Table of contents

1 Introduction

BITZER compressors are charged with a high-quality refrigeration compressor oil, suitable for the refrigerant used. These BITZER oils are subject to the BITZER quality management and are optimized for the respective compressors. Their chemical compatibility also with modern construction materials and new refrigerants has been extensively tested and approved. The oils offer outstanding lubrication characteristics and a favourable viscosity performance (high viscosity index).

In addition to this document, please also observe the operating instructions for the respective compressor.

2 Safety references

Authorized staff

All work done on the products and the systems in which they are or will be installed may only be performed by qualified and authorised staff who have been trained and instructed in all work. The qualification and competence of the qualified staff must correspond to the local regulations and guidelines.

Residual risks

The products, electronic accessories and further system components may present unavoidable residual risks. Therefore, any person working on it must carefully read this document! The following are mandatory:

- relevant safety regulations and standards
- generally accepted safety rules
- EU directives
- national regulations and safety standards

Depending on the country, different standards are applied when installing the product, for example: EN378, EN60204, EN60335, EN ISO14120, ISO5149, IEC60204, IEC60335, ASHRAE 15, NEC, UL standards.

Personal protective equipment

When working on systems and their components: Wear protective work shoes, protective clothing and safety goggles. In addition, wear cold-protective gloves when working on the open refrigeration circuit and on components that may contain refrigerant.

Fig. 1: Wear personal protective equipment!

Safety references

Safety references are instructions intended to prevent hazards. They must be stringently observed!

NOTICE
Safety reference to avoid situations which may result in damage to a device or its equipment.

CAUTION
Safety reference to avoid a potentially hazardous situation which may result in minor or moderate injury.

WARNING
Safety reference to avoid a potentially hazardous situation which could result in death or serious injury.

DANGER
Safety reference to avoid an imminently hazardous situation which may result in death or serious injury.

Concerning refrigeration compressor oils in general:

CAUTION
Oils may be harmful!
Observe the usual precautions for handling mineral oils and chemical products as well as good industrial hygiene practices.

- Provide adequate ventilation.
- Prevent formation of aerosols.
- Avoid skin contact.
- Wear required personal protective equipment (see respective material safety data sheet).
- Do not eat, drink or smoke when working with the product.
- Do not heat up the oil to temperatures close to its flash point.

First aid measures:

- Remove any clothing and shoes soiled by the product.
- In case of skin contact: wash carefully with soap and water.
- In case of eye contact: promptly wash eyes with plenty of water.
- In case of ingestion: rinse mouth thoroughly and get medical attention if necessary.
- In case of persistent symptoms: seek medical attention.

NOTICE
Fire hazard!
The used oil contains a relatively large amount of dissolved refrigerant.
Pack used oil safely. Dispose of in an environmentally friendly manner.

Hydrocarbons, for example propane, R290 or propene, R1270 and low-fluorinated flammable refrigerants, for example R1234yf, dissolve very well in refrigeration compressor oil at room temperature. This also applies to blends containing these substances.

Used oil from such systems may still contain relatively high percentages of dissolved flammable gases even at atmospheric pressure. These components gas out.

Observe during storage and transport:

- Fill used oil into pressure resistant vessels.
- Fill vessels with nitrogen as a protective gas and close them.
- Mark them, e. g. with the warning sign "flammable substance" W021 from ISO7010.

CAUTION
Oils may be environmentally hazardous and water-endangering!
Avoid release to the environment, do not allow to enter drainage system, surface or ground water.
Correctly dispose of the oil as pollutive waste, oberserve national and local regulations.

Material safety data sheets

Apart from this document, please observe the material safety data sheet (MSDS) for the respective oil. It contains information on toxicity, handling, personal protective equipment and disposal of the oil. Material safety data sheets for all BITZER oils are available *on request*.

When working on the refrigeration system:

CAUTION
Surface temperatures of more than 60°C or below 0°C.
Risk of burns or frostbite.
Close off accessible areas and mark them.
Before performing any work on the compressor: switch it off and let it cool down or warm up.

In addition to the safety references listed in this document, it is essential to observe the references and residual risks in the respective operating instructions!

