## Selecting Lubricatring Oil for SABROE Compressors

During the past few years Sabroe Refrigeration has experienced a number of problems with mineral oils, particularly in R717 plants. The problems can be divided into two groups:

**a**: The oil changes viscosity
**b**: The oil decomposes (becomes very black)

The problems have been seen with several mineral oil brands, often occuring within a few operating hours and resulting in severe consequences for both compressor and plants.

Following the careful investigation undertaken by Sabroe Refrigeration during the past few years, it has been decided to introduce a range of synthetic oils which can fulfil the demands of modern refrigeration plants.

Mineral oils may continue to be used in refrigeration plants, providing the lubricating quality is carefully monitored. For modern, high capacity refrigeration plants, where long lifetime for both lubricants and moving parts is expected, Sabroe Refrigeration recommends the choice of synthetic lubricating oils.

The application areas and specifications for these synthetic oils can be found in the following pages. Installers and/or users are at liberty to choose either Sabroe Refrigeration's own or alternative oil brands which fulfil the necessary specifications.

## General

This recommendation only deals with the lubrication of the compressor. The performance of the lubricant in the plant (receiver, evaporator, etc.) must, however, also be taken into consideration.

Lubricating oils with relatively high viscosities must be used to ensure satisfactory lubrication of refrigeration compressors.

To obtain the best lubrication, the oil must:

- Provide the required fluidity at the lowest evaporating temperature encountered in the plant and at the highest permissible temperatures in the compressors.
- Provide acceptable fluidity at start-up.
- Provide sufficient oxidation stability (the oil must be moisture-free when added to the system).
- Provide sufficient chemical stability when used together with the particular refrigerant.

In addition, the extent to which different refrigerants dissolve in the oil must be determined, so that the oil return systems, etc. can be designed to function properly.

## Stratification

It should be noted that in certain plants, particularly with HFC and HCFC refrigerants, the oil may stratify into layers in the refrigerant receivers and evaporators at certain operating conditions and at particular oil concentrations.

The *Oil recommendation diagrams* for SABROE compressors for HFC and HCFC will indicate the limits for Sabroe oils at which this stratification occurs. The oil concentrations stated in these diagrams must not be exceeded. This will enable suitable oil rectification/return systems to be designed to balance with the compressor oil "carry-over" so that the maximum concentration is not exceeded.
For area **A** in the diagrams, the max oil concentration in liquid phase must not exceed 2%. For the other area, the max. oil concentration must not exceed 5%. For area **B**: *please contact* Sabroe Refrigeration.

## Plants with several different compressor types/makes

In plants comprising several different interconnected compressor types and makes, it is strongly recommended that all compressors should use the same type of oil. This is essential where automatic oil return systems are employed.

If it is intended to change the oil from one type to another, please refer to the *Oil changing on SABROE compressors* later in this publication.

## Selecting the lubricating oil

There are a number of operating diagrams for the selection of lubricating oils for Sabroe compressors operating with various refrigerants. Once the **general** conditions concerning the lubrication of the compressor and oil type in the plant have been considered, the **specific plant conditions** must be taken into consideration.

Use the *Oil recommendation diagrams* to select the appropriate **oil code number.**

The **oil code number** consists of letters designating the oil type together with the Sabroe viscosity grade number.

| Code design | Oil types |
|---|---|
| M | Mineral oil |
| A | Synthetic oil based on Alkylbenzene |
| PAO | Synthetic oils based on Polyalphaolefin |
| AP | Mixture of A and PAO-oils |
| E | Synthetic ester-based lubricants |

In the *oil recommendation diagrams* for each refrigerant and compressor type, it is possible to determine the **code number** for the oil best suited to the operating conditions. With this **code number**, it is possible to select the correct Sabroe oil for the application. The marked area on each side of the separating line in the diagram shows the zone where both oils are useable.

## Oil types and oil companies

As a result of the large number of oil companies world-wide that deals in oil for refrigeration plants, it is impossible for Sabroe Refrigeration to test the many different brands of oil on the market. It is our experience, however, that some oil brands during use can change character and thus no longer fit the specifications given by the companies at delivery. We have thus experienced changes in the specifications as well as in the formula and performance without having had any information about this from the oil company. This makes it very difficult for Sabroe Refrigeration to give a general approval of the various oil brands.

For this reason Sabroe Refrigeration has, in cooperation with a large recognised oil company, developed a series of three oils which cover most purposes. Sabroe Refrigeration has however, also listed a limited number of oils which can be supplied through Sabroe Refrigeration. The typical data of these oils can be found in the *Data Sheet for Sabroe Oils*. We suggest you to use these Sabroe oils, which are delivered in 20 litre pails and 208 litre drums and can be ordered using the parts no. listed in the *List of Oils.*

It is of course possible to use similar oils from other oil companies, and in this connection, the *Data Sheet for Sabroe Oils* may be helpful.

Please note, however, that Sabroe Refrigeration has not tested any other oils than our own brand, and hence we cannot answer for the quality, the stability or the suitability of other oils for any purposes. The oil company in question is thus solely responsible for the quality and suitability of the oil delivered, and if any problems are experienced with these oils in the compressors or in the refrigeration plant, the oil supplier should be contacted directly.

When choosing oils from other oil companies, please pay particular attention to the oil's effectiveness in the compressor and the refrigeration plant as a whole.

Pay particular attention to the following aspects:

- Oil type
- Refrigerant type
- Compressor type
- Miscibility between refrigerant and oil
- Operating data for the compressor
    - Discharge gas temperature
    - Oil temperatures:

Reciprocating compressors:

Normal oil temp. in the crankcase 50-60 °C

Max. permitted oil temperature = Setting point for alarm

Min. permitted oil temperatures = setting point for alarm - if fitted

Screw compressors:

The oil temperature before injection in the compressor, but after the oil cooler

Max. permitted oil temperature = setting point for alarm

Min. permitted oil temperature = setting point for alarm

- Condensing pressure
- Evaporating pressure

- Oil viscosity in the compressor during operation and under the influence of:
    - Refrigerant type and solubility of refrigerant in the oil
    - Operating temperatures
    - Vapour pressure in the oil reservoir

    *Reciprocating compressor:* Suction pressure and oil temperature in the crankcase.

    *Screw compressor:* Discharge pressure and gas temperature.
- Compatibility with the neoprene O-rings: the aniline point gives an indication of how the O-ring material reacts to the oil. At an aniline point less than approximately 100°C the material tends to swell, and at an aniline point higher than approximately 120°C it tends to shrink.

  For this reason it is not recommended to change oil type from M oil to PAO oil as a leakage may occur if the O-rings are not changed. Sabroe Refrigeration therefore recommends using the Sabroe AP68 oil as it reduces the risk of leaks considerably in this case.

Sabroe Refrigeration can supply a calculation showing the operating data on request.

Attention is drawn to the following viscosity limits during operation:

- Optimum viscosity range (to be designed for) = 20 to 50 cSt
- Max. permissible viscosity =100 cSt
- Min. permissible viscosity =10 cSt
  (only applicable to HCFC and HFC under cartain operating conditions: 7cSt)
- Max. permissible viscosity during the starting of the compressor =
  500 cSt

Maximum refrigerant concentration in the oil at running condition: 25% - also if viscosity requirements are met.

## Use of mineral oil

Lately we have experienced a number of problems with mineral oil, particularly in R717 plants. The problems can be divided into two groups:

a. The oil changes viscosity within a few operating hours.

b. The oil decomposes (becomes very black) within a few operating hours.

The problems have been seen with several oil brands and have resulted in severe consequences for both compressors and plants.

When using mineral oil, it is thus important that the plant is monitored very closely, that oil samples are taken regularly (every 1-2,000 hours) and that the condition/colour of the oil is checked on a weekly basis.

Sabroe Refrigeration therefore recommends only to use M oil at moderate operating conditions - cf. the attached oil recommendation diagrams.

Sabroe Refrigeration is aware, however, that several customers have been using mineral oils for many years without problems. Those customers who wish to continue using mineral oils in existing, as well as new, compressors can do so, providing the compressor type and operating conditions are similar to the existing ones (excepting the HPC and HPO series compressors).

Sabroe Refrigeration has therefore decided to market a brand of mineral oil which has been tested and found to be suitable for most general refrigerating purposes.

If another brand of mineral oil is chosen, the specifications in the data sheet in this recommendation should be followed as a guideline.

Mineral oil can be used in refrigerating plants, providing the lubricating quality is carefully monitored. For modern, high capacity refrigeration plants, in which a long lifetime for both lubricant and moving parts is expected,
Sabroe Refrigeration recommends using synthetic lubricating oils.

A benefit of using the synthetic lubricant oil is a much lower oil carry-over to the plant and longer intervals between oil changes. A better fluidity at lower temperatures also gives an easier drainage at the cold parts of the plant.

## How to use the oil recommendation diagrams:

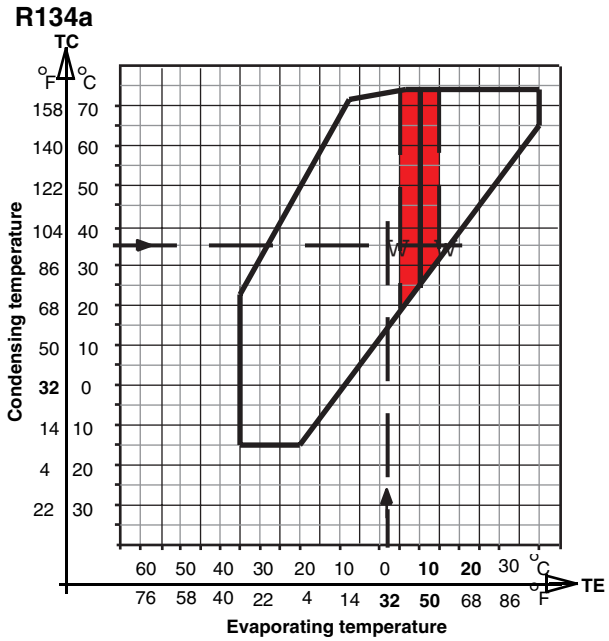
To determine the **code number,** first refer to the *Oil recommendation diagram* for the refrigerant and compressor type and then plot the proposed operating conditions.

