In Touch

Bock open type compressors F

The full range open type compressors and units

BOCK® COMPRESSORS

GEA Refrigeration Technologies / GEA Bock

GEA Refrigeration Technologies: Your partner for low temperatures

GEA Refrigeration Technologies, part of the internationally active GEA Group, is a synonym for industrial refrigeration technology. Since the end of the 19th century, it has been our business to cool processes and products, and to control the temperature of goods in transport.

You will find our solutions in the food and beverage sector; in the petrochemical, chemical, and pharmaceutical industries; on fishing ships; in natural gas liquefaction; in infrastructure facilities; and in ice factories. We are also at the top with know-how when it comes to refrigeration at leisure facilities. After all, we have been excited about refrigeration for decades now. As a result, our staff enthusiastically goes about its development and production projects – to include preventive and remedial maintenance of your refrigeration systems.

This enthusiasm is highly apparent in the daily work of all companies in our Segment. Whether it's complete systems or individual valves: we have the experience in every section of our company to optimally design, manufacture, and install refrigeration systems. And to take full advantage of this experience, we not only carry out development in our own company: we also manufacture, assemble, and test the core components. A chain is, after all, only as strong as its weakest link: and this also applies equally well to refrigeration technology, cooling processes, and cooling chains.

This makes it all the more important that you have a partner – in GEA Refrigeration Technologies – that has learned to master refrigeration from A to Z. And all of this since 1896, when Willem Grasso founded his refrigeration division. From this history of GEA Refrigeration Technologies, you will profit in the form of technical expertise and top sector know-how.

But we all live in the present and think about the future. We ponder a future in which more and more processes need energy around the world, and fewer natural resources are available. As a result, we have taken it as our goal to create solutions that are not only long-life and cost-effective, but also energy-saving and environment-protecting. We feel obligated to sustainability in many respects. Our objective is to produce longlife and material-saving products over the long run – as well as products that use environmentally benign refrigerants. And we aim to produce efficiently. But our responsibility does not end at the factory gate. As a result, we take great pains to ensure that our systems are energy-efficient and that they protect the climate. With GEA Refrigeration Technologies, you can also count on optimal economy: saving energy indeed means reducing money spent for energy. At the same time, you protect the environment. Thanks to our refrigeration technology, your processes will run more economically and more ecologically. To maintain our standard of living and to assure quality of life for future generations as well.

Our claim of combining economy with saving natural resources is reflected in all components of our company, such as the following: compressors, chillers, heat pumps, ice machines, fittings and valves, control systems, and many, many more. You can find proof of the above throughout the world. Our international corporate network – and above all our reference projects – are spread all over the globe.

06/2011 – 96023-06.2011-Gb ◦ Subject to modification

Contents

Open type compressors F

The F model series provides modern open type compressors for separate drive systems (using V belts or direct couplings). Load transfer through a V pair.
Very compact compressor design, robust and easy to handle. Oil pump lubrication as standard.

Available versions	
Single-stage compressors	6 model sizes with 8 capacity stages - from 10,5 to 178,4 m³/h (1450 rpm)
Compressors for NH_3	6 model sizes with 8 capacity stages - from 10,5 to 178,4 m³/h (1450 rpm)
Compressor units for direct drive	5 model sizes with 7 capacity stages - from 20,3 to 178,4 m³/h (1450 rpm)

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Semi-hermetic compressors HG (HA)

The Bock HG (Hermetic Gas-cooled) range of semi-hermetic compressors offers traditional suction gas-cooled compressor state of the art technology. These compressors of the highest quality standard excel in their running comfort, easy maintenance, efficiency and reliability. Suitable as standard for conventional or chlorine-free HFC refrigerants.
The HA (Hermetic Air-cooled) range, specially engineered by Bock, exists for deep-freezing applications, in particular for use with refrigerants R22 and R404A.

Available versions	
Single-stage compressors	8 model sizes with 26 capacity stages - from 5,4 to 279,8 m³/h (50 Hz)
CO_2 compressors subcritical	4 model sizes with 14 capacity stages - from 3,6 to 48,2 m³/h (50 Hz)
CO_2 compressors transcritical	3 model sizes with 11 capacity stages - from 2,7 to 20,1 m³/h (50 Hz)
R134a compressors	2 model sizes with 6 capacity stages - from 62,9 to 122,4 m³/h (50 Hz)
R407C compressors	1 model sizes with 4 capacity stages - from 18,8 to 33,1 m³/h (50 Hz)
R410A compressors	4 model sizes with 11 capacity stages - from 5,4 to 40,5 m³/h (50 Hz)
ATEX compressors	6 model sizes with 20 capacity stages - from 5,4 to 122,4 m³/h (50 Hz)
HC compressors	3 model sizes with 7 capacity stages - from 18,8 to 56,6 m³/h (50 Hz)
Aluminium compressors	2 model sizes with 10 capacity stages - from 11,1 to 66,1 m³/h (50 Hz)
2-pole compressors	1 model sizes with 3 capacity stages - from 44,3 to 66,1 m³/h (50 Hz)
Two-stage compressors	1 model sizes with 3 capacity stages - from (LP/HP) 93,7/46,9 to 122,4/61,2 m³/h (50 Hz)
Duplex compressors	7 model sizes with 23 capacity stages - from 5,4 to 367,2 m³/h (50 Hz)
Compressor units with receiver	7 model sizes with 23 capacity stages - from 5,4 to 183,6 m³/h (50 Hz)
Condenser units air-cooled	4 model sizes with 14 capacity stages - from 5,4 to 56,6 m³/h (50 Hz)

Vehicle compressors FK

Bock vehicle compressors of the FK range are the result of many years of experience in the domain of mobile cooling systems. Especially for bus and coach air-conditioning systems, they are among the standard units used by all well-known manufacturers, while also being well established in the domain of transport refrigeration systems and in other mobile and stationary refrigeration systems.
The unsurpassed light, compact, robust design and wide r.p.m. range are only some of the outstanding features of this unique product range of two, four and six cylinder compressors.
A wide variety of designs can be tailored to suit individual requirements.
The so-called K version is a special innovation with a unique valve plate system for maximum requirements in bus and coach airconditioning systems.

Available versions	
Compressors for bus and railway air-conditioning	4 model sizes with 16 capacity stages - from 118 to 976 cm³
Compressors for transport refrigeration and other applications	4 model sizes with 14 capacity stages - from 118 to 776 cm³

Single-stage compressors

The F model series provides modern open type compressors for separate drive systems using V belts or direct couplings. Load transfer through a V pair. Virtually all drive capacity requirements can be met.

Very compact compressor design, robust and easy to handle.

Oil pump lubrication as standard.

Type key

F X 14 / 1166

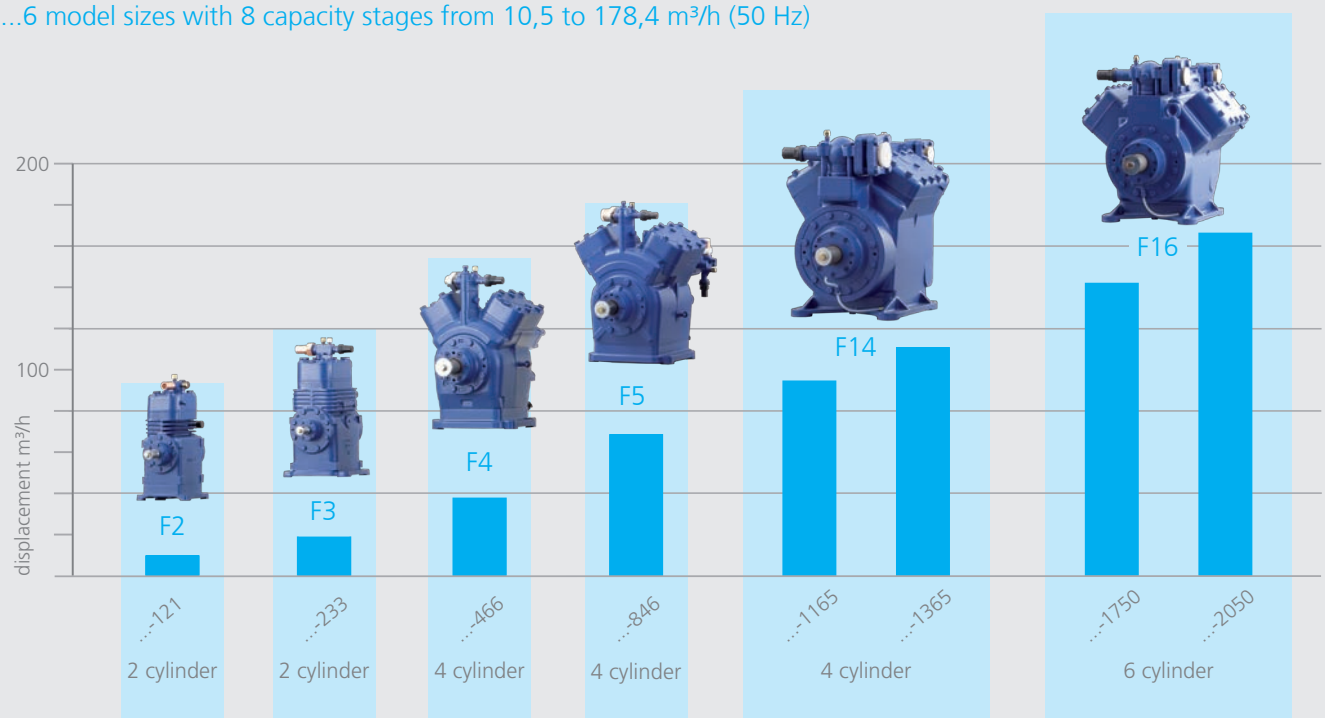
- Swept volume [2)]
- Size
- Ester oil filling [1)]
- Series

[1)] X - Ester oil filling (HFC refrigerant, e.g. R134a, R407C)

[2)] Indication only at F14, F16

The current program

...6 model sizes with 8 capacity stages from 10,5 to 178,4 m³/h (50 Hz)



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The open type 2-, 4- and 6-cylinder compressors

- Compact construction
- Robust and easy to handle
- Suitable for v-belt or coupling drive
- Large number of applications with a wide r.p.m. range
- Naturally with oil pump lubrication

Universal

- e.g. R134a, R404A, R507, R407C, R22
- One compressor design for all conventional refrigerants, for air conditioning applications, normal or deep-freezing. Maximum permissible operating pressure: 28 bar
- Compressor designs for NH_3
- Compressor designs for CO_2 on request

Quiet with low vibrations

- Large-dimensioned crankshaft area
- Dynamic mass balance
- High volume pressure area to dampen pulsations

Reliable and safe oil supply

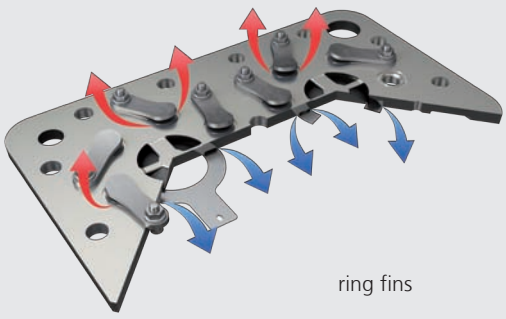
- Classic lubricating oil circuit with oil pump independent of rotating direction
- High-volume oil sump
- F 14, F 16 option of expanding the oil volume by 2.5 litres by raising the base plate (option)
- F 14, F 16 with connection facility for oil pressure monitoring via Δ P oil differential pressure sensor
- F 14, F 16 with practical oil service valve for clean oil changes without intervening in the refrigeration cycle
- Maximum slant of 30° possible in both axes (e.g. marine applications)

Low-wearing long-lifed mechanism

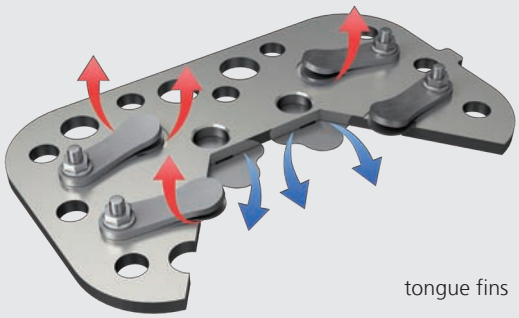
6-cylinder engine

- Solid construction and design
- Classic crankshaft construction with hardened surface
- Low-friction, wear-resistant plain bearings
- Aluminium pistons with two-ring assembly,
- F14, F16 three-ring assembly, compression ring chromehardened
- Aluminium con-rod in divided, screwed design, F14, F16 with high-strength small end bearings

Valve plate construction for safe operation



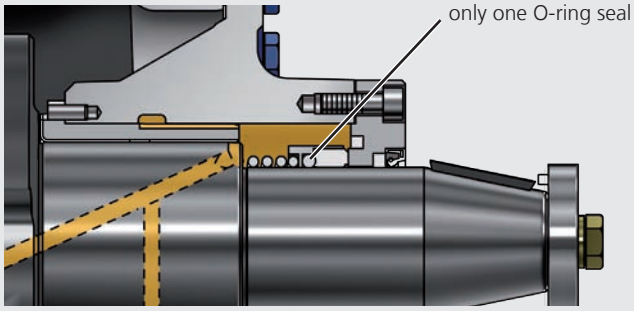
ring fins



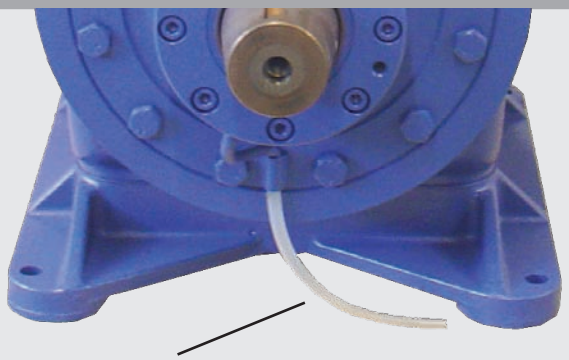
tongue fins

- Globally proven valve design with one-sided fixed tongue fins, intake side and pressure side (F 14, F 16 intake side formed as ring fins)
- Valves made out of high-quality, impact-resistant spring steel

Simply constructed floating ring seals



example: assembly shaft seal F16

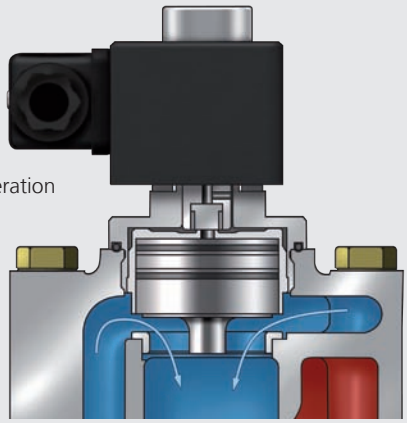


practical drain-option via free accessible piece of pipe

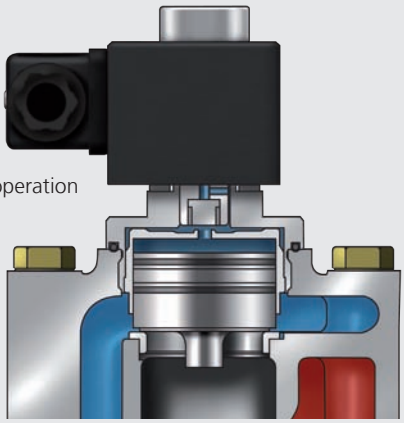
- Tried and tested construction for decades
- Only one o-ring seal, counter ring designed as the screw-on cover
- With oil washing for cooling and lubricating the whole unit
- So easy to change the shaft seal for maintenance purposes
- F14, F16 with practical piece of tube for controlled oil collection

Economic performance regulation (option)

Full load operation

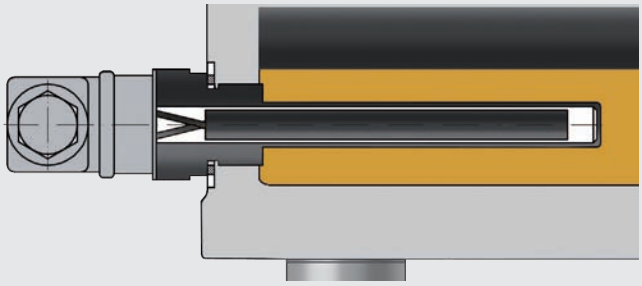


Partial load operation



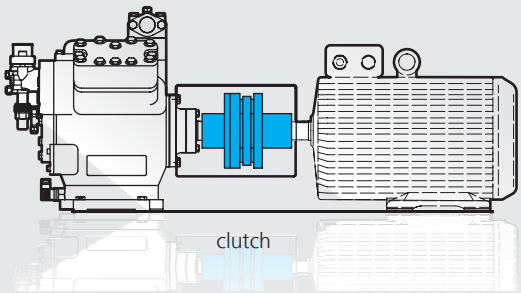
- Blocking of the intake of a cylinder bank with an electromagnetic pilot valve
- Possible regulating steps:
  4-cylinder-compressor: 50% 6-cylinder-compressor: 33% / 66%
- Infinite speed regulation (up to 60 Hz) via external frequency converter possible

Oil sump heating

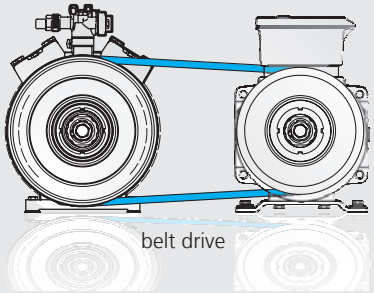


- Design with immersion sleeve
- Changes possible without intervening in the refrigeration cycle
- Standard for all 4 and 6 cylinder compressors
  (2 cylinder compressor option)

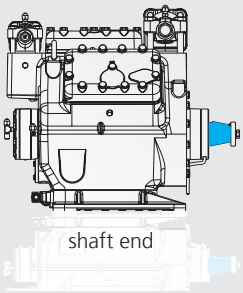
Various drive options



clutch



belt drive



shaft end

- Conical shaft end for safe force transmission and exact installation of the drive elements
- Drive via v-belt or coupling, with all the conventional drive sources
  (electric motors, combustible motors, hydraulic motors, etc.)

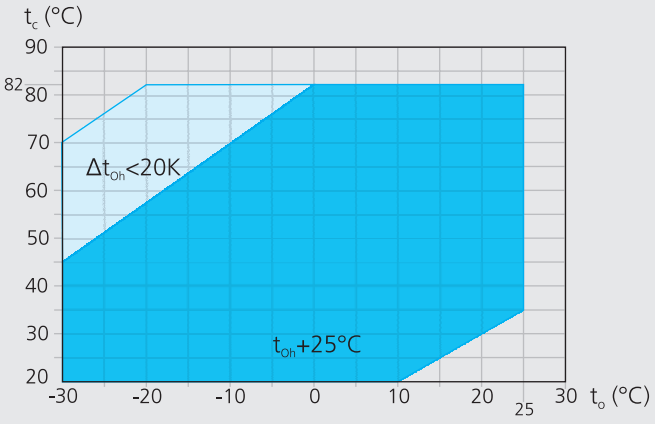
Acceptance by classification societies

DNV · BUREAU VERITAS · Lloyd's Register · Germanischer Lloyd

Acceptance by other classification societies on request.

R134a Limits of application

FX2, FX3, FX4, FX5, FX14, FX16



Unlimited application range

Supplementary cooling or reduced suction gas temperature

t_o Evaporating temperature (°C)
t_c Condensing temperature (°C)
t_{Oh} Suction gas temperature (°C)
Δt_{Oh} Suction gas overheating (K)

Maximum permissible operating pressure (LP/HP)[1]: 19/28 bar

[1] LP = low pressure HP = high pressure

R134a Notes

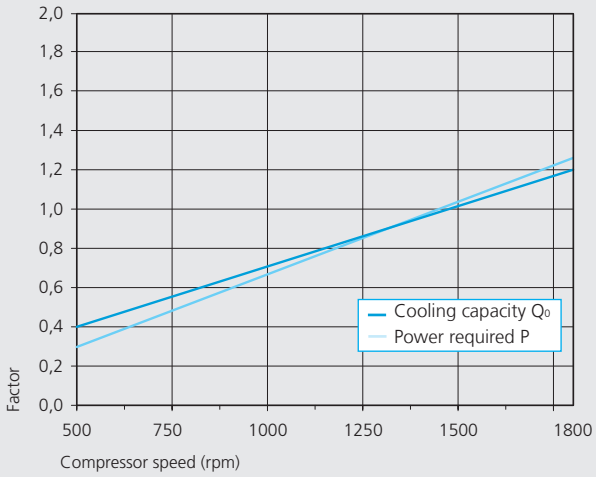
Limits of application

Compressor operation is possible within the examples in the diagram showing the limitations of use. The meaning of the surfaces marked in colour are to be observed. Limiting areas should not be selected for layout or continuous operating points.

Performance data

Performance specifications for the R134a are based on 25°C suction gas temperatures without liquid subcooling. Compressor speed 1450 rpm.
The values can be stated to judge the overall performance at other speed with the help of the calculation factors below.

For additional technical data for other operating points see GEA Bock software.



