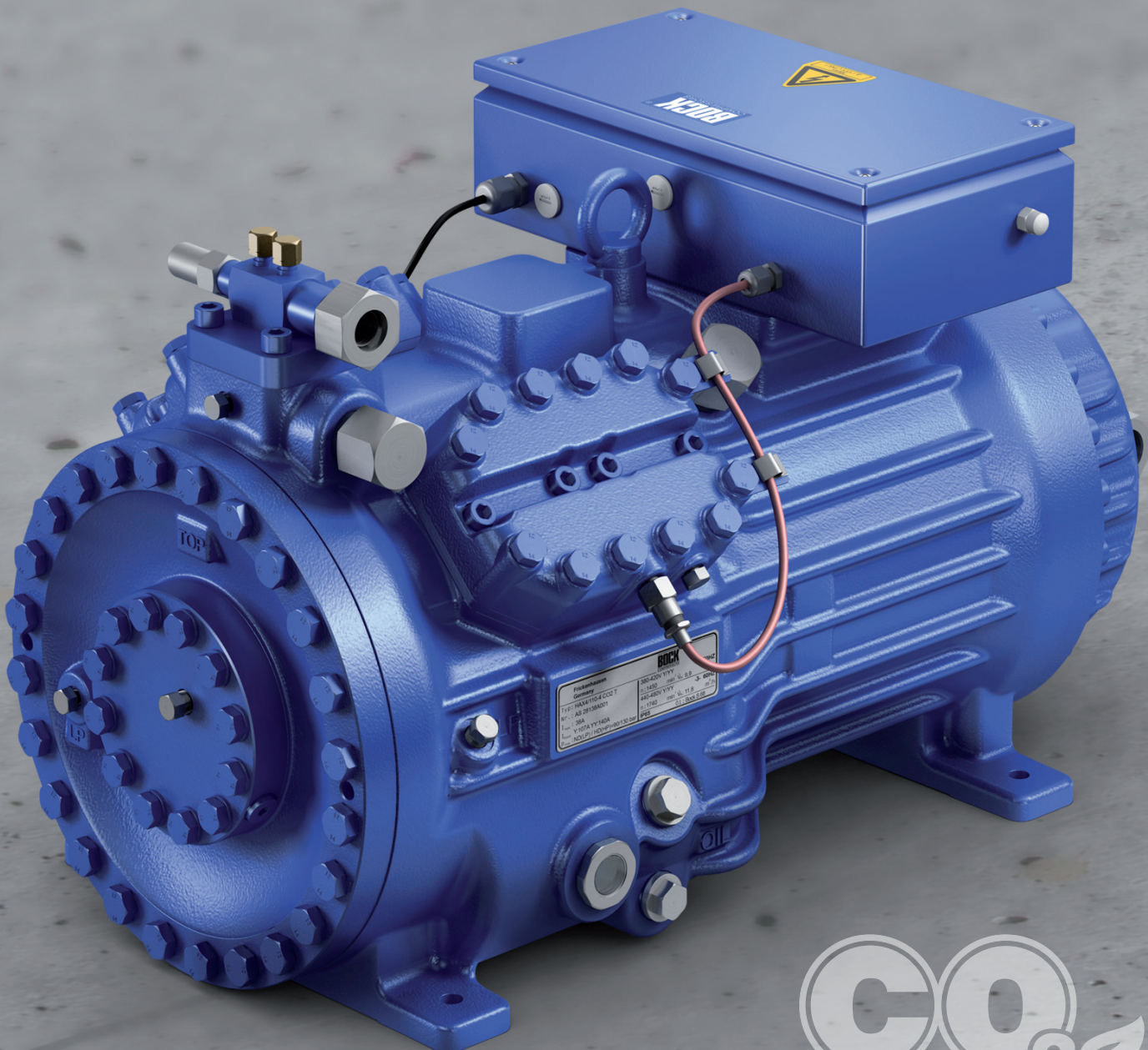


# CO<sub>2</sub> compressors - HG34 CO<sub>2</sub>T

Semi-hermetic 4-cylinder compressors for transcritical CO<sub>2</sub> applications



# CO<sub>2</sub> compressors (transcritical) - At a glance

Since the beginning of the 90's Bock and leading institutes and manufacturers are concerned with the development of compressors for the transcritical CO<sub>2</sub> process.

In the last few years, Bock CO<sub>2</sub> compressors were established in various applications. The current program of transcritical CO<sub>2</sub> compressors with the models RKX26 and HG2 CO<sub>2</sub> T is now extended by the 4-cylinder model HG34 CO<sub>2</sub> T with capacity stages from 9,9 to 20,1 m<sup>3</sup>/h.

## Important Information

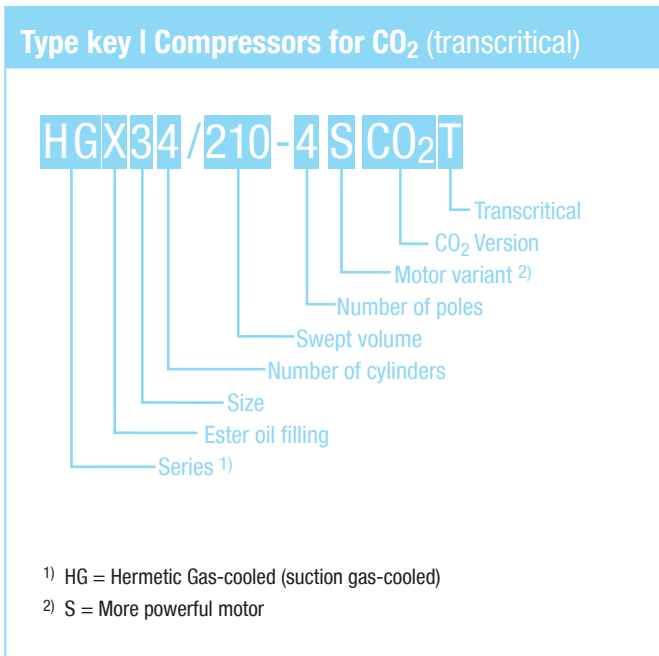
- Transcritical CO<sub>2</sub> applications are still in the development phase
- They require a completely new kind of system and control
- They are not a general solution for the substitution of F-gases
- We specifically point out that all information in this chapter has been made based on our current level of knowledge and may change at any time due to further development.
- Compressors can only be made available for selected projects