**Example (recip. compressors):**

| | | |
|---|---|---|
| Refrigerant: | **R134a** | |
| Condensing temp. | **TC** | **+35°C** |
| Evaporating temp. | **TE** | **-3°C** |

**Note:** *Plants may operate at different conditions from time to time, for example at different evaporating temperatures due to plant variations or at different condensing temperatures due to seasonal changes. By plotting TC and TE in the oil recommendation diagram, this example would require a No 1 oil. If, however, TE changes at certain times, e.g. from -3 to +7°C, a No 2 oil should be utilised. But, as +7°C is inside the marked area, the No 1 oil can be utilised also at this TE.*

*Fig. 1.1*




By referring to the *Oil recommendation table* placed at the bottom of each *oil recommendation diagram*, it is possible to select the **code number** for the appropriate oil type. In the example above, a **oil code number** E5 can be selected.

| Code no | Area no | |
|---|---|---|
| | 1 | 2 |
| E5 | ▲ | |
| E9 | | ▲ |

In plants which incorporate both screw and reciprocating compressors and where the recommendations indicate the use of different oil types, please contact Sabroe Refrigeration for advice.

## Changing oil on Sabroe compressors

The oil should never be changed to another type without consulting the oil supplier. Nor is it advisable to "top up" compressors with an other oil than the one already used for the particular plant and compressor.

Mixing different oils may result in operating problems in the refrigerant plant and damage to the compressors. Incompatibility between the different oil types may degrade the lubricating properties or may cause oil residues to form in the compressor or oil separator or in the plant. These oil residues can block filters and damage the moving parts in the compressor.

Furthermore, changing the oil from one type or make to another should only be undertaken in connection with a careful procedure involving the drainage and thorough evacuation of the refrigeration plant. Information on a suitable procedure can be obtained from Sabroe Refrigeration as well as from a number of oil companies.

It is imperative that oil is only used from the original container and that both the make and type complies with the specification for the plant.

Ensure that the original container is sealed during storage to prevent moisture from the air being absorbed into the oil - many oils, particulary the polyolester oils, are extremely hygroscopic. Consequently, it is recommended that the oil is only purchased in containers corresponding to the amount to be used on each occasion.

If the oil is only partially used, make sure that it is effectively re-sealed in the original container and that it is stored in a warm, dry place. Ideally with nitrogen blanking of the oil to keep the water content below 50 ppm.

Oil drums should, ideally, be "racked" and mounted with a proper barrel tap to ensure an effective airtight seal.

## Oil changing intervals

A list of the recommended intervals for changing the oil can be found in the compressor instruction manual. These are provided for guidance only. The actual interval between oil changes will often be determined by a variety of operating parameters within the plant.

It is strongly recommended to monitor the quality of the oil by carrying out oil analyses with regular intervals. This will also give a good indication of the condition of the plant. The service can be supplied by Sabroe Refrigeration or the oil suppliers.

Oil recommendation diagram symbols:

- ▲ In case of a new plant. Very suitable.
- ☆ In case you wish to change from mineral oil
- Ⓐ Max oil concentration in liquid phase at: $T_E$: 2% W
- Ⓑ Max oil concentration in liquid phase: contact Sabroe Refrigeration
- Ⓒ Min suction temperature -50°C: at TE< -50°C superheating must be introduced.
- * Dry expansion systems only. Flooded systems to be considered individually: contact Sabroe Refrigeration
- SH Suction gas superheat, K (Kelvin)
- ▨ Zone in which both oils are useable
- ▩ Calculation must be performed using COMP1

## Data Sheet for Listed Sabroe Oils

## Typical data for lubricating oils for Sabroe compressors

| Sabroe | Viscosity | | Viscosity | Spec. | Flash p. | Pour p. | Anilin | Acid no. |
|---|---|---|---|---|---|---|---|---|
| code | cSt 40°C | cSt 100°C | Index | grav. at 15°C | COC °C | °C | °C point | mg KOH/g |
| M1 | 63 | 6.4 | 14 | 0.91 | 202 | -36 | 81 | 0.02 |
| A3 | 97 | 8.1 | 13 | 0.86 | 206 | -32 | 78 | 0.05 |
| AP1 | 64 | 9.3 | 121 | 0.858 | 195 | -51 | 121 | 0.04 |
| PAO3 | 66 | 10.1 | 136 | 0.835 | 266 | <-45 | 138 | 0.03 |
| PAO5 | 94 | 13.7 | 147 | 0.838 | 255 | <-45 | 144 | 0.03 |
| PAO9 | 208 | 25 | 149 | 0.846 | 260 | <-39 | 154 | 0.03 |
| E3 | Due to the big difference between polyolester-based lubricants from various suppliers, it is not possible to present typical data for these oils. When using another oil brand than the one recommended by Sabroe Refrigeration, please contact the oil supplier to select the correct oil type. | | | | | | | |
| E5 | | | | | | | | |
| E9 | | | | | | | | |
| E11 | | | | | | | | |
| E85 | | | | | | | | |

The listed data are typical values and are intended as a guideline only when selecting a similar oil from a different oil company. Data equivalence alone does not necessarily qualify the oil for use in Sabroe Refrigeration's Sabroe compressors.

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## List of part numbers for available Sabroe oils

| Oil brand | Oil code no. | Part no. | |
|---|---|---|---|
| | | 20 litre pail | 208 litre pail |
| Mobil Gargoyle Arctic 300 | M1 (M68) | 1231-264 | 1231-296 |
| Sabroe Oil A100 | A3 (A100) | 1231-263 | 1231-262 |
| Sabroe Oil AP68 | AP1 (AP68) | 1231-257 | 1231-260 |
| Sabroe Oil PAO68 | PAO3 (P68) | 1231-256 | 1231-259 |
| Mobil Gargoyle Arctic SHC 228 | PAO5 (P100) | 1231-282 | 1231-283 |
| Mobil Gargoyle Arctic SHC 230 | PAO9 (P220) | 1231-284 | 1231-285 |
| Mobil EAL Arctic 68 | E3 (E68) | 1231-272 | 1231-273 |
| Mobil EAL Arctic 100 | E5 (E100) | 1231-274 | 1231-275 |
| Mobil EAL Arctic 220 | E9 (E220) | | 1231-279 |
| Sabroe H oil | E11 (E370) | 3914 1512 954 (a) | 9415 0008 000 |
| FUCHS DEA Reniso C85E | E85 (85) | 1231-304 2) | |

a) 18.9 litre pail (5 US gallons)

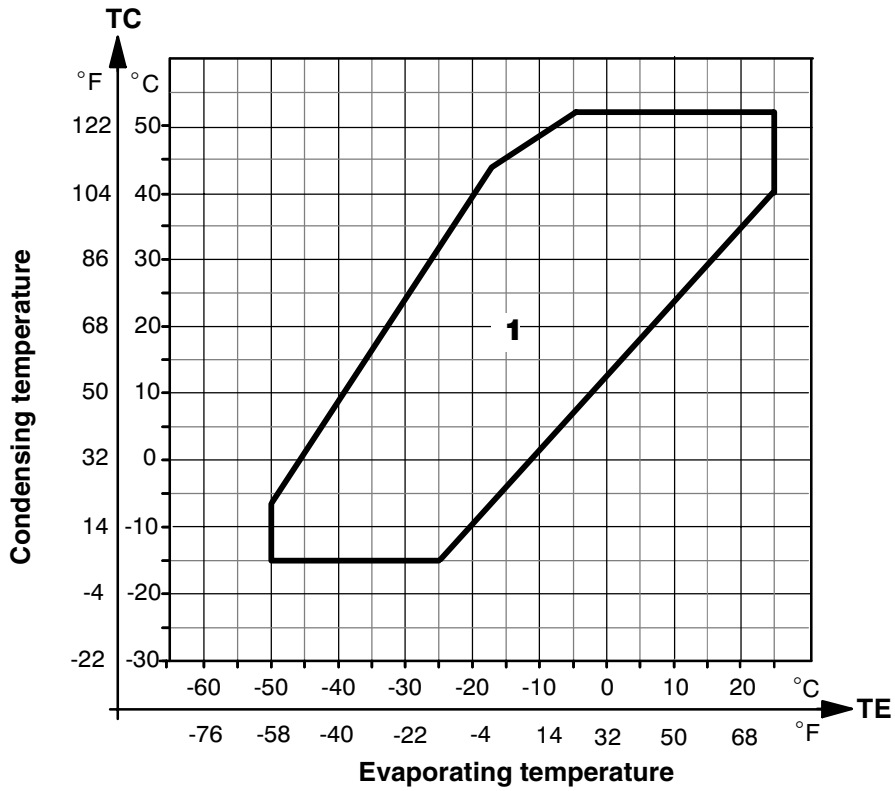
2) 10 litre

The oils recommended by the former Stal Refrigeration correspond to the following oils:

| Stal Refrigeration oil type | Sabroe oil |
|---|---|
| **A** | Mobil Gargoyle Arctic 300 - M1 (M68) |
| **B** | Sabroe Oil PAO 68 - PAO 3 (PAO 68) |
| **C** | Mobil Gargoyle Arctic SHC 230 - PAO 9 (PAO 220) |
| **H** | Sabroe H oil - E 11 (E 370) |