R134a			Performance data										1.450 rpm
Type	Cond. temp. °C		Cooling capacity $\dot{Q}_o$ [W]					Power P [kW]					
			Evaporating temperature °C										
			15	12,5	10	5	0	-5	-10	-15	-20	-25	-30
FX2	30	Q	10018	9158	8354	6903	5648	4570	3653	2878	2228	1684	1229
		P	0,92	0,97	1,01	1,05	1,04	1,01	0,95	0,87	0,78	0,69	0,60
	40	Q	8960	8176	7444	6126	4990	4017	3190	2490	1901	1404	981
		P	1,33	1,34	1,34	1,32	1,26	1,18	1,08	0,97	0,86	0,76	0,66
	50	Q	7870	7163	6504	5323	4308	3442	2707	2085	1559	1111	723
		P	1,68	1,66	1,63	1,55	1,45	1,33	1,20	1,07	0,94	0,83	0,74
	60	Q	6757	6128	5544	4500	3609	2852	2212	1671	1211	815	464
		P	1,99	1,94	1,88	1,75	1,61	1,45	1,30	1,15	1,01	0,90	0,81
	70	Q	5629	5079	4570	3667	2902	2257	1715	1256	865	522	211
		P	2,24	2,17	2,08	1,91	1,73	1,55	1,37	1,21	1,08	0,97	0,89
FX3	30	Q	19421	17754	16195	13383	10949	8861	7083	5580	4319	3265	2383
		P	1,79	1,89	1,96	2,03	2,02	1,95	1,84	1,68	1,51	1,33	1,16
	40	Q	17370	15850	14431	11877	9674	7787	6183	4827	3685	2721	1902
		P	2,57	2,60	2,60	2,56	2,45	2,29	2,10	1,89	1,68	1,47	1,29
	50	Q	15258	13887	12610	10319	8351	6672	5247	4042	3023	2154	1402
		P	3,26	3,22	3,17	3,01	2,81	2,58	2,33	2,07	1,83	1,61	1,43
	60	Q	13100	11881	10748	8725	6997	5530	4289	3240	2348	1580	900
		P	3,86	3,76	3,65	3,40	3,12	2,82	2,52	2,23	1,97	1,75	1,58
	70	Q	10912	9847	8861	7110	5627	4376	3324	2436	1677	1013	410
		P	4,35	4,20	4,04	3,71	3,36	3,00	2,67	2,35	2,09	1,87	1,73
FX4	30	Q	38841	35508	32390	26765	21899	17722	14165	11160	8638	6530	4767
		P	3,58	3,77	3,91	4,05	4,04	3,91	3,67	3,37	3,02	2,66	2,32
	40	Q	34740	31700	28861	23753	19347	15575	12367	9655	7369	5442	3804
		P	5,15	5,20	5,20	5,11	4,89	4,58	4,20	3,78	3,35	2,94	2,58
	50	Q	30516	27774	25219	20638	16702	13344	10494	8084	6045	4308	2805
		P	6,52	6,45	6,34	6,03	5,63	5,16	4,66	4,15	3,66	3,22	2,86
	60	Q	26201	23762	21496	17450	13994	11060	8578	6479	4696	3159	1800
		P	7,71	7,52	7,30	6,80	6,23	5,64	5,04	4,46	3,94	3,49	3,16
	70	Q	21825	19693	17721	14220	11254	8753	6648	4871	3353	2026	819
		P	8,70	8,40	8,08	7,41	6,71	6,01	5,33	4,71	4,17	3,74	3,46
FX5	30	Q	70611	64551	58883	48658	39811	32217	25751	20288	15703	11871	8666
		P	6,51	6,86	7,11	7,37	7,35	7,10	6,67	6,12	5,49	4,84	4,21
	40	Q	63155	57629	52468	43182	35173	28315	22483	17552	13397	9894	6916
		P	9,36	9,45	9,46	9,29	8,89	8,32	7,63	6,87	6,09	5,35	4,69
	50	Q	55477	50492	45848	37518	30364	24259	19078	14697	10990	7832	5099
		P	11,86	11,72	11,52	10,96	10,23	9,38	8,47	7,54	6,65	5,86	5,20
	60	Q	47632	43198	39078	31723	25440	20106	15594	11779	8537	5743	3271
		P	14,02	13,67	13,27	12,36	11,33	10,25	9,16	8,11	7,15	6,35	5,74
	70	Q	39677	35802	32216	25852	20459	15912	12086	8856	6096	3683	1490
		P	15,81	15,27	14,70	13,48	12,20	10,92	9,69	8,56	7,58	6,81	6,29

Based on 25°C suction gas temperature
without liquid subcooling

Supplementary cooling or
reduced suction gas temp.

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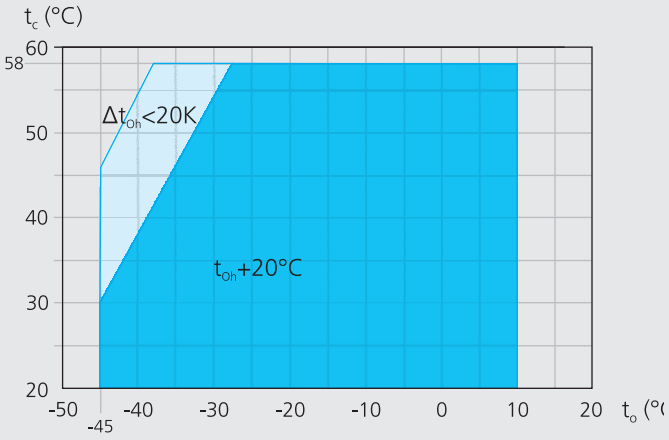
R134a			Performance data										1.450 rpm
Type	Cond. temp. °C		Cooling capacity $\dot{Q}_o$ [W]					Power P [kW]					
			Evaporating temperature °C										
			15	12,5	10	5	0	-5	-10	-15	-20	-25	-30
FX14/1166	30	Q	97150	88813	81014	66946	54774	44326	35430	27914	21605	16333	11923
		P	8,96	9,43	9,78	10,14	10,11	9,77	9,18	8,42	7,55	6,65	5,80
	40	Q	86892	79288	72188	59412	48392	38956	30932	24148	18432	13612	9515
		P	12,87	13,00	13,02	12,78	12,24	11,45	10,50	9,45	8,38	7,36	6,45
	50	Q	76328	69469	63079	51620	41776	33376	26248	20220	15120	10776	7015
		P	16,32	16,13	15,85	15,08	14,07	12,90	11,65	10,37	9,15	8,06	7,16
	60	Q	65534	59433	53766	43646	35002	27662	21454	16206	11746	7902	4501
		P	19,29	18,80	18,26	17,00	15,59	14,10	12,60	11,16	9,84	8,73	7,90
	70	Q	54590	49258 4	4325	35568	28148	21892	16628	12184	8387	5067	2050
		P	21,75	21,01	20,22	18,54	16,79	15,03	13,33	11,78	10,43	9,37	8,65
FX14/1366	30	Q	114013	104228	95076	78566	64282	52020	41580	32759	25356	19168	13993
		P	10,52	11,07	11,48	11,90	11,87	11,47	10,77	9,88	8,86	7,81	6,80
	40	Q	101973	93049	84717	69724	56792	45718	36302	28340	21632	15975	11167
		P	15,11	15,25	15,28	15,00	14,36	13,44	12,32	11,09	9,84	8,63	7,57
	50	Q	89575	81526	74027	60579	49027	39169	30804	23730	17745	12646	8233
		P	19,15	18,93	18,60	17,69	16,51	15,14	13,67	12,17	10,74	9,46	8,40
	60	Q	76908	69749	63098	51221	41077	32463	25178	19019	13785	9273	5282
		P	22,63	22,07	21,43	19,95	18,30	16,55	14,79	13,09	11,55	10,25	9,27
	70	Q	64065	57808	52019	41743	33034	25692	19514	14298	9843	5946	2405
		P	25,52	24,65	23,73	21,76	19,70	17,63	15,65	13,82	12,24	10,99	10,15
FX16/1751	30	Q	145822	133308	121602	100486	82215	66533	53180	41898	32429	24515	17897
		P	13,45	14,16	14,68	15,22	15,18	14,67	13,78	12,63	11,33	9,99	8,70
	40	Q	130423	119010	108353	89177	72636	58473	46429	36247	27667	20431	14282
		P	19,32	19,51	19,54	19,18	18,37	17,19	15,76	14,19	12,58	11,04	9,68
	50	Q	114566	104272	94681	77480	62705	50097	39399	30351	22696	16175	10530
		P	24,50	24,21	23,79	22,63	21,12	19,37	17,48	15,57	13,74	12,09	10,74
	60	Q	98365	89208	80702	65512	52538	41521	32203	24326	17631	11861	6756
		P	28,95	28,23	27,40	25,52	23,41	21,17	18,91	16,74	14,78	13,11	11,86
	70	Q	81937	73935	66531	53388	42250	32860	24959	18288	12589	7605	3076
		P	32,65	31,53	30,35	27,83	25,19	22,55	20,01	17,68	15,66	14,06	12,99
FX16/2051	30	Q	170924	156256	142534	117783	96368	77986	62334	49110	38011	28735	20977
		P	15,77	16,60	17,21	17,84	17,80	17,19	16,15	14,81	13,29	11,71	10,20
	40	Q	152875	139497	127005	104528	85140	68539	54422	42486	32429	23948	16740
		P	22,65	22,87	22,90	22,49	21,53	20,15	18,47	16,63	14,75	12,94	11,35
	50	Q	134288	122222	110980	90818	73499	58721	46181	35575	26602	18959	12342
		P	28,71	28,37	27,89	26,52	24,75	22,70	20,49	18,25	16,10	14,17	12,59
	60	Q	115298	104565	94594	76789	61582	48668	37746	28513	20666	13902	7919
		P	33,93	33,08	32,12	29,91	27,43	24,81	22,17	19,63	17,32	15,37	13,90
	70	Q	96042	86662	77983	62578	49523	38517	29255	21436	14757	8914	3606
		P	38,27	36,96	35,57	32,62	29,53	26,44	23,46	20,72	18,35	16,48	15,22

Based on 25°C suction gas temperature
without liquid subcooling

Supplementary cooling or
reduced suction gas temp.

R404A/R507 Limits of application

FX2, FX3, FX4, FX5, FX14, FX16



Unlimited application range

Supplementary cooling or reduced suction gas temperature

t_O Evaporating temperature (°C)
t_C Condensing temperature (°C)
t_{Oh} Suction gas temperature (°C)
Δt_{Oh} Suction gas overheating (K)

Maximum permissible operating pressure (LP/HP)[1]: 19/28 bar

[1] LP = low pressure HP = high pressure

R404A/R507 Notes

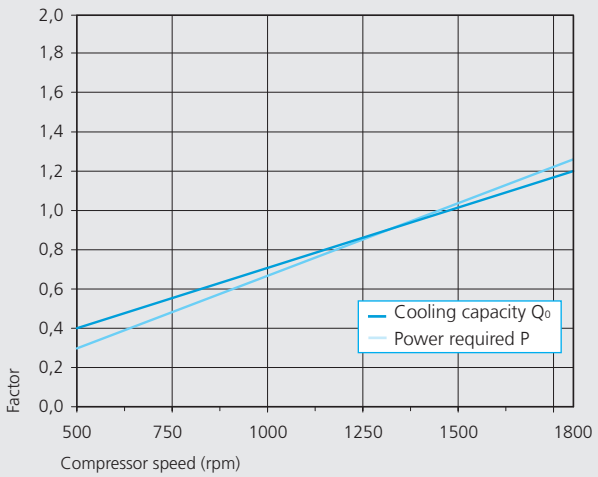
Limits of application

Compressor operation is possible within the examples in the diagram showing the limitations of use. The meaning of the surfaces marked in colour are to be observed. Limiting areas should not be selected for layout or continuous operating points.

Performance data

Performance specifications for R404A/R507 are based on 20°C suction gas temperatures without liquid subcooling. Compressor speed 1450 rpm.
The values can be stated to judge the overall performance at other speed with the help of the calculation factors below.

For additional technical data for other operating points see GEA Bock software.



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R404A/R507	Performance data	1.450 rpm

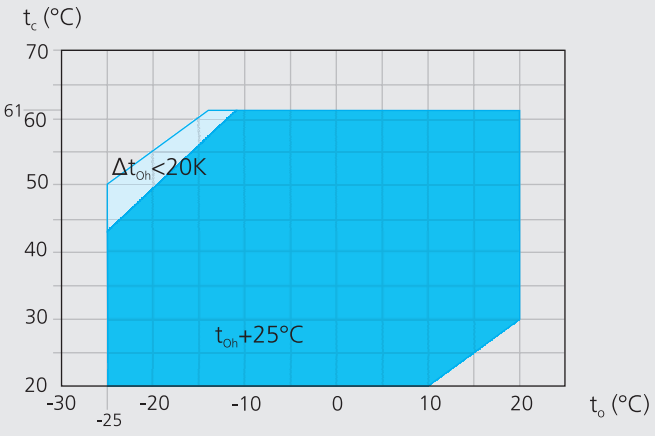
Type	Cond. temp. °C		Cooling capacity $\dot{Q}_o$ [W] / Power P [kW]	Evaporating temperature °C										
				10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
FX2	30	Q		13423	11418	9621	8020	6606	5366	4290	3366	2584	1933	1402	979
		P		2,21	2,19	2,13	2,05	1,94	1,80	1,65	1,48	1,31	1,12	0,94	0,75
	40	Q		11561	9785	8201	6797	5562	4485	3555	2761	2092	1537	1085	724
		P		2,65	2,56	2,44	2,30	2,13	1,95	1,76	1,55	1,34	1,12	0,91	0,70
	50	Q		9652	8113	6749	5548	4500	3593	2816	2159	1609	1157	791	
		P		3,03	2,88	2,71	2,51	2,30	2,07	1,83	1,59	1,34	1,10	0,86	
FX3	30	Q		28402	24165	20377	17011	14041	11442	9187	7251	5608	4231	3096	2175
		P		3,92	3,97	3,94	3,83	3,66	3,44	3,17	2,88	2,56	2,23	1,90	1,57
	40	Q		24498	20763	17437	14495	11911	9657	7710	6042	4628	3442	2458	1650
		P		4,97	4,85	4,66	4,41	4,11	3,77	3,40	3,01	2,61	2,21	1,83	1,46
	50	Q		20584	17356	14498	11985	9791	7889	6254	4860	3680	2690	1862	
		P		5,90	5,62	5,28	4,89	4,47	4,02	3,56	3,08	2,61	2,15	1,72	
FX4	30	Q		53909	45836	38585	32117	26393	21373	17019	13292	10151	7559	5476	3862
		P		8,34	8,30	8,09	7,73	7,25	6,68	6,04	5,36	4,66	3,96	3,29	2,69
	40	Q		46772	39538	33069	27326	22270	17862	14063	10834	8135	5928	4173	2832
		P		10,09	9,75	9,27	8,67	7,98	7,21	6,41	5,59	4,78	4,00	3,27	2,63
	50	Q		39157	32814	27179	22214	17880	14137	10946	8268	6064	4295	2922	
		P		11,44	10,83	10,10	9,28	8,40	7,47	6,53	5,59	4,69	3,85	3,09	
FX5	30	Q		95654	81844	69253	57854	47620	38522	30533	23624	17768	12938	9105	6242
		P		12,98	13,48	13,55	13,24	12,62	11,75	10,69	9,49	8,22	6,94	5,70	4,57
	40	Q		83330	70784	59401	49154	40014	31955	24949	18967	13981	9965	6890	4728
		P		16,87	16,64	16,05	15,16	14,03	12,72	11,28	9,79	8,29	6,85	5,53	4,39
	50	Q		70427	59251	49183	40194	32258	25345	19428	14480	10472	7377	5168	
		P		20,21	19,31	18,12	16,70	15,11	13,41	11,67	9,93	8,26	6,73	5,38	
FX14/1166	30	Q		131605	112604	95281	79598	65518	53000	42008	32503	24447	17801	12527	8587
		P		17,86	18,55	18,64	18,22	17,37	16,17	14,71	13,06	11,32	9,55	7,85	6,29
	40	Q		114650	97388	81727	67628	55054	43966	34326	26096	19237	13711	9480	6506
		P		23,21	22,89	22,08	20,86	19,30	17,49	15,52	13,47	11,41	9,43	7,61	6,04
	50	Q		96896	81521	67668	55301	44382	34871	26730	19922	14408	10150	7110	
		P		27,80	26,56	24,92	22,97	20,79	18,45	16,05	13,66	11,37	9,25	7,40	
FX14/1366	30	Q		154448	132149	111819	93414	76889	62199	49299	38144	28690	20890	14701	10078
		P		20,96	21,77	21,87	21,38	20,38	18,98	17,26	15,33	13,28	11,21	9,21	7,38
	40	Q		134550	114291	95912	79366	64609	51597	40284	30625	22575	16091	11125	7635
		P		27,24	26,87	25,91	24,48	22,65	20,53	18,22	15,80	13,39	11,06	8,93	7,09
	50	Q		113715	95670	79413	64900	52085	40923	31370	23380	16909	11912	8344	
		P		32,63	31,17	29,25	26,96	24,40	21,66	18,84	16,03	13,34	10,86	8,68	
FX16/1751	30	Q		197537	169017	143016	119476	98341	79552	63053	48786	36694	26719	18803	12890
		P		26,81	27,84	27,98	27,34	26,07	24,27	22,08	19,61	16,98	14,33	11,78	9,44
	40	Q		172088	146178	122670	101508	82635	65992	51523	39169	28874	20580	14229	9765
		P		34,84	34,36	33,14	31,30	28,97	26,26	23,30	20,21	17,12	14,15	11,42	9,06
	50	Q		145440	122361	101569	83006	66616	52340	40122	29903	21627	15236	10672	
		P		41,73	39,87	37,41	34,48	31,20	27,70	24,09	20,50	17,06	13,89	11,11	
FX16/2051	30	Q		231541	198112	167635	140043	115270	93247	73908	57185	43011	31318	22040	15108
		P		31,42	32,63	32,79	32,05	30,56	28,45	25,88	22,98	19,91	16,80	13,81	11,07
	40	Q		201712	171341	143787	118983	96860	77352	60392	45912	33845	24123	16679	11446
		P		40,83	40,28	38,85	36,69	33,96	30,78	27,31	23,69	20,07	16,59	13,39	10,62
	50	Q		170476	143424	119053	97295	78083	61350	47028	35051	25350	17858	12509	
		P		48,92	46,73	43,85	40,42	36,57	32,47	28,24	24,03	20,00	16,28	13,02	

Based on 20°C suction gas temperature
without liquid subcooling

Supplementary cooling or
reduced suction gas temp.

R407C Limits of application

FX2, FX3, FX4, FX5, FX14, FX16



Unlimited application range

Supplementary cooling or reduced suction gas temperature

t_O Evaporating temperature (°C)
t_C Condensing temperature (°C)
t_{Oh} Suction gas temperature (°C)
Δt_{Oh} Suction gas overheating (K)

Maximum permissible operating pressure (LP/HP)[1]: 19/28 bar

[1] LP = low pressure HP = high pressure

R407C Notes

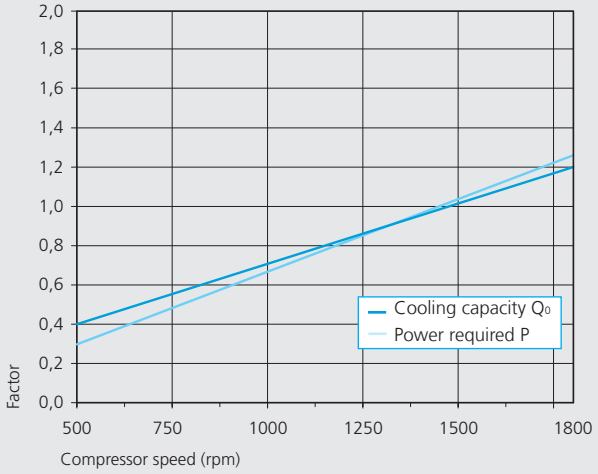
Limits of application

Compressor operation is possible within the examples in the diagram showing the limitations of use. The meaning of the surfaces marked in colour are to be observed. Limiting areas should not be selected for layout or continuous operating points.

Performance data

Performance specifications for R407C are based on 25°C suction gas temperatures without liquid subcooling. Compressor speed 1450 rpm.
The values can be stated to judge the overall performance at other speed with the help of the calculation factors below.

For additional technical data for other operating points see GEA Bock software.