## CO<sub>2</sub> as a refrigerant

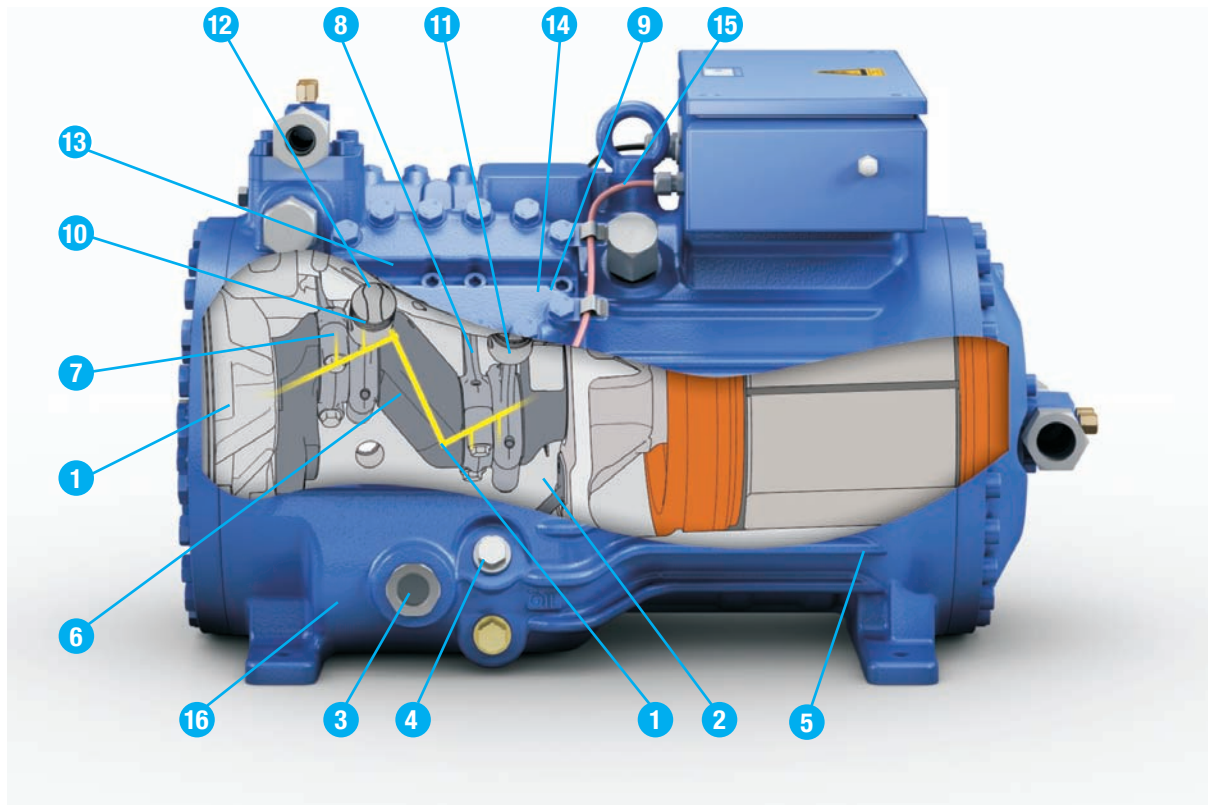
Within refrigeration technology, carbon dioxide (CO<sub>2</sub>) is known by the name R744 and has a long history.

It is a colourless gas which liquefies under pressure and has a slightly acidic smell. Carbon dioxide has no ozone depletion potential (ODP=0) and a negligible direct effect on global warming (GWP=1) when used as a refrigerant in closed systems.

It is not combustible, is chemically inactive and heavier than air. Carbon dioxide has a narcotic and asphyxiating effect on humans only at higher concentrations.



Available models	Displacement 50 Hz (1.450 rpm)
HGX34/110-4 CO <sub>2</sub> T HGX34/110-4 S CO <sub>2</sub> T	9,90 m <sup>3</sup> /h
HGX34/130-4 CO <sub>2</sub> T HGX34/130-4 S CO <sub>2</sub> T	11,30 m <sup>3</sup> /h
HGX34/150-4 CO <sub>2</sub> HGX34/150-4 S CO <sub>2</sub> T	12,90 m <sup>3</sup> /h
HGX34/170-4 CO <sub>2</sub> T HGX34/170-4 S CO <sub>2</sub> T	14,50 m <sup>3</sup> /h
HGX34/190-4 CO <sub>2</sub> T HGX34/190-4 S CO <sub>2</sub> T	16,30 m <sup>3</sup> /h
HGX34/210-4 CO <sub>2</sub> T HGX34/210-4 S CO <sub>2</sub> T	18,20 m <sup>3</sup> /h
HGX34/230-4 CO <sub>2</sub> T HGX34/230-4 S CO <sub>2</sub> T	20,10 m <sup>3</sup> /h



## Designed for CO<sub>2</sub> - built for the future

Bock HG34 CO<sub>2</sub> T - A compressor packed with more than 15 years of CO<sub>2</sub> compressor experience.

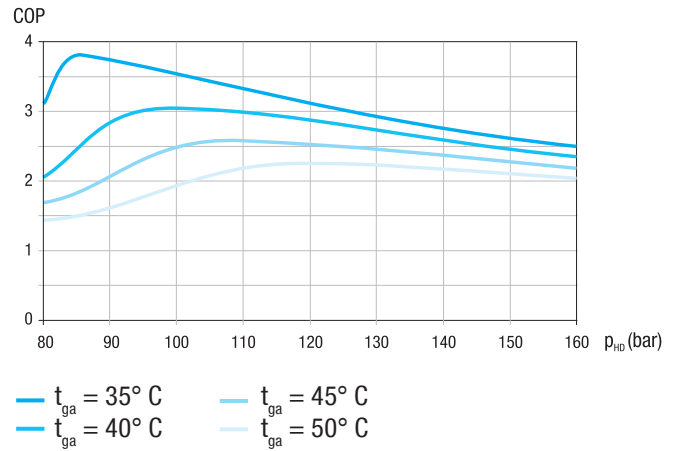
- |  |   |  |
|--|---|--|
| <ul style="list-style-type: none"> <li><b>1</b> Oil supply of bearings through forced lubrication and optimal oil circulation</li> <li><b>2</b> Low oil throw through a calmed lubrication circuit, minimum oil foaming and oil mist</li> <li><b>3</b> Calmed oil level for precise and safe indication of oil level in the sightglas</li> <li><b>4</b> Prevention against oil overfilling</li> <li><b>5</b> High-strength spheroidal cast iron housing for maximum operating pressures on the low pressure,- and high pressure side</li> <li><b>6</b> Tempered crankshaft with massive main bearing and optimised mass balance for highest running comfort</li> <li><b>7</b> Drop-forged, split steel connecting rod with bearing shell and bearing bush for highest dynamic loads and best emergency running properties</li> <li><b>8</b> Weight-optimised connecting rod for highest running comfort</li> </ul> | <ul style="list-style-type: none"> <li><b>9</b> Smallest possible piston diameter for maximum efficiency with CO<sub>2</sub></li> <li><b>10</b> Highest efficiency through hard chromium plated piston rings in triple assembly</li> <li><b>11</b> Hardened pistons with anti-friction coating at the piston skirt for minimum wear and high emergency running properties</li> <li><b>12</b> Piston heads with grooving of the suction reed valves outline for minimum clearance volume</li> <li><b>13</b> Thermal separations on the cylinder cover and in the compressor housing improve the temperature on the suction side</li> <li><b>14</b> Valve system with optimised flow and channels in the housing ensure lowest pressure drops and highest efficiency</li> <li><b>15</b> Thermal protection thermostat installed ex works as standard</li> <li><b>16</b> Oil sump heater installed ex works as standard</li> </ul> | <p>HA design in development</p> <p>In addition, the Bock characteristic features also apply to compressors of the type HG34 CO<sub>2</sub> T:</p> <ul style="list-style-type: none"> <li>- Easy maintenance, e.g. replaceable motors</li> <li>- Frequency converter</li> <li>- Bock MP10 electronic motor protection, especially easy to operate because of status indicators</li> </ul> |
|--|---|--|

## Special features of CO<sub>2</sub> transcritical

Based on the high CO<sub>2</sub> pressure and the low temperature of the critical point of 31°C (74 bar), transcritical operating conditions occur at higher temperatures at the heat exchanger. In this case, in comparison to subcritical applications, the refrigerant CO<sub>2</sub> can no longer be condensed. In this case, the refrigerant gas is heated in a gas cooler. The temperature and the pressure are not dependent on each other, compared to the subcritical operation.

