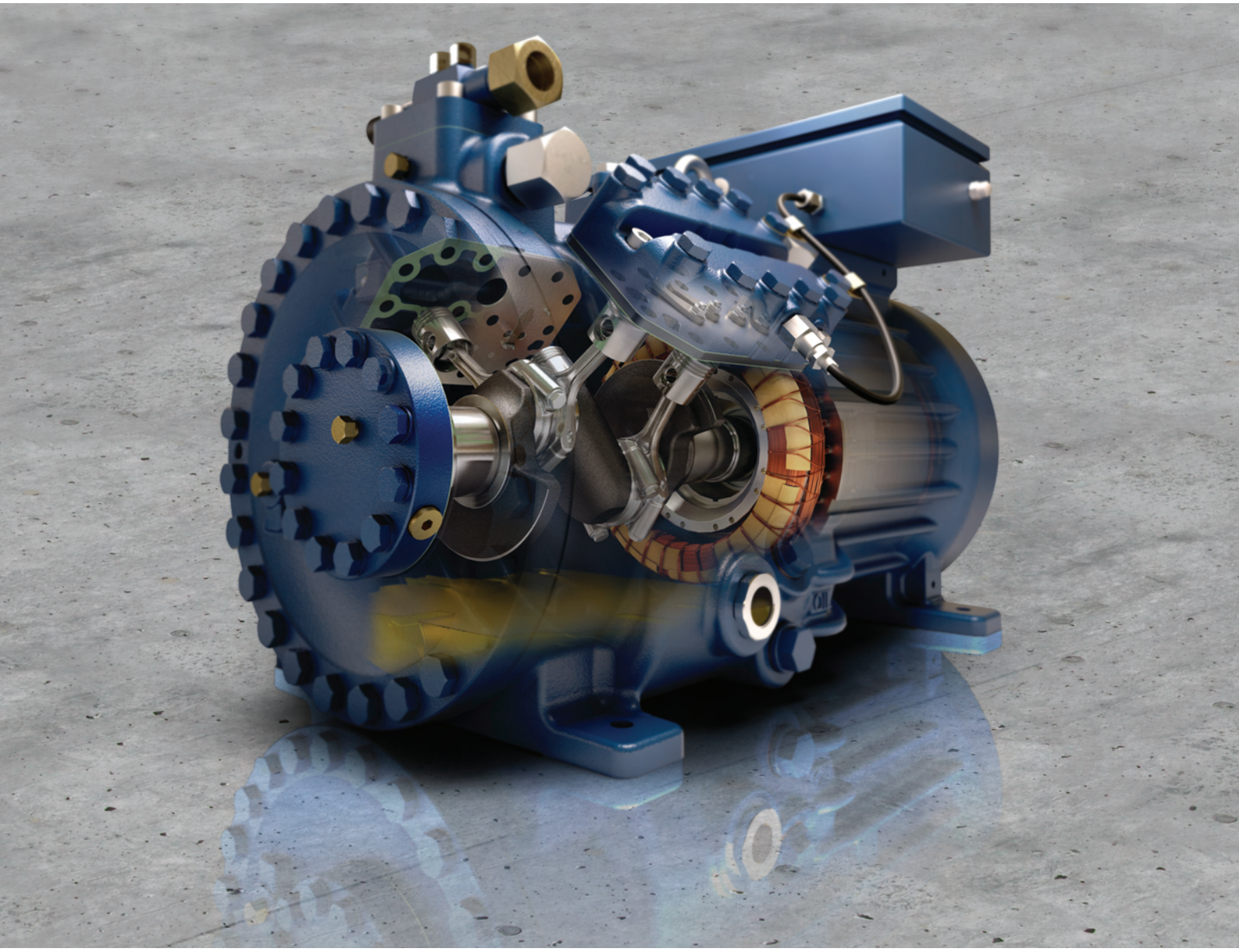

Built for CO_2 - Designed to Perform

Semi-hermetic Bock compressors for sub- and transcritical CO_2 (R744) applications

NEW!
up to 30 m³/h

The refrigerant R744

Our solutions are customer-oriented and user-friendly, because they are low-priced, energy-efficient, long-lasting and tailored to your individual needs.

In a lot of regions, the natural refrigerant CO2 has become an established alternative to conventional HFC refrigerants. At the Chillventa, GEA Refrigeration Technologies will present an extended and optimized range of semi-hermetic Bock compressors for subcritical as well as transcritical CO2 applications.

Already in the 1990s, Bock was recognized as a pioneer in the field of CO2 technology and could gain practical experience with regard to hundreds of mobile and stationary installations in the following years.

Parallel to the Chillventa, GEA Refrigeration Technologies expands the range of transcritical applications with the semi-hermetic 6-cylinder reciprocating compressor HGX46 CO2 T. Thus, GEA Refrigeration Technologies currently offers the biggest semi-hermetic reciprocating compressor for transcritical CO2 applications in the market. The compressor convinces through its size (displacement from 21,8 to 30,2 m³/h) and its outstanding COP (coefficient of performance).

It is based on the already available 4-cylinder model Bock HGX34 CO2 T – the first Bock compressor which was specifically developed for the specific requirements of the refrigerant CO2. The compressor distinguishes itself through highest COP in the compressor and in the application due to an outstanding volumetric and isotropic efficiency (> 0,7) for medium temperature cooling. The compressor is also characterized by its wide limits of application that allow amongst other things its very robust design. Since its market launch, the compressor is used in classical refrigeration applications as well as in numerous industrial heat pumps with highest COP.