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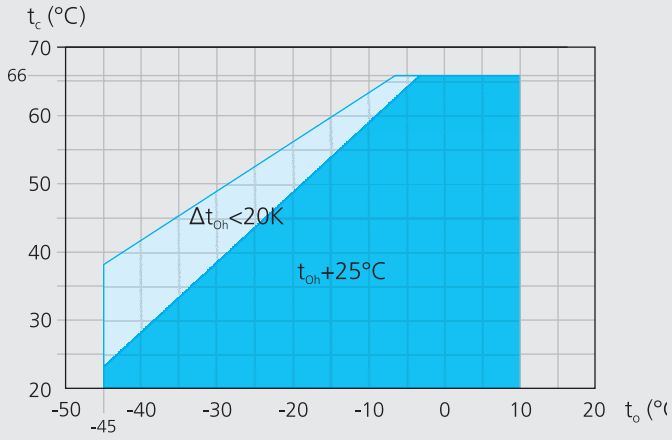
R407C			Performance data									1.450 rpm
Type	Cond. temp. °C		Cooling capacity $\dot{Q}_o$ [W]					Power P [kW]				
			Evaporating temperature °C									
			15	12,5	10	5	0	-5	-10	-15	-20	-25
FX2	30	Q	14121	12935	11824	9817	8075	6576	5296	4209	3292	2522
		P	1,39	1,47	1,54	1,60	1,61	1,56	1,47	1,36	1,23	1,10
	40	Q	12635	11555	10545	8724	7149	5796	4640	3657	2824	2117
		P	2,06	2,09	2,09	2,06	1,97	1,85	1,71	1,55	1,38	1,24
	50	Q	11089	10118	9213	7586	6184	4984	3960	3089	2346	1709
		P	2,65	2,62	2,57	2,45	2,29	2,11	1,91	1,72	1,54	1,38
FX3	30	Q	27301	25007	22860	18980	15614	12716	10240	8138	6366	4875
		P	2,69	2,85	2,97	3,10	3,11	3,01	2,85	2,63	2,38	2,13
	40	Q	24426	22338	20386	16867	13823	11206	8971	7071	5460	4092
		P	3,99	4,03	4,05	3,98	3,82	3,58	3,30	2,99	2,68	2,39
	50	Q	21437	19561	17812	14667	11957	9636	7656	5971	4536	3304
		P	5,12	5,06	4,97	4,74	4,43	4,07	3,70	3,32	2,97	2,67
FX4	30	Q	54466	49891	45607	37866	31151	25369	20429	16236	12699	9726
		P	5,37	5,69	5,92	6,18	6,20	6,01	5,68	5,24	4,75	4,24
	40	Q	48732	44566	40672	33651	27577	22356	17897	14107	10893	8163
		P	7,96	8,05	8,07	7,94	7,61	7,15	6,58	5,96	5,34	4,76
	50	Q	42767	39025	35535	29262	23855	19224	15274	11913	9050	6591
		P	10,21	10,09	9,92	9,45	8,83	8,13	7,38	6,63	5,93	5,32
FX5	30	Q	99116	90790	82994	68907	56687	46165	37174	29545	23110	17699
		P	9,77	10,35	10,78	11,25	11,27	10,94	10,33	9,53	8,64	7,73
	40	Q	88680	81100	74013	61236	50182	40682	32568	25671	19823	14856
		P	14,48	14,64	14,68	14,44	13,85	13,00	11,97	10,85	9,72	8,67
	50	Q	77827	71017	64665	53248	43410	34982	27794	21679	16469	11995
		P	18,57	18,36	18,05	17,19	16,08	14,79	13,42	12,06	10,78	9,68
FX14/1166	30	Q	136367	124912	114186	94805	77993	63517	51147	40650	31796	24352
		P	13,45	14,24	14,83	15,47	15,51	15,05	14,21	13,12	11,88	10,63
	40	Q	122008	111579	101830	84252	69043	55973	44809	35320	27274	20439
		P	19,92	20,14	20,20	19,87	19,06	17,89	16,47	14,93	13,37	11,93
	50	Q	107077	97708	88968	73262	59727	48130	38241	29828	22659	16503
		P	25,55	25,26	24,84	23,65	22,12	20,35	18,47	16,59	14,84	13,32
FX14/1366	30	Q	160037	146594	134006	111261	91531	74543	60025	47706	37314	28578
		P	15,78	16,71	17,40	18,16	18,20	17,66	16,68	15,39	13,95	12,47
	40	Q	143185	130946	119504	98876	81028	65689	52587	41450	32007	23987
		P	23,38	23,64	23,70	23,32	22,37	20,99	19,33	17,52	15,69	14,00
	50	Q	125661	114666	104410	85978	70093	56484	44878	35005	26592	19367
		P	29,99	29,64	29,15	27,76	25,96	23,88	21,68	19,47	17,41	15,63
FX16/1751	30	Q	204684	187491	171392	142302	117067	95339	76771	61015	47725	36551
		P	20,19	21,37	22,25	23,22	23,28	22,58	21,33	19,69	17,84	15,95
	40	Q	183133	167479	152845	126461	103634	84015	67258	53015	40937	30679
		P	29,91	30,23	30,32	29,82	28,61	26,85	24,72	22,40	20,07	17,90
	50	Q	160720	146658	133540	109966	89649	72243	57399	44771	34010	24770
		P	38,35	37,92	37,28	35,50	33,20	30,55	27,72	24,90	22,27	19,99
FX16/2051	30	Q	239918	219766	200895	166798	137219	111751	89987	71519	55940	42843
		P	23,66	25,05	26,08	27,22	27,28	26,47	25,00	23,08	20,91	18,70
	40	Q	214657	196309	179156	148231	121474	98478	78836	62141	47985	35960
		P	35,05	35,44	35,53	34,96	33,53	31,47	28,98	26,26	23,53	20,99
	50	Q	188386	171903	156528	128895	105081	84679	67280	52478	39865	29034
		P	44,95	44,44	43,70	41,62	38,92	35,81	32,50	29,19	26,10	23,43

Based on 25°C suction gas temperature
without liquid subcooling

Supplementary cooling or
reduced suction gas temp.

R22 Limits of application

FX2, FX3, FX4, FX5, FX14, FX16



Unlimited application range

Supplementary cooling or reduced suction gas temperature

t_O Evaporating temperature (°C)
t_C Condensing temperature (°C)
t_{Oh} Suction gas temperature (°C)
Δt_{Oh} Suction gas overheating (K)

Maximum permissible operating pressure (LP/HP)[1]: 19/28 bar

[1] LP = low pressure HP = high pressure

R22 Notes

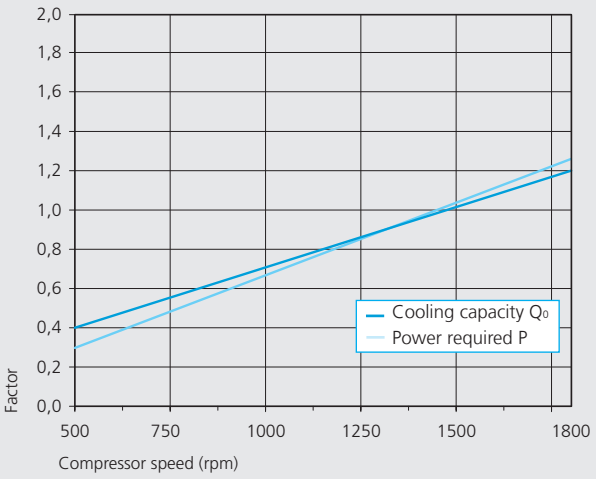
Limits of application

Compressor operation is possible within the examples in the diagram showing the limitations of use. The meaning of the surfaces marked in colour are to be observed. Limiting areas should not be selected for layout or continuous operating points.

Performance data

Performance specifications for R22 are based on 25°C suction gas temperatures without liquid subcooling. Compressor speed 1450 rpm.
The values can be stated to judge the overall performance at other speed with the help of the calculation factors below.

For additional technical data for other operating points see GEA Bock software.



06/2011 – 96023-06.2011-Gb ◦ Subject to modification

R22			Performance data										1.450 rpm
Type	Cond. temp. °C		Cooling capacity $\dot{Q}_o$ [W]					Power P [kW]					
			Evaporating temperature °C										
			10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
F2	30	Q	12420	10492	8792	7303	6007	4889	3932	3118	2431	1854	1370
		P	1,48	1,59	1,63	1,63	1,59	1,51	1,42	1,31	1,20	1,09	1,00
	40	Q	11359	9565	7987	6610	5415	4386	3507	2760	2129	1597	1147
		P	2,04	2,07	2,04	1,98	1,88	1,76	1,63	1,49	1,36	1,24	1,15
	50	Q	10263	8608	7157	5895	4805	3871	3074	2398			
		P	2,57	2,52	2,43	2,30	2,15	1,99	1,83	1,67			
F3	30	Q	24080	20342	17046	14158	11646	9479	7622	6044	4712	3593	2656
		P	2,87	3,08	3,16	3,16	3,08	2,93	2,75	2,54	2,33	2,12	1,94
	40	Q	22022	18543	15485	12814	10497	8503	6798	5350	4127	3095	2223
		P	3,96	4,01	3,96	3,83	3,64	3,41	3,16	2,89	2,64	2,41	2,23
	50	Q	19897	16687	13875	11429	9316	7503	5959	4649			
		P	4,99	4,89	4,71	4,46	4,18	3,86	3,54	3,23			
F4	30	Q	48161	40685	34091	28316	23293	18957	15244	12088	9424	7187	5312
		P	5,75	6,15	6,33	6,32	6,15	5,87	5,50	5,08	4,65	4,24	3,88
	40	Q	44044	37087	30970	25627	20994	17005	13596	10700	8253	6191	4446
		P	7,92	8,01	7,92	7,66	7,29	6,82	6,31	5,78	5,28	4,82	4,46
	50	Q	39795	33374	27750	22858	18632	15006	11917	9299			
		P	9,98	9,77	9,41	8,93	8,35	7,73	7,08	6,46			
F5	30	Q	87555	73963	61977	51477	42345	34463	27712	21975	17132	13065	9656
		P	10,45	11,18	11,51	11,49	11,19	10,67	10,00	9,24	8,46	7,71	7,06
	40	Q	80069	67422	56302	46589	38166	30915	24716	19452	15004	11254	8084
		P	14,40	14,57	14,39	13,93	13,25	12,41	11,48	10,52	9,59	8,76	8,10
	50	Q	72345	60673	50449	41554	33871	27281	21665	16905			
		P	18,14	17,77	17,11	16,23	15,18	14,05	12,88	11,74			
F14/1166	30	Q	120460	101761	85270	70824	58260	47416	38128	30234	23571	17976	13286
		P	14,38	15,39	15,83	15,80	15,39	14,68	13,76	12,71	11,63	10,61	9,72
	40	Q	110163	92762	77462	64100	52511	42534	34006	26763	20644	15484	11121
		P	19,82	20,05	19,80	19,16	18,22	17,07	15,79	14,47	13,20	12,06	11,14
	50	Q	99536	83477	69410	57173	46602	37535	29808	23259			
		P	24,96	24,45	23,54	22,32	20,89	19,33	17,72	16,15			
F14/1366	30	Q	141369	119424	100070	83117	68372	55646	44746	35482	27662	21096	15592
		P	16,88	18,06	18,58	18,55	18,06	17,23	16,15	14,92	13,65	12,45	11,40
	40	Q	129284	108863	90907	75225	61625	49917	39908	31409	24227	18172	13052
		P	23,26	23,53	23,24	22,49	21,39	20,03	18,53	16,98	15,49	14,15	13,08
	50	Q	116813	97966	81458	67096	54690	44049	34982	27296			
		P	29,29	28,69	27,62	26,20	24,52	22,68	20,79	18,96			
F16/1751	30	Q	180811	152743	127990	106306	87448	71171	57230	45381	35380	26982	19942
		P	21,58	23,09	23,76	23,72	23,10	22,03	20,65	19,08	17,46	15,92	14,59
	40	Q	165353	139235	116270	96212	78818	63843	51042	40171	30986	23241	16693
		P	29,74	30,09	29,72	28,76	27,35	25,62	23,70	21,72	19,81	18,10	16,73
	50	Q	149402	125297	104183	85815	69948	56338	44741	34911			
		P	37,46	36,69	35,33	33,51	31,36	29,01	26,60	24,25			
F16/2051	30	Q	211935	179036	150022	124606	102501	83422	67081	53193	41470	31626	23375
		P	25,30	27,07	27,85	27,80	27,08	25,83	24,21	22,37	20,47	18,66	17,10
	40	Q	193817	163203	136285	112775	92386	74833	59829	47086	36320	27242	19567
		P	34,86	35,27	34,83	33,71	32,06	30,03	27,78	25,45	23,22	21,21	19,61
	50	Q	175120	146867	122118	100588	81990	66037	52443	40921			
		P	43,91	43,01	41,41	39,28	36,76	34,00	31,17	28,42			

Based on 25°C suction gas temperature
without liquid subcooling

Supplementary cooling or
reduced suction gas temp.

F Type	Number of cylinders	Displacement (1.450 rpm)	Weight	Connections ①		Oil charge	Speed range
				Discharge line DV	Suction line SV		
		m³/h	kg	mm I inch	mm I inch	Ltr.	rpm
F2	2	10,5	18	16 I 5/8	16 I 5/8	0,8	960 - 1800
F3	2	20,3	28	22 I 7/8	28 I 1 1/8	1,5	960 - 1800
F4	4	40,5	51	28 I 1 1/8	35 I 1 3/8	2,6	500 - 1800
F5	4	73,7	85	35 I 1 3/8	2 x 35 I 2 x 1 3/8	3,8	500 - 1800
F14/1166	4	101,5	149	42 I 1 5/8	54 I 2 1/8	3,8	700 - 1800
F14/1366	4	118,9	149	42 I 1 5/8	54 I 2 1/8	3,8	700 - 1800
F16/1751	6	152,2	175	42 I 1 5/8	54 I 2 1/8	5,0	700 - 1800
F16/2051	6	178,4	175	42 I 1 5/8	54 I 2 1/8	5,0	700 - 1800

① For soldering connections

Oil sump heater: 230 V – 1 – 50/60 Hz

F2: 40 W (option)

F3: 60 W (option)

F4, F5: 80 W (standard)

F14, F16: 140 W (standard)

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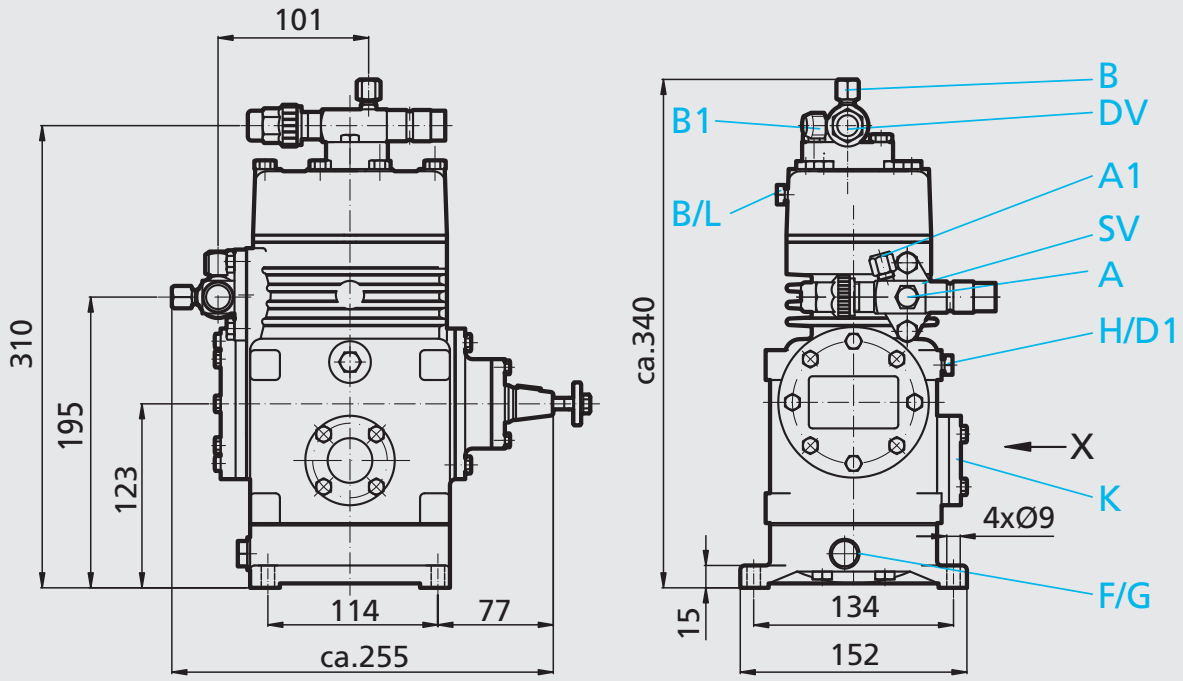
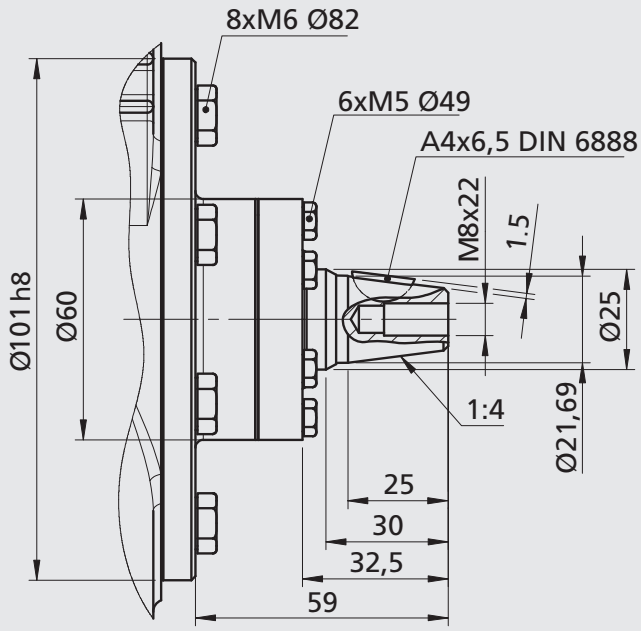
F2