# R717

**single-stage reciprocating compressor**



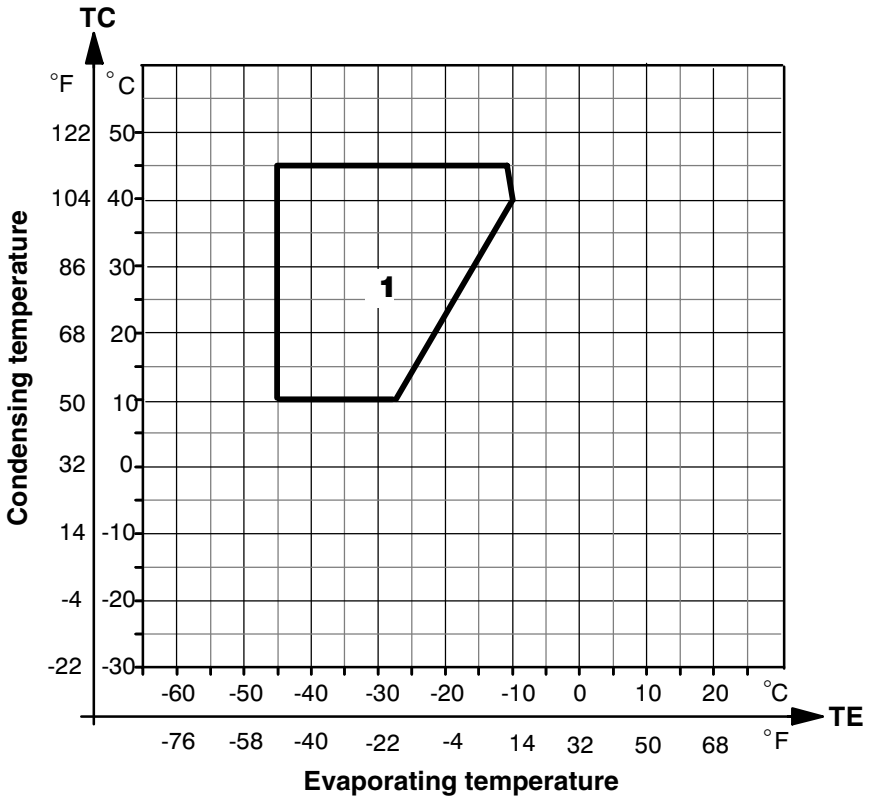

| Code no | Area no 1 |
|---|---|
| PAO 3 | ▲ |
| AP 1 | ☆/▲ |
| M1 | See note |

**Note:** Sabroe Refrigeration recommends that the use of M oil is restricted to moderately loaded compressors and that the oil quality is monitored carefully via regular oil analyses.

▲: Very suitable in case of a new plant.
☆: In case you wish to change from mineral oil.

# R717

**two-stage reciprocating compressors**



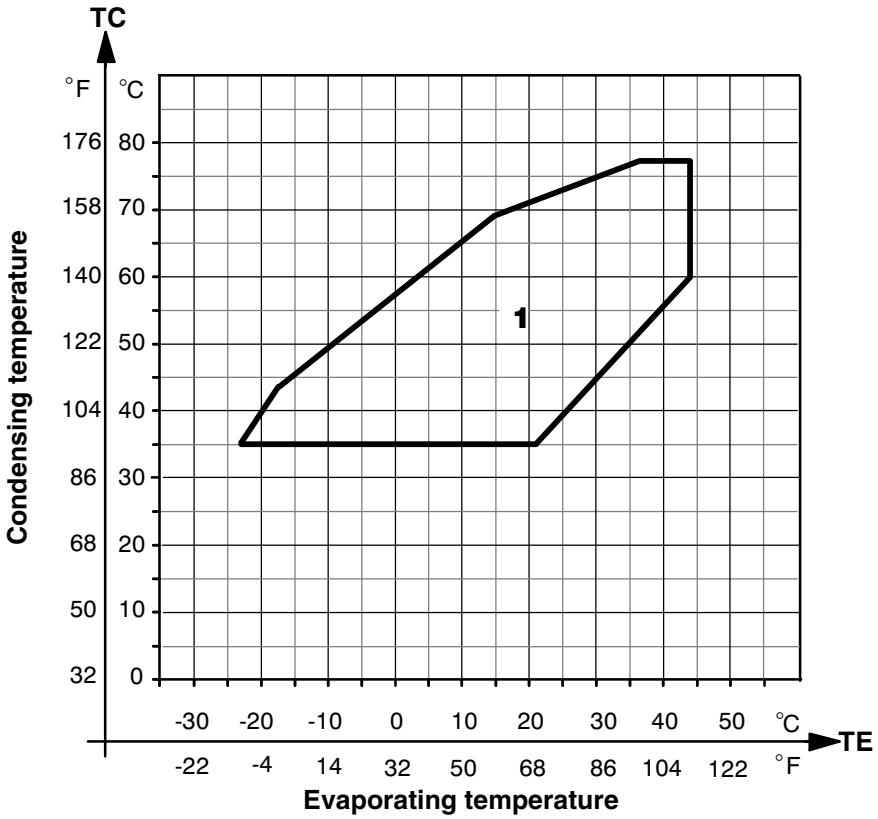

| Code no | Area no 1 |
|---|---|
| PAO 3 | ▲ |
| AP 1 | ☆/▲ |
| M1 | See note |

**Note:** Sabroe Refrigeration recommends that the use of M oil is restricted to moderately loaded compressors and that the oil quality is monitored carefully via regular oil analyses.

▲: Very suitable in case of a new plant.
☆: In case you wish to change from mineral oil.

# R717

**HPO and HPC reciprocating compressors**




| Code no | Area no 1 |
|---|---|
| PAO 5 | ▲ |

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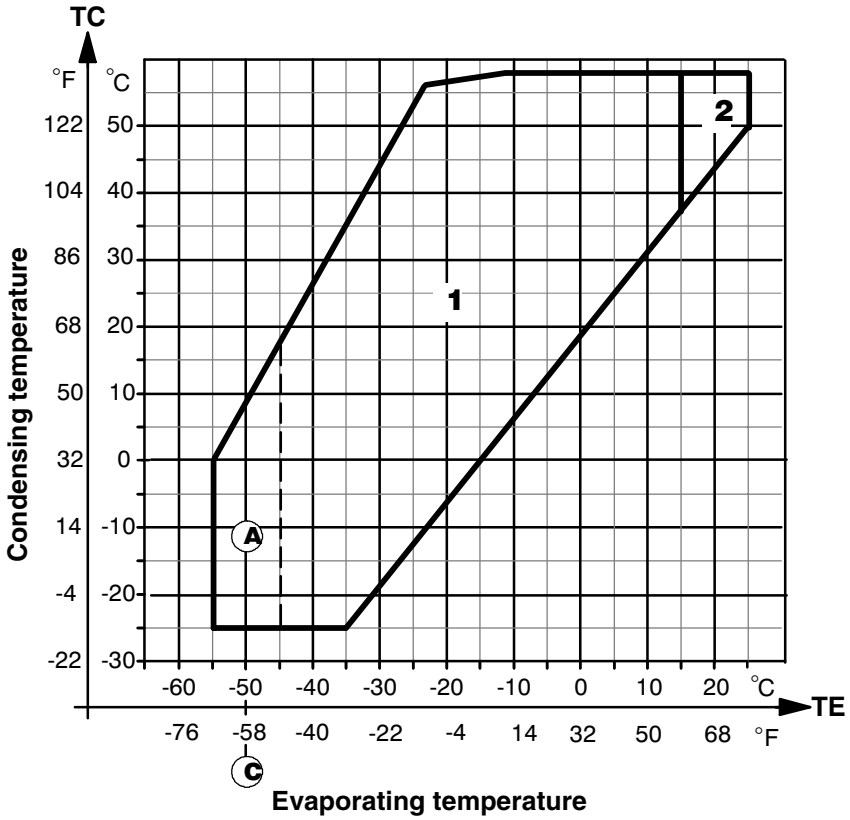
**Note:** Please observe: PAO 5 oil is the only oil which can be used in the HPO and HPC compressors

▲: Very suitable in case of a new plant.

# R22

**single-stage reciprocating compressors**

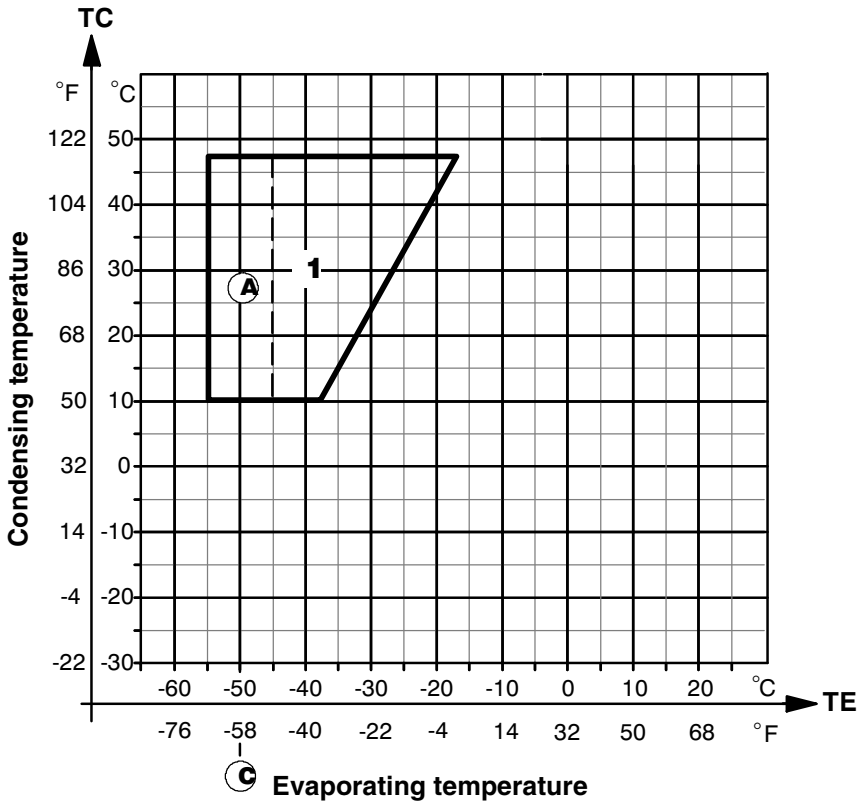



| Code no | Area no 1 |
|---|---|
| A 3 | ▲ |

▲: Very suitable in case of a new plant.
Ⓐ: Max oil concentration in liquid phase at TE: 2% W.
Ⓒ: Min suction temperature -50°C. At TE<-50°C superheating must be introduced.