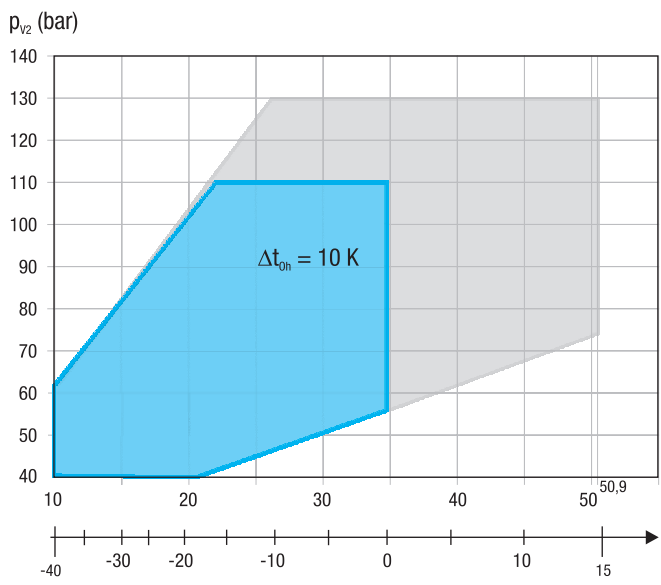
A special feature in these operating points is the necessary regulation of the high pressure at the so-called optimal high pressure. In doing this, the greatest possible enthalpy difference at the evaporator and the lowest possible power consumption of the compressor should be reached. In this way, the maximum coefficient of performance (COP) of the system is achieved. An additional valve with intelligent control after the high-pressure heat exchanger is needed for this in the system.

For additional information, see Bock software



$t_{ga}$  = Gas cooler outlet temperature  
 Limit conditions: isentropic compression  
 Evaporation pressure = 40 bar with internal heat exchanger

## CO<sub>2</sub> Operating limits HG34 CO<sub>2</sub> T



Unlimited application range

Motor version -S- (more powerful motor)

$t_0$  Evaporating temperature (°C)  
 $\Delta t_{0n}$  Suction gas superheat (K)  
 $p_0$  Suction pressure (bar)  
 $p_{v2}$  Discharge end pressure (bar)

Max. permissible pressure (LP/HP)<sup>1)</sup>: 100/150 bar

<sup>1)</sup> LP = low pressure HP = high pressure

## Notes

**Operating limits**

Compressor operation is possible within the limits shown on the application diagrams. Please note the coloured areas. Compressor application limits should not be chosen for design purposes or continuous operation.

**Performance data**

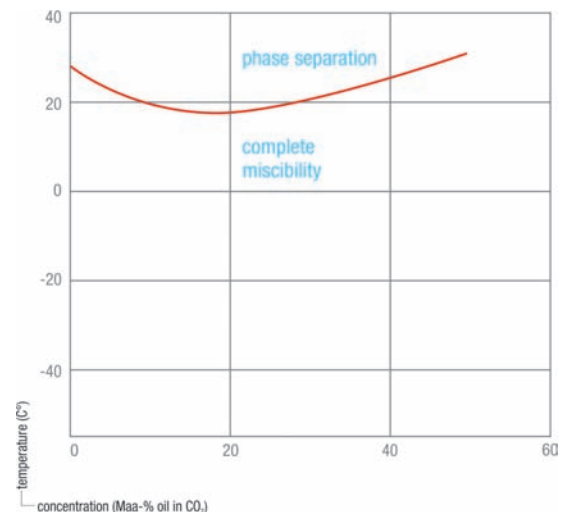
The performance data for CO<sub>2</sub> are based on 10 K suction-gas superheating at 50 Hz. In case of subcritical operating conditions, no liquid undercooling takes place. The performance data for transcritical operating conditions are specified close to the "optimal high pressure". The optimal high pressure is thereby related to an ideal cyclic process.

Conversion factor for 60 Hz = 1,2

## Notes

**Oil**

The compressors are equipped with Bock C85E, a special oil filling, which is available directly from Bock. This is a synthetic ester oil with high thermal load resistance, allowing good mixing solubility with CO<sub>2</sub>. It possesses a special additive, which protects the compressors against wear, even when subjected to extreme loads, such as those which exist in CO<sub>2</sub> systems. This oil can be used both in transcritical and subcritical systems.



## Notes on performance data

**Subcritical performance data 50 Hz**

Relative to 10 K suction gas superheat without liquid subcooling

**Transcritical performance data 50 Hz**

Relative to 10 K suction gas superheat

The performance data are indicated at a high pressure level, which is close to an optimal high pressure level. Optimal high pressure is thereby related to an ideal cyclic process.

Please note that all measured data represent preliminary values. Subject to change without notice.

$t_c$  = Condensing temperature

$t_{ga}$  = Gas cooler outlet temperature

$p_{v2}$  = Pressure at the compressor outlet [bar]

Optimal high pressure is outside of the operating limits. Performance data are indicated at maximal possible high pressure.

# CO<sub>2</sub> compressors (transcritical) - Performance data

CO <sub>2</sub>		Performance data										50 Hz		
Type		Cooling capacity Q <sub>0</sub> [W]					Power consumption P <sub>e</sub> [kW]							
		Evaporating temperature °C												
		15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	
HGX34/110-4 CO <sub>2</sub> T	t <sub>c</sub> °C	SUBCRITICAL												
	10	Q							30550	25750	21300	17300	13650	10500
		P							6,40	6,50	6,55	6,50	6,30	6,00
	15	Q				39750	34200	29050	24200	19750	15750	12150	9100	
		P				6,75	7,00	7,15	7,25	7,20	7,05	6,75	6,30	
	20	Q			43050	37250	31850	26800	22100	17850	14100	10800	8000	
	P			7,40	7,65	7,85	7,95	7,95	7,85	7,60	7,15	6,60		
	25	Q			38550	33100	28050	23350	19150	15350	12050	9250		
	P			8,40	8,65	8,80	8,85	8,75	8,50	8,10	7,50			
	30	Q			31200	26400	22000	18050	14600	11600	9150			
	P			9,55	9,75	9,80	9,75	9,50	9,15	8,55				
HGX34/110-4 S CO <sub>2</sub> T	t <sub>c</sub> °C	SUBCRITICAL												
	10	Q							30550	25750	21300	17300	13650	10500
		P							6,40	6,50	6,55	6,50	6,30	6,00
	15	Q				39750	34200	29050	24200	19750	15750	12150	9100	
		P				6,75	7,00	7,15	7,25	7,20	7,05	6,75	6,30	
	20	Q			43050	37250	31850	26800	22100	17850	14100	10800	8000	
	P			7,40	7,65	7,85	7,95	7,95	7,85	7,60	7,15	6,60		
	25	Q			44350	38550	33100	28050	23350	19150	15350	12050	9250	
	P			8,10	8,40	8,65	8,80	8,85	8,75	8,50	8,10	7,50		
	30	Q		41900	36350	31200	26400	22000	18050	14600	11600	9150		
	P		8,90	9,25	9,55	9,75	9,80	9,75	9,50	9,15	8,55			
HGX34/110-4 CO <sub>2</sub> T	t <sub>ga</sub> °C	TRANSCRITICAL												
	30	p <sub>v2</sub>				75	75	75	75	75	75	75	75	
		Q				31650	26850	22500	18600	15150	12100	9400		
		P				10,00	10,15	10,20	10,10	9,80	9,40	8,75		
	35	p <sub>v2</sub>				90	90	90	90	90	85			
		Q				31150	26350	22000	18100	14600	10950			
	P				12,10	12,10	11,95	11,55	11,00	9,95				
40	p <sub>v2</sub>				100	105	105	105	100	85				
	Q				27650	23700	19550	15750	12350	5500				
	P				13,45	13,85	13,35	12,65	11,55	9,95				
45	p <sub>v2</sub>				110	110	110	110	100					
	Q				24000	20050	16450	13150	9150					
	P				14,70	14,35	13,75	12,95	11,55					
50	p <sub>v2</sub>				110	110	110	110	100					
	Q				18300	15350	12600	10100	5900					
	P				14,70	14,35	13,75	12,95	11,55					
HGX34/110-4 S CO <sub>2</sub> T	t <sub>ga</sub> °C	TRANSCRITICAL												
	30	p <sub>v2</sub>	75	75	75	75	75	75	75	75	75	75		
		Q	49150	42750	36950	31650	26850	22500	18600	15150	12100	9400		
		P	8,95	9,35	9,75	10,00	10,15	10,20	10,10	9,80	9,40	8,75		
	35	p <sub>v2</sub>	85	85	85	90	90	90	90	90	80			
		Q	45050	39200	33850	31150	26350	22000	18100	14600	11450	5850		
	P	10,50	10,90	11,25	12,10	12,10	11,95	11,55	11,00	10,20	8,95			
40	p <sub>v2</sub>	100	100	100	100	105	105	105	100	90				
	Q	43800	37850	32500	27650	23700	19550	15750	12350	8050				
	P	12,90	13,25	13,45	13,45	13,85	13,35	12,65	11,55	10,20				
45	p <sub>v2</sub>	110	110	115	115	115	120	115	100					
	Q	38450	33150	29250	24700	20550	17050	13300	9150					
	P	14,50	14,75	15,50	15,30	14,85	14,45	13,20	11,55					
50	p <sub>v2</sub>	125	125	130	130	130	130	115	100					
	Q	35400	30500	27400	23250	19500	16000	10750	5900					
	P	16,90	16,95	17,40	16,85	16,05	14,95	13,20	11,55					

