

RECIPROCATING COMPRESSORS FOR INDUSTRIAL REFRIGERATION RC9 SERIES



RC9

RC9 SERIES

The Grasso RC9 series is a range of high quality, high speed, open type reciprocating refrigeration compressors. The series is designed to operate with ammonia, R22, R134a, R404A and other new refrigerants in practically every type of industrial refrigeration and freezing installation. The RC9 series is also used for Grasso's reciprocating ammonia-liquid chillers.

The series comprises:

- 3 single-stage models with swept volumes of 140, 280 and 420 m³/h (83, 166 and 249 CFM) at 1450 min⁻¹.
- 2 two-stage models with LP swept volumes of 140 and 280 m³/h (83 and 166 CFM) at 1450 min⁻¹.

All models are available with survey certificates from:

- Lloyd's Register of Shipping
- TÜV
- other approvals on request.



In addition to the bare compressor a wide assortment of standard accessories is available. In this way one is free to select the required accessories and to build-up the optimum compressor configuration.

THE MANY ACCESSORIES

- Grasso Monitron[®] electronic control device
- Alternatively the RC9 can be delivered with a traditional gauge panel, pressure safety switches and an electrically operated capacity control system (manually operated capacity control on request)
- Compact oil separators
- Complete range of interstage coolers
- Flexible drive couplings
- V-belt drives
- Base frames for all applications
- Standard spare parts kits and tools

Two-stage reciprocating compressor package, type RCU219, also available with Grasso Monitron[®] electronic control device



TAKE A LOOK AT THE GRASSO RC9

A close look at the Grasso RC9 reveals the technical properties and the important features.

Reliability is mainly a matter of good engineering practice and experience. Experience that leads to expertise and that's to be found in every part of the Grasso RC9 compressor.

Minimum oil consumption is ensured by three compression rings and high efficiency oil scraper rings.

Quickly adaptable to varying operating conditions. Each cylinder is equipped with a hydraulically operated valve lifting mechanism giving an absolutely reliable capacity control and 100% unloaded starting.

Quiet operation is guaranteed by the dynamically balanced crankshaft resulting in smooth vibration free running.

Safety is ensured by the built-in protection against damage caused by incidental liquid hammer.

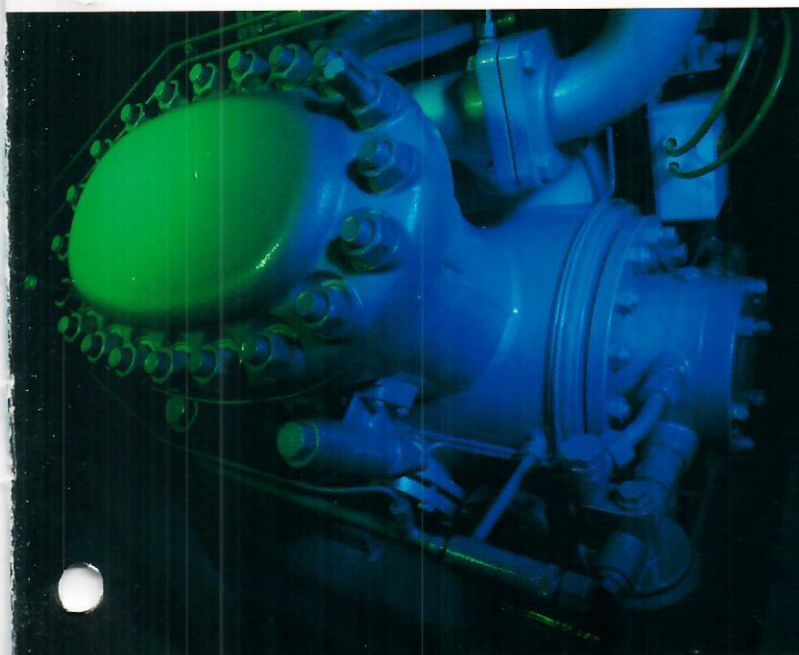
Extra safety is ensured by the fact that the oil return flow is visible through one or two built-in sight glasses.

Long life is achieved by the use of effective oil purification via two oil filters.

Low cost servicing is possible, as for each compressor series most service items are common throughout the range, which reduces duplication of spare parts.

Quick & easy maintenance is obtained because all parts subject to wear can easily be reached via large service covers and removed or replaced with a minimum of special tools. The piston/connecting rod assembly can be freely removed without removing the cylinder liner.

Simple cleaning of the suction gas strainer is another example of the easy maintenance philosophy behind the RC9 series. The gauze strainer element is a large surface area metal strainer that can be readily removed.



