



DAWSON ISOBLAST BLAST FREEZER

A9400-01

TECHNICAL MANUAL



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A. INTRODUCTION

General Description



General Description

Dawson Isoblast Blast Freezer

A9400-01

A blast cooling system based on operation in 32°C ambient conditions, but also can operate in higher ambient temperatures. Compressors are from the Bitzer range and run on R404A with RL32H oil

The following main components are included:

Twin compressors operating as two independent systems cycling to provide blast / hold / tempering operation

Twin interlaced evaporator coil with centrifugal fans

Electric defrost heaters suitable for use in tempering / heating operation mode

Split circuit condenser coil fitted with axial fans with EC variable speed motors

All necessary components and controls required to operate and manage the above compressors, these include oil separators, liquid receivers, suction accumulators, protective devices and crankcase heaters.

Primary compressor control panels (per compressor) including starter gear, sub-fusing and Carel slave compressor controller

Mains distribution panel wired to incoming mains termination panel

Primary control panel including master controller and user interface allowing selection of operation function and input of adjustable control parameters

The above components all assembled into a robust stainless steel frame assembly integrated into a portable coldroom with integral evaporator



B. EC DECLARATION OF CONFORMITY

EC Declaration of Conformity

PED Assessment Form



Hubbard Products Ltd
Hillview
Otley, Ipswich
Suffolk
IP6 9NP
Tel: 01473 890522

EC DECLARATION OF CONFORMITY

Hubbard Products Ltd hereby declares that the products listed below are intended to be incorporated into a refrigeration system and should not be put into operation until the system has been declared as being in conformity with the requirements of the relevant EC Directives.

This declaration is based on the design and construction of the equipment in the form brought onto the market by Hubbard Products Ltd. Any alterations made to the machinery without prior consultation with Hubbard Products Ltd render this declaration invalid.

Relevant EC Directives:

Machinery Directive (2006/42/EC)

LV Directive (73/23/EEC in the version of (93/68/EEC)

Pressure Equipment Directive (97/23/EEC) and Conformity Assessment Module

Category III: Module H

Notified Body:

Zurich Engineering,
126 Hagley Road,
Edgbaston,
Birmingham,
B16 9PF

Applied harmonised standards:

BS EN 378-1:2008	Specification for refrigerating systems and heat pumps. Safety and environmental requirements. Basic requirements, definitions, classification and selection criteria
BS EN 378-2:2008	Specification for refrigerating systems and heat pumps. Safety and environmental requirements. Design, construction, testing, marking and documentation
BS EN ISO 12100-1:2003	Safety of machinery. Basic concepts, general principles for design. Basic terminology, methodology
BS EN ISO 12100-2:2003	Safety of machinery. Basic concepts, general principles for design. Technical principles
	Electromagnetic compatibility. Generic immunity standard. Industrial environment
BS EN 60204-1:2006	Safety of machinery. Electrical equipment of machines. General requirements

Model name	ISOBLAST
Model Part No	A9400-01
Description	Blast freezer comprising two compressors, receivers, oil separators / oil management systems, suction accumulators all integrated into a single frame incorporating a dual circuit condenser and evaporator. The system is designed to operate on refrigerant R404A and is provided with highside and lowside PRVs.
Serial No	See Serial Plate fitted to unit

Signature of HPL
designated "responsible person"

Position of signatory

David Stoddart
COMMERCIAL DIRECTOR



C. TECHNICAL DATA AND OPERATING INSTRUCTIONS

Technical Data

Detailed Description

Carel Controls Operator Manual

Isoblast Technical Data

Compressor type	Semi-hermetic reciprocating
Model	6GE-34Y-40P
Compressor noise level	55-64dB (A) @ 10m (free-field conditions). Depending on running conditions
Refrigerant	R404A
Charge weight	28 kg per system
Standard oil type	ICI Emkerate RL32H
Standard electrical supply	125A TPN+E
Condenser	Integral twin-circuit 3-fan condenser with 3-phase EC fans
Condenser air-flow	10.44 m ³ /s
Condenser sound pressure level	58dB (A) @ 10m (free-field conditions)
Evaporator	Integral twin-circuit 2 - fan evaporator with axial high pressure fans
Evaporator air-flow	8m ³ /s @ 44Pa coil resistance
Defrost method	Electric
Drain pan defrost method	Electric

Cooling capacity as follows:

32°C Ambient

Room temp °C	0	-5	-10	-15	-20	-25	-30	-35
Gross Comp duty kW	148.6	122.6	100.0	80.8	64.2	50.4	37.5	27.9
Total power input kW	68.0	62.2	56.4	50.6	45.0	39.5	34.4	29.5
Unit COP	2.07	1.84	1.63	1.44	1.25	1.07	0.86	0.67
Total design current A	126.9	118.1	109.1	100.3	91.9	84.1	77.1	70.9

Unit Noise Level

The finite noise level produced will depend on the ambient temperature and the temperature of the product loaded, the figures quoted are indicative only and may be used only as a guide.

Typically the noise level will be around 66 dB (A) @ 10m when the unit is first loaded, but the noise level may be higher in ambient temperature above 32°C.

As the product is cooled the noise produced will decline towards 55dB (A) @ 10m as the product cools towards the temperature set point.

Dawson Isoblast – Detailed description

The complete system comprises two Bitzer compressors, a dual circuit interlaced evaporator and a dual circuit split condenser; there are two entirely separate systems, the operation and interaction of which are described below:

Control panels

The control panel suite is split across four enclosures, each compressor has a dedicated control panel, a mains incomer is accommodated in a third enclosure and the fourth panel provides common controls for the system; the controls within the panels are allocated as follows:

Compressor panels

The compressor panels are fitted with a Carel controller which provides control of all compressor functions. The Carel compressor controller (the slave controller) is instructed by the master controller (on the common controls panel) regarding the status of the compressor (on / off) and the capacity required.

Mains incomer

The mains incomer houses the main unit isolator and distribution bus-bars, transformer for the common control panels and the current transformer for load shedding (see later).

Common controls

The common control panel controls the evaporator fans, defrost heaters, container services and condenser fans. The main Carel controller is mounted on the door (the master controller); this provides primary temperature control and defrost control. Instructions are passed from this controller to the slave controllers in the compressor panels regarding the status and capacity of the compressors. Alarm signals are also passed along this network between the master and slave controllers. The master controller monitors the condensing pressure associated with each compressor and controls the condenser fans according to the higher condensing pressure.

The compressor assemblies

Each compressor assembly comprises:

Bitzer compressor fitted with HP safety switch (pre-set) and LP switch (adjustable). The compressor is fitted with cylinder unloaders providing 33/66/100% loading, this controlled by the master controller. A high pressure transducer measures the discharge pressure associated with each compressor; this information is passed to the master controller and the EC condenser fans are controlled against the higher discharge pressure. An oil pressure differential switch is connected to the compressor, lack of oil pressure for a pre-set time will result in the compressor being turned off, this alarm condition is manually reset on the switch.

A high efficiency oil separator / reservoir is provided with sight glasses and an oil heater. Oil is supplied to the compressor, via an oil filter, through a solenoid valve which is energised to open when the compressor runs. The compressor discharge line is provided with a check valve.

An insulated suction accumulator is fitted, this is provided with a pressure relief valve.

A 30 litre receiver with sight glasses and dual pressure relief valves is provided; this feeds into a liquid line with a replaceable liquid filter and sight glass.

The supply of liquid into the evaporator is controlled by a Carel E2V stepper valve, this valve is controlled according to the superheat measured at the evaporator outlet. The superheat at the evaporator outlet is calculated according to the temperature and pressure measured at the evaporator outlet, the probe and transducer are accessed through the side door of the container, this door also provides service access to defrost heaters, drain heaters and the air-off face of the evaporator coil.

The evaporator

The evaporator has two circuits, one associated with each compressor; as noted above, the control of the stepper valve associated with each evaporator circuit is a function of the compressor slave controller. The evaporator fans, the defrost heaters and the drain pan heaters are all controlled by the master controller in the common controls panel. The defrost heaters are split into two circuits and the drain pan heaters are controlled as a third independent circuit.

The condenser

The condenser is split into two circuits and is fitted with two variable speed EC fans. One circuit is associated with each compressor and the control of fan speed is determined by the master controller, by comparing the actual discharge pressure with the setpoint in each circuit; the fans are controlled against the higher discharge pressure.

Container services

Various container services are supplied from the common controls panel and inputs from the container are passed to the master controller to allow control of the refrigeration system. The container services include:

Container lights (supply only, switched inside container).

Door trim heaters, both main access door and sides doors (supply only, controlled inside container).

Mains failure alarm (output from common control panel to beacon / sounder on container). Mains failure alarm can be muted using the mute switch on the common control panel.

Temperature alarm (output from data logger to beacon / sounder on container).

Trapped person alarm (output through trapped person switch inside container to beacon / sounder on container). Operation of the trapped person switch inside the container will disable the refrigeration system.

Door switch on main access doors allowing the master controller to control the refrigeration system according to door opening; the operation of the door switch will be detailed under 'modes of operation'.

Modes of operation

The system will operate in different ways as follows:

Turning the unit on or off

The main isolator should be turned on for several hours prior to initial starting of the unit; this will allow the compressor oil to be pre-heated. In order to allow pre-heating, all isolators need to be turned on and the compressor and system switches in the off position. The oil temperature can be monitored in the compressor engineering screen. The Bitzer recommendation is that the oil should be pre-heated to a temperature 15-20 °C above ambient. The time taken to achieve the required oil temperature will depend on the ambient temperature and on the temperature of the oil when the system is first started.

Once pre-heated, the blast freeze temperature setpoint can be confirmed in the master controller, the doors closed, the compressor and system switches set to the on position and the unit allowed to start.

Turning off the unit is achieved by setting the system switch to the off position. If the unit is required for the next batch within a few hours then the isolators should be left closed, this to allow the oil heaters to maintain oil temperature and avoid the need for pre-heating prior to the next batch.

Normal operation

When the container is loaded with warm product and turned on the master controller will first turn on the evaporator fans then compare the measured return air temperature (evaporator air-on temperature) with the temperature setpoint.

Depending on the error between the return air temperature and setpoint, the master controller will decide which compressor to start and what capacity level is required. The slave controllers will show which is the lead compressor and which is the lag compressor; on initial start-up number 1 compressor will lead – the master controller will alternate lead and lag after the lead compressor has run for a pre-set time (usually 24 hours).

The master controller will instruct the appropriate slave controller to open the appropriate evaporator stepper valve and start the lead compressor at 33%; depending on the temperature error the lead compressor will gradually be loaded up to 100% capacity at which point the lag compressor will run and load in the same manner until the unit is running at full capacity. There will be a delay on initial start-up before the first compressor runs, during this time the slave controller will show 'safe mode'. This delay period allows time for the compressor to be fully unloaded prior to starting.

As the discharge pressure increases the condenser fans will be instructed to run, as noted previously the fans are variable speed EC fans, these will operate proportionally depending on the error between the actual discharge pressure and the setpoint. As previously noted the compressor will operate according to the higher discharge pressure.

As the return air temperature falls towards setpoint the lag compressor will start to unload, usually during a blast cycle there will be a considerable period of time where the lead compressor is running at 100% capacity and the lag compressor is modulating to balance the return air temperature against

setpoint as the product releases its heat into the container. Eventually a point will be reached where the lag compressor cycles off; at this point the temperature may be maintained by the lead compressor alone or, more likely, the lead compressor will be required to restart. The compressors are protected by an anti short cycle time (hereafter ASCT); the ASCT is a true start to start timer so if the compressor has run for long enough for the ASCT to time out (10 minutes) when it stops then it would be available for immediate restart. If the compressor is stopped and waiting for the ASCT to time out then the display will show 'comp off / ASC'.

As the blast cycles progresses there will reach a point where the lead compressor will maintain the container temperature, at this point the lag compressor will stop and the lead compressor will start to unload and modulate against the temperature error between return air temperature and setpoint.

Door opening

If the door is opened beyond the door open threshold time (usually 30 seconds) the compressors and evaporator fans will stop. Once the door is closed and normal restart sequence will ensue; the lead compressor will start and load up to 100% followed by the lag compressor as required.

If the door remains open in excess of 2 hours then a forced defrost will be initiated once the door is closed; the compressors will restart in the usual manner at the end of the defrost.

Defrosting

There are three methods of initiating defrost, these are:

Scheduled timed defrost, this is factory pre-set to occur every 6 hours.

Forced defrost initiated by a door opening above 2 hours, as noted above.

Manual defrost, this initiated by pressing and holding the 'down arrow' and 'esc' buttons on the master controller for 5 seconds.

All defrosts proceed in the same manner. The first stage of defrost is activation of the drain pan heaters, with a scheduled or a manual defrost the pan heaters are operated while the refrigeration system is still cooling the container; with a forced defrost the compressors are already cycled off due to the door opening so neither the evaporator fans or compressors run.

At the end of 'pan heater mode' the compressors and evaporator fans will stop and the stepper valves will be instructed to close. At this point the defrost heaters will be activated and the coil defrost will proceed; defrost will terminate on either temperature or, if the temperature is not achieved, time. The defrost termination probe is located low down on the air-on face of the evaporator.

Once defrost is terminated a 'drain down' period will be initiated; in this mode the lead compressor will run at 33% capacity with the evaporator fans off. This period allows any residual water on the coil to re-freeze rather than being drawn off the evaporator by the action of the evaporator fans. At the end of drain down the evaporator fans will restart and normal refrigeration control will resume.

Load shedding

A current transformer is located in the mains incomer panel allowing the master controller to monitor the total current consumption of the unit. There is a pre-set limit (usually 160A) and if the current consumption exceeds this level then the lag compressor capacity will be reduced until the maximum consumption is not exceeded. This feature allows the system to operate on a range of different supplies without exceeding the capability of the protective device.

Engineering screens

Both the slave controllers and the master controller have engineering screens associated; these screens are password protected. Access to the engineering screens is restricted to trained engineers only; the password is issued during training or may alternatively be issued by Dawson Rentals in exceptional circumstances. There are various screens allowing the engineer to view the operation of the system in real time as follows:

Compressor slave controller

Screen 1

Run:	Black block indicates the compressor running
ActC:	Current compressor capacity provided
ReqC:	Compressor capacity currently being requested by master controller
Oil:	Black block indicates the oil solenoid energised
ECF:	Black block indicates condenser fans running
SP:	Current suction pressure from transducer at evaporator outlet
DP:	Current discharge pressure from transducer fitted to compressor
ST:	Current suction temperature from probe at evaporator outlet
SH:	Current superheat at evaporator outlet
EEV:	Shows how far open the main evaporator stepper valve is open
Mode:	Description of various modes can be found in the controller section
Status:	Description of various status messages can be found in the controller section

Screen 2

Sys OK:	Black block indicates system healthy
Safe T:	Shows the safe mode timer counting down before the compressor can start
ASC:	Shows the ASCT timer counting down before the compressor can start
Mode:	Description of various modes can be found in the controller section
Status:	Description of various status messages can be found in the controller section

Screen 3

This shows a pictorial simulation of the live operation of the evaporator; on a single screen you can see superheat, superheated suction temperature at the evaporator outlet, the suction pressure and temperature measured at the evaporator outlet, the status of the stepper valve (on / standby) and how far open the stepper valve is open both in number of steps (0 to 480 steps are available) and as a percentage of maximum capacity.

Common controls master controller

Screen 1

Heater bank:	Black block indicates the defrost heaters are on (bank 1 & 2)
Pan:	Black block indicates the drain pan heaters are on
Evap:	Black block indicates evaporator fan running Bell symbol indicates the fan circuit breaker has tripped
C1:	Black block indicates compressor 1 is on Bell symbol indicates compressor 1 has tripped 'T' indicates that the compressor is unavailable until the ASCT has timed out
R:	Indicates the current capacity requested of compressor 1 by the master
A:	Indicates the current capacity delivered by compressor 1
C2:	All as compressor 1 above
Mode:	Description of various modes can be found in the controller section
Status:	Description of various status messages can be found in the controller section

Screen 2

Box temp:	Shows current return air temperature
Term temp:	Shows the current temperature of the defrost termination probe
Consumption:	Shows the current consumed by the unit
Mode:	Description of various modes can be found in the controller section
Status:	Description of various status messages can be found in the controller section

Screen 3

Next def:	Shows the time before the next scheduled defrost
Def dur:	Shows current defrost duration (only when currently in defrost)
Last def:	Shows duration of the last defrost
Next rot:	Countdown timer showing the next rotation of the lead compressor
Door open:	Shows duration of current door opening (or 0 if door currently closed)

Carel Controls Operator Manual for Dawson's ISO (50kW) Unit

Common Controls Control Panel Door Indication (Container Control System)	
System Fault	The Carel Container Control System has a fault - Read Carel Display and press Alarm Key Icon flashing Red
12v On	12v dc Supply is operating and functional
Battery Charging	12v dc Battery is being charged
Charging Fault	12v dc Battery Charger is faulty
Overtemp Reset Pushbutton	Resets the Overtemp Alarm on critical Box Temp
System Off/On	Turns Carel control of Container on and off for control of Blast or Tempering
12v Off/On Switch	Turns 12v Off and On, leave in On position
Cooling/Tempering Switch	Turns Carel control strategy for either Cooling Blast Mode or Tempering Mode
Mains Fail On/Mute Switch	On Mains Failure, switch to mute to silence external Mains Fail Alarm Beacon / Sounder
Carel Control System	Control Panel Door and Container Rear Door Mounted Displays to control the container (see below)

Compressor 1 and 2 Control Panel Door Indication (Compressor Control System)	
Compressor Fault	The Carel Compressor Control System has a fault - Read Carel Display and press Alarm Key Icon flashing Red
Fault Reset Pushbutton	Resets Motor Fault and Low Oil Level alarms only
Compressor Off/On Switch	Makes Compressor available for control in either lead or lag configuration
Carel Control System	Control Panel Door Mounted Display to control the compressor (see below)

Incomer Control Panel Door Indication	
Lights Off/On Switch	Turns lighting within the Pack housing on



Carel Display Layout

 **Alarm Key**, flashes red on any System Alarm, press to view Alarms

 **Program Key**, used to access Menu and Parameter changing

 **Escape Key**, used to escape from Menu or Parameter Data entry

 **Up Key**, used for scrolling through Menu's or Parameter Data Entry

 **Enter Key**, used for confirming selection of Menu or Parameter Data

 **Down Key**, used for scrolling through Menu's or Parameter Data entry

Common Controls Operator Main Screen (Container Control System)				
50kW Blast	Unit:01	50kW Blast Unit Temp Setpoint Next Def Mode	Type of Blast Unit Selected in Blast Mode from door switch Carel Unit address (pLAN) Current Container Temperature Container Temperature Setpoint Time till next Defrost Commencement Current Refrigeration Operational Mode	01 degC degC mins
Temp : -10.5°C				
Setpoint : -25.0°C				
Next Def: 123m				
Mode: Cool Mode				

Compressor Operational Mode Designations		Mode:	Compressor Operational Mode Designations		Status:
None	Compressor not required		UnitOn	Compressor Operational	
Comp Running	Compressor is running		OFFbyMSTSwitch	Compressor turned off by Control Panel On/Off Sw	
Comp Available	Compressor is selected and available		OFFbyInterlock	Compressor turned off ny Safety Interlock	
Comp Starting	Compressor in Starting Sequence		OFFbyAlarm	Compressor turned off by an Alarm (Check Alarm Icon Key)	
Comp PD Mode	Compressor Pumpdown Mode		OFFbyDisplay	Compressor turned off by Display	
Comp Off	Compressor is Off		OFFbyConnection	Compressor turned off by incorrect setup	
Comp Off / ASC	Compressor is Off & in Anti Short Cycle		OFFbyConfig	Compressor turned off by incorrect configuration	
Safe Mode	Compressor in Safe Mode after Alarm (enables start delay to protect comp on first power up and after a shutdown caused by an alarm)		OFFbyNetwork	Compressor turned off by Network pLAN Fault	
Comp Waiting	Compressor is waiting to start		OFFbyRotation	Compressor turned off by Comp rotation	
			OFFbyMotorFault	Compressor turned off by Motor Fault (Reset PB)	
			OFFbyOilPress	Compressor turned off by Oil Press (Reset on sw)	
			OFFbyCompSwitch	Compressor turned off by Comp Selector Switch	
			OFFbyOverload	Compressor turned off by O/load (Reset at O/load)	
			OFFbyLowPress	Compressor turned off by Low Pressure (Auto Rst)	
			OFFbyMSTSwitch	Compressor turned off by Master Unit off Switch	
			OFFbyHighPress	Compressor turned off by High Pressure (Auto Rst)	
			Resetting	Resetting because of Motor Fault	

To View Alarms (on all Carel Controllers)		To View Alarm Log (on all Carel Controllers)	
To View Alarms press  Scroll through Alarms using  		To View Alarm log press  Scroll through Alarm Log using  	
To Clear Alarms press  and hold for 5 seconds		Until  Press ENTER to DATA LOGGER appears on screen then	
Clearing of alarms only active if alarms were present and have reset		Press  Scroll through logs using  	
To Exit press  (and repeat) until Main Menu appears			

Blast Mode Information (Blast Mode Selection): Screen B01 (Setpoint) to select Blast Mode Control Options	
Blast Mode: Continuous Blast Blast Mode: Blast Time + Hold Blast Mode: Blast Schedule Blast Mode: Blast Temp + Hold	Runs blast on a single setpoint Runs a blast/holding cycle based on time (two setpoints) Runs a blast schedule with two setpoints, off mode with a day/week schedule with up to four time zones Runs a blast/holding cycle based on skin/core probe

To change Container (Box) Blast Regulation Mode (password 6161) : Carel Common Controls (Not Carel Compressor Controllers)	
To change Box Setpoint press  Scroll through Menu using   Choose  B.Setpoint Press  Enter P/word	(After entering correctly password) Setpoint Screen (B01) with current setpoint displayed To change Blast regulation mode press 

Press			until 6 is displayed	Press		
Press			until 1 is displayed	Press		
Press			until 6 is displayed	Press		
Press			until 1 is displayed	Press		

Press			until required mode displayed
Press			to confirm setpoint
Press			(and repeat) until Main Menu appears

To change Container (Box) Temperature Setpoint (password 6161) : Carel Common Controls (Not Carel Compressor Controllers)

To change Box Setpoint press		Scroll through Menu using			
Choose		B.Setpoint	Press		Enter P/word
Press			until 6 is displayed	Press	
Press			until 1 is displayed	Press	
Press			until 6 is displayed	Press	
Press			until 1 is displayed	Press	

(After entering correctly password)
Setpoint Screen (B01) with current setpoint displayed

To change Box Setpoint press			
Press			until required SP displayed
Press			to confirm setpoint
Press			(and repeat) until Main Menu appears



D. INSTALLATION SAFETY INSTRUCTIONS

Publication P1743 Rev 03

IMPORTANT: This document must be read before commencing any work on the compressor pack.



INSTALLATION SAFETY INSTRUCTIONS

Introduction

These pages contain important safety information. Please read carefully before commencing any work on the equipment to which the instructions refer.

It is assumed that installation, commissioning, service and maintenance activities will be undertaken only by competent personnel who have been trained for the activity and are familiar with this type of equipment and the handling of refrigerants and their disposal. If in doubt, contact Hubbard Products Ltd.

Storage

Equipment should be stored, prior to installation, in warm, dry conditions, free from dust, vibration and extremes of temperature and humidity.

Lifting

No attempt should be made to lift the equipment manually. Provision has been made for the unit to be lifted by forklift or by correctly positioned and secured slings. A test lift, to a height of 2.5 cms, is suggested to prove the tackle arrangement. Suitable protective equipment should be used by all personnel involved in the lifting/siting process.

Installation Application

Under no circumstances must the equipment be used for any purpose other than that for which it was specifically designed.

The equipment must be located on, and secured to a solid, level base or framework designed for the purpose.

Access must be provided to allow safe working for both installation and servicing of all electrical and refrigeration components. A safe exit path must be provided in the event of a mishap. During installation, the space must be adequately ventilated to remove any potentially toxic/asphyxiating/explosive gases that may otherwise build up.

All pipework connected to the equipment must be adequately supported and all electrical components and supplies connected to the equipment must conform to IEE regulations.

Refer to the individual electrical drawings supplied with the equipment for details of the electrical circuitry.



Extreme care should be exercised when opening any part of the refrigerant pipework to atmosphere for the purpose of connecting pipework etc. The systems contain a positive pressure of inert gas, when despatched, which will be released upon any breach of the equipment's pipework or pressure vessels.

Commissioning

In accordance with BSEN378, check any connected componentry for the correct refrigerant flow configuration. Ensure that the entire system is leak tight, evacuated and moisture free before charging with the designated refrigerant.

Check that the equipment contains sufficient lubricant for initial run. Check that any additional lubricants nominated by the manufacturer are compatible with the intended use and refrigerant.

Check rotation of fans fitted, ensure that the airflow is in the required direction. Before operating ensure that all shut off valves are positioned at the correct setting for safe running.

Before operating, check all safety pressure switches for operating and setting.

Before operating, ensure that all covers, guards and panels that may have been removed during installation, are correctly replaced and secured.

Servicing and Maintenance

Ultimately the servicing schedule is the responsibility of the end user, however consideration should be given to the following:

Six monthly checks of:

Lubricant level/pressure/condition. Refrigerant level/condition. Air flow over all air cooled components. Tightness of all fasteners especially electrical terminals.

Refrigerant gases are subject to the Environmental Protection Act 1990 "Control of Hazardous Substances" and must be treated as such at all times. Lubricants must also be disposed of in a safe and responsible manner. Isolate equipment from the mains electrical supply before carrying out any maintenance work on the equipment. Replace all guards/covers before restarting the equipment.

Substances Hazardous to Health

Under normal operating conditions there should be no substances present that may be hazardous to health.

As already mentioned, consideration must, however, be given to the siting of the unit. COSHH requirements must be adhered to when installing/commissioning/servicing maintaining the system.



E. COMMISSIONING, SERVICE AND MAINTENANCE

P2153 Commissioning and Maintenance Hubbard Multi -
Compressor Packs



Commissioning and Maintenance Hubbard multi-compressor packs.

These instructions, recommendations are provided as a guide for the commissioning and maintenance of multi-compressor assemblies supplied by Hubbard Products Limited, these should be used in conjunction with your company's health and safety regulations, written work instructions and working practises to ensure that equipment is installed in a safe working manner. Further requirements may be specified by the end user or local legislation. Risk assessments should be carried out to ensure the safety of those conducting the work and anybody who may come into contact with the equipment during any of these procedures. Please ensure you are equipped with the correct and appropriate PPE, personnel protection equipment before commencing any work. Any work carried out should be completed by competent qualified personnel.

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Commissioning;

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Commissioning

1 Post Transport Checks

On siting the unit, we recommend the security of all electrical connections is checked, and system flanges, rotalock valves, and flexible connections are secure. Where flexible hose lines are used please ensure that the outer material is not subject to rupture due to contact with other surfaces.

Before initial operation we recommend that crankcase heaters are operated for 24 hours prior to compressor operation to ensure correct lubrication properties are provided.

The packs are factory tested, but we recommend a further pressure test after transport and positioning to help prevent leakage in operation. Pressure testing should be carried out according to your companies test procedures and where applicable in accordance current P.E.D. recommendations, F-gas regulations and your customers requirements. The following is a recommendation only. For further information on pressure testing visit www.ior.org.uk technical publications.

2 Leak testing by Pressure Testing

Before pressure test it is necessary to identify the refrigerant for operation, positions of all pressure relief valves fitted and values, devices with restrictive pressure values (e.g. LP switches) , and the system design maximum operating pressures. The maximum operating pressures of the high and low side of the system will be stated on the serial plate, note however that safety switches should be set 10% below these values to prevent pressure relief valves discharging.

If you intend to pressure test with the pressure relief valves fitted the maximum values for test should be:

If high side pressure relief valves are fitted only:

High side: 80% of high PRV valve rating.

Low side: 80% of high PRV valve rating*

*** Before testing ensure with supplier that the equipment has been designed to operate at these conditions, as pipe-work gauges may be incorrect. The Serial Plate will specify the maximum low side design pressure, if low side is stated lower than high then a low side pressure relief valve must be fitted.**

If high side and low side pressure relief valves are fitted:

High side: 80% of high PRV valve rating.

Low side: 80% of low PRV valve rating



If you intend to test to higher pressures or strength test the system please remove the pressure relief valves before commencing to retain their integrity. The maximum operating pressures of the high and low side of the system will be stated on the serial plate, note however that safety switches should be set 10% below these values to prevent pressure relief valves discharging.

The standard test pressure for an example for R404A as specified by EN378 for an ambient condition of 32°C maximum, condensing, maximum 55°C is:

	HP Side	LP Side
Leak pressure Test at 80% of valve rating:	19.8 barg	11.2 barg
Leak test / Pressure Test, recommended	24.8 barg	14.1 barg
Strength test (1.3 x Leak test pressure)	32.3 barg	18.3 barg

Procedure:

Testing by visual examination, and a proprietary bubble solution. Ensure your supply cylinder of OFN is fitted with a pressure limiting device set at just above your maximum test pressure value. Never move a cylinder with a regulator fitted.

At this stage the refrigeration compressors must remain electrically isolated from the system.

Open all liquid and suction valves and ensure that no system circuits are isolated by closed solenoid valves or non-return valves etc. First introduce dry oxygen free nitrogen (OFN) at a pressure of 3 barg to the system and check for audible leaks. If all components and pipe-work is sound, before proceeding to the second stage it is necessary that the following components are isolated:

1. Compressors
2. Low Pressure Switches
3. Dead Zone Pressure Switch
4. Transducers

The test pressure should now be increased to 10 barg using dry oxygen free nitrogen in stages of no more than 3 bar at a time. Listen for audible leaks and watch the gauge for pressure loss at each increment. Use leak detection soapy water at each joint to identify any small leaks. Leaks encountered should be repaired with the system de-pressurised.

When the test pressure has reached 10 bar, thoroughly test all joints and components etc. for leaks. The pressure should then be increased to no more than the maximum leak test pressure allowed for the particular section of the system, isolating any PRV's or controls etc. which may be susceptible to the test pressure, and all components should again be checked for leaks.



Strength Test

Follow the above procedure then prove the system. The system should be held at test pressure for at least 15 minutes. If the pressure has not significantly reduced then the system can be slowly vented to the leak test pressure value. At which point the system should be checked again for leaks.

After all tests are completed the system should be de-pressurised gradually.

3 Electrical Testing

BEFORE commencing any testing procedure, a check must be made to ensure that NO electronic or extra low voltage devices are connected. COMPLETE isolation of these items must be achieved prior to testing.

1. Test for earth continuity. This test is to verify that in no instance should the resistance between the earth conductor (or control panel main earth terminals) and the metal parts exceed 0.1 ohm.

The electrician MUST ensure that the resistance in the earth conductor between the mains incoming supply and our control panel earth terminal does NOT exceed the figure quoted above. It is also the responsibility of the electrician to ensure that the earth conductor into our control panel is sized in accordance with the latest edition of I.E.E. regulations.

A current of 25 amps should be passed between the control panel main earth terminal and all exposed metal parts in turn. The test shall be made at a voltage not exceeding 6v ac.

Small isolated metal parts on, in or through non-conducting material, and separated by such material from current carrying parts in such a way they cannot become live, should not be included in the test.

2. A test of polarity should be made and it should be verified that all fuses and single pole control devices are connected in the phase conductor only:

4 Charging Refrigerant into the System

Initial charging should only be completed once the system has been proven to be leak free. The charging point is located on the liquid line adjacent to the drier assembly. Liquid or gas should not be added through the low pressure side of the system.

5 Commissioning

Commissioning Step One

1. Remove the main fuses or switch off the circuit breakers for the compressors.



2. Switch on the main isolator on the pack.
3. Switch on each system, individually; checking as the systems are brought on that fans, lights etc. are operating properly. Check liquid solenoid valves operation and rotation of condenser fans (when fitted). When satisfied that all systems are functioning, switch off main supply.
4. Replace compressor fuses or switch on circuit breaker for the lead compressor only to ensure all systems are refrigerating during commissioning.

It is essential that each compressor is checked for correct operation individually so that should any problems occur it should prove to be a fairly straightforward matter to discover where the fault lies.

5. Check operation of electronic compressor controller and LP switches and HP controls.
6. Check oil level in the compressors and the receiver and add oil if necessary.
7. Switch on the main isolator. Providing enough refrigerant is in the system, the lead compressor will start up and adding more refrigerant to the plant can commence.

Commissioning Step Two

Charging of the system should continue until the receiver is approximately 25% full, and the discharge pressure approaching design value. When this condition has been reached, shut off all charging cylinders and allow the compressor to run normally.

Check now that all the systems/stubs are refrigerating satisfactorily, evaporators fully frosted etc.

Commissioning Step Three

Now replace remaining compressor fuse circuit breakers and allow electronic compressor controller to stage in compressors as required.

Commissioning Step Four

During the general commissioning the following electrical items should be checked:

1. Sub fuses, circuit breakers correct.
2. Main fuses, circuit breakers are correct and balanced.
3. Main compressor fuses and circuit breakers are correct.
4. All cable connections are tight.
5. Motor starter controls/contactors overloads are set correctly.
6. Check all contactors operate correctly.

6 Operational Checkout

When the system has been charged and has operated for at least 2 hours at normal operating conditions without any indication of malfunction, it should be allowed to operate overnight on



automatic controls. Then a thorough re-check of the entire system operation should be made as follows:

1. Check the pack head and suction pressures. If the pressures are not within the system design limits, determine why and take corrective action.
2. Check the liquid line sight-glass and expansion valves operation. If there are indications that more refrigerant is required, leak test all connections and system components and repair any leaks before adding refrigerant.
3. Observe oil levels in the compressor sight-glass and add oil as necessary (bottom sight-glass on reservoir should show full and top sight-glass empty).

4. Thermostatic expansion valves must be checked for proper superheat settings.

Expansion valve phials must be in positive thermal contact with suction lines.

Valves with high superheat settings produce little refrigeration and poor oil return.

Too little superheat causes low refrigerant capacity and promotes liquid slugging and compressor oil removal. **LIQUID REFRIGERANT MUST BE PREVENTED FROM REACHING THE COMPRESSORS.**

5. Using suitable instruments carefully check line voltage and amperages at the compressor terminals. Voltage should be within 10% of the nameplate voltage.

The current should not exceed that on the nameplate rating. If amperage draw is excessive, immediately determine the cause and take corrective action. On three phase motor-compressors, check to see that a balanced load is drawn by each phase. Check all fan motors on air-cooled condensers and in fixture evaporator coils for correct rotation. Fan motor mounts and fan blades should be carefully checked for tightness and proper alignment. If belt drives are used, check the belt tension.

All motors requiring lubrication should be oiled or greased as per manufacturer's recommendations. Check all electrical load bearing terminals for tightness.

6. When this stage is reached, the packs can now be left running on full automatic operation, commissioning sheets checked and completed. The plant should be allowed to run for a further few days and then a further check made of all controls and any minor adjustments made. A thorough leak test should now be carried out in cases/cold-rooms/plant-rooms and all pipe work. Check compressor suction line filters and liquid line drier cores after 7/10 days operation for foreign materials etc. (see below).

7. The hints and procedures on commissioning are based on experience to date and checks made of packs running during both winter and summer periods. Do ensure that the settings of the components are correct before making any adjustments.

8. **DO NOT** adjust components without satisfying yourself that there is good reason to do so. If adjustments are carried out, record the final setting on the commissioning report.



7 Driers, Filters etc. - Guide

1. Oil Separator/Reservoir Filter

- i) After 24-48 hours maximum from initial start up of pack, replace with a new filter.
- ii) The replacement filter is usually considered suitable "for life", but should the system oil charge become particularly dirty over a period of time, then it is recommended to inspect the filter and replace if necessary.

Note - these filters cannot be cleaned for re-use.

2. Suction Filter Core

- i) Ensure suction filter is fitted before initial start up, we provide a felt core with the pack.
- ii) Remove after 7-10 days from initial start.
- Hi) Replace core if alterations are made to plant / pipe-work to prevent damage to compressors. If a compressor fails due to an electrical fault a burn out core can be fitted to prevent further damage to the remaining compressors.

2. Liquid Drier Core

- i) Ensure drier core is fitted before initial start up.
- ii) Replace with new drier core after 7-10 days from initial start.
- iii) Check sight-glass/moisture indicator on each service visit and at least on a twice yearly basis.
- iv) Replace drier core as necessary.

3. Lubrication Oil Condition

- i) Check cleanliness of oil after 7-10 days from initial start up.
- ii) If necessary and if the general system is particularly dirty then replace with a complete oil change.
- iii) Check oil condition on each service visit and at least on a twice yearly basis.
- iv) Complete system oil changes should be considered annually or after 5000 hours operation, but certainly no longer than two years between changes.



Service and Maintenance

The following notes are not designed as a definitive guide, as components fitted to the pack may vary. The maintenance procedures should be applied in conjunction with your companies work instructions and working practises. Any further information not covered by this section may be obtained from Hubbard Products Ltd on request.

1 Oil Management System

Oil management systems are supplied as either low or high pressure; low pressure systems differentiate pressure at the separator itself, high pressure systems at the oil regulator. Please consider all pack systems as operating with oil return at high pressure, unless stipulated.

The pack is fitted with a suitable sized oil separator – reservoir, either coalescing or helical. Where coalescing filters are used suitable connection points are provided to measure the differential across the integral filter, where the differential exceeds the manufacturers specified value the filter will require changing, nominally 0.9 barg / 13.5psig (refer to component instructions). Alternatively a pressure differential gauge may be fitted, and may be linked to the pack panel to provide a fault indicator.

All compressors have oil level switch assemblies, which are of the solid state opto-electronic sensing type or oil level float type. These devices regulate oil to the compressor and maintain correct crankcase oil level and also can provide control alarm functions.

To assist with service/maintenance operations, shut-off valves are fitted to most components to enable isolation.

Operation

The oil is separated from the discharge gas in the oil separator. The oil then passes into the separator oil reservoir section. The oil reservoir section retains enough oil to supply the compressor oil/level regulators under all conditions. From the oil reservoir section the oil is supplied to the compressor oil manifold where it is fed to individual compressors by dictates of a return level switch either opto-electronic or mechanical and associated solenoid valve or float valve.

2 Changing the Compressor Oil

Refrigeration oil is of bright, transparent appearance even after extended operation. However, various conditions of the system can affect the oil such as insufficient evacuation of the system on start up, dirt from the pipework on installation and excessive discharge temperatures. Initial Oil type is stated on the serial plate, for alternatives refer to Hubbard Technical.



When the oil is seen to be in an unclean condition it should be changed to avoid consequential compressor damage.

The following procedures should be followed:

1. Fit a suction gauge to the compressor shut off valve.
2. Close the valve ahead of the oil manifold.
3. Close the compressor suction valve. To allow the compressor to pump out the crankcase it will be necessary to set down the compressor safety switch and compressor control to 0 barg.
4. When the crankcase is pumped out turn off the compressor control switch, or associated circuit breakers.
5. Shut the compressor discharge valve.
6. Allow the oil to drain into a suitable receptacle. Under normal circumstances, the compressor will not require flushing with a cleaning agent, but should it be considered necessary, the operation should be carried out at this stage.
7. Fill the compressor with oil to the recommended level.
8. Carry out a thorough leak test.
9. Break the vacuum with the gas through the suction valve then leave in a shutdown position.

Carry out the above procedure on all compressors.

3 Oil filters / driers

An oil filter / strainer may be fitted downstream of the oil separator outlet to remove system debris from the oil before returning to the compressor. With systems operating with POE oil a combined filter and drier assembly may be used to reduce moisture within the system. Filters should be replaced when the pressure drop across the valve is in excess of 1 barg / 15 psig (refer to manufacturers instructions), measured across the Schrader points provided.