3 General properties of refrigeration compressor oils

Refrigeration compressor oils not only have to lubricate the moving compressor parts, but (according to individual design and circuit) also seal the compression chamber and valves as well as dissipate heat. In order to ensure oil circulation and return from the system as well as to avoid lack of oil, the oil must be sufficiently soluble in the refrigerant (exception: R717 - ammonia, see Technical Information *AT-640*): Phase separation can lead to malfunctions e.g. in the evaporator, receiver and heat exchanger. Another important parameter is the viscosity over the whole temperature range: In the compressor, the oil must be adequately viscous, while still flowing sufficiently in the cold part of the system. In addition, the oil should be age-resistant, thermally and chemically stable.

NOTICE
Oil with high water content may damage compressor and refrigeration system!
Avoid air intake into the system and oil containers.
Use only originally sealed oil containers. Opened oil containers should be closed tightly and their content be used up as quickly as possible.
For used oils: Observe the warning values on water content.

Water in the refrigerating circuit can lead to corrosion and to freezing of the expansion valve. It adversely affects lubricity and stability of the oils. With some refrigerants (e.g. CO_2) or oils (e.g. ester oils), water also reacts by forming acids – the acid in turn corrodes metal surfaces, and the water cannot be removed anymore by evacuation. Special care is necessary with polyalkylene glycol oils (PAG), polyvinyl ether oils (PVE) and polyolester oils (POE): They are strongly hygroscopic, i.e. they withdraw water from ambient air. This dissolves in the oil and can therefore not be recognised visually.

4 Oils for BITZER scroll compressors

Characterising the oils

Oil	Oil type	Applications	Designation on compressor
BSE35K	polyolester oil (POE)	oil charge for ESH7	"Y" (e.g. ESH730BY)
BSE55	polyolester oil (POE)	oil charge for ELA, ELH, ELV	"Y" (e.g. ELV5243Y)
BVC32	polyvinyl ether oil (PVE)	oil charge for ORBIT	"V" (e.g. GSD60154VAB)
BSG68K	polyalkylene glycol oil (PAG)	oil charge for ORBIT with refrigerant R290 (propane)	"Z" (e.g. GSP60235ZL)

Tab. 1: BITZER oils for scroll compressors

NOTICE
Risk of compressor damage!
BITZER scroll compressors may only be operated with the indicated original BITZER oils!

Low GWP refrigerants: stricter requirements for refrigeration systems

Many refrigerant blends with low global warming potential (GWP) such as R452B and R454B contain the unsaturated compound R1234yf. This is highly soluble in oil and leads to a strong reduction of viscosity. Therefore, sufficient superheat has to be ensured! The low chemical stability (which is desirable for a low GWP) requires particular care regarding cleanliness, dryness and evacuation of the refrigerant circuit.

Material safety data sheets

Apart from this document, please observe the material safety data sheet (MSDS) for the respective oil. It contains information on toxicity, handling, personal protective equipment and disposal of the oil. Material safety data sheets for all BITZER oils are available *on request*.

Application range

Oil	compressor series	suitable e.g. for refrigerants	Application range
BSE35K	ESH7	R134a R404A R407C R507A	air conditioning, heat pumps, process cooling
BSE55	ELA, ELH, ELV	R134a R407C R513A	transport (cooling, air conditioning, heat pumps)
BVC32	ORBIT series (GSD / GSU / GED)	R410A R32 R452B R454B	air conditioning, heat pumps, process cooling
BSG68K	ORBIT series (GSP)	R290 R1270	air conditioning, heat pumps, process cooling

Tab. 2: Application range of oils in BITZER scroll compressors. For application limits see also BITZER SOFTWARE.

Technical data

	BSE35K	BSE55	BVC32	BSG68K	Unit
Density at 15°C	1.006	1.010	0.93	1.003	g/ml
Flashpoint	247	280	178	>200	°C
Pour point	-57	-51	-48	-46	°C
Kinematic viscosity					
at 20°C	74	147	100		cSt
at 40°C	32	55	32	68	cSt
at 100°C	6	9	5	16	cSt
Specific heat capacity					
at 40°C	1.94	1.92	2.01		kJ/kg*K
at 100°C	2.12	2.09	2.14		kJ/kg*K
Thermal conductivity					
at 40°C	0.15	0.14	0.13		W/m*K
at 100°C	0.14	0.15			W/m*K