# R22

**two-stage reciprocating compressors**




| Code no | Area no 1 |
|---|---|
| A 3 | ▲ |

▲: Very suitable in case of a new plant.
Ⓐ: Max oil concentration in liquid phase at TE: 2% W.
Ⓒ: Min suction temperature -50°C. At TE<-50°C superheating must be introduced.

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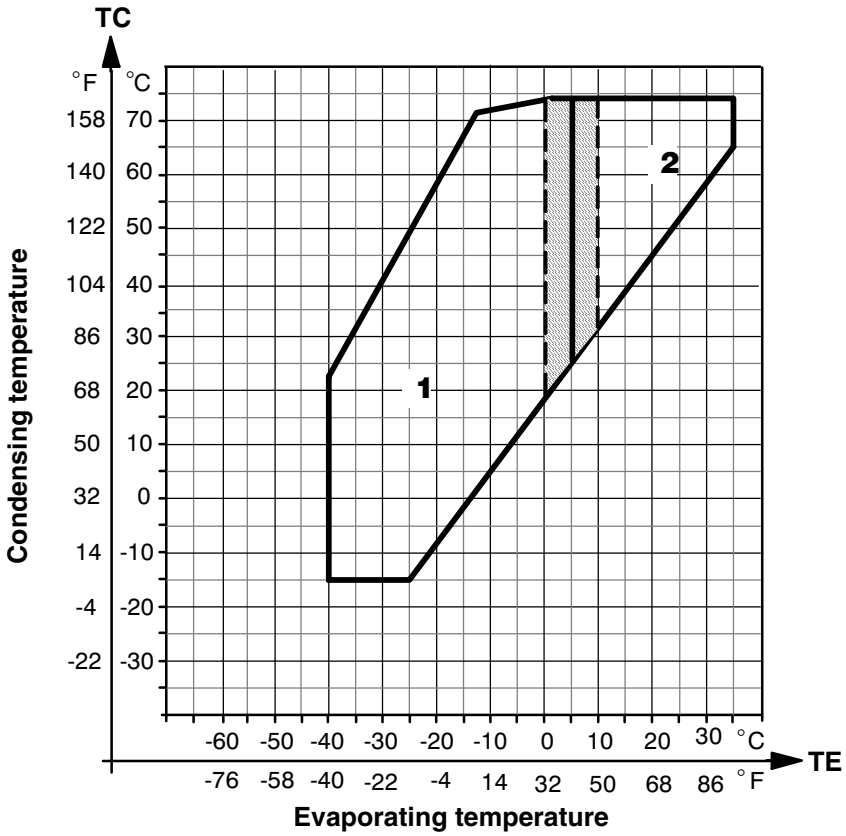
# R134a

**single-stage reciprocating compressors**

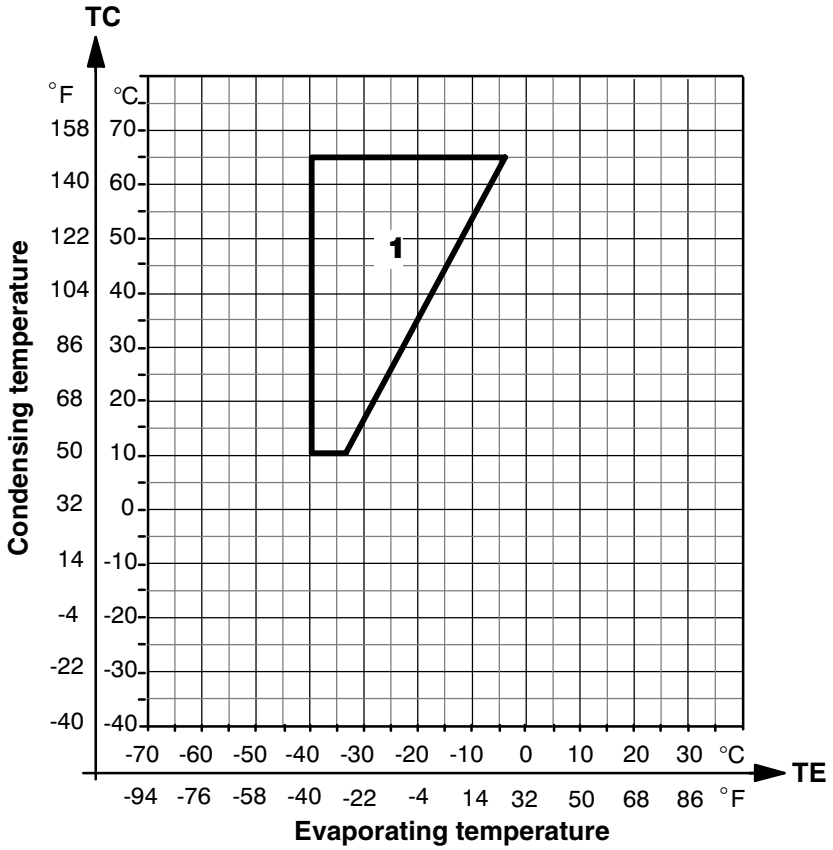



| Code no | Area no | |
|---|---|---|
| | 1 | 2 |
| E 5 | ▲ | |
| E 9 | | ▲ |

▲: Very suitable in case of a new plant.
▨: Zone in which both oils are applicable.:

# R134a

**two-stage reciprocating compressors**

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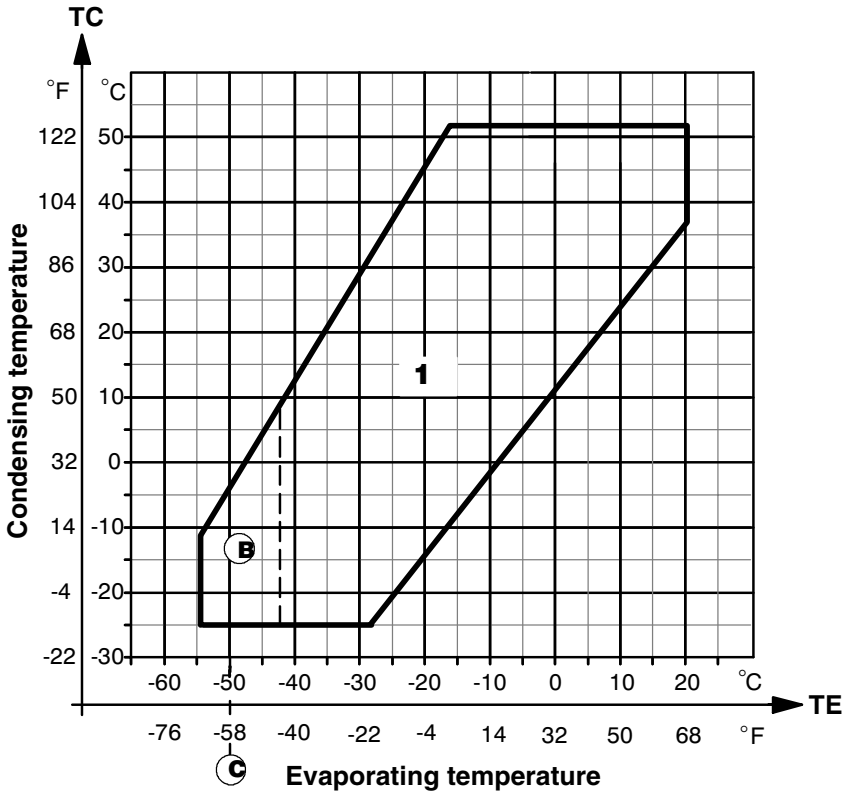
| Code no | Area no 1 |
|---|---|
| E 5 | ▲ |

▲: Very suitable in case of a new plant.

# R407C

**single-stage reciprocating compressors**




| Code no | Area no |
|---|---|
| | 1 |
| E 3 | ▲ |

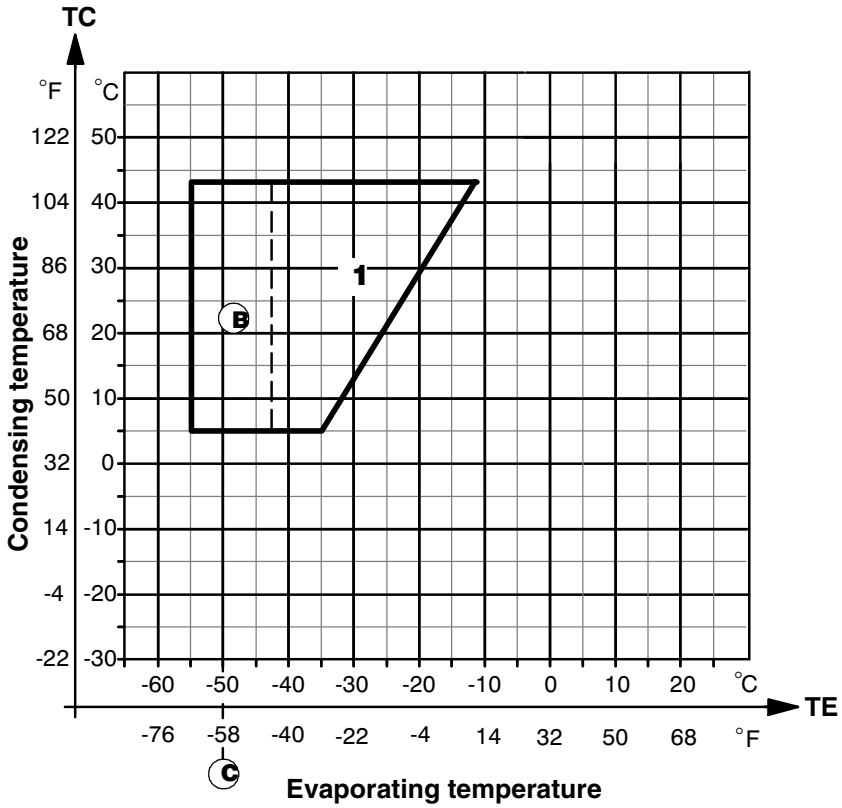
▲: : Very suitable in case of a new plant.