4 Solenoid Valves

Solenoid valves are used where required on the liquid injection lines (LT scroll) and oil lines (all compressor types) Depending on their application they may be either energized to open or energized to close. When used in normal application very few problems will arise. However, listed below are points that should be observed.

1. When energized, solenoid coils should not be taken off the solenoid centre post (armature) as this will cause overheating resulting in the windings failing.
2. A common problem is when dirt or scale in the system is deposited on the valve seat, allowing refrigerant to pass through the valve.



5 Changing a Compressor.

These instructions may be supplemented by additional reference material provided.

Should the need arise to change a compressor the following sequence should be followed:

Electrical

1. Turn off the power and control circuit of the compressor to be removed and attach a notice to the panel stating that work is being carried out on the equipment.
2. Disconnect the wires from the compressor terminals taking note of the position of each cable.
3. Remove the conduits and cable from the terminal box.

Mechanically Isolate the Compressor

4. Back seat the suction and discharge service valves and fit a gauge to each valve.
5. Front seat the suction and discharge service valves and close the oil supply valve line or oil balance line shut off valve (if mechanical balance line is fitted).
6. Bleed the discharge pressure into the suction header and then remove the remaining refrigerant from the compressor using a reclaim pump if necessary.
7. Disconnect the suction valve, discharge valve, the oil level control / balance line and any control switch hoses from the compressor.

Removing the Compressor

8. Remove the compressor fixings.
9. Physically remove compressor off the pack framework, with due attention to health and safety requirements for lifting and handling of the compressor.
10. Remove the optic oil level switch and fittings carefully for re-use on the replacement compressor.
11. All valve openings and fitting apertures in the old compressor must then be blanked off to prevent oil spillage and any contamination within the compressor.

Installation

12. The new compressor can now be installed on the pack.
13. Replace the compressor mounting bolts loosely, not forgetting any spacers that may have been fitted.
14. Using new gaskets, and thread sealant, connect the service valves onto the compressor ensuring that no strain is put on the suction and discharge pipework.
Reconnect the oil line and the oil level control / balance line.
15. Tighten the compressor bolts.
16. Re-install wiring in compressor terminal box.
17. leak test and evacuate the compressor before opening any valve.
18. Start up the compressor and check the running current is correct.
19. Ensure that the compressor is operating correctly.



6 Replacing the liquid line Drier Core/s

Whenever the refrigeration plant is opened to the atmosphere there is the possibility of ingress of moisture into the system. New liquid line drier cores should be fitted.

This should be carried out as follows:

1. Close valve before drier shell and allow system to evacuate liquid charge from assembly.
2. Isolate the liquid line filter shell.
3. If bypass is fitted open bypass valve to allow system to operate otherwise switch off the unit.
4. Fit gauges to the Schrader point between the drier and sight glass and reclaim any gas remaining.
5. Remove the drier end cap and fit new drier core after ensuring that no foreign matter is present in the drier body or on the mesh filter.

Notes:

The drier core should not be opened from its sealed can until immediately before fitting into the drier body.

6. Leak test.
7. Evacuate the air from the drier through the charging point.
8. Open the liquid line valve after the drier.
9. Open the liquid line valve before the drier.
10. Restart the unit.

7 Pressure Relief Valve/s

Hubbard may fit either single or twin relief valves, with or without bursting disc assemblies according to customer's specification.

1. Pressure relief valves are preset to discharge at a set pressure dependant on refrigerant, system design and placement within the circuit. No attempt should be made to adjust this setting or to check the setting by discharging the valve. Valves should be removed before testing to a value in excess of 80% of the valve setting.
2. Should the need to replace a valve arise, this can be achieved by shutting off the faulty valve by either removing the system charge on assemblies fitted with single relief valves or via a dual shut off valve assembly in which the pressure relief valve is mounted.
3. During installation of the pack the pipework from the pressure relief valves should be run out of the building and vented safely into the atmosphere. No restriction such as pipe caps Etc. should be left in or on the pipework leading from the pressure relief valves to the outside as any back pressure will change the relief set point of the valves. Pipe-work should be sized to provide correct discharge flow rate for system design.



4. Relief valves that have been found to have discharged refrigerant should be replaced as positive sealing after discharge is not guaranteed.
5. During maintenance checks a leak test should be carried out in case of seeping occurring.

Pressure Relief Valve Testing and Replacement

Inspect the valves every 6 – 12 months. Replace every 5 years. See the attached 'Tech Tip' sheets on page 13 of this document.

8 Pressure switches and transducers

Transducers

Transducers that incorporate Schrader depressors will be supplied fitted directly to a port, those without will include a valve for isolation purposes to allow for maintenance.

Pressure switches – Safety.

Pressure switches fitted to compressor bodies, of either the adjustable or pre-set cartridge type will NOT be fitted with Schrader valves; this is to ensure that these safety switches are reacting to a definite pressure that cannot be influenced by mechanical tolerances.

Pressure switches – Control.

When fitted LP control switches will normally be assembled to a manifold, which for maintenance purposes will be isolatable via a valve from the pressure source.

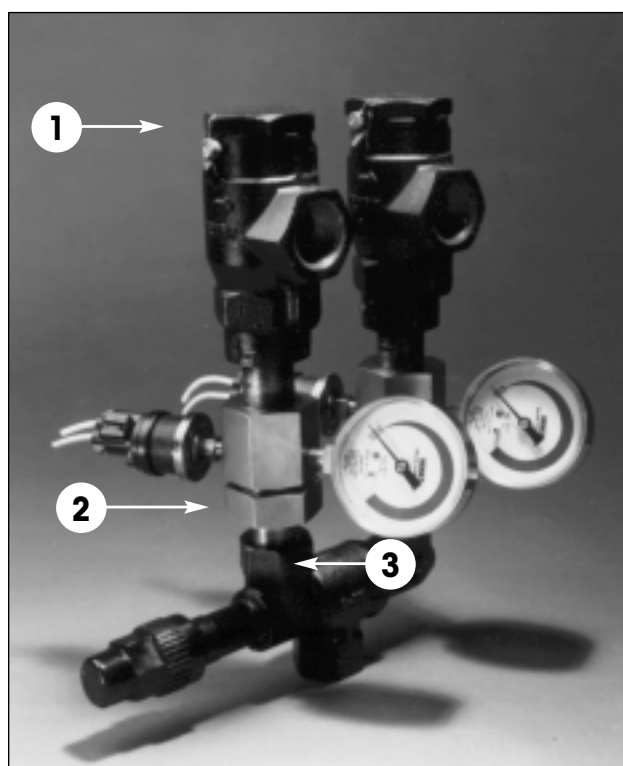
High Pressure switch testing

Periodically, as deemed by customer requirements, remove the high pressure switch from the system and apply dry nitrogen pressure using a calibrated gauge of a suitable range and ensure that the switch breaks and resets in line with the settings shown on the attached data sheet. Refit the switch, leak test and set the system back in operation.

Safety Relief Valves

Replacement, Maintenance,
Installation Recommendations

tech
tips



1. Relief Valve
2. "SENTRY" Rupture Disc Assembly
3. Three-Way Dual Shut-Off Valve

Safety relief valves are relatively maintenance free devices. Even so, we would recommend a periodic inspection of these devices every 6-12 months. A visual inspection should be made to verify the condition of the valves. While performing this inspection, some of the conditions to watch for are:

- A. Broken or missing seal wires.
- B. Signs of corrosion that could prevent the valve from functioning properly.
- C. Valve leakage.
- D. Missing nameplate.
- E. "Stacked" relief valves:

A common maintenance error is to add a second relief valve onto the outlet of an existing relief valve that is leaking. This "stacking" of relief valves is not permissible by code. By installing two relief valves in sequence, you add back-pressure above the first relief valve piston—causing a change in the pressure setting. For example, the estimated relieving pressure of a valve stack could be:

First relief valve:	300 PSI Setting
Second relief valve:	+ 300 PSI Setting
Total valve stack:	600 PSI Setting

As the relief flow then passes through the second valve, the valve stack also experiences a change in relieving capacity.

If any of these conditions exist, the valve should be replaced.

The condition of the discharge piping should also be inspected. Valves should be piped to insure that they do not collect dirt and debris. Vent pipes should be protected to prevent the entrance of rain water

which would inhibit valve operation. Any problems with the vent line should be corrected.

After maintenance the major issue concerning relief valves is "when and how often should the system relief valves be changed?" Relief valves should be changed out after discharge to ensure safeguarding a system with a properly set relief valve. Most systems are subject to accumulations of piping debris such as metal shavings and solder impurities as the system is fitted for installation. These impurities are generally blown into the relief valve seats at the time the valve is discharged. The impinged debris then inhibits the relief valve from reseating at its originally set pressure. In addition, the valves are then found to relieve at considerably lower pressure settings than the stamped valve setting due to the force of the reclosing action.

Replacement intervals for valves that have not discharged may be dictated by city, state or federal regulations. In addition, they may also be regulated by industry standards, company policies, insurance requirements or unwritten accepted standards of good practice.

In the case of city, state or federal regulations and insurance copy regulations, there appear to be no written rules covering the replacement schedule. However, these agencies do govern by verbal requirements requesting that system operators/owners provide proof of the reliability of the existing relief valves.

The International Institute of Ammonia Refrigeration (IAR) in their Bulletin 109 "IAR Minimum Safety Criteria for a Safe Ammonia Refrigeration System" recommends that the relief valve be replaced or inspected, cleaned and tested every five (5) years.

ANSI STD K61.1-1989: "Safety Requirements for the Storage and Handling of Anhydrous Ammonia" is very specific in its requirements.

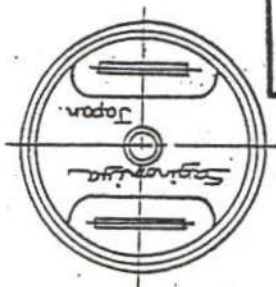
PARAGRAPH 5.8.15 STATES: "No container pressure relief devices shall be used after the replacement date as specified by the manufacturer of the device. If no date is specified a pressure relief valve shall be replaced no later than five years following the date of its manufacture etc."

In industrial refrigeration the current recommendation is to replace the relief valves on a five (5) year cycle. We fully support and recommend that the five (5) year replacement time frame be complied with. However, be sure to check with the other agencies to verify that a more stringent regulation is not applicable.

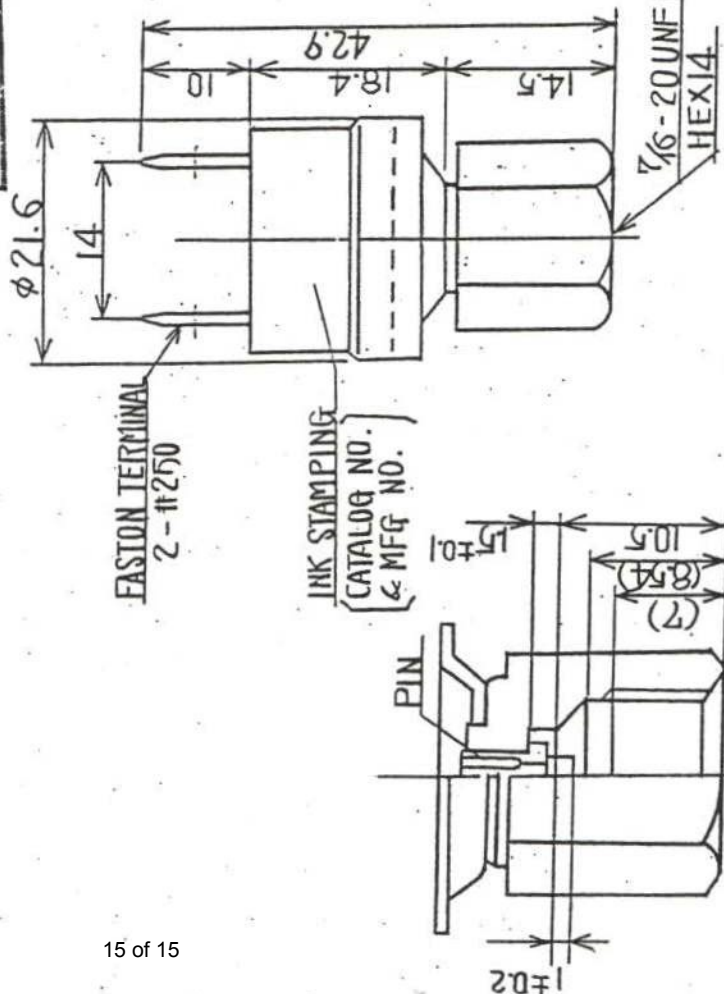
Beyond these recommendations there are a number of factors to be considered when selecting and installing relief valves.

1. Provide a pressure vessel which will permit the relief valve to be set at least 25% above the maximum system pressure. However, the relief valve setting cannot exceed the maximum allowable working pressure as stamped on the vessel the relief valve is protecting.
2. Select a relief valve to have sufficient capacity.
3. Select a relief valve suitable for the refrigerant.
4. Install the relief valve so that it will be exposed to refrigerant vapor, i.e. above the liquid level.
5. Install the relief valves where they are accessible for inspection and replacement.
6. Do not discharge relief valves prior to installation or when pressure testing the system.
7. Use the proper size and length of discharge tube or pipe. Correct sizing is required to prevent back-pressure from building up in the discharge line, preventing the relief valve from discharging at its rated capacity.
8. The use of a three-way valve with two relief devices, which comply with the code requirements for vessels 10 cubic feet or more in gross volume, is recommended for any installation containing a large quantity of expensive refrigerant.
9. When the outlets of two or more relief devices are connected to a common header, the size of the header must be large enough to remain unaffected by back-pressure—even if all the relief devices were to discharge simultaneously.

By following these simple rules and recommendations you can be assured that your system is protected by a properly functioning relief valve.



THERMOFROST CRYO PLC
UNCONTROLLED DOCUMENT
 IN ACCORDANCE WITH BS5750 QUALITY ASSURANCE



DETAIL FOR SCHRAEDER DEPRESSOR

WITH SCHRAEDER DEPRESSOR

OPERATING PRESS. CHARACTERISTICS		OPERATING PRESS. SETTING		R A N G E		DIFFERENTIAL	
		OFF	ON	MIN	MAX	MIN	MAX
		±10	±15	—	—	—	—
		23	17	—	—	—	—
ELECTRICAL RATINGS	RATED AMPS. A		RATED VOLTAGE V _P (COS φ)		A O. DC		
	NON-INDUCTIVE AMPS.				125 250 12		
	INDUCTIVE AMPS.		FULL LOAD AMPS		1 1.6 1.4 —		
			STARTING AMPS.		1.6 1.4 1.4 —		
						0.45 1.2 1.1 1.1 —	
TYPE OF CONTACT		<					



F. COMPONENT DETAILS

Bitzer Operating Instructions

Henry Helical Oil Separators (S-5188)

Henry Sentry Safety Device Assemblies

Henry Pressure Relief Valves

Henry Oil Regulator Shut Off Valves

Castel Dual Shut Off Safety Valves

Danfoss Ball Valves

Danfoss Pressure Controls

Carel pCO5 User Manual



THE HEART OF FRESHNESS

SEMI-HERMETIC

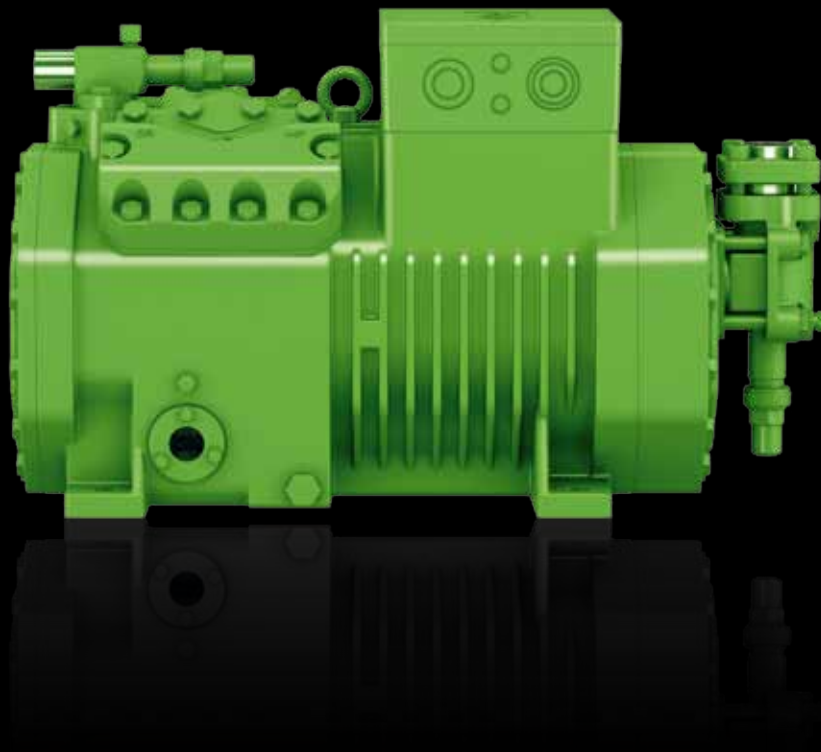
RECIPROCATING COMPRESSORS

HALBHERMETISCHE HUBKOLBENVERDICHTER

COMPRESSEURS HERMÉTIQUES ACCESSIBLES À PISTON

NEW ECOLINE

New Series



50 Hz // KP-104-2



Halbhermetische Hubkolbenverdichter

Semi-hermetic Reciprocating Compressors

Compresseurs hermétiques accessibles à piston

Inhalt	Seite	Content	Page	Sommaire	Page
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Die besonderen Attribute der BITZER ECOLINE Verdichter	4	The special highlights of the BITZER ECOLINE compressors	4	Les caractéristiques particulières des compresseurs BITZER ECOLINE	4
Die Leistungspalette	5	The capacity range	5	La gamme de puissance	5
Einsatzgrenzen für		Application limits for		Limites d'application pour	
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Leistungsdaten für		Performance data for		Données de puissance pour	
R134a Motorversion 1 und 2	13	R134a Motor version 1 and 2	13	R134a Version moteur 1 et 2	13
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Die neuen BITZER ECOLINE Verdichter

Der Einfluss der Kältetechnik auf die Umwelt steht zunehmend im Fokus der öffentlichen Diskussion. Dabei ist die Energie-Effizienz von Kälteanlagen ein entscheidender Faktor. Je niedriger der Energieverbrauch, desto günstiger sind Umweltbilanz und Lebenszykluskosten. Deshalb sind in verschiedenen Regionen (u.a. in der EU) bereits Richtlinien und Normen in Kraft getreten oder in Vorbereitung, in denen Mindestanforderungen hinsichtlich Energie-Effizienz festgeschrieben werden.

BITZER hat schon immer besonderen Wert auf die Wirtschaftlichkeit der Verdichter gelegt und vor einigen Jahren die speziell für R134a optimierte BITZER ECOLINE Serie eingeführt. R134a bietet insbesondere für Normalkühlung und Wärmepumpen sehr günstige Eigenschaften. Dazu gehören die besonders hohe Wirtschaftlichkeit, moderate Drucklagen (reduzierte Leckrate) und der geringste GWP Wert aller nicht brennbaren HFKW-Kältemittel. Dies ermöglicht mit den neuen, auch bei sehr niedrigen Verflüssigungstemperaturen einsetzbaren BITZER ECOLINE Verdichtern

The new BITZER ECOLINE compressors

The influence of refrigeration on the environment has increasingly become the focus of public discussion. Therefore, energy efficiency of refrigeration systems is an essential criterion. The lower the energy consumption, the more favorable are the environmental balance and life cycle costs. Thus in several regions (such as the EU) Directives and Standards have come into effect or are in preparation in order to define minimum requirements with respect to energy efficiency.

BITZER has always paid special attention to the efficiency of compressors and a few years ago introduced the BITZER ECOLINE series, which has been optimized especially for R134a. R134a offers very favorable characteristics especially for medium temperature and heat pump applications. This includes the extra high efficiency, moderate pressure levels (reduced leakage rates) and the lowest GWP value of all non-flammable HFC refrigerants. This gives the new BITZER ECOLINE compressors, which can also be used at very low condensing temperatures, a

Les nouveaux compresseurs BITZER ECOLINE

L'influence de la réfrigération sur l'environnement est de plus en plus au centre des discussions publiques. C'est pourquoi l'efficacité énergétique des installations frigorifiques constitue un facteur essentiel. Une faible consommation en énergie permet d'améliorer surtout le bilan environnemental et les coûts liés au cycle de vie. Pour cette raison, plusieurs régions (entre autres dans l'UE) ont voté ou préparé des directives et normes qui définissent les exigences minimales en ce qui concerne l'efficacité énergétique.

BITZER a toujours attaché une grande importance à la rentabilité des compresseurs et a introduit, il y a quelques années, la série BITZER ECOLINE particulièrement optimisée pour R134a. Pour la réfrigération à moyenne température et les pompes à chaleur, R134a offre des caractéristiques favorables. Ceci contient l'efficacité plus élevée, des niveaux de pressions modérés (des taux de fuites réduits) et la valeur du potentiel de réchauffement de la planète (GWP) le plus réduit de tous les HFC combustibles. Pour cette raison il est possible de réaliser des uniques efficacités saisonnières favorables avec les nouveaux com-

eine unvergleichlich günstige saisonale Energieeffizienz. So wurde auch in Studien nachgewiesen, dass für Supermarktanwendungen eine Hybrid-Ausführung mit R134a bei Normalkühlung in Kaskade mit CO₂ Tiefkühlung eine besonders günstige Öko-Effizienz (Optimum in Lebenszyklus-Kosten und TEWI) sowie niedrigen Energiebedarf aufweist.

Die BITZER ECOLINE Serie wurde jetzt durch weitere Modelle ergänzt und für den universellen Einsatz von unterschiedlichen Kältemitteln bei gleichzeitig vergrößerten Einsatzbereichen weiterentwickelt.

Zu den Kältemitteln gehören: R134a, R404A, R407A, R407C, R407F, R507A und R22.

Die Verdichter sind auch bereits für den Betrieb mit "Low-GWP" HFO-Kältemitteln und HFO-/HFKW-Gemischen ausgelegt.

Die Leistungszahl (COP) der neuen BITZER ECOLINE Modelle konnte gegenüber der bisherigen Baureihe um bis zu 12% verbessert werden.

Dies wird u.a. erreicht durch eine weitere Optimierung der Ventilplatten, reduzierte Strömungsverluste und Druckgaspulsationen sowie speziell angepasste, besonders effiziente Motoren.

Die Verdichter sind für den Betrieb mit Frequenzumrichter von 30 bis 70 Hz ausgelegt – CE3 bis BE6 von 25 bis 70 Hz. Dadurch kann die Kälteleistung der Anlage genau dem Bedarf angepasst werden.

Bei R134a Verdichtern (Ausführung "Motor 3") ist Frequenzumrichter-Betrieb bis 70 Hz mit dem Standardmotor (für Netzspannung 400V/3/50Hz) möglich. Detaillierte Erläuterungen zum Betrieb mit Frequenzumrichter siehe Seiten 7 und 8.

beneficial seasonal energy efficiency beyond comparison. Studies have demonstrated that for supermarket applications a hybrid version with R134a for medium temperature application in cascade with CO₂ low temperature application offers a particularly advantageous ecological efficiency (optimum of life cycle costs and TEWI) as well as a low energy demand.

More models have now been added to the BITZER ECOLINE series and it has been further developed for the universal use with different refrigerants at an extended application range.

The refrigerants include: R134a, R404A, R407A, R407C, R407F, R507A and R22.

The compressors are also designed for the operation with "Low-GWP" HFO refrigerants and HFO/HFC blends.

The COP of the new BITZER ECOLINE models could be improved by up to 12% compared to the previous series.

This is achieved by further optimized valve plates, reduced flow losses and discharge gas pulsations, as well as specially adapted highly efficient motors.

The compressors are designed for the operation with frequency inverter from 30 to 70 Hz – CE3 to BE6 from 25 to 70 Hz. Thus the cooling capacity of the plant can be adjusted exactly to the demand.

Compressors for R134a ("motor version 3") are suitable for the operation with frequency inverter up to 70 Hz with standard motor (for supply voltage 400V/3/50Hz). Detailed explanations to operation with frequency inverter see pages 7 and 8.

presseurs BITZER ECOLINE applicables aussi à des basses températures de condensation. Etudes ont prouvées que pour d'applications supermarché une version hybride avec R134a pour la réfrigération à moyenne température en cascade avec CO₂ réfrigération à basses températures présente une efficacité d'écologie extrêmement favorable (solution idéale en matière des coûts du cycle de vie et TEWI) ainsi qu'un besoin énergétique très faible.

La série BITZER ECOLINE a été complétée par d'autres modèles et a fait l'objet d'un perfectionnement continu pour l'utilisation universelle de différents fluides frigorigènes dans un domaine d'application étendu.

Cela s'applique aux fluides frigorigènes suivants: R134a, R404A, R407A, R407C, R407F, R507A et R22.

Les compresseurs sont déjà conçus pour l'utilisation avec des fluides frigorigènes HFO à faible GWP and des mélanges HFO/HFC.

La rentabilité de performance (COP) des nouveaux modèles BITZER ECOLINE peut être améliorée de jusqu'à 12% par rapport à la série précédente.

Cela peut être obtenu par une optimisation des plaques à clapets, une réduction de la perte de charge et des pulsations des gaz ainsi que par l'utilisation des moteurs adaptés spécialement et particulièrement efficaces.

Les compresseurs sont conçus pour le fonctionnement avec un convertisseur de fréquences de 30 à 70 Hz – CE3 à BE6 de 25 à 70 Hz – ce qui permet d'adapter la puissance frigorifique exactement au besoin respectif.

Il est possible d'utiliser les compresseurs pour R134a (version "moteur 3") avec un convertisseur de fréquences jusqu'à 70 Hz avec le moteur standard (pour tension de réseau 400V/3/50Hz). Explications détaillées au fonctionnement avec convertisseur de fréquences voir pages 7 et 8.



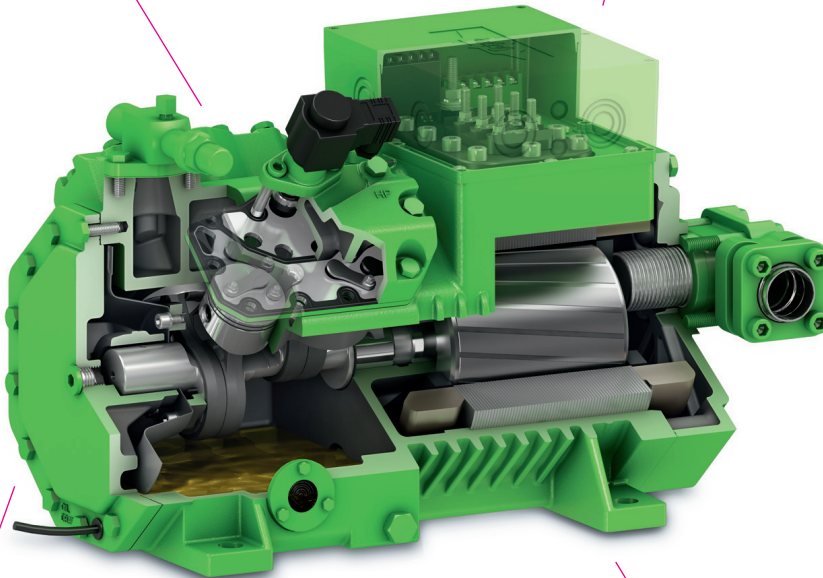
**Die besonderen Attribute der
BITZER ECOLINE Verdichter**

**The special highlights of the
BITZER ECOLINE compressors**

**Les caractéristiques particulières
des compresseurs BITZER ECOLINE**

- Neues Ventilplatten-Design
- New valve plate design
- Nouveau design de la plaque à clapets

- Neue Gestaltung des Zylinderkopfes – geringe Pulsationen
- New cylinder head design – less pulsation
- Nouveau concept de la tête de culasse – pulsations faibles



- Minimale Druckverluste durch optimierte Strömungsverhältnisse
- Optimized gas flow for minimum pressure drop
- Pertes de pression minimisées grâce aux rapports de flux optimisés

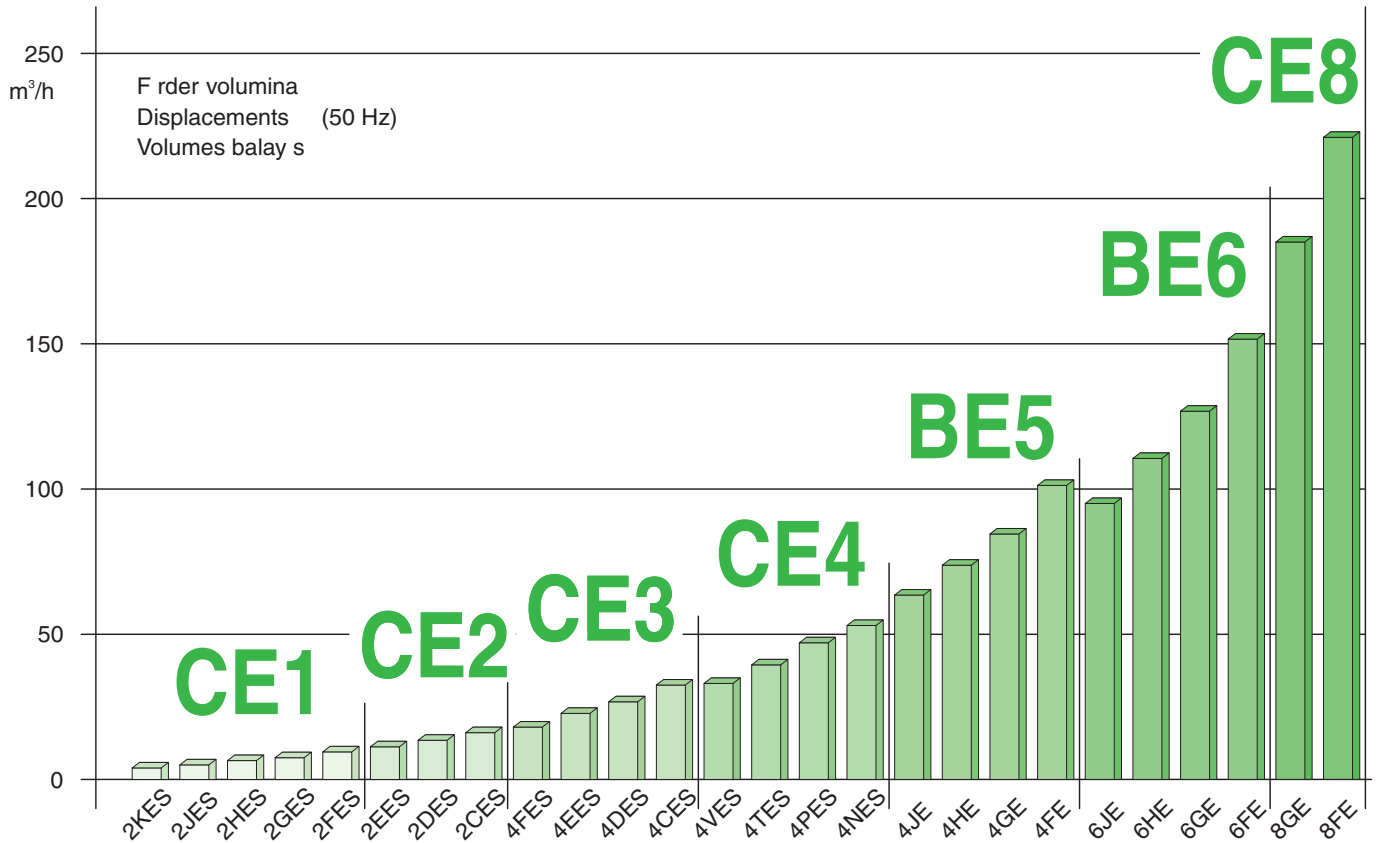
- Neue Konstruktion von Kolben und Pleuel
- New piston and connecting rod design
- Piston et bielle nouvellement conçus

- Speziell angepasster, besonders effizienter Motor
- Specially adapted highly efficient motor
- Moteur adapté spécialement et particulièrement efficace

Die Leistungspalette

The capacity range

La gamme de puissance



Erläuterung der Typenbezeichnung

Beispiel

4 N E S – 20 Y – 40PKennziffer für Zylinderzahl
(doppelt bei Tandem-Verdichter)**4 N E S – 20 Y – 40P**

Kennbuchstabe für Bohrung x Hub

4 N E S – 20 Y – 40PKennbuchstabe für BITZER ECOLINE
Serie**4 N E S – 20 Y – 40P**Kennbuchstabe für Zentrifugal-
schmierung**4 N E S – 20 Y – 40P**

Kennziffer für Motorgröße

4 N E S – 20 Y – 40P

Kennbuchstabe für Esteröl-Füllung

4 N E S – 20 Y – 40P

Motorkennung

Explanation of model designation

Example

4 N E S – 20 Y – 40PIndex for number of cylinders
(double with tandem compressor)**4 N E S – 20 Y – 40P**

Identification letter for bore x stroke

4 N E S – 20 Y – 40PIdentification letter for BITZER ECOLINE
series**4 N E S – 20 Y – 40P**

Code for centrifugal lubrication

4 N E S – 20 Y – 40P

Code for motor size

4 N E S – 20 Y – 40P

Identification letter for ester oil charge

4 N E S – 20 Y – 40P

Motor code

Explication de la désignation des types

Exemple

4 N E S – 20 Y – 40PChiffre-index pour le nombre de cylindres
(double en cas de compresseur tandem)**4 N E S – 20 Y – 40P**

Codification pour alésage x course

4 N E S – 20 Y – 40P

Codification pour série BITZER ECOLINE

4 N E S – 20 Y – 40P

Codification pour lubrification centrifuge

4 N E S – 20 Y – 40P

Code pour taille de moteur

4 N E S – 20 Y – 40P

Codification pour charge d'huile ester

4 N E S – 20 Y – 40P

Code de moteur



Eine eng gestufte Verdichterpalette für moderne Kälte-, Klima- und Wärmepumpenanlagen

Mit der neuen BITZER ECOLINE Serie bietet BITZER hocheffiziente, universell einsetzbare Verdichter, die die anspruchsvollen Anforderungen moderner Kälteanlagen erfüllen:

Erweiterter Einsatzbereich

- R134a bis $t_c = 85^\circ\text{C}$
R404A und R507A bis $t_c = 62^\circ\text{C}$

Energie-effizient

- hohe Kälteleistung und minimaler Energiebedarf durch:
 - besonders effiziente Arbeitsventile
 - minimalen Schadraum
 - wirtschaftlichen, großvolumigen Motor
 - reduzierte Strömungsverluste bei niedrigen Verflüssigungstemperaturen

Verschleißfestes Triebwerk

- oberflächengehärtete Exzenter- und Kurbelwellen
- reibungsarme Lager und Alu-Kolben
- hartverchromte Kolbenringe

Leise und schwingungsarm

- optimierter Massenausgleich
- geringe Druckgaspulsationen durch spezielle Zylinderkopfausführung

Minimaler Platzbedarf

- äußerst kompakte Abmessungen

Robust

- stabile Ventilplattenkonstruktion
- Ventile aus schlagzähem Federstahl
- verschleißfestes Triebwerk

Wirtschaftliche Leistungsregelung

- Zylinderabschaltung oder Drehzahlregelung möglich
- Zylinderabschaltung bereits ab $18 \text{ m}^3/\text{h}$ Hubvolumen (50 Hz) möglich
 - 4-Zylinder-Verdichter: 50%
 - 6-Zylinder-Verdichter: 66% / 33%
 - 8-Zylinder-Verdichter: 75% / 50%
- Taktende Zylinderabschaltung, z.B. 4-Zylinder-Verdichter auf beiden Zylinderköpfen: 100% bis ca. 10%
- Tandem-Verdichter bereits ab $22,7 \text{ m}^3/\text{h}$ bis $303 \text{ m}^3/\text{h}$ (50 Hz)
- erprobter Parallelbetrieb
- Drehzahlregelung von 25 bis 70 Hz
Erläuterungen hierzu siehe Seiten 7 und 8

A closely graduated product range for modern refrigeration, A/C, and heat pump systems

With the new BITZER ECOLINE series BITZER offers highly efficient all-purpose compressors, which meet the challenging demands of modern refrigeration systems:

Extended application range

- R134a up to $t_c = 85^\circ\text{C}$
R404A and R507A up to $t_c = 62^\circ\text{C}$

Energy efficient

- high cooling capacity and minimum energy requirement:
 - highly efficient working valves
 - minimum clearance volume
 - efficient, large-volume motor
 - reduced flow losses at low condensing temperatures

Wear resistant drive gear

- surface hardened eccentric shaft and crankshaft
- low friction bearings and aluminium pistons
- hard chrome plated piston rings

Quiet with low vibration

- optimized mass balance
- low discharge gas pulsations due to special cylinder head design

Minimum space requirement

- very compact design

Robust

- solid valve plate design
- valves made of impact resistant spring steel
- wear resistant drive gear

Efficient capacity control

- cylinder shut-off or VSD capacity control possible
- cylinder shut-off possible from $18 \text{ m}^3/\text{h}$ displacement (50 Hz) on
 - 4 cylinder compressor: 50%
 - 6 cylinder compressor: 66% / 33%
 - 8 cylinder compressor: 75% / 50%
- Fast cycling cylinder shut-off, e.g. 4 cylinder compressor on both cylinder heads: 100% to approx. 10%
- tandem compressors from $22,7 \text{ m}^3/\text{h}$ to $303 \text{ m}^3/\text{h}$ (50 Hz)
- approved parallel operation
- VSD capacity control from 25 to 70 Hz
Explanations see pages 7 and 8

Une vaste gamme de compresseurs pour les installations modernes destinées à la réfrigération, la climatisation et le chauffage thermodynamique

Avec la série BITZER ECOLINE, BITZER vous propose des compresseurs hautement efficaces et universellement utilisables permettant de satisfaire les exigences des installations frigorifiques modernes:

Domaine d'application étendu

- R134a jusqu'à $t_c = 85^\circ\text{C}$
R404A et R507A jusqu'à $t_c = 62^\circ\text{C}$

Efficacité énergétique

- haute puissance frigorifique et consommation minimale d'énergie grâce aux caractéristiques suivantes:
 - soupapes de travail particulièrement efficaces
 - espace mort minimal
 - moteur économique à gros volume
 - réduction de la perte de charge à de basses températures de condensation

Mécanisme d'entraînement résistant à l'usure

- arbres excentriques et vilebrequins trempés en surface
- roulements à faible friction et pistons en aluminium
- bagues de piston en chrome dur

Silence et faibles vibrations

- équilibrage de masse optimisé
- réduction des pulsations des gaz grâce à une tête de culasse spéciale

Encombrement minimal

- dimensions extrêmement compactes

Robustesse

- construction stable de plaques à clapets
- soupapes en acier ressort à haute résistance aux chocs
- mécanisme d'entraînement résistant à l'usure

Régulation économique de la puissance

- déconnexion des cylindres ou réglage de la vitesse possible
- déconnexion des cylindres possible déjà à partir d'une capacité de refoulement de $18 \text{ m}^3/\text{h}$ (50 Hz)
 - compresseur à 4 cylindres: 50%
 - compresseur à 6 cylindres: 66% / 33%
 - compresseur à 8 cylindres: 75% / 50%
- Déconnexion rapide des cylindres, p.ex. compresseur à 4 cylindres au deux culasses: 100% à env. 10%
- compresseur tandem déjà à partir de $22,7 \text{ m}^3/\text{h}$ jusqu'à $303 \text{ m}^3/\text{h}$ (50 Hz)
- fonctionnement en parallèle testé
- réglage de la vitesse de 25 à 70 Hz
Explications voir pages 7 et 8

BITZER ECOLINE Verdichter für Frequenzumrichter-Betrieb bis 70 Hz

Alle BITZER ECOLINE Verdichter sind für den Betrieb bis 70 Hz ausgelegt und optimiert. Je nach Kältemittel und Einsatzbedingungen kann dabei ein Verdichter mit PW Standardmotor (400V-3-50Hz) eingesetzt werden oder ein Sondermotor (230V/400V-3-50Hz*) erforderlich sein, der in Dreieckschaltung (230VΔ-3-50Hz) angeschlossen wird. Letzteres gilt für Verdichter mit Motorversion 1 und 2, sofern sie im gesamten dokumentierten Einsatzbereich betrieben werden sollen. Der Einsatz eines PW Standardmotors für 400 V oder Anschluss eines 230/400V Motors in Sternschaltung muss wegen des abfallenden Drehmoments beim Betrieb oberhalb 50 Hz (Abb. 1) individuell mit BITZER abgestimmt werden – siehe auch Technische Information KT-420.