Tab. 3: Technical data of the oils for BITZER scroll compressors

Miscibility gaps BSE35K and BVC32

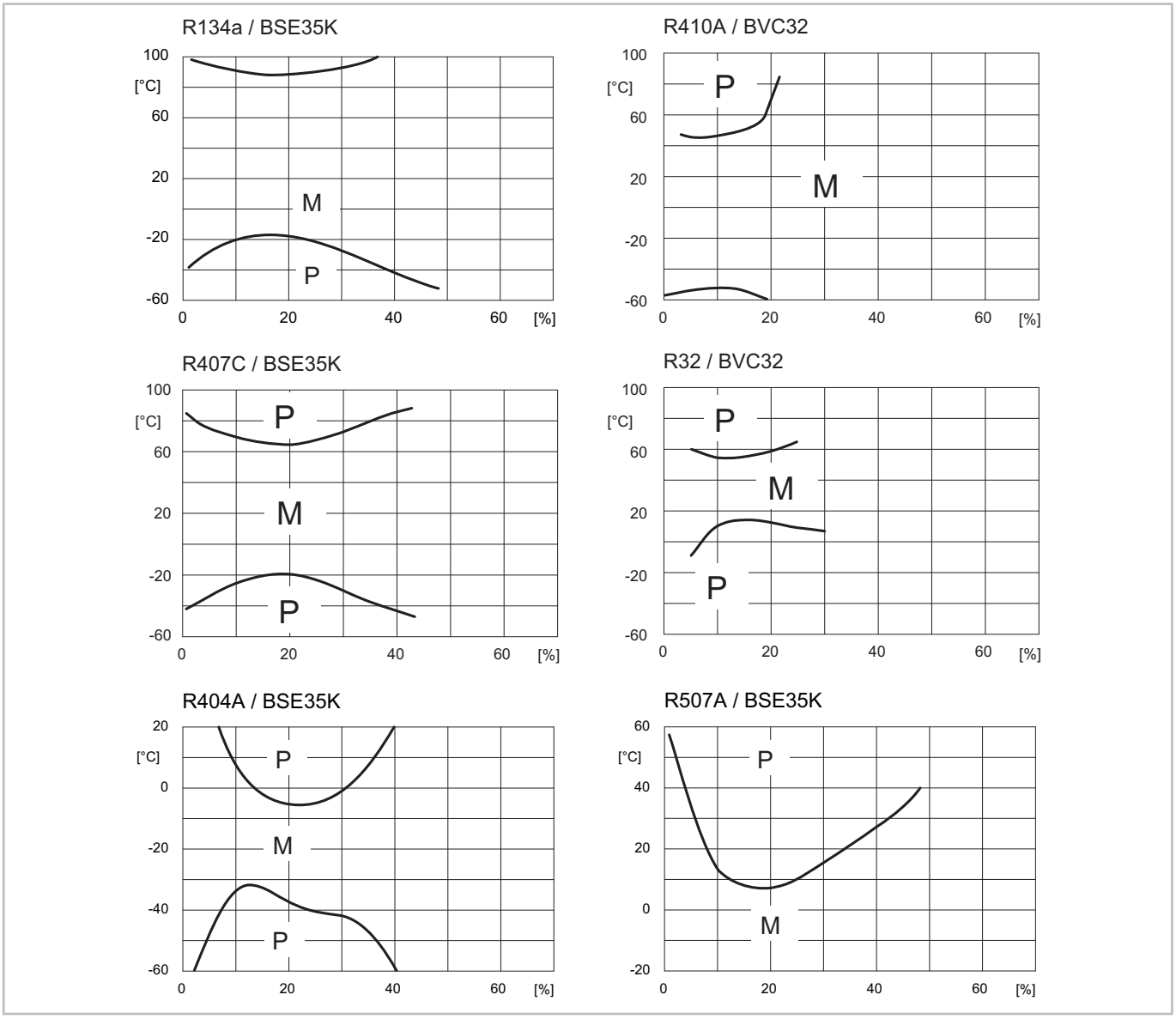

Fig. 2: Miscibility gaps for oils BSE35K and BVC32: Limit temperature depending on oil content (mass % of oil in oil refrigerant blend).
M: Range of complete miscibility.
P: Phase separation range (miscibility gap).