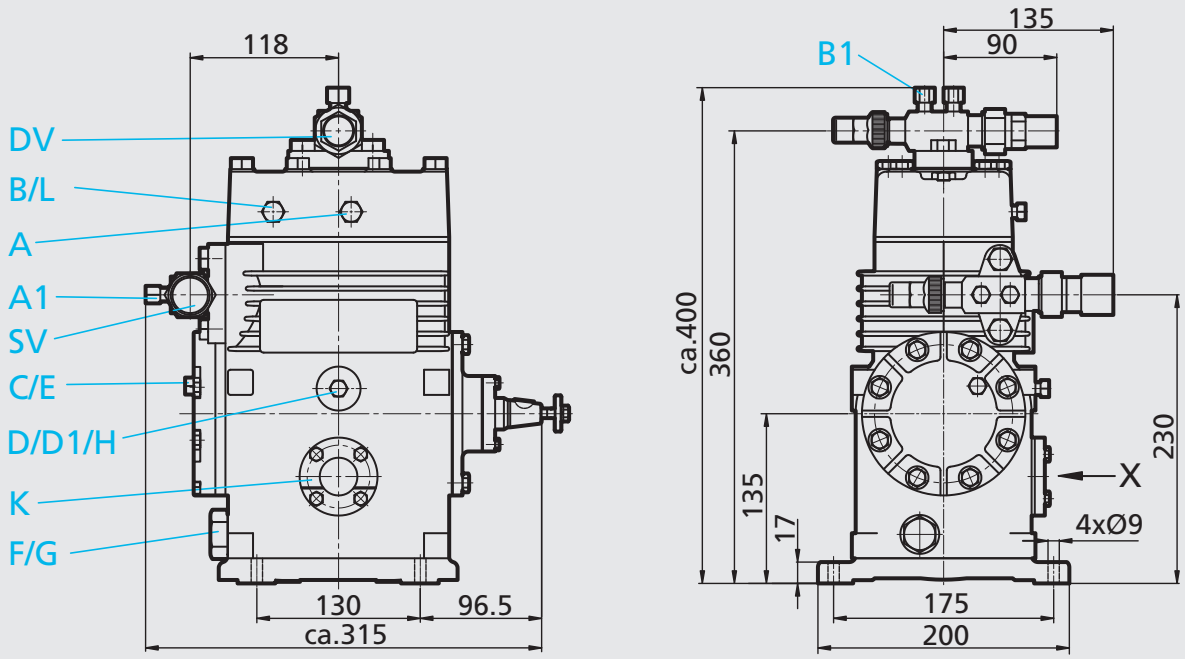
Shaft end



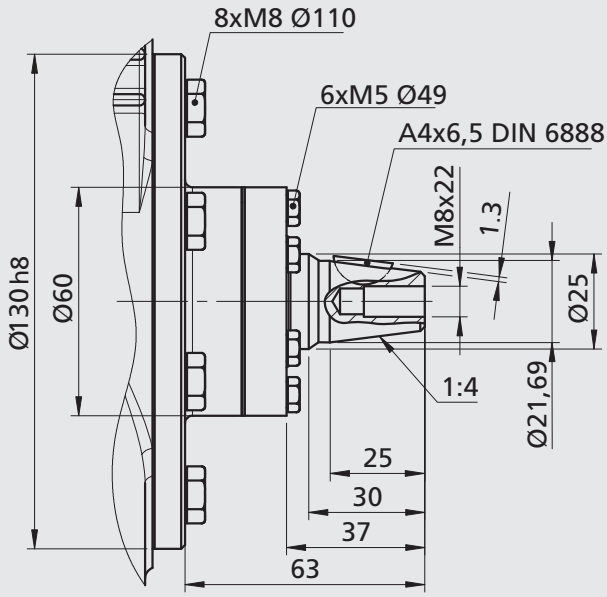
Dimensions in mm

- Connections see page 31
- Dimensions for view X see page 29

F3



Shaft end



Dimensions in mm

- Connections see page 31
- Dimensions for view X see page 29

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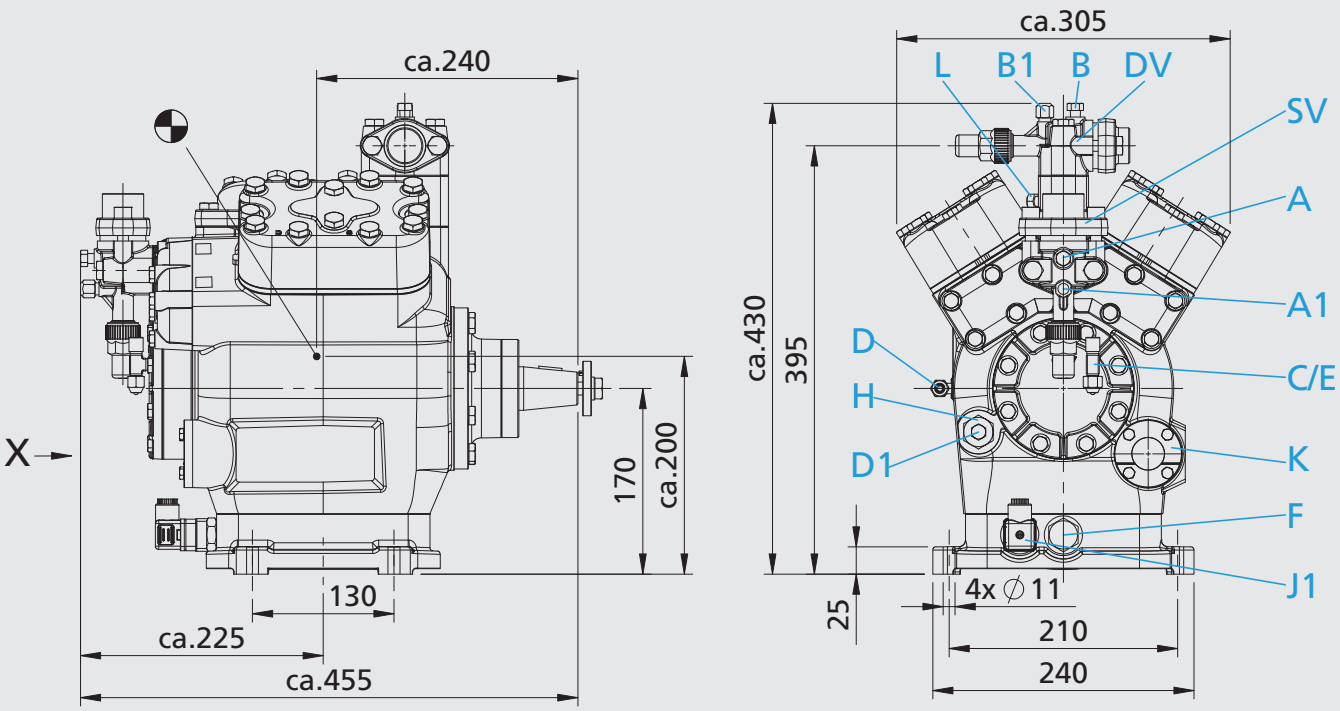
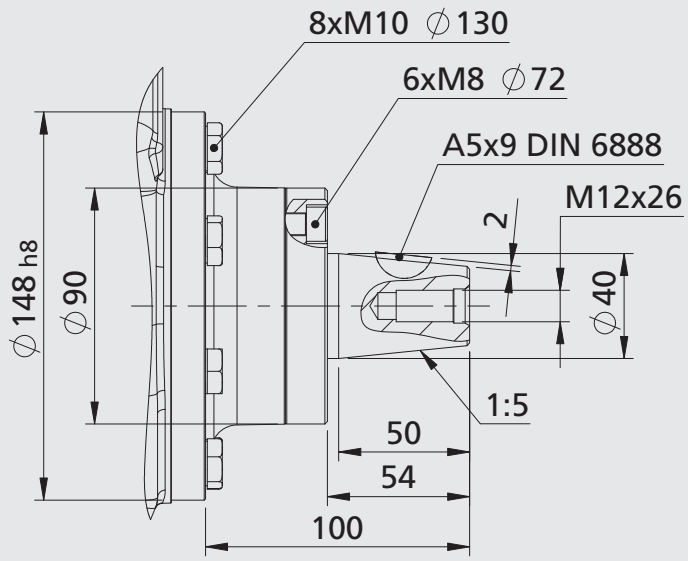
F4



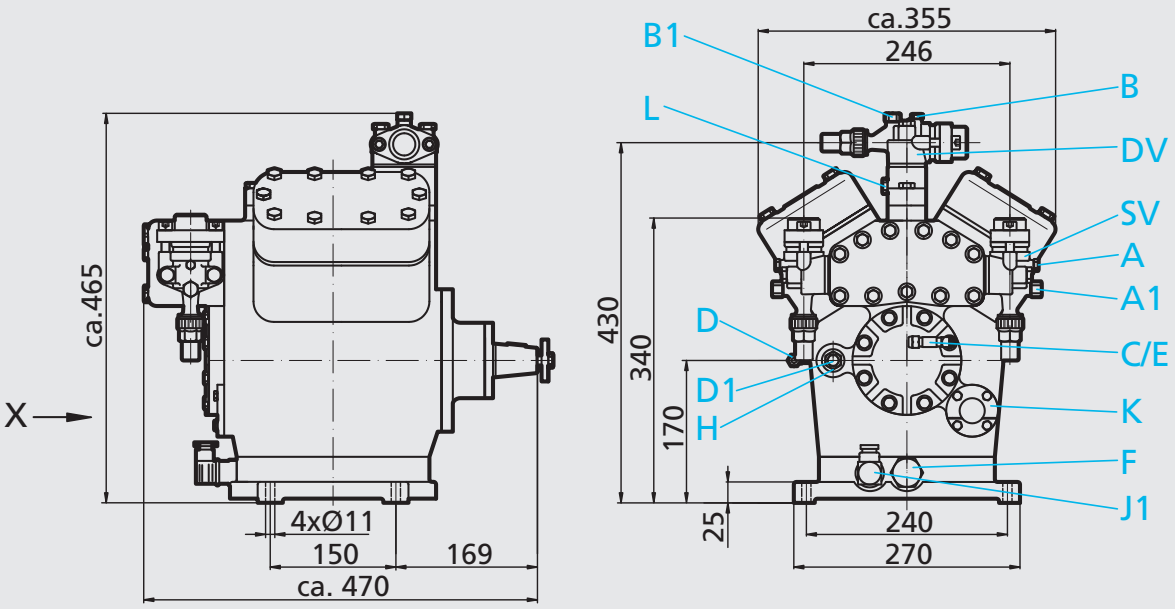
Shaft end



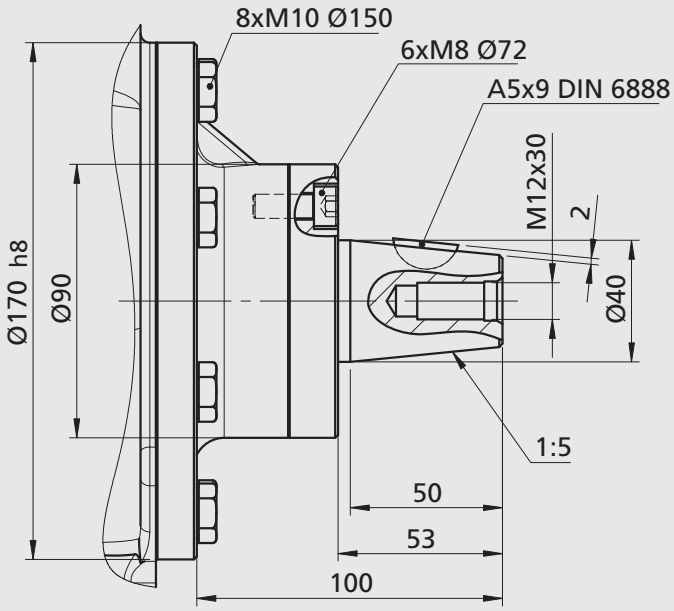
Dimensions in mm
Centre of gravity

- Connections see page 31
- Dimensions for view X see page 29

F5



Shaft end



Dimensions in mm

- Connections see page 31
- Dimensions for view X see page 29

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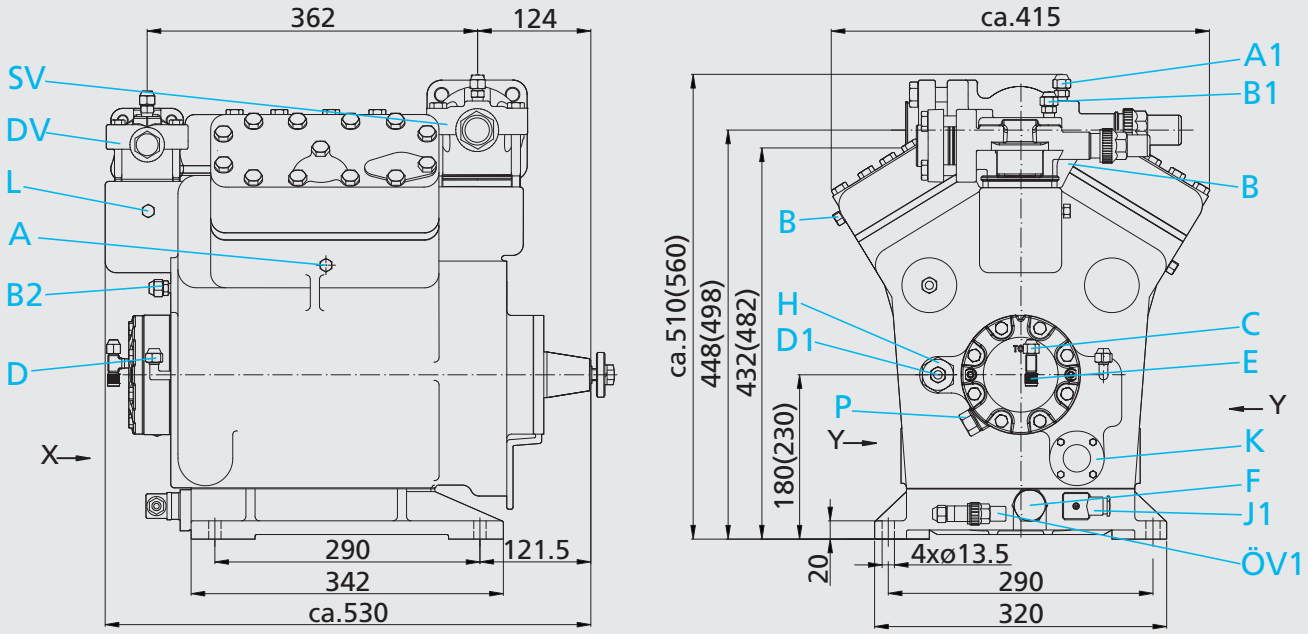
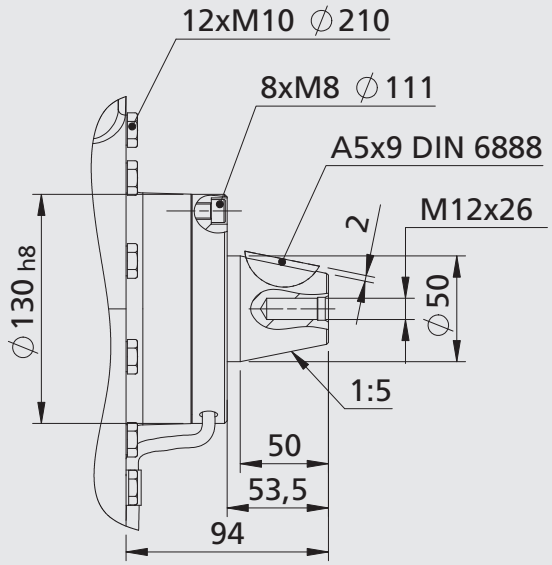
F14

F14/1166 F14/1366



Shaft end

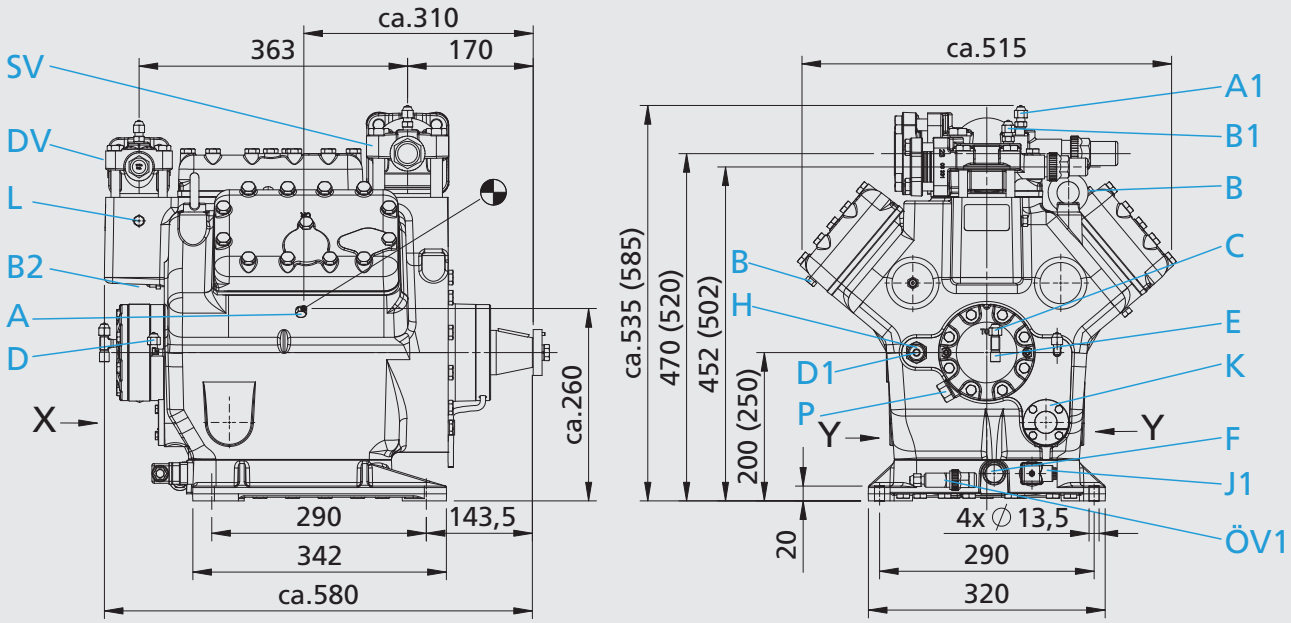


Dimensions in mm

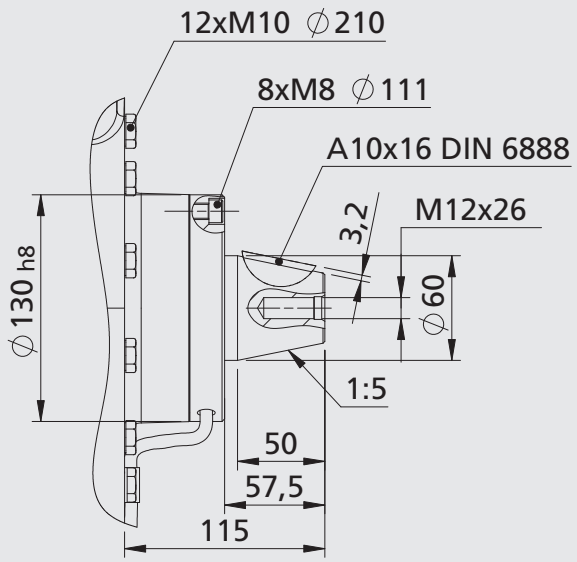
- Connections see page 31
- Dimensions for view X see page 29

F16

F16/1751 F16/2051



Shaft end



Dimensions in mm

Centre of gravity

- Connections see page 31
- Dimensions for view X see page 29

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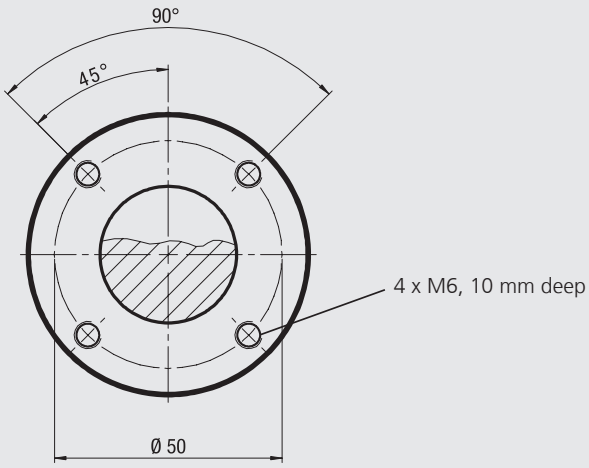
View X,Y

- Oil sight glass
- Connection facility for parallel operation

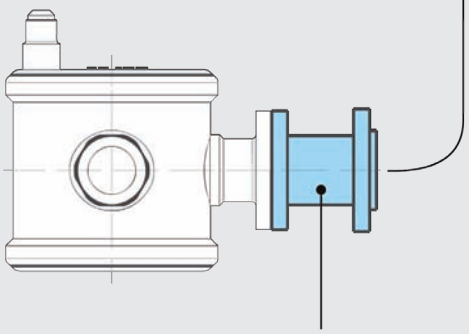
Position view X:
F2, F3, F4, F5, F14, F16
4 hole oil sightglass

Position view Y:
F14, F16
Second oil sightglass can be attached as an option
(available as original equipment only)



Connection facilities

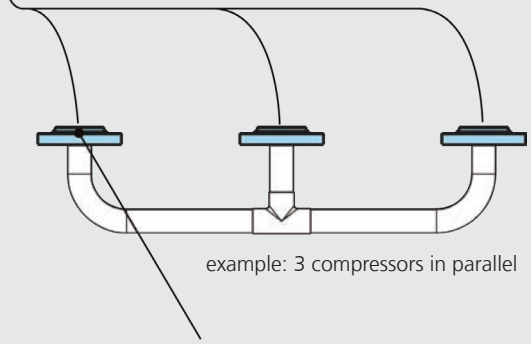
A Operation with oil level regulator



Art.Nr. 80462

Bock adapter for oil level regulator,
fits the makes ESK, AC+R, CARLY.
3 hole fastener on the side of the oil level regulator
4 hole fastener on the side of the compressor

B Operation with common oil-gas balance pipe



example: 3 compressors in parallel

Art.Nr. 80463

Bock adapter for oil-gas regulator,
single design, 4 hole steel connector for
Pipe Ø 35 mm, fits all sightglass positions.
1 item per compressor required.

Dimensions and connections

Connections		F2	F3	F4	F5	F14	F16
SV DV	Suction line Discharge line			see technical data, page 22			
A	Connection suction side, not lockable	7/16 " UNF	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF
A1	Connection suction side, lockable	7/16 " UNF	7/16 " UNF	7/16 " UNF	7/16 " UNF	7/16 " UNF	7/16 " UNF
B	Connection discharge side, not lockable	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF
B1	Connection discharge side, lockable	7/16 " UNF	7/16 " UNF	7/16 " UNF	7/16 " UNF	7/16 " UNF	7/16 " UNF
B2	Connection discharge side, not lockable	-	-	-	-	7/16 " UNF	7/16 " UNF
C	Connection oil pressure safety switch OIL	-	1/8 " NPTF	7/16 " UNF	7/16 " UNF	7/16 " UNF	7/16 " UNF
D	Connection oil pressure safety switch LP	-	1/8 " NPTF	7/16 " UNF	7/16 " UNF	7/16 " UNF	7/16 " UNF
D1	Connection oil return from oil separator	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF	5/8 " UNF	5/8 " UNF
E	Connection oil pressure gauge	-	1/8 " NPTF	7/16 " UNF	7/16 " UNF	7/16 " UNF	7/16 " UNF
F	Oildrain	R 3/8 "	M 22 x 1,5	M 22 x 1,5	M 22 x 1,5	M 26 x 1,5	M 26 x 1,5
G	Oil sump heater plug	R 3/8 "	M 22 x 1,5	-	-	-	-
H	Oil charge plug	1/8 " NPTF	1/8 " NPTF	M 22 x 1,5	M 22 x 1,5	M 22 x 1,5	M 22 x 1,5
J1	Oil sump heater	- [1]	- [1]	M 22 x 1,5	M 22 x 1,5	M 22 x 1,5	M 22 x 1,5
K	Sight glass	4 hole M 6	4 hole M 6	4 hole M 6	4 hole M 6	4 hole M 6 [2]	4 hole M 6 [2]
L	Connection thermal protection thermostat	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF
P	Connection oil pressure differential sensor	-	-	-	-	M 20 x 1,5	M 20 x 1,5
ÖV1	Oil service valve	-	-	-	-	7/16 " UNF	7/16 " UNF

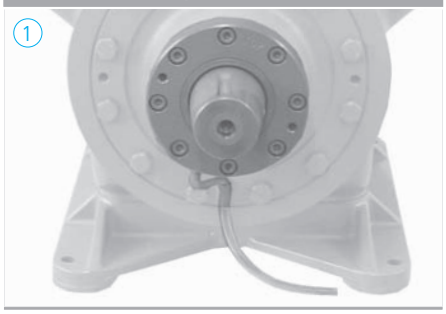
[1] Oil sump heating optional

[2] Second sightglass can be attached,
Positioning view Y (optional, available only as original equipment)

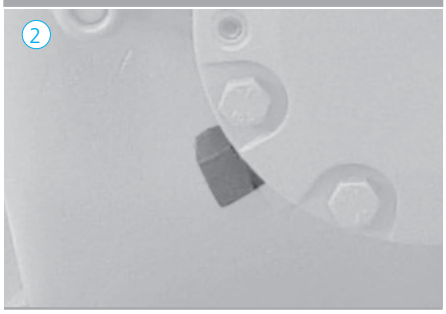
Scope of supply

Scope of supply	F2	F3	F4	F5	F14	F16
Open type compressor with suction and discharge shutt-off valves	●	●	●	●	●	●
Two cylinder, cylinder arrangement in row	●	●				
Four cylinder, cylinder arrangement in V			●	●	●	
Six cylinder, cylinder arrangement in W						●
Seat front bearing flange	●	●	●	●	●	●
① Shaft seal with piece of tube for controlled oil collection					●	●
② Oil pump cover with screw-in option for oil differential pressure switch (Δp-switch by Kriwan)					●	●
Oil sump heater 230 V - 1 - 50/60 Hz, 80 W			●	●		
Oil sump heater 230 V - 1 - 50/60 Hz, 140 W					●	●
③ Oil service valve					●	●
Oil filling: F: FUCHS Reniso SP 46 FX: FUCHS Reniso Triton SE 55	●	●	●	●	●	●
Sight glass	●	●	●	●	●	●
Compressor safety valve			●	●	●	●
Inert gas charge	●	●	●	●	●	●

