



Grasso SC Series

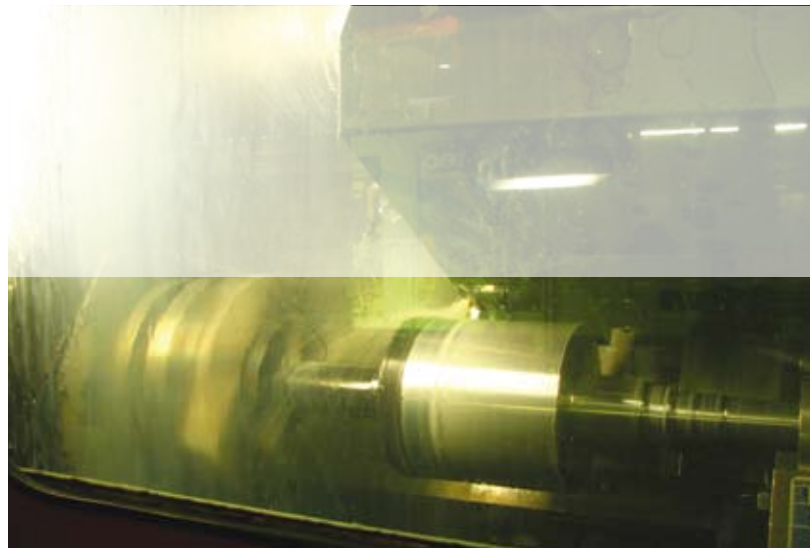
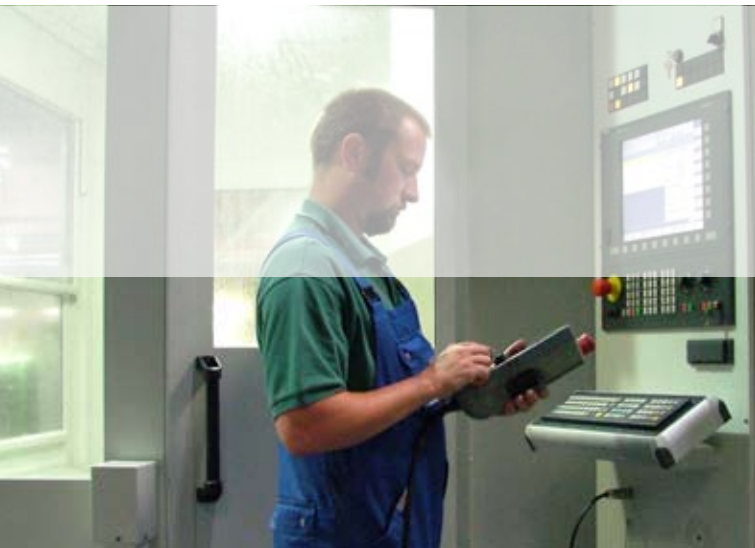
Screw compressors
for industrial refrigeration

GEA Refrigeration



Grasso

Reliability, Efficiency & Experience



Grasso screw compressors reflect the simplicity of design, optimal energy efficiency and long lifetime of components combined with quiet operation and smooth running features.

One of the main targets, during the design of a new compressor, is to find simple solutions whilst using standard components. As a result, Grasso screw compressors incorporate unique selling proposition and innovations which guarantee fast and efficient maintenance on-site.

From day one in the development of a Grasso screw compressor, our experienced team of engineers takes care of the important

aspects of design being reliable and high efficient within the need to protect and conserve global energy resources.

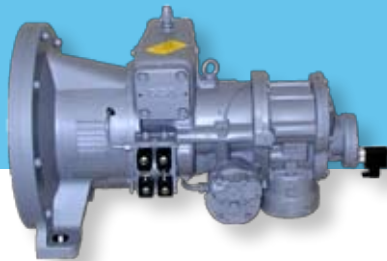
Each compressor undergoes numerous testing procedures before it leaves the factory including an operational run on a special test rig. These large scale procedures are a process of Grasso's quality management system which are certified to ISO 9001 that ensures customers receive highly reliable components for their refrigeration systems.