* Verdichter 2KES-05(Y) bis 4CES-9(Y) sind standardmäßig mit 230/400V-3-50Hz Motoren ausgestattet und können je nach Anwendung entweder bei 400 V in Sternschaltung oder 230 V in Dreieckschaltung betrieben werden.

BITZER ECOLINE compressors for frequency inverter operation up to 70 Hz

All BITZER ECOLINE compressors have been designed and optimized for the operation up to 70 Hz. Depending on the refrigerant and the application conditions a compressor can be used with a PW standard motor (400V-3-50Hz), or a special motor (230V/400V-3-50Hz*) may be required which is connected in delta wiring (230VΔ-3-50Hz). This applies to compressors with motor versions 1 and 2 if they are operated within the entire displayed application range. If a PW standard motor for 400 V is used or a 230/400V motor is connected in star wiring, consultation with BITZER is necessary due to the dropping torque at operation above 50 Hz (fig. 1) – see also Technical Information KT-420.

* Compressors 2KES-05(Y) to 4CES-9(Y) are delivered with 230/400V-3-50Hz motors as standard; depending on the application they may be operated in star wiring at 400 V or in delta wiring at 230 V.

Compresseurs BITZER ECOLINE pour le fonctionnement avec convertisseur de fréquences jusqu'à 70 Hz

Tous les compresseurs BITZER ECOLINE sont spécifiquement conçus et optimisés pour un fonctionnement jusqu'à 70 Hz. En fonction du fluide frigorigène et des conditions d'emploi, un compresseur équipé d'un moteur PW standard (400V-3-50Hz) peut être utilisé ou d'un moteur spécial (230V/400V-3-50Hz*) en câblage en triangle (230VΔ-3-50Hz) peut être nécessaire. Ceci s'applique aux compresseurs équipés des versions moteurs 1 et 2, à moins qu'ils soient destinés à une utilisation couvrant tout le champ d'application documenté. En raison de la torque qui baisse à partir de 50 Hz (fig. 1), consultez BITZER avant tout emploi d'un moteur PW standard pour 400 V ou d'un moteur 230/400V en câblage en étoile – voir les Informations Techniques KT-420.

* Les compresseurs de série des types 2KES-05(Y) jusqu'à 4CES-9(Y) sont équipés de moteurs 230/400V-3-50Hz et peuvent fonctionner à 400 V en connexion étoile ou à 230 V en connexion triangle.

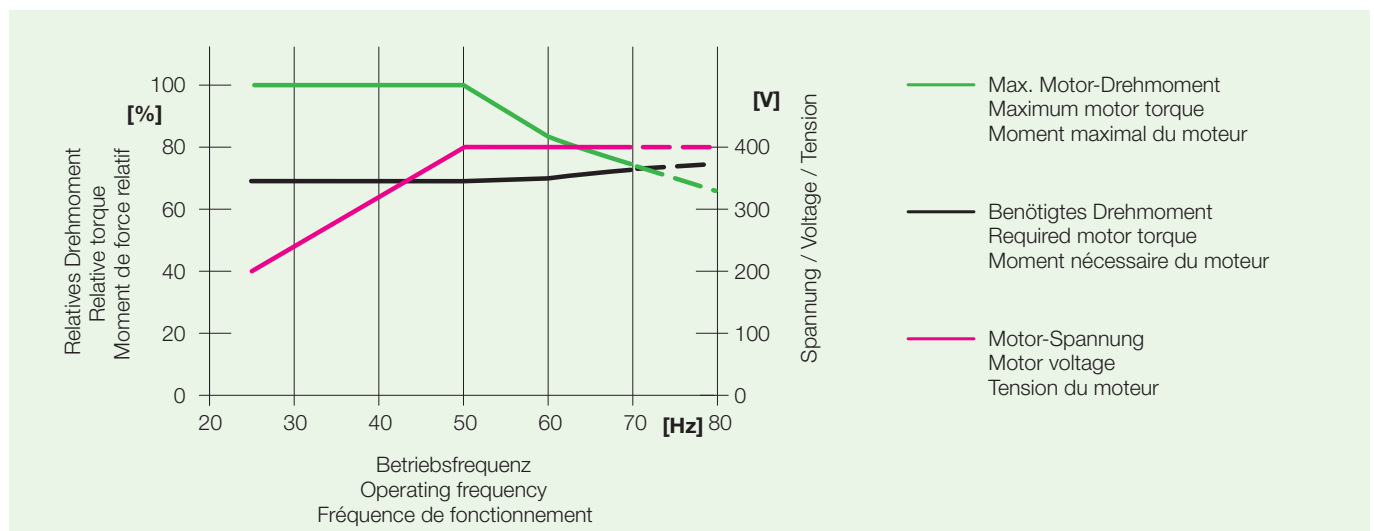


Abb. 1

Fig. 1

Fig. 1



R134a Verdichter mit Motorversion 3

sind so konzipiert, dass sie mit dem Standard PW-Motor für 400V-3-50Hz mit Frequenzumrichter im gesamten Einsatzbereich ohne Einschränkungen bis 70 Hz bei 400 V in sog. "Feldschwäche" betrieben werden können. Der Bereich der Feldschwäche beginnt dort, wo die Ausgangsspannung des Umrichters nicht weiter erhöht werden kann, die Frequenz jedoch weiter ansteigt. Wird die Frequenz bei gleichbleibender Spannung (400 V) erhöht, sinkt das Drehmoment des eingebauten Asynchronmotors (Abb. 1). Die Motoren sind deshalb so ausgelegt, dass der Rückgang des Drehmoments oberhalb 50 Hz kompensiert werden kann.

Diese spezifische Motorausführung ermöglicht eine einfache und sichere Auslegung von Verdichter sowie Frequenzumrichter und bietet einen Kostenvorteil durch Einsatz des Standardmotors. Darüber hinaus ergeben sich Kosteneinsparungen bei der elektrischen Installation auf Grund des geringeren Betriebsstroms im Vergleich zu einem Sondermotor (230V-3-50Hz).

Der Frequenzumrichter wird auf den maximalen Betriebsstrom bei 400V-3-70Hz ausgelegt. Der betreffende "Auslegungsstrom für 70 Hz FU Betrieb" ist unter Technische Daten (Seite 28) und auf dem Verdichter-Typschild aufgeführt. Der elektrische Anschluss des Motors erfolgt wie bei Direktanlauf entsprechend Abb. 2. Schützauslegung nach Kategorie AC3, bezogen auf den maximalen Betriebsstrom bei 70 Hz.

R134a compressors with motor 3

are designed in such a way that they can be operated within the complete application range up to 70 Hz without restrictions at 400 V (in the so-called "field weakness") using the standard PW motor for 400V-3-50Hz with frequency inverter. The field weakness range begins at the point where the inverter's output voltage cannot be further raised, though the frequency still increases. If the frequency is raised at constant voltage (400 V), the torque of the built-in asynchronous motor drops (fig. 1). Thus the motors are designed in such a way that the dropping torque above 50 Hz can be compensated.

This specific motor design allows an easy and safe selection of compressor and frequency inverter and offers a cost advantage by applying the standard motor. Moreover costs are reduced at the electrical installation due to the low operating current compared to a standard motor (230V-3-50Hz).

The frequency inverter is selected for the maximum operating current at 400V-3-70Hz. The respective "selection current for 70 Hz FI operation" is displayed under Technical Data (page 28) and on the compressor's name plate. The electrical connection of the motor is carried out as for direct start according to fig. 2. Contactor selection according to AC3, based on the maximum operating current at 70 Hz.

Les compresseurs R134a avec la version moteur 3

sont conçus pour un fonctionnement en «affaiblissement de champ» sans limites jusqu'à 70 Hz à 400 V avec les moteurs PW standard pour 400V-3-50Hz et avec convertisseur de fréquences sur tout le champ d'applications. La zone d'affaiblissement de champ commence là, où la tension de sortie du convertisseur de fréquences ne peut plus être augmentée mais où la fréquence continue de monter. Quand la fréquence baisse sous une tension constante (400 V), la torque du moteur asynchrone va baisser (fig. 1). Ainsi les moteurs sont conçus pour compenser cette réduction de la torque au-dessus de 50 Hz.

Cette version moteur spécifique permet une conception aisée et sécurisée des compresseurs ainsi que des convertisseurs de fréquences et offre donc aussi un avantage de prix grâce à l'utilisation d'un moteur standard. D'autres avantages de prix résultent de l'installation électrique qui consomme moins d'énergie qu'un moteur spécial (230V-3-50Hz).

Le convertisseur de fréquences est adapté à un courant de service maximal à 400V-3-70Hz. Le «courant de service pour un fonctionnement à 70 Hz du convertisseur de fréquences» est détaillé sous les Données Techniques (page 28) ainsi que sur la plaque signalétique du compresseur. En cas d'un démarrage direct, la connexion électrique du moteur est réalisée selon fig. 2. Conception des contacteurs selon la catégorie AC3 pour un courant de service maximal à 70 Hz.

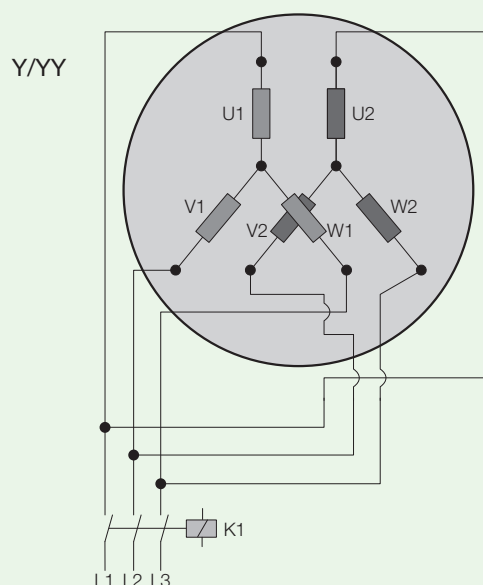


Abb. 2

Fig. 2

Fig. 2



Lieferumfang und Zubehör

siehe Preisliste

Sonder-Ausstattung

Je nach Baureihe u. a. Ölsumpfheizung, Öldifferenzdruck-Schalter oder Ölniveau-Überwachung (CE4-Serie), integrierte Anlaufentlastung, integrierte Leistungsregelung, Zusatzlüfter, Druckgas-Temperaturfühler.

Leistungsdaten

Erläuterungen siehe Seite 12.

Extent of delivery and accessories

refer to Price List

Optional extras

Depending on series among others: crankcase heater, differential oil pressure switch or oil level monitoring (CE4 series), integrated start unloader, integrated capacity control, additional fan, discharge gas temperature sensor.

Performance data

Explanations see page 12.

Etendue de la fourniture et accessoires

voir notre Tarif

Accessoires livrables en option

Dépendant du série: résistance de carter, pressostat différentiel d'huile ou contrôle de niveau d'huile (série CE4), démarrage à vide intégré, régulation de puissance intégrée, ventilateur additionnel, sonde de température du gaz au refoulement.

Données de puissance

Explications voir page 12.



Einsatzgrenzen

bezogen auf 20°C Sauggasttemperatur

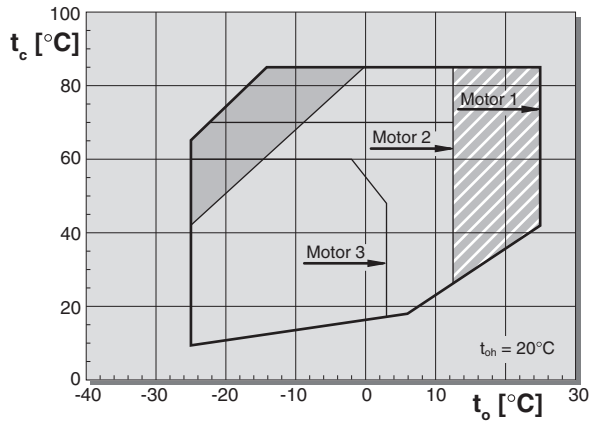
Application limits

relating to 20°C suction gas temperature

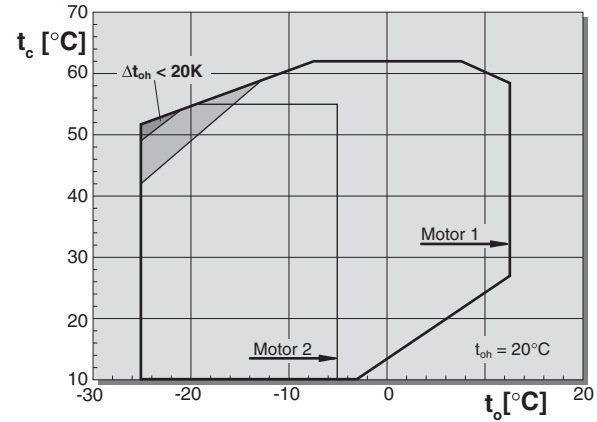
Limites d'application

se référant à une température du gaz d'aspiration de 20°C

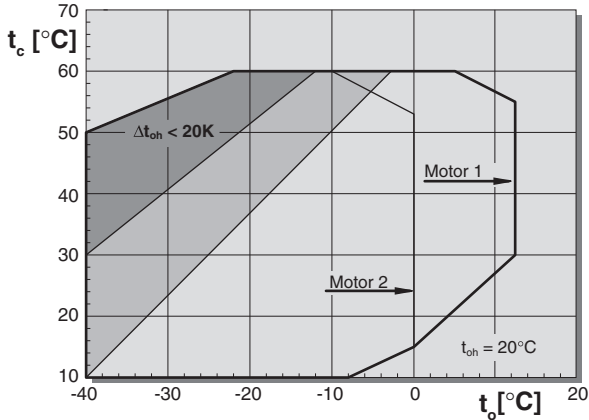
R134a ①, ②



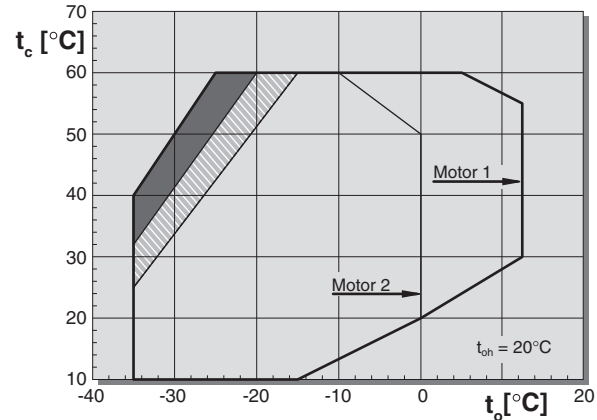
R407C ①, ②, ③



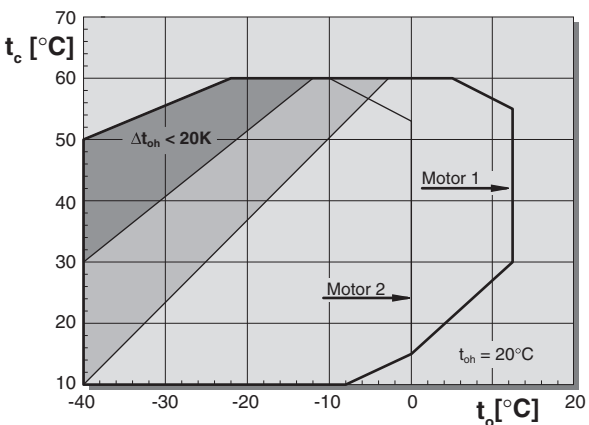
R407A 2KES-05Y .. 4CES-9Y ③



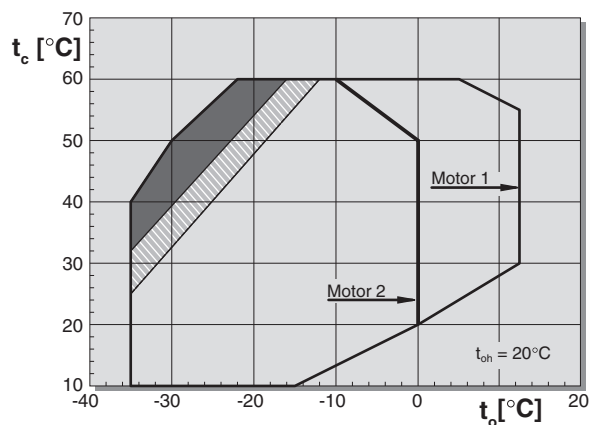
R407A 4VES-7Y .. 6FE-50Y ③, ④



R407F 2KES-05Y .. 4CES-9Y ③



R407F 4VES-7Y .. 6FE-50Y ③, ④



① 8GE-50Y .. 8FE-70Y:
minimale Verdampfungstemperatur -20°C

② Mit R134a bei $t_o > 70^\circ\text{C}$ muss Öl BSE55 verwendet werden (anstelle BSE32)

③ Verdampfungs- und Verflüssigungstemperaturen beziehen sich auf Taupunktwerte (Satttdampf)

④ Tiefere Verdampfungstemperaturen sind durch Einsatz von **CC** möglich.
Auslegung auf Anfrage.

① 8GE-50Y .. 8FE-70Y:
minimum evaporating temperature -20°C

② For R134a and $t_o > 70^\circ\text{C}$ oil BSE55 has to be used (instead of BSE32)

③ Evaporating and condensing temperatures are based on dew point conditions (saturated vapour)

④ Lower evaporating temperatures are possible with **CC** operation.
Selection upon request.

① 8GE-50Y .. 8FE-70Y:
température d'évaporation minimale -20°C

② Pour R134a et $t_o > 70^\circ\text{C}$ il faut utiliser huile BSE55 (en lieu de BSE32)

③ Les températures d'évaporation et de condensation se réfèrent aux valeurs du point de rosée (conditions de vapeurs saturées)

④ Températures d'évaporation plus basses sont possible par opération avec **CC**.
Sélection sur demande.

Einsatzgrenzen

bezogen auf 20°C Sauggastemperatur

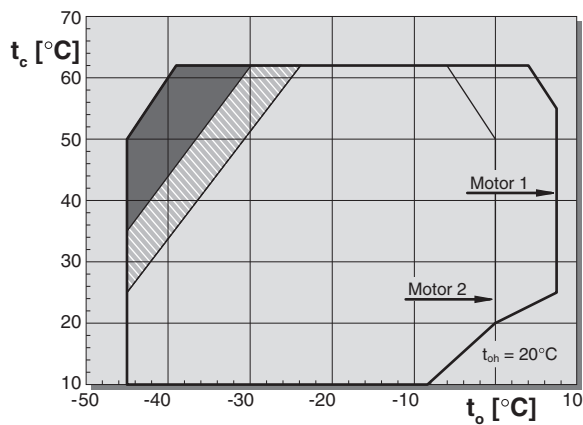
Application limits

relating to 20°C suction gas temperature

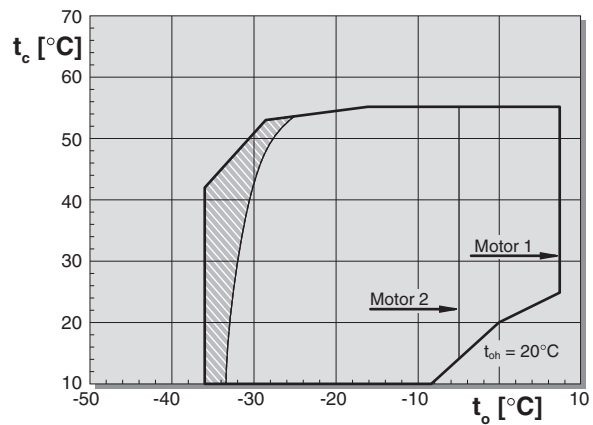
Limites d'application

se référant à une température du gaz d'aspiration 20°C

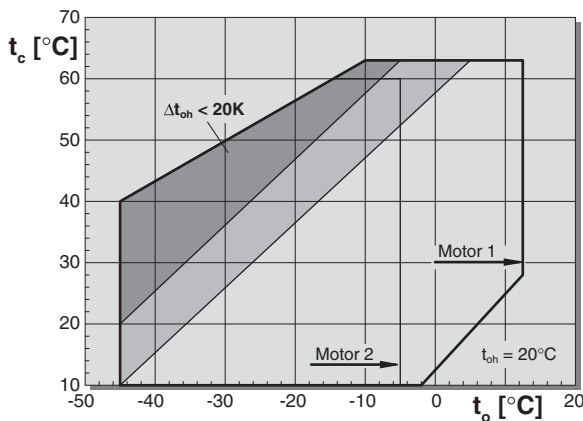
R404A ■ R507A 2KES-05Y .. 6FE-50Y



R404A ■ R507A 8GE-50Y .. 8FE-70Y^①

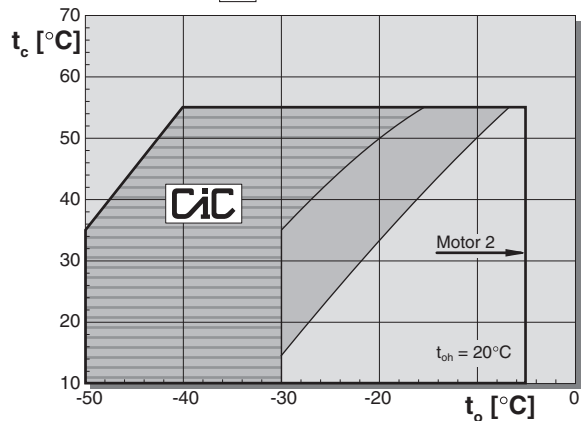


R22 2KES-05 .. 4CES-9

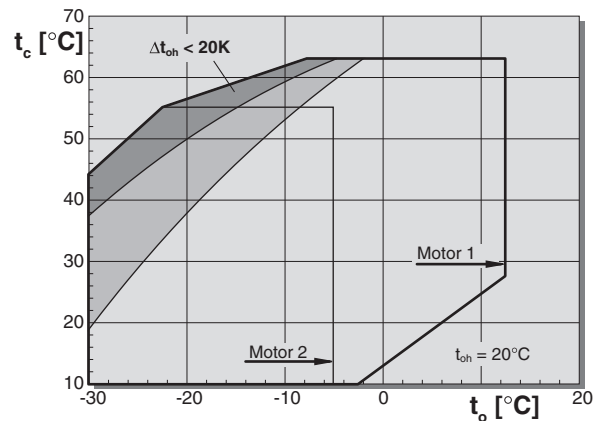


R22 4VES-7 .. 6FE-40

mit / with / avec



R22 4VES-7 .. 8FE-70^①



t_o	Verdampfungstemperatur (°C)
t_{oh}	Sauggastemperatur (°C)
Δt_{oh}	Sauggas-Überhitzung (K)
t_c	Verflüssigungstemperatur (°C)
	Zusatzkühlung oder max. 0°C Sauggastemperatur
	Zusatzkühlung
	Zusatzkühlung + eingeschränkte Sauggastemperatur entsprechend einer <20 K Sauggas-Überhitzung
	Zusatzkühlung oder eingeschränkte Sauggastemperatur entsprechend einer <20 K Sauggas-Überhitzung
	Sauggas-Überhitzung >10 K
	Zusatzlüfter +

t_o	Evaporating temperature (°C)
t_{oh}	Suction gas temperature (°C)
Δt_{oh}	Suction gas superheat (K)
t_c	Condensing temperature (°C)
	Additional cooling or max. 0°C suction gas temperature
	Additional cooling
	Additional cooling + limited suction gas temperature according to <20 K suction gas superheat
	Additional cooling or limited suction gas temperature according to <20 K suction gas superheat
	Suction gas superheat >10 K
	Additional fan +

t_o	Température d'évaporation (°C)
t_{oh}	Température du gaz d'aspiration (°C)
Δt_{oh}	Surchauffe du gaz d'aspiration (K)
t_c	Température de condensation (°C)
	Refroid. additionnel ou max. 0°C température du gaz d'aspiration
	Refroid. additionnel
	Refroid. additionnel + température du gaz d'aspiration limitée suivant à une surchauffe du gaz d'aspiration de <20 K
	Refroid. additionnel ou température du gaz d'aspiration limitée suivant à une surchauffe du gaz d'aspiration de <20 K
	Surchauffe du gaz d'aspiration >10 K
	Ventilation +



Leistungsdaten

Im vorliegenden Prospekt sind Leistungsdaten für R134a, R404A, R407A und R407F dokumentiert.

Leistungsdaten für andere Kältemittel auf Anfrage.

Alle Leistungswerte basieren auf der europäischen Norm EN 12900 und 50 Hz-Betrieb. Leistungsdaten für individuelle Betriebsbedingungen und 60 Hz-Betrieb siehe BITZER Software.

Alle Daten sind **ohne** Flüssigkeits-Unterkühlung dokumentiert. Basierend auf EN 12900 ergeben sich dadurch deutliche Unterschiede gegenüber Daten, bei denen 5 bzw. 8,3 K Unterkühlung in die Kälteleistung einbezogen sind. Weitere Erläuterungen siehe Kältemittel-Report (A-500).

Leistungsdaten R134a

Für R134a stehen BITZER ECOLINE Verdichter in 3 Ausführungsvarianten zur Verfügung:

Motorversion 1

für Hochtemperatur Klima- und Wärmepumpen-Anwendungen bis $t_c = 85^\circ\text{C}$

Motorversion 2

für Normal- und Klimakühlung bis $t_c = 70^\circ\text{C}$

Motorversion 3

optimiert für Normalkühlung mit erweitertem Einsatzbereich und der Option für FU-Betrieb bis 70 Hz mit Standard-motor

Leistungsdaten

Motorversion 1 und 2: Seiten 13 – 16
Motorversion 3: Seite 17

Leistungsdaten R404A/R507A (R407A, R407F)

Für R404A/R507A (R407A, R407F) stehen BITZER ECOLINE Verdichter in 2 Ausführungsvarianten zur Verfügung:

Motorversion 1

für Normal- und Klimakühlung bis $t_c = 62^\circ\text{C}$

Motorversion 2

optimiert für erweiterten Einsatzbereich bei Normal- und Tiefkühlung bis $t_c = 62^\circ\text{C}$

Leistungsdaten

Motorversion 1 und 2: Seiten 18 – 21

Performance data

This brochure displays performance data for R134a, R404A, R407A, and R407F.

Performance data for other refrigerants upon request.

Performance data are based on the European Standard EN 12900 and 50 Hz operation. Performance data for individual operating conditions and 60 Hz operation see BITZER Software.

All data do **not** include liquid subcooling. Based on EN 12900 the rated cooling capacity and efficiency (COP) show therefore lower values in comparison to data based on 5 or 8.3 K subcooling. For further information see Refrigerant Report (A-501).

Performance data R134a

For R134a BITZER ECOLINE compressors are offered in 3 versions:

Motor version 1

for high temperature A/C and heat pump applications up to $t_c = 85^\circ\text{C}$

Motor version 2

for medium temperature and A/C applications up to $t_c = 70^\circ\text{C}$

Motor version 3

optimized for medium temperature application with enhanced application limits and the option of FI operation up to 70 Hz with standard motor

Performance data

Motor version 1 and 2: Pages 13 – 16
Motor version 3: Page 17

Performance data R404A/R507A (R407A, R407F)

For R404A/R507A (R407A, R407F) BITZER ECOLINE compressors are offered in 2 versions:

Motor version 1

for medium temperature and A/C applications up to $t_c = 62^\circ\text{C}$

Motor version 2

optimized for enhanced application limits at medium and low temperature application up to $t_c = 62^\circ\text{C}$

Performance data

Motor version 1 and 2: Pages 18 – 21

Données de puissance

Dans cette brochure se trouvent des données de puissance pour R134a, R404A, R407A et R407F.

Données de puissance pour autres fluides frigorigènes sur demande.

Les données de puissance se basent sur la norme européenne EN 12900 et sur un fonctionnement à 50 Hz. Données de puissance pour des conditions de fonctionnement individuelles et pour fonctionnement à 60 Hz voir BITZER Software.

Toutes les données sont établies **sans** sous-refroidissement. Ainsi, basées sur la norme EN 12900, apparaissent des différences importantes lors de la comparaison avec les données pour lesquelles, 5 resp. 8,3 K de sous-refroidissement ont été pris en considération. Pour plus d'informations voir "Refrigerant Report" (A-501).

Données de puissance R134a

Pour R134a 3 variantes de compresseurs BITZER ECOLINE sont disponible:

Versión moteur 1

pour applications de climatisation et pompe à chaleur à haute température jusqu'à $t_c = 85^\circ\text{C}$

Versión moteur 2

pour la réfrigération à moyenne température et de climatisation jusqu'à $t_c = 70^\circ\text{C}$

Versión moteur 3

optimisée pour la réfrigération à moyenne température avec champ d'application élargi et l'option à fonctionnement avec convertisseur de fréquences jusqu'à 70 Hz avec moteur standard

Données de puissance

Versión moteur 1 et 2: Pages 13 – 16
Versión moteur 3: Page 17

Données de puissance R404A/R507A (R407A, R407F)

Pour R404A/R507A (R407A, R407F) 2 variantes de compresseurs BITZER ECOLINE sont disponible:

Versión moteur 1

pour la réfrigération à moyenne température et de climatisation jusqu'à $t_c = 62^\circ\text{C}$

Versión moteur 2

optimisée pour champ d'application élargi à la réfrigération à moyenne température et à basse température jusqu'à $t_c = 62^\circ\text{C}$

Données de puissance

Versión moteur 1 et 2: Pages 18 – 21

R134a ■ Motor 1/Motor 2



Leistungswerte 50 Hz

bezogen auf Sauggasttemperatur 20°C,
ohne Flüssigkeits-Unterkühlung

Performance data 50 Hz

relating to 20°C suction gas tempera-
ture, without liquid subcooling

Données de puissance 50 Hz

à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ Compressor type Compresseur type	Verfl. Temp. Cond. temp. Temp. de cond. °C	↓	Kälteleistung Cooling capacity Puissance frigorifique				Leistungsaufnahme Power consumption Puissance absorbée			
			Q _o [Watt]				P _e [kW]			
			Verdampfungstemperatur °C			Evaporating temperature °C	Température d'évaporation °C			
			15	10	5	0	-5	-10	-15	-20
2KES-05Y	40	Q		2770	2250	1810	1420	1090	815	580
		P		0,68	0,64	0,59	0,55	0,50	0,45	0,39
	50	Q		2420	1960	1570	1220	930	685	470
		P		0,78	0,72	0,67	0,61	0,55	0,49	0,41
	60	Q		2090	1690	1350	1050	790	570	385
		P		0,87	0,81	0,74	0,67	0,60	0,51	0,42
2JES-07Y	40	Q		3540	2880	2310	1820	1400	1040	740
		P		0,86	0,82	0,77	0,72	0,66	0,59	0,51
	50	Q		3100	2510	2000	1570	1190	875	605
		P		0,98	0,93	0,87	0,80	0,72	0,64	0,53
	60	Q		2690	2170	1730	1340	1020	735	495
		P		1,10	1,04	0,96	0,88	0,79	0,68	0,56
2HES-1Y	40	Q		4650	3820	3100	2490	1960	1520	1140
		P		1,02	0,99	0,94	0,89	0,83	0,76	0,68
	50	Q		4080	3330	2690	2150	1680	1280	940
		P		1,18	1,13	1,07	0,99	0,91	0,81	0,70
	60	Q		3510	2850	2290	1810	1390	1040	740
		P		1,35	1,27	1,18	1,08	0,97	0,84	0,71
2HES-2Y	60	Q	4240	3490	2850	2290	1810	1390	1040	740
		P	1,39	1,33	1,25	1,17	1,08	0,97	0,86	0,73
	70	Q	3560	2920	2370	1890	1480	1120	820	560
		P	1,57	1,48	1,38	1,27	1,15	1,02	0,87	0,71
	80	Q	2850	2340	1890	1500	1160	860	610	
		P	1,75	1,63	1,51	1,37	1,22	1,05	0,88	
2GES-2Y	40	Q		5400	4450	3630	2930	2320	1810	1370
		P		1,19	1,15	1,11	1,05	0,98	0,90	0,81
	50	Q		4760	3910	3180	2550	2010	1540	1150
		P		1,38	1,32	1,24	1,16	1,06	0,95	0,84
	60	Q		4120	3370	2730	2170	1690	1280	935
		P		1,56	1,47	1,36	1,25	1,12	0,99	0,84
2FES-2Y	40	Q		6850	5640	4590	3690	2920	2270	1720
		P		1,43	1,38	1,32	1,24	1,15	1,04	0,92
	50	Q		5880	4820	3910	3130	2450	1880	1400
		P		1,69	1,60	1,49	1,38	1,25	1,11	0,96
	60	Q		4960	4060	3270	2600	2020	1530	1110
		P		1,90	1,78	1,64	1,49	1,33	1,15	0,97
2FES-3Y	60	Q	6000	4960	4060	3280	2610	2030	1540	1120
		P	2,12	1,99	1,86	1,72	1,57	1,41	1,24	1,06
	70	Q	4970	4110	3350	2690	2130	1640	1230	875
		P	2,35	2,20	2,03	1,85	1,66	1,47	1,27	1,06
	80	Q	3960	3270	2660	2130	1670	1280	940	
		P	2,58	2,39	2,18	1,96	1,74	1,51	1,27	
2EES-2Y	40	Q		8600	7040	5700	4560	3580	2760	2070
		P		1,78	1,70	1,60	1,48	1,34	1,20	1,04
	50	Q		7440	6070	4900	3890	3040	2320	1710
		P		2,09	1,95	1,79	1,62	1,44	1,25	1,07
	60	Q		6290	5110	4100	3230	2500	1880	1350
		P		2,34	2,14	1,93	1,71	1,48	1,27	1,06
2EES-3Y	60	Q	7650	6290	5110	4100	3230	2500	1880	1350
		P	2,51	2,33	2,14	1,94	1,73	1,51	1,30	1,10
	70	Q	6260	5120	4140	3290	2560	1950	1420	990
		P	2,74	2,50	2,26	2,01	1,76	1,51	1,27	1,04
	80	Q	4840	3940	3150	2470	1890	1390	975	
		P	2,89	2,60	2,31	2,02	1,73	1,45	1,19	
2DES-2Y	40	Q		10240	8390	6800	5450	4300	3320	2510
		P		2,15	2,06	1,93	1,79	1,62	1,45	1,27
	50	Q		8870	7260	5870	4680	3670	2810	2090
		P		2,54	2,37	2,17	1,97	1,75	1,53	1,31
	60	Q		7530	6130	4940	3910	3040	2300	1680
		P		2,86	2,61	2,35	2,09	1,82	1,56	1,32
2DES-3Y	60	Q	9140	7530	6130	4940	3910	3040	2300	1680
		P	3,01	2,80	2,57	2,32	2,07	1,82	1,57	1,33
	70	Q	7510	6160	4990	3990	3130	2390	1770	1250
		P	3,31	3,02	2,73	2,43	2,13	1,84	1,55	1,29
	80	Q	5830	4760	3820	3020	2320	1730	1230	
		P	3,52	3,17	2,82	2,46	2,12	1,79	1,47	
2CES-3Y	40	Q		12530	10290	8370	6720	5320	4140	3150
		P		2,60	2,50	2,36	2,19	1,99	1,79	1,58
	50	Q		10900	8940	7250	5810	4580	3540	2670
		P		3,08	2,88	2,66	2,42	2,17	1,91	1,66
	60	Q		9290	7600	6150	4900	3840	2940	2180
		P		3,49	3,20	2,90	2,59	2,28	1,98	1,69

Hinweis zum Betrieb siehe Einsatzgrenzen,
Seite 10

Vorläufige Daten

Notes on the operation see application limits,
page 10

Tentative data

Pour des informations relatives au fonctionne-
ment, voir limites d'application à la page 10

Valeurs provisoires



R134a ■ Motor 1/Motor 2

Leistungswerte 50 Hz

bezogen auf Sauggasttemperatur 20°C,
ohne Flüssigkeits-Unterkühlung

Performance data 50 Hz

relating to 20°C suction gas tempera-
ture, without liquid subcooling

Données de puissance 50 Hz

à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ Compressor type Compresseur type	Verfl. Temp. Cond. temp. Temp. de cond. °C	↓	Kälteleistung Cooling capacity Puissance frigorifique				Q _o	[Watt]	Leistungsaufnahme Power consumption Puissance absorbée				P _e	[kW]
			Verdampfungstemperatur °C						Evaporating temperature °C		Température d'évaporation °C			
			15	10	5	0			-5	-10	-15	-20		
2CES-4Y	60	Q	11250	9290	7600	6150	4900	3840	2940	2180				
		P	3,69	3,44	3,17	2,88	2,58	2,28	1,99	1,70				
	70	Q	9290	7650	6240	5010	3960	3060	2310	1670				
		P	4,08	3,74	3,40	3,04	2,69	2,34	2,00	1,69				
	80	Q	7250	5950	4820	3830	2980	2260	1650					
		P	4,37	3,96	3,54	3,12	2,72	2,33	1,96					
4FES-3Y	40	Q		13590	11040	8880	7060	5520	4240	3190				
		P		2,78	2,65	2,48	2,28	2,06	1,83	1,60				
	50	Q		11650	9440	7560	5970	4630	3510	2590				
		P		3,24	3,01	2,75	2,48	2,19	1,90	1,62				
	60	Q		9730	7840	6240	4880	3730	2780	1990				
		P		3,60	3,28	2,94	2,60	2,25	1,90	1,57				
4FES-5Y	60	Q	11910	9730	7850	6250	4890	3740	2790	2000				
		P	3,83	3,55	3,25	2,93	2,60	2,26	1,92	1,60				
	70	Q	9620	7820	6270	4950	3820	2860	2070	1410				
		P	4,15	3,79	3,41	3,01	2,62	2,22	1,83	1,47				
	80	Q	7340	5930	4720	3660	2760	2000	1360					
		P	4,35	3,91	3,45	2,99	2,53	2,08	1,65					
4EES-4Y	40	Q		17030	14000	11410	9190	7320	5730	4410				
		P		3,52	3,36	3,16	2,93	2,67	2,40	2,12				
	50	Q		14760	12110	9830	7890	6240	4850	3690				
		P		4,18	3,90	3,59	3,26	2,91	2,56	2,22				
	60	Q		12500	10230	8280	6610	5190	3980	2980				
		P		4,75	4,35	3,93	3,51	3,08	2,67	2,27				
4EES-6Y	60	Q	15130	12500	10230	8280	6610	5190	3980	2980				
		P	5,02	4,67	4,30	3,90	3,50	3,09	2,69	2,31				
	70	Q	12450	10270	8380	6750	5340	4150	3130	2280				
		P	5,57	5,11	4,63	4,15	3,66	3,19	2,73	2,30				
	80	Q	9760	8040	6540	5230	4100	3130	2300					
		P	6,02	5,45	4,88	4,31	3,75	3,21	2,70					
4DES-5Y	40	Q		20500	16690	13470	10750	8460	6550	4980				
		P		4,16	3,96	3,71	3,42	3,11	2,77	2,43				
	50	Q		17650	14360	11550	9180	7180	5510	4130				
		P		4,88	4,54	4,17	3,77	3,35	2,93	2,51				
	60	Q		14830	12030	9630	7600	5890	4450	3270				
		P		5,47	5,00	4,50	4,00	3,49	2,99	2,51				
4DES-7Y	60	Q	18090	14830	12030	9640	7610	5890	4460	3280				
		P	5,79	5,38	4,94	4,47	3,98	3,49	3,01	2,54				
	70	Q	14720	12040	9730	7740	6050	4610	3410	2420				
		P	6,34	5,80	5,24	4,66	4,08	3,51	2,96	2,43				
	80	Q	11350	9250	7420	5850	4490	3340	2370					
		P	6,72	6,07	5,40	4,72	4,05	3,40	2,78					
4CES-6Y	40	Q		25050	20450	16560	13260	10490	8170	6250				
		P		5,05	4,82	4,54	4,20	3,83	3,44	3,04				
	50	Q		21700	17690	14290	11400	8970	6950	5270				
		P		5,94	5,55	5,12	4,65	4,16	3,67	3,19				
	60	Q		18320	14920	12010	9540	7450	5710	4260				
		P		6,69	6,14	5,57	4,98	4,38	3,80	3,24				
4CES-9Y	60	Q	22300	18320	14920	12010	9540	7450	5710	4260				
		P	7,20	6,69	6,14	5,57	4,98	4,38	3,80	3,24				
	70	Q	18240	14980	12160	9750	7680	5930	4470	3250				
		P	7,95	7,29	6,59	5,88	5,18	4,49	3,82	3,19				
	80	Q	14170	11620	9390	7470	5820	4410	3220					
		P	8,53	7,71	6,88	6,05	5,24	4,45	3,71					
4VES-7Y	40	Q		26950	22000	17720	14090	11020	8440	6290				
		P		5,15	4,97	4,68	4,29	3,85	3,38	2,90				
	50	Q		22950	18680	15000	11850	9160	6880	4960				
		P		6,04	5,65	5,17	4,64	4,09	3,53	3,01				
	60	Q		19060	15480	12380	9690	7380	5400	3700				
		P		6,77	6,18	5,54	4,88	4,22	3,57	2,97				
4VES-10Y	60	Q	23300	19010	15330	12200	9550	7340	5500	3990				
		P	7,07	6,60	6,06	5,47	4,83	4,19	3,56	2,95				
	70	Q	18940	15360	12300	9700	7510	5670	4160	2930				
		P	7,75	7,11	6,42	5,70	4,96	4,24	3,55	2,92				
	80	Q	14450	11620	9200	7150	5420	3980	2810					
		P	8,26	7,47	6,65	5,82	5,00	4,22	3,50					
4TES-9Y	40	Q		32350	26450	21400	17080	13420	10340	7760				
		P		6,20	5,98	5,64	5,19	4,68	4,13	3,56				
	50	Q		27700	22600	18210	14450	11240	8510	6210				
		P		7,29	6,82	6,27	5,65	5,00	4,35	3,72				
	60	Q		23100	18840	15140	11930	9160	6780	4740				
		P		8,20	7,51	6,77	5,99	5,21	4,45	3,74				
4TES-12Y	60	Q	28200	23050	18660	14920	11760	9100	6900	5090				
		P	8,80	8,20	7,51	6,77	5,99	5,21	4,45	3,74				
	70	Q	23000	18750	15090	11980	9360	7160	5350	3870				
		P	9,79	8,98	8,10	7,18	6,23	5,29	4,39	3,55				
	80	Q	17690	14320	11420	8960	6890	5160	3750					
		P	10,65	9,69	8,64	7,53	6,39	5,25	4,14					