Miscibility gaps BSE55

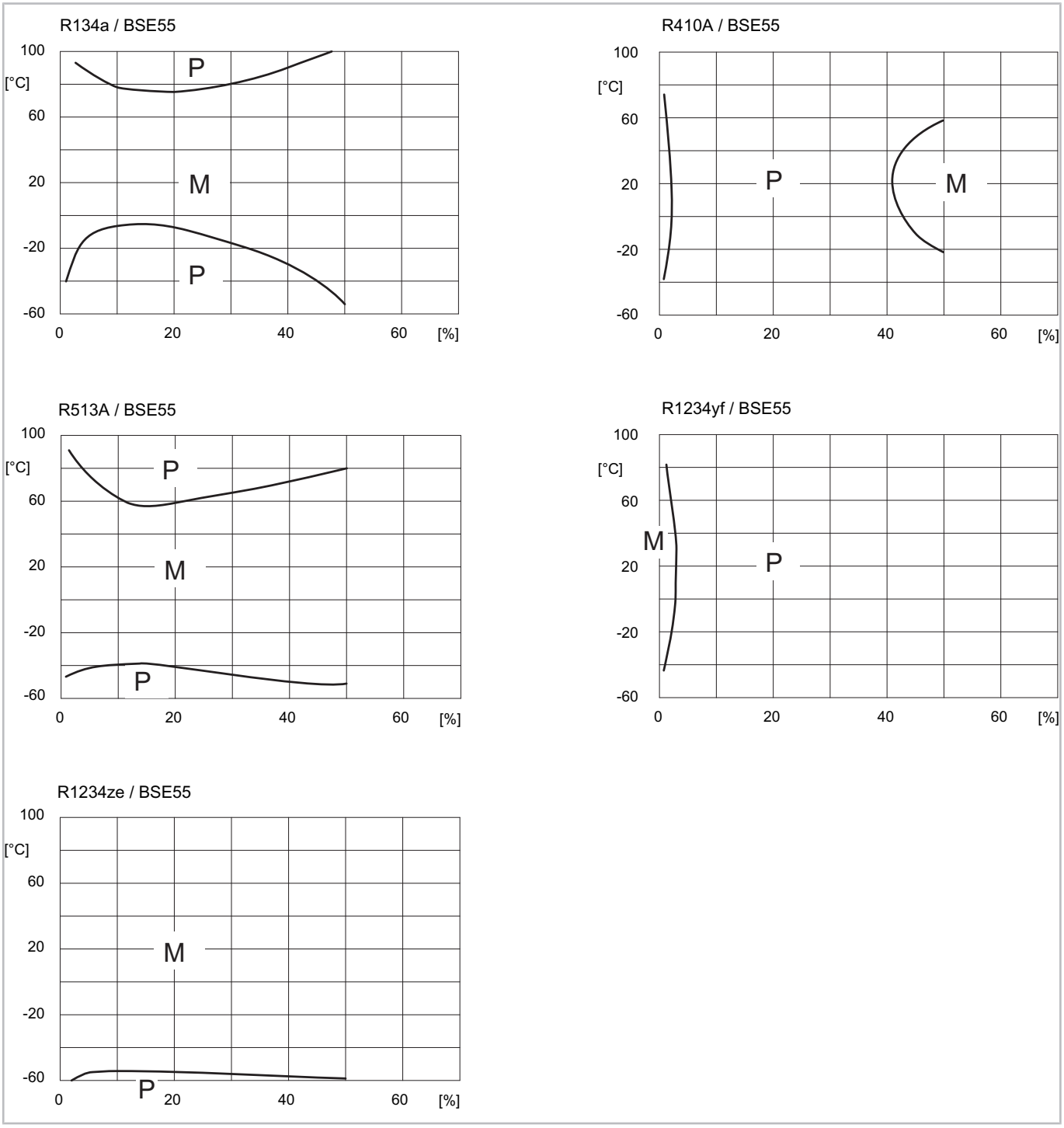

Fig. 3: Miscibility gaps for oil BSE55: Limit temperature depending on oil content (mass % of oil in oil refrigerant blend).
M: Range of complete miscibility.
P: Phase separation range (miscibility gap).