Ⓑ: Max oil concentration in liquid phase: contact Sabroe Refrigeration

Ⓒ: Min suction temperature -50°C. At TE<-50°C superheating must be introduced.

# R407C

**two-stage reciprocating compressors**

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| Code no | Area no 1 |
|---|---|
| E 3 | ▲ |

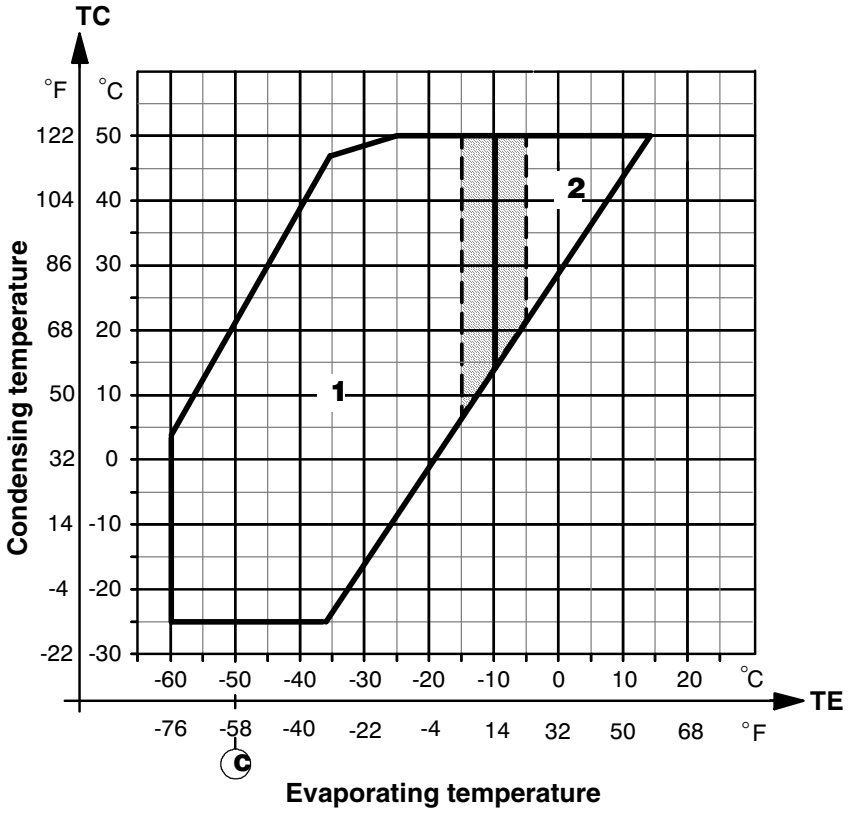
▲: : Very suitable in case of a new plant.

Ⓑ: Max oil concentration in liquid phase: contact Sabroe Refrigeration

Ⓒ: Min suction temperature -50°C. At TE<-50°C superheating must be introduced.

# R404A

**single-stage reciprocating compressors**




| Code no | Area no | |
|---|---|---|
| | 1 | 2 |
| E 3 | ▲ | |
| E 5 | | ▲ |

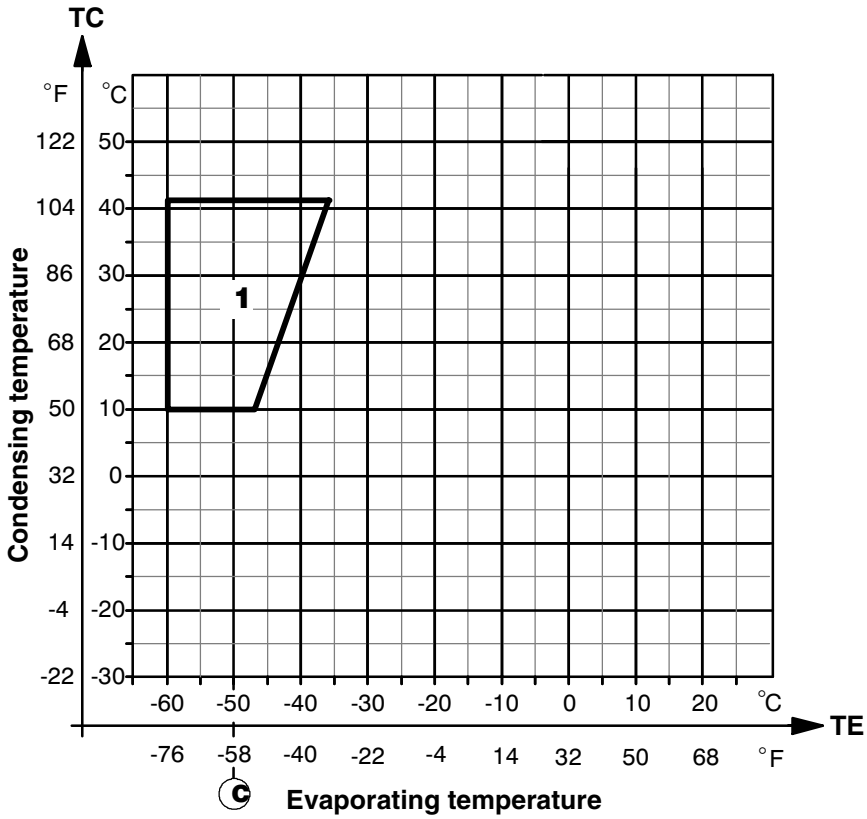
▲: : Very suitable in case of a new plant.

Ⓒ: Min suction temperature -50°C. At TE<-50°C superheating must be introduced

▨: Zone in which both oils are applicable.

# R404A

**two-stage reciprocating compressors**

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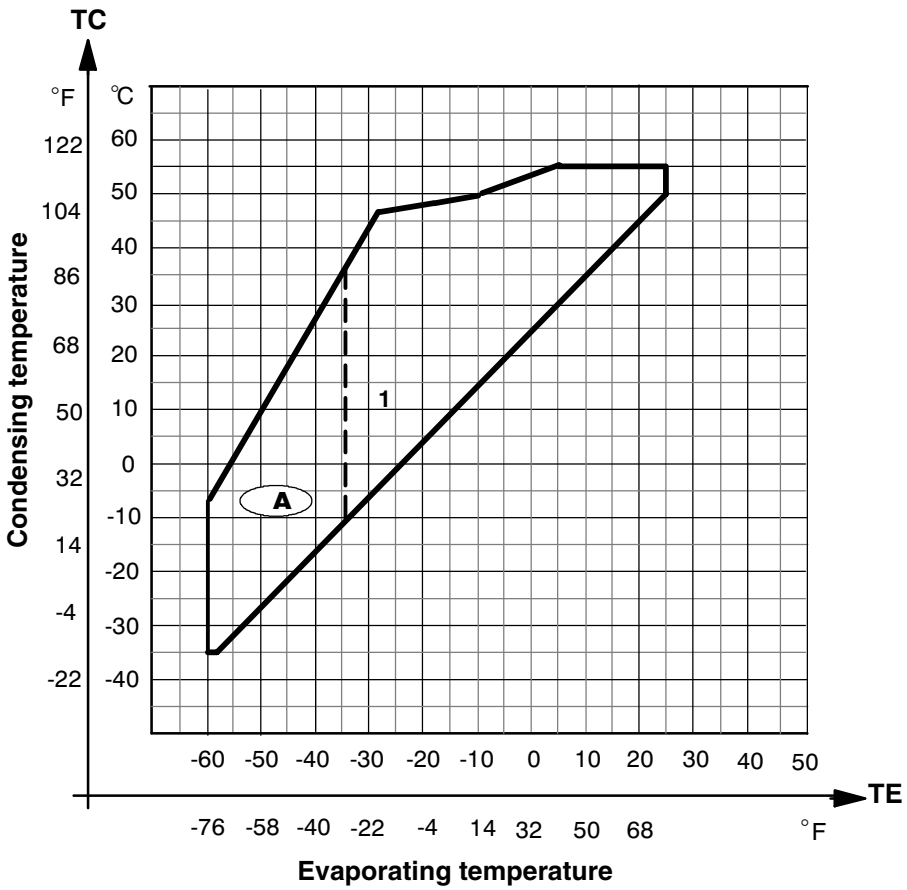
| Code no | Area no 1 |
|---|---|
| E 3 | ▲ |

▲: : Very suitable in case of a new plant.

Ⓒ: Min suction temperature -50°C. At TE<-50°C superheating must be introduced.

# R410A

**HPO and HPC reciprocating compressors**



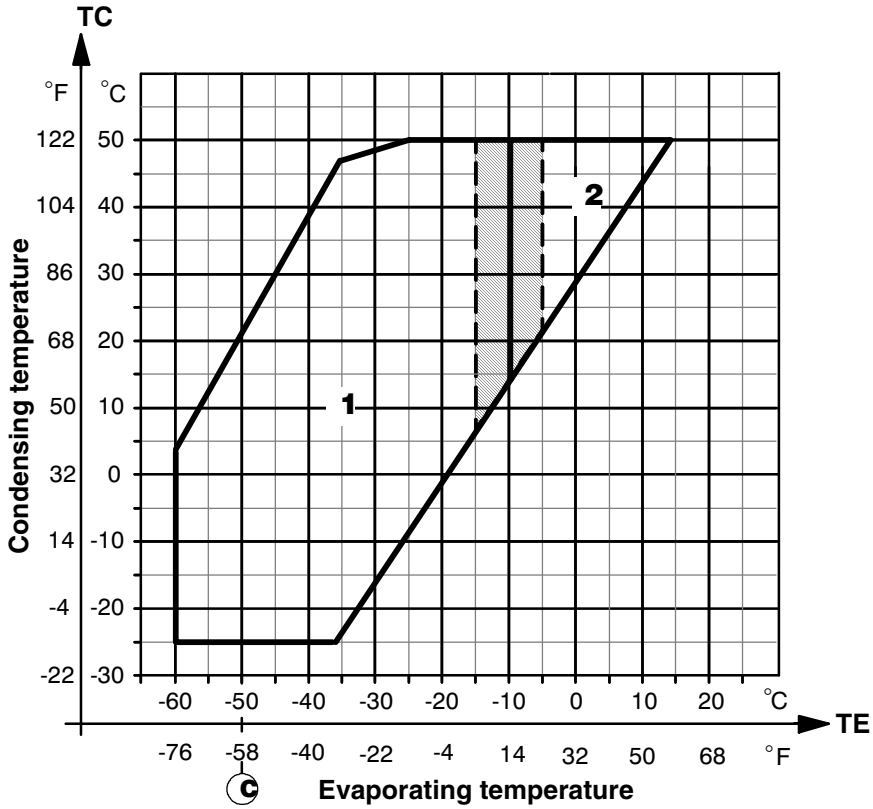

| Code no | Area no 1 |
|---|---|
| E 5 | ▲ |

▲: : Very suitable in case of a new plant.