Reliable products and optimal support from experienced staff

Designed for compression of refrigerants

Grasso screw compressors are designed for compression of refrigerants applied to industrial refrigeration, air conditioning, heat pumps, and gas compression. They are characterized by over 50 years of experience as well as continual developments and patented innovations in screw compressor technology.

Developed especially for applications in industrial refrigeration and air conditioning with capacities of around 200 to 8,700 kW (57 to 2,476 tons), Grasso screw compressors can be used for booster and high pressure (28 bar/ 52 bar), single- or two-stage and heat pump applications up to 52 bar. The complete range of Grasso screw compressors covers swept volume flows from 230 to 8,560 m³/h (136 to 5,038 cfm) at 2940 rpm.



- 3D technology in design, manufacturing on highly exact NC tool machines and quality control by a 3D coordinate measuring machine ensures high Grasso quality
- Patented rotor profile, designed for efficient operation, smooth running and a minimum of wear
- Teeth ratio 5:6 of male/ female rotor pair and optimized ratio between rotor length and diameter calculated for each compressor size together with optimum teeth heights and rotor wrap angles
- Patented anti gas pulsation system, preventing pulsations in part load and at high pressure ratios
- Capacity is stepless adjustable between 0 % and 100 %
- One standardized wearless position indicator system for all compressor models which is connected to the control slide and hermetically sealed
- Variable Vi options for an efficient operation even at part load by optimizing the internal compression process
- Highest product lifetime and reliability by a simple design with proven components as well as hydraulic axial force compensation and high-performance bearings

Common features of Grasso screw compressors

Grasso's screw compressor program contains 22 different compressor sizes, divided into three design families SMALL (SH series), MEDIUM (MC series) and LARGE (LT series).

SMALL series screw compressors (SH series)

The SH series screw compressors were developed especially for the smaller volume flow rates of the Grasso range. Due to optional integration of package components like suction and discharge check valves, suction and oil filters, into the compressor, they are more than bare shaft screw compressors. They are a step forward to an entire compressor package. With their simple design and the removal of many connection points they are characterised by a compact, light and space-saving construction.

The package design has been simplified by integrating the entire oil management system (with only one oil connection) and important package modules into the compressor. The integration of the proven components into the compressor results in improved quality, greater safety and sealing and a high level of reliability in the resulting product, the screw compressor package.

The SH compressors are equipped with the sensor interfaces for pressure and temperature monitoring and for indicating the position of the control slide and

with the active interfaces of the integrated solenoid valve blocks for setting a combined Vi at part load. The direct assignment of the solenoid valves to the Vi and part load controller, together with the connection of the pressure and temperature sensor system on the compressor, simplifies assembly and servicing of the package. With the patented parallel slide system, Vi and part load control can be carried out independently but at the same time, allowing the screw compressor to have a low-loss working process even at part load.

Technical features

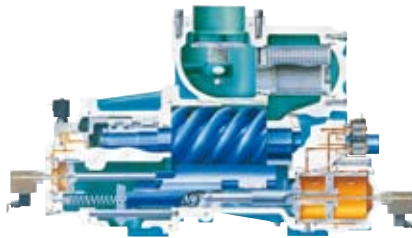
- Integration of package components
- Integration of the oil management system
- Space-saving compact design
- Maximum operating safety and sealing
- Suitable for all standard DIN-flange motors
- Rotors fully bedded on rolling bearings
- Low-noise and low-vibration running characteristic
- Anti gas pulsation system for safe part load operation
- High COP values in full and in part load due to Vi control in part load using parallel slide system (PS system)
- Stepless adjustable capacity control
- Nonwearing hermetically sealed position indicating system for control slide



MEDIUM series screw compressors (MC series)

MC series screw compressors are characterized by the integration of unit components and by their simple, compact and space-saving construction inside the compressor package. A suction non-return valve, suction filter, oil pump and oil-hydraulic system with associated solenoid valve assemblies for Vi and part load adjustment are integrated in the compressor.

This greatly reduces the internal pipework within the package. The control lines for the solenoid valves for Vi part load control are connected directly to the compressor.