R134a ■ Motor 1/Motor 2



Leistungswerte 50 Hz

bezogen auf Sauggasttemperatur 20°C,
ohne Flüssigkeits-Unterkühlung

Performance data 50 Hz

relating to 20°C suction gas tempera-
ture, without liquid subcooling

Données de puissance 50 Hz

à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ Compressor type Compresseur type	Verfl. Temp. Cond. temp. Temp. de cond. °C	↓	Kälteleistung Cooling capacity Puissance frigorifique				Leistungsaufnahme Power consumption Puissance absorbée			
			Q _o [Watt]				P _e [kW]			
			Verdampfungstemperatur °C			Evaporating temperature °C	Température d'évaporation °C			
			15	10	5	0	-5	-10	-15	-20
4PES-12Y	40	Q		37450	30500	24500	19450	15170	11570	8570
		P		7,03	6,75	6,34	5,82	5,23	4,59	3,94
	50	Q		31800	25800	20700	16280	12530	9360	6700
		P		8,18	7,63	6,98	6,26	5,50	4,73	3,96
	60	Q		26300	21300	16970	13240	10020	7260	4910
		P		9,10	8,29	7,43	6,52	5,60	4,68	3,79
4PES-15Y	60	Q	32250	26250	21100	16740	13050	9960	7400	5310
		P	9,88	9,20	8,40	7,53	6,62	5,70	4,80	3,96
	70	Q	26100	21100	16830	13210	10160	7610	5520	3810
		P	10,81	9,85	8,83	7,76	6,69	5,64	4,66	3,76
	80	Q	19800	15860	12490	9630	7230	5240	3620	
		P	11,40	10,20	8,97	7,74	6,53	5,38	4,34	
4NES-14Y	40	Q		43850	35800	28900	23000	18050	13860	10370
		P		8,33	7,99	7,51	6,92	6,24	5,51	4,76
	50	Q		37400	30500	24500	19410	15050	11350	8240
		P		9,72	9,08	8,33	7,50	6,62	5,71	4,82
	60	Q		31150	25350	20300	15960	12200	8970	6210
		P		10,89	9,96	8,94	7,88	6,80	5,73	4,69
4NES-20Y	60	Q	38400	31450	25450	20400	16070	12460	9450	6980
		P	11,84	11,05	10,13	9,13	8,08	7,02	6,00	5,04
	70	Q	31400	25600	20600	16390	12810	9820	7350	5330
		P	13,03	11,92	10,73	9,49	8,25	7,04	5,91	4,88
	80	Q	24150	19570	15630	12280	9450	7100	5170	
		P	13,84	12,43	10,99	9,54	8,13	6,79	5,57	
4JE-15Y	40	Q		48650	40050	32650	26300	20850	16230	12330
		P		9,30	8,98	8,52	7,94	7,28	6,56	5,81
	50	Q		42250	34700	28200	22600	17800	13720	10260
		P		10,94	10,34	9,62	8,80	7,93	7,03	6,13
	60	Q		35950	29400	23800	18920	14750	11200	8180
		P		12,35	11,47	10,50	9,47	8,39	7,30	6,23
4JE-22Y	60	Q	42750	35250	28700	23100	18280	14150	10630	7670
		P	12,90	12,14	11,25	10,25	9,18	8,06	6,93	5,80
	70	Q	35050	28750	23300	18550	14470	10970	7990	5480
		P	14,25	13,18	12,00	10,74	9,42	8,08	6,74	5,43
	80	Q	27150	22100	17710	13890	10580	7740	5320	
		P	15,18	13,81	12,34	10,80	9,24	7,66	6,11	
4HE-18Y	40	Q		57400	47250	38550	31100	24750	19390	14870
		P		11,20	10,74	10,12	9,38	8,56	7,68	6,77
	50	Q		49800	40950	33300	26800	21250	16530	12570
		P		13,12	12,33	11,42	10,41	9,34	8,25	7,16
	60	Q		42200	34600	28100	22500	17690	13630	10220
		P		14,77	13,67	12,47	11,21	9,91	8,61	7,35
4HE-25Y	60	Q	50700	41900	34300	27700	22050	17170	13030	9520
		P	15,31	14,39	13,35	12,20	10,98	9,71	8,41	7,11
	70	Q	41600	34350	28000	22500	17680	13550	10000	6980
		P	16,96	15,71	14,36	12,93	11,44	9,91	8,37	6,82
	80	Q	32500	26700	21650	17200	13290	9890	6930	
		P	18,29	16,71	15,06	13,34	11,57	9,77	7,95	
4GE-23Y	40	Q		65100	53500	43600	35150	27900	21800	16640
		P		13,25	12,56	11,73	10,77	9,73	8,63	7,50
	50	Q		56200	46000	37250	29800	23450	18110	13640
		P		15,37	14,31	13,13	11,86	10,52	9,16	7,81
	60	Q		47000	38250	30750	24400	18980	14450	10690
		P		17,11	15,70	14,20	12,63	11,03	9,43	7,86
4GE-30Y	60	Q	59100	48900	40100	32450	25850	20200	15350	11250
		P	17,91	16,76	15,49	14,13	12,70	11,21	9,68	8,14
	70	Q	48500	40150	32800	26450	20900	16070	11910	8320
		P	19,88	18,33	16,70	15,00	13,25	11,46	9,65	7,83
	80	Q	37800	31250	25500	20400	15880	11910	8390	
		P	21,63	19,66	17,65	15,61	13,53	11,42	9,31	
4FE-28Y	40	Q		79200	65200	53300	43100	34450	27200	21100
		P		16,66	15,80	14,74	13,54	12,23	10,88	9,53
	50	Q		69300	57000	46500	37550	29900	23500	18130
		P		19,43	18,07	16,56	14,95	13,29	11,63	10,01
	60	Q		59300	48750	39700	31900	25300	19760	15110
		P		21,81	19,99	18,06	16,08	14,09	12,15	10,31
4FE-35Y	60	Q	70300	58100	47600	38550	30800	24200	18670	14040
		P	22,82	21,16	19,35	17,44	15,47	13,49	11,56	9,72
	70	Q	58000	47850	39100	31500	25000	19480	14800	10880
		P	25,10	22,97	20,73	18,44	16,14	13,87	11,70	9,66
	80	Q	45500	37500	30500	24450	19210	14740	10940	
		P	26,89	24,33	21,70	19,06	16,46	13,94	11,56	

Hinweis zum Betrieb siehe Einsatzgrenzen,
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Pour des informations relatives au fonctionne-
ment, voir limites d'application à la page 10

Vorläufige Daten

Tentative data

Valeurs provisoires



R134a ■ Motor 1/Motor 2

Leistungswerte 50 Hz

bezogen auf Sauggasttemperatur 20°C,
ohne Flüssigkeits-Unterkühlung

Performance data 50 Hz

relating to 20°C suction gas tempera-
ture, without liquid subcooling

Données de puissance 50 Hz

à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ Compressor type Compresseur type	Verfl. Temp. Cond. temp. Temp. de cond. °C		Kälteleistung Cooling capacity Puissance frigorifique				Q _o	[Watt]	Leistungsaufnahme Power consumption Puissance absorbée				P _e	[kW]
			Verdampfungstemperatur °C						Evaporating temperature °C		Température d'évaporation °C			
			15	10	5	0			-5	-10	-15	-20		
6JE-25Y	40	Q		72500	59400	48200		38650	30550	23700	18020			
		P		14,27	13,64	12,81		11,82	10,70	9,50	8,24			
	50	Q		62700	51200	41400		33000	25850	19840	14830			
		P		16,66	15,56	14,30		12,92	11,45	9,94	8,42			
6JE-33Y	60	Q		52800	42950	34500		27300	21150	15990	11680			
		P		18,57	17,03	15,37		13,63	11,84	10,04	8,28			
	70	Q	65500	53800	43600	34900	27500	21200	15960	11590				
		P	19,68	18,38	16,91	15,30	13,61	11,87	10,13	8,42				
6HE-28Y	80	Q	53700	43850	35300	28000	21800	16550	12160	8520				
		P	21,80	19,99	18,06	16,04	13,99	11,94	9,94	8,02				
	40	Q	41700	33900	27100	21300	16310	12120	8630					
		P	23,44	21,14	18,78	16,38	13,99	11,65	9,41					
6HE-35Y	50	Q		85100	69800	56800	45700	36300	28350	21700				
		P		16,80	16,08	15,12	13,98	12,70	11,31	9,87				
	60	Q		73800	60500	49050	39300	31000	24000	18130				
		P		19,76	18,48	17,02	15,42	13,72	11,98	10,23				
6GE-34Y	70	Q		62500	51100	41200	32800	25650	19630	14590				
		P		22,21	20,41	18,47	16,44	14,37	12,31	10,29				
	80	Q	75400	62000	50400	40500	32050	24850	18790	13740				
		P	23,32	21,73	19,95	18,02	15,99	13,92	11,86	9,86				
6FE-44Y	60	Q	61800	50600	41000	32650	25550	19530	14470	10260				
		P	25,79	23,62	21,31	18,92	16,49	14,07	11,72	9,47				
	70	Q	48050	39200	31500	24900	19220	14430	10410					
		P	27,69	24,96	22,16	19,33	16,53	13,80	11,18					
6GE-40Y	80	Q		97100	79900	65100	52500	41800	32800	25300				
		P		20,01	18,97	17,72	16,32	14,78	13,16	11,50				
	40	Q		84100	69100	56200	45200	35850	27950	21350				
		P		23,32	21,71	19,93	18,04	16,05	14,03	12,01				
6FE-50Y	50	Q		71100	58300	47400	38000	29950	23150	17410				
		P		25,98	23,86	21,60	19,26	16,88	14,50	12,18				
	60	Q	87300	72200	59100	47900	38300	30100	23150	17340				
		P	27,61	25,84	23,85	21,69	19,42	17,11	14,80	12,56				
8GE-50Y	70	Q	72100	59500	48600	39200	31100	24200	18420	13550				
		P	30,50	28,15	25,63	23,00	20,32	17,64	15,03	12,54				
	80	Q	56400	46500	37850	30400	23950	18480	13860					
		P	32,80	29,91	26,90	23,84	20,78	17,78	14,90					
8FE-60Y	40	Q		116700	96100	78400	63300	50600	39800	30800				
		P		24,10	22,92	21,50	19,88	18,12	16,25	14,32				
	50	Q		101300	83300	67900	54700	43500	34050	26100				
		P		27,97	26,15	24,13	21,97	19,69	17,36	15,02				
8FE-70Y	60	Q		85800	70600	57400	46150	36550	28350	21500				
		P		31,11	28,72	26,17	23,50	20,77	18,04	15,35				
	70	Q	101500	83900	68800	55700	44500	34900	26800	19980				
		P	32,26	30,19	27,90	25,45	22,88	20,24	17,58	14,95				
8FE-80Y	80	Q	82500	68300	55900	45100	35800	27850	21050	15300				
		P	34,83	32,27	29,50	26,60	23,60	20,57	17,57	14,64				
	40	Q	63400	52400	42800	34350	27000	20700	15200					
		P	36,60	33,60	30,41	27,09	23,71	20,33	17,03					
8GE-60Y	50	Q		132800	109300	89100	71700	56900	44250	33550				
		P		29,95	28,56	26,64	24,36	21,88	19,35	16,93				
	60	Q		115500	94700	76800	61400	48200	36900	27350				
		P		34,28	31,85	29,02	25,96	22,86	19,90	17,25				
8FE-90Y	70	Q		98000	80100	64600	51200	39650	29750	21350				
		P		37,78	34,41	30,77	27,08	23,55	20,39	17,81				
	80	Q	118600	98000	80100	64600	51200	39650	29750	21350				
		P	40,67	37,80	34,46	30,85	27,19	23,69	20,56	18,00				
8FE-100Y	80	Q	97800	80600	65600	52500	41150	31350	22900	15680				
		P	44,40	40,61	36,47	32,21	28,12	24,43	21,41	19,31				
	40	Q	76600	63000	51000	40500	31300	23350	16450					
		P	47,52	42,94	38,13	33,42	29,13	25,57	23,06					
8FE-110Y	50	Q		155700	128500	105000	84700	67300	52500	39800				
		P		35,08	33,54	31,35	28,70	25,77	22,77	19,87				
	60	Q		135100	111100	90400	72500	57000	43750	32400				
		P		40,29	37,52	34,22	30,63	26,95	23,41	20,22				
8FE-120Y	70	Q		114400	93800	75800	60300	46800	35150	25100				
		P		44,44	40,54	36,27	31,91	27,69	23,90	20,78				
	80	Q	138100	114400	93800	75800	60300	46800	35150	25100				
		P	47,40	44,28	40,52	36,37	32,10	27,97	24,23	21,15				
8FE-130Y	80	Q	113300	93600	76400	61300	48200	36700	26750	18090				
		P	51,51	47,34	42,64	37,75	32,97	28,62	25,02	22,48				
	40	Q	88200	72700	59000	46850	36200	26850	18650					
		P	54,59	49,50	44,07	38,68	33,71	29,55	26,57					

Hinweis zum Betrieb siehe Einsatzgrenzen,
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ment, voir limites d'application à la page 10

Vorläufige Daten

Tentative data

Valeurs provisoires

R134a ■ Motor 3



Leistungswerte 50 Hz

bezogen auf Sauggastemperatur 20°C,
ohne Flüssigkeits-Unterkühlung

Performance data 50 Hz

relating to 20°C suction gas tempera-
ture, without liquid subcooling

Données de puissance 50 Hz

à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ	Verfl. Temp.			Kälteleistung Cooling capacity Puissance frigorifique	Q _o	[Watt]	Leistungsaufnahme Power consumption Puissance absorbée	P _e	[kW]
Compressor type	Cond. temp.								
Compresseur type	Temp. de cond. °C	↓	Verdampfungstemperatur °C			Evaporating temperature °C	Température d'évaporation °C		
			0	-5		-10		-15	-20
4VES-6Y	30	Q	20400	16310		12850		9950	7550
		P	4,03	3,83		3,52		3,15	2,73
	40	Q	17720	14090		11020		8440	6290
		P	4,68	4,29		3,85		3,38	2,90
	50	Q	15000	11850		9160		6880	4960
		P	5,17	4,64		4,08		3,53	3,01
4TES-8Y	30	Q	24500	19660		15550		12100	9230
		P	4,83	4,59		4,24		3,82	3,34
	40	Q	21400	17080		13420		10340	7760
		P	5,64	5,19		4,68		4,13	3,56
	50	Q	18210	14450		11240		8510	6210
		P	6,27	5,65		5,00		4,35	3,72
4PES-10Y	30	Q	28300	22600		17750		13710	10360
		P	5,49	5,20		4,79		4,31	3,77
	40	Q	24500	19450		15170		11570	8570
		P	6,34	5,82		5,23		4,59	3,94
	50	Q	20700	16280		12530		9360	6700
		P	6,98	6,26		5,50		4,73	3,96
4NES-12Y	30	Q	33250	26600		21000		16330	12430
		P	6,48	6,14		5,68		5,14	4,55
	40	Q	28950	23100		18100		13910	10420
		P	7,52	6,93		6,26		5,53	4,78
	50	Q	24600	19470		15110		11410	8290
		P	8,35	7,53		6,64		5,74	4,85
4JE-13Y	30	Q	37300	30200		24100		18920	14560
		P	7,36	7,01		6,54		5,98	5,36
	40	Q	32800	26400		21000		16370	12470
		P	8,66	8,06		7,36		6,60	5,81
	50	Q	28350	22750		17950		13880	10430
		P	9,82	8,97		8,05		7,09	6,13
4HE-15Y	30	Q	43800	35450		28350		22300	17220
		P	8,68	8,21		7,63		6,95	6,23
	40	Q	38550	31100		24750		19390	14870
		P	10,22	9,46		8,61		7,71	6,78
	50	Q	33300	26800		21250		16530	12570
		P	11,56	10,52		9,42		8,29	7,18
4GE-20Y	30	Q	50500	41050		32900		26000	20200
		P	10,31	9,70		8,97		8,15	7,27
	40	Q	44850	36350		29100		22900	17720
		P	12,14	11,19		10,15		9,05	7,92
	50	Q	38700	31200		24800		19400	14870
		P	13,69	12,42		11,09		9,73	8,38
4FE-25Y	30	Q	60000	48550		38900		30800	24000
		P	12,71	11,93		11,01		9,99	8,92
	40	Q	53300	43100		34450		27200	21100
		P	14,91	13,67		12,34		10,96	9,59
	50	Q	46500	37550		29900		23500	18130
		P	16,79	15,13		13,43		11,72	10,08
6JE-22Y	30	Q	55500	44700		35600		27900	21500
		P	10,87	10,39		9,70		8,86	7,90
	40	Q	48850	39200		31000		24050	18280
		P	12,88	11,93		10,84		9,63	8,37
	50	Q	42100	33500		26250		20150	15050
		P	14,51	13,13		11,65		10,11	8,58
6HE-25Y	30	Q	64500	52000		41500		32650	25250
		P	12,91	12,25		11,40		10,39	9,28
	40	Q	56800	45700		36300		28350	21700
		P	15,30	14,13		12,81		11,40	9,93
	50	Q	49050	39300		31000		24000	18130
		P	17,27	15,61		13,87		12,08	10,29
6GE-30Y	30	Q	74900	60700		48700		38600	30150
		P	15,21	14,37		13,37		12,23	11,01
	40	Q	66300	53700		43000		33950	26400
		P	18,07	16,70		15,20		13,62	11,99
	50	Q	57600	46600		37200		29250	22600
		P	20,47	18,61		16,67		14,69	12,71
6FE-40Y	30	Q	88800	71800		57500		45450	35400
		P	18,27	17,27		16,08		14,73	13,27
	40	Q	78400	63300		50600		39800	30800
		P	21,50	19,88		18,12		16,25	14,32
	50	Q	67900	54700		43500		34050	26100
		P	24,13	21,97		19,69		17,36	15,02

Vorläufige Daten

Tentative data

Valeurs provisoires



R404A

Leistungswerte 50 Hzbezogen auf Sauggasttemperatur 20°C,
ohne Flüssigkeits-Unterkühlung**Performance data 50 Hz**relating to 20°C suction gas tempera-
ture, without liquid subcooling**Données de puissance 50 Hz**à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ Compressor type Compresseur type	Verfl. Temp. Cond. temp. Temp. de cond. °C	↓	Kälteleistung Cooling capacity Puissance frigorifique		Q _o		[Watt]		Leistungsaufnahme Power consumption Puissance absorbée		P _e		[kW]	
			Verdampfungstemperatur °C		Evaporating temperature °C		Température d'évaporation °C							
			5	0	-5	-10	-15	-20	-25	-30	-35	-40		
2KES-05Y	30	Q	4290	3570	2940	2390	1920	1510	1160	865	610	395		
		P	0,81	0,80	0,78	0,75	0,72	0,68	0,63	0,57	0,50	0,42		
	40	Q	3520	2920	2390	1940	1540	1200	900	650	435	255		
		P	0,96	0,93	0,89	0,84	0,79	0,72	0,65	0,57	0,47	0,36		
	50	Q	2810	2320	1890	1520	1190	910	670	460	285	140		
		P	1,11	1,05	0,99	0,92	0,84	0,76	0,66	0,55	0,43	0,30		
2JES-07Y	30	Q	5670	4730	3920	3210	2600	2070	1620	1230	900	625		
		P	1,08	1,07	1,05	1,02	0,97	0,91	0,84	0,76	0,66	0,56		
	40	Q	4740	3950	3250	2650	2130	1680	1290	960	675	440		
		P	1,31	1,27	1,21	1,14	1,06	0,98	0,87	0,76	0,64	0,51		
	50	Q	3850	3190	2620	2120	1680	1300	980	700	465	265		
		P	1,53	1,45	1,36	1,26	1,14	1,02	0,89	0,75	0,60	0,44		
2HES-1Y	30	Q		5920	4910	4040	3280	2630	2070	1590	1180	840		
		P		1,45	1,38	1,31	1,23	1,14	1,04	0,93	0,82	0,69		
	40	Q		4950	4090	3340	2690	2130	1650	1240	890	595		
		P		1,70	1,59	1,47	1,35	1,21	1,08	0,94	0,79	0,64		
	50	Q		4000	3290	2670	2130	1660	1250	905	615	365		
		P		1,92	1,76	1,60	1,43	1,26	1,09	0,91	0,73	0,55		
2HES-2Y	30	Q	7200	6020	5000	4110	3340	2680	2110	1620	1210	855		
		P	1,42	1,40	1,37	1,32	1,25	1,16	1,06	0,95	0,83	0,70		
	40	Q	6060	5060	4190	3420	2760	2190	1700	1270	910	610		
		P	1,70	1,64	1,56	1,47	1,36	1,23	1,10	0,96	0,80	0,64		
	50	Q	4940	4110	3380	2740	2190	1700	1290	935	630	375		
		P	1,96	1,85	1,73	1,59	1,44	1,28	1,11	0,93	0,75	0,56		
2GES-2Y	30	Q	8230	6890	5730	4720	3850	3090	2450	1890	1420	1030		
		P	1,67	1,65	1,60	1,53	1,45	1,34	1,23	1,10	0,96	0,81		
	40	Q	6910	5780	4790	3930	3190	2540	1990	1520	1110	775		
		P	2,00	1,93	1,83	1,72	1,59	1,45	1,30	1,13	0,96	0,79		
	50	Q	5650	4710	3890	3180	2560	2020	1560	1160	825	540		
		P	2,33	2,20	2,05	1,90	1,72	1,54	1,35	1,16	0,96	0,76		
2FES-2Y	30	Q		8690	7220	5940	4830	3870	3050	2350	1750	1250		
		P		2,02	1,98	1,91	1,80	1,67	1,51	1,35	1,17	0,98		
	40	Q		7190	5960	4880	3950	3150	2450	1860	1360	930		
		P		2,37	2,27	2,13	1,97	1,79	1,60	1,39	1,18	0,97		
	50	Q		5770	4770	3900	3140	2480	1910	1420	1000	650		
		P		2,72	2,55	2,36	2,15	1,92	1,68	1,44	1,20	0,97		
2FES-3Y	30	Q	10320	8640	7170	5900	4800	3850	3030	2330	1740	1250		
		P	2,03	2,00	1,95	1,86	1,76	1,63	1,49	1,34	1,17	1,00		
	40	Q	8560	7160	5930	4860	3940	3130	2440	1850	1350	930		
		P	2,46	2,37	2,25	2,10	1,94	1,77	1,58	1,38	1,17	0,96		
	50	Q	6890	5760	4760	3890	3130	2470	1900	1410	995	645		
		P	2,88	2,72	2,53	2,33	2,11	1,88	1,64	1,40	1,15	0,91		
2EES-2Y	30	Q		10920	9070	7470	6080	4890	3860	2980	2230	1600		
		P		2,37	2,28	2,16	2,01	1,85	1,67	1,47	1,27	1,07		
	40	Q		9250	7670	6300	5100	4070	3180	2420	1770	1220		
		P		2,81	2,64	2,45	2,23	2,01	1,77	1,53	1,28	1,04		
	50	Q		7490	6180	5040	4050	3190	2450	1820	1280	830		
		P		3,16	2,91	2,65	2,37	2,09	1,80	1,51	1,23	0,95		
2EES-3Y	30	Q	13040	10920	9070	7470	6080	4890	3860	2980	2230	1600		
		P	2,40	2,36	2,27	2,16	2,02	1,87	1,69	1,50	1,31	1,11		
	40	Q	11070	9250	7670	6300	5100	4070	3180	2420	1770	1220		
		P	2,89	2,76	2,61	2,43	2,23	2,02	1,79	1,55	1,32	1,08		
	50	Q	8980	7490	6180	5040	4050	3190	2450	1820	1280	830		
		P	3,27	3,08	2,86	2,62	2,36	2,09	1,82	1,54	1,26	0,99		
2DES-2Y	30	Q		12990	10810	8910	7270	5860	4640	3590	2710	1960		
		P		2,87	2,76	2,62	2,45	2,25	2,03	1,80	1,55	1,31		
	40	Q		11040	9170	7540	6120	4900	3850	2940	2180	1530		
		P		3,42	3,22	2,98	2,73	2,46	2,17	1,88	1,59	1,30		
	50	Q		8960	7420	6070	4890	3870	2990	2240	1600	1070		
		P		3,87	3,57	3,25	2,92	2,58	2,23	1,88	1,55	1,22		
2DES-3Y	30	Q	15500	12990	10810	8910	7270	5860	4640	3590	2710	1960		
		P	2,87	2,81	2,71	2,58	2,41	2,22	2,01	1,79	1,56	1,33		
	40	Q	13180	11040	9170	7540	6120	4900	3850	2940	2180	1530		
		P	3,47	3,32	3,13	2,92	2,68	2,42	2,15	1,87	1,59	1,31		
	50	Q	10720	8960	7420	6070	4890	3870	2990	2240	1600	1070		
		P	3,97	3,73	3,46	3,17	2,86	2,53	2,21	1,88	1,55	1,24		
2CES-3Y	30	Q		15890	13250	10950	8960	7250	5770	4500	3420	2500		
		P		3,47	3,35	3,19	2,98	2,75	2,50	2,23	1,94	1,66		
	40	Q		13550	11280	9310	7590	6110	4830	3730	2790	2000		
		P		4,15	3,92	3,65	3,35	3,03	2,70	2,36	2,02	1,69		
	50	Q		11060	9180	7540	6120	4880	3810	2890	2110	1450		
		P		4,73	4,38	4,01	3,62	3,22	2,81	2,41	2,01	1,64		
2CES-4Y	30	Q	18920	15890	13250	10950	8960	7250	5770	4500	3420	2500		
		P	3,49	3,42	3,31	3,15	2,96	2,74	2,49	2,23	1,95	1,68		
	40	Q	16150	13550	11280	9310	7590	6110	4830	3730	2790	2000		
		P	4,24	4,06	3,84	3,59	3,31	3,00	2,68	2,35	2,02	1,70		
	50	Q	13190	11060	9180	7540	6120	4880	3810	2890	2110	1450		
		P	4,86	4,58	4,27	3,92	3,56	3,18	2,79	2,40	2,02	1,65		

R404A



Leistungswerte 50 Hz

bezogen auf Sauggastemperatur 20°C,
ohne Flüssigkeits-Unterkühlung

Performance data 50 Hz

relating to 20°C suction gas tempera-
ture, without liquid subcooling

Données de puissance 50 Hz

à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ	Verfl. Temp.	Kälteleistung Cooling capacity Puissance frigorifique										Q _o	[Watt]	Leistungsaufnahme Power consumption Puissance absorbée										P _e	[kW]
Compressor type	Cond. temp.																								
Compresseur type	Temp. de cond. °C	↓	Verdampfungstemperatur °C			Evaporating temperature °C			Température d'évaporation °C																
			5	0	-5	-10	-15	-20	-25	-30	-35	-40													
4FES-3Y	30	Q		17510	14460	11840	9610	7700	6100	4750	3640	2720													
		P		3,71	3,61	3,45	3,25	3,01	2,74	2,44	2,14	1,84													
	40	Q		14840	12260	10040	8140	6520	5140	3990	3030	2250													
		P		4,44	4,23	3,96	3,66	3,33	2,97	2,61	2,24	1,89													
	50	Q		12030	9940	8140	6580	5250	4120	3170	2380	1730													
		P		5,03	4,71	4,35	3,96	3,54	3,11	2,68	2,26	1,85													
	30	Q		21050	17510	14460	11840	9610	7710	6100	4750	3640	2720												
		P		3,69	3,66	3,56	3,41	3,22	2,99	2,73	2,45	2,16	1,86												
4FES-5Y	40	Q		17810	14830	12260	10040	8140	6510	5140	3990	3030	2240												
		P		4,48	4,34	4,14	3,89	3,61	3,29	2,96	2,61	2,26	1,91												
	50	Q		14400	12010	9940	8130	6580	5250	4130	3180	2380	1730												
		P		5,12	4,88	4,58	4,25	3,88	3,49	3,09	2,68	2,27	1,87												
4EES-4Y	30	Q		22100	18300	15010	12200	9790	7760	6050	4630	3460													
		P		4,75	4,61	4,40	4,12	3,80	3,43	3,05	2,65	2,26													
	40	Q		18810	15550	12740	10330	8270	6520	5060	3830	2830													
		P		5,71	5,42	5,06	4,65	4,20	3,73	3,25	2,77	2,31													
	50	Q		15360	12690	10380	8390	6690	5240	4020	3010	2170													
		P		6,52	6,07	5,58	5,05	4,49	3,92	3,35	2,80	2,27													
	30	Q		26400	22000	18160	14880	12060	9660	7630	5930	4510	3340												
		P		4,70	4,65	4,51	4,30	4,04	3,72	3,38	3,00	2,62	2,23												
4EES-6Y	40	Q		22400	18650	15390	12590	10180	8120	6380	4920	3700	2700												
		P		5,72	5,52	5,24	4,90	4,51	4,08	3,63	3,17	2,71	2,25												
	50	Q		18240	15170	12510	10200	8220	6520	5080	3870	2870	2040												
		P		6,57	6,22	5,81	5,35	4,85	4,32	3,78	3,23	2,69	2,18												
4DES-5Y	30	Q		26200	21750	17860	14540	11700	9280	7250	5550	4140													
		P		5,64	5,47	5,22	4,89	4,51	4,08	3,63	3,16	2,70													
	40	Q		22400	18530	15190	12320	9870	7790	6030	4580	3370													
		P		6,74	6,40	5,97	5,49	4,97	4,42	3,86	3,30	2,76													
	50	Q		18440	15220	12440	10040	8000	6260	4800	3600	2600													
		P		7,69	7,17	6,59	5,96	5,31	4,65	3,99	3,35	2,74													
	30	Q		31450	26250	21750	17870	14540	11700	9280	7250	5550	4140												
		P		5,60	5,54	5,39	5,15	4,84	4,47	4,06	3,63	3,18	2,73												
4DES-7Y	40	Q		26900	22400	18540	15190	12320	9870	7790	6040	4580	3370												
		P		6,81	6,57	6,25	5,85	5,40	4,91	4,39	3,85	3,31	2,79												
	50	Q		22150	18430	15220	12440	10040	8000	6260	4810	3600	2600												
		P		7,83	7,43	6,96	6,42	5,84	5,23	4,61	3,98	3,36	2,77												
4CES-6Y	30	Q		31750	26300	21650	17610	14160	11220	8730	6650	4930													
		P		6,82	6,61	6,29	5,88	5,40	4,87	4,31	3,74	3,17													
	40	Q		27150	22400	18350	14850	11850	9310	7180	5400	3930													
		P		8,10	7,66	7,14	6,54	5,90	5,22	4,54	3,86	3,21													
	50	Q		22500	18520	15080	12120	9610	7480	5690	4220	3010													
		P		9,19	8,55	7,83	7,07	6,27	5,47	4,67	3,90	3,17													
	30	Q		38000	31750	26300	21650	17610	14160	11220	8730	6650	4930												
		P		6,91	6,82	6,61	6,29	5,88	5,40	4,87	4,31	3,74	3,17												
4CES-9Y	40	Q		32600	27150	22400	18350	14850	11850	9310	7180	5400	3930												
		P		8,42	8,10	7,66	7,14	6,54	5,90	5,22	4,54	3,86	3,21												
	50	Q		27100	22500	18520	15080	12120	9610	7480	5690	4220	3010												
		P		9,75	9,19	8,55	7,83	7,07	6,27	5,47	4,67	3,90	3,17												
4VES-7Y	30	Q		34100	28150	23000	18590	14820	11600	8890	6630	4750													
		P		7,15	6,92	6,55	6,07	5,52	4,91	4,27	3,64	3,04													
	40	Q		28800	23650	19180	15360	12110	9350	7040	5130	3560													
		P		8,58	8,04	7,39	6,68	5,91	5,13	4,35	3,60	2,91													
	50	Q		23550	19180	15430	12210	9480	7190	5280	3710	2440													
		P		9,77	8,92	8,02	7,08	6,12	5,18	4,28	3,43	2,67													
	30	Q		41050	34150	28150	23000	18590	14810	11600	8890	6630	4760												
		P		6,97	6,92	6,71	6,38	5,94	5,42	4,85	4,25	3,65	3,07												
4VES-10Y	40	Q		34800	28800	23650	19180	15350	12100	9350	7040	5140	3580												
		P		8,54	8,20	7,72	7,15	6,50	5,79	5,06	4,33	3,62	2,95												
	50	Q		28600	23550	19180	15420	12200	9480	7190	5280	3720	2470												
		P		9,84	9,22	8,50	7,70	6,86	5,98	5,11	4,26	3,45	2,73												
4TES-9Y	30	Q		40850	33800	27700	22450	17970	14150	10930	8230	6000													
		P		8,60	8,32	7,89	7,34	6,69	5,98	5,24	4,50	3,79													
	40	Q		34700	28600	23300	18750	14870	11580	8820	6520	4630													
		P		10,32	9,70	8,96	8,13	7,24	6,33	5,42	4,54	3,72													
	50	Q		28500	23300	18860	15040	11780	9030	6740	4840	3300													
		P		11,75	10,80	9,77	8,69	7,58	6,49	5,42	4,43	3,52													
	30	Q		49200	40950	33850	27700	22450	17930	14100	10870	8180	5950												
		P		8,52	8,43	8,16	7,74	7,20	6,57	5,88	5,17	4,45	3,76												
4TES-12Y	40	Q		41800	34700	28550	23200	18670	14780	11500	8750	6470	4600												
		P		10,43	10,00	9,42	8,73	7,94	7,09	6,21	5,34	4,49	3,71												
	50	Q		34450	28500	23300	18810	14990	11730	9000	6720	4850	3330												
		P		12,07	11,32	10,45	9,50	8,48	7,44	6,40	5,39	4,45	3,60												

Hinweis zum Betrieb siehe Einsatzgrenzen,
Seite 11

Notes on the operation see application limits,
page 11

Pour des informations relatives au fonctionne-
ment, voir limites d'application à la page 11

