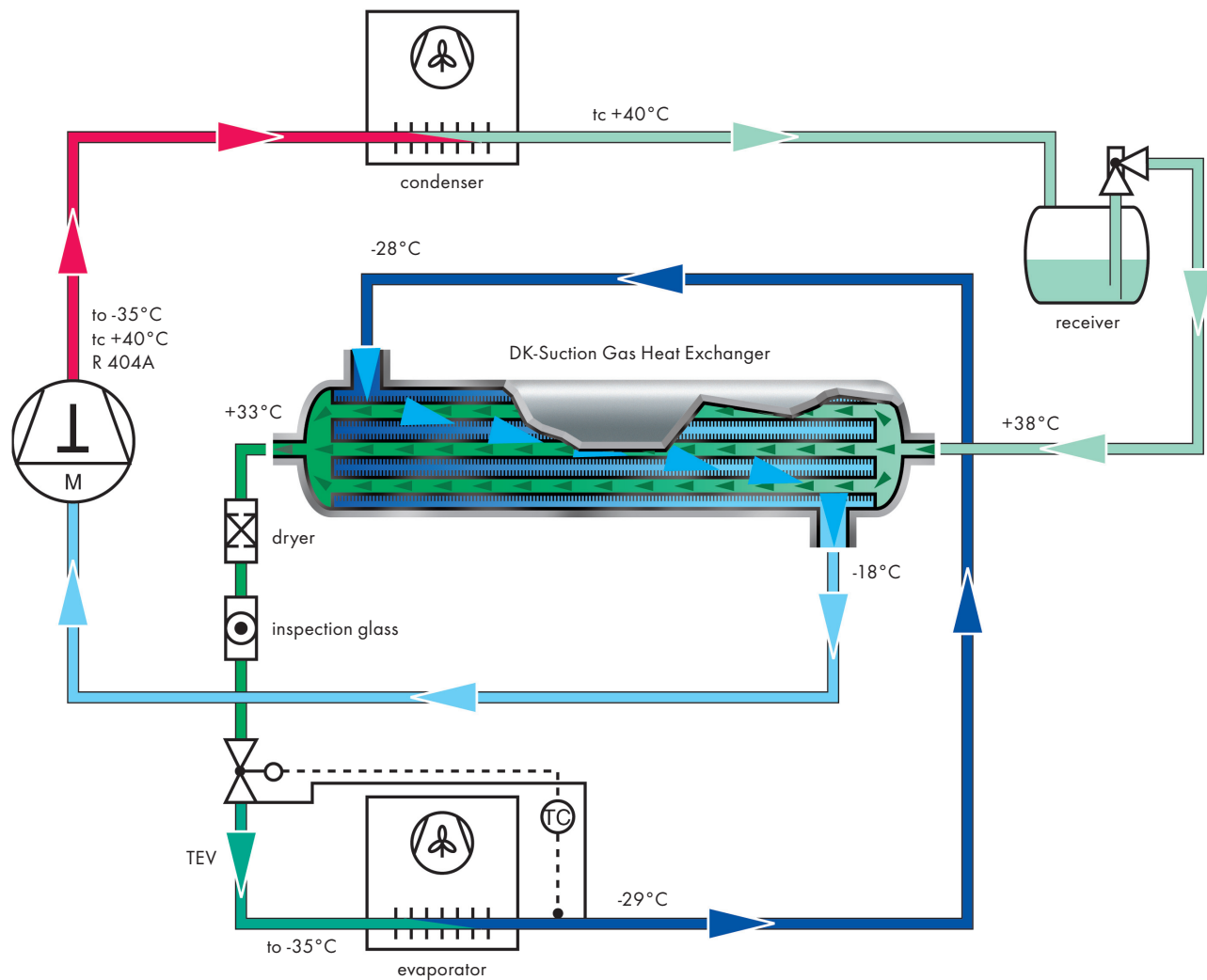




Cooling. Heating.
Innovation.

DK-Suction Gas Heat Exchanger



NEW

DK-Suction-Gas Heat Exchanger for subcritical CO₂-refrigeration plants

max. operating pressure liquid 45 bar
max. operating pressure suction line 45 bar

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Description of Suction Gas Heat Exchanger

DK-Suction Gas Heat Exchangers ensure the safety of the compressor and optimise the capacity of the refrigeration unit with a precision-degree valuation of the liquid subcooling and suction gas overheating of the refrigeration units.