Technical features

- Integration of package components
- Integrated oil distribution system
- Compact design and simple installation
- Roller bearings for thrust and radial load
- Low-noise and low-vibration running characteristics
- High COP values in all situations due to stepless Vi and capacity control using parallel slide system
- Anti gas pulsation system for safe part load operation
- Nonwearing hermetically sealed position indicating system

LARGE series screw compressors (LT series)

LT series screw compressors have all the latest features of Grasso screw compressor technology.

The tandem slide system together with the compressor control device offers new possibilities for combined Vi part load

adjustment. LT series screw compressors are installed in the large series screw package in the traditional manner. The optimal Vi-values for compression in full and part load conditions are calculated and hydraulically adjusted by the compressor control device.



Technical features

- Optimized main rotor dimensions result in high COP values
- High COP values for full and part load operation thanks to stepless Vi part load control with tandem slide system (TS system)
- Extremely long service life
- Compact and simple design for modern package installations and easy maintenance
- Rotors have antifriction and sleeve bearings for maximum loads
- Excellent noise and vibration characteristic in all operating states
- Anti gas pulsation system for safe part load operation
- Nonwearing hermetically sealed position indicating system

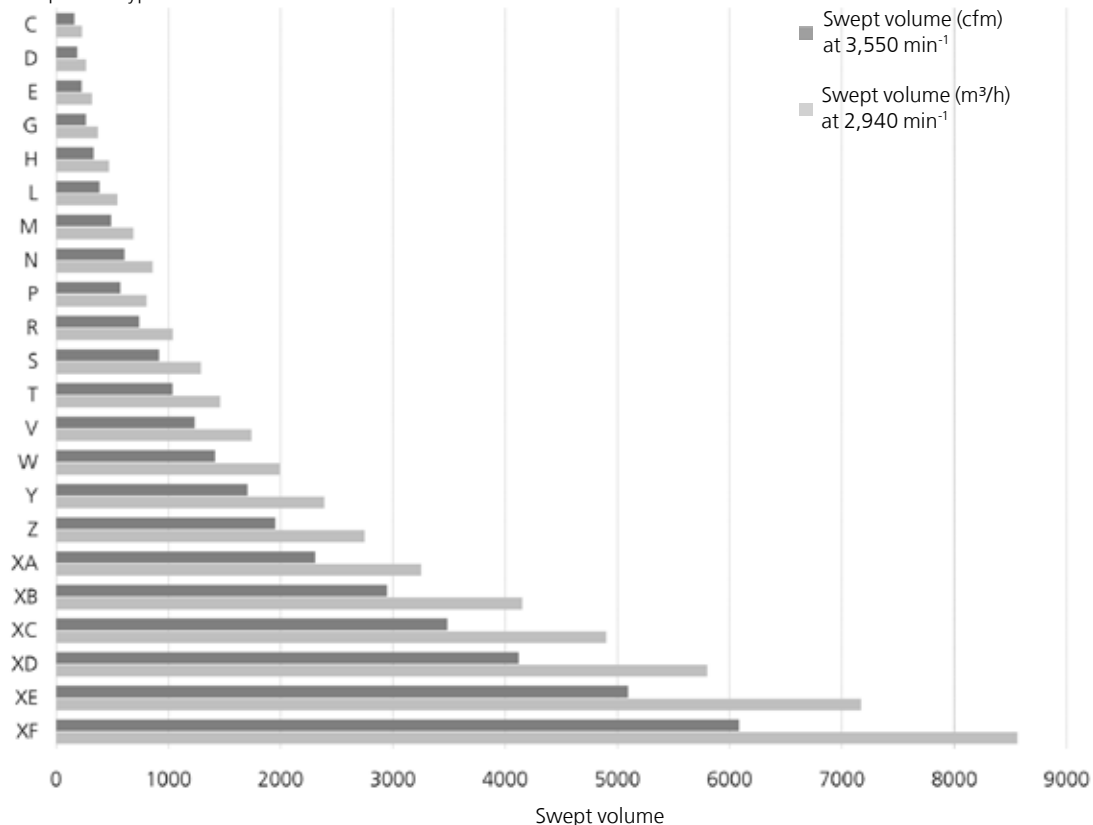
The Grasso screw compressor program

Compressor type		Swept volume (m ³ /h) ¹⁾	Swept volume (cfm) ²⁾	Dimensions (mm)			NB1 (mm) ³⁾	NB2 (mm) ⁴⁾	Mass (kg)
				L	B	H			