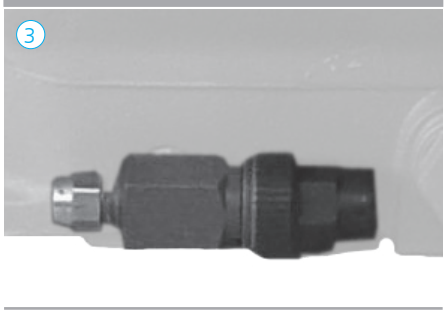
Shaft seal with piece of tube



Screw-in option for oil differential pressure switch



Oil service valve



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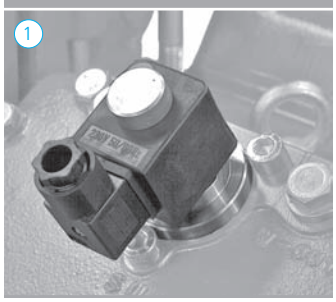
Accessories	F2	F3	F4	F5	F14	F16
① Start unloader 230 V - 1 - 50/60 Hz, IP 65, without check valve, including thermal protection thermostat (bimetallic sensor)		●	●	●	●	●
② Capacity regulator 230 V - 1 - 50/60 Hz, IP 65 1 Capacity regulator = 50 % residual capacity			●	●	●	
Capacity regulator 230 V - 1 - 50/60 Hz, IP 65 1-2 Capacity regulator = 66/33 % residual capacity						●
③ Compressor flywheel	●	●	●	●	●	●
④ Shaft coupling for direct drive [1]	●	●	●	●	●	●
⑤ Oil pressure safety switch MP 54 230 V - 1 - 50/60 Hz, IP 20, incl. mounting		●	●	●	●	●
Oil differential pressure switch (Δp-switch by Kriwan) 220-240 V - 1 - 50/60 Hz					●	●
⑥ Oil sump heater 230 V - 1 - 50/60 Hz, IP 65	●	●				
⑦ Two additional sight glasses (both-sided), positioning view Y [2]					●	●
⑧ Thermal protection thermostat (bimetal sensor)	●	●	●	●	●	●
⑨ Water-cooled cylinder covers Sea water resistant water-cooled cylinder covers		●	●	●	●	●
⑩ Elevated base plate (oil volume plus 2.5 litres)					●	●

[1] Please state motor Ø and feather key groove dimensions when ordering shafts
[2] Available as original equipment only

Start unloader

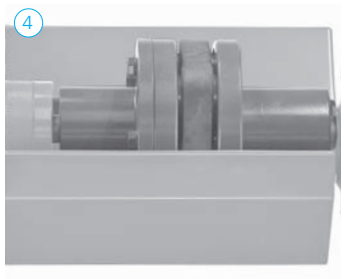


Capacity regulator

Compressor flywheel

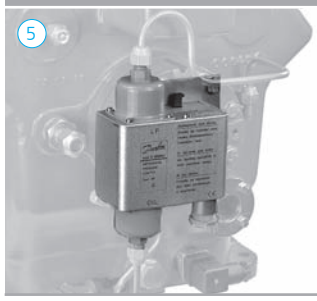
F2: Ø 165,2 x SPA
F3: Ø 210,2 x SPA
F4: Ø 210,3 x SPA
F5: Ø 230,4 x SPA
F14: Ø 322 x SPB
F16: Ø 322 x SPB

Shaft coupling



F2: WK 42.44
F3: WK 42.44
F4: WK 70.40
F5: WK 70.40
F14: WK 190.50
F16: WK 190.60

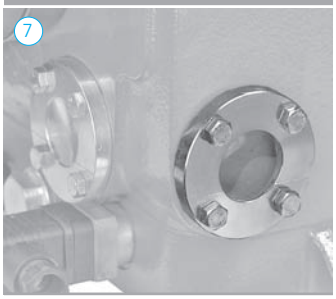
Oil pressure safety switch



Oil sump heater

F2: 40 Watt
F3: 60 Watt

Sight glass



Thermal protection thermostat

Water-cooled cylinder covers

Elevated base plate

Compressors for NH_3

Based on the F compressor series, a specially modified selection of compressors is available for use with the refrigerant R 717.

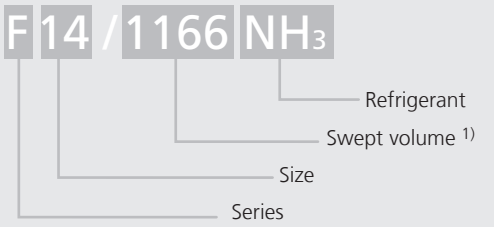
The particular features:

2, 4 and 6 cylinder models with displacements of 10 to 180 m³/h (1450 rpm)

Deviations from the basis compressor F:

- Pistons with three-ring assembly
- Con-rod with additional oil supply oil to the small end
- Valve plate with optimised pressure unit
- Shut-off valve with steel connector for welded joints
- All connections are designed as compression joints for steel pipes
- F14 NH3, F16 NH3 with increased oil volume by elevated base plate
- Special oil filling for NH3 (Fuchs Reniso KC 68)
- You will find further information on the F basis compressors in the chapter entitled „F series single-stage compressors“ from page 8 onwards.

Type key



1) Indication only at F14, F16

The current program

...6 model sizes with 8 capacity stages from 10,5 to 178,4 m³/h (1.450 rpm)

Models available	Displacement (1.450 rpm) [m³/h]
F2 NH3	10,5
F3 NH3	20,3
F4 NH3	40,5
F5 NH3	73,7
F14 NH3	101,5 / 118,9
F16 NH3	152,2 / 178,4

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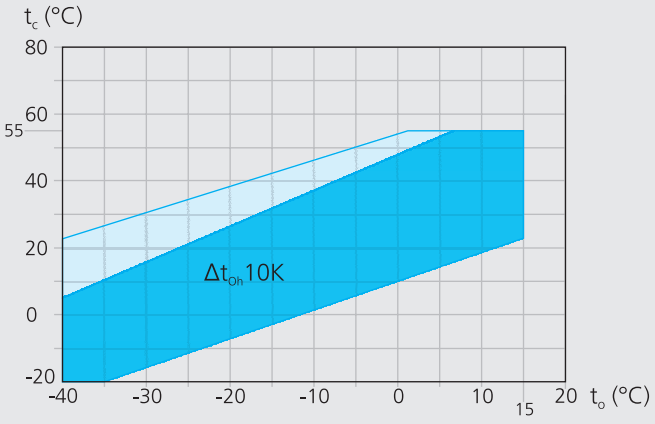
NH_3 Limits of application — F2 NH_3, F3 NH_3, F4 NH_3, F5 NH_3, F14 NH_3, F16 NH_3



Unlimited application range

Supplementary cooling necessary (e.g. water-cooled cylinder covers)

t_O Evaporating temperature (°C)
t_C Condensing temperature (°C)
Δt_{Oh} Suction gas overheating (K)

Maximum permissible operating pressure (LP/HP)[1]: 19/25 bar

[1] LP = low pressure HP = high pressure

NH_3 Notes

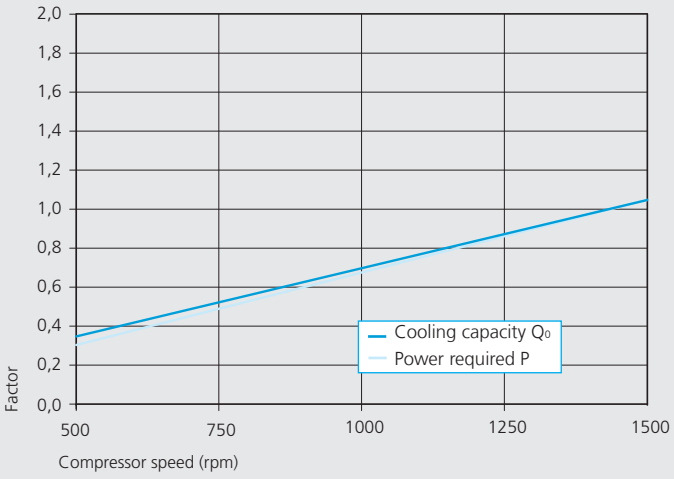
Limits of application

Compressor operation is possible within the examples in the diagram showing the limitations of use. The meaning of the surfaces marked in colour are to be observed. Limiting areas should not be selected for layout or continuous operating points.

Performance data

Performance specifications for the NH_3 are based on 10 K suction gas overheating without liquid subcooling. Compressor speed 1450 rpm. The values can be stated to judge the overall performance at other speed with the help of the calculation factors below.

For additional technical data for other operating points see GEA Bock software.



Operation with NH_3 and R723

NH_3 is a refrigerant traditionally used in industry and largescale refrigeration system, as NH_3 has considerably more vapouration heat and thus a larger volumetric refrigerating capacity than most F gases. That is why operating NH_3 at small capacities (< 30 KW, e.g. in the commercial sector) can be problematic.

NH_3 has a high adiabatic index and thus significantly higher pressure gas temperatures. On one hand, this greatly limits the application range with regard to low temperatures; on the other hand, this requires thermally highly stable refrigeration oils. Nonsoluable mineral oils with a viscosity of 68 are used as standard - Fuchs Reniso KC 68. Flooded operation is customary.

In the case of dry expansion, please note that overheating results in higher hot-gas temperatures. That is why only low temperature conditions are possible or multi-stage refrigeration systems are necessary.

The use of mixable polyalkylene glycol oils (PAG) with dry expansion must be viewed critically due to the moisture problem (refrigerant NH_3 < 400 ppm and PAG oil < 250 ppm must be run extremely dry!)

For systems with plate heat exchangers, for example, the small pipe dimensions can result in oil return problems. Polyalphaolefin oils (PAO), e.g. Fuchs Reniso Synth 68, have proven themselves in the first applications. They are currently being tested in the field.

So far there has not yet been enough experience with R723 (60 % NH_3 + 40 % Dimethylether) to recommend its use. For R723, we also recommend using Reniso Synth 68.

Please consult our technical service if you have any questions about the current status of development.

NH3			Performance data											1.450 rpm
Type	Cond. temp. °C		Cooling capacity $\dot{Q}_o$ [W]				Power P [kW]							
			Evaporating temperature °C											
			15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
F2 NH3	10	Q					9554	7647	6011	4628	3477	2539	1794	1223
		P					1,30	1,26	1,20	1,12	1,03	0,94	0,85	0,78
	20	Q			13512	11006	8821	6938	5337	3999	2903	2032	1364	881
		P			1,45	1,48	1,46	1,41	1,34	1,25	1,14	1,03	0,92	0,83
	30	Q	18423	15250	12448	9997	7879	6073	4560	3320	2334	1583		
		P	1,68	1,78	1,82	1,81	1,75	1,66	1,55	1,41	1,25	1,09		
	40	Q	17056	13970	11267	8926	6927	5252	3880					
		P	2,29	2,32	2,30	2,22	2,09	1,92	1,73					
	50	Q	15665	12721	10169	7991								
		P	3,00	2,93	2,80	2,61								
F3 NH3	10	Q					18403	14729	11579	8914	6697	4890	3455	2356
		P					2,51	2,43	2,31	2,15	1,98	1,81	1,64	1,50
	20	Q			26028	21200	16991	13364	10280	7702	5593	3914	2628	1698
		P			2,79	2,84	2,81	2,72	2,58	2,40	2,20	1,99	1,78	1,59
	30	Q	35488	29375	23977	19257	15177	11698	8783	6395	4497	3049		
		P	3,24	3,42	3,50	3,48	3,38	3,21	2,98	2,71	2,41	2,09		
	40	Q	32853	26910	21703	17193	13343	10116	7474					
		P	4,42	4,48	4,42	4,27	4,02	3,70	3,32					
	50	Q	30174	24503	19589	15392								
		P	5,77	5,64	5,39	5,03								
F4 NH3	10	Q					36805	29458	23158	17828	13394	9780	6911	4711
		P					5,02	4,86	4,61	4,30	3,96	3,61	3,28	3,00
	20	Q			52057	42401	33983	26728	20560	15404	11186	7828	5256	3395
		P			5,59	5,68	5,63	5,44	5,16	4,80	4,40	3,98	3,56	3,18
	30	Q	70975	58750	47955	38514	30353	23396	17567	12791	8993	6098		
		P	6,47	6,85	7,00	6,96	6,75	6,41	5,95	5,41	4,82	4,19		
	40	Q	65706	53820	43405	34386	26687	20232	14948					
		P	8,83	8,96	8,85	8,54	8,05	7,41	6,65					
	50	Q	60348	49007	39177	30785								
		P	11,55	11,29	10,79	10,07								
F5 NH3	10	Q					66919	53561	42105	32415	24352	17782	12565	8566
		P					9,13	8,84	8,39	7,82	7,20	6,56	5,96	5,45
	20	Q			94648	77092	61787	48596	37382	28008	20337	14233	9557	6174
		P			10,16	10,33	10,23	9,90	9,38	8,73	8,00	7,23	6,48	5,79
	30	Q	129046	106818	87191	70026	55187	42538	31939	23256	16351	11087		
		P	11,77	12,45	12,72	12,65	12,28	11,65	10,83	9,84	8,76	7,61		
	40	Q	119466	97855	78918	62519	48521	36786	27178					
		P	16,06	16,28	16,09	15,52	14,63	13,47	12,09					
	50	Q	109724	89103	71232	55972								
		P	20,99	20,52	19,61	18,30								

Based on 10 K suction gas overheating
without liquid subcooling

Supplementary cooling necessary

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NH3			Performance data											1.450 rpm
Type	Cond. temp. °C		Cooling capacity $\dot{Q}_o$ [W]				Power P [kW]							
			Evaporating temperature °C											
			15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
F14/1166 NH3	10	Q					92172	73773	57994	44647	33542	24492	17307	11798
		P					12,57	12,17	11,55	10,78	9,92	9,04	8,21	7,50
	20	Q			130365	106184	85103	66934	51489	38577	28012	19604	13164	8503
		P			13,99	14,23	14,09	13,63	12,92	12,03	11,02	9,96	8,92	7,97
	30	Q	177743	147128	120094	96452	76013	58590	43992	32032	22521	15270		
		P	16,21	17,14	17,53	17,43	16,91	16,05	14,91	13,56	12,06	10,48		
	40	Q	164549	134782	108699	86112	66831	50668	37434					
		P	22,12	22,43	22,16	21,38	20,16	18,56	16,65					
	50	Q	151131	122728	98112	77094								
		P	28,92	28,27	27,01	25,21								
F14/1366 NH3	10	Q					108063	86492	67993	52344	39325	28714	20291	13832
		P					14,74	14,27	13,54	12,64	11,63	10,60	9,63	8,79
	20	Q			152842	124492	99776	78475	60366	45229	32842	22983	15433	9969
		P			16,41	16,69	16,52	15,98	15,15	14,10	12,92	11,68	10,46	9,34
	30	Q	208388	172495	140800	113081	89119	68691	51577	37555	26404	17903		
		P	19,01	20,10	20,55	20,43	19,83	18,82	17,48	15,90	14,14	12,29		
	40	Q	192919	158020	127441	100959	78354	59404	43889					
		P	25,93	26,29	25,98	25,07	23,63	21,76	19,52					
	50	Q	177188	143888	115028	90387								
		P	33,90	33,14	31,67	29,56								
F16/1751 NH3	10	Q					138257	110659	86991	66970	50313	36738	25960	17697
		P					18,86	18,26	17,33	16,17	14,88	13,56	12,32	11,25
	20	Q			195548	159276	127655	100402	77233	57866	42018	29405	19745	12755
		P			20,99	21,35	21,14	20,44	19,38	18,04	16,52	14,94	13,38	11,95
	60	Q	266615	220692	180141	144678	114020	87885	65988	48049	33782	22905		
		P	24,32	25,72	26,29	26,14	25,37	24,08	22,37	20,34	18,09	15,72		
	40	Q	246823	202173	163049	129168	100247	76002	56152					
		P	33,17	33,64	33,24	32,07	30,24	27,83	24,97					
	50	Q	226696	184092	147168	115642								
		P	43,37	42,40	40,51	37,82								
F16/2051 NH3	10	Q					162095	129738	101990	78517	58988	43072	30436	20749
		P					22,11	21,40	20,31	18,95	17,44	15,90	14,44	13,19
	20	Q			229263	186737	149664	117712	90549	67843	49262	34475	23150	14954
		P			24,61	25,03	24,78	23,97	22,72	21,15	19,37	17,51	15,69	14,02
	30	Q	312583	258742	211199	169622	133679	103037	77366	56333	39606	26855		
		P	28,51	30,15	30,82	30,65	29,74	28,23	26,22	23,84	21,21	18,44		
	40	Q	289379	237031	191161	151438	117531	89106	65833					
		P	38,89	39,44	38,97	37,60	35,45	32,63	29,27					
	50	Q	265781	215832	172542	135580								
		P	50,85	49,71	47,50	44,34								

Based on 10 K suction gas overheating
without liquid subcooling

Supplementary cooling necessary

F NH3 Type	Number of cylinders	Displacement (1.450 rpm)	Weight	Connections ①		Oil charge	Speed range
				Discharge line DV	Suction line SV		
		m³/h	kg	mm	mm	Ltr.	rpm
F2 NH3	2	10,5	18	18	18	0,8	960 - 1450
F3 NH3	2	20,3	28	25	30	1,5	960 - 1450
F4 NH3	4	40,5	51	30	38	2,6	700 - 1450
F5 NH3	4	73,7	85	38	2 x 38	3,8	700 - 1450
F14/1166 NH3	4	101,5	157	49	60	6,3	700 - 1450
F14/1366 NH3	4	118,9	158	49	60	6,3	700 - 1450
F16/1751 NH3	6	152,2	183	49	60	7,5	700 - 1450
F16/2051 NH3	6	178,4	183	49	60	7,5	700 - 1450

① for welded connections

Oil sump heater: 230 V – 1 – 50/60 Hz

F2 NH3: 40 W (option)

F3 NH3: 60 W (option)

F4 NH3, F5 NH3: 80 W (standard)

F14 NH3, F16 NH3: 140 W (standard)

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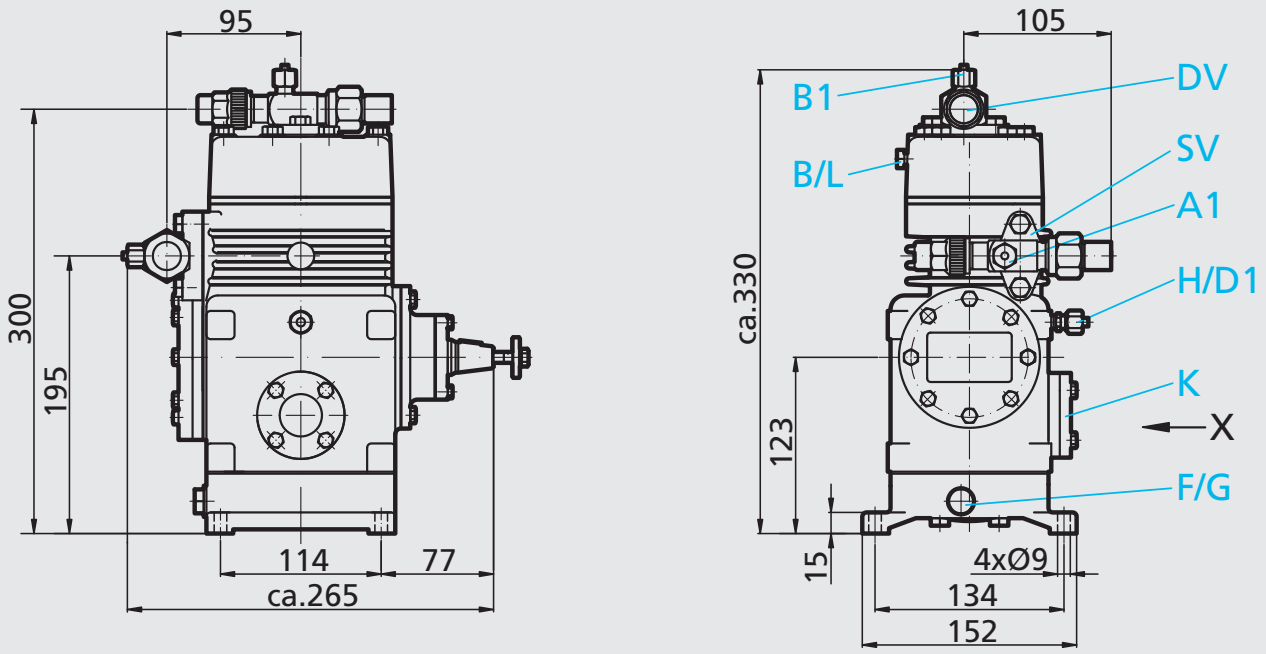
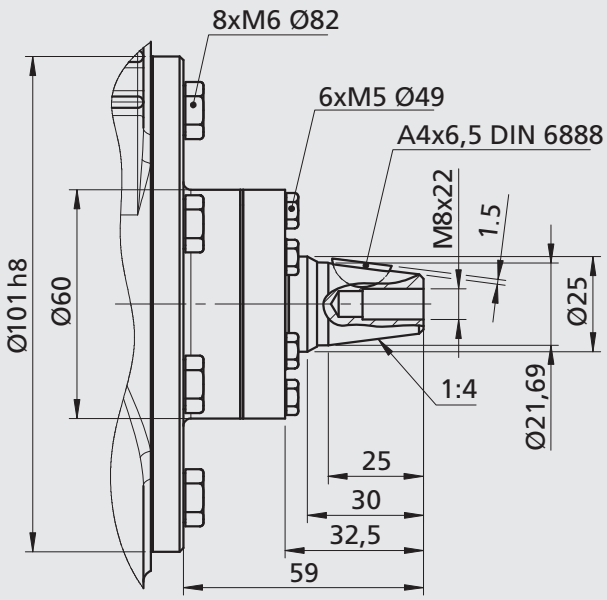
F2 NH3