CO <sub>2</sub>		Performance data											50 Hz
Type		Cooling capacity Q <sub>0</sub> [W]					Power consumption P <sub>e</sub> [kW]						
		Evaporating temperature °C											
		15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40
HGX34/130-4 CO <sub>2</sub> T	t <sub>c</sub> °C	SUBCRITICAL											
	10	Q						35100	29600	24500	19850	15700	12050
		P						7,35	7,50	7,55	7,45	7,25	6,90
	15	Q				45650	39300	33300	27750	22650	18050	13950	10450
		P				7,75	8,05	8,20	8,30	8,25	8,10	7,75	7,25
	20	Q			49400	42800	36550	30750	25400	20500	16150	12350	9150
		P			8,50	8,80	9,05	9,15	9,15	9,00	8,70	8,25	7,55
	25	Q			44250	38000	32200	26850	21950	17600	13850	10650	
		P			9,65	9,95	10,10	10,15	10,05	9,75	9,30	8,65	
	30	Q			35800	30300	25300	20750	16750	13350	10500		
		P			10,95	11,20	11,25	11,20	10,95	10,50	9,85		
HGX34/130-4 CO <sub>2</sub> T	t <sub>ga</sub> °C	TRANSCRITICAL											
	30	P <sub>v2</sub>			75	75	75	75	75	75	75	75	
		Q			36300	30800	25850	21400	17400	13900	10800		
		P			11,50	11,70	11,70	11,60	11,30	10,75	10,05		
	35	P <sub>v2</sub>			90	90	90	90	90	85	75		
		Q			35750	30250	25250	20800	16750	12550	3500		
		P			13,90	13,90	13,70	13,25	12,60	11,45	10,05		
	40	P <sub>v2</sub>			100	105	105	105	100	85			
		Q			31750	27250	22450	18050	14200	6300			
		P			15,45	15,90	15,35	14,55	13,25	11,45			
	45	P <sub>v2</sub>			110	110	110	110	100				
		Q			27550	23000	18900	15100	10550				
		P			16,85	16,45	15,80	14,85	13,25				
	50	P <sub>v2</sub>			110	110	110	110	100				
		Q			21050	17600	14450	11550	6800				
		P			16,85	16,45	15,80	14,85	13,25				
HGX34/130-4 S CO <sub>2</sub> T	t <sub>c</sub> °C	SUBCRITICAL											
	10	Q						35100	29600	24500	19850	15700	12050
		P						7,35	7,50	7,55	7,45	7,25	6,90
	15	Q				45650	39300	33300	27750	22650	18050	13950	10450
		P				7,75	8,05	8,20	8,30	8,25	8,10	7,75	7,25
	20	Q			49400	42800	36550	30750	25400	20500	16150	12350	9150
		P			8,50	8,80	9,05	9,15	9,15	9,00	8,70	8,25	7,55
	25	Q			50900	44250	38000	32200	26850	21950	17600	13850	10650
		P			9,30	9,65	9,95	10,10	10,15	10,05	9,75	9,30	8,65
	30	Q			48100	41750	35800	30300	25300	20750	16750	13350	10500
		P			10,20	10,65	10,95	11,20	11,25	11,20	10,95	10,50	9,85
HGX34/130-4 S CO <sub>2</sub> T	t <sub>ga</sub> °C	TRANSCRITICAL											
	30	P <sub>v2</sub>	75	75	75	75	75	75	75	75	75	75	
		Q	56450	49100	42400	36300	30800	25850	21400	17400	13900	10800	
		P	10,25	10,75	11,20	11,50	11,70	11,70	11,60	11,30	10,75	10,05	
	35	P <sub>v2</sub>	85	85	85	90	90	90	90	90	90	80	
		Q	51700	45000	38850	35750	30250	25250	20800	16750	13150	6700	
		P	12,05	12,55	12,90	13,90	13,90	13,70	13,25	12,60	11,70	10,25	
	40	P <sub>v2</sub>	100	100	100	100	105	105	100	90			
		Q	50250	43450	37300	31750	27250	22450	18050	14200	9200		
		P	14,80	15,20	15,40	15,45	15,90	15,35	14,55	13,25	11,70		
	45	P <sub>v2</sub>	110	110	115	115	115	120	115	100			
		Q	44150	38050	33550	28350	23600	19550	15250	10550			
		P	16,65	16,95	17,80	17,55	17,05	16,60	15,15	13,25			
	50	P <sub>v2</sub>	125	125	130	130	130	130	115	100			
		Q	40650	35000	31450	26700	22350	18350	12350	6800			
		P	19,40	19,45	19,95	19,35	18,40	17,15	15,15	13,25			