Grasso SH series	C	231	164	939	585	560	80	50	313
	D	265	188	968	585	560	80	50	324
	E	321	228	1004	675	670	100	65	460
	G	372	264	1033	675	670	100	65	471
Grasso MC	H	471	335	938	425	554	125	80	340
	L	544	387	974	425	554	125	80	365
	M	690	490	1090	480	610	150	100	580
	N	860	611	1135	480	610	150	100	640
Grasso LT series	P	805	572	817	600	525	150	100	595
	R	1040	739	965	660	570	175	100	895
	S	1290	917	1032	660	570	175	100	960
	T	1460	1038	1125	660	570	175	100	1060
	V	1740	1236	1040	750	670	250	150	1186
	W	1990	1418	1145	750	670	250	150	1200
	Y	2390	1703	1161	750	670	250	150	1308
	Z	2748	1953	1315	760	700	250	150	1670
	XA	3250	2309	1425	760	700	250	150	1740
	XB	4150	2949	1410	900	850	300	200	2100
	XC	4900	3486	1480	900	850	300	200	2400
	XD	5800	4122	1560	900	850	300	200	2600
XE	7110	5095	1625	980	980	400	250	3500	
XF	8560	6083	1725	980	980	400	250	3850	

1) at 2,940 min⁻¹ (50 Hz), 2) at 3,550 min⁻¹ (60 Hz), 3) suction connection, 4) discharge connection

Swept volumes

Compressor type



Grasso 28 bar compressors

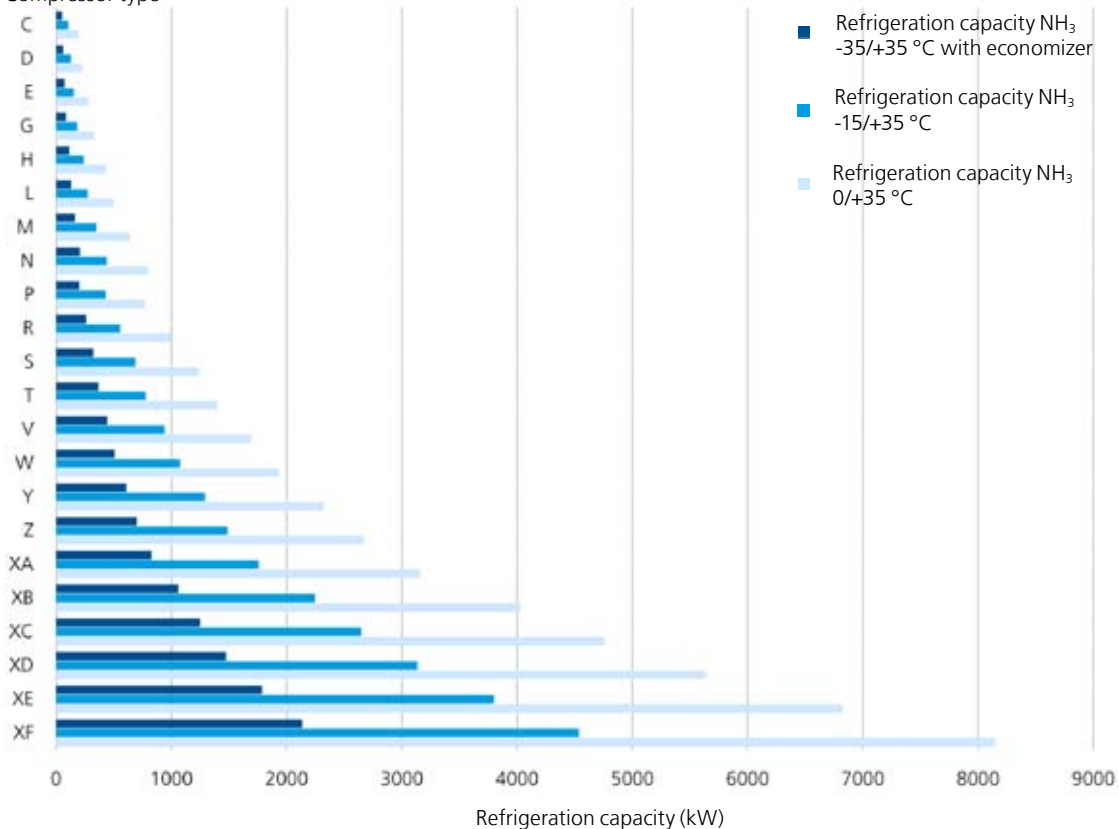
Compressor type	Swept volume (m ³ /h) ¹⁾	Swept volume (cfm) ²⁾	28 bar compressor NH ₃		
			Refrigeration capacity -35/+35 °C (kW) ³⁾	Refrigeration capacity -15/+35 °C (kW)	Refrigeration capacity 0/+35 °C (kW)
C	231	164	50	107	194
D	265	188	60	126	230
E	321	228	72	153	279
G	372	264	85	181	330
H	471	335	112	237	431
L	544	387	129	273	498
M	690	490	165	350	637
N	860	611	206	436	795
P	805	572	201	429	772
R	1040	739	260	554	997
S	1290	917	322	687	1236
T	1460	1038	364	777	1399
V	1740	1236	443	940	1690
W	1990	1418	506	1075	1932
Y	2390	1703	608	1291	2321
Z	2748	1953	700	1485	2670
XA	3250	2309	827	1756	3157
XB	4150	2949	1060	2245	4030
XC	4900	3486	1247	2648	4759
XD	5800	4122	1476	3135	5634
XE	7110	5095	1788	3797	6825
XF	8560	6083	2135	4533	8148

