STANDARD 0182-002

ORIGINAL SIZE A 3 | MAIN SCALE

SABROE
P. O. BOX 1810, DK 8270 HOJBJERG, DENMARK
PHONE: +456271266. TELEX: 68740 SABRO DK
FAX: +456274474. CABLE: SABROE AARHUS

TITLE
Oliefyldning-vægt-shipping volume
Oil charge-weight-shipping volume
SAB 128 unit.

NO 4840 - 071 | REV | SHEET NO /

B

C