# CO<sub>2</sub> compressors (transcritical) - Performance data

CO <sub>2</sub>		Performance data											50 Hz	
Type		Cooling capacity Q <sub>0</sub> [W]					Power consumption P <sub>e</sub> [kW]							
		Evaporating temperature °C												
		15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	
HGX34/150-4 CO <sub>2</sub> T	t <sub>c</sub> °C	SUBCRITICAL												
	10	Q							39950	33650	27850	22550	17850	13700
		P							8,35	8,50	8,55	8,50	8,25	7,85
	15	Q				51950	44700	37900	31600	25800	20550	15900	11850	
		P				8,85	9,15	9,35	9,45	9,40	9,20	8,85	8,25	
	20	Q			56200	48700	41600	35000	28900	23350	18400	14100	10450	
		P			9,65	10,05	10,30	10,45	10,40	10,25	9,90	9,35	8,60	
25	Q			50350	43250	36650	30550	25000	20050	15750	12100			
	P			11,00	11,30	11,50	11,55	11,45	11,10	10,60	9,85			
30	Q			40750	34500	28750	23600	19050	15150	11950				
	P			12,50	12,75	12,80	12,70	12,45	11,95	11,20				
HGX34/150-4 CO <sub>2</sub> T	t <sub>ga</sub> °C	TRANSCRITICAL												
	30	p <sub>v2</sub>			75	75	75	75	75	75	75	75		
		Q			41300	35050	29400	24300	19800	15800	12300			
		P			13,05	13,30	13,35	13,20	12,85	12,25	11,40			
	35	p <sub>v2</sub>			90	90	90	90	90	85				
		Q			40700	34400	28750	23650	19050	14250				
		P			15,85	15,80	15,55	15,10	14,35	13,00				
40	p <sub>v2</sub>			100	105	105	105	100	85					
	Q			36100	31000	25500	20550	16150	7150					
	P			17,55	18,05	17,45	16,55	15,05	13,00					
45	p <sub>v2</sub>			110	110	110	110	110						
	Q			31350	26200	21500	17150	12000						
	P			19,20	18,75	18,00	16,90	15,05						
50	p <sub>v2</sub>			110	110	110	110	100						
	Q			23950	20050	16450	13150	7750						
	P			19,20	18,75	18,00	16,90	15,05						
HGX34/150-4 S CO <sub>2</sub> T	t <sub>c</sub> °C	SUBCRITICAL												
	10	Q							39950	33650	27850	22550	17850	13700
		P							8,35	8,50	8,55	8,50	8,25	7,85
	15	Q				51950	44700	37900	31600	25800	20550	15900	11850	
		P				8,85	9,15	9,35	9,45	9,40	9,20	8,85	8,25	
	20	Q			56200	48700	41600	35000	28900	23350	18400	14100	10450	
		P			9,65	10,05	10,30	10,45	10,40	10,25	9,90	9,35	8,60	
25	Q			57900	50350	43250	36650	30550	25000	20050	15750	12100		
	P			10,60	11,00	11,30	11,50	11,55	11,45	11,10	10,60	9,85		
30	Q		54700	47500	40750	34500	28750	23600	19050	15150	11950			
	P		11,60	12,10	12,50	12,75	12,80	12,70	12,45	11,95	11,20			
HGX34/150-4 S CO <sub>2</sub> T	t <sub>ga</sub> °C	TRANSCRITICAL												
	30	p <sub>v2</sub>	75	75	75	75	75	75	75	75	75	75		
		Q	64200	55850	48250	41300	35050	29400	24300	19800	15800	12300		
		P	11,65	12,25	12,70	13,05	13,30	13,35	13,20	12,85	12,25	11,40		
	35	p <sub>v2</sub>	85	85	85	90	90	90	90	90	80			
		Q	58850	51200	44200	40700	34400	28750	23650	19050	14950	7600		
		P	13,70	14,25	14,65	15,85	15,80	15,55	15,10	14,35	13,30	11,65		
40	p <sub>v2</sub>	100	100	100	100	105	105	105	100	90				
	Q	57200	49450	42450	36100	31000	25500	20550	16150	10500				
	P	16,85	17,30	17,55	17,55	18,05	17,45	16,55	15,05	13,30				
45	p <sub>v2</sub>	110	110	115	115	115	120	115	100					
	Q	50200	43300	38200	32250	26850	22250	17400	12000					
	P	18,95	19,30	20,25	19,95	19,35	18,90	17,20	15,05					
50	p <sub>v2</sub>	125	130	130	130	130	130	115	100					
	Q	46300	39850	35800	30400	25450	20900	14050	7750					
	P	22,10	22,15	22,70	22,00	20,95	19,50	17,20	15,05					



CO <sub>2</sub>		Performance data											50 Hz	
Type		Cooling capacity Q <sub>0</sub> [W]						Power consumption P <sub>e</sub> [kW]						
		Evaporating temperature °C												
		15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	
HGX34/170-4 CO <sub>2</sub> T	t <sub>c</sub> °C	SUBCRITICAL												
	10	Q						45100	38000	31450	25500	20150	15500	
		P						9,45	9,60	9,70	9,60	9,30	8,85	
	15	Q					58650	50450	42800	35650	29100	23200	17950	13400
		P					10,00	10,35	10,55	10,65	10,65	10,40	10,00	9,35
	20	Q				63450	54950	46950	39500	32600	26350	20750	15900	11750
		P				10,90	11,30	11,60	11,75	11,75	11,60	11,20	10,60	9,70
	25	Q			56850	48850	41350	34450	28200	22600	17750	13650		
		P			12,45	12,80	13,00	13,05	12,90	12,55	11,95	11,10		
	30	Q			46000	38950	32450	26650	21500	17100	13500			
		P			14,10	14,35	14,45	14,35	14,05	13,45	12,65			
HGX34/170-4 CO <sub>2</sub> T	t <sub>ga</sub> °C	TRANSCRITICAL												
	30	p <sub>v2</sub>			75	75	75	75	75	75	75			
		Q			46650	39550	33200	27450	22350	17850	13900			
		P			14,75	15,00	15,05	14,90	14,50	13,80	12,90			
	35	p <sub>v2</sub>			90	90	90	90	90	85				
		Q			45950	38850	32450	26700	21500	16100				
		P			17,85	17,85	17,60	17,05	16,02	14,70				
40	p <sub>v2</sub>			100	105	105	105	100	85					
	Q			40750	34950	28800	23200	18250	8100					
	P			19,85	20,40	19,70	18,70	17,00	14,70					
45	p <sub>v2</sub>			110	110	110	110	100						
	Q			35400	29550	24250	19400	13500						
	P			21,65	21,15	20,30	19,10	17,00						
50	p <sub>v2</sub>			110	110	110	110	100						
	Q			27000	22600	18600	14850	8750						
	P			21,65	21,15	20,30	19,10	17,00						
HGX34/170-4 S CO <sub>2</sub> T	t <sub>c</sub> °C	SUBCRITICAL												
	10	Q						45100	38000	31450	25500	20150	15500	
		P						9,45	9,60	9,70	9,60	9,30	8,85	
	15	Q					58650	50450	42800	35650	29100	23200	17950	13400
		P					10,00	10,35	10,55	10,65	10,65	10,40	10,00	9,35
	20	Q				63450	54950	46950	39500	32600	26350	20750	15900	11750
		P				10,90	11,30	11,60	11,75	11,75	11,60	11,20	10,60	9,70
25	Q			65400	56850	48850	41350	34450	28200	22600	17750	13650		
	P			11,95	12,45	12,80	13,00	13,05	12,90	12,55	11,95	11,10		
30	Q		61750	53600	46000	38950	32450	26650	21500	17100	13500			
	P		13,10	13,70	14,10	14,35	14,45	14,35	14,05	13,45	12,65			
HGX34/170-4 S CO <sub>2</sub> T	t <sub>ga</sub> °C	TRANSCRITICAL												
	30	p <sub>v2</sub>	75	75	75	75	75	75	75	75	75			
		Q	72500	63050	54450	46650	39550	33200	27450	22350	17850	13900		
		P	13,15	13,80	14,35	14,75	15,00	15,05	14,90	14,50	13,80	12,90		
	35	p <sub>v2</sub>	85	85	90	90	90	90	90	90	80			
		Q	66400	57800	49900	45950	38850	32450	26700	21500	16850	8600		
		P	15,45	16,10	16,55	17,85	17,85	17,60	17,05	16,02	15,00	13,15		
40	p <sub>v2</sub>	100	100	100	100	105	105	105	100	90				
	Q	64600	55850	47900	40750	34950	28800	23200	18250	11850				
	P	19,00	19,50	19,80	19,85	20,40	19,70	18,70	17,00	15,00				
45	p <sub>v2</sub>	110	110	115	115	115	120	115	100					
	Q	56700	48900	43100	36400	30300	25150	19600	13500					
	P	21,40	21,75	22,85	22,55	21,85	21,30	19,45	17,00					
50	p <sub>v2</sub>	125	125	130	130	130	130	115	100					
	Q	52250	45000	40400	34300	28750	23550	15900	8750					
	P	24,95	25,00	25,60	24,85	23,65	22,05	19,45	17,00					