All capacity data are calculated at 2,940 min⁻¹, with 5 K superheat and 0 K subcooling. Economizer: open flash

1) at 2,940 min⁻¹ (50 Hz), 2) at 3,550 min⁻¹ (60 Hz), 3) with economizer

28 bar compressor refrigeration capacity with NH₃

Compressor type



Grasso 52 bar compressors

All Grasso screw compressors are available for two pressure levels: 28 bar and 52 bar maximum design pressure. The 52 bar compressors were introduced as a result of hot gas defrosting requirements with CO₂, new heat pump applications with higher temperature levels and other applications with a higher pressure level.

The new 52 bar series comprises 22 frame sizes covering a range of swept volume flows from 231 to 8560 m³/h. The increase of the permissible design pressure up to 52 bar results from the intention to defrost CO₂ cascade refrigeration systems by hot gas.

The waste-heat utilization sector also tends to higher useful warm-water temperatures in new applications of the heat

pump technology with ammonia. Heat pumps using ammonia with a useful hot water temperature level of 80 °C are available by means of the 52 bar range compressors. The 52 bar compressors contain the well-known features of the Grasso screw compressors.

These compressors have a fixed internal volume ratio (Vi) in the range from 1.2 to 5.5. The smaller Vi values are essential for efficient operation at high suction pressures and small pressure ratios.

Specific features

- Housing material with a higher strength e.g. nodular cast iron
- Stronger thrust bearing design at male rotor: 'Triax' Design
- High performance shaft seal
- High pressure components e.g. solenoid valve block
- Stronger driving shaft end if required
- Special rotor design to meet the high bearing load if required