A close look at a Grasso RC9

THE GRASSO RC9 TAKEN APART

Investigating a Grasso compressor at every single detail through an engineer's eye, reveals the many talents, basic know-how, experienced workmanship and skill that are required to build a compressor with the outstanding features of Grasso RC9 series. Have a look at these details and see what they stand for.

DISCHARGE VALVE ASSEMBLY

A single discharge valve ring in the RC9 ensures efficient gas passage at low lifting height. Like the suction valve, the discharge valve assembly employs the latest sinusoidal spring design.

CYLINDER LINER

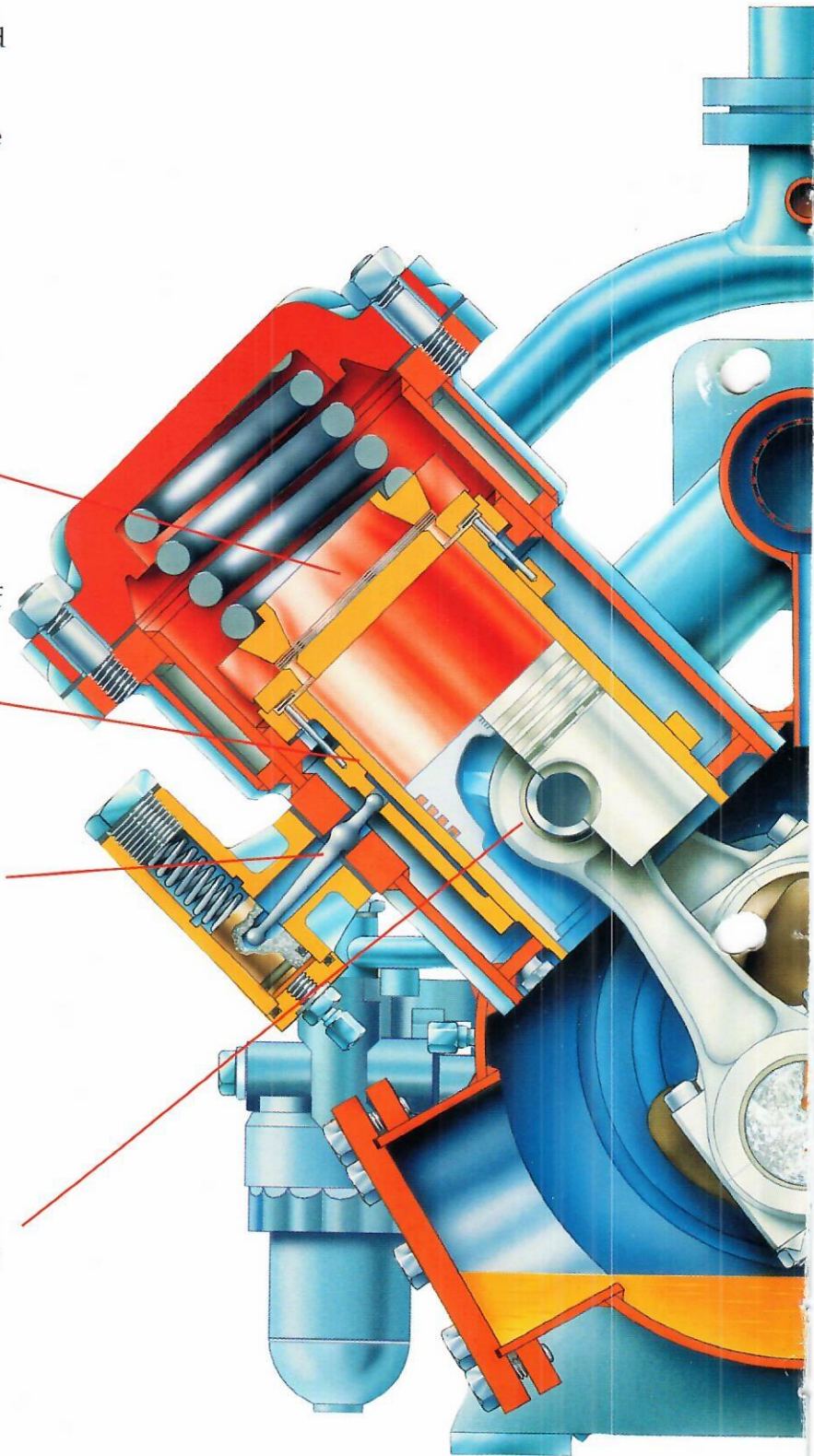
The interchangeable cylinder liners are made of fine grade cast iron. Fine boring and honing results in a smooth running surface.