# CO<sub>2</sub> compressors (transcritical) - Performance data

CO <sub>2</sub>		Performance data										50 Hz		
Type		Cooling capacity Q <sub>0</sub> [W]					Power consumption P <sub>e</sub> [kW]							
		Evaporating temperature °C												
		15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	
HGX34/190-4 CO <sub>2</sub> T	t <sub>c</sub> °C	SUBCRITICAL												
	10	Q						50550	42600	35250	28550	22600	17350	
		P						10,55	10,80	10,85	10,75	10,45	9,95	
	15	Q					65750	56600	48000	40000	32650	26000	20100	15000
		P					11,20	11,60	11,85	11,95	11,90	11,65	11,20	10,45
	20	Q				71150	61650	52650	44300	36550	29550	23250	17800	13200
	P				12,25	12,70	13,05	13,20	13,20	13,00	12,55	11,85	10,90	
	25	Q			63750	54750	46350	38650	31600	25350	19900	15300		
	P			13,95	14,35	14,60	14,65	14,45	14,05	13,40	12,45			
	30	Q			51550	43650	36400	29850	24100	19200	15150			
	P			15,80	16,10	16,20	16,10	15,75	15,10	14,15				
HGX34/190-4 CO <sub>2</sub> T	t <sub>ga</sub> °C	TRANSCRITICAL												
	30	p <sub>v2</sub>			75	75	75	75	75	75	75	75		
		Q			52300	44350	37200	30800	25050	20000	15550			
		P			16,55	16,80	16,85	16,70	16,25	15,50	14,45			
	35	p <sub>v2</sub>			90	90	90	90	90	85				
		Q			51500	43550	36400	29900	24100	18050				
	P			20,05	20,00	19,70	19,10	18,15	16,45					
40	p <sub>v2</sub>			100	105	105	105	100	85					
	Q			45700	39200	32300	26000	20450	9050					
	P			22,25	22,85	22,10	20,95	19,05	16,45					
45	p <sub>v2</sub>			110	110	110	110	100						
	Q			39700	33150	27200	21700	15150						
	P			24,30	23,70	22,75	21,40	19,05						
50	p <sub>v2</sub>			110	110	110	110	100						
	Q			30300	25350	20850	16650	9800						
	P			24,30	23,70	22,75	21,40	19,05						
HGX34/190-4 S CO <sub>2</sub> T	t <sub>c</sub> °C	SUBCRITICAL												
	10	Q						50550	42600	35250	28550	22600	17350	
		P						10,55	10,80	10,85	10,75	10,45	9,95	
	15	Q					65750	56600	48000	40000	32650	26000	20100	15000
		P					11,20	11,60	11,85	11,95	11,90	11,65	11,20	10,45
	20	Q				71150	61650	52650	44300	36550	29550	23250	17800	13200
	P				12,25	12,70	13,05	13,20	13,20	13,00	12,55	11,85	10,90	
	25	Q			73300	63750	54750	46350	38650	31600	25350	19900	15300	
	P			13,40	13,95	14,35	14,60	14,65	14,45	14,05	13,40	12,45		
	30	Q			69250	60100	51550	43650	36400	29850	24100	19200	15150	
	P			14,70	15,35	15,80	16,10	16,20	16,10	15,75	15,10	14,15		
HGX34/190-4 S CO <sub>2</sub> T	t <sub>ga</sub> °C	TRANSCRITICAL												
	30	p <sub>v2</sub>	75	75	75	75	75	75	75	75	75	75		
		Q	81250	70700	61050	52300	44350	37200	30800	25050	20000	15550		
		P	14,75	15,50	16,10	16,55	16,80	16,85	16,70	16,25	15,50	14,45		
	35	p <sub>v2</sub>	85	85	85	90	90	90	90	80				
		Q	74450	64800	55950	51500	43550	36400	29900	24100	18050			
	P	17,35	18,05	18,55	20,05	20,00	19,70	19,10	18,15	16,45				
40	p <sub>v2</sub>	100	100	100	100	105	105	105	100	90				
	Q	72400	62600	53700	45700	39200	32300	26000	20450	13250				
	P	21,30	21,90	22,20	22,25	22,85	22,10	20,95	19,05	16,85				
45	p <sub>v2</sub>	110	110	115	115	115	120	115	100					
	Q	63550	54800	48300	40800	33950	28150	22000	15150					
	P	240	24,40	25,60	25,25	24,50	23,90	21,80	19,05					
50	p <sub>v2</sub>	125	125	130	130	130	130	115	100					
	Q	58550	50450	45300	38450	32200	26400	17800	9800					
	P	27,95	28,05	28,70	27,85	26,50	24,70	21,80	19,05					

CO <sub>2</sub>		Performance data											50 Hz	
Type		Cooling capacity Q <sub>0</sub> [W]						Power consumption P <sub>e</sub> [kW]						
		Evaporating temperature °C												
		15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	
HGX34/210-4 CO <sub>2</sub> T	t <sub>c</sub> °C	SUBCRITICAL												
	10	Q						56300	47450	39250	31800	25150	19350	
		P						11,80	12,00	12,10	12,00	11,65	11,05	
	15	Q			73250	63050	53450	44550	36350	28950	22400	16750		
		P			12,45	12,90	13,20	13,35	13,30	13,00	12,45	11,65		
	20	Q				79300	68650	58650	49350	40750	32900	25950	19850	14700
		P				13,65	14,15	14,50	14,70	14,70	14,50	14,00	13,25	12,15
	25	Q			71000	61000	51650	43050	35200	28250	22200	17050		
		P			15,55	16,00	16,25	16,30	16,10	15,70	14,95	13,90		
	30	Q				57450	48650	40550	33300	26850	21350	16850		
		P				17,60	17,95	18,10	17,95	17,55	16,85	15,80		
HGX34/210-4 CO <sub>2</sub> T	t <sub>ga</sub> °C	TRANSCRITICAL												
	30	p <sub>v2</sub>			75	75	75	75	75	75	75	75		
		Q			58250	49400	41450	34300	27900	22300	17350			
		P			18,45	18,70	18,80	18,60	18,10	17,25	16,10			
	35	p <sub>v2</sub>			90	90	90	90	90	85				
		Q			57350	48500	40550	33350	26850	20100				
		P			22,30	22,30	21,95	21,25	20,20	18,35				
	40	p <sub>v2</sub>			100	105	105	105	100	85				
	Q			50900	43700	36000	29000	22750	10100					
	P			24,75	25,45	24,60	23,35	21,20	18,35					
	45	p <sub>v2</sub>			110	110	110	110	110					
	Q			44200	36950	30300	24200	16900						
	P			27,05	26,40	25,35	23,85	21,20						
	50	p <sub>v2</sub>			110	110	110	110	110					
	Q			33750	28250	23200	18550	10900						
	P			27,05	26,40	25,35	23,85	21,20						
HGX34/210-4 S CO <sub>2</sub> T	t <sub>c</sub> °C	SUBCRITICAL												
	10	Q						56300	47450	39250	31800	25150	19350	
		P						11,80	12,00	12,10	12,00	11,65	11,05	
	15	Q			73250	63050	53450	44550	36350	28950	22400	16750		
		P			12,45	12,90	13,20	13,35	13,30	13,00	12,45	11,65		
	20	Q				79300	68650	58650	49350	40750	32900	25950	19850	14700
		P				13,65	14,15	14,50	14,70	14,70	14,50	14,00	13,25	12,15
	25	Q			81650	71000	61000	51650	43050	35200	28250	22200	17050	
		P			14,95	15,55	16,00	16,25	16,30	16,10	15,70	14,95	13,90	
	30	Q			77150	67000	57450	48650	40550	33300	26850	21350	16850	
		P			16,40	17,10	17,60	17,95	18,10	17,95	17,55	16,85	15,80	
HGX34/210-4 S CO <sub>2</sub> T	t <sub>ga</sub> °C	TRANSCRITICAL												
	30	p <sub>v2</sub>	75	75	75	75	75	75	75	75	75	75		
		Q	90550	78800	68050	58250	49400	41450	34300	27900	22300	17350		
		P	16,45	17,25	17,95	18,45	18,70	18,80	18,60	18,10	17,25	16,10		
	35	p <sub>v2</sub>	85	85	90	90	90	90	90	90	90	80		
		Q	82950	72200	62350	57350	48500	40550	33350	26850	21050	10700		
		P	19,30	20,10	20,70	22,30	22,30	21,95	21,25	20,20	18,75	16,45		
	40	p <sub>v2</sub>	100	100	100	100	105	105	105	100	90			
	Q	80650	69750	59850	50900	43700	36000	29000	22750	14750				
	P	23,75	24,35	24,75	24,75	25,45	24,60	23,35	21,20	18,75				
	45	p <sub>v2</sub>	110	110	115	115	115	120	115	100				
	Q	70800	61050	53850	45450	37850	31400	24500	16900					
	P	26,75	27,20	28,55	28,15	27,30	26,60	24,25	21,20					
	50	p <sub>v2</sub>	125	125	130	130	130	130	115	100				
	Q	65250	56200	50450	42850	35900	29450	19850	10900					
	P	31,15	31,20	32,00	31,00	29,55	27,50	24,25	21,20					