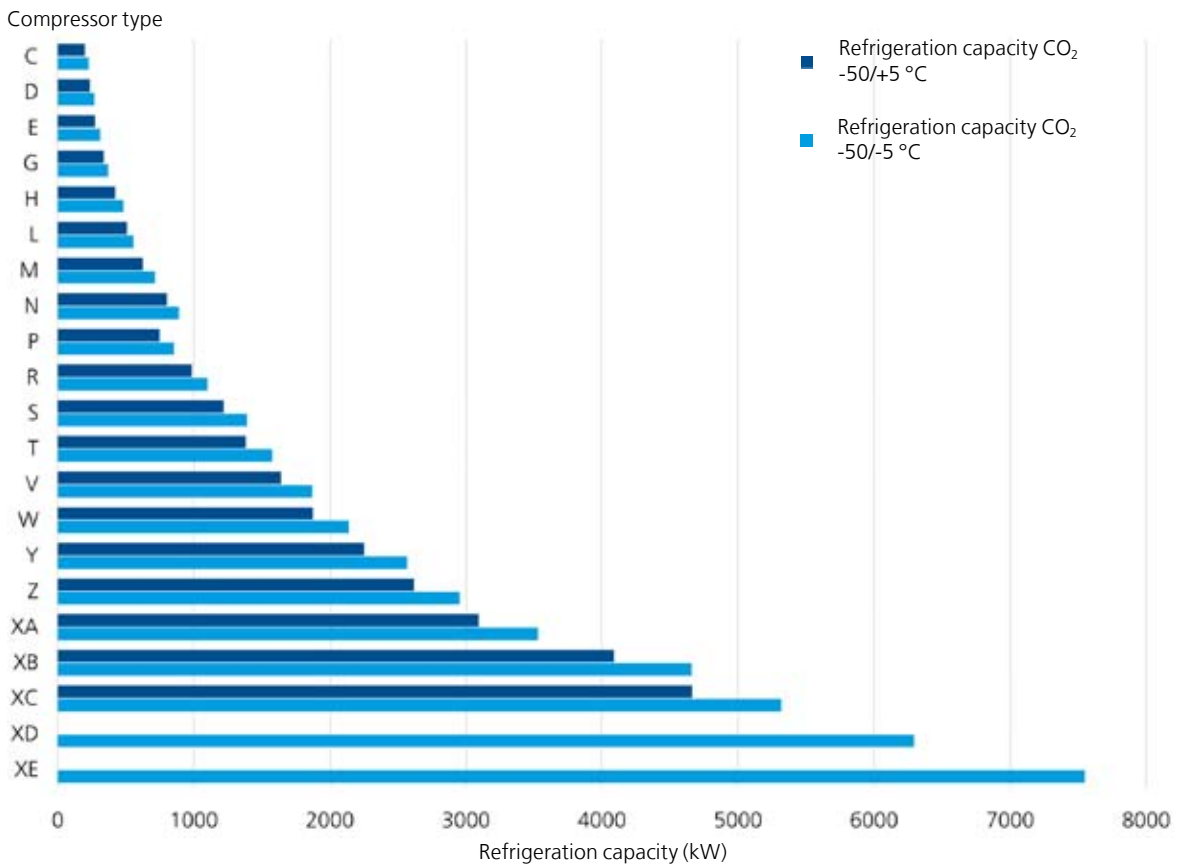
The table below and the charts on the next page show the refrigeration and heating capacities for CO₂ and NH₃ applications exemplified with three different operating conditions: -50/-5 °C for the low temperature stage of cascade systems, -50/+5 °C for the hot gas defrosting mode and for ammonia heat pumps at +35/+80 °C.

Compressor type ¹⁾	Swept volume (m ³ /h) ²⁾	Swept volume (cfm) ³⁾	52 bar compressor		
			CO ₂		NH ₃ (heat pump)
			Refrigeration capacity -50/-5 °C (kW)	Refrigeration capacity -50/+5 °C (kW)	Heating capacity +35/+80 °C (kW)
C	231	164	226	198	598
D	265	188	268	235	
E	321	228	312	273	851
G	372	264	369	337	
H	471	335	482	422	1303
L	544	387	556	507	1510
M	690	490	712	625	1901
N	860	611	888	802	
P	805	572	851	747	2345
R	1040	739	1100	984	2992
S	1290	917	1391	1220	3720
T	1460	1038	1574	1381	4198
V	1740	1236	1870	1640	5051
W	1990	1418	2138	1874	5795
Y	2390	1703	2568	2252	
Z	2748	1953	2953	2616	7905
XA	3250	2309	3528	3093	
XB	4150	2949	4659	4087	12329
XC	4900	3486	5318	4664	
XD	5800	4122	6295		
XE	7110	5095	7550		