Vorläufige Daten

Tentative data

Valeurs provisoires

**R404A****Leistungswerte 50 Hz**bezogen auf Sauggasttemperatur 20°C,
ohne Flüssigkeits-Unterkühlung**Performance data 50 Hz**relating to 20°C suction gas tempera-
ture, without liquid subcooling**Données de puissance 50 Hz**à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ Compressor type Compresseur type	Verfl. Temp. Cond. temp. Temp. de cond. °C	↓	Kälteleistung Cooling capacity Puissance frigorifique		Q _o		[Watt]		Leistungsaufnahme Power consumption Puissance absorbée		P _e		[kW]	
			Verdampfungstemperatur °C		Evaporating temperature °C		Température d'évaporation °C							
			5	0	-5	-10	-15	-20	-25	-30	-35	-40		
4PES-12Y	30	Q	47250	38900	31750	25600	20350	15900	12160	9050	6500			
		P	9,72	9,36	8,84	8,18	7,43	6,61	5,75	4,89	4,05			
	40	Q	40000	32800	26550	21200	16680	12860	9660	7020	4870			
		P	11,51	10,78	9,93	8,97	7,95	6,90	5,84	4,81	3,83			
	50	Q	32550	26500	21250	16790	13010	9830	7200	5040	3300			
		P	12,92	11,84	10,67	9,43	8,17	6,90	5,66	4,49	3,41			
4PES-15Y	30	Q	57000	47300	38950	31700	25550	20300	15800	12050	8930	6370		
		P	9,90	9,72	9,35	8,82	8,15	7,39	6,56	5,69	4,83	4,00		
	40	Q	48200	39800	32600	26400	21050	16520	12710	9520	6890	4760		
		P	11,96	11,40	10,67	9,82	8,87	7,86	6,82	5,78	4,77	3,83		
	50	Q	39450	32400	26350	21150	16680	12920	9760	7140	5000	3280		
		P	13,69	12,78	11,73	10,58	9,38	8,14	6,91	5,71	4,58	3,55		
4NES-14Y	30	Q	55400	45700	37400	30250	24150	18980	14650	11050	8090			
		P	11,59	11,15	10,54	9,78	8,91	7,97	6,98	5,98	5,00			
	40	Q	47200	38800	31550	25400	20100	15640	11910	8820	6290			
		P	13,74	12,91	11,93	10,84	9,67	8,45	7,23	6,03	4,88			
	50	Q	38550	31550	25500	20350	15950	12240	9140	6580	4510			
		P	15,46	14,25	12,93	11,53	10,08	8,61	7,17	5,79	4,49			
4NES-20Y	30	Q	67000	55700	46000	37600	30400	24300	19080	14710	11080	8100		
		P	11,68	11,45	11,00	10,38	9,62	8,76	7,83	6,86	5,90	4,99		
	40	Q	56900	47200	38800	31550	25400	20100	15660	11940	8860	6350		
		P	14,06	13,42	12,60	11,64	10,58	9,45	8,29	7,14	6,03	5,00		
	50	Q	46800	38700	31700	25650	20450	16070	12380	9310	6780	4740		
		P	16,19	15,16	13,99	12,72	11,39	10,03	8,67	7,36	6,13	5,02		
4JE-15Y	30	Q	62400	51900	42850	34950	28200	22400	17440	13250	9730			
		P	13,05	12,56	11,91	11,12	10,22	9,24	8,21	7,15	6,10			
	40	Q	53400	44300	36400	29550	23650	18600	14300	10680	7650			
		P	15,41	14,50	13,46	12,31	11,10	9,84	8,56	7,29	6,06			
	50	Q	44200	36500	29850	24050	19080	14810	11200	8160	5640			
		P	17,40	16,10	14,69	13,22	11,71	10,18	8,67	7,21	5,82			
4JE-22Y	30	Q	73700	61600	51100	42050	34200	27450	21650	16740	12580	9090		
		P	13,02	12,72	12,23	11,57	10,79	9,89	8,91	7,88	6,83	5,77		
	40	Q	63000	52500	43400	35500	28700	22800	17780	13520	9920	6930		
		P	15,71	14,96	14,05	13,02	11,88	10,67	9,42	8,14	6,87	5,62		
	50	Q	51900	43200	35500	28850	23100	18150	13930	10350	7350	4860		
		P	18,00	16,83	15,53	14,13	12,67	11,16	9,64	8,13	6,66	5,24		
4HE-18Y	30	Q	72700	60500	50000	40900	33050	26300	20600	15750	11680			
		P	15,66	15,02	14,20	13,22	12,12	10,94	9,71	8,45	7,21			
	40	Q	62200	51700	42600	34700	27900	22050	17080	12890	9390			
		P	18,50	17,36	16,08	14,69	13,23	11,72	10,20	8,71	7,28			
	50	Q	51400	42650	35000	28350	22600	17720	13570	10070	7160			
		P	20,93	19,32	17,61	15,84	14,03	12,22	10,44	8,74	7,14			
4HE-25Y	30	Q	86000	72100	59900	49400	40300	32500	25750	20050	15230	11180		
		P	15,55	15,15	14,55	13,76	12,83	11,78	10,64	9,44	8,22	7,00		
	40	Q	73600	61500	51000	41900	34000	27200	21400	16470	12310	8830		
		P	18,63	17,74	16,68	15,47	14,16	12,76	11,32	9,85	8,40	6,99		
	50	Q	60700	50700	41900	34250	27600	21900	17040	12910	9440	6560		
		P	21,22	19,88	18,41	16,82	15,15	13,44	11,71	10,00	8,34	6,76		
4GE-23Y	30	Q	83800	69900	57800	47350	38350	30650	24100	18540	13880			
		P	18,72	17,88	16,84	15,63	14,30	12,88	11,41	9,93	8,48			
	40	Q	71800	59800	49350	40300	32550	25900	20200	15420	11430			
		P	22,15	20,71	19,13	17,44	15,68	13,88	12,09	10,34	8,68			
	50	Q	59300	49300	40600	33050	26550	21000	16290	12320	9010			
		P	25,11	23,12	21,03	18,88	16,72	14,58	12,50	10,52	8,68			
4GE-30Y	30	Q	98700	82700	68800	56800	46350	37400	29700	23150	17640	13020		
		P	18,19	17,66	16,90	15,94	14,83	13,60	12,27	10,88	9,47	8,06		
	40	Q	84400	70600	58600	48200	39200	31400	24800	19160	14410	10450		
		P	21,62	20,56	19,30	17,89	16,37	14,75	13,09	11,40	9,74	8,13		
	50	Q	69400	57900	48000	39300	31800	25350	19820	15140	11210	7950		
		P	24,47	22,94	21,24	19,42	17,52	15,56	13,59	11,64	9,75	7,96		
4FE-28Y	30	Q	99400	83000	68800	56400	45800	36700	28950	22350	16830			
		P	22,31	21,42	20,27	18,88	17,32	15,63	13,86	12,07	10,28			
	40	Q	85000	71000	58800	48200	39000	31100	24350	18590	13720			
		P	26,16	24,66	22,93	21,01	18,96	16,82	14,65	12,49	10,38			
	50	Q	70100	58600	48500	39650	32000	25350	19630	14710	10520			
		P	29,47	27,37	25,09	22,66	20,14	17,57	15,02	12,51	10,11			
4FE-35Y	30	Q	117900	99000	82600	68300	56000	45400	36300	28550	22000	16460		
		P	22,43	21,87	21,00	19,85	18,49	16,95	15,28	13,53	11,76	10,00		
	40	Q	100500	84500	70500	58300	47700	38550	30650	23900	18160	13310		
		P	26,81	25,61	24,13	22,42	20,53	18,51	16,40	14,25	12,12	10,04		
	50	Q	82600	69500	58000	47900	39100	31500	24850	19140	14240	10070		
		P	30,62	28,79	26,73	24,48	22,09	19,60	17,07	14,55	12,08	9,70		
6JE-25Y	30	Q	92400	76900	63500	51900	41850	33250	25950	19790	14610			
		P	19,14	18,51	17,59	16,43	15,09	13,60	12,02	10,39	8,77			
	40	Q	79400	65900	54100	43900	35150	27700	21300	15970	11510			
		P	22,59	21,37	19,90	18,24	16,43	14,52	12,56	10,61	8,70			
	50	Q	66100	54600	44550	35900	28450	22100	16750	12260	8540			
		P	25,49	23,72	21,74	19,60	17,36	15,06	12,75	10,48	8,31			

R404A



Leistungswerte 50 Hz

bezogen auf Sauggastemperatur 20°C,
ohne Flüssigkeits-Unterkühlung

Performance data 50 Hz

relating to 20°C suction gas tempera-
ture, without liquid subcooling

Données de puissance 50 Hz

à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ	Verfl. Temp.	↓	Kälteleistung Cooling capacity Puissance frigorifique										Q ₀	[Watt]	Leistungsaufnahme Power consumption Puissance absorbée										P _e	[kW]																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
Compressor type	Cond. temp.		Verdampfungstemperatur °C												Evaporating temperature °C												Température d'évaporation °C																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
Compresseur type	Temp. de cond. °C		5			0			-5			-10			-15			-20			-25			-30			-35			-40																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									

Hinweis zum Betrieb siehe Einsatzgrenzen,
Seite 11

Notes on the operation see application limits,
page 11

Pour des informations relatives au fonctionne-
ment, voir limites d'application à la page 11

Vorläufige Daten

Tentative data

Valeurs provisoires



R407A

Leistungswerte 50 Hzbezogen auf Sauggasttemperatur 20°C,
ohne Flüssigkeits-Unterkühlung**Performance data 50 Hz**relating to 20°C suction gas tempera-
ture, without liquid subcooling**Données de puissance 50 Hz**à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ	Verfl. Temp.	Kälteleistung Cooling capacity Puissance frigorifique		Q _o	[Watt]	Leistungsaufnahme Power consumption Puissance absorbée		P _e	[kW]		
Compressor type	Cond. temp.										
Compresseur type	Temp. de cond. °C										
		↓	Verdampfungstemperatur °C			Evaporating temperature °C		Température d'évaporation °C			
			0	-5	-10	-15	-20	-25	-30	-35	-40
2KES-05Y	20	Q	4010	3280	2650	2110	1650	1260	940	670	445
		P	0,62	0,62	0,60	0,57	0,53	0,48	0,42	0,36	0,31
	30	Q	3530	2870	2300	1820	1400	1060	770	530	335
		P	0,78	0,75	0,70	0,64	0,58	0,51	0,43	0,36	0,29
	40	Q	3060	2460	1950	1520	1160	850	600	390	220
		P	0,91	0,85	0,77	0,69	0,61	0,52	0,42	0,34	0,25
	50	Q	2570	2050	1600	1230	910	645	430	255	115
		P	1,01	0,92	0,82	0,72	0,61	0,50	0,39	0,29	0,19
2JES-07Y	20	Q	5230	4290	3470	2780	2190	1690	1280	925	640
		P	0,81	0,81	0,79	0,75	0,70	0,64	0,57	0,50	0,43
	30	Q	4640	3780	3050	2420	1890	1450	1070	760	510
		P	1,03	0,99	0,93	0,86	0,77	0,69	0,60	0,50	0,42
	40	Q	4040	3270	2620	2060	1590	1190	865	595	375
		P	1,21	1,13	1,04	0,94	0,83	0,72	0,60	0,49	0,39
	50	Q	3440	2760	2190	1700	1290	940	660	430	250
		P	1,37	1,25	1,13	0,99	0,86	0,72	0,59	0,46	0,34
2HES-1Y	20	Q	6600	5410	4400	3530	2790	2170	1640	1200	840
		P	1,01	1,01	0,98	0,93	0,87	0,79	0,70	0,62	0,53
	30	Q	5860	4790	3870	3090	2430	1870	1400	1010	690
		P	1,29	1,23	1,16	1,07	0,97	0,86	0,75	0,63	0,53
	40	Q	5130	4170	3350	2650	2050	1560	1150	805	530
		P	1,53	1,43	1,31	1,19	1,05	0,91	0,77	0,63	0,50
	50	Q	4380	3540	2820	2200	1690	1260	900	610	380
		P	1,74	1,60	1,44	1,27	1,10	0,94	0,77	0,61	0,46
2GES-2Y	20	Q	7720	6340	5150	4140	3280	2550	1940	1430	1010
		P	1,17	1,17	1,14	1,09	1,01	0,93	0,83	0,73	0,63
	30	Q	6870	5620	4550	3640	2860	2210	1660	1210	835
		P	1,49	1,43	1,35	1,25	1,14	1,01	0,89	0,76	0,64
	40	Q	6020	4900	3940	3120	2430	1850	1370	980	655
		P	1,78	1,66	1,53	1,39	1,23	1,08	0,92	0,77	0,62
	50	Q	5160	4170	3330	2620	2010	1510	1090	755	485
		P	2,03	1,86	1,68	1,49	1,31	1,12	0,93	0,75	0,58
2FES-2Y	20	Q	9730	7990	6500	5230	4150	3230	2460	1820	1290
		P	1,46	1,46	1,42	1,36	1,26	1,15	1,03	0,90	0,78
	30	Q	8670	7090	5750	4600	3620	2800	2110	1540	1070
		P	1,90	1,82	1,71	1,58	1,43	1,27	1,10	0,94	0,79
	40	Q	7600	6190	4980	3950	3090	2360	1750	1250	850
		P	2,30	2,14	1,96	1,76	1,56	1,35	1,15	0,96	0,77
	50	Q	6520	5280	4220	3320	2560	1930	1410	980	640
		P	2,68	2,43	2,17	1,92	1,66	1,41	1,17	0,94	0,73
2EES-2Y	20	Q	11390	9320	7550	6040	4750	3670	2760	2000	1380
		P	1,67	1,66	1,61	1,52	1,41	1,27	1,12	0,97	0,81
	30	Q	10080	8210	6610	5250	4090	3120	2310	1640	1100
		P	2,13	2,04	1,91	1,75	1,57	1,38	1,18	0,98	0,79
	40	Q	8760	7090	5660	4440	3420	2560	1850	1270	810
		P	2,54	2,36	2,15	1,92	1,68	1,44	1,19	0,95	0,73
	50	Q	7440	5960	4710	3650	2760	2020	1410	925	535
		P	2,87	2,61	2,33	2,04	1,74	1,44	1,16	0,88	0,63
2DES-2Y	20	Q	13530	11090	8990	7200	5680	4400	3320	2430	1690
		P	2,00	2,00	1,94	1,84	1,70	1,54	1,36	1,18	0,99
	30	Q	12000	9780	7890	6280	4910	3760	2800	2010	1370
		P	2,58	2,47	2,31	2,12	1,91	1,68	1,44	1,20	0,98
	40	Q	10450	8470	6780	5340	4130	3120	2280	1590	1040
		P	3,09	2,87	2,62	2,35	2,06	1,76	1,47	1,19	0,93
	50	Q	8900	7160	5670	4420	3360	2490	1770	1190	730
		P	3,51	3,20	2,86	2,51	2,15	1,80	1,45	1,13	0,83
2CES-3Y	20	Q	16520	13560	11010	8840	7000	5440	4140	3060	2160
		P	2,42	2,42	2,35	2,24	2,08	1,89	1,68	1,47	1,25
	30	Q	14690	12000	9700	7750	6090	4690	3530	2570	1790
		P	3,12	3,00	2,82	2,60	2,34	2,08	1,80	1,52	1,26
	40	Q	12830	10430	8380	6640	5170	3940	2920	2090	1410
		P	3,75	3,50	3,21	2,89	2,55	2,21	1,87	1,54	1,24
	50	Q	10980	8870	7070	5550	4270	3210	2330	1620	1060
		P	4,29	3,92	3,53	3,12	2,70	2,29	1,89	1,52	1,18
4FES-3Y	20	Q	18040	14750	11930	9520	7480	5770	4330	3140	2160
		P	2,63	2,62	2,54	2,40	2,22	2,00	1,77	1,52	1,28
	30	Q	15930	12950	10400	8240	6410	4880	3600	2560	1710
		P	3,36	3,21	3,00	2,75	2,46	2,16	1,84	1,53	1,23
	40	Q	13800	11140	8870	6940	5330	3980	2870	1970	1250
		P	3,97	3,69	3,36	3,00	2,62	2,23	1,85	1,48	1,14
	50	Q	11670	9330	7340	5670	4270	3120	2180	1420	825
		P	4,47	4,06	3,62	3,16	2,69	2,23	1,78	1,36	0,98

R407A



Leistungswerte 50 Hz

bezogen auf Sauggastemperatur 20°C,
ohne Flüssigkeits-Unterkühlung

Performance data 50 Hz

relating to 20°C suction gas tempera-
ture, without liquid subcooling

Données de puissance 50 Hz

à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ	Verf. Temp.	Kälteleistung Cooling capacity Puissance frigorifique		Q _o		[Watt]		Leistungsaufnahme Power consumption Puissance absorbée		P _e		[kW]	
Compressor type	Cond. temp.												
Compresseur type	Temp. de cond. °C												
		↓	Verdampfungstemperatur °C				Evaporating temperature °C		Température d'évaporation °C				
			0	-5	-10	-15	-20	-25	-30	-35	-40		
4EES-4Y	20	Q	22800	18670	15120	12090	9520	7350	5540	4040	2810		
		P	3,30	3,29	3,18	3,01	2,78	2,50	2,20	1,88	1,58		
	30	Q	20200	16430	13220	10490	8190	6250	4640	3320	2250		
		P	4,25	4,06	3,80	3,47	3,11	2,71	2,31	1,91	1,54		
	40	Q	17520	14170	11300	8880	6840	5140	3740	2600	1690		
		P	5,07	4,71	4,29	3,83	3,34	2,84	2,34	1,87	1,44		
4DES-5Y	50	Q	14860	11910	9410	7300	5540	4080	2880	1930	1170		
		P	5,75	5,22	4,65	4,06	3,46	2,86	2,29	1,75	1,27		
	20	Q	27100	22200	18000	14420	11380	8810	6670	4890	3430		
		P	3,91	3,90	3,79	3,59	3,33	3,01	2,67	2,31	1,95		
	30	Q	24000	19580	15780	12550	9820	7530	5630	4060	2790		
		P	5,03	4,82	4,52	4,15	3,73	3,28	2,82	2,36	1,93		
4CES-6Y	40	Q	20900	16930	13540	10670	8260	6250	4580	3230	2140		
		P	6,00	5,59	5,11	4,58	4,03	3,45	2,89	2,35	1,85		
	50	Q	17780	14300	11340	8840	6750	5010	3600	2450	1550		
		P	6,81	6,21	5,57	4,89	4,20	3,52	2,87	2,26	1,71		
	20	Q	33100	27150	22050	17700	14010	10900	8300	6140	4360		
		P	4,74	4,74	4,61	4,38	4,08	3,71	3,30	2,88	2,47		
4VES-7Y	30	Q	29400	24000	19410	15490	12180	9390	7080	5170	3620		
		P	6,10	5,86	5,51	5,08	4,60	4,07	3,53	3,00	2,49		
	40	Q	25700	20850	16750	13260	10330	7880	5860	4210	2880		
		P	7,30	6,82	6,27	5,65	5,00	4,33	3,67	3,04	2,46		
	50	Q	21950	17730	14130	11090	8550	6440	4700	3300	2190		
		P	8,32	7,62	6,87	6,09	5,29	4,49	3,73	3,01	2,37		
4TES-9Y	20	Q	35050	28650	23200	18500	14530	11170	8360	6010			
		P	4,94	4,90	4,73	4,45	4,10	3,69	3,24	2,77			
	30	Q	30950	25150	20200	15990	12420	9420	6920	4860			
		P	6,27	5,97	5,57	5,09	4,54	3,96	3,35	2,75			
	40	Q	26800	21600	17210	13470	10320	7680	5500	3720			
		P	7,41	6,86	6,24	5,55	4,82	4,08	3,34	2,63			
4PES-12Y	50	Q	22550	18060	14230	10980	8260	6000	4150				
		P	8,34	7,55	6,71	5,84	4,94	4,05	3,19				
	20	Q	42250	34600	28100	22500	17740	13730	10370	7570			
		P	5,96	5,92	5,73	5,42	5,01	4,53	4,01	3,46			
	30	Q	37450	30550	24600	19590	15330	11740	8740	6270			
		P	7,61	7,27	6,81	6,25	5,61	4,93	4,23	3,53			
4NES-14Y	40	Q	32600	26400	21150	16690	12910	9750	7140	4990			
		P	9,05	8,42	7,70	6,90	6,05	5,19	4,32	3,49			
	50	Q	27700	22300	17710	13820	10550	7840	5600				
		P	10,27	9,37	8,39	7,38	6,33	5,30	4,29				
	20	Q	49000	40050	32400	25850	20300	15600	11670	8400			
		P	6,80	6,74	6,51	6,14	5,65	5,09	4,47	3,82			
4JE-15Y	30	Q	43200	35150	28200	22350	17350	13160	9670	6790			
		P	8,62	8,21	7,66	7,00	6,25	5,45	4,63	3,80			
	40	Q	37400	30200	24050	18810	14410	10730	7690	5200			
		P	10,16	9,42	8,57	7,63	6,64	5,62	4,61	3,62			
	50	Q	31500	25200	19870	15340	11540	8380	5800				
		P	11,40	10,35	9,21	8,02	6,80	5,59	4,40				
4PES-12Y	20	Q	57300	46950	38050	30450	24000	18550	13980	10170			
		P	8,04	7,98	7,72	7,30	6,74	6,08	5,36	4,61			
	30	Q	50800	41350	33350	26500	20700	15800	11730	8370			
		P	10,27	9,80	9,16	8,40	7,53	6,60	5,63	4,68			
	40	Q	44100	35700	28600	22500	17360	13070	9520	6620			
		P	12,18	11,33	10,34	9,25	8,09	6,91	5,73	4,58			
4PES-12Y	50	Q	37400	30100	23850	18560	14130	10440	7410				
		P	13,78	12,56	11,24	9,85	8,43	7,01	5,63				
	20	Q	64400	52900	42950	34450	27150	20900	15610	11070			
		P	9,49	9,24	8,82	8,26	7,58	6,83	6,02	5,19			
	30	Q	56900	46500	37600	29900	23300	17740	13010	9030			
		P	11,72	11,09	10,31	9,42	8,44	7,40	6,35	5,29			
4PES-12Y	40	Q	49450	40150	32150	25350	19520	14610	10490	7060			
		P	13,61	12,62	11,52	10,32	9,06	7,77	6,48	5,21			
	50	Q	42000	33850	26900	20950	15900	11670	8170				
		P	15,15	13,85	12,44	10,95	9,43	7,90	6,39				

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ment, voir limites d'application à la page 10

Valeurs provisoires



R407A

Leistungswerte 50 Hzbezogen auf Sauggasttemperatur 20°C,
ohne Flüssigkeits-Unterkühlung**Performance data 50 Hz**relating to 20°C suction gas tempera-
ture, without liquid subcooling**Données de puissance 50 Hz**à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ	Verfl. Temp.		Kälteleistung Cooling capacity Puissance frigorifique				Q _o	[Watt]	Leistungsaufnahme Power consumption Puissance absorbée				P _e	[kW]
Compressor type	Cond. temp.													
Compresseur type	Temp. de cond. °C	↓	Verdampfungstemperatur °C			Evaporating temperature °C			Température d'évaporation °C					
			0	-5	-10	-15	-20	-25	-30	-35	-40			
4HE-18Y	20	Q	75000	61700	50300	40400	31950	24700	18560	13290				
		P	11,12	10,84	10,36	9,71	8,94	8,07	7,14	6,19				
	30	Q	66600	54500	44150	35250	27600	21150	15650	11020				
		P	13,85	13,11	12,21	11,17	10,03	8,84	7,62	6,42				
	40	Q	58100	47300	38000	30100	23350	17620	12830	8830				
		P	16,22	15,06	13,76	12,36	10,89	9,40	7,91	6,47				
4GE-23Y	50	Q	49600	40100	32000	25100	19250	14320	10230					
		P	18,23	16,68	15,01	13,28	11,50	9,73	8,00					
	20	Q	86500	71300	58200	46950	37300	29000	21950	15910				
		P	12,98	12,69	12,15	11,41	10,53	9,54	8,50	7,45				
	30	Q	77000	63300	51400	41200	32500	25100	18780	13460				
		P	16,34	15,50	14,46	13,26	11,96	10,60	9,23	7,89				
4FE-28Y	40	Q	67500	55200	44600	35500	27800	21200	15710	11120				
		P	19,35	18,00	16,49	14,87	13,18	11,48	9,80	8,20				
	50	Q	58000	47200	37900	30000	23300	17620	12900					
		P	22,02	20,20	18,25	16,23	14,19	12,16	10,22					
	20	Q	102800	84700	69000	55600	44050	34200	25750	18550				
		P	15,27	14,91	14,28	13,41	12,36	11,19	9,95	8,69				
6JE-25Y	30	Q	91400	74900	60800	48600	38200	29400	21850	15540				
		P	19,05	18,08	16,87	15,47	13,95	12,34	10,71	9,10				
	40	Q	79900	65200	52500	41700	32500	24700	18110	12650				
		P	22,36	20,82	19,08	17,21	15,24	13,24	11,25	9,32				
	50	Q	68400	55500	44450	35000	27000	20300	14660					
		P	25,19	23,14	20,93	18,61	16,23	13,86	11,55					
6HE-28Y	20	Q	96500	79300	64400	51700	40750	31400	23400	16610				
		P	14,18	13,81	13,18	12,33	11,31	10,18	8,96	7,71				
	30	Q	85400	69800	56400	44850	35000	26600	19520	13550				
		P	17,54	16,59	15,42	14,07	12,60	11,05	9,45	7,87				
	40	Q	74200	60200	48250	38000	29300	21900	15730	10600				
		P	20,39	18,91	17,24	15,43	13,54	11,59	9,65	7,75				
6GE-34Y	50	Q	63000	50800	40300	31400	23850	17510	12250					
		P	22,72	20,75	18,62	16,39	14,09	11,79	9,52					
	20	Q	112600	92600	75400	60600	47950	37100	27850	19940				
		P	16,64	16,23	15,50	14,52	13,35	12,04	10,65	9,23				
	30	Q	99900	81800	66200	52900	41450	31700	23500	16530				
		P	20,76	19,65	18,28	16,72	15,01	13,21	11,38	9,57				
6FE-44Y	40	Q	87100	70900	57000	45150	35000	26450	19250	13260				
		P	24,33	22,58	20,62	18,51	16,30	14,05	11,82	9,66				
	50	Q	74400	60200	48050	37650	28900	21500	15350					
		P	27,36	25,02	22,51	19,89	17,22	14,55	11,95					
	20	Q	129100	106200	86500	69600	55100	42650	32050	23000				
		P	19,27	18,78	17,93	16,79	15,43	13,91	12,29	10,65				
6FE-44Y	30	Q	114600	93900	76100	60800	47650	36500	27100	19130				
		P	24,16	22,85	21,24	19,41	17,40	15,30	13,18	11,09				
	40	Q	100000	81500	65600	51900	40350	30500	22300	15410				
		P	28,48	26,39	24,07	21,57	18,97	16,34	13,74	11,25				
	50	Q	85500	69200	55300	43400	33350	24900	17860					
		P	32,20	29,39	26,39	23,28	20,12	17,00	13,97					
6FE-44Y	20	Q	154200	127000	103500	83400	66100	51300	38600	27800				
		P	23,19	22,65	21,69	20,39	18,82	17,07	15,20	13,31				
	30	Q	137100	112400	91200	72900	57300	44050	32800	23300				
		P	28,88	27,41	25,58	23,49	21,20	18,79	16,34	13,93				
	40	Q	119800	97800	78800	62500	48700	37000	27150	18970				
		P	33,86	31,53	28,92	26,09	23,14	20,13	17,14	14,26				
6FE-44Y	50	Q	102600	83300	66700	52500	40500	30400	22000					
		P	38,16	35,05	31,70	28,20	24,63	21,07	17,60					

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Tentative data

Valeurs provisoires

R407F



Leistungswerte 50 Hz

bezogen auf Sauggastemperatur 20°C,
ohne Flüssigkeits-Unterkühlung

Performance data 50 Hz

relating to 20°C suction gas tempera-
ture, without liquid subcooling

Données de puissance 50 Hz

à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ	Verf. Temp.	Kälteleistung Cooling capacity Puissance frigorifique		Q _o [Watt]		Leistungsaufnahme Power consumption Puissance absorbée		P _e [kW]			
Compressor type	Cond. temp.										
Compresseur type	Temp. de cond. °C										
		↓	Verdampfungstemperatur °C			Evaporating temperature °C		Température d'évaporation °C			
			0	-5	-10	-15	-20	-25	-30	-35	-40
2KES-05Y	20	Q	4210	3440	2780	2220	1740	1340	1000	715	480
		P	0,65	0,65	0,63	0,60	0,55	0,50	0,44	0,38	0,32
	30	Q	3730	3030	2430	1920	1490	1130	825	570	370
		P	0,82	0,79	0,74	0,68	0,61	0,54	0,46	0,38	0,30
	40	Q	3250	2620	2080	1630	1240	915	645	425	250
		P	0,96	0,90	0,82	0,73	0,64	0,55	0,45	0,36	0,27
2JES-07Y	50	Q	2770	2210	1730	1330	985	705	470	285	135
		P	1,08	0,98	0,88	0,77	0,65	0,54	0,42	0,31	0,21
	20	Q	5490	4500	3650	2930	2310	1790	1350	990	685
		P	0,85	0,85	0,83	0,79	0,73	0,67	0,60	0,52	0,45
	30	Q	4890	3990	3220	2570	2010	1540	1140	820	550
		P	1,08	1,04	0,98	0,90	0,82	0,72	0,63	0,53	0,44
2HES-1Y	40	Q	4290	3480	2790	2200	1700	1280	930	640	410
		P	1,29	1,20	1,10	0,99	0,88	0,76	0,64	0,52	0,41
	50	Q	3690	2970	2350	1830	1390	1020	720	470	275
		P	1,45	1,33	1,20	1,06	0,91	0,77	0,63	0,49	0,36
	20	Q	6920	5680	4620	3710	2940	2290	1740	1280	905
		P	1,06	1,06	1,03	0,98	0,91	0,83	0,74	0,65	0,55
2GES-2Y	30	Q	6180	5060	4090	3270	2570	1980	1490	1080	740
		P	1,36	1,30	1,23	1,13	1,03	0,91	0,79	0,67	0,55
	40	Q	5440	4430	3560	2820	2190	1670	1230	870	575
		P	1,62	1,52	1,40	1,26	1,12	0,97	0,82	0,67	0,54
	50	Q	4700	3800	3030	2370	1820	1360	975	665	415
		P	1,86	1,70	1,53	1,36	1,18	1,00	0,82	0,65	0,49
2FES-2Y	20	Q	8090	6650	5410	4360	3460	2690	2050	1520	1080
		P	1,23	1,23	1,19	1,14	1,06	0,97	0,87	0,77	0,66
	30	Q	7240	5930	4810	3850	3030	2340	1770	1290	900
		P	1,57	1,51	1,42	1,32	1,20	1,07	0,94	0,80	0,67
	40	Q	6390	5210	4190	3330	2600	1980	1470	1050	710
		P	1,89	1,76	1,62	1,47	1,31	1,14	0,98	0,81	0,66
2EES-2Y	50	Q	5530	4480	3580	2810	2170	1630	1180	820	525
		P	2,17	1,98	1,79	1,59	1,39	1,19	0,99	0,80	0,62
	20	Q	10200	8390	6830	5500	4370	3410	2600	1930	1380
		P	1,54	1,54	1,50	1,43	1,33	1,21	1,08	0,95	0,82
	30	Q	9130	7480	6070	4860	3830	2970	2240	1640	1150
		P	2,01	1,93	1,81	1,67	1,51	1,34	1,17	0,99	0,83
2DES-2Y	40	Q	8060	6580	5300	4210	3290	2520	1880	1350	915
		P	2,46	2,28	2,09	1,88	1,66	1,44	1,22	1,01	0,82
	50	Q	6980	5660	4530	3570	2760	2080	1520	1060	695
		P	2,89	2,61	2,33	2,05	1,77	1,50	1,25	1,00	0,78
	20	Q	11950	9790	7930	6350	5010	3870	2920	2130	1480
		P	1,75	1,75	1,69	1,60	1,49	1,34	1,19	1,02	0,86
2CES-3Y	30	Q	10610	8660	6980	5550	4340	3320	2470	1760	1190
		P	2,25	2,16	2,02	1,85	1,66	1,46	1,25	1,04	0,84
	40	Q	9300	7540	6030	4750	3670	2760	2000	1380	880
		P	2,70	2,50	2,29	2,04	1,79	1,53	1,27	1,02	0,78
	50	Q	7980	6420	5080	3950	2990	2200	1540	1010	580
		P	3,07	2,78	2,49	2,18	1,86	1,55	1,24	0,94	0,67
2DES-2Y	20	Q	14190	11630	9450	7580	5990	4640	3520	2580	1810
		P	2,11	2,10	2,04	1,94	1,79	1,62	1,44	1,24	1,05
	30	Q	12630	10320	8330	6640	5210	4000	2990	2160	1480
		P	2,73	2,61	2,45	2,25	2,02	1,78	1,53	1,28	1,04
	40	Q	11090	9010	7220	5700	4420	3350	2450	1720	1130
		P	3,28	3,05	2,79	2,50	2,19	1,88	1,57	1,27	0,99
2CES-3Y	50	Q	9540	7690	6110	4770	3640	2700	1920	1290	790
		P	3,75	3,41	3,05	2,68	2,30	1,92	1,56	1,21	0,88
	20	Q	17310	14220	11570	9300	7370	5750	4380	3240	2310
		P	2,55	2,55	2,48	2,36	2,19	1,99	1,77	1,54	1,32
	30	Q	15460	12650	10250	8190	6450	4980	3760	2750	1920
		P	3,30	3,17	2,98	2,75	2,48	2,20	1,90	1,61	1,34
2CES-3Y	40	Q	13620	11090	8920	7080	5520	4210	3130	2240	1520
		P	3,98	3,72	3,41	3,07	2,71	2,35	1,99	1,64	1,32
	50	Q	11770	9520	7600	5970	4600	3460	2520	1760	1150
		P	4,58	4,19	3,76	3,32	2,88	2,44	2,02	1,61	1,25

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ment, voir limites d'application à la page 10

Valeurs provisoires

**R407F****Leistungswerte 50 Hz**bezogen auf Sauggasttemperatur 20°C,
ohne Flüssigkeits-Unterkühlung**Performance data 50 Hz**relating to 20°C suction gas tempera-
ture, without liquid subcooling**Données de puissance 50 Hz**à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ Compressor type Compresseur type	Verfl. Temp. Cond. temp. Temp. de cond. °C		Kälteleistung Cooling capacity Puissance frigorifique					Q _o	[Watt]	Leistungsaufnahme Power consumption Puissance absorbée					P _e	[kW]
			Verdampfungstemperatur °C							Evaporating temperature °C		Température d'évaporation °C				
			0	-5	-10	-15	-20			-25	-30	-35	-40			
4FES-3Y	20	Q	18900	15470	12530	10020	7890	6100	4590	3350	2330					
		P	2,77	2,76	2,67	2,53	2,34	2,11	1,86	1,60	1,35					
	30	Q	16800	13670	11000	8720	6800	5190	3840	2740	1840					
		P	3,55	3,39	3,17	2,91	2,61	2,29	1,95	1,62	1,31					
	40	Q	14670	11850	9450	7410	5700	4270	3090	2130	1360					
		P	4,22	3,92	3,57	3,19	2,79	2,38	1,97	1,58	1,21					
4EES-4Y	20	Q	12530	10040	7910	6120	4620	3380	2370	1560	920					
		P	4,76	4,33	3,86	3,37	2,88	2,38	1,91	1,46	1,05					
	30	Q	23900	19590	15890	12720	10040	7770	5880	4300	3010					
		P	3,47	3,46	3,36	3,17	2,93	2,64	2,32	1,99	1,67					
	40	Q	21300	17340	13970	11110	8680	6640	4950	3550	2420					
		P	4,50	4,30	4,02	3,68	3,30	2,88	2,46	2,04	1,64					
4DES-5Y	20	Q	18630	15070	12040	9470	7310	5510	4020	2810	1830					
		P	5,40	5,01	4,57	4,08	3,56	3,03	2,50	2,00	1,54					
	30	Q	15960	12810	10130	7870	5980	4410	3130	2100	1290					
		P	6,15	5,58	4,97	4,34	3,70	3,07	2,46	1,89	1,37					
	40	Q	28400	23300	18910	15170	11990	9310	7070	5200	3680					
		P	4,12	4,11	3,99	3,79	3,51	3,18	2,81	2,43	2,06					
4CES-6Y	20	Q	25300	20650	16680	13280	10410	8000	5990	4340	3000					
		P	5,32	5,09	4,78	4,39	3,95	3,48	2,99	2,51	2,05					
	30	Q	22200	18010	14420	11380	8820	6680	4920	3480	2320					
		P	6,38	5,94	5,43	4,87	4,28	3,68	3,08	2,50	1,97					
	40	Q	19090	15370	12200	9520	7280	5420	3900	2670	1700					
		P	7,27	6,63	5,94	5,22	4,49	3,77	3,07	2,41	1,82					
4VES-7Y	20	Q	34700	28500	23150	18620	14760	11510	8780	6520	4660					
		P	4,99	4,99	4,85	4,62	4,29	3,91	3,48	3,04	2,60					
	30	Q	31000	25350	20500	16380	12890	9960	7520	5520	3880					
		P	6,44	6,19	5,83	5,38	4,86	4,31	3,74	3,17	2,63					
	40	Q	27300	22200	17820	14130	11020	8420	6270	4520	3100					
		P	7,74	7,24	6,65	6,00	5,31	4,61	3,90	3,23	2,61					
4TES-9Y	20	Q	23550	19030	15190	11940	9210	6940	5080	3580	2390					
		P	8,86	8,12	7,32	6,49	5,63	4,79	3,97	3,21	2,52					
	30	Q	37000	30250	24450	19510	15350	11850	8940	6550						
		P	5,03	5,04	4,92	4,67	4,34	3,92	3,45	2,95						
	40	Q	32550	26500	21300	16910	13170	10040	7430	5280						
		P	6,51	6,25	5,88	5,41	4,86	4,25	3,61	2,95						
4PES-12Y	20	Q	28150	22800	18240	14330	11030	8240	5920	4010						
		P	7,80	7,28	6,67	5,97	5,22	4,43	3,62	2,82						
	30	Q	23800	19160	15190	11800	8910	6480	4450							
		P	8,87	8,10	7,25	6,34	5,40	4,43	3,48							
	40	Q	44550	36450	29500	23600	18610	14430	10950	8080						
		P	6,03	6,06	5,92	5,64	5,24	4,76	4,20	3,61						
4NES-14Y	20	Q	39300	32050	25800	20550	16080	12320	9190	6610						
		P	7,84	7,55	7,12	6,56	5,91	5,20	4,44	3,66						
	30	Q	34050	27700	22200	17540	13570	10240	7450	5150						
		P	9,43	8,83	8,11	7,30	6,41	5,48	4,53	3,58						
	40	Q	28900	23400	18640	14570	11110	8180	5740							
		P	10,78	9,88	8,89	7,83	6,71	5,58	4,45							
4JE-15Y	20	Q	51800	42300	34150	27250	21400	16480	12400	9040						
		P	6,89	6,90	6,72	6,38	5,91	5,34	4,69	3,99						
	30	Q	45500	37000	29750	23550	18300	13890	10230	7220						
		P	8,88	8,52	8,01	7,35	6,59	5,75	4,86	3,95						
	40	Q	39300	31800	25350	19880	15240	11340	8090	5410						
		P	10,58	9,87	9,03	8,07	7,04	5,95	4,83	3,72						
4FES-3Y	20	Q	33100	26600	21050	16270	12230	8820	5980							
		P	11,96	10,92	9,76	8,52	7,22	5,89	4,56							
	30	Q	60900	49800	40300	32200	25400	19660	14890	10970						
		P	8,14	8,17	7,98	7,59	7,05	6,38	5,62	4,81						
	40	Q	53700	43750	35250	28000	21900	16750	12470	8940						
		P	10,57	10,17	9,58	8,82	7,93	6,96	5,92	4,85						
4EES-4Y	20	Q	46500	37750	30250	23850	18440	13870	10060	6920						
		P	12,69	11,88	10,89	9,78	8,57	7,30	6,00	4,70						
	30	Q	39400	31850	25350	19770	15030	11040	7700							
		P	14,46	13,25	11,90	10,45	8,94	7,39	5,84							
	40	Q	68500	56100	45450	36400	28700	22250	16820	12320						
		P	9,68	9,53	9,17	8,65	8,00	7,25	6,44	5,60						
4DES-5Y	20	Q	61100	49850	40200	32000	25050	19170	14260	10180						
		P	12,20	11,61	10,85	9,96	8,98	7,92	6,84	5,77						
	30	Q	53400	43400	34850	27500	21300	16050	11670	8060						
		P	14,34	13,36	12,24	11,02	9,73	8,41	7,09	5,80						
	40	Q	45550	36800	29350	22950	17520	12960	9170							
		P	16,10	14,77	13,33	11,82	10,26	8,70	7,16							

R407F



Leistungswerte 50 Hz

bezogen auf Sauggastemperatur 20°C,
ohne Flüssigkeits-Unterkühlung

Performance data 50 Hz

relating to 20°C suction gas tempera-
ture, without liquid subcooling

Données de puissance 50 Hz

à une température du gaz d'aspiration de
20°C se référant, sans sous-refroidissement
de liquide