# CO<sub>2</sub> compressors (transcritical) - Performance data

CO <sub>2</sub>		Performance data											50 Hz			
Type		Cooling capacity Q <sub>0</sub> [W]						Power consumption P <sub>e</sub> [kW]								
		Evaporating temperature °C														
		15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40			
HGX34/230-4 CO <sub>2</sub> T	t <sub>c</sub> °C	SUBCRITICAL														
	10	Q							62400	52550	43500	35250	27850	21400		
		P							13,05	13,30	13,40	13,30	12,90	12,25		
	15	Q	81150						69850	59250	49350	40300	32100	24800	18550	
		P	13,80						14,30	14,65	14,80	14,70	14,40	13,80	12,90	
	20	Q	87850						76050	65000	54650	45100	36450	28750	22000	16300
		P	15,15						15,70	16,10	16,30	16,30	16,05	15,50	14,65	13,45
25	Q	78700						67600	57250	47700	39050	31300	24550	18900		
	P	17,20						17,70	18,00	18,05	17,85	17,40	16,55	15,40		
30	Q	63650						53900	44950	36850	29750	23700	18650			
	P	19,50						19,90	20,05	19,90	19,45	18,65	17,50			
HGX34/230-4 CO <sub>2</sub> T	t <sub>ga</sub> °C	TRANSCRITICAL														
	30	p <sub>v2</sub>	75						75	75	75	75	75	75		
		Q	64550						54750	45900	38000	30950	24700	19200		
		P	20,40						20,75	20,80	20,60	20,05	19,10	17,80		
	35	p <sub>v2</sub>	90						90	90	90	85				
		Q	63550						53750	44900	36950	29750	22300			
		P	24,70						24,70	24,30	23,55	22,40	20,35			
40	p <sub>v2</sub>	100						105	105	105	100	85				
	Q	56400						48400	39850	32100	25200	11200				
	P	27,45						28,20	27,25	25,85	23,50	20,35				
45	p <sub>v2</sub>	110						110	110	110	110					
	Q	49000						40900	33550	26800	18700					
	P	30,00						29,25	28,10	26,40	23,50					
50	p <sub>v2</sub>	110						110	110	110	110					
	Q	37400						31300	25700	20550	12050					
	P	30,00						29,25	28,10	26,40	23,50					
HGX34/230-4 S CO <sub>2</sub> T	t <sub>c</sub> °C	SUBCRITICAL														
	10	Q							62400	52550	43500	35250	27850	21400		
		P							13,05	13,30	13,40	13,30	12,90	12,25		
	15	Q	81150						69850	59250	49350	40300	32100	24800	18550	
		P	13,80						14,30	14,65	14,80	14,70	14,40	13,80	12,90	
	20	Q	87850						76050	65000	54650	45100	36450	28750	22000	16300
		P	15,15						15,70	16,10	16,30	16,30	16,05	15,50	14,65	13,45
25	Q	90500						78700	67600	57250	47700	39050	31300	24550	18900	
	P	16,55						17,20	17,70	18,00	18,05	17,85	17,40	16,55	15,40	
30	Q	85450						74200	63650	53900	44950	36850	29750	23700	18650	
	P	18,15						18,95	19,50	19,90	20,05	19,90	19,45	18,65	17,50	
HGX34/230-4 S CO <sub>2</sub> T	t <sub>ga</sub> °C	TRANSCRITICAL														
	30	p <sub>v2</sub>	75	75	75	75	75	75	75	75	75	75	75			
		Q	100300	87300	75400	64550	54750	45900	38000	30950	24700	19200				
		P	18,20	19,10	19,85	20,40	20,75	20,80	20,60	20,05	19,10	17,80				
	35	p <sub>v2</sub>	85	85	85	90	90	90	90	90	90	80				
		Q	91900	80000	69100	63550	53750	44900	36950	29750	23350	11900				
		P	21,40	22,25	24,70	24,70	24,70	24,30	23,55	22,40	20,80	18,20				
40	p <sub>v2</sub>	100	100	100	100	105	105	105	100	90						
	Q	89350	77250	66300	56400	48400	39850	32100	25200	16350						
	P	26,20	27,00	27,40	27,45	28,20	27,25	25,85	23,50	20,80						
45	p <sub>v2</sub>	110	115	115	115	115	120	115	100							
	Q	78450	67650	59650	50350	41900	34750	27150	18700							
	P	29,60	30,10	31,60	31,15	30,25	29,50	26,90	23,50							
50	p <sub>v2</sub>	125	125	130	130	130	130	115	100							
	Q	72300	62250	55900	47450	39750	32600	21950	12050							
	P	34,50	34,60	35,45	34,35	32,70	30,50	26,90	23,50							

CO <sub>2</sub> Type	Number of cylinders	Displacement 50 / 60 Hz m <sup>3</sup> /h	Electrical data ③				Weight kg	Connections		Oil-charge Ltr.
			Voltage	Max. working current	Max. power consumption	Starting current (rotor locked)		Discharge line DV	Suction line SV	
			①	②	②	A		⑤	⑥	
				PW*1+2		PW*1/PW*1+2	mm	mm   inch		
HGX34/110-4 CO <sub>2</sub> T	4	9,90 / 11,80	④	24,9	14,7	85/110	194	22	28 / 1 1/8	2,5
HGX34/110-4 S CO <sub>2</sub> T	4	9,90 / 11,80	④	31,0	17,7	110/141	197	22	28 / 1 1/8	2,5
HGX34/130-4 CO <sub>2</sub> T	4	11,30 / 13,60	④	28,5	16,9	85/110	194	22	28 / 1 1/8	2,5
HGX34/130-4 S CO <sub>2</sub> T	4	11,30 / 13,60	④	35,3	20,3	110/141	197	22	28 / 1 1/8	2,5
HGX34/150-4 CO <sub>2</sub> T	4	12,90 / 15,40	④	33,5	19,2	110 / 141	197	22	28 / 1 1/8	2,5
HGX34/150-4 S CO <sub>2</sub> T	4	12,90 / 15,40	④	39,3	23,1	127 / 158	200	22	28 / 1 1/8	2,5
HGX34/170-4 CO <sub>2</sub> T	4	14,50 / 17,40	④	37,6	21,7	110 / 141	196	22	28 / 1 1/8	2,5
HGX34/170-4 S CO <sub>2</sub> T	4	14,50 / 17,40	④	44,3	26,1	152 / 183	209	22	28 / 1 1/8	2,5
HGX34/190-4 CO <sub>2</sub> T	4	16,30 / 19,60	④	41,3	24,3	127 / 158	200	22	28 / 1 1/8	2,5
HGX34/190-4 S CO <sub>2</sub> T	4	16,30 / 19,60	④	49,6	29,2	152 / 183	209	22	28 / 1 1/8	2,5
HGX34/210-4 CO <sub>2</sub> T	4	18,20 / 21,80	④	46,0	27,0	152 / 183	200	22	28 / 1 1/8	2,5
HGX34/210-4 S CO <sub>2</sub> T	4	18,20 / 21,80	④	55,4	32,5	156 / 193	215	22	28 / 1 1/8	2,5
HGX34/230-4 CO <sub>2</sub> T	4	20,10 / 24,10	④	50,9	30,0	152 / 183	209	22	28 / 1 1/8	2,5
HGX34/230-4 S CO <sub>2</sub> T	4	20,10 / 24,10	④	65,5	36,1	191 / 245	217	22	28 / 1 1/8	2,5

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

**Oil sump heater 110-240 V - 1 - 50/60 Hz (standard)**

- PTC heater, 50-120 W, self-regulating



Oil sump heater is necessary due to the high CO<sub>2</sub> solubility in the oil.