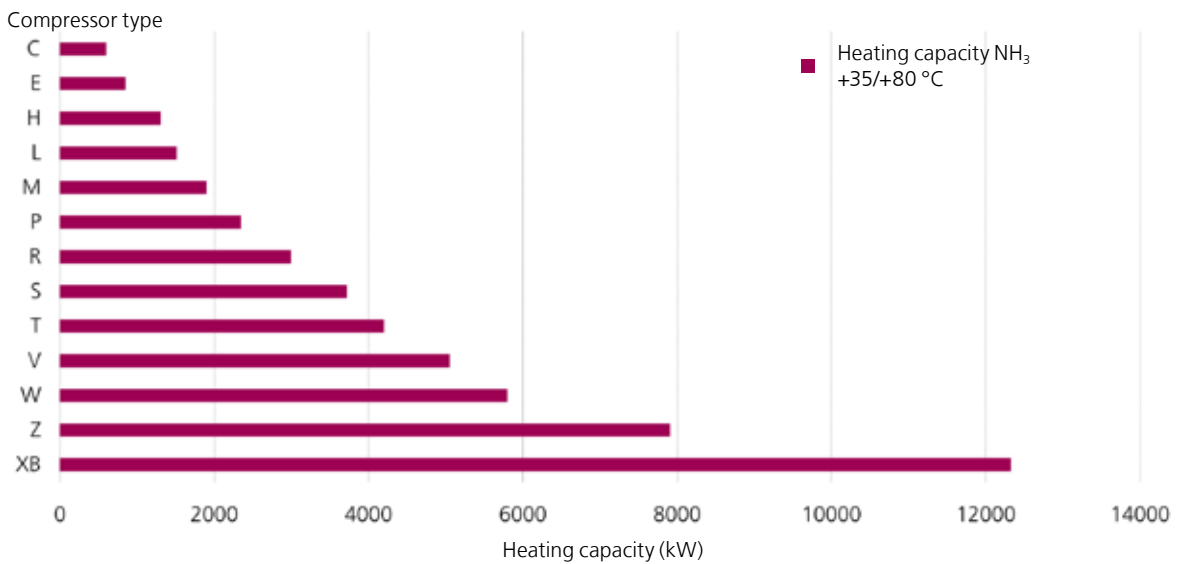
All capacity data are calculated at 2,940 min⁻¹, with 5 K superheat and 0 K subcooling.

1) regarding swept volume flow, 2) at 2,940 min⁻¹ (50 Hz), 3) at 3,550 min⁻¹ (60 Hz)

52 bar compressor refrigeration capacity with CO₂

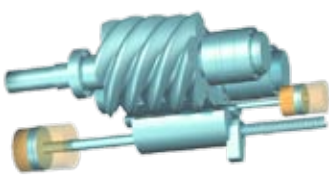


52 bar compressor heating capacity with NH₃

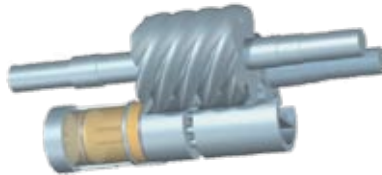


Highest standards Highest quality

- Technical solutions with highest engineering standards to minimize the operating costs (energy consumption) and noise level are characteristic features of Grasso screw compressors.
- The Vi adjustment at full and part load operation minimizes (down to part loads of 40%) the energy consumption. As a result operating costs up to 20% can be saved.
- The set of rotors with 5 teeth (male rotor) and 6 teeth (female rotor) enlarges the wide field of operating conditions for compressors with an optimized Vi and enables the operation at higher condensing pressures, since unequal loads on the radial bearings are avoided.
- The patented line generated rotor profile, manufactured with highest accuracy during the hobbing process, guarantees the best sealing between neighbouring working chambers, wear free operation and less noise emissions even at higher speed.
- Grasso uses proven standardized solutions for the main functional elements for each compressor and each design family.
- The hermetically sealed position indicating system for capacity and Vi control slide provides a standard output signal from 4 to 20 mA. The indicating system is adjustable and is adapted to all compressor sizes by using a system of specific springs.
- Depending on the customers requirements, the solenoid valve blocks are equipped with coils, suitable for one of five standard voltages. The solenoid valves and the position indicating system are also available for different explosion-proof requirements and UL-approval.
- German version has two more characteristics