Verdichter Typ	Verfl. Temp.		Kälteleistung Cooling capacity Puissance frigorifique				Q _o	[Watt]	Leistungsaufnahme Power consumption Puissance absorbée				P _e	[kW]
Compressor type	Cond. temp.													
Compresseur type	Temp. de cond. °C	↓	Verdampfungstemperatur °C			Evaporating temperature °C			Température d'évaporation °C					
			0	-5	-10	-15	-20	-25	-30	-35	-40			
4HE-18Y	20	Q	80000	65600	53300	42800	33900	26350	20050	14800				
		P	11,35	11,19	10,78	10,18	9,43	8,56	7,64	6,68				
	30	Q	71600	58500	47400	37850	29750	22900	17170	12420				
		P	14,43	13,74	12,86	11,82	10,67	9,46	8,21	6,99				
	40	Q	62800	51200	41250	32700	25500	19380	14270	10050				
		P	17,10	15,94	14,63	13,20	11,70	10,17	8,65	7,18				
4GE-23Y	50	Q	53800	43700	35000	27500	21200	15890	11460					
		P	19,37	17,79	16,09	14,31	12,50	10,69	8,93					
	20	Q	92400	75900	61700	49650	39400	30750	23500	17440				
		P	13,19	13,01	12,55	11,86	10,99	10,00	8,93	7,85				
	30	Q	82800	67900	55000	44050	34750	26900	20300	14790				
		P	16,90	16,10	15,08	13,87	12,54	11,13	9,70	8,30				
4FE-28Y	40	Q	72900	59600	48100	38300	30000	22950	17050	12160				
		P	20,21	18,84	17,29	15,61	13,86	12,09	10,34	8,67				
	50	Q	62700	51100	41000	32450	25150	19020	13890					
		P	23,12	21,22	19,20	17,10	14,97	12,88	10,86					
	20	Q	110400	90700	73800	59300	47050	36700	28000	20800				
		P	15,59	15,38	14,85	14,05	13,04	11,88	10,63	9,36				
6JE-25Y	30	Q	98900	81100	65700	52600	41500	32100	24200	17660				
		P	19,84	18,93	17,75	16,36	14,83	13,19	11,53	9,88				
	40	Q	87100	71100	57400	45700	35750	27350	20300	14500				
		P	23,54	22,00	20,25	18,34	16,34	14,29	12,26	10,31				
	50	Q	74800	60900	48900	38700	30000	22650	16540					
		P	26,72	24,63	22,37	20,01	17,59	15,19	12,85					
6HE-28Y	20	Q	102700	84100	68200	54600	43100	33350	25250	18500				
		P	14,47	14,24	13,70	12,92	11,93	10,81	9,59	8,34				
	30	Q	91600	74800	60300	48000	37550	28750	21400	15290				
		P	18,27	17,37	16,23	14,89	13,40	11,82	10,20	8,59				
	40	Q	80100	65100	52200	41200	31900	24050	17500	12110				
		P	21,48	20,00	18,31	16,47	14,54	12,55	10,57	8,64				
6GE-34Y	50	Q	68200	55100	43900	34300	26200	19400	13740					
		P	24,11	22,10	19,93	17,65	15,32	12,97	10,67					
	20	Q	120100	98500	80000	64200	50800	39500	30050	22200				
		P	16,99	16,74	16,13	15,22	14,09	12,79	11,40	9,97				
	30	Q	107400	87800	71000	56700	44550	34300	25750	18660				
		P	21,62	20,58	19,25	17,69	15,96	14,13	12,27	10,43				
6FE-44Y	40	Q	94200	76800	61800	49000	38200	29050	21400	15110				
		P	25,63	23,88	21,90	19,75	17,49	15,19	12,92	10,73				
	50	Q	80600	65400	52300	41200	31750	23800	17170					
		P	29,03	26,65	24,08	21,40	18,68	15,97	13,34					
	20	Q	138300	113400	92100	74000	58600	45600	34700	25750				
		P	19,69	19,39	18,67	17,62	16,29	14,79	13,17	11,52				
6GE-34Y	30	Q	123600	101100	81800	65400	51400	39650	29800	21700				
		P	25,19	23,96	22,39	20,55	18,53	16,39	14,23	12,11				
	40	Q	108500	88400	71300	56600	44150	33650	24900	17660				
		P	30,04	27,95	25,59	23,04	20,38	17,69	15,05	12,53				
	50	Q	92800	75400	60400	47600	36800	27650	20050					
		P	34,22	31,33	28,25	25,06	21,84	18,67	15,63					
6FE-44Y	20	Q	165200	135800	110500	89000	70600	55100	42100	31300				
		P	23,67	23,35	22,55	21,35	19,83	18,10	16,24	14,34				
	30	Q	148300	121500	98500	78900	62200	48100	36350	26550				
		P	30,04	28,66	26,89	24,81	22,50	20,06	17,58	15,14				
	40	Q	130500	106500	86000	68400	53500	40950	30500	21800				
		P	35,60	33,27	30,63	27,76	24,75	21,70	18,68	15,80				
6FE-44Y	50	Q	111900	91000	73100	57800	44800	33900	24850					
		P	40,36	37,18	33,76	30,20	26,58	23,01	19,56					

Hinweis zum Betrieb siehe Einsatzgrenzen,
Seite 10

Vorläufige Daten

Notes on the operation see application limits,
page 10

Tentative data

Pour des informations relatives au fonctionne-
ment, voir limites d'application à la page 10

Valeurs provisoires



Technische Daten

Technical data

Caractéristiques techniques

Verdichter Typ	Motor Version	Förder- volumen bei 1450 min ⁻¹	Anzahl der Zylinder	Öl- füllung	Gewicht	Rohranschlüsse				CR – Stufen –	Motor- Anschluss	Elektrische Daten		
Compressor type	Motor version	Displace- ment at 1450 min ⁻¹	Number of cylinders	Oil charge	Weight	DL Druckleitung	SL Saugleitung	Pipe connections		CR – Steps –	Motor connection	Max. Betriebs- strom	Max. Leistungs- aufnahme	Auslegungs- strom für 70 Hz FU-Betrieb
Com- presseur type	Version moteur	Volume balayé à 1450 min ⁻¹	Nombre de cylindres	Charge d'huile	Poids	DL Conduite de ref.	SL Conduite d'aspiration	Raccords		CR – Etages –	Raccordement de moteur	Caractéristiques électriques		
		m ³ /h		dm ³	kg	mm	inch	mm	inch	% ①	Volt ②	Amp. ③	kW ④	Courant de sélection pour opération 70 Hz CF Amp. ⑤
2KES-05(Y)	1	4,06	2	1,0	43	12	1/2	16	5/8	–	Δ / Y	4,9/2,8	1,5	
2JES-07(Y)	1	5,21	2	1,0	43	12	1/2	16	5/8			6,4/3,7	1,9	
2HES-1(Y)	2	6,51	2	1,0	44	12	1/2	16	5/8			6,7/3,8	2,0	
2HES-2(Y)	1	7,58	2	1,0	45	12	1/2	16	5/8			7,8/4,5	2,4	
2GES-2(Y)	1	7,58	2	1,0	45	12	1/2	16	5/8			8,7/5,0	2,7	
2FES-2(Y)	2	9,54	2	1,0	45	12	1/2	16	5/8			9,2/5,3	2,9	
2FES-3(Y)	1	9,54	2	1,0	47	12	1/2	16	5/8			10,7/6,1	3,4	
2EES-2(Y)	2	11,4	2	1,5	68	16	5/8	22	7/8			10,4/6,0	3,3	
2EES-3(Y)	1	11,4	2	1,5	71	16	5/8	22	7/8			13,4/7,5	3,8	
2DES-2(Y)	2	13,4	2	1,5	68	16	5/8	22	7/8			13,4/7,5	4,0	
2DES-3(Y)	1	13,4	2	1,5	71	16	5/8	22	7/8			15,0/8,6	4,6	
2CES-3(Y)	2	16,2	2	1,5	70	16	5/8	22	7/8			15,8/9,1	5,0	
2CES-4(Y)	1	16,2	2	1,5	70	16	5/8	22	7/8			17,4/10,0	5,6	
4FES-3(Y)	2	18,1	4	2,0	82	16	5/8	22	7/8			16,5/9,5	5,3	
4FES-5(Y)	1	18,1	4	2,0	86	16	5/8	22	7/8			18,8/10,8	5,8	
4EES-4(Y)	2	22,7	4	2,0	84	16	5/8	28	1 1/8	50	PW ⑥	21,2/12,2	6,9	
4EES-6(Y)	1	22,7	4	2,0	86	16	5/8	28	1 1/8			23,7/13,6	7,6	
4DES-5(Y)	2	26,8	4	2,0	86	22	7/8	28	1 1/8			25,2/14,5	8,1	
4DES-7(Y)	1	26,8	4	2,0	89	22	7/8	28	1 1/8			28,7/16,5	8,9	
4CES-6(Y)	2	32,5	4	2,0	91	22	7/8	28	1 1/8			30,8/17,7	9,7	
4CES-9(Y)	1	32,5	4	2,0	91	22	7/8	28	1 1/8			35,1/20,2	11,3	
4VES-6Y	3				129							9,4	6	14,8
4VES-7(Y)	2	34,7	4	2,6	129	22	7/8	28	1 1/8			16,6	11	
4VES-10(Y)	1				139							19,9	12	
4TES-8Y	3				134							11,4	7	17,6
4TES-9(Y)	2	41,3	4	2,6	134	28	1 1/8	35	1 3/8			19,9	13	
4TES-12(Y)	1				141							25,1	14	
4PES-10Y	3				139			35	1 3/8			12,9	8	21,0
4PES-12(Y)	2	48,5	4	2,6	139	28	1 1/8	35	1 3/8			22,7	14	
4PES-15(Y)	1				147			42	1 5/8			28,2	16	
4NES-12Y	3				141			35	1 3/8			14,9	9	25,2
4NES-14(Y)	2	56,2	4	2,6	141	28	1 1/8	35	1 3/8			26,6	17	
4NES-20(Y)	1				150			42	1 5/8			33,2	19	
4JE-13Y	3				179							18,8	11	28,6
4JE-15(Y)	2	63,5	4	4,0	190	28	1 1/8	42	1 5/8			30,8	19	
4JE-22(Y)	1				190							37,2	21	
4HE-15Y	3				183			42	1 5/8			21,4	13	32,5
4HE-18(Y)	2	73,7	4	4,0	190	28	1 1/8	42	1 5/8			36,7	22	
4HE-25(Y)	1				194			54	2 1/8			44	25	
4GE-20Y	3				192							24,6	16	38,1
4GE-23(Y)	2	84,6	4	4,5	192	28	1 1/8	54	2 1/8			43,9	27	
4GE-30(Y)	1				206							51,2	28	
4FE-25Y	3				196							30,5	19	46,6
4FE-28(Y)	2	101,8	4	4,5	207	28	1 1/8	54	2 1/8			52,8	31	
4FE-35(Y)	1				207							62,1	35	

Ölsumpheizung

- 230V
- 2KES-05(Y) .. 2FES-3(Y): 0 .. 60 W PTC-Heizung selbst-regulierend
 - 2EES-2(Y) .. 4CES-9(Y): 0 .. 120 W PTC-Heizung selbst-regulierend
 - 4VES-6Y .. 4NES-20(Y): 0 .. 140 W PTC-Heizung selbst-regulierend
 - 4JE-13Y .. 8FE-70(Y): 140 W
- obligatorisch bei
- Außenaufstellung des Verdichters
 - langen Stillstandszeiten
 - großer Kältemittel-Füllmenge
 - Gefahr von Kältemittel-Kondensation in den Verdichter

Crankcase heater

- 230V
- 2KES-05(Y) .. 2FES-3(Y): 0 .. 60 W self-regulating PTC heater
 - 2EES-2(Y) .. 4CES-9(Y): 0 .. 120 W self-regulating PTC heater
 - 4VES-6Y .. 4NES-20(Y): 0 .. 140 W self-regulating PTC heater
 - 4JE-13Y .. 8FE-70(Y): 140 W
- mandatory in case of
- outdoor installation of the compressor
 - long shut-off periods
 - high refrigerant charge
 - danger of refrigerant condensation into the compressor

Résistance de carter

- 230V
- 2KES-05(Y) .. 2FES-3(Y): 0 .. 60 W résistance CTP autorégulante
 - 2EES-2(Y) .. 4CES-9(Y): 0 .. 120 W résistance CTP autorégulante
 - 4VES-6Y .. 4NES-20(Y): 0 .. 140 W résistance CTP autorégulante
 - 4JE-13Y .. 8FE-70(Y): 140 W
- obligatoire pour
- installation extérieure du compresseur
 - longues périodes d'immobilisation
 - haute charge de fluide frigorigène
 - risque de condensation de fluide frigorigène dans le compresseur

Technische Daten

Technical data

Caractéristiques techniques

Verdichter Type	Motor Version	Förder- volumen bei 1450 min ⁻¹	Anzahl der Zylinder	Öl- füllung	Gewicht	Rohranschlüsse				CR – Stufen –	Motor- Anschluss	Elektrische Daten		
Compressor type	Motor version	Displace- ment at 1450 min ⁻¹	Number of cylinders	Oil charge	Weight	DL Druckleitung	SL Saugleitung	Pipe connections		CR – Steps –	Motor connection	Max. Betriebs- strom	Max. Leistungs- aufnahme	Auslegungs- strom für 70 Hz FU-Betrieb
Com- presseur type	Version moteur	Volume balayé à 1450 min ⁻¹	Nombre de cylindres	Charge d'huile	Poids	DL Discharge line	SL Suction line	Raccords		CR – Etages –	Raccordement de moteur	Max. operating current	Max. power con- sumption	Selection current for 70 Hz FI operation
		m ³ /h		dm ³	kg	mm	inch	mm	inch	% ^①	Volt ^②	Amp. ^③	kW ^③	Courant de sélection pour opération 70 Hz CF Amp. ^⑤
6JE-22Y	3				213							26,6	16	42,4
6JE-25(Y)	2	95,3	6	4,75	228	35	1 3/8	54	2 1/8			46,4	27	
6JE-33(Y)	1				231							53,2	30	
6HE-25Y	3				224							31,3	19	48,2
6HE-28(Y)	2	110,5	6	4,75	228	35	1 3/8	54	2 1/8			53,2	33	
6HE-35(Y)	1				235							64,4	36	
6GE-30Y	3				228							38	23	58,4
6GE-34(Y)	2	126,8	6	4,75	228	35	1 3/8	54	2 1/8			65,5	40	
6GE-40(Y)	1				238							73,9	42	
6FE-40Y	3				238							48,5	27	75,5
6FE-44(Y)	2	151,6	6	4,75	241	42	1 5/8	54	2 1/8			83,2	46	
6FE-50(Y)	1				241							96,2	51	
8GE-50(Y)	2				342							92	51	
8GE-60(Y)	1	185	8	5,0	350	42	1 5/8	76	3 1/8			113	63	
8FE-60(Y)	2				361							113	63	
8FE-70(Y)	1	221	8	5,0	374	54	2 1/8	76	3 1/8			139	78	

Erläuterungen

- ① CR Leistungsregler (Option)
220 .. 240 V/1/50/60 Hz
- ② Toleranz (±10%) bezogen auf Mittelwert
des Spannungsbereichs.
Andere Spannungen und Stromarten
auf Anfrage.
- ③ Daten bezogen auf 400 V/3/50 Hz bei
direktem Netzbetrieb.
Für die Auslegung von Schützen,
Zuleitungen und Sicherungen max.
Betriebsstrom / max. Leistungsaufnahme
berücksichtigen. Siehe auch ⑤.
Schütze: Gebrauchskategorie AC3.
Überstromrelais zur Absicherung des
max. Betriebsstroms einsetzen.
- ④ PW: Motor für Teilwicklungsanlauf
(Part Winding) Y/YY
• 4VES-6Y .. 6FE-50(Y)
Wicklungsteilung 50%/50%
• 8GE-50(Y) .. 8FE-70(Y) Δ/ΔΔ
Wicklungsteilung 60%/40%
• Für PW-Anlauf Motorschütze auf
ca. 60% des max. Betriebsstroms
auslegen.
Ausführung für Y/Δ auf Anfrage
- ⑤ Daten für die Auslegung des Frequenz-
umrichters (FU) – Motorversion 3
(R134a Verdichter):
bezogen auf 400 V/3/50 Hz Netzspan-
nung und Einsatz des 400 V/3/50 Hz
Standardmotors für FU-Betrieb bis 70 Hz.
FU mit Motorversion 1 und 2:
Betrieb im gesamten Anwendungsbe-
reich oberhalb 50 Hz erfordert Motor mit
Sonderspannung.
Auslegung auf Anfrage.

Explanations

- ① CR Capacity control (option)
220 .. 240 V/1/50/60 Hz
- ② Tolerance (±10%) based on mean value
of voltage range. Other voltages and
electrical supplies upon request.
- ③ Data refer to 400 V/3/50 Hz at direct
mains operation.
For the selection of contactors, cables
and fuses the max. operating current /
max. power consumption must be
considered. See also ⑤.
Contactors: operational category AC3.
Use thermal overload relay to limit max.
operating current.
- ④ PW: motor for Part Winding start Y/YY
• 4VES-6Y .. 6FE-50(Y)
winding partition 50%/50%
• 8GE-50(Y) .. 8FE-70(Y) Δ/ΔΔ
winding partition 60%/40%
• For Part Winding start select motor
contactors for approx. 60% of the
max. operating current.
Y/Δ version upon request
- ⑤ Data for frequency inverter (FI) selection
– motor version 3 (R134a compressors):
based on 400 V/3/50 Hz supply voltage
and use of 400 V/3/50 Hz standard
motor for FI operation up to 70 Hz.
FI with motor version 1 and 2:
operation in the entire application range
above 50 Hz requires motor with special
voltage.
Selection upon request.

Explications

- ① CR régulateur de puissance (option)
220 .. 240 V/1/50/60 Hz
- ② Tolérance (±10%) par rapport à la tension
moyenne de la plage. D'autres types de
courant et tensions sur demande.
- ③ Données se référant à 400 V/3/50 Hz opéré
directement au réseau électrique.
Pour la sélection des contacteurs, des
câbles d'alimentation et des fusibles tenir
compte du courant de service max. / de la
puissance absorbée max. Voir aussi ⑤.
Contacteurs: catégorie d'utilisation AC3.
Utiliser des relais thermiques pour protéger le
courant de service max.
- ④ PW: moteur pour démarrage en bobinage
partiel (part-winding) Y/YY
• 4VES-6Y .. 6FE-50(Y)
partage de bobinage 50%/50%
• 8GE-50(Y) .. 8FE-70(Y) Δ/ΔΔ
partage de bobinage 60%/40%
• Pour démarrage en bobinage partiel sélec-
tionner les contacteurs du moteur à environ
60% du courant de service max.
Version pour Y/Δ sur demande
- ⑤ Données pour la sélection du convertisseur
de fréquences (CF) – version de moteur 3
(compresseurs R134a):
se réfèrent à une tension de réseau de
400 V/3/50 Hz et l'emploi du moteur standard
400 V/3/50 Hz pour fonctionnement avec
convertisseur de fréquences jusqu'à 70 Hz.
CF avec version de moteur 1 et 2:
pour fonctionnement en tout le champ
d'application au-dessus de 50 Hz un moteur
de tension spéciale est nécessaire.
Sélection sur demande.

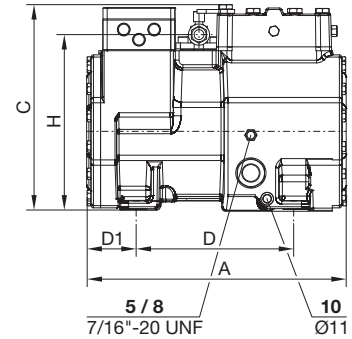
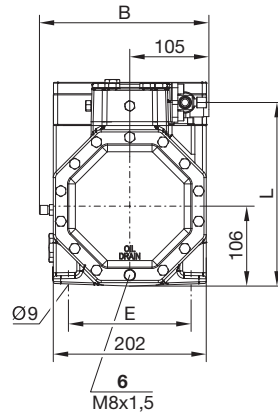
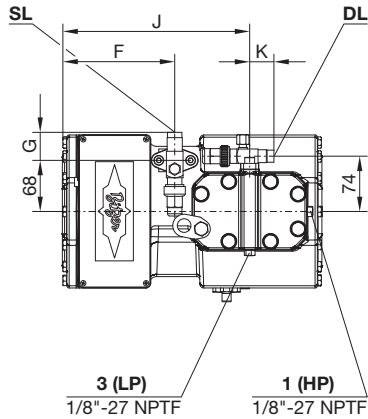


Maßzeichnungen

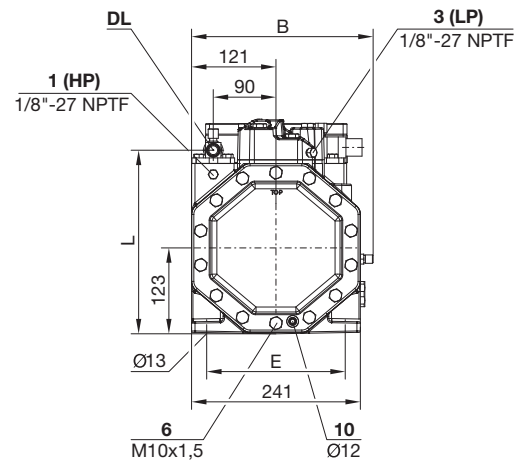
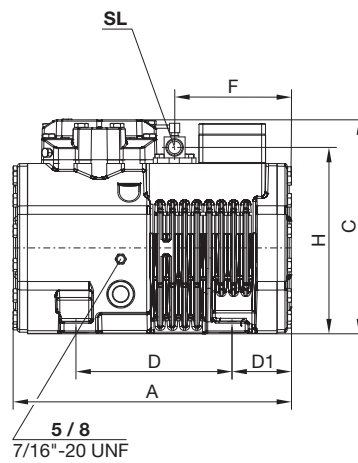
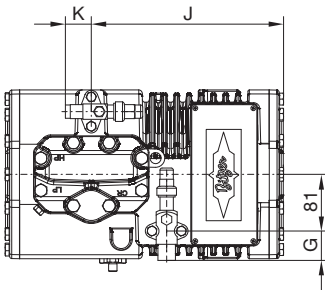
Dimensional drawings

Croquis cotés

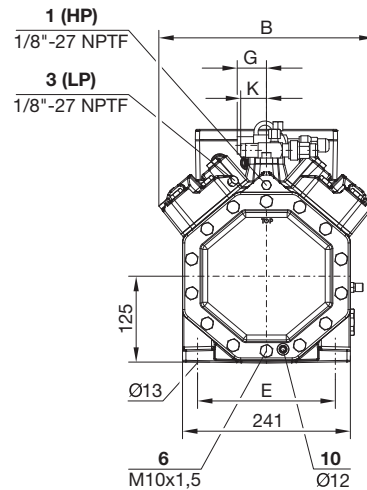
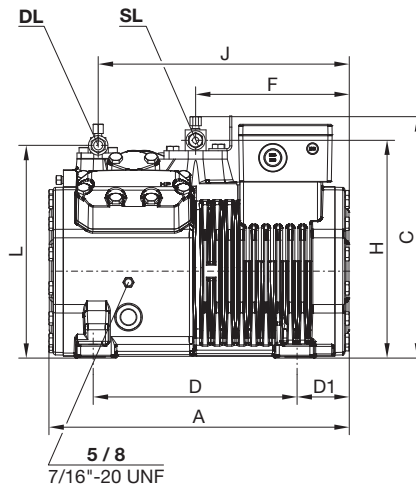
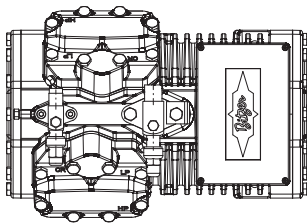
2KES-05(Y) .. 2FES-3(Y)



2EES-2(Y) .. 2CES-4(Y)



4FES-3(Y) .. 4CES-9(Y)



	A	B	C	D	D1	E	F	G	H	J	K	L
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
2KES-05(Y), 2JES-07(Y), 2HES-1(Y), 2HES-2(Y) 2GES-2(Y), 2FES-2(Y), 2FES-3(Y)	343	220	273	208	65	162	148	37	242	247	32	232
2EES-2(Y), 2EES-3(Y), 2DES-2(Y), 2DES-3(Y) 2CES-3(Y), 2CES-4(Y)	398	259	307	223	85	198	167	42	266	275	37	262
4FES-3(Y), 4FES-5(Y)	432	309	347	293	75	198	221	42	313	361	37	306
4EES-4(Y), 4EES-6(Y)	432	309	352	293	75	198	221	56	316	361	37	306
4DES-5(Y)	432	309	352	293	75	198	221	56	316	361	42	310
4DES-7(Y), 4CES-6(Y), 4CES-9(Y)	457	309	352	293	101	198	246	56	316	386	42	310

Legende für Anschlüsse siehe Seite 33

Legend for connections see page 33

Légende des raccords voir page 33

Croquis cotés

1 (HP)

2 (HP)

1/8"-27 NPTF

1/8"-27 NPTF

B

152

5

Ø21

E

300

19

6

10

16

M10x1,5

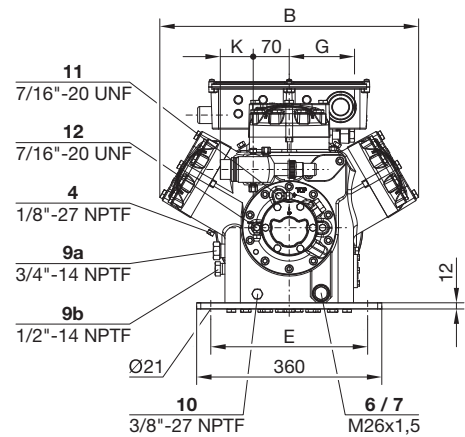
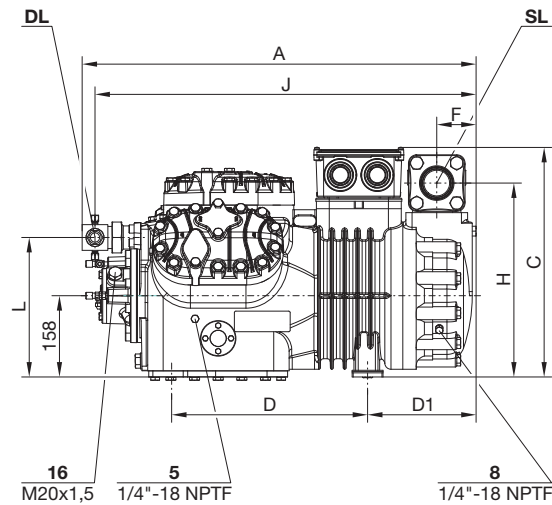
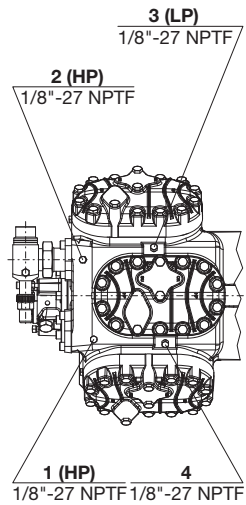
Ø12

M20x1,5

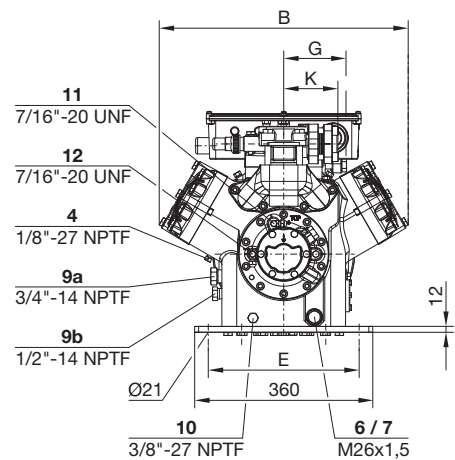
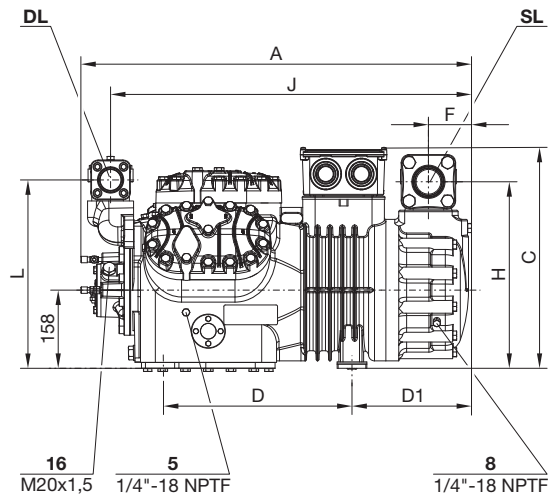
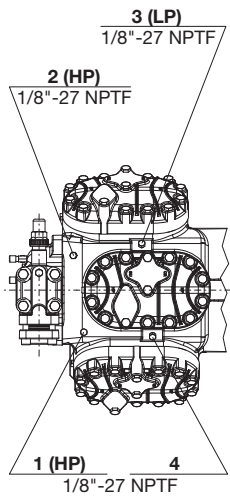
Légende des raccords voir page 33

Croquis cotés

6JE-22Y .. 6GE-40(Y)



6FE-40Y / 6FE-50(Y)



	A mm	B mm	C mm	D mm	D1 mm	E mm	F mm	G mm	H mm	J mm	K mm	L mm
6JE-22Y, 6JE-25(Y)	766	503	447	381	211	305	76	127	377	740	64	271
6JE-33(Y)	797	503	447	381	242	305	87	127	377	771	64	271
6HE-25Y, 6HE-28(Y)	766	503	447	381	211	305	76	127	377	740	64	271
6HE-35(Y)	797	503	447	381	242	305	87	127	377	771	64	271
6GE-30Y, 6GE-34(Y)	766	503	447	381	211	305	76	127	377	740	64	271
6GE-40(Y)	797	503	447	381	242	305	87	127	377	771	64	271
6FE-40Y, 6FE-44(Y)	790	503	447	381	242	305	87	127	377	729	111	381
6FE-50(Y)	790	503	447	381	242	305	87	127	377	729	111	381

Legende für Anschlüsse siehe Seite 33

Legend for connections see page 33

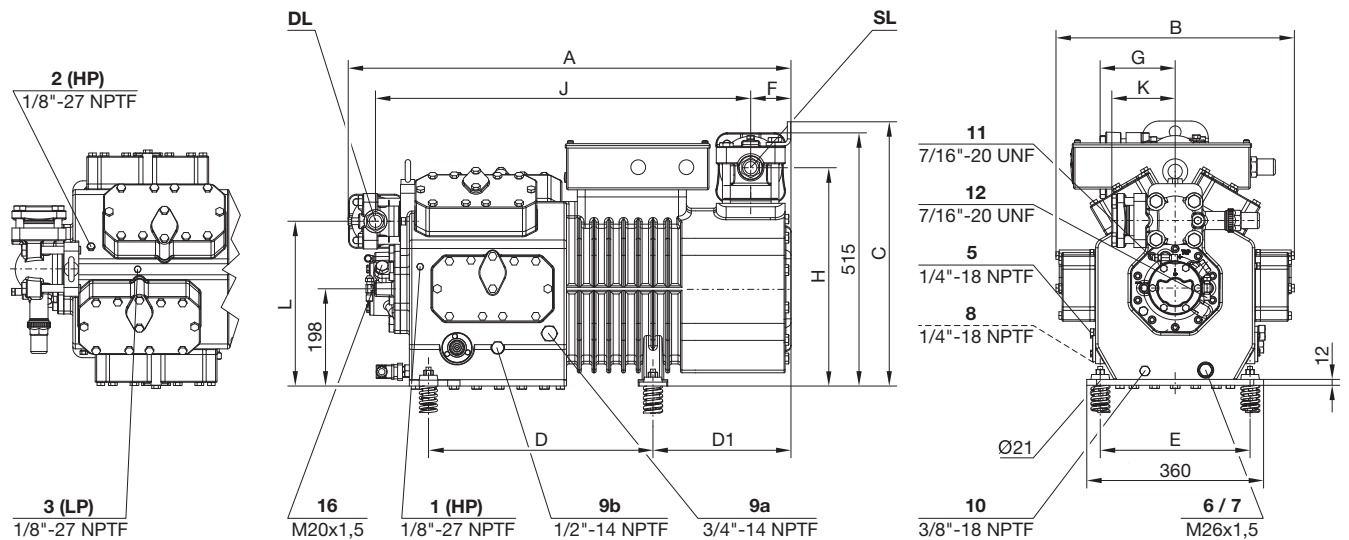
Légende des raccords voir page 33

Maßzeichnungen

Dimensional drawings

Croquis cotés

8GE-50(Y) .. 8FE-70(Y)



	A	B	C	D	D1	E	F	G	H	J	K	L
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
8GE-50(Y), 8GE-60(Y)	886	485	538	457	281	305	82	158	445	757	110	336
8FE-60(Y), 8FE-70(Y)	902	485	538	457	281	305	82	158	444	764	129	336

Anschluss-Positionen

- 1 Hochdruck-Anschluss (HP)
- 2 Druckgas-Temperaturfühler (HP) oder CIC-Sensor
- 3 Niederdruck-Anschluss (LP)
- 4 CIC-System: Sprühdüse (LP)
- 5 Öleinfüll-Stopfen
- 6 Ölabblass
- 7 Ölfilter (Magnetschraube)
- 8 Ölrückführung (Ölabscheider)
- 9a Gasausgleich (Parallelbetrieb)
- 9b Ölausgleich (Parallelbetrieb)
- 10 Ölsumpfheizung
- 11 Öldruck-Anschluss +
- 12 Öldruck-Anschluss -
- 16 Anschluss für Ölüberwachung (Ölsensor oder Öldifferenzdruck-Schalter "Delta-P")
- 21 Anschluss für Ölserviceventil

Connection positions

- 1 High pressure connection (HP)
- 2 Discharge gas temp. sensor (HP) or CIC sensor
- 3 Low pressure connection (LP)
- 4 CIC System: spray nozzle (LP)
- 5 Oil fill plug
- 6 Oil drain
- 7 Oil filter (magnetic screw)
- 8 Oil return (oil separator)
- 9a Gas equalisation (parallel operation)
- 9b Oil equalisation (parallel operation)
- 10 Crankcase heater
- 11 Oil pressure connection +
- 12 Oil pressure connection -
- 16 Connection for oil monitoring (oil sensor or differential oil pressure switch "Delta-P")
- 21 Connection for oil service valve

Position des raccords

- 1 Raccord haute pression (HP)
- 2 Sonde de température du gaz au refoulement (HP) ou sonde de CIC
- 3 Raccord basse pression (LP)
- 4 Système CIC: gicleur à pulvérisation (LP)
- 5 Bouchon pour le remplissage d'huile
- 6 Vidage d'huile
- 7 Filtre à l'huile (vis magnétique)
- 8 Retour d'huile (séparateur d'huile)
- 9a Egalisation de gaz (fonctionnement en parallèle)
- 9b Egalisation d'huile (fonctionnement en parallèle)
- 10 Résistance de carter
- 11 Raccord de la pression d'huile +
- 12 Raccord de la pression d'huile -
- 16 Raccord pour contrôle d'huile (sonde d'huile ou pressostat différentiel d'huile "Delta-P")
- 21 Raccord pour vanne de service d'huile

2D-Zeichnungen im DXF-Format,
3D-Zeichnungen im STP-Format

- sind auf der CD-ROM der BITZER Software enthalten
- können von Web-Site herunter geladen werden:
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3D dessins en forme STP

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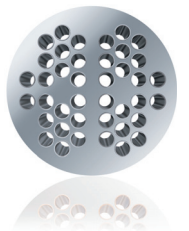
Notes

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Notes

A large rectangular area filled with a green dotted grid pattern, intended for handwritten notes.





BITZER Kühlmaschinenbau GmbH
Eschenbrünlestraße 15 // 71065 Sindelfingen // Germany
Tel +49 [0]70 31 932-0 // Fax +49 [0]70 31 932-147
bitzer@bitzer.de // www.bitzer.de

HELICAL OIL SEPARATORS



Helical Oil Separators: The helical oil separator features a centrifugal flow path achieving approximately 99. x% efficiency of oil separation with low pressure drop. Testing by an independent laboratory found that only .006% oil by volume was being discharged into the system after leaving a helical oil separator.

How the Helical Oil Separator functions: Upon separator entry, refrigerant gas containing oil in aerosol form, encounters the leading edge of the helical fighting. The gas/oil mixture is centrifugally forced along the spiral path of the helix, causing heavier oil particles to spin to the perimeter, where impingement with a screen layer occurs. The screen layer serves dual functions as an oil stripping and draining medium. Separated oil flows downward along the boundary of the shell through a baffle and into the oil collection area at the bottom of the separator. The specially engineered baffle isolates the oil collection area and eliminates oil reentrainment by preventing turbulence. Virtually oil-free refrigerant gas exits through a fitting just below the lower edge of the helical fighting. A float activated oil return valve allows the captured oil to return to the crankcase or oil reservoir, thereby completing the oil circuit. Our Patented Mechanical Design offers high oil separation efficiency, plus the following advantages not found in a Coalescing Oil Separator:

- Low pressure drop throughout the entire range of velocities found in a refrigeration system.
- No clogging elements because of too much oil in the system.
- No oil blow-out at start-up from oil left in a coalescing element.
- Oil can be drained from the separator when necessary through a 1/8" NPT fitting at the bottom of the separator.



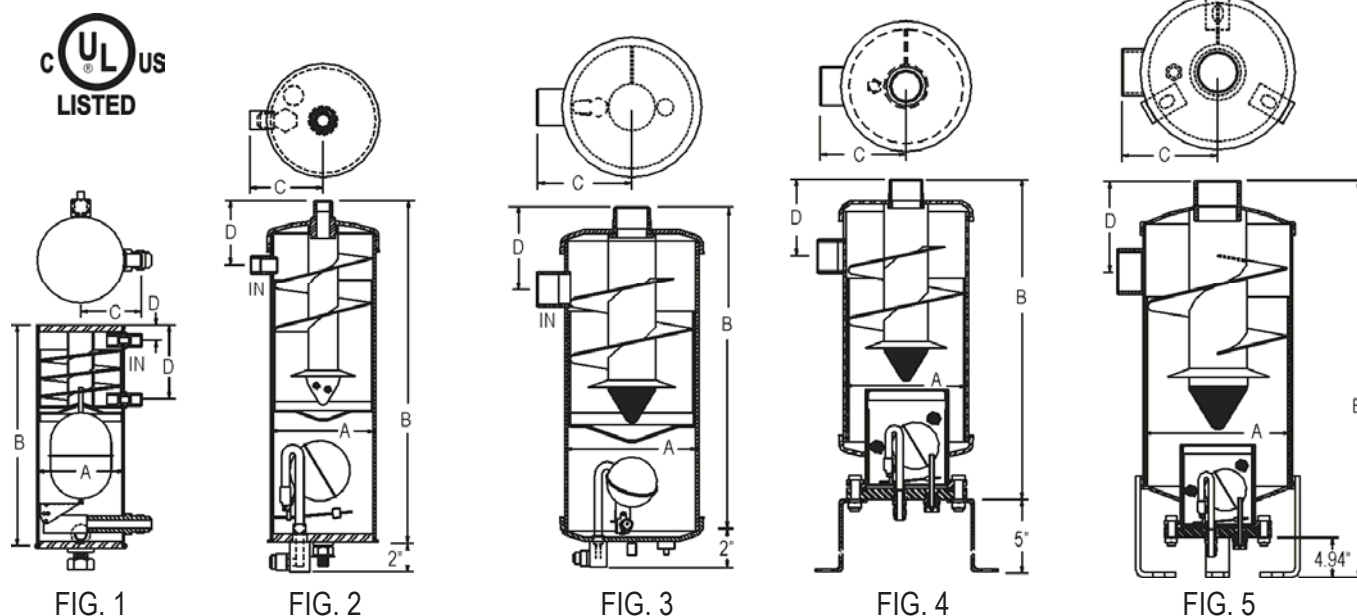
How the Conventional Oil Separator functions: Refrigerant gas from the compressor containing oil in aerosol form enters the separator and passes through the inlet baffling. As it passes through the inlet screen, the fine particles collide with one another and form heavier particles that impinge on the surface of the shell wall. The gas then passes through the outlet screen where there is a final separation. The oil free gas escapes through the outlet fitting and goes to the condenser. The separated oil drips to the bottom of the separator where a float operated needle valve returns the oil to the crankcase or oil reservoir in the same way as the Helical Oil Separator.

Selecting the size of an Oil Separator: Although Oil Separator catalogs show capacity in tons or horsepower, the actual tonnage or B.T.U. capacity of a system may vary widely from the horsepower size of the compressor.



The selection of an oil separator should be completed using the methodology shown on page 4. It is important this process not be ignored as it will affect the oil separation efficiency. The DCFM and tonnage ratings have been developed around internal testing to allow wide enough ranges where the oil separation efficiency is optimal and pressure drop is no greater than 0.5 psi.