At the Chillventa 2012, the Bock CO2 compressor range will be rounded off by the efficiency-optimized version of the subcritical compressor series HGX12e. The compact, semi-hermetic 2-cylinder reciprocating compressors in combination with transcritical applications can excellently be used in low temperature applications.

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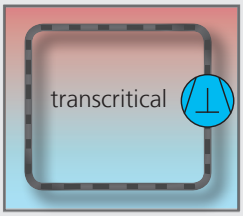
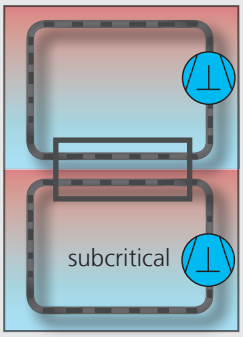
CO_2 system examples



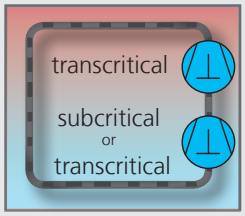
Single-stage applications

Single-stage transcritical CO_2 applications are used in the field of medium temperature refrigeration. They can be operated very efficiently, if the high pressure is operated in the subcritical range over a long period. Using the high-pressure side, it is appropriate to use the application in the transcritical range also in combination with refrigeration, due to a big temperature glide and a relatively high discharge end temperature for specific heat pumps and the heat recovery.
Transcritical Bock CO_2 compressors are used.



Cascade application

In a cascade system, different refrigerants are used in an application. They are combined in two refrigerating circuits that are separated from each other. A solution with CO_2 in low temperature refrigeration is very interesting due to economic reasons and the perspective of efficiency. The high temperature stage is used as a condenser in the CO_2 application. Here it is possible to use different refrigerants like hydrocarbons, ammonia and also HFCs like R134a.
Subcritical Bock CO_2 compressors are used in the low temperature stage.



Booster applications

Regarding applications with CO_2 in low and medium temperature refrigeration, so-called Booster systems are used. High pressure of low temperature compressor is discharged directly to the suction side of the second compressor stage. Different plant constructions of these Booster applications are used for example in supermarket applications.
Transcritical and subcritical Bock CO_2 compressors are used.

Compressor types

ML-Version	For medium and low temperature applications at low and medium evaporating temperatures, oil charge C85E
S-Version	For frequency control and extended application range, equipped with more powerful drive motor, oil charge C85E
SH-Version	For heat pumps and at high evaporating temperatures, equipped with more powerful drive motor, oil charge C150E

Designed for CO_2 - built for the future

Bock HGX34 CO_2 T - A compressor packed with more than 15 years of CO_2 compressor experience.

Flexible application range, depending on the application (accessories)

Thermal separations on the cylinder cover and in the compressor housing reduce the superheat on the suction side

Special coating at the piston for minimum wear and high emergency running properties, piston heads with grooving of the suction reed valves outline for minimum clearance volume

Highest efficiency through hard chromium plated piston rings in triple assembly

Weight-optimized connecting rod for highest running comfort

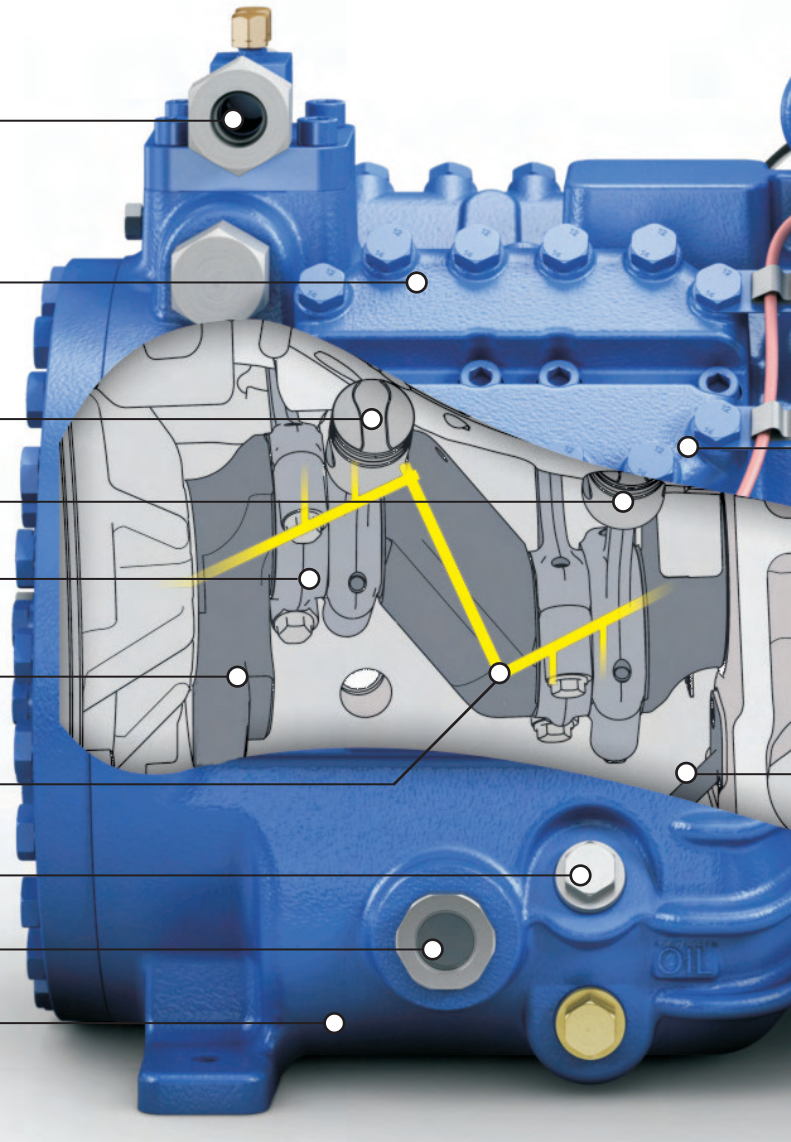
Tempered crankshaft with massive main bearing and optimised mass balance for highest running comfort