Ⓐ: Max oil concentration in liquid phase at: TE: 2%W

# R507

**single-stage reciprocating compressors**

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| Code no | Area no | |
|---|---|---|
| | 1 | 2 |
| E 3 | ▲ | |
| E 5 | | ▲ |

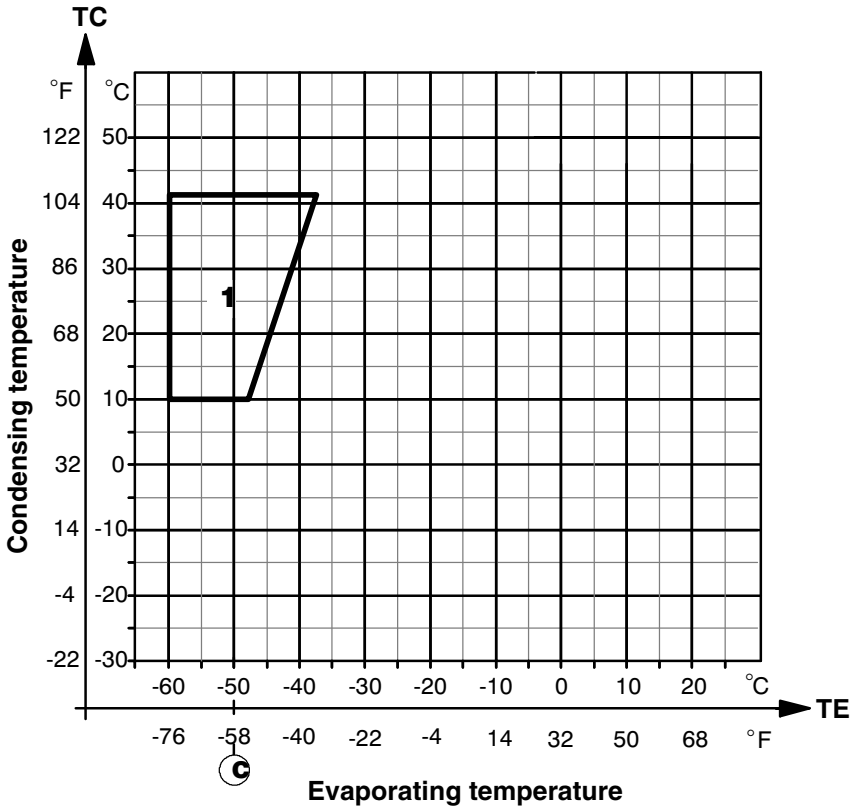
▲: : Very suitable in case of a new plant.

Ⓒ: Min suction temperature -50°C. At TE<-50°C superheating must be introduced.

▨: Zone in which both oils are applicable.

# R507

**two-stage reciprocating compressors**



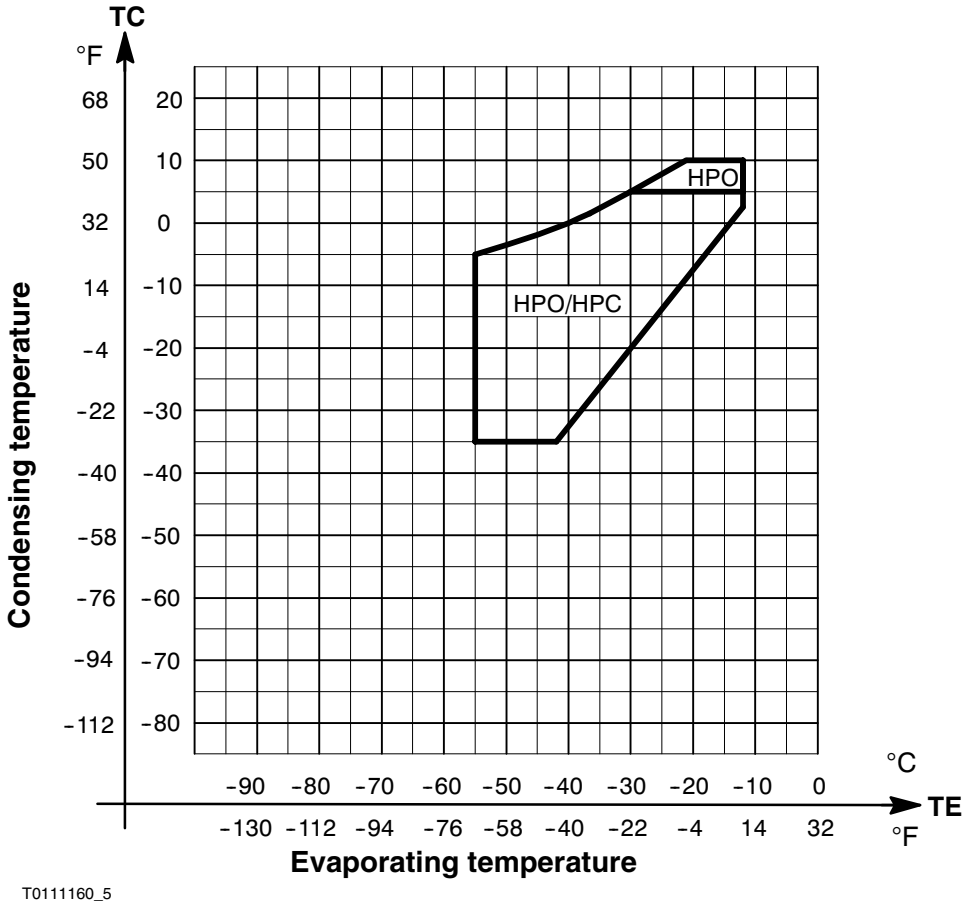

| Code no | Area no 1 |
|---|---|
| E 5 | ▲ |

▲: : Very suitable in case of a new plant.

Ⓒ: Min suction temperature -50°C. At TE<-50°C superheating must be introduced.

# R744

**single-stage**
**reciprocating**
**compressor**

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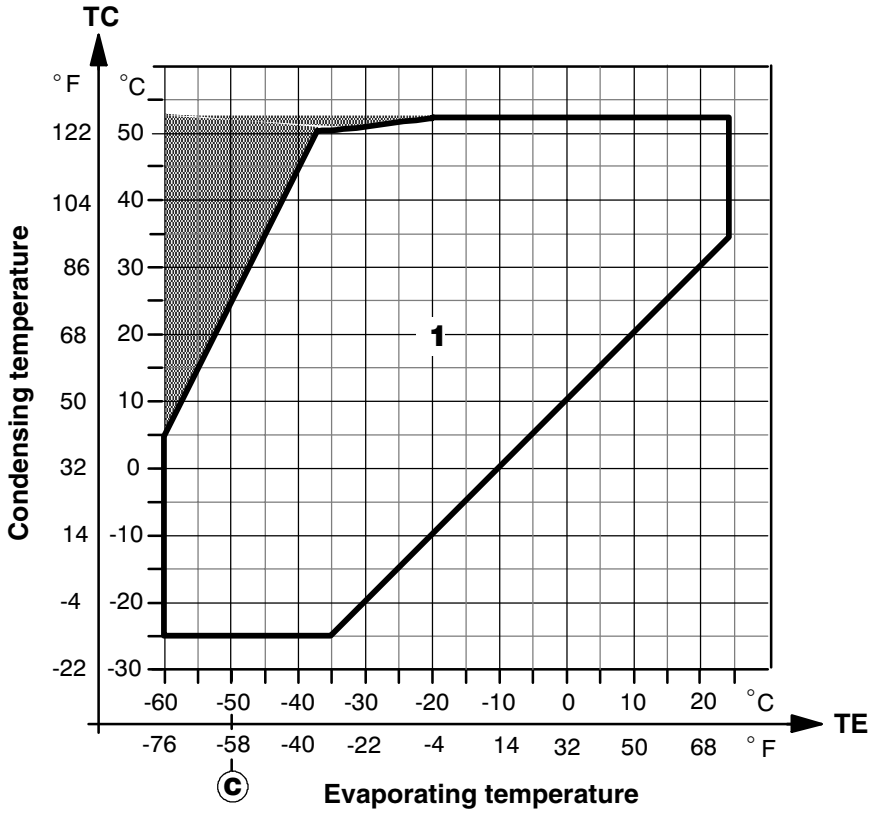
| Code no | Area no 1 |
|---|---|
| E 85 | ▲ |

▲: Very suitable in case of a new plant.

# R717

**screw compressors**

| Code no. | Area no. 1 |
|---|---|
| PAO3 | ▲ |
| AP1 | ☆/▲ |
| M1 | See **note** |




**Note:** Sabroe Refrigeration recommends that the use of M oils is resticted to moderately loaded compressors and that the oil quality is monitored carefully via regular oil analyses

HLI: Calculation must be performed using COMP1.

▲: In case of a new plant. Very suitable.

☆: Max oil concentration in liquid phase: contact Sabroe Refrigeration.