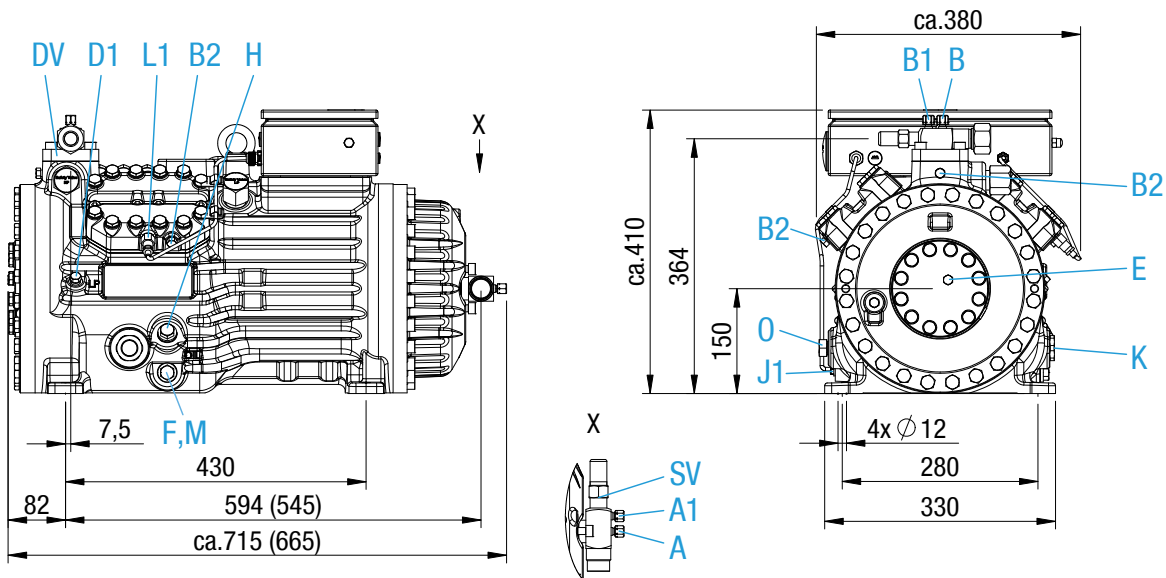
**Explanations:**

- ① Tolerance (± 10%) relates to the mean value of the voltage range. Other voltages and current types on request.
- ② Take account of the max. operating current / max. power consumption when designing contactors, leads and fuses. Switches: Service category AC3
- ③ All data are based on the mean value of the voltage range.
- ④ 380-420 V Y/YY - 3 - 50 Hz PW  
440-480 V Y/YY - 3 - 60 Hz PW  
PW = Part Winding, Part Winding, motors for part winding start (no start unloaders required)  
- Winding ratios: 70% / 30%  
- Designs for Y/Δ on request
- ⑤ Compression joint for steel pipes
- ⑥ For soldering connections

# CO<sub>2</sub> compressors (transcritical) - Dimensions & connections

## HGX34 CO<sub>2</sub> T

HGX34/110-4 (S) CO<sub>2</sub> T    HGX34/150-4 (S) CO<sub>2</sub> T    HGX34/190-4 (S) CO<sub>2</sub> T    HGX34/230-4 (S) CO<sub>2</sub> T  
 HGX34/130-4 (S) CO<sub>2</sub> T    HGX34/170-4 (S) CO<sub>2</sub> T    HGX34/210-4 (S) CO<sub>2</sub> T



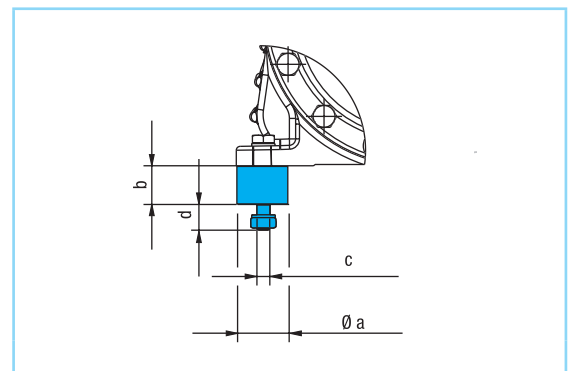
Dimensions in ( ) = HGX34/110-4 CO<sub>2</sub> T    HGX34/130-4 CO<sub>2</sub> T    HGX34/150-4 CO<sub>2</sub> T    HGX34/170-4 CO<sub>2</sub> T    HGX34/210-4 CO<sub>2</sub> T  
 HGX34/110-4 S CO<sub>2</sub> T    HGX34/130-4 S CO<sub>2</sub> T    HGX34/150-4 S CO<sub>2</sub> T    HGX34/190-4 CO<sub>2</sub> T

Dimensions in mm

- Connections see page 15

## Dimensions for anti-vibration pad

Type	Ø a mm	b mm	c mm	d mm
HGX34 CO <sub>2</sub> T	50	30	M10	25



Connections		HGX34 CO <sub>2</sub> T
<b>SV</b>	Suction line	Please refer to technical data! Page 13
<b>DV</b>	Discharge line	
<b>A</b>	Connection suction side, not lockable	7/16" UNF
<b>A1</b>	Connection suction side, lockable	7/16" UNF
<b>B</b>	Connection discharge side, not lockable	7/16" UNF
<b>B1</b>	Connection discharge side, lockable	7/16" UNF
<b>B2</b>	Connection discharge side, not lockable	1/8" UNF
<b>D1</b>	Connection oil return from oil separator	1/4" NPTF
<b>E</b>	Connection oil pressure gauge	1/8" NPTF
<b>F</b>	Oil drain	M22 x 1,5
<b>H</b>	Oil charge plug	M22 x 1,5
<b>J1</b>	Oil sump heater	Ø 15 mm
<b>K</b>	Sight glass	1 1/8" - 18 UNEF
<b>L1</b>	Thermal protection thermostat	1/8" NPTF
<b>M</b>	Oil filter	M22 x 1,5
<b>O</b>	Connection oil level regulator	1/2" NPTF

#### Scope of supply HGX34 CO<sub>2</sub> T

Semi-hermetic 2 cylinder reciprocating compressor with drive motor for part winding start – 4 pole version

380-420 V Y/YY - 3 - 50 Hz

440-480 V Y/YY - 3 - 60 Hz

Single-section compressor housing

Winding protection with PTC resistor sensors and electronic motor protection unit Bock MP10

Thermal protection thermostat (PTC sensor) IP67

Oil sump heater 110-240 V - 1 - 50/60 Hz, 50-120 W

PTC heater, self regulating

Oil charge: Bock C85E <sup>1)</sup>

Sight glass

Compressor decompression valve suction and discharge line

Discharge line shut off valve incl. cutting ring version

Suction line shut off valve with soldered joint

Inert gas charge

4 anti-vibration pads enclosed

<sup>1)</sup>Also available as refill unit in 1 liter packaging

#### Accessories HGX34 CO<sub>2</sub> T

Suction line shut off valve incl. cutting ring version

[www.bock.de](http://www.bock.de)



Bock Kältemaschinen GmbH  
Benzstraße 7  
D-72636 Frickenhausen  
Telephone: +49 7022 9454-0  
Fax: +49 7022 9454-137  
[mail@bock.de](mailto:mail@bock.de)  
[www.bock.de](http://www.bock.de)