Oil supply of bearings through forced lubrication and optimal oil circulation

Prevention against oil overfilling

Calmed oil level for precise and safe indication of oil level in the sightglass

Oil sump heater installed as scope of supply



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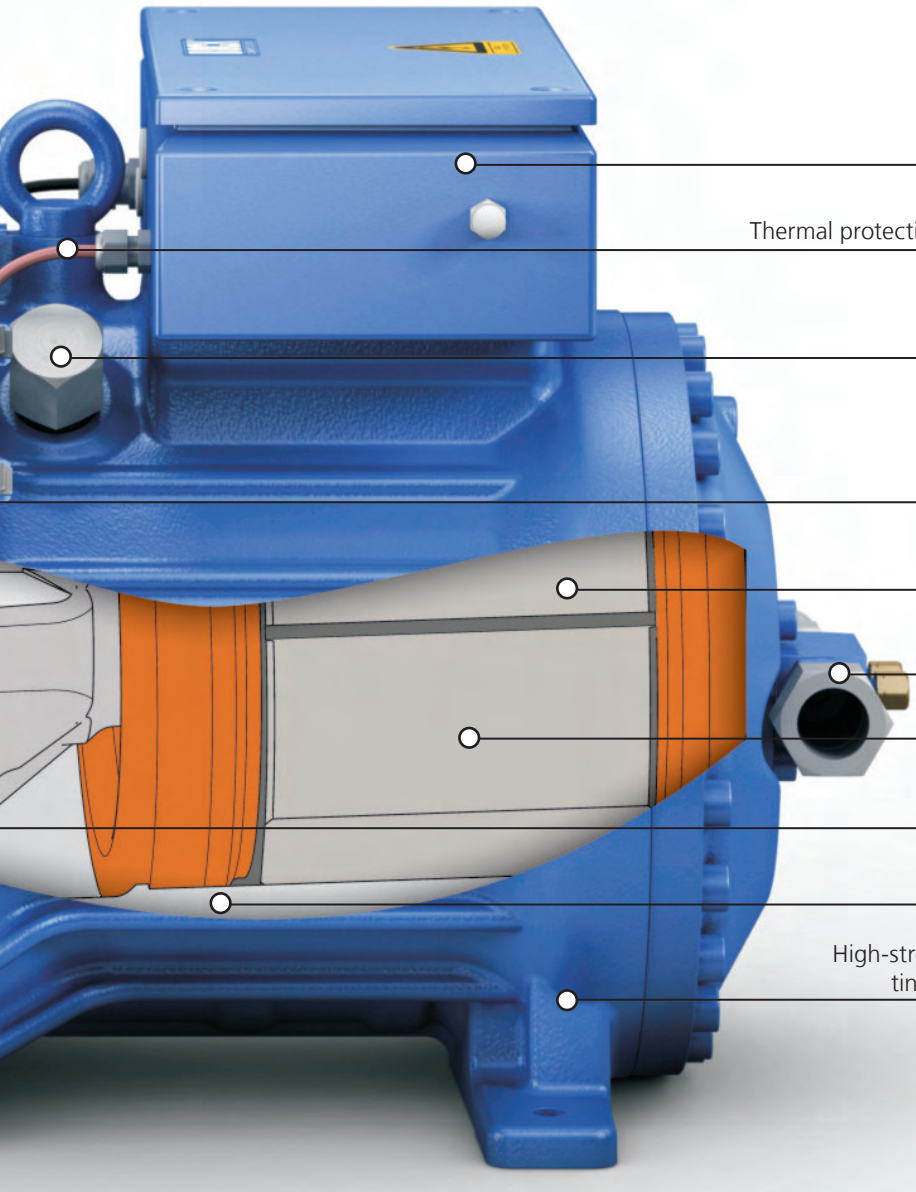


Bock MP10 electronic motor protection, especially easy to operate because of status indicators

Thermal protection thermostat for pressure gas temperature monitoring

Pressure relief valve for HP and LP side

Valve system with optimized flow and channels in the housing ensure lowest pressure drops and highest efficiency

Suction gas cooled, variable speed control of motor by frequency converter (25 - 70 Hz)

Flexible connection options depending on the application (accessories)