Improved Performance of the Refrigeration Unit

DK focuses on all activities related to the planning and manufacturing of components that aim at improving the performance balance of refrigeration units. Certain refrigerants – especially R404A – allow for a performance gain from subcooling the liquid that exceeds the performance loss following superheating of the suction gas, due to a larger volume. Subcooling the liquid by 10 K in a refrigeration unit to -10°C produces an increased output of approx. 10%. Other refrigerants, such as R134a, produce a smaller performance gain.

When operating a refrigeration unit with a thermo-controlled expansion valve, the evaporator is pre-set to overheating at 6 K, to ensure complete evaporation. This entails that only 85% of the evaporator surface instead of the entire evaporator is used for the actual evaporation of the refrigerant, while 15% of the evaporator surface are required to achieve overheating.

With the DK-Suction Gas Heat Exchanger, overheating in the evaporator can be set with an electronic expansion valve as low as possible and the probe of the expansion valve can be placed, as usual, at the end of the evaporator. And even when operating a thermo-controlled expansion valve operation is possible without overheating in the evaporator. The suction gas heat exchanger is then to be mounted directly at the evaporator's outlet and the probe of the expansion valve at the outlet of the suction gas heat exchanger.

The evaporator can thus be used 100%. When using an evaporator of the same capacity, a higher evaporation temperature thus produces the same refrigeration output. This is one of the main energetic advantages of the DK-Suction Gas Heat Exchanger.

Compressor Safety

A major advantage of the Suction Gas Heat Exchanger is the optimal safety of the compressor. All compressor manufacturers welcome an increase in the suction gas temperature. The raised temperature prevents the oil in the compressor from cooling excessively, which is beneficial to the compressor's lubrication. Also, the DK-Suction Gas Heat Exchanger can eliminate so-called liquid slugging. This added safety feature for the compressor is achieved by completely evaporating all liquid particles contained in the suction gas heat exchanger.

Additional Advantages

A particularity of the DK-Suction Gas Heat Exchanger is the precision-degree calculation of the liquid subcooling and suction gas superheating. This seems very important for us since, although excessive subcooling leads to an increase of the energetic benefit, it also raises the condenser's final temperature which, if too high, is known to cause the compressor to fail.

A further advantage of the DK-Suction Gas Heat Exchanger is to be seen in the fact that a precision calculation of the number of inner tubes required inside the shell tube results in a balanced ratio of available surface for suction gas- and liquid-carrying lines; paired with the special mountings of the inner tubes completes the reasons why the DK-Suction Gas Heat Exchanger runs without a noteworthy loss of pressure in gas-carrying as well as liquid-carrying lines.

Our complete program supplies DK-Suction Gas Heat Exchangers with suction line connections ranging between 28 and 133 mm, as well as liquid line connections ranging from 16 to 64 mm.



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Design of a compressor with/without DK-Suction Gas Heat Exchanger

Design with the aid of the BITZER software

without DK-Suction Gas Heat Exchanger

Default values	
Type of compressor	4DC -5.2Y -40S
Refrigerant	R404A
Reference temperature	Dew point
Evaporation	-10° C
Condensation	45° C
Liquid sub-cooling	0K
Suction gas temperature	2° C
Grid supply	400V -3 -50Hz
Usable overheating	7.00K
Output regulator	100%

with DK-Suction Gas Heat Exchanger

Default values	
Type of compressor	4DC -5.2Y -40S
Refrigerant	R404A
Reference temperature	Dew point
Evaporation	-10° C
Condensation	45° C
Liquid sub-cooling	10K
Suction gas temperature	20° C
Grid supply	400V -3 -50Hz
Usable overheating	7.00K
Output regulator	100%

Result	
Type of compressor	4DC -5.2Y -40S
Refrigeration capacity	12.08 kW
Refrigeration capacity*	13.12 kW
Evaporation capacity	11.54 kW
Power consumption	6.25 kW
Power (400V)	10.89 A
Voltage range	380 -420V
Condensation capacity (with WA)	18.02 kW
Performance number	1.93
Performance number*	2.10
Mass flow rate	421 kg/h
Type of operation	Standard