HELICAL OIL SEPARATORS



Catalog Number	Fig. No.	Size Conn. ODS	Dimensions in Inches					Capacity in Tons of Ref. at Evap. Temp.						Nom. DCFM	Pre-Charge Oil (oz)
			A	B	C	D	R-134a		R-22		R-404a/R-507				
							-40°F	+40°F	-40°F	+40°F	-40°F	+40°F			
S-5180	1	1/4"	2.5	6.38	1.75	0.44	2.12	0.40	0.50	0.55	0.60	0.50	0.60	0.5	14
S-5181	1	3/8"	2.5	7.5	1.75	0.5	3.25	0.90	1.00	1.20	1.40	1.00	1.20	1.1	14
S-5182	2	1/2"	4	13	2.75	2.44		1.30	1.50	1.80	2.00	1.50	1.90	1.7	14
S-5185	2	5/8"	4	15	2.75	2.5		2.40	2.90	3.60	4.00	3.00	3.70	3.4	14
S-5187	2	7/8"	4	17	3	2.94		4.70	5.70	6.80	7.60	5.70	7.00	6.5	14
S-5188	2	1 1/8"	4	19	3	3.06		8.00	9.50	11.40	12.70	9.30	11.50	10.7	14
S-5190	3	1 3/8"	6	15	4.25	3.69		11.60	13.90	16.40	18.40	13.60	16.40	15.5	40
S-5192	3	1 5/8"	6	17	4.25	3.95		16.40	19.10	22.90	25.60	18.60	22.90	21.4	40
S-5194	3	2 1/8"	6	17	4.38	4.19		24.90	29.40	35.40	39.10	28.60	35.40	33.0	40
S-5290	4	1 3/8"	6	15	4.25	3.69		11.60	13.90	16.40	18.40	13.60	16.40	15.5	25
S-5292	4	1 5/8"	6	17	4.25	3.95		16.40	19.10	22.90	25.60	18.60	22.90	21.4	25
S-5294	4	2 1/8"	6	17	4.38	4.19		24.90	29.40	35.40	39.10	28.60	35.40	33.0	25
S-5202	5	2 1/8"	8	24	5.38	5.06		29.40	35.00	41.80	46.60	34.30	42.10	39.2	25
S-5203	5	2 5/8"	10	27	6.5	5.63		48.60	58.10	70.10	78.10	58.10	71.60	66.6	25
S-5204	5	3 1/8"	12	30	7.75	6.45		71.60	85.10	102.60	114.60	85.10	105.10	97.6	25

DCFm & Tonnage Ratings revised for optimal oil separation and minimal pressure drop. Replacement components on page 9.

U.S. patents #5,113,671 #5,404,730 #5,271,245; Mexico 173552; Denmark, France, Great Britain, Italy 0 487 959; Germany P69106849.6-08; Taiwan UM-74863; & other U.S. & foreign patents pending. Standard 3/8" flare oil return connection & 1/8" FPT oil drain; 3/8" O.D.S. oil return connection available by ordering an "X" suffix (i.e. S-5292X). All the capacities shown are based on 105°F condensing. See page 4 for sizing instructions.



Industrial & Commercial Refrigeration Products 800.96.HENRY

R2

GUARDIAN-SEPARATOR

Reservoir



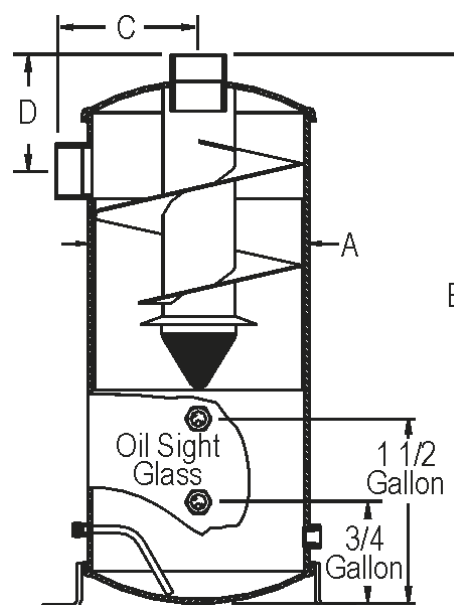
The captured oil is retained in the oil reservoir in the lower portion of the oil separator. Install the Roto Loc Valve Cat. No. 2-030-130 (which is provided) to the Roto Loc Spud on the bottom of the Oil Separator/Reservoir. Connect the 3/8" return line from the valve directly to the Electro-Mech Regulators. This valve is the distribution valve to the OIL LEVEL REGULATORS (open position). To add or remove oil from the OIL RESERVOIR, close the valve and use the 1/4" flare connection on the side of the valve. Open the valve after service. Oil Level Regulators are activated by the lowering of the oil level in the compressor crankcase. The oil is fed from the Oil Reservoir to the Electro-Mechanical Oil Regulator and into the crankcase until the set oil level is attained.

The heart of any oil control system is a high efficiency Helical Oil Separator. For parallel compressor systems application we recommend our S-5300 Series Helical Oil Separator/Reservoir combinations.

How it Works:

The Helical Oil Separator features a centrifugal flow path achieving approximately 99% efficiency of oil separation with low pressure drop. Testing by an independent laboratory found that only .006% oil by volume was being discharged into the system after leaving a helical oil separator. Virtually oil-free refrigerant gas exists through a fitting just below the lower edge of the helical flighting.

For use with S-9030 Electro-Mechanical Regulators and Optronic Sensors



Catalog Number	Size Conn. ODS	Dimensions in Inches				Capacity in Tons of Ref. at Evap. Temp. (Nominal)						Nom. DCFM	Pre- Charge Oil (oz)
		A	B	C	D	R-134a		R-22		R-404a/R-507			
						-40°F	+40°F	-40°F	+40°F	-40°F	+40°F		
S-5390	1 3/8"	6	33.5	4.25	3.69	11.60	13.90	16.40	18.40	13.60	16.40	15.5	2
S-5392	1 5/8"	6	33.5	4.25	3.95	16.40	19.10	22.90	25.60	18.60	22.90	21.4	2
S-5394	2 1/8"	6	33.5	4.38	4.19	24.90	29.40	35.40	39.10	28.60	35.40	33	2
S-5302	2 1/8"	8	25.5	5.38	5.06	29.40	35.00	41.80	46.60	34.30	42.10	39.2	2
S-5303	2 5/8"	10	30	6.5	5.63	48.60	58.10	70.10	78.10	58.10	71.60	66.7	2
S-5304	3 1/8"	12	30	7.75	6.45	71.60	85.10	102.60	114.60	85.10	105.10	97.6	2

U.S. patents #5,113,671 #5,404,730 #5,271,245; Mexico 173552; Denmark, France, Great Britain, Italy 0 487 959; Germany P69106849.6-08; Taiwan UM-74863; & other U.S. & foreign patents pending. Standard 3/8" flare oil return connection & 1/2" FPT low oil return connection & 1/2" FPT low level alarm connection. All the capacities shown are based on 105°F condensing. See page 4 for sizing instructions.



Industrial & Commercial Refrigeration Products 800.96.HENRY

R3

OIL SEPARATORS



Calculating Separator DCFM

Correct oil separator sizing is essential for proper oil separation and minimal pressure drop across the separator. The following example will demonstrate how to select an oil separator based on four primary system conditions and using the DCFM charts on the following page. It is important to determine the discharge cubic feet per minute of the hot gas flow approaching the separator. The DCFM is a theoretical sizing value used to predict which model will offer the best oil separation efficiency for a set of conditions. Henry offers three different designs, helical, conventional screen, and coalescing.

Sizing Notes

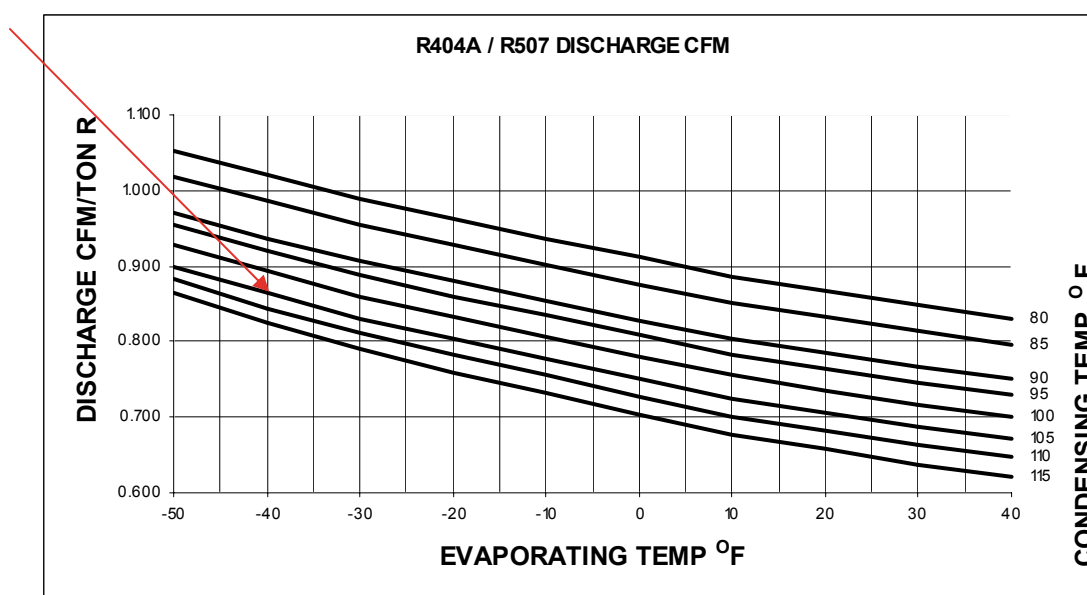
Helical Separators: This design relies on adequate gas velocities to allow for oil extraction from the hot gas so sizing according to the DCFM rating is important. Page 6 shows the min/max ratings allowed for sufficient separation and low pressure drop. When sized correctly the helical models will separate 95-99% of the oil from the hot gas.

Conventional Screen: This oil separator should not be undersized (calculated DCFM greater than 125% of nominal), which would cause higher gas velocities to pass through the inlet/outlet screens. Higher flow velocities may cause pre-mature failure of the screens.

Selection Example

Primary Conditions

Evaporating Temperature, -40°F
 Condensing Temperature, 105°F
 Tons of Refrigeration or Air Conditioning, 20 Tons



Following the 105°F condensing temp line from the right side to the vertical line at -40°F corresponds to ~0.87 on the DCFM/Ton axis. This factor is multiplied by the Tons of refrigeration (0.86×20) to yield 17.2 DCFM.



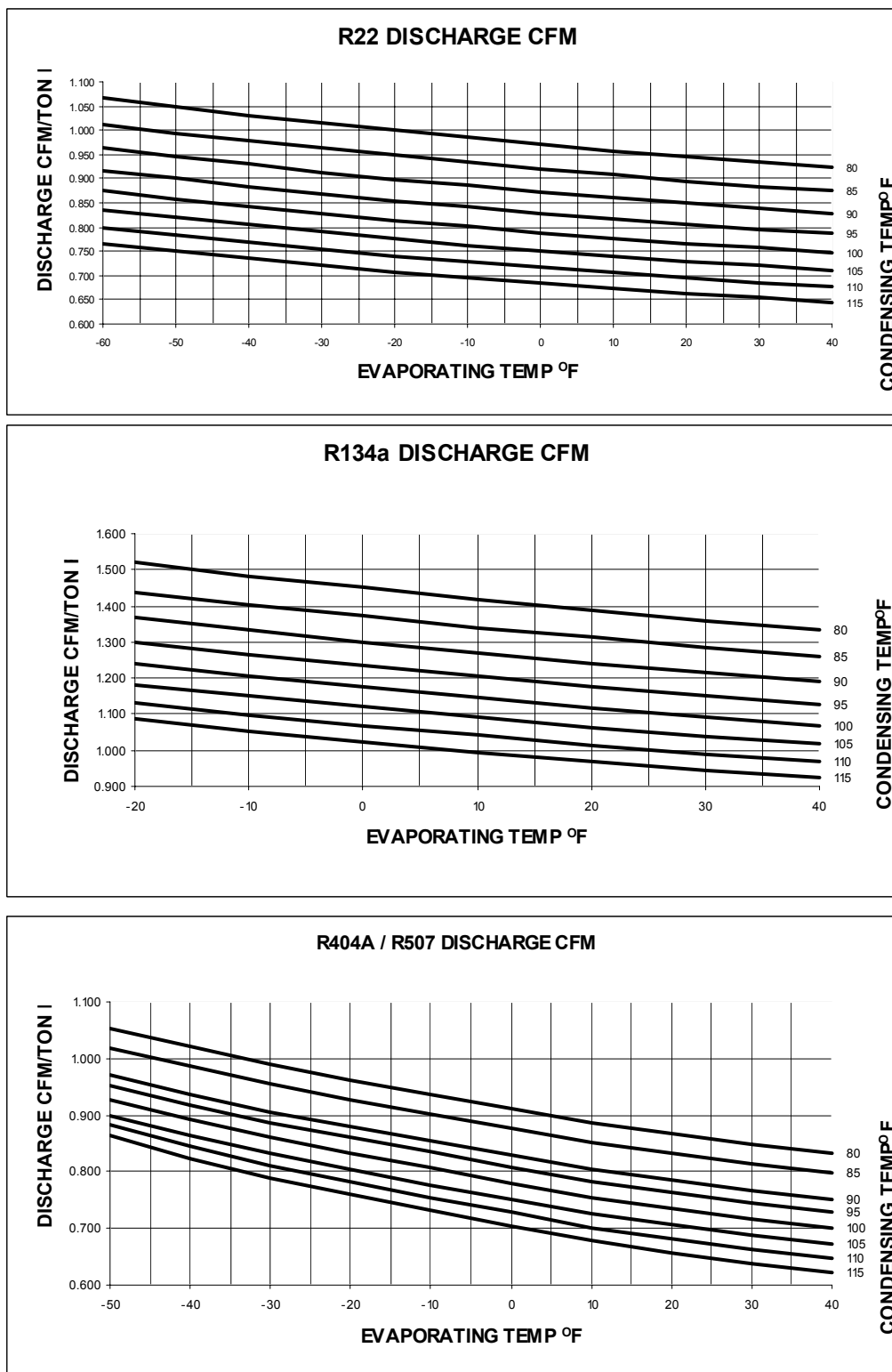
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R4

OIL SEPARATORS



Calculating Separator DCFM Continued



OIL SEPARATORS

Sizing Charts



Min/Max DCFMs shown below for various common refrigerants at specific conditions. For other conditions and refrigerants please consult the factory.

Catalog Number	R404a, -40F Evap. 105F Cond.				R22, 40F Evap. 105F Cond.			
	MINIMUM DCFM	MAXIMUM DCFM	MINIMUM TONS	MAXIMUM TONS	MINIMUM DCFM	MAXIMUM DCFM	MINIMUM TONS	MAXIMUM TONS
S-5180	0.46	0.55	0.41	0.49	0.45	0.63	0.49	0.69
S-5181	0.60	1.58	0.54	1.41	0.61	1.84	0.66	2
S-5182	1.17	2.18	1.05	1.95	1.15	2.53	1.25	2.75
S-5185	3.0	3.6	2.7	3.2	3.0	4.2	3.3	4.5
S-5187	4.6	8.1	4.1	7.2	4.5	9.5	4.9	10.3
S-5188	6.0	14.8	5.4	13.2	6.1	17.3	6.6	18.8
S-5190	8.5	21.9	7.6	19.6	8.4	25.4	9.1	27.6
S-5192	10.7	30.9	9.6	27.6	10.7	36.4	11.6	39.6
S-5194	16.9	47.1	15.1	42.1	16.6	55.3	18.1	60.1
S-5290	8.5	21.9	7.6	19.6	8.4	25.4	9.1	27.6
S-5292	10.7	30.9	9.6	27.6	10.7	36.4	11.6	39.6
S-5294	16.9	47.1	15.1	42.1	16.6	55.3	18.1	60.1
*S-5202	21.9	54.6	19.6	48.9	22.2	63.6	24.1	69.1
*S-5203	46.0	84.0	41.1	75.1	45.2	98.5	49.1	107.1
*S-5204	70.6	119.8	63.1	107.1	70.9	139.9	77.1	152.1

Catalog Number	R134a, 40F Evap. 105F Cond.				R407c, 40F Evap. 105F Cond.			
	MINIMUM DCFM	MAXIMUM DCFM	MINIMUM TONS	MAXIMUM TONS	MINIMUM DCFM	MAXIMUM DCFM	MINIMUM TONS	MAXIMUM TONS
S-5180	0.46	0.76	0.33	0.54	0.46	0.58	0.44	0.56
S-5181	0.60	2.19	0.43	1.56	0.60	1.68	0.58	1.62
S-5182	1.19	3.01	0.85	2.15	1.14	2.34	1.1	2.25
S-5185	3.01	4.98	2.15	3.55	3.02	3.85	2.9	3.7
S-5187	4.63	11.22	3.3	8	4.58	8.63	4.4	8.3
S-5188	6.03	20.61	4.3	14.7	6.03	15.81	5.8	15.2
S-5190	8.55	30.29	6.1	21.6	8.42	22.98	8.1	22.1
S-5192	10.66	42.91	7.6	30.6	10.50	33.38	10.1	32.1
S-5194	16.97	65.35	12.1	46.6	17.26	50.80	16.6	48.85
S-5290	8.55	30.29	6.1	21.6	8.42	22.98	8.1	22.1
S-5292	10.66	42.91	7.6	30.6	10.50	33.38	10.1	32.1
S-5294	16.97	65.35	12.1	46.6	17.26	50.80	16.6	48.85
*S-5202	22.23	75.86	15.85	54.1	21.94	57.82	21.1	55.6
*S-5203	45.01	117.93	32.1	84.1	45.86	90.58	44.1	87.1
*S-5204	71.66	167.01	51.1	119.1	70.82	128.02	68.1	123.1

- *Rates also apply to Guardian Separator/Reservoir S-53** types.
- Minimum DCFM & tons should be met in order to ensure proper oil separation.*
- Maximum DCFM & tons should not be exceeded due to pressure drop will become greater than 0.5 psi.



Industrial & Commercial Refrigeration Products 800.96.HENRY

R6

CONVENTIONAL

Oil Separators



Features:

- **Connections** are nickel plated steel
- **Oil flow rate @ 175 PSI** differential .80 gal/min.
- **3/8" flare oil return connection**
- **All capacities** shown are based on 100°F condensing
- **Brass screws** on inlet and
- **All capacities** shown are based on 100°F condensing
- **Minimum tonnage** is 33% of rated capacity
- **Working Pressure:** 450 PSI

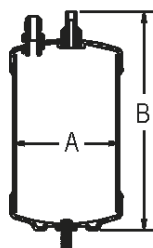


FIG. 1

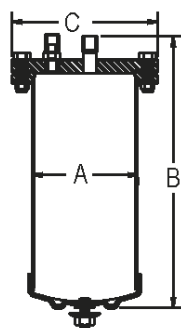


FIG. 2

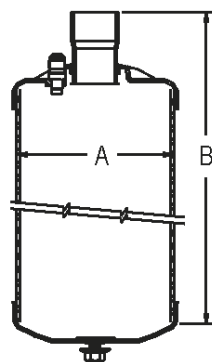


FIG. 3

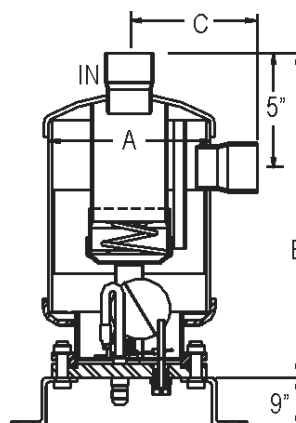


FIG. 4

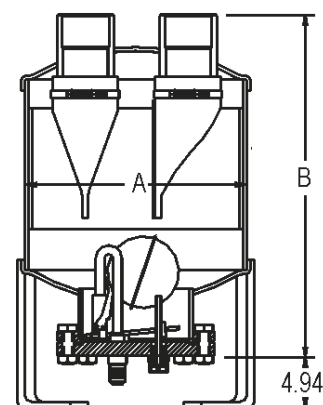


FIG. 5

Catalog Number	Size Conn. O.D.S.	Fig #	Dimensions in Inches			Capacity in Tons of Ref. at Evap. Temp. (Nominal)						Max. Discharge CFM	Pre-Charge Amount
			Dia. A	B	C	R-134a		R-22		R-404a/R-507			
						-40°F	+40°F	-40°F	+40°F	-40°F	+40°F		
S-5580	1/4"	1	4	8.25	—	0.5	0.8	0.8	1.0	0.8	1.0	0.75	12
S-5581	3/8"	1	4	8.25	—	0.8	1.0	1.0	1.5	1.0	1.5	1.0	12
S-5582	1/2"	1	4	10.25	—	1.0	1.5	1.5	2.0	1.5	2.0	1.5	12
S-5585	5/8"	1	4	14.25	—	3.0	4.0	4.5	5.5	4.0	5.5	4.0	12
S-5587	7/8"	1	4	17.75	—	4.5	5.5	7.0	8.0	6.5	8.5	6.5	12
S-5588	1 1/8"	1	4	21	—	6.0	7.5	9.0	10.5	8.5	11.0	8.0	12
S-5590	1 3/8"	1	4	21.25	—	8.0	9.5	11.5	13.5	10.5	14.0	10.0	12
S-5882	1/2"	2	4	10.25	5.50	1.0	1.5	1.5	2.0	1.5	2.0	1.5	12
S-5885	5/8"	2	4	14.25	5.50	3.0	4.0	4.5	5.5	4.0	5.5	4.0	12
S-5887	7/8"	2	4	17.75	5.50	4.5	5.5	7.0	8.0	6.5	8.5	6.0	12
S-5888	1 1/8"	2	4	21	5.50	6.0	7.5	9.0	10.5	8.5	11.0	8.0	12
S-5890	1 3/8"	2	4	12.25	5.50	8.0	9.5	11.5	13.5	10.5	14.0	10.0	12
S-5687	7/8"	3	6	11.12	—	6.0	7.0	9.0	10.0	8.0	10.0	7.5	30
S-5688	1 1/8"	3	6	15.38	—	8.0	10.0	11.0	12.0	9.0	13.0	9.0	30
S-5690	1 3/8"	3	6	15.63	—	9.0	12.0	13.0	14.0	12.0	15.0	11.0	30
S-5692	1 5/8"	3	6	18.63	—	11.0	13.0	16.0	18.0	15.0	19.0	14.0	30
S-5694	2 1/8"	3	6	19.12	—	18.0	21.0	25.0	30.0	24.0	31.0	22.5	30
S-5792	1 5/8"	4	6	20.25	4.25	11.0	13.0	16.0	18.0	15.0	19.0	14.0	20
S-5794	2 1/8"	4	6	20.31	4.50	18.0	21.0	25.0	30.0	24.0	31.0	22.5	20
S-1901	1 5/8"	5	8	21	—	14.0	17.0	20.0	24.0	19.0	25.0	18.0	20
S-1902	2 1/8"	5	8	21	—	21.0	25.0	30.0	35.0	28.0	37.0	27.0	20
S-1903	2 5/8"	5	10	21.50	—	37.0	46.0	50.0	65.0	48.0	68.0	49.0	20
S-1904	3 1/8"	5	12	25.75	—	52.0	64.0	75.0	90.0	72.0	94.0	68.0	20

S-5500, S-5800, S-5600, S-5700: Connections are nickel plated steel. S-1900: Connections are copper plated steel.
Oil flow rate @ 175 PSI differential: 0.80 gal/min.



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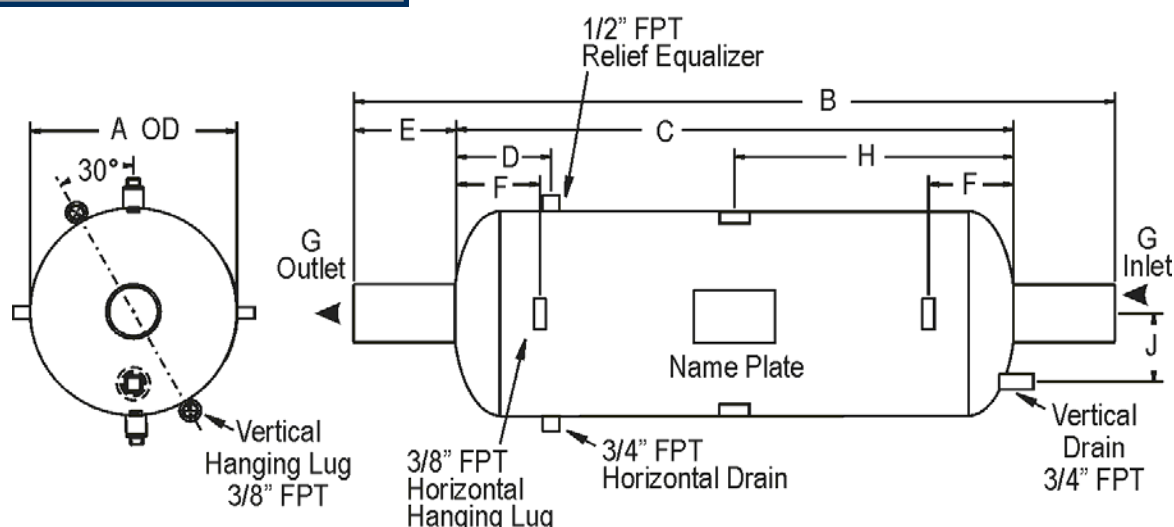
ALL-WELDED COALESCING

Oil Separators



Features:

- Constructed in accordance with ASME Section VIII
- Assembly is all welded steel
- Designed specifically for all reciprocating refrigeration compressors: Halocarbons, Ammonia and Hydrocarbons
- Provides 10 times the oil removal rate of conventional oil separators
- **5 models to choose from** covering entire range of single stage and booster compressors
- **Oil float valve assembly** with shut off valve available as optional accessory (SN-9142) See page 10.
- **Max. Allowable Working Pressure: 400 PSI**
Note: can be mounted either horizontally or vertically



D.C.F.M. Rating (Discharge Volumetric Flow)

Refrigerant		COS-030	COS-070	COS-140	COS-205	COS-250
Group 1	R-717 (Ammonia), Natural Gas	30	70	140	205	250
Group 2	R-290 (Propane), R744 (Carbon Dioxide)	25	65	135	200	225
Group 3	R-22, R-23, R-407C, R-410A, R508B	20	50	105	150	180
Group 4	R-134A, R-404A, R-507A, R-417A, R422D, R434A	19	45	95	140	160

* For other Halocarbon Refrigerants Contact our Sales Office

Catalog Number	Dimensions in Inches								Conn. Size & Type G	Approx. Ship Wt. In Lbs.
	A	B	C	D	E	F	H	J		
COS-030 (F)	8.63	33	24	5	6.5	4	12	3	2" BW (2 1/8 ODS)	78
COS-070 (F)	12.75	43	34	7	6.5	5	17	4	2 1/2" BW (2 5/8 ODS)	238
COS-140 (F)	16	51	42	8	6.5	7.13	21	5	3" BW (3 1/8 ODS)	333
COS-205	18	61	52	8	6	7.63	26	5	4" BW	462
COS-250	20	65	53	9	6	8.25	26.5	6	5" BW	536

- Add suffix "F" to Catalog Number (Halocarbon):
e.g. COS-030 has a 2 1/8 Butt Weld Connection; COS-030F has a 2 1/8 ODS Connection which can be cut back to 2" BW.



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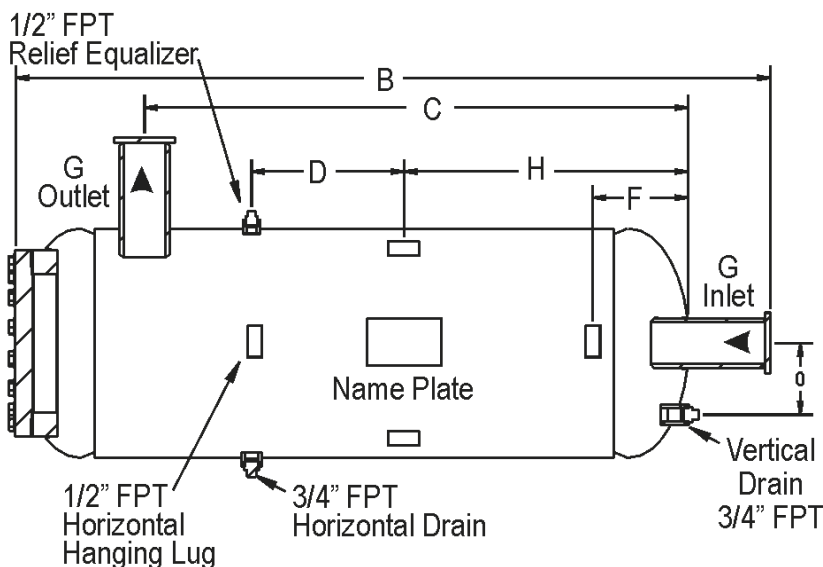
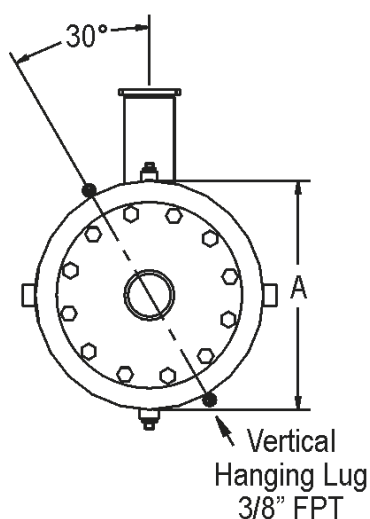
COALESCING OIL SEPARATORS

For Replaceable Cartridges



Features:

- Constructed in accordance with ASME Section VIII
- Assembly allows for easy replacement of the coalescing cartridge
- Designed specifically for all reciprocating refrigeration compressors: Halocarbons, Ammonia and Hydrocarbons
- Provides 10 times the oil removal rate of conventional oil separators
- **Five models** to choose from covering entire range of single stage and booster compressors
- **Removable and replaceable cartridges.**
- **Oil float valve assembly** (SN-9142 See page 10) with shut off valve available as optional accessory
- **Max. Allowable Working Pressure: 400 PSI**



Refrigerant	D.C.F.M. Rating				
	COSM-030	COSM-070	COSM-140	COSM-205	COSM-250
R-717	30	70	140	205	250
R-22, R-502*	22	50	105	150	185

* For other Halocarbon Refrigerants Contact our Sales Office

Catalog Number	Dimensions in Inches							Connection G	Approx. Ship Wt. in Lbs.
	A	B	C	D	E	F	H		
COSM-030 (F)	8 5/8	27 1/2	22 1/2	7	6 1/2	4	12	2 1/8 ODS (2) •	138
COSM-070 (F)	12 3/4	37 1/4	31	10	6 1/2	5	17	2 5/8 ODS (2 1/2) •	379
COSM-140 (F)	16	46	38 1/2	13	6 1/2	7 1/8	21	3 1/8 ODS (3) •	566
COSM-205 (F)	18	58 1/2	49 1/2	18	6	7 5/8	26	4 Weld Stud	773
COSM-250 (F)	20	60 3/4	50 1/2	17 1/2	6	8 1/4	26 1/2	5 Weld Stud	896

- Add suffix "F" to Catalog Number (Halocarbon):
e.g. COS-030 has a 2 1/8 Butt Weld Connection; COS-030F has a 2 1/8 ODS Connection which can be cut back to 2" BW.



Industrial & Commercial Refrigeration Products 800.96.HENRY

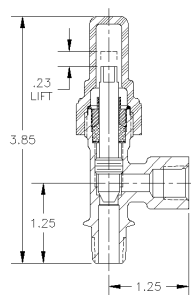
OIL SEPARATORS



Features:

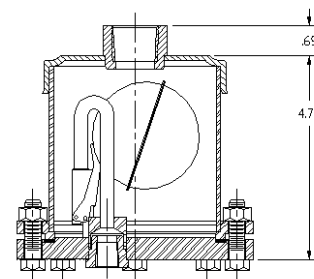
- ODS or butt weld connections available
- **Stainless Steel 303** screen mesh filter media.
- **Oil Float Valve Assembly** with shut-off valve (SN-9142 available as optional accessory) suitable for ammonia use.
- **All Welded Design**
- **Oil Separators** are all rated at 400 P.S.I. working pressure
- Constructed in accordance with ASME Section VIII
- **Max. Allowable Working Pressure: 400 PSI**

Shutoff Valve: 7771

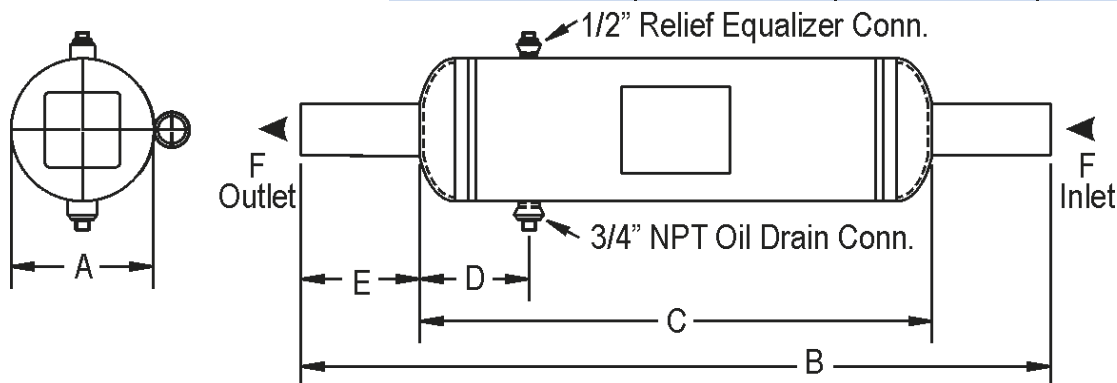


Oil Float Valve: SN-9142

Replacement Float: SN-9140-30



Catalog Number	Description	Inlet	Outlet
SN-9142	Oil Float Valve	3/4" NPT Int.	1/4" NPT Int.
7771	Shutoff Valve	1/4" NPT Ext.	1/4" NPT Int.



Catalog Number	Rating in CFM*		Shipping Weight lbs.	Dimensions in Inches					F	
	Max.	Min.		A	B	C	D	E	Weld Stud	O.D.S. **
O-100 (F)	100	20	38	6-5/8	32	24	5-1/2	4	2	2-1/8
O-175 (F)	175	30	45	8-5/8	32	24	5-1/2	4	2-1/2	2-5/8
O-250 (F)	250	50	76	10-3/4	32	24	5-1/2	4	2-1/2	2-5/8
O-350 (F)	350	75	120	12-3/4	40	32	9-1/2	4	3	3-1/8
O-650	650	100	172	14	40	32	9-1/2	4	4	—
O-900	900	150	251	16	52	44	15-1/2	4	4	—
O-1500	1500	250	367	20	56	44	15-1/2	6	6	—

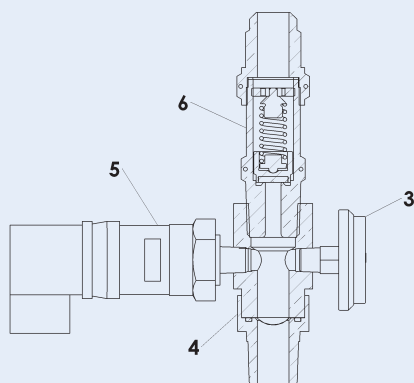
* Compressor Displacement in cubic feet per minute. ** Weld stub connections are standard.



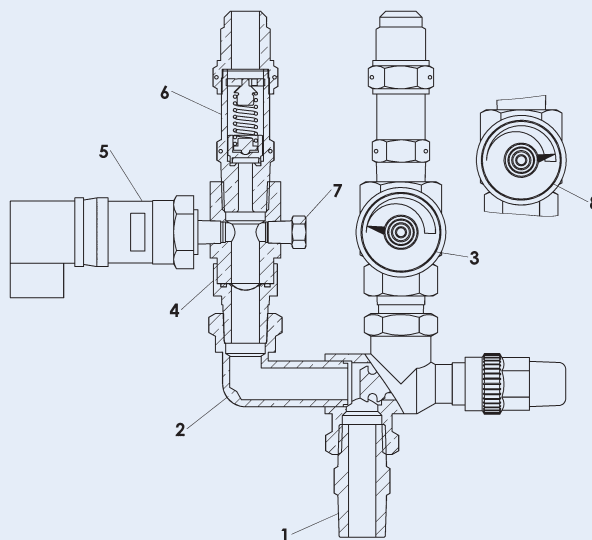
Industrial & Commercial Refrigeration Products 800.96.HENRY

R10

SENTRY SAFETY DEVICE ASSEMBLIES



SENTRY SINGLE SAFETY
DEVICE ASSEMBLY



SENTRY DUAL SAFETY
DEVICE ASSEMBLY

- | | | | |
|-------------------|-----------------------------------|-----------------------------------|--------------------------------|
| 1 Pipe nipple | 3 G15 gauge (no pressure applied) | 5 SW60 Pressure switch (optional) | 7 Plug, 1/8 NPT |
| 2 Three-way valve | 4 Rupture disc | 6 Relief valve | 8 G15 gauge (pressure applied) |

Refer to relevant catalogue pages for information on each component.

The primary purpose of a Sentry safety device assembly is to provide a positive seal between the system and atmosphere and facilitate an indicating device to be fitted. The indicating device notifies the user if the pressure relief valve has discharged. This is a requirement of Refrigeration Standard EN378.

A dual Sentry safety device assembly also provides a safe and economical method for replacing safety devices on a pressure vessel. Typically, this vessel will be a refrigerant liquid receiver. The Sentry assembly protects the receiver from over-pressure.

The Sentry safety device assemblies comprise a number of items from the Henry Technologies product range. There are two versions; a single safety device assembly and a dual safety device assembly.

The single safety device assembly comprises of a pressure relief valve, rupture disc, pressure indicator gauge and an optional pressure switch.

The dual safety device assembly comprises two pressure relief valves, two rupture discs, two pressure indicator gauges, two optional pressure switches and a three way valve.

Note: Each pressure relief device must have the required capacity to protect the vessel from over-pressure.

For both assemblies, a 1/8" NPT rupture disc blanking plug is required if the user does not fit both the pressure gauge and pressure switch. For the dual assembly, a pipe nipple is normally required to assemble the three-way valve to the pressure vessel.

In general, the user needs to order the individual items in each assembly. For popular combinations, SDK safety device kits are available.

Applications and Features

In line with the Institute of Refrigeration Guidelines (UK), Henry Technologies recommend that pressure relief valves and low side rupture discs be replaced at least every 5 years. All high side rupture discs should be replaced every 2 years. These intervals may have to be reduced if other regulations apply. The dual Sentry assembly provides a convenient solution for the replacement of safety devices along with other user benefits.

The features of a dual Sentry Assembly are:-

- Safe, easy and economical maintenance:** The three-way valve permits replacement of one of the relief devices, while the other is protecting the pressure vessel. In this way, a vessel is protected from over-pressure during servicing. It also allows a pressure relief device to be replaced in-situ, without removing the system refrigerant charge.
- Protection against over-pressure:** the rupture disc and relief valve will open at a pre-determined value to prevent excessive pressure.
- Code Compliance:** Refrigeration Codes specify that a three-way valve is required on vessels of a certain size.
- Hermetic sealing:** During normal operation, the rupture disc prevents any leakage or weeping of refrigerant through the relief valve.
- Warning of safety device discharge:** Both the pressure gauge and pressure switch indicate if the relief valve has discharged. The pressure gauge provides a visual indication. The pressure switch provides an electrical signal which can be used as an alarm.
- Inter-space monitoring:** The pressure gauge and pressure indicator can be used to check that the bursting disc is intact. This provides a warning in case there is a build up of pressure behind the disc, as a result of damage. Any back pressure will increase the design relief pressure of the rupture disc.