Winding protection with PTC resistor sensors

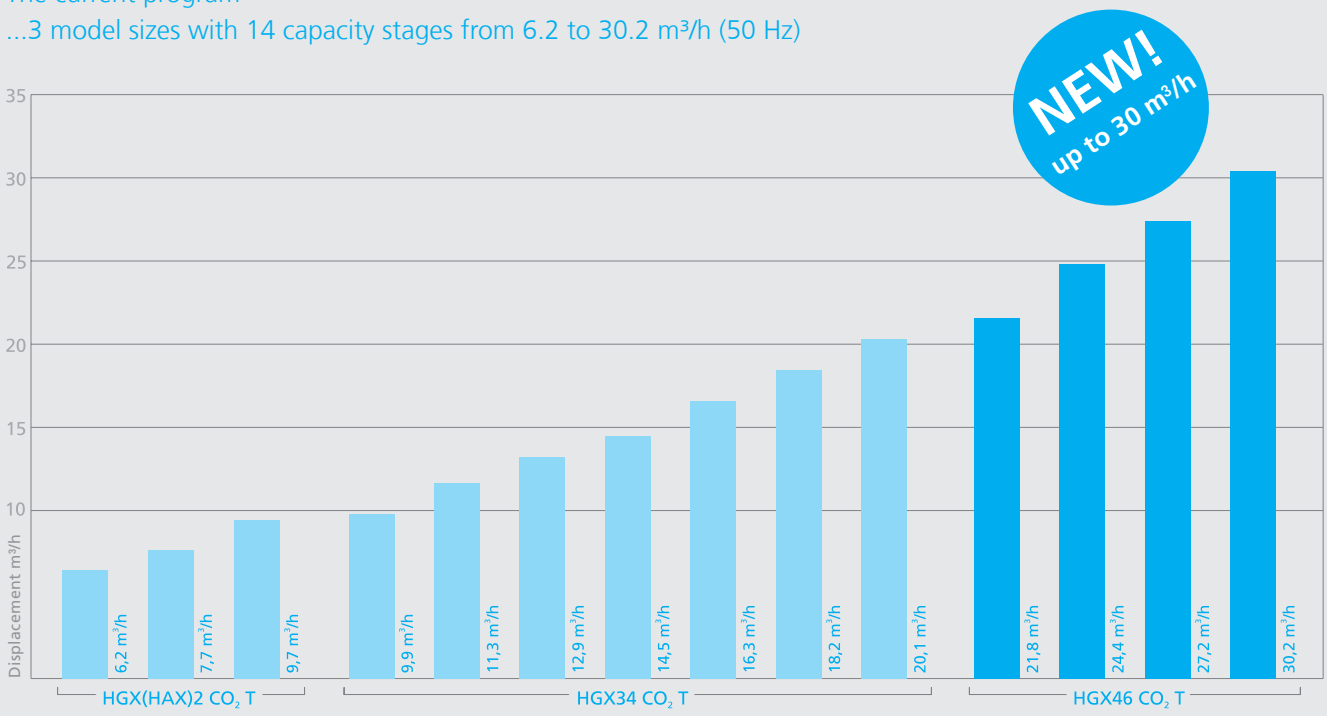
Low oil throw through a calmed lubrication circuit, minimum oil foaming and oil mist

Wide application range, subcritical and transcritical operating possible

High-strength spheroidal cast iron housing for maximum operating pressures on the low pressure- and high pressure side

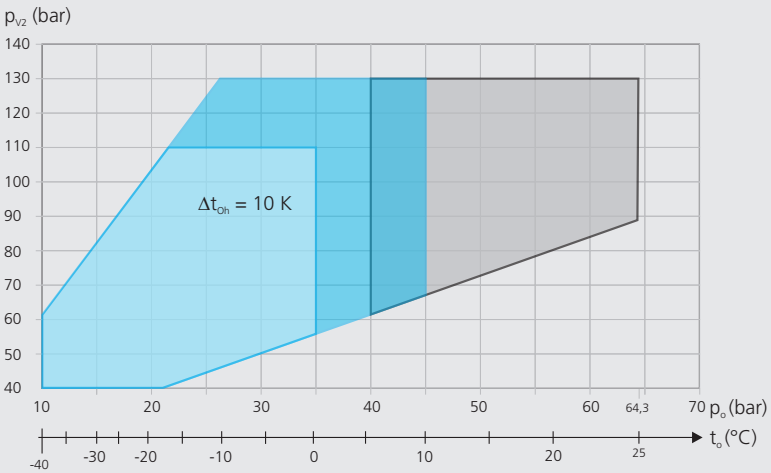
The current program

...3 model sizes with 14 capacity stages from 6.2 to 30.2 m³/h (50 Hz)



CO_2 Operating limits

HGX34 CO_2 T, HGX46 CO_2 T



- Compressor type ML
- Compressor type S
- Compressor type SH

t_O	Evaporating temperature (°C)
Δt_{Oh}	Suction gas superheat (K)
p_o	Suction pressure (bar)
p_{V2}	Discharge end pressure (bar)

Max. permissible operating pressure (LP/HP)[1]: 100/150 bar

[1] LP = low pressure HP = high pressure

CO_2 Notes

Operating limits

Compressor operation is possible within the limits shown on the application diagram. Compressor application limits should not be chosen for design purposes or continuous operation.

Performance data

The performance data for CO_2 are based on 10 K suction gas superheating at **50 Hz mains frequency.**
In case of subcritical operating conditions, no liquid subcooling takes place. The performance data for transcritical operating conditions are specified close to the „optimal high pressure". The optimal high pressure is thereby related to an ideal cyclic process.

Conversion factor for 60 Hz = 1.2

Performance data for other operating points, see GEA Bock software.

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CO_2 Compressors (transcritical)