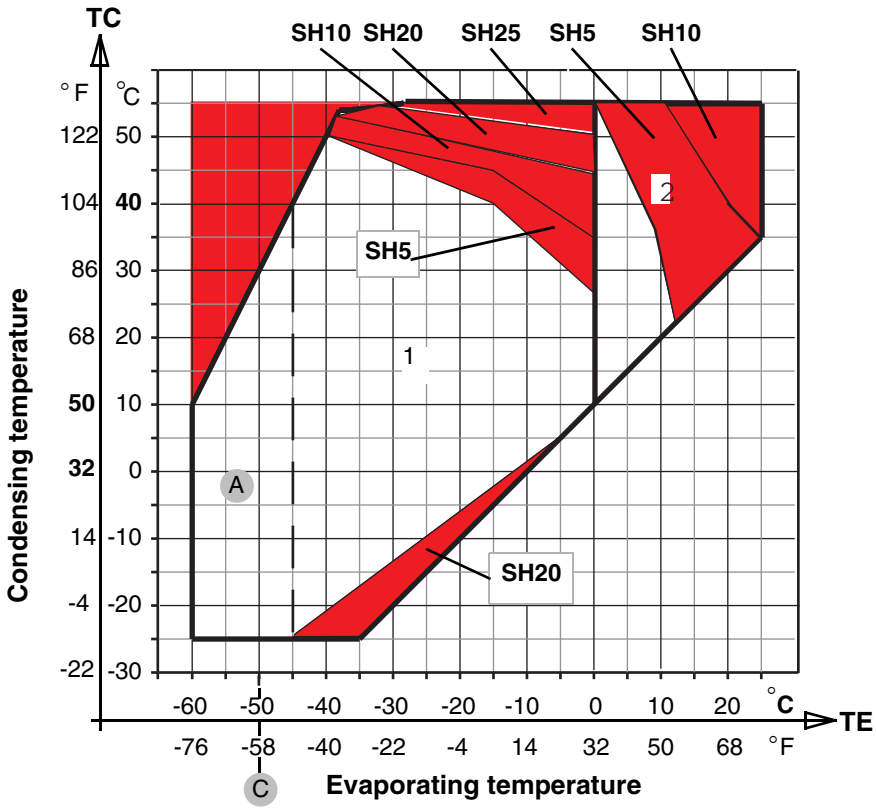
C Min suction temperature -50°C: at TE< -50°C superheating must be introduced.

Suction gas superheat, K (Kelvin).

# R22

**screw compressors with journal bearings or roller bearings**

| Code no | Area no | |
|---|---|---|
| | 1 | 2* |
| A3 | ▲ | |
| PAO 5 | | ▲ |




Using the calculating programme COMP1 it is possible to optimize the requirement for suction superheat values (SH) as stated in the diagram. See *Oil types and oil companies* in this section. Due to the ongoing development of lubrication oils, please contact Sabroe Refrigeration for an update on the requirement for superheat.

HLI: Calculation must be performed using COMP1.

▲: In case of a new plant. Very suitable.

Ⓐ: Max oil concentration in liquid phase at: $T_E$: 2% W

Ⓒ: Min suction temperature -50°C: at TE< -50°C superheating must be introduced.

* : Dry expansion systems only. Flooded systems to be considered individually: contact Sabroe Refrigeration

SH: Suction gas superheat, K (Kelvin)

Calculation must be performed using COMP1

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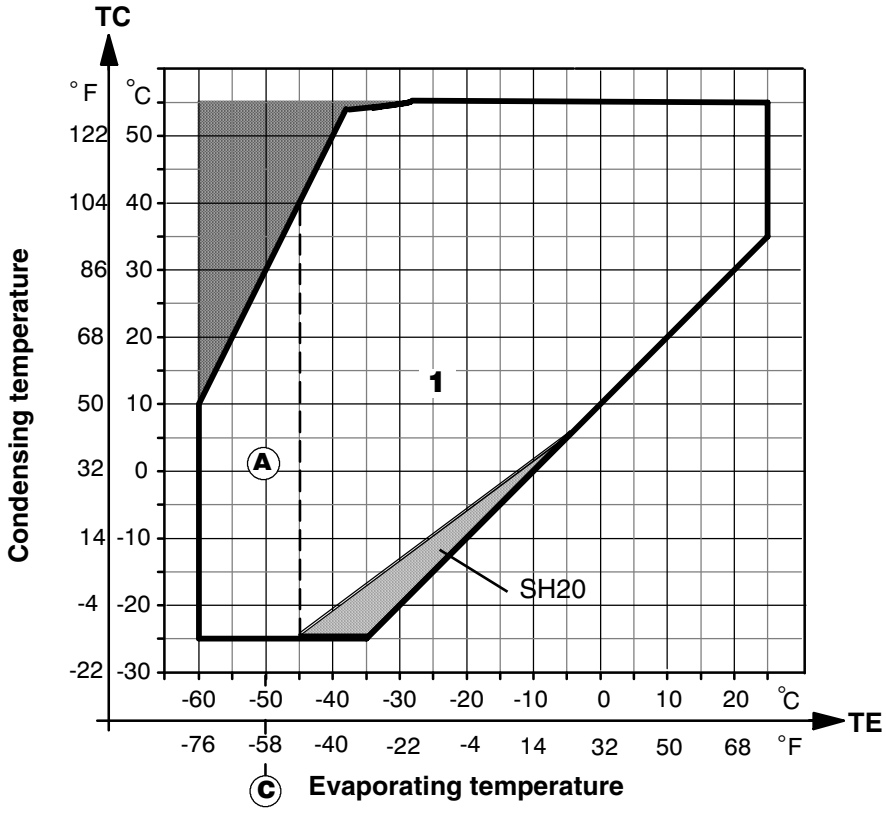
# R22

**screw compressors**
**with roller bearings only**




| Code no | Area no 1 |
|---|---|
| A3 | ▲ |

Using the calculating programme COMP1 it is possible to optimize the requirement for suction superheat values (SH) as stated in the diagram. See *Oil types and oil companies* in this section. Due to the ongoing development of lubrication oils, please contact Sabroe Refrigeration for an update on the requirement for superheat.

**HLI: Calculation must be performed using COMP1.**

▲: In case of a new plant. Very suitable.

Ⓐ: Max oil concentration in liquid phase at: $T_E$: 2% W

Ⓒ: Min suction temperature -50°C: at TE< -50°C superheating must be introduced.

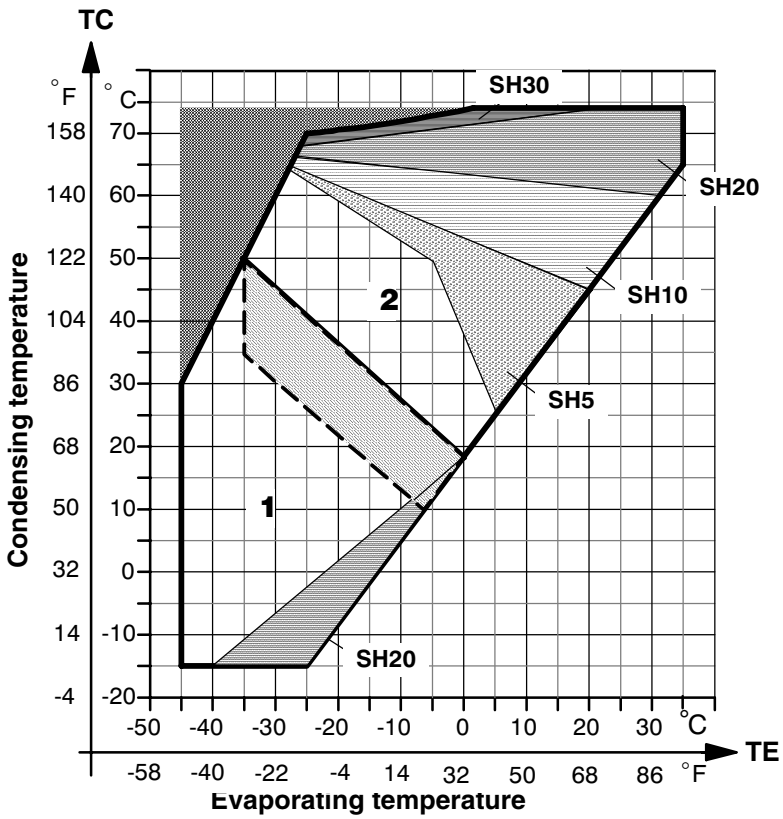
* Dry expansion systems only. Flooded systems to be considered individually: contact Sabroe Refrigeration

SH: Suction gas superheat, K (Kelvin)

▒: Calculation must be performed using COMP1

# R134a

**screw compressors**




| Code no | Area no (See note) | |
|---|---|---|
| | 1 | 2 |
| E5 | ▲ | |
| E9 | | ▲ |

Note: For the compressors type "S", "Rotatune", "SAB81", "SAB83", and "SAB85" only Sabroe oil H is approved.

Using the calculating programme COMP1 it is possible to optimize the requirement for suction superheat values (SH) as stated in the diagram. See *Oil types and oil companies* in this section. Due to the ongoing development of lubrication oils, please contact Sabroe Refrigeration for an update on the requirement for superheat.

HLI : Calculations must be performed using COMP1.

▲ : In case of a new plant. Very suitable.