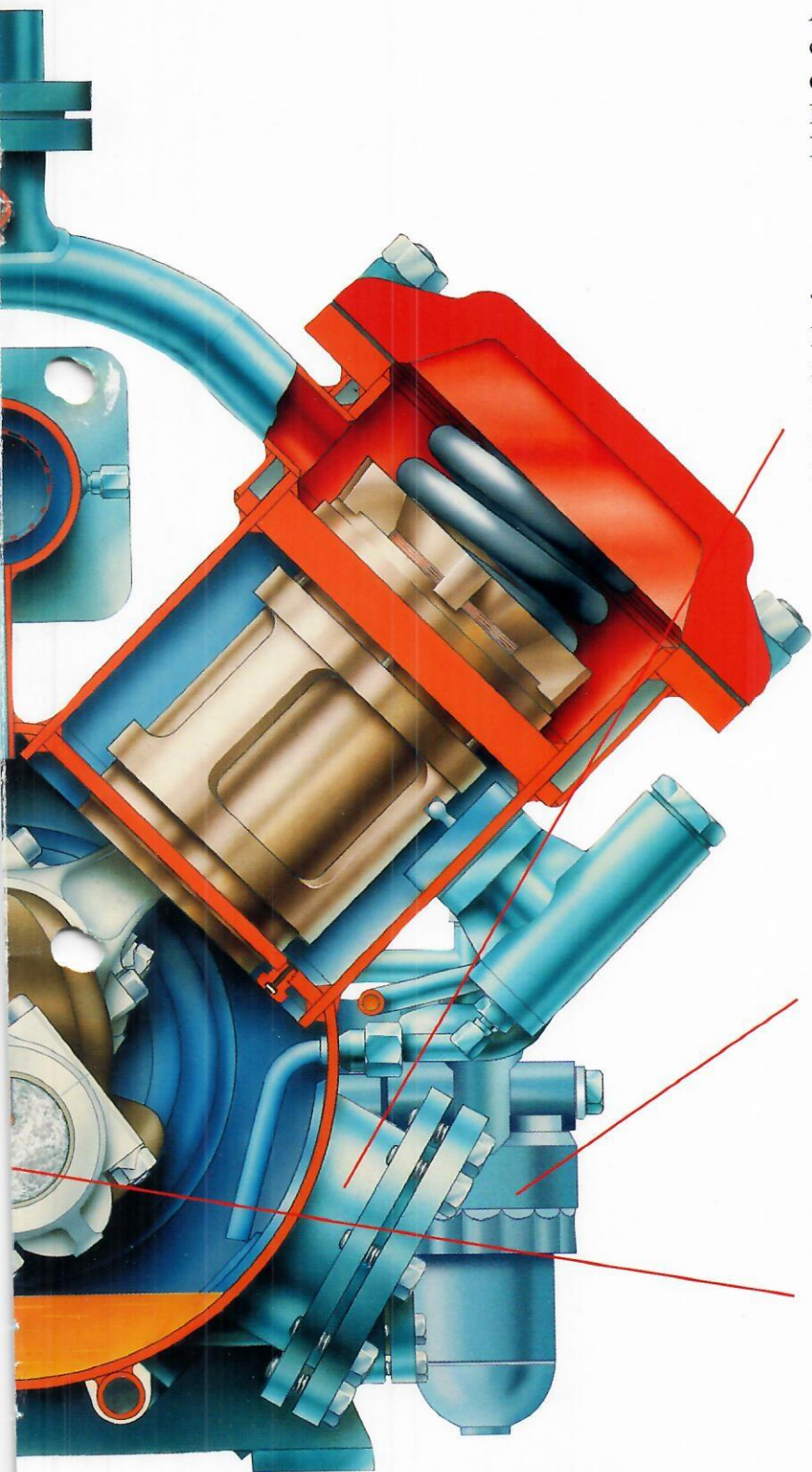
SUCTION VALVE LIFTING

Loading and unloading the cylinders is achieved by a fail-safe hydraulic/mechanical suction valve lifting mechanism on each individual cylinder.

PISTON/CONNECTING ROD ASSEMBLY

The aluminium-alloy piston/connecting rod assembly can easily be removed via the top of the cylinder. Compression forces are effectively taken up by a bearing shell in the big end and a bronze bush (or needle bearing in HP-cylinders) in the small end of the connecting rod. This small end is provided with good lubrication via an oil passage through the connecting rod.





ROTARY SHAFT SEAL

A perfect gastight sealing of the crankshaft drive end through the main bearing cover is obtained by means of a special rotary shaft seal. Effective cooling of the seal by a full flow of lubricating oil guarantees a long service life.