Miscibility gaps BSG68K

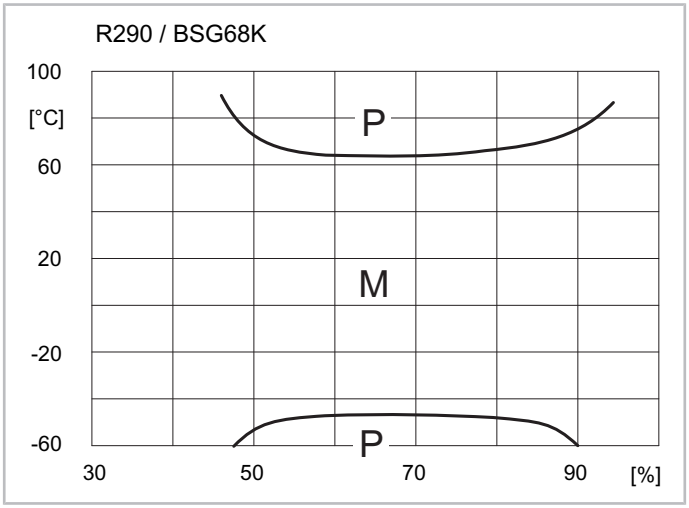

Fig. 4: Miscibility gaps for oil BSG68K: Limit temperature depending on oil content (mass % of oil in oil refrigerant blend).
M: Range of complete miscibility.
P: Phase separation range (miscibility gap).

Refrigerant solubility in oil

The following diagrams can be used to read off the refrigerant content in the lubricant depending on refrigerant pressure and oil temperature.

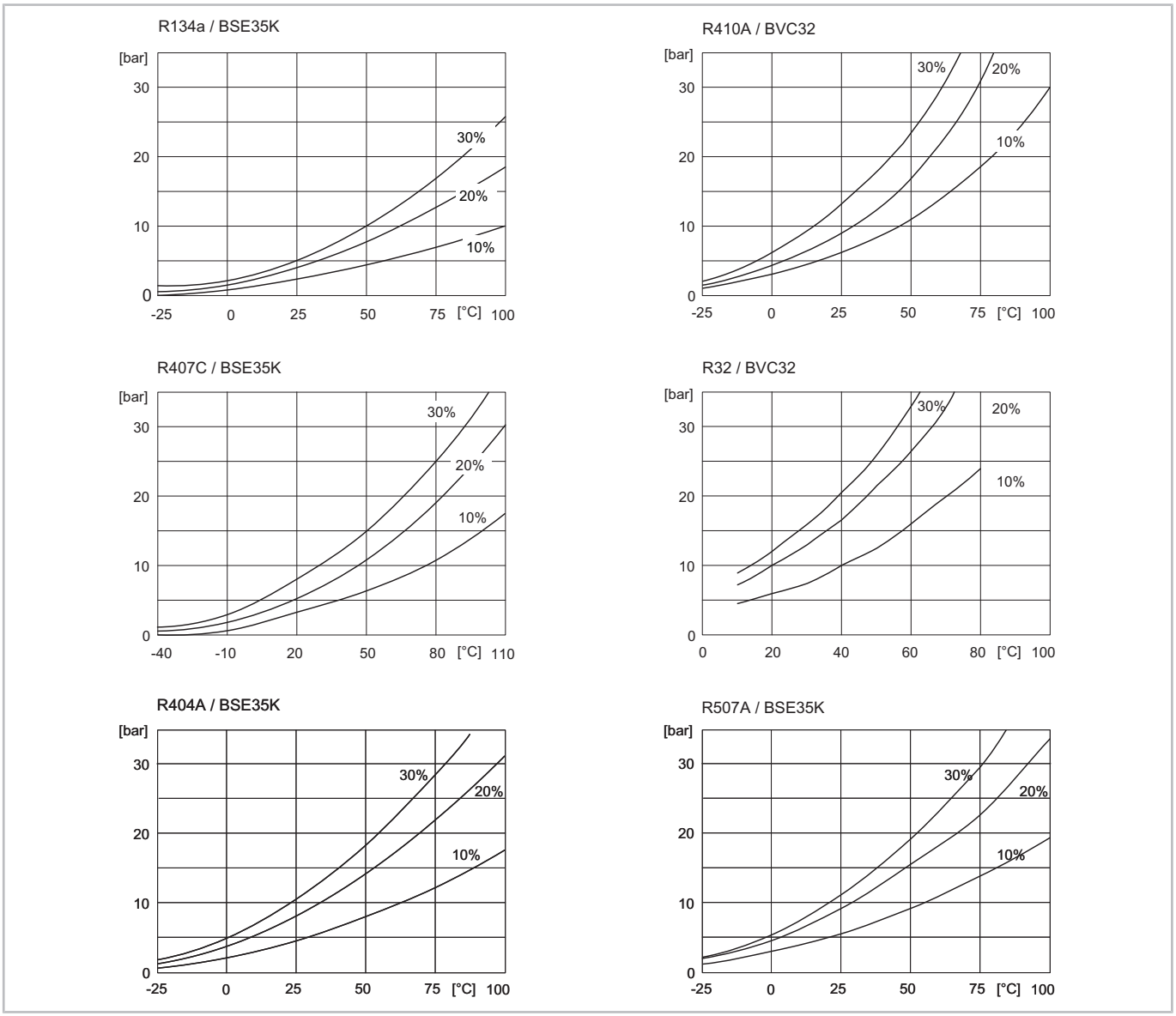

Fig. 5: Oils BSE35K and BVC32: Refrigerant pressure depending on oil temperature and refrigerant content (mass % of refrigerant in oil-refrigerant blend).