In comparison, the features of a single Sentry assembly are; protection against over-pressure, hermetic sealing, warning of safety device discharge and inter-space monitoring.

SENTRY SAFETY DEVICE ASSEMBLIES

Sentry Assembly Combinations

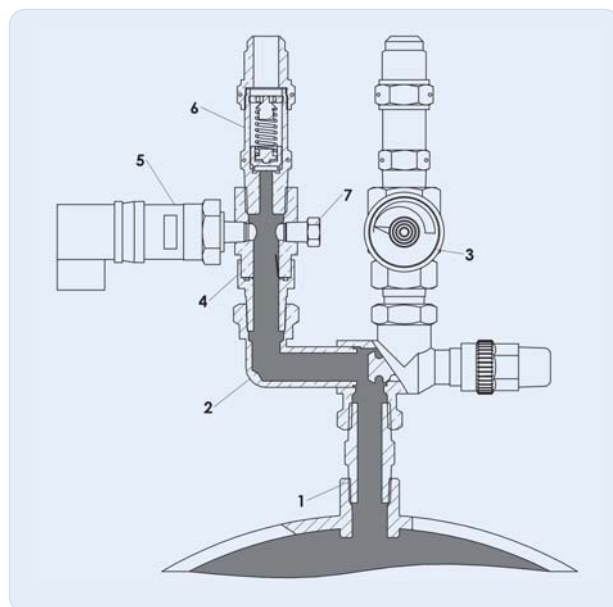
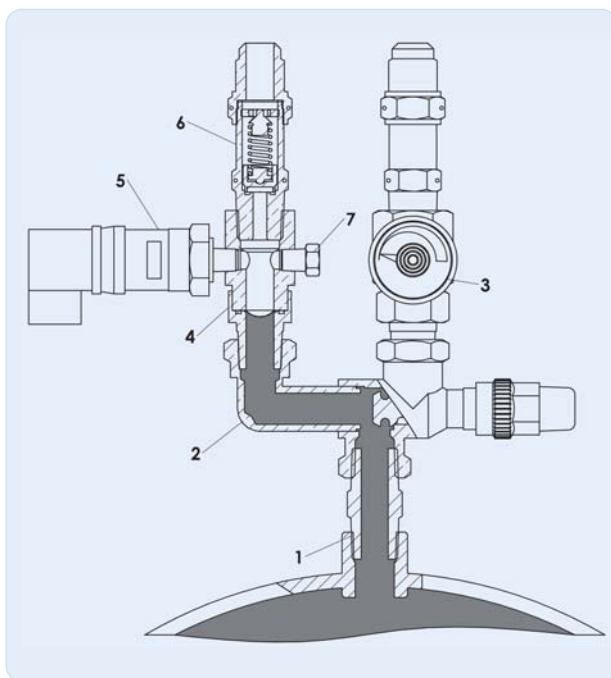
The table shows the recommended relief valve, rupture disc and three-way valve combinations. Please refer to the relief valve catalogue pages for outlet connection sizes.

Relief Valve	Rupture Disc	Three-Way Valve	Conn Size, inch (NPT)
Part No	Part No	Part No	
526E	5525	923	3/8
5231A	5525	923	3/8
5231B	5526	925	1/2
5232A, 5240	5526	8021A or 925 (see note)	1/2
5340	5626	8021A	1/2
5242	5627	8022A or 927 (see note)	3/4
5342, 5344A	5627	8022A	3/4
5244, 5344, 5345	5628	8024-CE	1
5246, 5346	5629	8025-CE	1 1/4

Note: Where possible, it is best to select the three way valve model with the larger Kv value.

How it works

The diagram (below) shows the rupture disc intact. Normal system pressure acts on the rupture disc. There is no pressure in the chamber between the rupture disc and relief valve. Note that the pressure is diverted to one side of the three-way valve only, allowing the valve on the other side to be safely removed, if required.



The diagram (above) shows the rupture disc burst. The pressure is now contained by the relief valve only. The pressure switch would now detect the pressure in the chamber between the rupture disc and relief valve. The gauge, if fitted, would indicate that pressure is acting in this chamber. In this condition, the relief valve will have discharged due to system over-pressure. Both the relief valve and rupture disc now need to be replaced.

PRESSURE RELIEF VALVES

The function of a Pressure Relief Valve is to protect against over-pressure. For safety reasons, excessive over-pressure in any part of the refrigeration system must be avoided

Applications

A typical application for a Henry Technologies pressure relief valve (PRV) is to protect a liquid receiver from being over-pressurised. In the event of a fire, any liquid refrigerant inside the receiver will evaporate resulting in an increase in pressure. The PRV will safely control this increase in pressure by venting the vapour from the receiver. Another application is to protect equipment from compressor over-pressure.

Henry Technologies pressure relief valves are designed to discharge vapour and should not be used to vent liquid refrigerant. The valves are "back-pressure dependent" and are therefore required to discharge to atmosphere.

The brass and stainless steel series valves are suitable for use with HCFC and HFC refrigerant gases. The stainless steel series valves are also suitable for ammonia.

Once a PRV has discharged, replacement is recommended, as the set pressure can no longer be guaranteed. Refer to Installation Section for further information.

In line with the Institute of Refrigeration Guidelines (UK), Henry Technologies recommend that a PRV should be replaced at least every 5 years. These intervals may have to be reduced if other regulations apply.

It is recommended to have a relief valve pressure setting at least 25% higher than the maximum system operating pressure. The PRV set pressure should not be higher than the design pressure (MWP) of the vessel.

How it works

A conventional PRV is designed to open at a predetermined pressure - the set pressure. A spring exerts a sealing force on a valve seat via a piston seal assembly. At a pressure equal to the set pressure, the piston will start to lift resulting in a small amount of flow through the valve. From this point, the pressure force acting on the piston increases significantly and overcomes the spring force. This imbalance of forces causes the valve to "pop" fully open. By design, the difference in pressure from the valve set point to the fully open condition is no more than 10%. System pressure is controlled/reduced by venting the refrigerant vapour through the valve. The valve then re-closes at a pressure where the spring force overcomes the piston force. Under normal system operating conditions, the pressure at the valve inlet is below the set pressure. Only under abnormal operating conditions should the PRV be open.

Main features

- Proven safe design
- Category IV PED compliant
- Precision machined parts for reliability
- High flow capacity
- Compact
- Non-stick teflon valve seal
- Blow-out proof seal design
- Seal material with high chemical resistance
- Tamper proof
- Test Certificates available on request
- Non-standard pressure settings available on request



Technical Specification

All Henry Technologies PRV's are designed and manufactured to the intent of ASME VIII Division 1.

For 526, 5230 and 5231 series models:-

Set pressure range = 14 to 31 barg
 Allowable operating temperature = -40°C to +107°C

For 5232 and 524 series models:-

Set pressure range = 10.3 to 31 barg
 Allowable operating temperature = -40°C to +107°C

For 53 series models:-

Set pressure range = 10.3 to 31 barg
 Allowable operating temperature = -29°C to +135°C

Materials of Construction

For all 52 series valves, the main body and outlet connection are made from brass. Valve internals such as the piston and adjusting gland are either made from brass, plated steel or stainless steel.

For the 53 series valves, the main body is made from stainless steel. The outlet connection and valve internals are made from either plated steel or stainless steel.

For all valves, the seal is made from premium quality teflon (PTFE). All springs are made from high strength plated alloy steel.

PRESSURE RELIEF VALVES



Angle Relief Valve - Brass

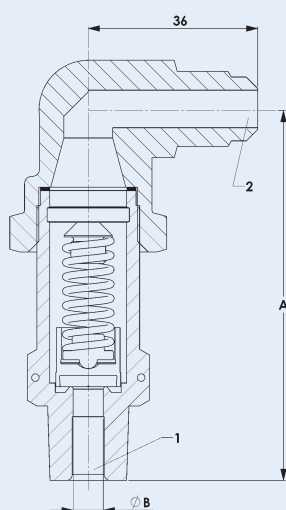
Part No	Conn Size (inch)		Dimensions (mm)		Flow Area (mm ²)	K _{dr}	Weight (kg)	CE Cat
	Inlet	Outlet	A	ØB				
526E-xx.x BAR-CE	3/8 MPT	3/8 SAE Flare	78	6.35	31.67	0.41	0.26	Cat IV

Straight-through Relief Valves - Brass

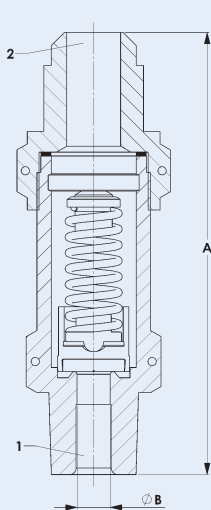
Part No	Conn Size (inch)		Dimensions (mm)		Flow Area (mm ²)	K _{dr}	Weight (kg)	CE Cat
	Inlet	Outlet	A	ØB				
5230A-xx.x BAR-CE	1/4 MPT	1/2 SAE Flare	85	6.35	31.67	0.68	0.18	Cat IV
5231A-xx.x BAR-CE	3/8 MPT	1/2 SAE Flare	85	6.35	31.67	0.68	0.19	Cat IV
5231B-xx.x BAR-CE	1/2 MPT	5/8 SAE Flare	91	6.35	31.67	0.68	0.22	Cat IV
5232A-xx.x BAR-CE	1/2 MPT	3/4 SAE Flare	109	9.5	71.26	0.67	0.44	Cat IV
5240-xx.x BAR-CE	1/2 MPT	3/4 FPT	95	9.5	71.26	0.67	0.41	Cat IV
5242-xx.x BAR-CE	3/4 MPT	3/4 FPT	95	9.5	71.26	0.67	0.45	Cat IV
5244-xx.x BAR-CE	1 MPT	1 FPT	106	12.7	126.68	0.68	0.66	Cat IV
5246-xx.x BAR-CE	1 1/4 MPT	1 1/4 FPT	145	17.9	250.41	0.60	1.48	Cat IV

Straight-through Relief Valves - Stainless Steel

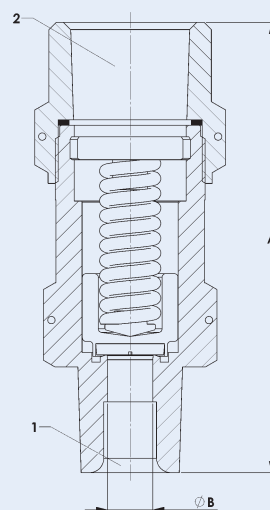
Part No	Conn Size (inch)		Dimensions (mm)		Flow Area (mm ²)	K _{dr}	Weight (kg)	CE Cat
	Inlet	Outlet	A	ØB				
5340-xx.x BAR-CE	1/2 MPT	3/4 FPT	94	9.5	71.26	0.67	0.39	Cat IV
5342-xx.x BAR-CE	3/4 MPT	3/4 FPT	94	9.5	71.26	0.67	0.43	Cat IV
5344A-xx.x BAR-CE	3/4 MPT	1 FPT	106	12.7	126.68	0.68	0.56	Cat IV
5344-xx.x BAR-CE	1 MPT	1 FPT	106	12.7	126.68	0.68	0.62	Cat IV
5345-xx.x BAR-CE	1 MPT	1 1/4 FPT	149	17.9	250.41	0.6	1.25	Cat IV
5346-xx.x BAR-CE	1 1/4 MPT	1 1/4 FPT	145	17.9	250.41	0.6	1.37	Cat IV



526 SERIES



523 SERIES



524 & 53 SERIES

- ① Inlet
- ② Outlet

Standard settings are (barg): 10.3, 13.8, 14.0, 16.2, 17.2, 20.7, 24.1, 24.8, 25.9, 27.6, 29.3 and 31.0

PRESSURE RELIEF VALVES



Valve Capacity Ratings (kg Air/min) @ 20°C.								
Part No	Standard Pressure setting (barg)							
	10.3	14	16.2	20.7	24.1	24.8	27.6	31
*526E-CE	N/A	3	3.4	4.4	5	5.1	5.8	6.5
*5230A-CE	N/A	4.9	5.8	7.3	8.4	8.6	9.6	10.8
*5231A-CE								
*5231B-CE								
5232A-CE	8.4	11.5	12.7	16	18.6	19.1	21.2	23.9
5240-CE								
5242-CE								
5340-CE								
5342-CE								
5244-CE	15.1	20.7	23	29	33.6	34.5	38.2	42.8
5344-CE								
5344A-CE								
5246-CE	26.5	34.5	40.2	50.7	58.8	60.5	66.9	75.0
5345-CE								
5346-CE								
*Minimum set pressure is 14 barg.								

Performance data

The valve discharge capacities are presented in the table for standard pressure settings.

For other pressure settings, the capacity can be determined by using a standard pressure setting as a basis.

Example:

The 526E valve capacity is required for a pressure setting of 15 barg.

$$\text{Capacity (new setting)} = \left(\frac{P(\text{new setting}) + 1.013}{P(\text{std setting}) + 1.013} \right) \times \text{Capacity (std setting)}$$

In this case, the most convenient standard pressure set to use is 14 barg.

$$\text{Capacity (15 barg)} = \left(\frac{15 + 1.013}{14 + 1.013} \right) \times 3.0 = \left(\frac{16.013}{15.013} \right) \times 3.0 = 3.2 \text{ kg/min of air}$$

All capacities are shown in kg/min of air @ 20°C. Air is used as a reference medium.

To convert from air to refrigerant capacity, the following formula can be used:-

$$W_r = \frac{W_{\text{air}}}{r_w}$$

Where:-

W_r = Mass flow of refrigerant, kg/min

W_{air} = Mass flow of air, kg/min

r_w = Conversion factor

For simplicity, r_w factors are presented for a number of common refrigerants. Using these factors will give an approximate solution. If a high degree of accuracy is required, the user should consult reference (1). This reference details a formula for the r_w factor.

Refrigerant	Conversion factor, r_w
R22	0.61
R134a	0.57
R404A	0.59
R407C	0.62
R410A	0.67
R717	1.33

Current European Refrigeration Standards do not use air capacity for valve selection. To suit some users Henry Technologies has however included this information.

In line with current European standards, an alternative approach is recommended by Henry Technologies. Flow capacity is calculated using the valve flow area, A , and the de-rated coefficient of discharge, K_d . These parameters are listed in the Dimension Tables.

PRESSURE RELIEF VALVES



Selection Guidelines

For safety reasons, relief valve selection should only be carried out by suitably qualified engineers.

It is important to select/size a relief valve taking into account all possible sources of over-pressure such as external heat, internal heat, compressor operation and liquid expansion. System control methodology, type of equipment used, etc. dictate the number of over-pressure sources that need to be taken into account for PRV selection.

Henry Technologies pressure relief valves are designed to discharge refrigerant vapour and are therefore not recommended for protection against liquid over-pressure.

As a pressure relief valve is a safety device, it is essential that a proper selection is made. The European Standards EN378 (reference 2) and EN13136 (reference 3) are recommended for selection. In some cases, existing National Standards should be consulted.

An example selection is included using the recommended approach from the above references. This example shows the calculation for an external fire case only. Different formulae are required for the other sources of over-pressure.

Example

A liquid receiver is to be protected from over-pressure due to fire.

Receiver dimensions = 2.2m long (L) x 0.254m outside diameter (D)

Refrigerant = R404A

Pressure setting = 20.7 barg

$$Q_{md} = \frac{3600 \times \varphi \times A_{surf}}{h_{vap}}$$

Q_{md} = Minimum required discharge capacity, of refrigerant, of the pressure relief valve, kg/hour

φ = Density of heat flow rate, kW/m². The standards assume a value of 10 kW/m² but state that a higher value can be used if necessary. This figure relates to an un-lagged vessel.

A_{surf} = External surface area of the vessel, m²

h_{vap} = Heat of vapourisation calculated at 1.1 times the set pressure, in bar a, of the pressure relief valve, kJ/kg

Note:

When the relief valve setting is close to the critical pressure of the refrigerant, this sizing method may not be applicable.

$$A_{surf} = (\pi \times D \times L) + 2 \left(D^2 \times \frac{\pi}{4} \right)$$

Hence,

$$A_{surf} = (\pi \times 0.254 \times 2.2) + 2 \left(0.254^2 \times \frac{\pi}{4} \right) = 1.86 \text{ m}^2$$

Calculate the heat of vapourisation, h_{vap} , taken at 1.1 times set pressure:-

$$(20.7 \times 1.1) + 1.013 = 23.78 \text{ bar a}$$

From refrigerant property tables, use saturated vapour and liquid enthalpies at the above pressure.

Vapor = 285.8 kJ/kg; Liquid = 181.2 kJ/kg

$$h_{vap} = (285.8 - 181.2) = 104.6 \text{ kJ/kg}$$

$$Q_{md} = \frac{3600 \times 10 \times 1.86}{104.6} = 640 \text{ kg/hr, R404A}$$

To calculate the mass flow rate through a PRV, the equation is:-

$$Q_m = 0.2883 \times C \times A \times K_{dr} \times \sqrt{\frac{P_o}{V_o}}$$

This equation assumes critical flow.

C = Function of the isentropic exponent

A = Flow area of PRV, mm²

K_{dr} = De-rated coefficient of discharge of PRV

P_o = Actual relieving pressure, $P_o = 1.1P_{set} + P_{atm}$, bar a

V_o = Specific volume of saturated vapor @ P_o , m³/kg

Refrigerant data should be referenced for the C and V_o values.

The objective is to select a PRV which results in $Q_m > Q_{md}$. In this way, the relieving capacity of the PRV is greater than required thus avoiding excessive vessel pressure. The user must select a valve model with an adequate ($A \times K_{dr}$) factor.

For this example, a 523 series model has been selected with an orifice size of 6.35mm. From the dimension table, $A = 31.67 \text{ mm}^2$, $K_{dr} = 0.68$

$$Q_m = 0.2883 \times 2.49 \times 31.67 \times 0.68 \times \sqrt{\frac{23.78}{0.0074}} = 876.4 \text{ kg/hr, R404A}$$

Therefore, for this example suitable models are 5230A, 5231A or 5231B. The final choice depends on the preferred inlet and outlet connection sizes.

Additional notes:-

1. If a Henry Technologies rupture disc is used in conjunction with a Henry Technologies PRV, then the PRV capacity should be de-rated by 10%. In the above example, the PRV capacity would be de-rated to 788.8 kg/hr (876.4×0.9).
2. It is important not to grossly over-size a PRV as the performance can be affected. Contact Henry Technologies for further guidance.
3. Inlet and outlet piping must be sized to an appropriate standard to avoid excessive pressure losses. Excessive pressure losses affect valve performance. Consult reference 3.

References:-

(1) ANSI/ASHRAE 15-2004 (2) EN 378-2:2000* (3) EN 13136:2001*

*Latest revisions at time of publication. At time of publication, these standards were under review. The user should ensure the latest revisions are referenced.

Installation – Main issues

1. Connect the relief valve at a location above the liquid refrigerant level, in the vapour space. Stop valves should not be located between the vessel and the relief valve except the three-way type.
2. Do not discharge the relief valve prior to installation or when pressure testing the system.
3. Pressure relief valves should be mounted vertically.
4. Relief valves should be changed out after discharge. Most systems are subject to accumulations of debris. Particles of metal and dirt are generally blown onto relief valve seats during discharge. This inhibits the relief valve from re-sealing at the original set pressure. A valve can also relieve at a lower pressure than the stamped valve setting due to the force of the re-closing action.
5. The pipe-work must not impose loads on the relief valve. Loads can occur due to misalignment, thermal expansion, discharge gas thrust, etc.

OIL REGULATOR SHUT-OFF VALVES

The function of Oil Regulator Shut-off valves is to provide a means for equipment isolation. Horizontal and vertical models are available.

Applications

These valves are positioned on the oil inlet and equalisation pipe lines of Henry Technologies Oil Level Regulators. This allows each oil level regulator to be isolated in the event that servicing is required on the compressor, oil level regulator, strainer, etc.

The valves are suitable for HCFC and HFC refrigerants, along with their associated oils.

On request, these valves can be supplied with a higher pressure rating for sub-critical CO₂ and R410A applications.

Main features

- Two mounting options – horizontal and vertical
- 360° positioning via swivel connection

Technical Specification

Allowable operating pressure = 0 to 34.5 barg

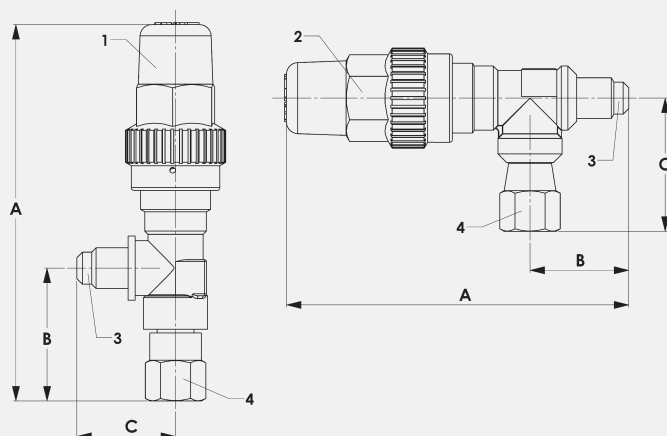
Allowable operating temperature = -10°C to +100°C

Materials of Construction

The main body and swivel nut are made from brass. The stem is made from plated steel. The stem seal cap is made from moulded plastic.



Part No	Conn Size (inch)		Dimensions (mm)			Type	Weight (kg)	CE Cat
	Fixed	Swivel	A	B	C			
S-9106E	1/4 SAE Flare	1/4 SAE Female Flare	102	37	27	Vertical	0.14	SEP
S-9106H	3/8 SAE Flare	3/8 SAE Female Flare	92	27	39	Horizontal	0.16	SEP
S-9106V	3/8 SAE Flare	3/8 SAE Female Flare	104	39	32	Vertical	0.17	SEP
S-9106EH	1/4 SAE Flare	1/4 SAE Female Flare	92	27	36	Horizontal	0.15	SEP



- ① Vertical type
- ② Horizontal type
- ③ Fixed connection
- ④ Swivel connection

OIL REGULATOR SHUT-OFF VALVES

ISTRUZIONI

Rubinetto di scambio:
3032/33
3032/44

INSTRUCTIONS
Dual shut - off valve:
3032/33
3032/44

- 1 VALVOLA DI SICUREZZA
- 2 COPPIA DI ATTACCHI FILETTATI
- 3 ANELLI DI TENUTA "O RING"
- 4 RUBINETTO DI SCAMBIO
- 5 ASTA

- a Avvitare e serrare la coppia di attacchi filettati 2 sugli attacchi di entrata delle valvole di sicurezza
- b Posizionare gli anelli di tenuta 3 negli alloggiamenti del rubinetto di scambio 4 lubrificandoli leggermente
- c Avvitare i raccordi girevoli della coppia di attacchi filettati 2 sul rubinetto e serrarli alla coppia di 60 Nm
- d Montare il rubinetto completo sul recipiente

La commutazione tra le due vie si realizza tramite rotazione dell'asta 5

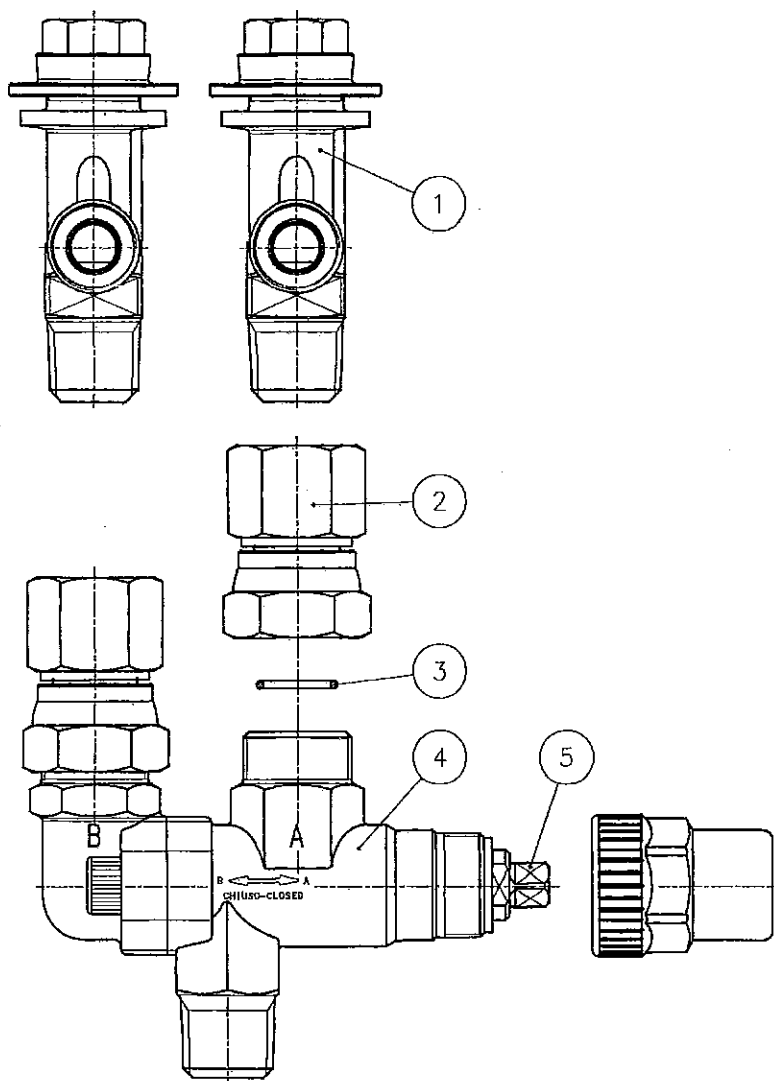
N.B. In condizioni di lavoro, l'asta 5 deve essere serrata contro una delle due sedi del rubinetto (coppia consigliata 25 Nm)

- 1 SAFETY VALVES
- 2 THREADED CONNECTIONS
- 3 "O" RINGS
- 4 DUAL SHUT - OFF VALVE
- 5 ROD

- a Screw and tighten the two threaded connections 2 on the access fitting of safety valves
- b Place the sealing "O" rings 3 in the housings of the dual valve 4 after slight lubrication
- c Screw the couplings of the two threaded connections 2 on the dual valve and tighten with the torque of 60 Nm
- d Install the complete dual valve on the vessel

Shifting from one way to the other is performed by rotation of the rod 5

N.B. Under operating conditions, the rod 5 shall be tightened against one of the two sides of the dual valve (recommended torque 25 Nm)



Castel 20060 PESSANO - ITALY

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ISTRUZIONI

Rubinetto di scambio:

3032/64
3032/66
3032/88
3032/108

INSTRUCTIONS

Dual shut - off valve:

3032/64
3032/66
3032/88
3032/108

- 1 VALVOLA DI SICUREZZA
- 2 RUBINETTO DI SCAMBIO
- 3 ASTA

- a Avvitare le valvole di sicurezza 1 sul rubinetto di scambio 2
- b Montare il rubinetto completo sul recipiente

La commutazione tra le due vie si realizza tramite rotazione dell'asta 3

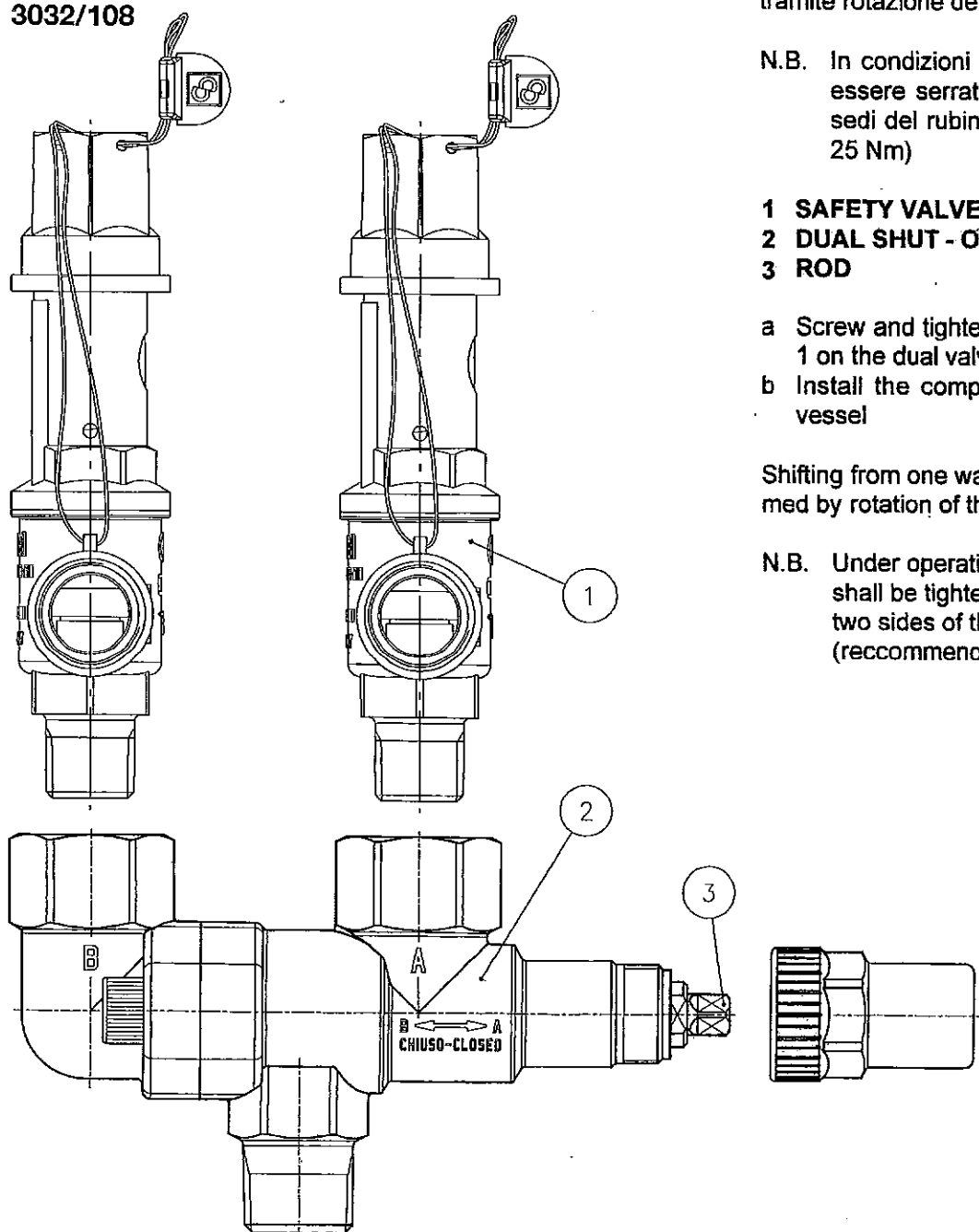
N.B. In condizioni di lavoro, l'asta 3 deve essere serrata contro una delle due sedi del rubinetto (coppia consigliata 25 Nm)

- 1 SAFETY VALVES
- 2 DUAL SHUT - OFF VALVE
- 3 ROD

- a Screw and tighten the two safety valves 1 on the dual valve 2
- b Install the complete dual valve on the vessel

Shifting from one way to the other is performed by rotation of the rod 3

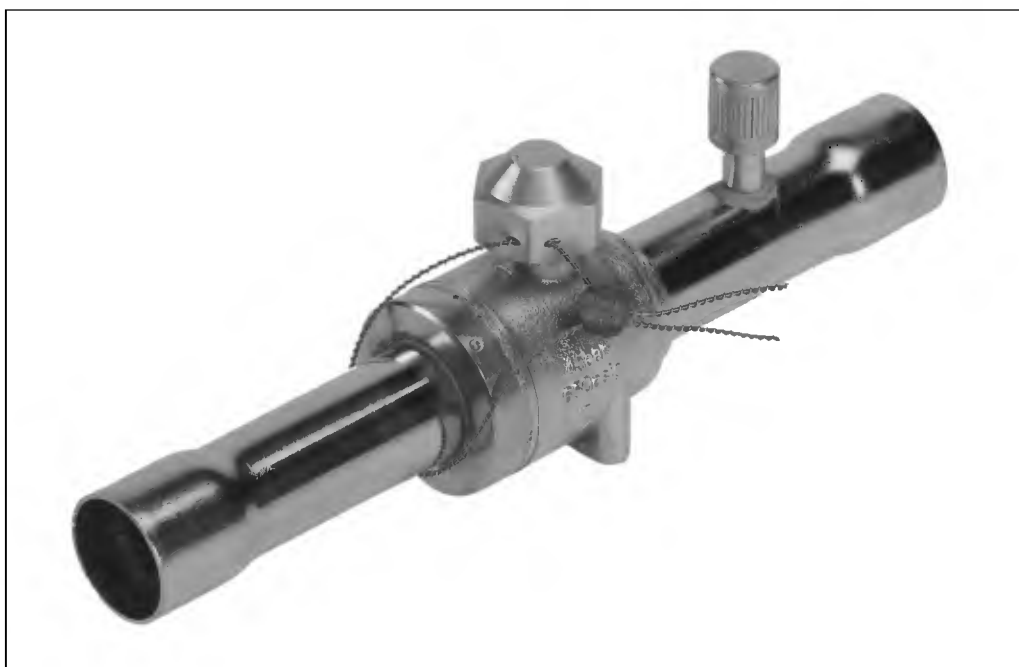
N.B. Under operating conditions, the rod 3 shall be tightened against one of the two sides of the dual valve (recommended torque 25 Nm)





Ball valves, type GBC

Introduction



Danfoss ball valves, type GBC, are manually operated shut-off valves suitable for bi-directional flow.

GBC valves are used in liquid, suction and hot-gas lines in refrigeration and air-conditioning systems.

GBC valves offer maximum tightness across the seat/seal.

The ball valves give maximum flow in the fully open position. They are designed for operation within a broad temperature range.

GBC valves are equipped with a one-piece seal cap and can be wire sealed to prevent unintentional cap removal or tampering in-between services.

Features

- Flow without pressure drop.
- ¼ turn from fully open to fully closed valve.
- Rotation stop for fully open and fully closed valve.
- Ball status indicator on spindle top indicating open or closed position.
- Holes for panel mounting.
- Bi-directional flow, i.e. valve orientation is unimportant.
- Laser welded construction.
- Burst-proof spindle design.
- Valve seal of modified PTFE.
- Valve design prevents liquids from being trapped internally.
- One-piece seal cap for safety purpose – complies with European Safety Directive EN 378*.

Technical data

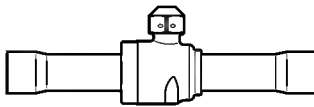
Refrigerants	CFC, HCFC, HFC
Temperature range	–40 → +150°C (–40 → +300°F)
Max. working pressure (PS/MWP)	45 bar (653 psig)
Max. test pressure	65 bar (943 psig)
Approvals	

*Safety and environmental requirements

Technical leaflet
Ball valves, type GBC
Ordering

The product range consists of two valve types: one with and one without access port. Both versions can be supplied in inch or

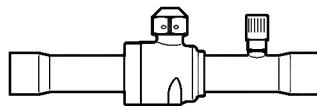
millimetre sizes from $\frac{1}{4}$ in. to $3\frac{1}{8}$ in. (6 mm to 54 mm). All valves have holes for panel mounting.



GBC without access port

GBC without access port

Type	Solder ODF connection		Solder ODF connection		K _v value *) [m ³ /h]
	[in.]	Code no.	[mm]	Code no.	
GBC 6s	$\frac{1}{4}$	009G7020	6	009G7030	1.96
GBC 10s	$\frac{3}{8}$	009G7021	10	009G7031	5.68
GBC 12s	$\frac{1}{2}$	009G7022	12	009G7032	10.58
GBC 16s	$\frac{5}{8}$	009G7023	16	009G7023	14.11
GBC 18s	$\frac{3}{4}$	009G7024	18	009G7035	20.42
GBC 22s	$\frac{7}{8}$	009G7025	22	009G7025	28.17
GBC 28s	$1\frac{1}{8}$	009G7026	28	009G7033	51.95
GBC 35s	$1\frac{3}{8}$	009G7027	35	009G7027	80.89
GBC 42s	$1\frac{5}{8}$	009G7028	42	009G7034	121.07
GBC 54s	$2\frac{1}{8}$	009G7029	54	009G7029	224.96
GBC 67s	$2\frac{5}{8}$	009G7036			245.78
GBC 79s	$3\frac{1}{8}$	009G7037			222.52



GBC with access port

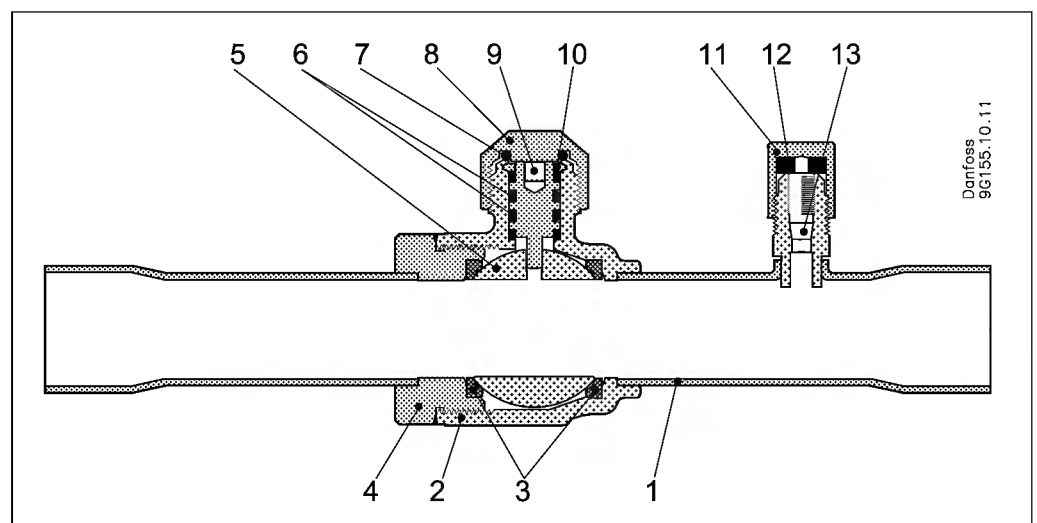
GBC with access port

Type	Solder ODF connection		Solder ODF connection		K _v value *) [m ³ /h]
	[in.]	Code no.	[mm]	Code no.	
GBC 6s	$\frac{1}{4}$	009G7050	6	009G7060	1.96
GBC 10s	$\frac{3}{8}$	009G7051	10	009G7061	5.68
GBC 12s	$\frac{1}{2}$	009G7052	12	009G7062	10.58
GBC 16s	$\frac{5}{8}$	009G7053	16	009G7053	14.11
GBC 18s	$\frac{3}{4}$	009G7054	18	009G7065	20.42
GBC 22s	$\frac{7}{8}$	009G7055	22	009G7055	28.17
GBC 28s	$1\frac{1}{8}$	009G7056	28	009G7063	51.95
GBC 35s	$1\frac{3}{8}$	009G7057	35	009G7057	80.89
GBC 42s	$1\frac{5}{8}$	009G7058	42	009G7064	121.07
GBC 54s	$2\frac{1}{8}$	009G7059	54	009G7059	224.96
GBC 67s	$2\frac{5}{8}$	009G7066			245.78
GBC 79s	$3\frac{1}{8}$	009G7067			222.52

*) CFD calculated values (Computational Fluid Dynamics)

Construction

1. Connection
2. Laser-welded valve body
3. Ball seat (modified PTFE)
4. Valve adapter
5. Stainless steel ball
6. Double spindle O-ring seal (chloroprene)
7. Cap O-ring seal (chloroprene)
8. Seal cap
9. Spindle
10. Support gasket
11. Access port cap
12. Seal gasket
13. Schraeder valve



Direct flow gives maximum through-flow with minimum pressure drop across valve. The combination of laser-welded valve body (2), ball seat/seal (3), double spindle O-ring seal (6), and cap O-ring (7) gives absolutely minimum leakage.