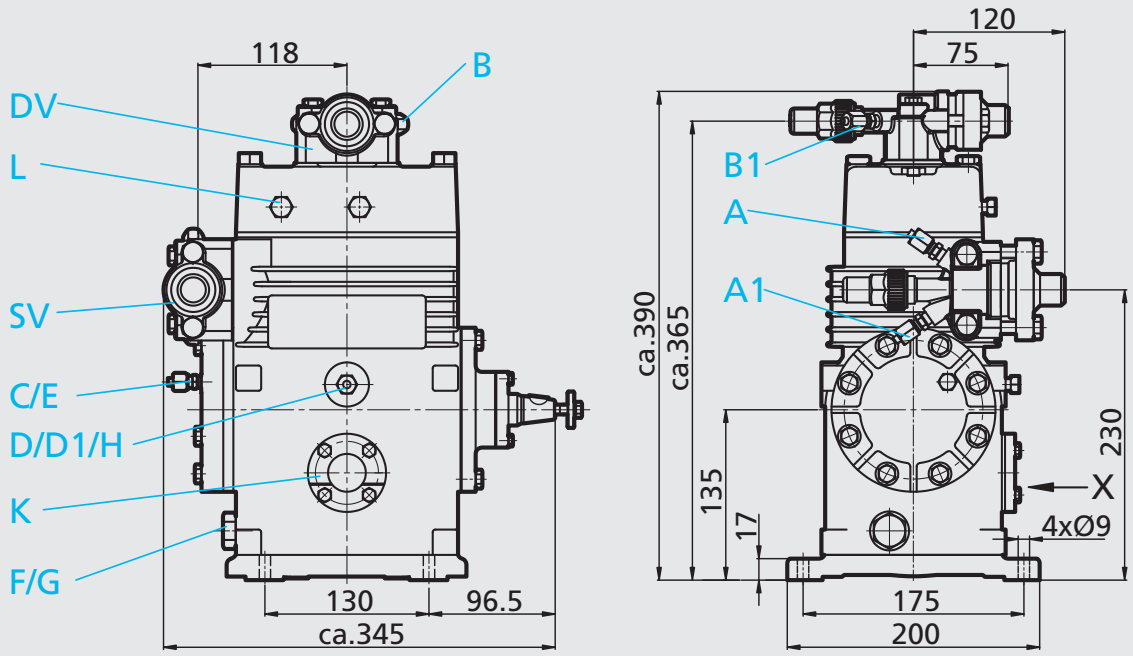
Shaft end



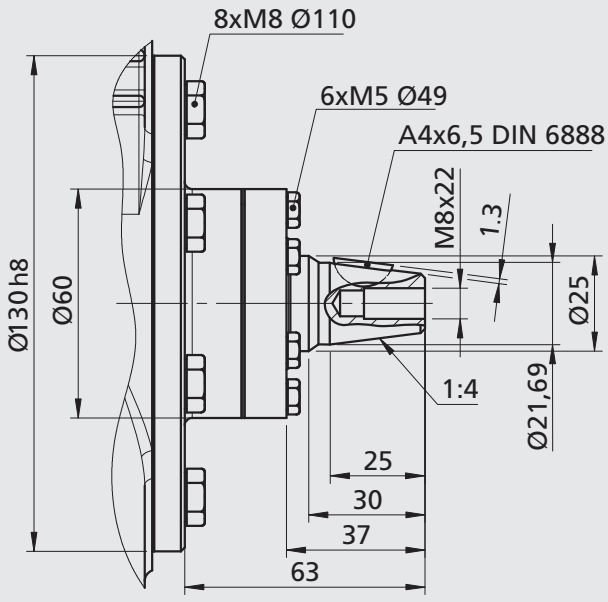
Dimensions in mm

- Connections see page 47
- Dimensions for view X see page 47

F3 NH3



Shaft end



Dimensions in mm

- Connections see page 47
- Dimensions for view X see page 47

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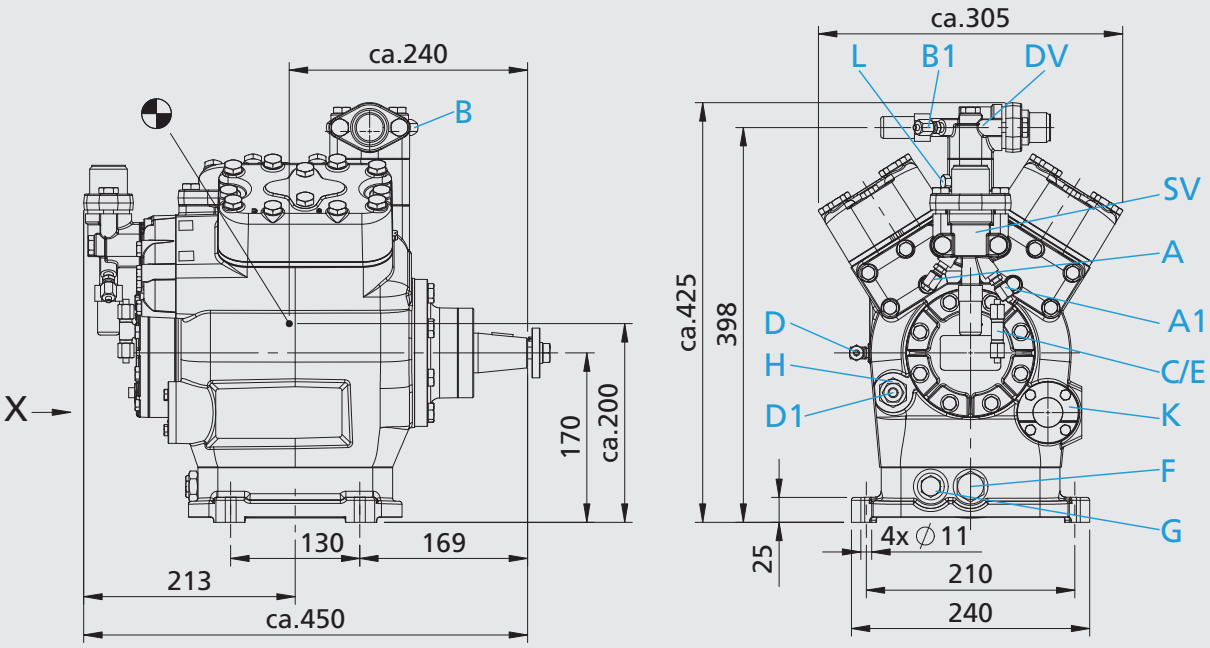
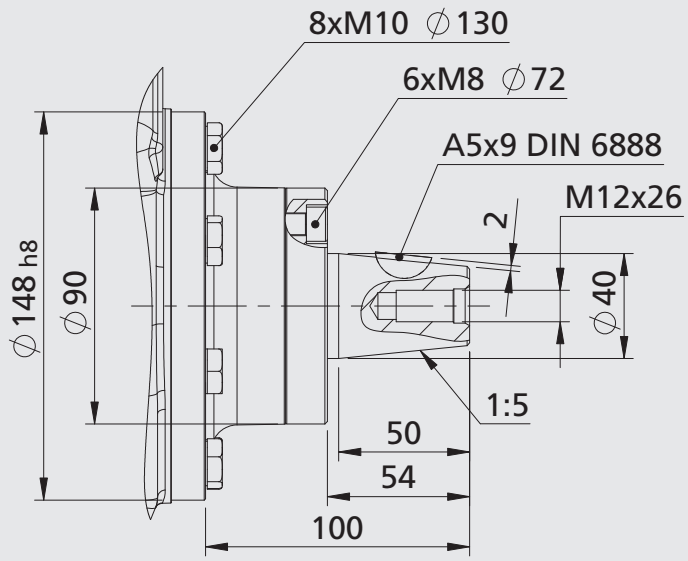
F4 NH3



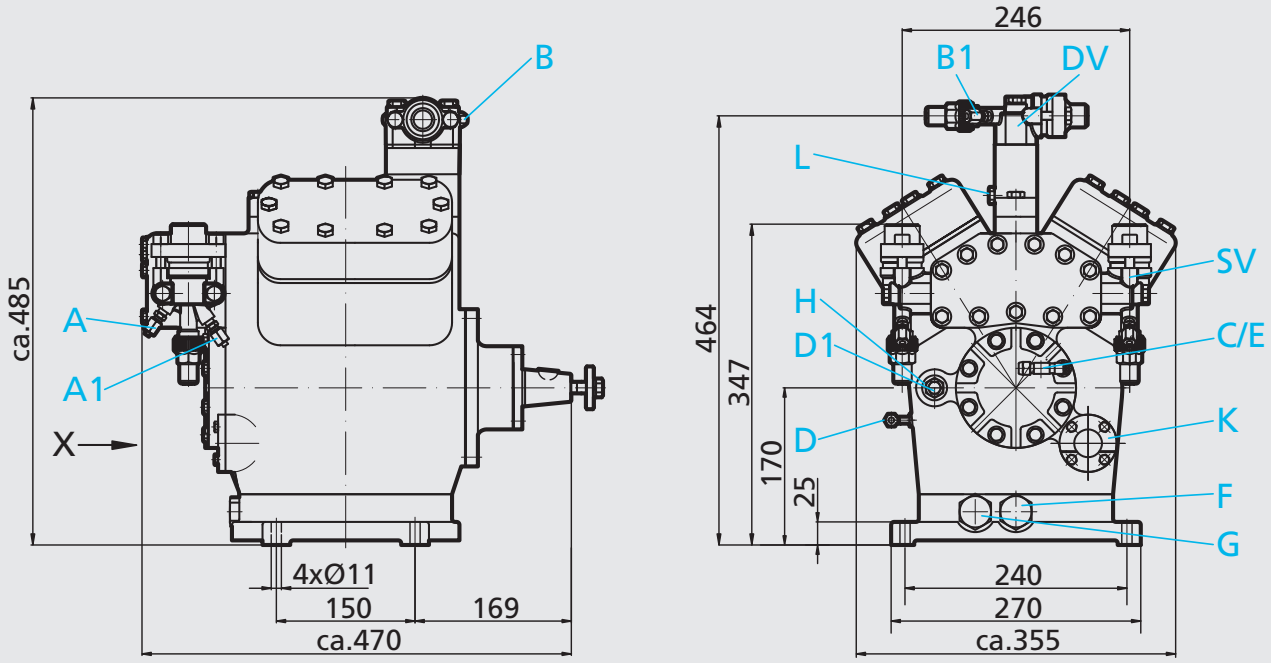
Shaft end



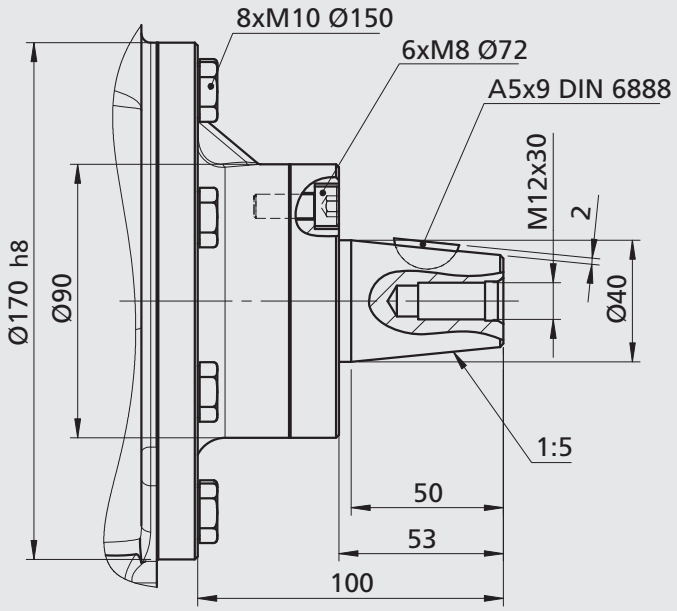
Dimensions in mm
Centre of gravity

- Connections see page 47
- Dimensions for view X see page 47

F5 NH3



Shaft end



Dimensions in mm

- Connections see page 47
- Dimensions for view X see page 47

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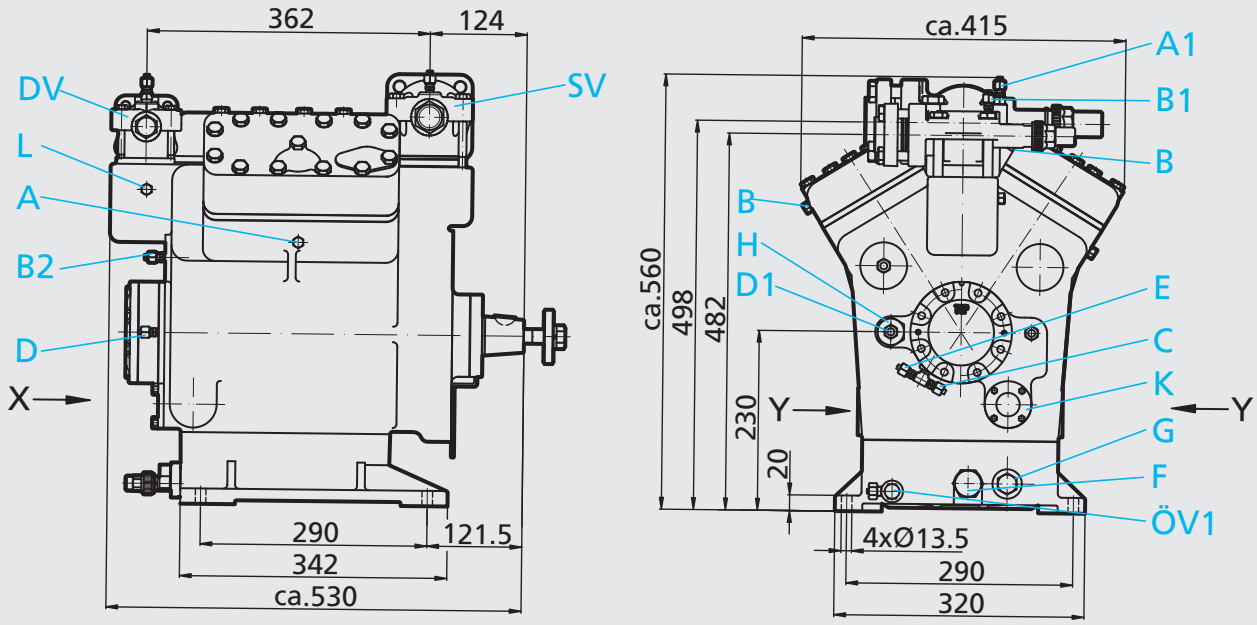
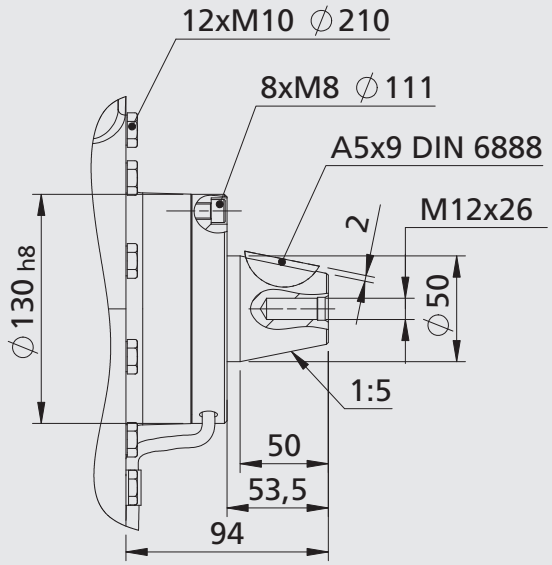
F14 NH3

F14/1166 NH3 F14/1366 NH3



Shaft end

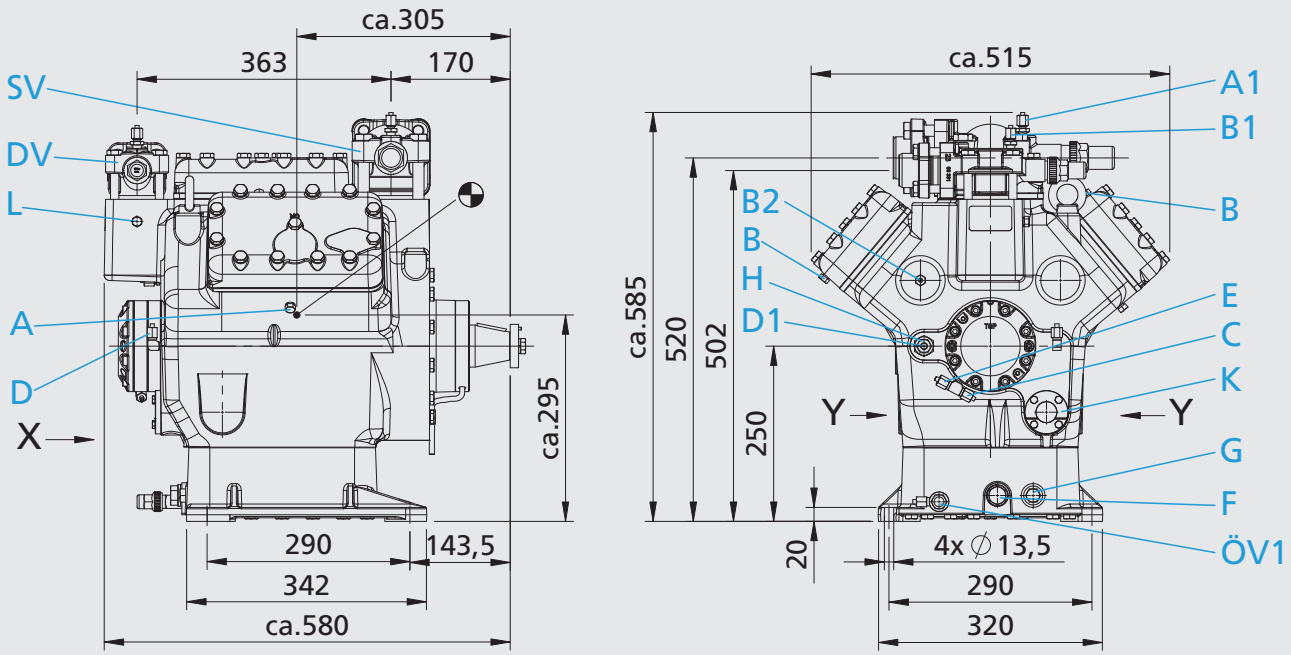


Dimensions in mm

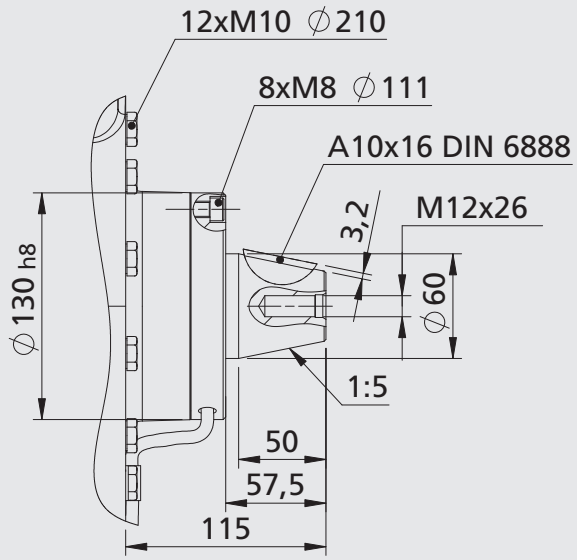
- Connections see page 47
- Dimensions for view X see page 47