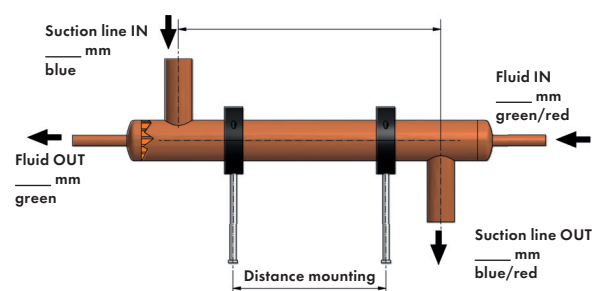
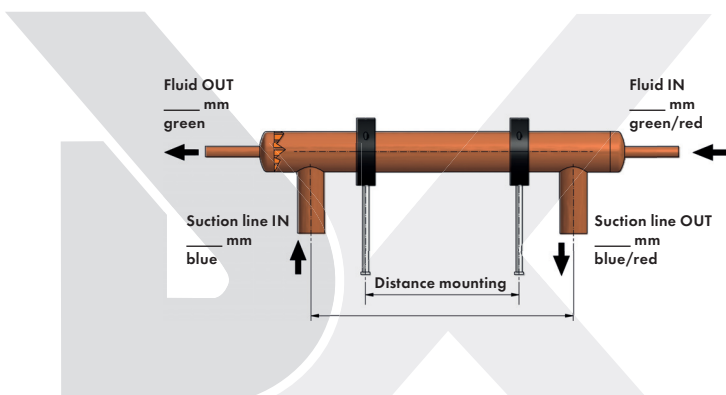
Result	
Type of compressor	4DC -5.2Y -40S
Refrigeration capacity	14.93 kW
Refrigeration capacity*	13.12 kW
Evaporation capacity	12.60 kW
Power consumption	6.25 kW
Power (400V)	10.89 A
Voltage range	380 -420V
Condensation capacity (with WA)	19.06 kW
Performance number	2.39
Performance number*	2.10
Mass flow rate	393 kg/h
Type of operation	Standard

It quickly emerges that the same power draw reaches an improvement of the refrigeration capacity of the condenser of 11.54 kW to 12.6 kW = 1.04 kW = 9.2%.

* according to EN 12900 (20° C Suction gas temperature / 0 K Liquid sub-cooling)

Bottom connections

Top/bottom connections



Overview of DK-Suction Gas Heat Exchangers (1.0 m)

The following table itemizes the range of standard DK-Suction Gas Heat Exchangers: (1.0 m length of exchanger) model 42/3x13 to model 219/64x13 = 9 designs with liquid connections ranging between 12 and 64 mm and suction gas connections between 28 and 133 mm.

Typ	42/ 3x13	54/ 5x13	64/ 7x13	76/ 9x13	89/ 12x13	108/ 20x13	133/ 30x13	159/ 40x13	219/ 64x13
External pipe (mm)	42	54	64	76	89	108	133	159	219
Internal tubes	3x13	5x13	7x13	9x13	12x13	20x13	30x13	40x13	64x13
Length of internal tubes (mm)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Distance mounting (mm)	500	500	500	500	500	500	500	500	500
Total length (mm)	1.500	1.500	1.500	1.500	1.500	1.550	1.550	1.550	1.600
Total height (mm)	360	370	380	400	420	450	480	500	560
Suction line (mm)	28	35	42	54	64	76	89	108	133
Liquid line (mm)	16	18	22	22	28	35	42	54	64
Surface LP side (m ²)	0,48	0,8	1,12	1,44	1,92	3,2	4,8	6,4	10,24
Capacity of heat exchanger (W) ¹⁾	1.550	2.590	3.620	4.665	6.220	10.360	15.550	20.700	33.100
Content of outer pipe area (LP side) in dm ³	0,8	1,3	1,9	2,8	4,0	5,5	8,3	12,4	26,1
Content of tube area (HP side) in dm ³	0,26	0,35	0,5	0,6	0,8	1,3	2	2,8	4,8
Weight (kg/m)	5	9	13	17	22	33	41	52	87
Weight (kg per 0,1 m)	0,5	0,5	1	1	2	3	4	5	6

Max. operating pressure: outer pipe area (OA) 16 bars - tube area (TA) 30 bars

1) Capacity quoted for R404A installation conditions:

Normal cooling refrigeration units: Subcooling of liquid from +40°C to +30°C - overheating of suction gas from ±0°C to +20°C

Deep freezing refrigeration units: Subcooling of liquid from +40°C to +35°C - overheating of suction gas from -25°C to -15°C