PS (Parallel Slide) system for Vi and part load control at SH and MC series



TS (Tandem Slide) system for Vi and part load control at LT series



Position indicating system for capacity and Vi control slides, MC Series

Technical standards and proven functional elements

**Grasso's production facilities in Europe,
sales organization and service staff are available world-wide**

For us from Grasso, quality and reliability are the key terms. Optimal maintenance is also essential to avoid breakdowns and maximize the productivity of your plant. Therefore our objective is that the products we supply are used in the right application, properly installed and main-

tained with the highest standards. With this in mind, we offer you the support of a worldwide service and backup network, to your service 24 hours a day, 7 days a week! A guarantee for maximum safety and reliability for your installation.



Grasso: a synonym for service - worldwide

With the information from the internet you can select the correct compressor for your specific needs. This information also enables you to choose the right compressor technology and to install and service our compressors.

We have made this information available on our website. Visit us at www.grasso.de and find out everything that you want to know concerning our compressors. Compressor cooling capacities and power consumption can easily be calculated with our compressor selection software (COMSEL).

The flexible and comprehensive portfolio of Grasso's screw compressors offers a customized solution for each application. We have established a long and fruitful partnership with our customers.

Grasso Homepage

www.grasso.de

Grasso hotlines

Screw compressors & accessories

Parts: +49 (0)172 - 301 45 79

Service: +49 (0)172 - 391 20 50

24 hours - 7 days a week

Comprehensive and totally accessible

GEA Grasso GmbH and GEA Grasso B.V. are among the world's leading manufacturers of state-of-the-art reciprocating and screw compressors. Our innovative packages, chillers and components for industrial refrigeration plants, freezing and air conditioning systems are also recognized for their exceptional reliability and efficiency. With headquarters in the Netherlands and with production facilities in the Netherlands and Germany, more than 90% of our production is ex-

ported to countries all over the world. Grasso is readily accessed and at your service, through its sales offices in Australia, China, the Czech Republic, Denmark, France, Germany, Indonesia, Italy, Kazakhstan, Lithuania, the Netherlands, the Philippines, Poland, Portugal, Romania, Russia, Slovakia, South Africa, Thailand, United Kingdom, Ukraine, the United States and Uzbekistan.

The Grasso range includes:

- Grasso screw compressors and packages; single- and two-stage, 22 screw compressor models with swept volumes ranging from 230 to 8,560 m³/h (136 to 5,069 cfm)
- Grasso reciprocating compressors and packages; single- and two-stage, 48 types, with swept volumes ranging from 100 to 2,390 m³/h (59 to 1,410 cfm)
- Grasso ammonia liquid chillers for air conditioning or process cooling; reciprocating compressor types ranging from 100 to 2,200 kW (28 to 627 tons) and screw compressor types ranging from 200 to 8,700 kW (57 to 1,710 tons)
- Grasso system control the electronic control unit for compressors and packages
- Grasso purger for non-condensable gases
- Grasso ammonia dryer removes water from the ammonia circuit
- Maintenance of refrigeration systems



GEA Refrigeration

GEA Grasso GmbH

Holzhauser Straße 165, 13509 Berlin,
Germany
Phone +49 (0)30 43 592 677, Fax+49 (0)30 43 592 777
www.grasso.de
info@grasso.de

GEA Refrigeration

GEA Grasso B.V.

Parallelweg 27, 5223 AL 's-Hertogenbosch
The Netherlands
Phone +31 (0)73 6203 911, Fax+31 (0)73 6214 320
www.grasso.nl
info@grasso.nl