F16 NH3

F16/1751 NH3 F14/2051 NH3



Shaft end



Dimensions in mm
Centre of gravity

- Connections see page 47
- Dimensions for view X see page 47

Connections		F2 NH3	F3 NH3	F4 NH3	F5 NH3	F14 NH3	F16 NH3
SV DV	Suction line Discharge line			see technical data, page 40			
A	Connection suction side, not lockable [1]	-	Ø 6 mm	Ø 6 mm	Ø 6 mm	1/8 " NPTF	1/8 " NPTF
A1	Connection suction side, lockable [1]	Ø 6 mm	Ø 6 mm	Ø 6 mm	Ø 6 mm	Ø 6 mm	Ø 6 mm
B	Connection discharge side, not lockable	1/8 " NPTF	Ø 6 mm [1]	Ø 6 mm [1]	Ø 6 mm [1]	1/8 " NPTF	1/8 " NPTF
B1	Connection discharge side, lockable [1]	Ø 6 mm	Ø 6 mm	Ø 6 mm	Ø 6 mm	Ø 6 mm	Ø 6 mm
B2	Connection discharge side, not lockable [1]	-	-	-	-	Ø 6 mm	Ø 6 mm
C	Connection oil pressure safety switch OIL [1]	-	Ø 6 mm	Ø 6 mm	Ø 6 mm	Ø 6 mm	Ø 6 mm
D	Connection oil pressure safety switch LP [1]	-	Ø 10 mm	Ø 6 mm	Ø 6 mm	Ø 6 mm	Ø 6 mm
D1	Connection oil return from oil separator [1]	Ø 10 mm	Ø 10 mm	Ø 10 mm	Ø 10 mm	Ø 10 mm	Ø 10 mm
E	Connection oil pressure gauge [1]	-	Ø 6 mm	Ø 6 mm	Ø 6 mm	Ø 6 mm	Ø 6 mm
F	Oildrain	R 3/8 "	M 22 x 1,5	M 22 x 1,5	M 22 x 1,5	M 26 x 1,5	M 26 x 1,5
G	Oil sump heater plug	R 3/8 "	M 22 x 1,5	M 22 x 1,5	M 22 x 1,5	M 22 x 1,5	M 22 x 1,5
H	Oil charge plug	Ø 10 mm[1]	Ø 10 mm[1]	M 22 x 1,5	M 22 x 1,5	M 22 x 1,5	M 22 x 1,5
K	Sight glass	4 hole M 6	4 hole M 6	4 hole M 6	4 hole M 6	4 hole M 6 [2]	4 hole M 6 [2]
L	Connection thermal protection thermostat	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF	1/8 " NPTF
ÖV1	Oil service valve [1]	-	-	-	-	Ø 6 mm	Ø 6 mm

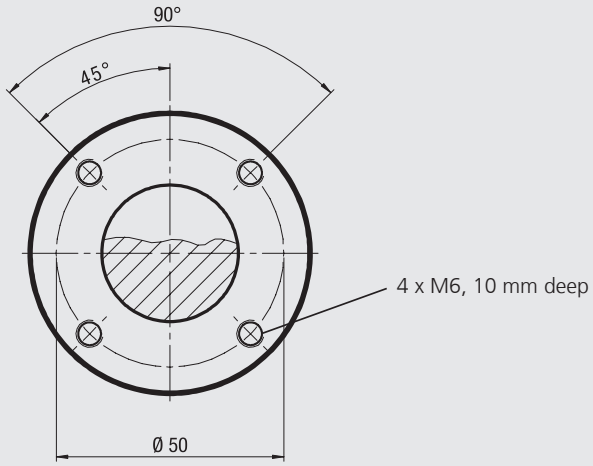
[1] Compression joint for steel pipes
[2] Second sightglass can be attached, Positioning view Y (optional, only as original equipment)

View X,Y

- Oil sight glass
- Connection facility for parallel operation

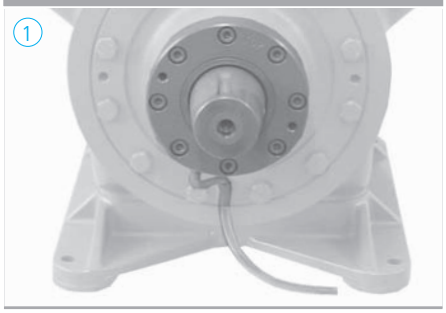
Position view X:
F2 NH3, F3 NH3, F4 NH3, F5 NH3, F14 NH3, F16 NH3
4 hole oil sightglass

Position view Y:
F14 NH3, F16 NH3
Second oil sightglass can be attached as an option
(available as original equipment only)



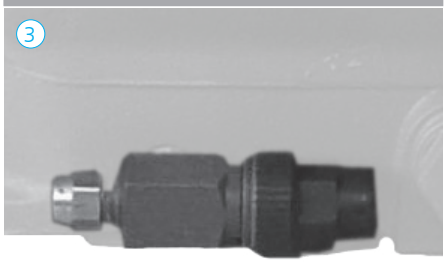
Scope of supply	F2 NH_3	F3 NH_3	F4 NH_3	F5 NH_3	F14 NH_3	F16 NH_3
Open type compressor for NH_3 with suction and discharge shutt-off valves	●	●	●	●	●	●
Two cylinder, cylinder arrangement in row	●	●				
Four cylinder, cylinder arrangement in V			●	●	●	
Six cylinder, cylinder arrangement in W						●
Seat front bearing flange	●	●	●	●	●	●
① Shaft seal with piece of tube for controlled oil collection					●	●
② Elevated base plate (oil volume plus 2.5 litres)					●	●
③ Oil service valve					●	●
Oil filling: FUCHS Reniso KC 68	●	●	●	●	●	●
Sight glass	●	●	●	●	●	●
Compressor safety valve			●	●	●	●
Inert gas charge	●	●	●	●	●	●

Shaft seal with piece of tube



Elevated base plate

Oil service valve



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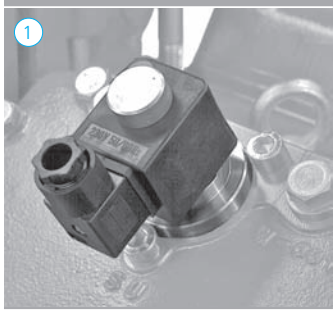
Accessories	F2 NH_3	F3 NH_3	F4 NH_3	F5 NH_3	F14 NH_3	F16 NH_3
① Start unloader 230 V - 1 - 50/60 Hz, IP 65, without check valve, including thermal protection thermostat (bimetallic sensor)		●	●	●	●	●
② Capacity regulator 230 V - 1 - 50/60 Hz, IP 65 1 Capacity regulator = 50 % residual capacity			●	●	●	
Capacity regulator 230 V - 1 - 50/60 Hz, IP 65 1-2 Capacity regulator = 66/33 % residual capacity						●
③ Compressor flywheel	●	●	●	●	●	●
④ Shaft coupling for direct drive [1]	●	●	●	●	●	●
⑤ Oil pressure safety switch MP 54 230 V - 1 - 50/60 Hz, IP 20, incl. mounting		●	●	●	●	●
⑥ Oil sump heater 230 V - 1 - 50/60 Hz, IP 65	●	●	●	●	●	●
⑦ Two additional sight glasses (both-sided), positioning view Y [2]					●	●
⑧ Thermal protection thermostat (bimetal sensor)	●	●	●	●	●	●
⑨ Water-cooled cylinder covers Sea water resistant water-cooled cylinder covers		●	●	●	●	●

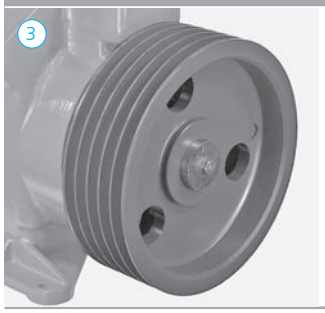
[1] Please state motor Ø and feather key groove dimensions when ordering shafts
[2] Available as original equipment only

Start unloader



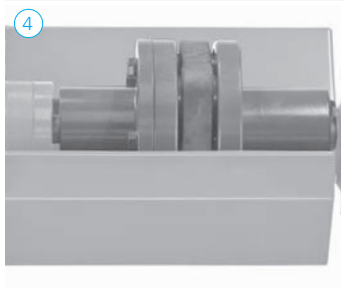
Capacity regulator

Compressor flywheel



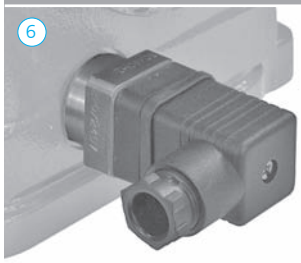
F2 NH_3:	Ø 165,2 x SPA
F3 NH_3:	Ø 210,2 x SPA
F4 NH_3:	Ø 210,3 x SPA
F5 NH_3:	Ø 230,4 x SPA
F14 NH_3:	Ø 322 x SPB
F16 NH_3:	Ø 322 x SPB

Shaft coupling



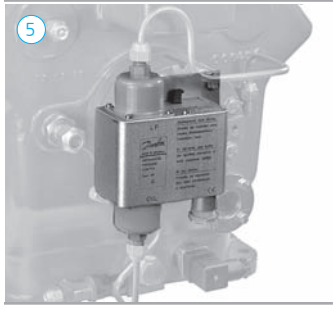
F2 NH_3:	WK 42.44
F3 NH_3:	WK 42.44
F4 NH_3:	WK 70.40
F5 NH_3:	WK 70.40
F14 NH_3:	WK 190.50
F16 NH_3:	WK 190.60

Oil sump heater

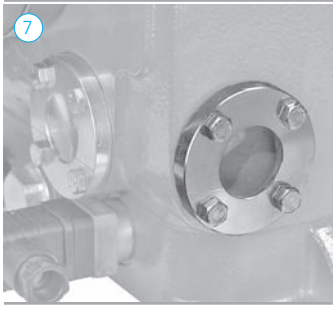


F2 NH_3:	40 Watt
F3 NH_3:	60 Watt
F4 NH_3:	80 Watt
F5 NH_3:	80 Watt
F14 NH_3:	140 Watt
F16 NH_3:	140 Watt

Oil pressure safety switch

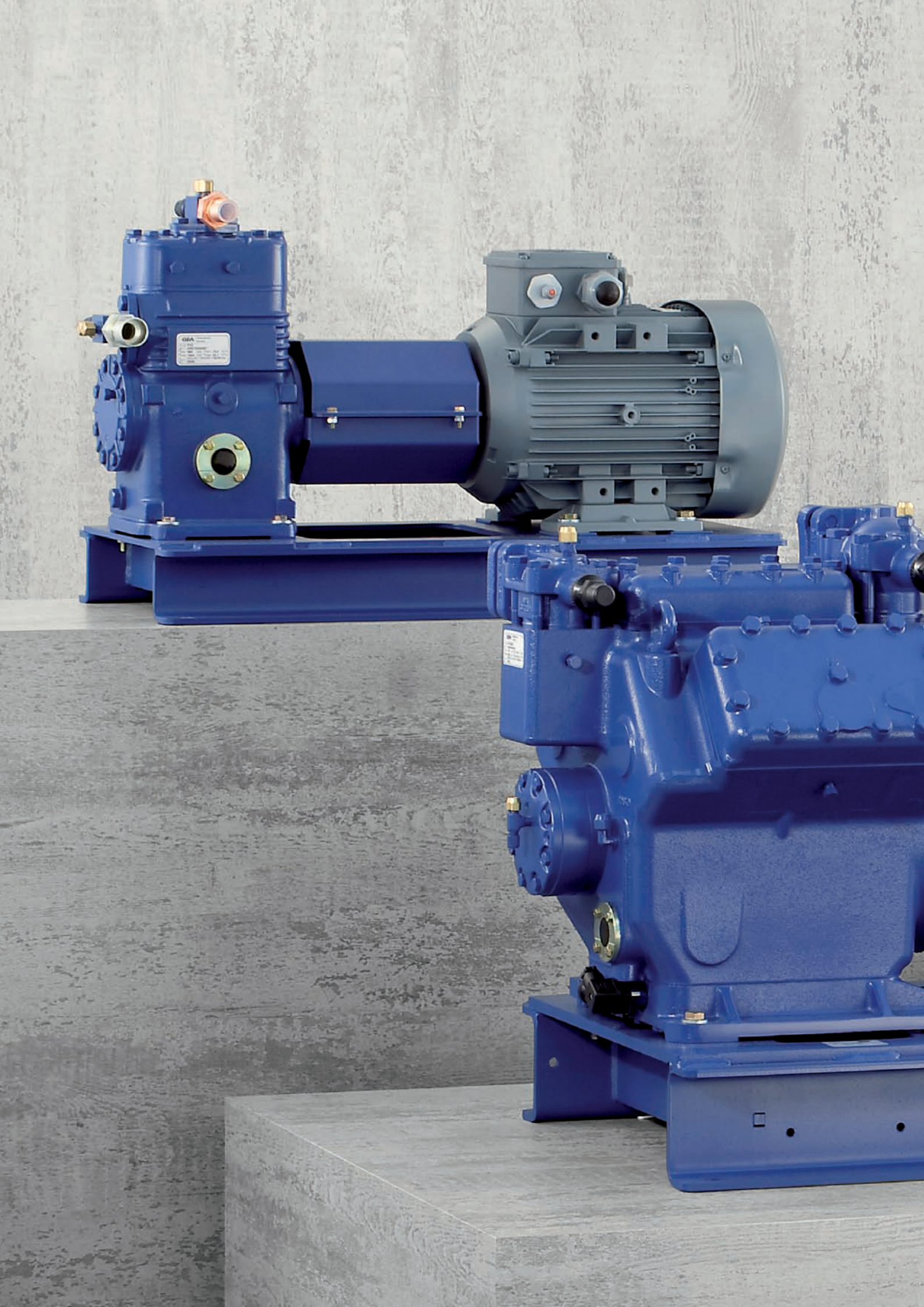


Sight glass

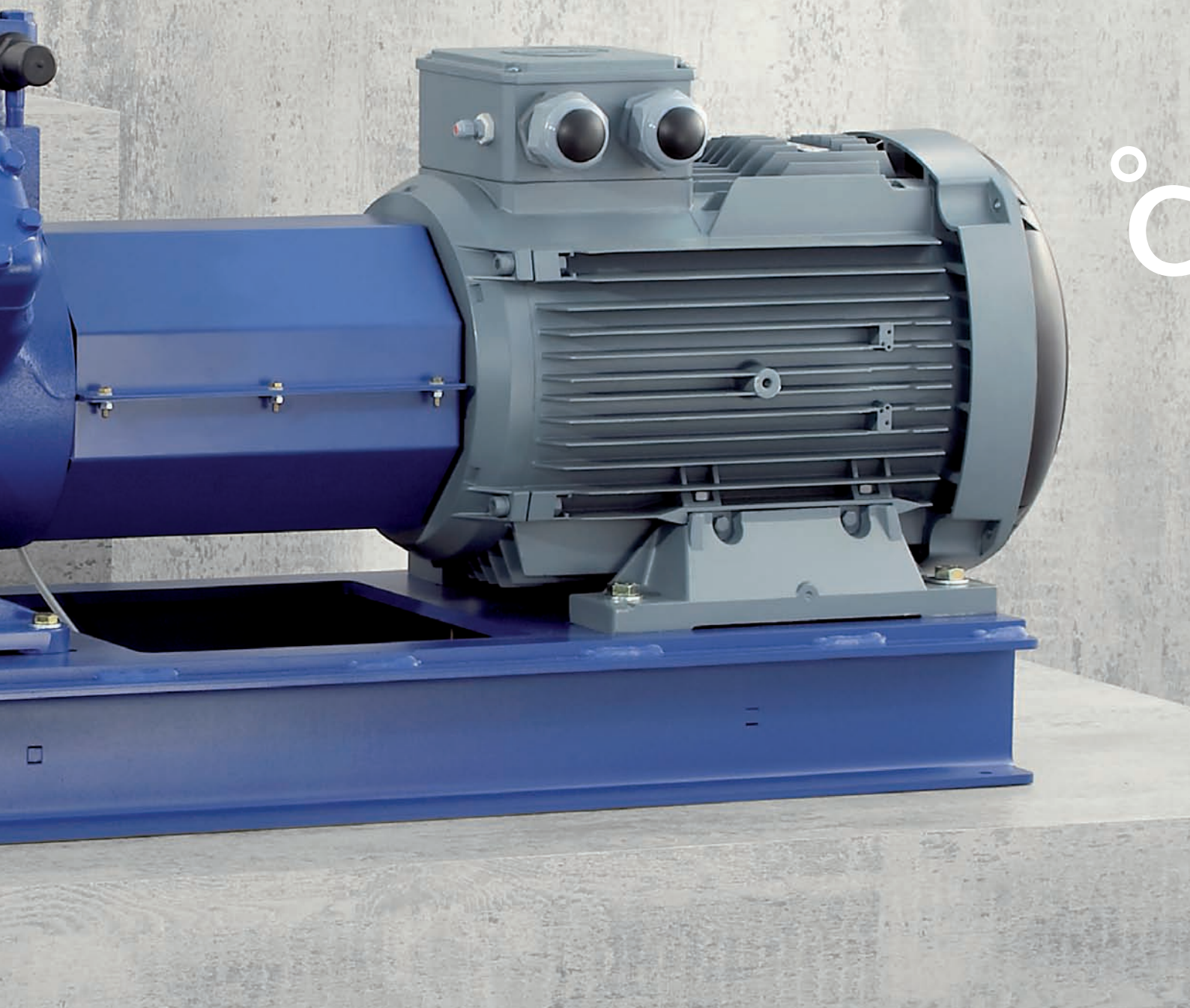


Thermal protection thermostat

Water-cooled cylinder covers



Compressor units for direct drive



Based on the F compressor series with its many designs and application options, a selection of compressor units with compact construction is available for use with direct drive.
Force transmission is by an elastic shaft coupling. B3 drive motors can be used as drives (optional).

The particular features:

Designed for optimum running comfort
- Robust profile base frame as a welded construction
- Large rotating mass in the coupling elements

Service-friendly
- Elastic shaft coupling, divided several times
- Possible to change the coupling or floating ring seal without changing the position of the compressor or drive motor

Type key

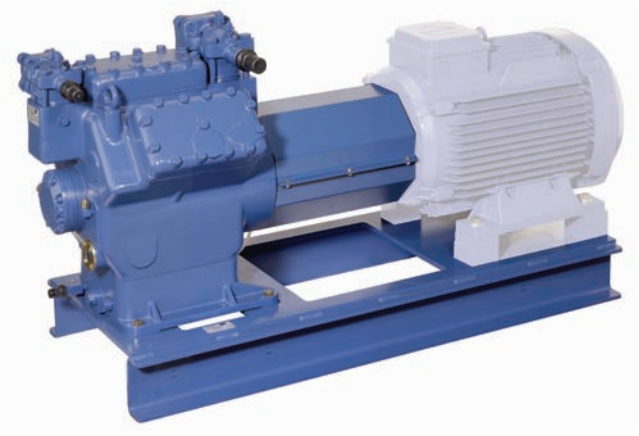
FDK X 14 / 1166 NH_3

- Refrigerant [3]
- Swept volume [2]
- Size
- Ester oil filling
- Series [1]

1) X - Ester oil filling (HFC refrigerant, e.g. R134a, R407C)
2) Indication only at F14, F16
3) Indication only at NH_3 version

The current program
...5 model sizes with 7 capacity stages from 20,3 to 178,4 m³/h (50 Hz)

Models available	Displacement (1.450 rpm) [m³/h]
FDK 3 FDK 3 NH_3	20,3
FDK 4 FDK 4 NH_3	40,5
FDK 5 FDK 5 NH_3	73,7
FDK 14 FDK 14 NH_3	101,5 / 118,9
FDK 16 FDK 16 NH_3	152,2 / 178,4



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Limits of application

You will find the operating limits diagrams for the various refrigerants in the chapter entitled „F series single-stage compressors“ from page 13 onwards as well as in „F compressors for NH_3 series“ from page 37 onwards.

Performance data

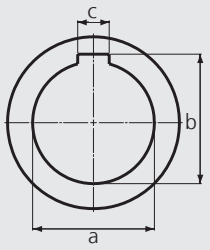
You will find the performance data for the various refrigerants in the chapter entitled „F series single-stage compressors“ from page 14 onwards as well as in „F compressors for NH_3 series“ from page 38 onwards.

Technical data

You will find the technical data for the various compressors in the chapter entitled „F series single-stage compressors“ from page 22 onwards as well as in „F compressors for NH_3 series“ from page 40 onwards.

Scope of supply

- Open type F or F-NH_3 compressors for direct drive
- Mounted on a profile base frame
- With shaft coupling and coupling protection
- Hub on the motor side of the shaft coupling manufactured according to customer specifications. Required dimensions, see Fig. (otherwise after processing)
- Without drive motor
- 4 rubber sheets as an extra item



You will find further information on the scope of supply for the individual basic compressors in the chapter entitled „F series single-stage compressors“ from page 32 onwards as well as in „F compressors for NH_3 series“ from page 48 onwards.

Accessories

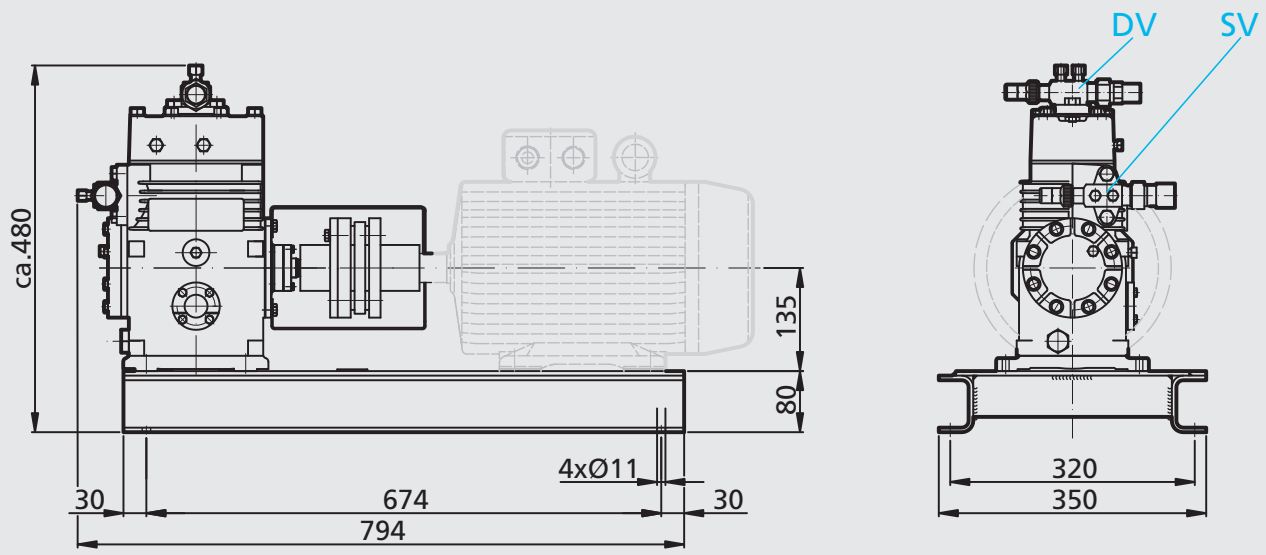
- Drive motors 4 to 55 KW (B3 drive motor), mounted and aligned
- Instrument panel can be equipped with [1]:
  HP-, LP switch and pressure gauge, oil pressure gauge, oil differential pressure switch

You will find the accessories for the various compressors in the chapter entitled „F series single-stage compressors“ from page 33 onwards as well as in „F compressors for NH_3 series“ from page 49 onwards.