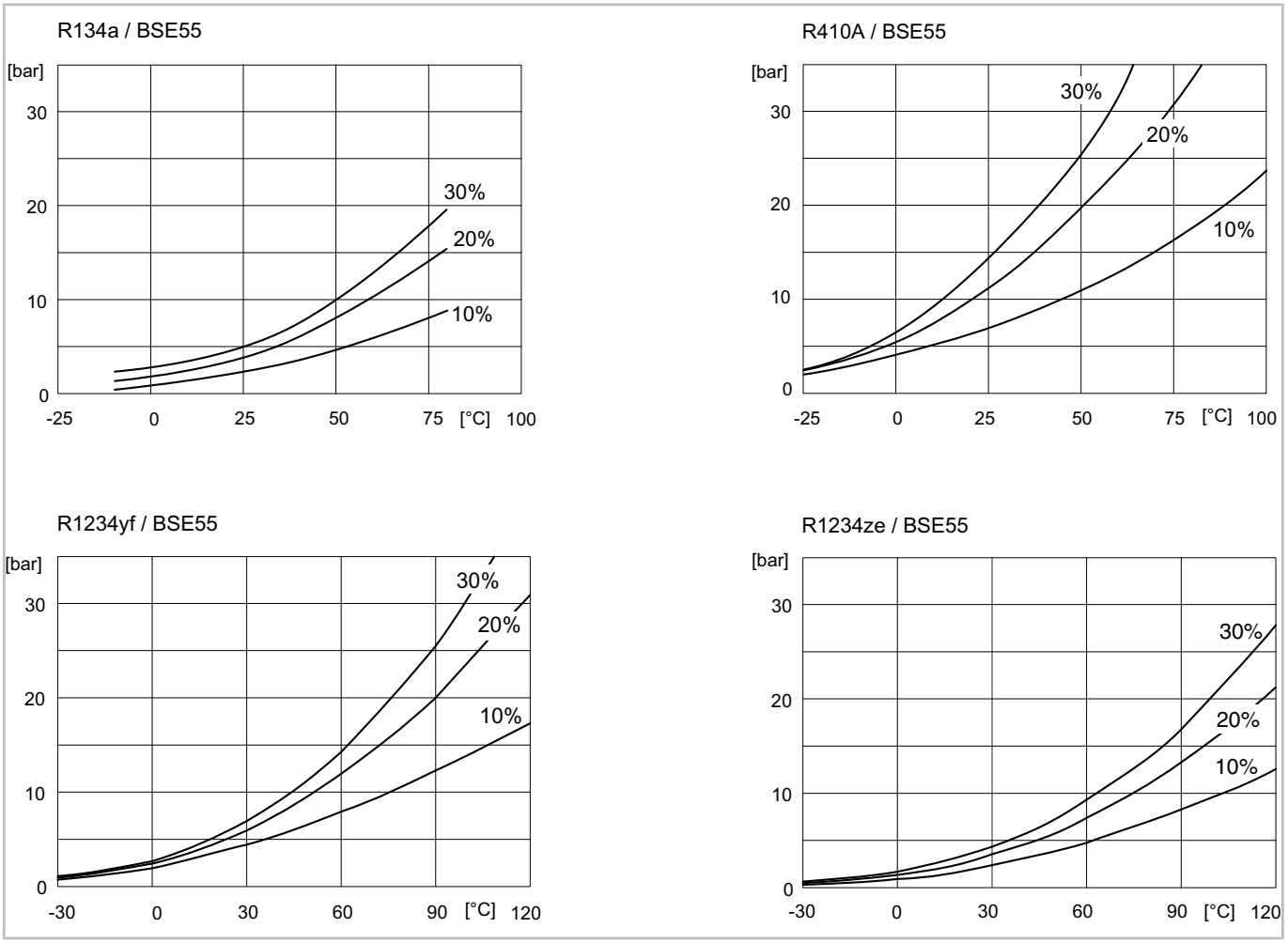

Fig. 6: Oil BSE55: Refrigerant pressure depending on oil temperature and refrigerant content (mass % of refrigerant in oil-refrigerant blend).