CO_2	Performance data									50 Hz
Compressor Type	Displacement m^3/h (50 Hz)	**Normal cooling** (transcritical) Gascooler outlet conditions +35°C (90 bar) / Evaporating temp. -10°C *			**Normal cooling** (subcritical) Condensing temp. +15°C / Evaporating temp. -10°C *			**Heat pump** Gascooler outlet conditions +25°C (100 bar) / Evaporating temp. +5°C *		
		$\dot{Q}_o$ [W]	P_e [kW]	COP	$\dot{Q}_o$ [W]	P_e [kW]	COP	$\dot{Q}_o$ [W]	P_e [kW]	COP
HGX34/110-4 ML CO_2 T	9.9	21700	11.70	1.85	34300	6.59	5.20	--	--	--
HGX34/110-4 S CO_2 T HGX34/110-4 SH CO_2 T								44600	13.30	3.35
HGX34/130-4 ML CO_2 T	11.3	24700	13.30	1.86	39100	7.55	5.18	--	--	--
HGX34/130-4 S CO_2 T HGX34/130-4 SH CO_2 T								50900	15.10	3.37
HGX34/150-4 ML CO_2 T	12.9	28200	15.20	1.86	44700	8.58	5.21	--	--	--
HGX34/150-4 S CO_2 T HGX34/150-4 SH CO_2 T								57900	17.30	3.35
HGX34/170-4 ML CO_2 T	14.5	31800	17.10	1.86	50300	9.59	5.25	--	--	--
HGX34/170-4 S CO_2 T HGX34/170-4 SH CO_2 T								65300	19.50	3.35
HGX34/190-4 ML CO_2 T	16.3	35400	19.30	1.83	56200	10.80	5.20	--	--	--
HGX34/190-4 S CO_2 T HGX34/190-4 SH CO_2 T								73200	21.80	3.36
HGX34/210-4 ML CO_2 T	18.2	39900	21.50	1.86	62900	12.10	5.20	--	--	--
HGX34/210-4 S CO_2 T HGX34/210-4 SH CO_2 T								82100	24.40	3.36
HGX34/230-4 ML CO_2 T	20.1	44200	24.30	1.82	69400	14.00	4.96	--	--	--
HGX34/230-4 S CO_2 T HGX34/230-4 SH CO_2 T								90700	27.60	3.29
HGX46/250-4 ML CO_2 T	21.8	47700	25.70	1.86	75400	14.50	5.20	--	--	--
HGX46/250-4 S CO_2 T HGX46/250-4 SH CO_2 T								98000	29.20	3.36
HGX46/280-4 ML CO_2 T	24.4	53700	28.80	1.86	84400	16.30	5.18	--	--	--
HGX46/280-4 S CO_2 T HGX46/280-4 SH CO_2 T								111000	32.80	3.38
HGX46/310-4 ML CO_2 T	27.2	59700	32.30	1.85	94100	18.20	5.17	--	--	--
HGX46/310-4 S CO_2 T HGX46/310-4 SH CO_2 T								123000	36.60	3.36
HGX46/345-4 ML CO_2 T	30.2	66100	35.60	1.86	105000	20.10	5.22	--	--	--
HGX46/345-4 S CO_2 T HGX46/345-4 SH CO_2 T								136000	40.50	3.36

* according to EN 12900

CO_2 Compressors (transcritical)

CO_2 Type	Number of cylinders	Displacement 50 / 60 Hz	Electrical data				Weight	Connections ④		Oil charge
			Voltage ①	Max. working current ②	Max. power consumption ②	Starting current (rotor locked) ②		Discharge line DV	Suction line SV ⑤	
		m³/h		A	kW	A	kg	mm	mm I Inch	Ltr.
				* PW 1+2		*PW1 / PW 1+2				
HGX34/110-4 ML CO_2 T	4	9.90 / 11.80	③	24.6	14.5	85 / 110	194	22	28 I 1 1/8	2.5
HGX34/110-4 S CO_2 T	4	9.90 / 11.80	③	30.5	17.3	110 / 141	197	22	28 I 1 1/8	2.5
HGX34/110-4 SH CO_2 T	4	9.90 / 11.80	③	⑥	⑥	⑥	197	22	28 I 1 1/8	2.5
HGX34/130-4 ML CO_2 T	4	11.30 / 13.60	③	28.1	16.5	85 / 110	194	22	28 I 1 1/8	2.5
HGX34/130-4 S CO_2 T	4	11.30 / 13.60	③	34.6	19.9	110 / 141	197	22	28 I 1 1/8	2.5
HGX34/130-4 SH CO_2 T	4	11.30 / 13.60	③	⑥	⑥	⑥	197	22	28 I 1 1/8	2.5
HGX34/150-4 ML CO_2 T	4	12.90 / 15.40	③	32.8	18.8	110 / 141	197	22	28 I 1 1/8	2.5
HGX34/150-4 S CO_2 T	4	12.90 / 15.40	③	38.7	22.7	127 / 158	200	22	28 I 1 1/8	2.5
HGX34/150-4 SH CO_2 T	4	12.90 / 15.40	③	⑥	⑥	⑥	200	22	28 I 1 1/8	2.5
HGX34/170-4 ML CO_2 T	4	14.50 / 17.40	③	36.9	21.2	110 / 141	196	22	28 I 1 1/8	2.5
HGX34/170-4 S CO_2 T	4	14.50 / 17.40	③	43.2	25.4	152 / 183	209	22	28 I 1 1/8	2.5
HGX34/170-4 SH CO_2 T	4	14.50 / 17.40	③	⑥	⑥	⑥	209	22	28 I 1 1/8	2.5
HGX34/190-4 ML CO_2 T	4	16.30 / 19.60	③	40.7	23.9	127 / 158	200	22	28 I 1 1/8	2.5
HGX34/190-4 S CO_2 T	4	16.30 / 19.60	③	48.7	28.7	152 / 183	209	22	28 I 1 1/8	2.5
HGX34/190-4 SH CO_2 T	4	16.30 / 19.60	③	⑥	⑥	⑥	209	22	28 I 1 1/8	2.5
HGX34/210-4 ML CO_2 T	4	18.20 / 21.80	③	45.2	26.6	152 / 183	200	22	28 I 1 1/8	2.5
HGX34/210-4 S CO_2 T	4	18.20 / 21.80	③	54.5	32.0	156 / 193	215	22	28 I 1 1/8	2.5
HGX34/210-4 SH CO_2 T	4	18.20 / 21.80	③	⑥	⑥	⑥	215	22	28 I 1 1/8	2.5
HGX34/230-4 ML CO_2 T	4	20.10 / 24.10	③	50.8	29.9	152 / 183	209	22	28 I 1 1/8	2.5
HGX34/230-4 S CO_2 T	4	20.10 / 24.10	③	60.2	36.0	231 / 283	217	22	28 I 1 1/8	2.5
HGX34/230-4 SH CO_2 T	4	20.10 / 24.10	③	⑥	⑥	⑥	217	22	28 I 1 1/8	2.5
HGX46/250-4 ML CO_2 T	6	21.80 / 26.20	③	53.9	31.7	156 / 193	239	22	28 I 1 1/8	2.5
HGX46/250-4 S CO_2 T	6	21.80 / 26.20	③	63.7	38.2	231 / 283	247	22	28 I 1 1/8	2.5
HGX46/250-4 SH CO_2 T	6	21.80 / 26.20	③	⑥	⑥	⑥	247	22	28 I 1 1/8	2.5
HGX46/280-4 ML CO_2 T	6	24.40 / 29.30	③	59.5	35.6	231 / 283	247	22	28 I 1 1/8	2.5
HGX46/280-4 S CO_2 T	6	24.40 / 29.30	③	71.4	43.0	231 / 283	247	22	28 I 1 1/8	2.5
HGX46/280-4 SH CO_2 T	6	24.40 / 29.30	③	⑥	⑥	⑥	247	22	28 I 1 1/8	2.5
HGX46/310-4 ML CO_2 T	6	27.20 / 32.60	③	66.4	39.9	231 / 283	247	28	35 I 1 3/8	2.5
HGX46/310-4 S CO_2 T	6	27.20 / 32.60	③	82.9	47.7	289 / 399	265	28	35 I 1 3/8	2.5
HGX46/310-4 SH CO_2 T	6	27.20 / 32.60	③	⑥	⑥	⑥	265	28	35 I 1 3/8	2.5
HGX46/345-4 ML CO_2 T	6	30.20 / 36.20	③	73.1	44.0	231 / 283	247	28	35 I 1 3/8	2.5
HGX46/345-4 S CO_2 T	6	30.20 / 36.20	③	90.9	53.1	289 / 399	265	28	35 I 1 3/8	2.5
HGX46/345-4 SH CO_2 T	6	30.20 / 36.20	③	⑥	⑥	⑥	265	28	35 I 1 3/8	2.5