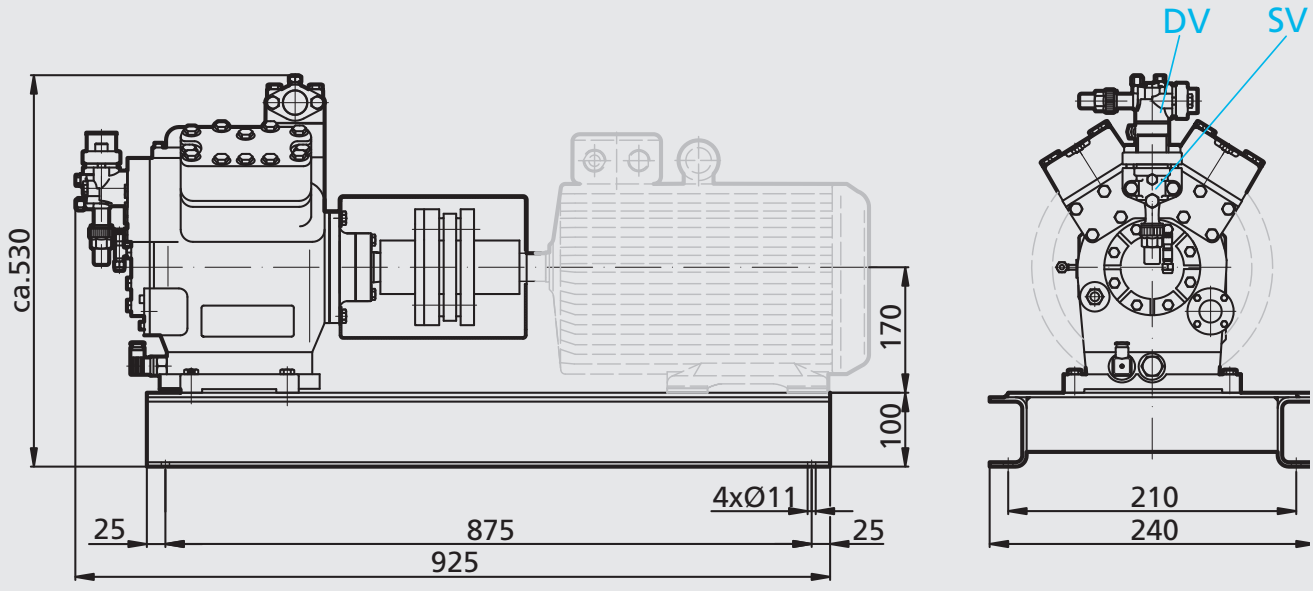
[1] not available for NH_3 version

Dimensions and connections

FDK3



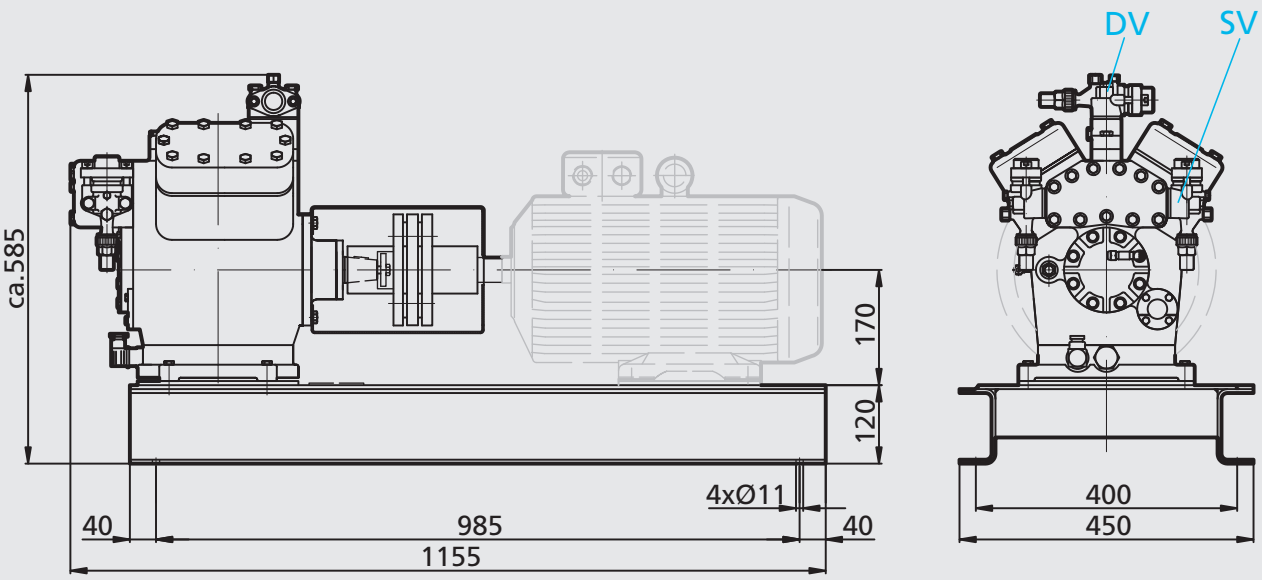
FDK4



Dimensions in mm
Motor optional

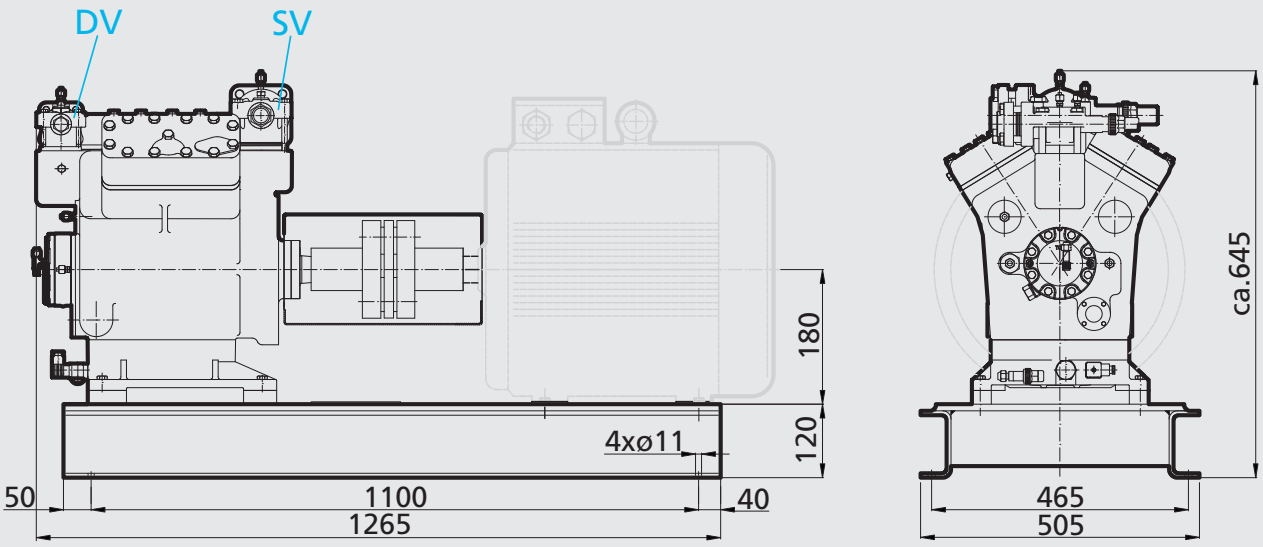
- Connections see page 31
- Dimensions for view X see page 29

FDK5



FDK14

FDK14/1166 FDK14/1366



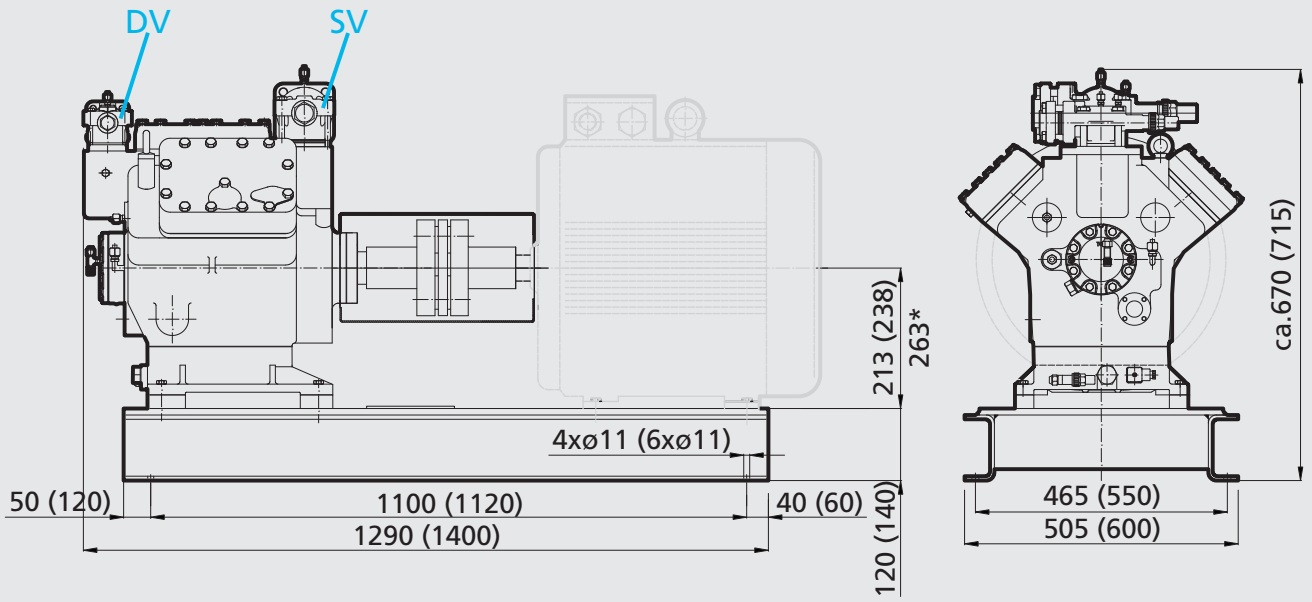
Dimensions in mm
Motor optional

- Connections see page 31
- Dimensions for view X see page 29

Dimensions and connections

FDK16

FDK16/1751 FDK16/2051



Dimensions in mm
Motor optional

- Connections see page 31
- Dimensions for view X see page 29

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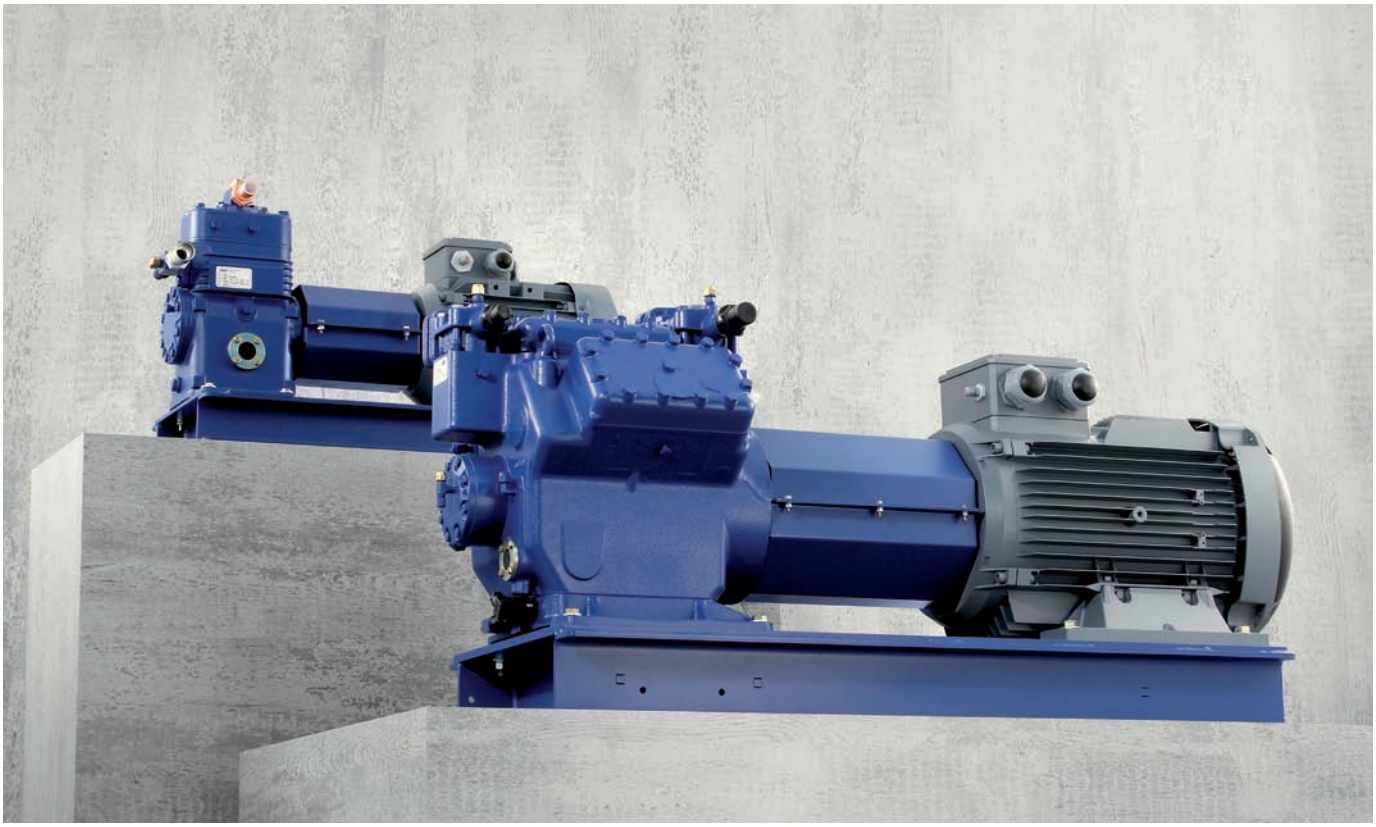
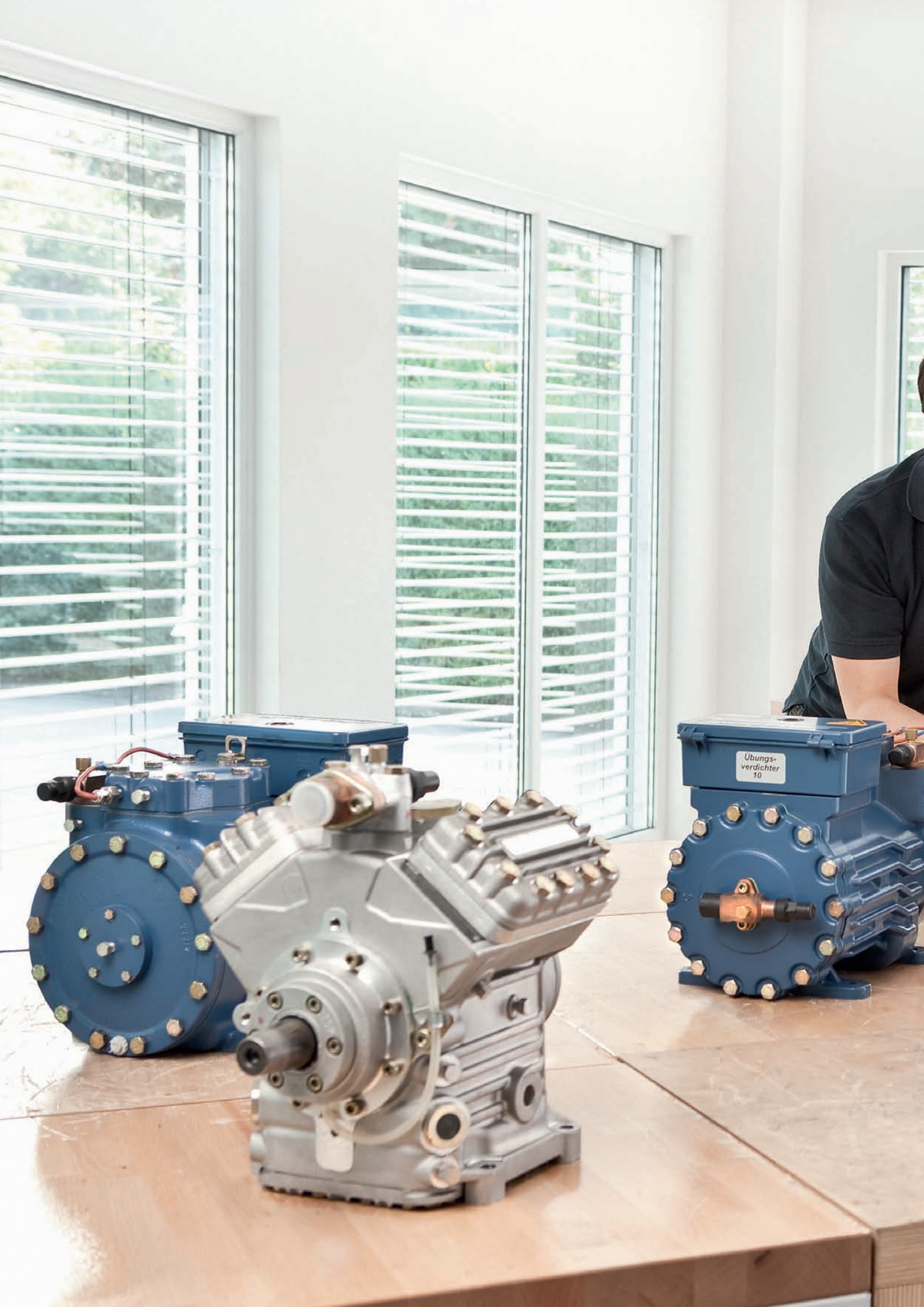
Dimensions and connections




Übungs-
verdichter
10

Service - Made by GEA Bock

Because you're never done learning - GEA Bock training and workshops on compressors

Many years ago, GEA Bock intensified its commitment in the area of customer training.
And so we offer a comprehensive array of attractive training events, from two-day practitioners' workshops in Frickenhausen to afterwork workshops throughout Germany. Regardless of the type of training you are interested in.

Three things are characteristic of all GEA Bock training:
- The captivating way that the training director Peter Spies carries out the events
- The strong practice orientation of the training events, and
- the fact that all training events from GEA Bock are offered as a free service

Current training dates can be found on the Internet at www.bock.de

Overview of training events offered:

- GEA Bock Practitioners' Workshop
- Training tailored to your individual needs
- Training for your entire staff
- Training on your premises

For additional questions or advice, please contact our training director:

Peter Spies
Telephone +49 (7022) 945 4-157
Fax +49 (7022) 945 4-137
Email: Peter.Spies@bock.de

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Worldwide, Up-to-Date, Comprehensive - GEA Bock on the Internet - www.bock.de

Products

- Comprehensive product catalogue
- Data on all products
- Dimensions and exploded views
- Spare parts lists

Sales network

- Contact persons in over 60 countries
- Direct link to your trading partner

Company

- Current company information
- Company film
- Subsidiaries
- History
- References

News

- Company news
- Product news
- Current dates

Know-How

- Error analysis tool
- VAP software download
- Comprehensive information

Contact

- Contact data for GEA Bock and subsidiaries
- Hotline

After Sale Service

GEA Bock offers you individual, personal consultation and assistance after the purchase as well.

As a customer, GEA Bock always has competent contact people available to you for technical questions.

Outside our business hours, you can reach us on our free hotline: 00 800 / 800 000 88
from Monday to Saturday, 8:00 a.m. to 9:00 p.m.

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Quality by GEA Bock -
The benchmark in cooling and air-conditioning

The name GEA Bock stands worldwide for compressor technology with the highest level of quality.

The goal of quality leadership in all product areas has always been at the centre of our company philosophy in our over 75-year history.

Today, permanent optimisation of quality, not just on the product but in all areas, is the core of GEA Bock's company strategy.

GEA Bock meets the requirements of DIN EN ISO 9001:2000, certified through DQS, as well as numerous additional European and globally recognised standards.

In addition, GEA Bock maintains a system of internal company standards, which go well beyond public regulations in many points.

Certified quality from GEA Bock

QUALITY SYSTEM
DQS
certified by DQS according to DIN EN ISO 9001 Reg. No. 2177

CERTIFIED IQNet MANAGEMENT SYSTEM

ASERCOM

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