SH : Suction gas superheat, K (Kelvin)

: Zone in which both oils are useable

: Calculation must be performed using COMP1

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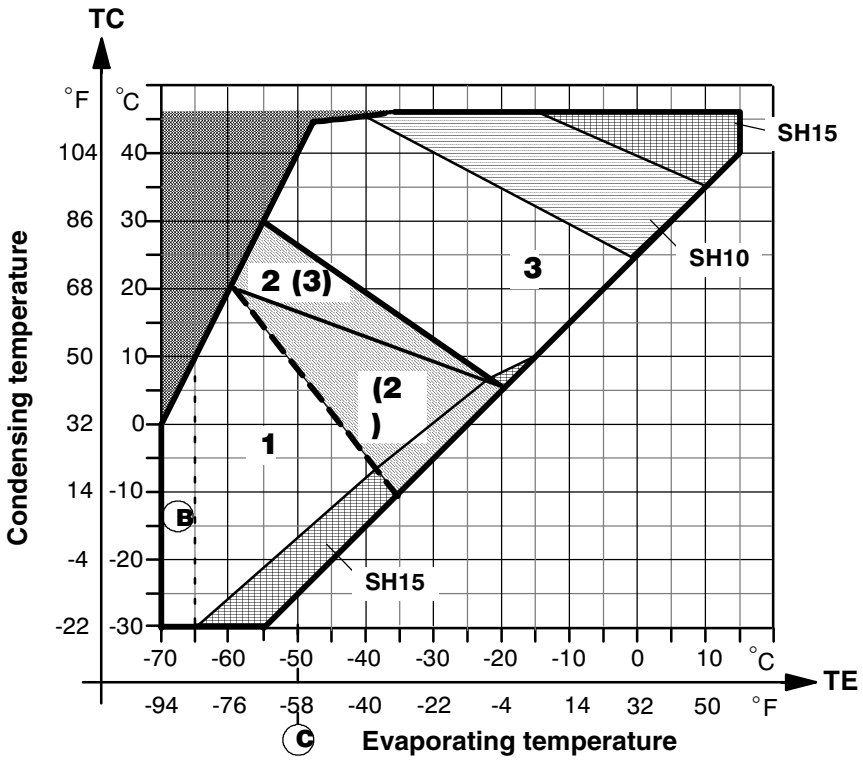
# R404A

**screw compressors**




| Code no | Area no (See note) | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| E3 | ▲ | | |
| E5 | | ▲ | |
| E9 | | | ▲ |

Note: For the compressors type "S", "Rotatune", "SAB81", "SAB83", and "SAB85" only Sabroe oil H is approved.

Using the calculating programme COMP1 it is possible to optimize the requirement for suction superheat values (SH) as stated in the diagram. See *Oil types and oil companies* in this section. Due to the ongoing development of lubrication oils, please contact Sabroe Refrigeration for an update on the requirement for superheat.

HLI : Calculation must be performed using COMP1.

▲ : In case of a new plant. Very suitable.

Ⓑ : Max oil concentration in liquid phase: contact Sabroe Refrigeration

Ⓒ : Min suction temperature -50°C: at TE< -50°C superheating must be introduced.

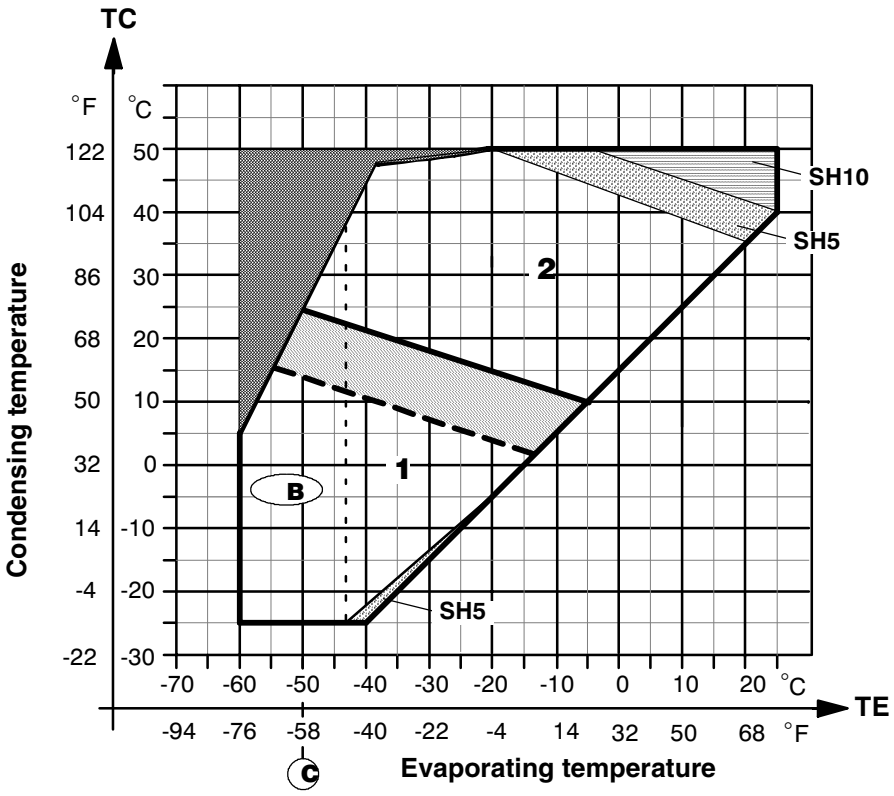
SH : Suction gas superheat, K (Kelvin)

: Zone in which both oils are useable

: Calculation must be performed using COMP1

# R407C

**screw compressors**




| Code no | Area no (See note) | |
|---|---|---|
| | 1 | 2 |
| E3 | ▲ | |
| E9 | | ▲ |

Note: For the compressors type "S", "Rotatune", "SAB81", "SAB83", and "SAB85" only Sabroe oil H is approved.

Using the calculating programme COMP1 it is possible to optimize the requirement for suction superheat values (SH) as stated in the diagram. See *Oil types and oil companies* in this section. Due to the ongoing development of lubrication oils, please contact Sabroe Refrigeration for an update on the requirement for superheat.

HLI : Calculation must be performed using COMP1.

▲ : In case of a new plant. Very suitable.

Ⓑ : Max oil concentration in liquid phase: contact Sabroe Refrigeration

Ⓒ : Min suction temperature -50°C: at TE< -50°C superheating must be introduced.

SH : Suction gas superheat, K (Kelvin)

: Zone in which both oils are useable

: Calculation must be performed using COMP1

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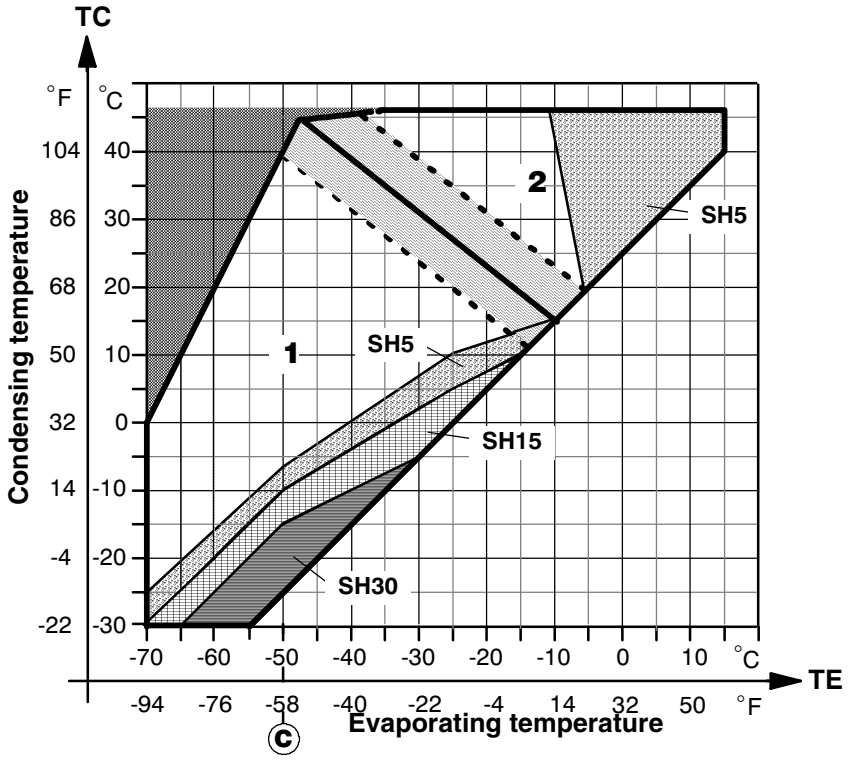
# R507

**screw compressors**




| Code no | Area no (See note) | |
|---|---|---|
| | 1 | 2 |
| E5 | ▲ | |
| E9 | | ▲ |

Note: For the compressors type "S", "Rotatune", "SAB81", "SAB83", and "SAB85" only Sabroe oil H is approved.

Using the calculating programme COMP1 it is possible to optimize the requirement for suction superheat values (SH) as stated in the diagram. See *Oil types and oil companies* in this section. Due to the ongoing development of lubrication oils, please contact Sabroe Refrigeration for an update on the requirement for superheat.

HLI : Calculation must be performed using COMP1.

▲ : In case of a new plant. Very suitable.

Ⓒ : Min suction temperature -50°C: at TE< -50°C superheating must be introduced.

SH : Suction gas superheat, K (Kelvin)

: Zone in which both oils are useable

: Calculation must be performed using COMP1

## List of Major Oil Companies

The oil from the companies listed below are NOT tested by Sabroe Refrigeration and are therefore NOT approved by Sabroe Refrigeration either. The following list reflects the information provided by the companies themselves. The assessment of durability and suitability of specific oils for specific purposes are entirely at the companies' own discretion. Oils tested and approved by Sabroe Refrigeration can be found in the *"List of part numbers for available Sabroe oils"*.

| Oil Company | Oil Types | | | | |
|---|---|---|---|---|---|
| | M | A | PAO | AP | E |
| Aral | • | | | | • |
| Avia | • | | | | |
| BP | • | • | • | | • |
| Castrol | • | • | • | | • |
| Chevron (UK: Gulf Oil) | • | | • | | • |
| CPI Engineering Services | • | | • | | • |
| DEA | • | • | • | | • |
| Elf / Lub Marine 1 | • | • | | | • |
| Esso/Exxon | • | • | • | | |
| Fina | • | • | | | • |
| Fuchs | • | • | • | | • |
| Hydro-Texaco | • | • | • | | • |
| ICI | | | | | • |
| Kuwait Petroleum (Q8) | • | | | • | |
| Mobil | • | • | • | • | • |
| Petro-Canada | • | | | | |
| Shell | • | • | • | | • |
| Statoil | • | • | | | |
| Sun Oil | • | | | | • |