* PW = Part Winding, motors for part winding start 1 = 1. part winding 2 = 2. part winding

Explanations:

① Tolerance (± 10%) relates to the mean value of the voltage range.
Other voltages and current types on request.

② - The specifications for max. power consumption apply for 50 Hz operation. For 60 Hz operation, the specifications have to be mulitplied by the factor 1.2.
- Take account of the max. operating current / max. power consumption when designing contactors, leads and fuses.
Switches: Service category AC3

③ 380-420 V Y/YY - 3 - 50 Hz PW
440-480 V Y/YY - 3 - 60 Hz PW
PW = Part Winding, motors for part winding start
(no start unloaders required)
- Winding ratios: 70% / 30%
- Design for Y/Δ on request

④ Compression joint for steel pipes

⑤ For soldering connections

⑥ Values on request

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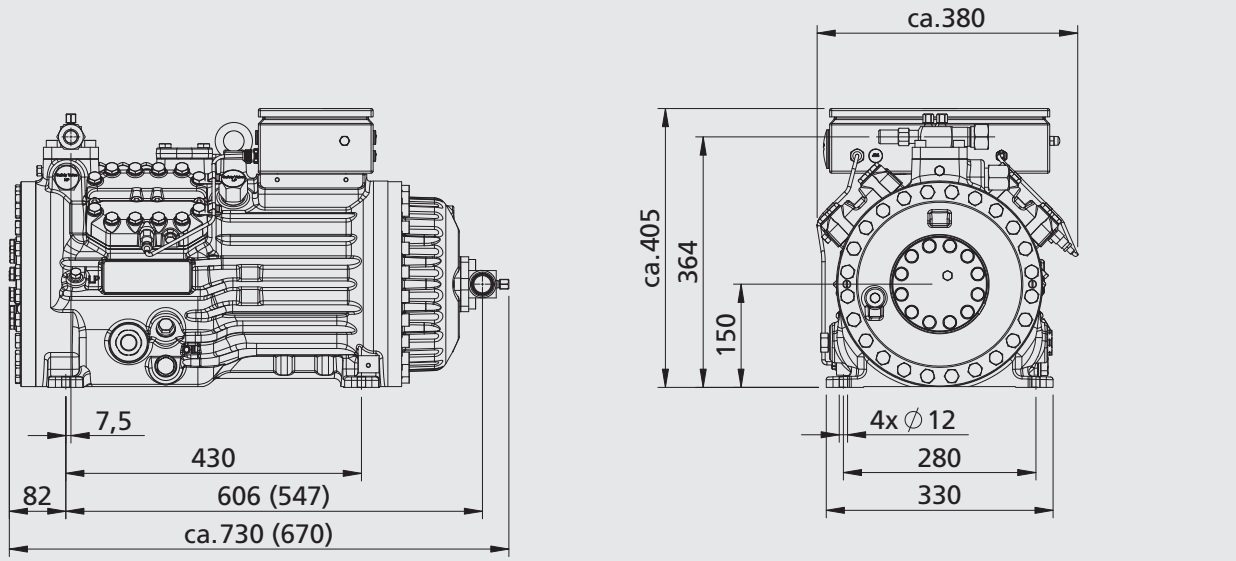
HGX34 CO_2 T