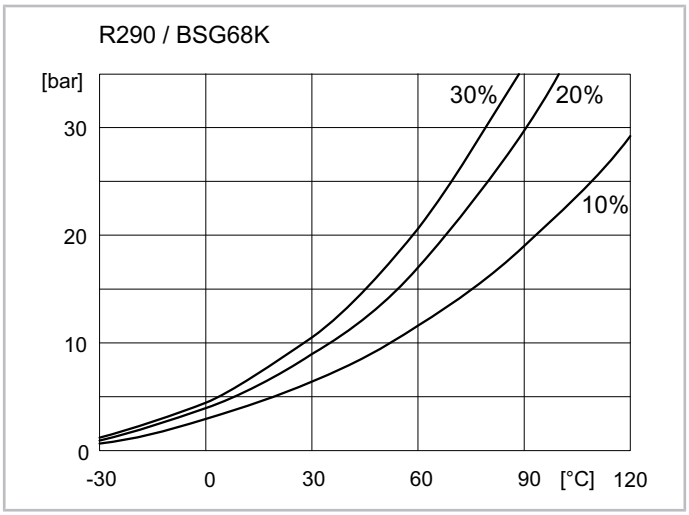

Fig. 7: Oil BSG68K: Refrigerant pressure depending on oil temperature and refrigerant content (mass % of refrigerant in oil-refrigerant blend).

Warning values for used oils

The listed refrigeration compressor oils are categorized as group KD according to DIN51503, Part 1. To determine the used condition of the BSE35K POE oil, e.g. with respect to water content or total acid number (TAN), the reference values of DIN 51503, Part 2, apply. For the BVC32 PVE oil, the warning values provided by the manufacturer apply.

Oil	Kinematic viscosity at 40°C (DIN EN ISO3104)	Max. water content (DIN51777-2)	Total acid number (DIN51558-1)
BSE35K	outside of 27 .. 37 cSt (*)	200 mg H_2O/kg oil	0.2 mg KOH/g
BSE55	outside of 47 .. 63 cSt (*)	200 mg H_2O/kg Öl	0,2 mg KOH/g
BVC32	outside of 27 .. 37 cSt (*)	500 mg H_2O/kg oil	0.2 mg KOH/g
BSG68K	outside of 58 .. 78 cSt (*)	800 mg H_2O/kg oil	0.2 mg KOH/g

Tab. 4: Warning values for used BITZER oils.

(*): that is ± 15% of the value for new oil

When using A2L or A3 refrigerants:

NOTICE
Fire hazard!
The used oil contains a relatively large amount of dissolved refrigerant.
Pack used oil safely. Dispose of in an environmentally friendly manner.

Hydrocarbons, for example propane, R290 or propene, R1270 and low-fluorinated flammable refrigerants, for example R1234yf, dissolve very well in refrigeration compressor oil at room temperature. This also applies to blends containing these substances.

Used oil from such systems may still contain relatively high percentages of dissolved flammable gases even at atmospheric pressure. These components gas out.

Observe during storage and transport:

- ▸ Fill used oil into pressure resistant vessels.
- ▸ Fill vessels with nitrogen as a protective gas and close them.
- ▸ Mark them, e. g. with the warning sign "flammable substance" W021 from ISO7010.

Elastomer compatibility

Polyolester oils (POE) with HFC and HFO refrigerants (and blends containing them):

Relevant literature recommends the following seal materials:

- acrylonitrile butadiene rubber, nitrile content >36%
- hydrogenated acrylonitrile butadiene rubber, nitrile content >36%
- ethylene propylene diene rubber

Polyvinyl ether oils (PVE) with HFC and HFO refrigerants (and blends containing them):

- chloroprene rubber
- hydrogenated acrylonitrile butadiene rubber, nitrile content >36%

Polyalkylene glycol oils (PAG) with R290:

Relevant literature recommends the following seal materials:

- chlorobutadiene rubber, e.g. neoprenes
- acrylonitrile butadiene rubber, nitrile content >36%
- hydrogenated acrylonitrile butadiene rubber, nitrile content >36%
- fluorinated rubber

Sommaire