HGX34/110-4 CO_2 T
HGX34/130-4 CO_2 T
HGX34/150-4 CO_2 T
HGX34/170-4 CO_2 T
HGX34/190-4 CO_2 T
HGX34/210-4 CO_2 T
HGX34/230-4 CO_2 T

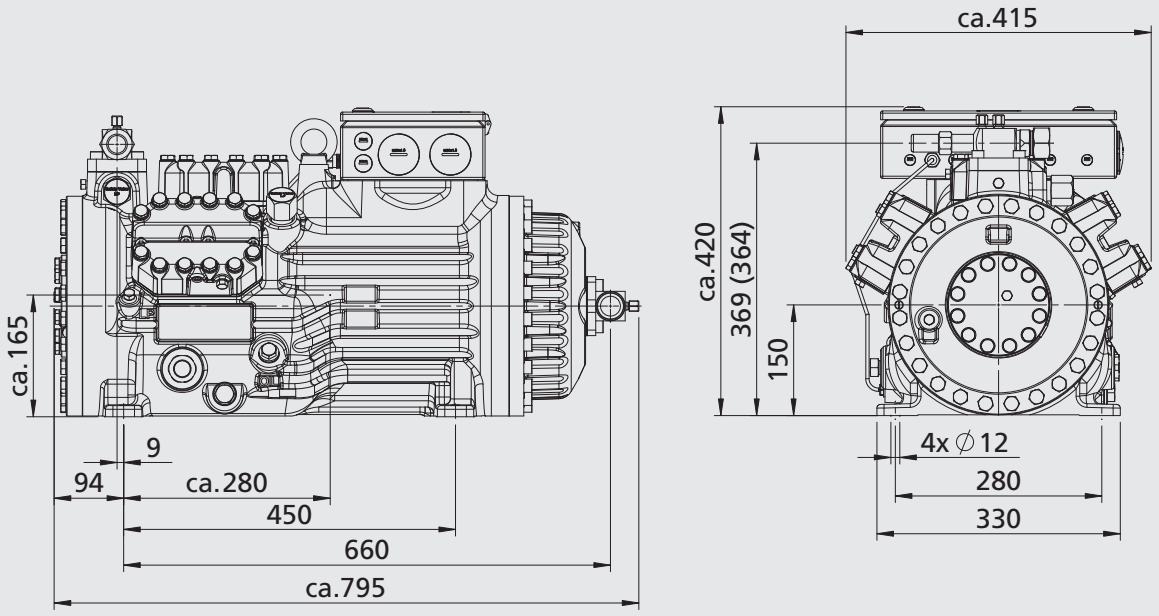


Dimensions in ( ) =

HGX34/110-4 ML CO_2 T	HGX34/130-4 ML CO_2 T	HGX34/150-4 ML CO_2 T	HGX34/170-4 ML CO_2 T	HGX34/210-4 ML CO_2 T
HGX34/110-4 S CO_2 T	HGX34/130-4 S CO_2 T	HGX34/150-4 S CO_2 T	HGX34/190-4 MLCO$_2$ T	
HGX34/110-4 SH CO_2 T	HGX34/130-4 SH CO_2 T	HGX34/150-4 SH CO_2 T		

HGX46 CO_2 T

HGX46/250-4 CO_2 T
HGX46/280-4 CO_2 T
HGX46/310-4 CO_2 T
HGX46/345-4 CO_2 T



Dimensions in ( ) =

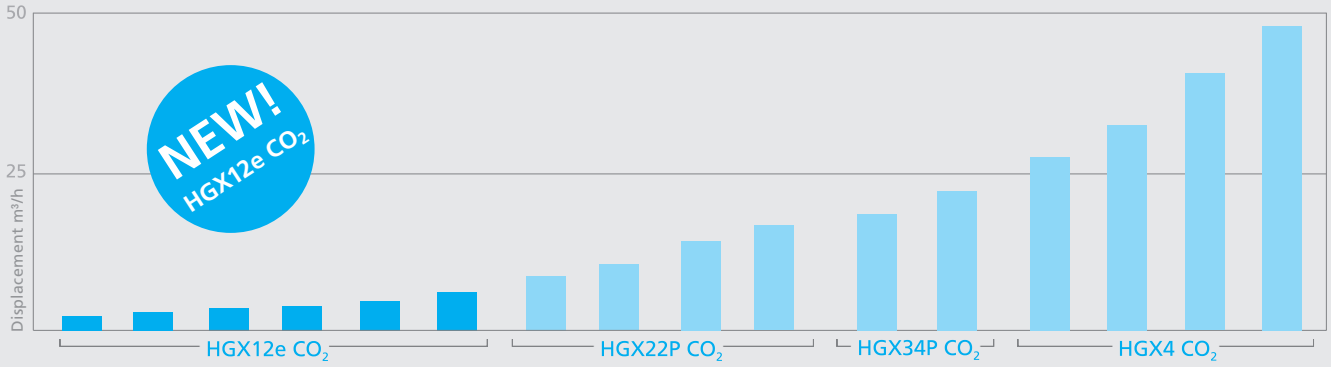
HGX46/250-4 ML CO_2 T	HGX46/280-4 ML CO_2 T	
HGX46/250-4 S CO_2 T	HGX46/280-4 S CO_2 T	
HGX46/250-4 SH CO_2 T	HGX46/280-4 SH CO_2 T	

Dimensions in mm

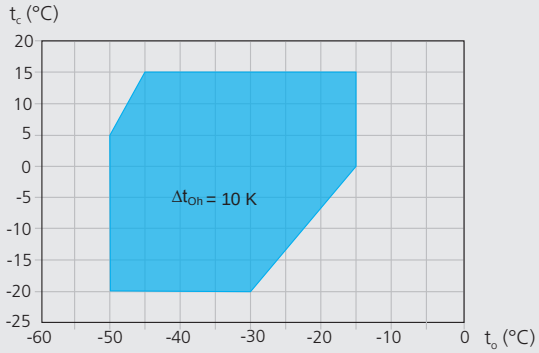
CO_2 Compressors (subcritical)

The current program

...4 model sizes with 16 capacity stages from 2.0 to 48.2 m³/h (50 Hz)



CO_2 Operating limits



HGX12e CO_2

Unlimited application range

t_o Evaporating temperature (°C)

t_c Condensing temperature (°C)

Δt_{oh} Suction gas superheat (K)

Max. permissible operating pressure (LP/HP)[1] 40/55 bar

[1] LP = low pressure HP = high pressure

CO_2 Notes

Operating limits

Compressor operation is possible within the limits shown on the application diagram. Compressor application limits should not be chosen for design purposes or continuous operation.

Restrictions to the operating limits may occur when using the Bock EFC (Electronic Frequency Control). Further information see separate brochure "Bock semi-hermetic compressors - Electronic Controls".

Performance data

The performance data for CO_2 are based on 10 K suction gas superheat without liquid subcooling, at **50 Hz power supply frequency.**

Conversion factor for 60 Hz = 1.2

Performance data for other operating points, see GEA Bock software.

CO_2 Performance data 50 Hz

Compressor Type	m³/h (50 Hz)	Deep freezing Condensing temp. +5°C / Evaporating temp. -35°C *			Deep freezing Condensing temp. -5°C / Evaporating temp. -35°C *		
		$\dot{Q}_o$ [W]	P_e [kW]	COP	$\dot{Q}_o$ [W]	P_e [kW]	COP
HGX12e/20-4 S CO_2	1.6	2190	0.88	2.49	2710	0.72	3.76
HGX12e/30-4 S CO_2	2.6	3450	1.38	2.50	4280	1.16	3.69
HGX12e/40-4 S CO_2	3.6	4920	1.97	2.50	6090	1.64	3.71
HGX12e/50-4 S CO_2	4.5	6180	2.49	2.48	7670	2.04	3.76
HGX12e/60-4 S CO_2	5.4	7660	3.01	2.54	9310	2.44	3.82
HGX12e/75-4 S CO_2	6.4	9090	3.57	2.55	11100	2.86	3.88

* according to EN 12900

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CO_2 Compressors (subcritical)

CO_2 Type	Number of cylinders	Displacement 50 / 60 Hz	Electrical data				Weight	Connections ④		Oil charge
			Voltage ①	Max. working current ②	Max. power consumption ②	Starting current (rotor locked) ②		Discharge line DV	Suction line SV ⑤	
		m³/h		A	kW	A	kg	mm I Inch	mm I Inch	Ltr.
				Δ / Y		Δ / Y				
HGX12e/20-4 S CO_2	2	1.60 / 1.90	③	4.0 / 2.3	1.2	24 / 14	49	12 I 1/2	16 I 5/8	0.8
HGX12e/30-4 S CO_2	2	2.60 / 3.10	③	6.0 / 3.5	1.8	40 / 23	49	12 I 1/2	16 I 5/8	0.8
HGX12e/40-4 S CO_2	2	3.60 / 4.30	③	8.3 / 4.8	2.6	40 / 23	53	12 I 1/2	16 I 5/8	0.8
HGX12e/50-4 S CO_2	2	4.50 / 5.40	③	9.7 / 5.6	3.3	43 / 25	53	12 I 1/2	16 I 5/8	0.8
HGX12e/60-4 S CO_2	2	5.40 / 6.50	③	13.3 / 7.7	3.9	69 / 40	49	12 I 1/2	16 I 5/8	0.8
HGX12e/75-4 S CO_2	2	6.40 / 7.70	③	15.7 / 9.0	4.7	69 / 40	49	12 I 1/2	16 I 5/8	0.8

Explanations:

① Tolerance (± 10%) relates to the mean value of the voltage range. Other voltages and current types on request.

② - The specifications for max. power consumption apply for 50 Hz operation. For 60 Hz operation, the specifications have to be mulitplied by the factor 1.2.
- Take account of the max. operating current / max. power consumption when designing contactors, leads and fuses. Switches: Service category AC3

③ 220-240 V Δ / 380-420 V Y - 3 - 50 Hz
265-290 V Δ / 440-480 V Y - 3 - 60 Hz

④ For soldering connections

Oil sump heater 110-240 V - 1 - 50/60 Hz
50-120 W, PTC heater, self-regulating, installation in housing bore

Type key for the sub and transcritical GEA Bock compressor program

HG X 12 e / 75 - 4 S CO_2 T

- T: Transcritical
- CO_2: CO_2 Version
- S: Compressor variant [4]
- 4: Number of poles
- 75: Swept volume
- e: Series [3]
- 12: Number of cylinders
- X: Size
- HG: Ester oil filling [2]
- HG: Series [1]

[1] HG = Compressor Hermetic Gas-cooled (suction gas cooled)
[2] X = Special Ester oil for CO_2
[3] P = Additional declaration for Pluscom compressors
e = Additional declaration for e-series compressors
[4] ML = For medium and low temperature applications at low and medium evaporating temperatures
S = For frequency control and extended application range
SH = For heat pumps and at high evaporating temperatures, oil charge changed

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GEA Group is a global engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881, the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX Europe 600 Index.

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