THE WELDED STEEL CRANKCASE

has proven its unique design in more than 30,000 Grasso compressors. It is low in weight and provides rapid heat dissipation. The crankcase is absolutely gastight and impactproof. A completely smooth internal surface guarantees the good condition of the oil.

OIL PUMP AND FILTERS

The gear pump, driven directly by the crankshaft, provides separate pressures for two oil systems: lubrication system and control oil system. The excess oil of the control system is released via a built-in relief valve. The pump also includes an automatically operating hydraulic time delay valve, ensuring complete unloaded starting before control oil pressure is admitted to the valve lifting mechanisms. A metal gauze suction filter element and a replaceable discharge filter cartridge provides for an excellent filtering of the lubricating oil.

CRANKSHAFT AND MAIN BEARINGS

The crankshaft is of high quality cast iron with exceptionally good running properties and wear resistance. The main bearings are bushes pressed into the cast iron bearing covers.

ADVANTAGES OF THE WELDED DESIGN

The time has now come to move away from HCFC refrigerants. Only substances with zero Ozone Depletion Potential and preferably zero Global Warming Potential should be considered as optimum choice refrigerants for current and future applications. With today's safe, reliable cooling systems, ammonia has been rediscovered as an effective refrigerant. Ammonia is environmentally safe, has no global warming or ozone depletion potential, has superior thermodynamic properties, is economical and is readily available world-wide.

Major Advantages of Ammonia:

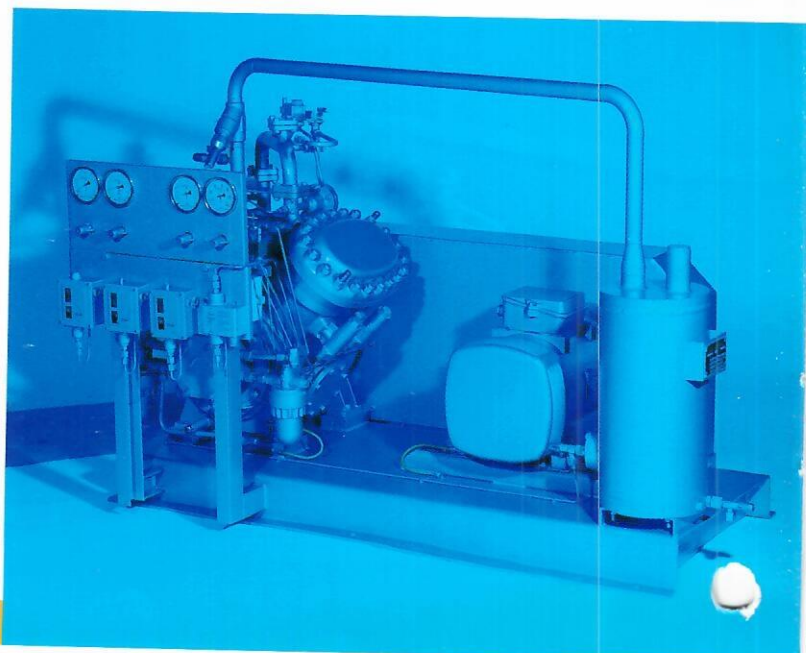
- Zero Ozone Depletion Potential
- Zero Global Warming Potential
- Superior thermodynamic properties
 - Thermal conductivity 5 times greater than R22
 - High latent heat capacity
- Better performance characteristics
 - Volumetric efficiency up to 10% better than HCFC's
 - Lower density through suction and discharge valves
 - Toleration of small percentage of water
- Easy automatic detection of possible leakage
- Economical: low-price refrigerant
- World-wide availability

Due to its relatively high discharge temperature, the choice for ammonia as a refrigerant could limit the choice of compressor. All cast iron compressors are designed to allow the suction gas flow through the compressor housing where the heat cannot be dissipated quickly and therefore limits the field of applications.

The Grasso RC9 series of compressors (as well as the RC12 series) are the only refrigeration compressors with external suction- and discharge manifolds, which are welded to the cylinders. This design virtually minimizes additional superheating of the suction gas. In addition, the special cylinder head construction made from steel with its high heat dissipation coefficient helps to keep the discharge temperature low. Consequently, the fields of application of Grasso compressors are unmatched by any other compressor design.

The RC9 compressors do not need additional cooling, such as water cooling or injection systems for any operating condition. Neither is there a need for oil coolers. In addition to the above advantages, the low power consumption and the proven Grasso reliability make this compressor series the first choice for industrial refrigeration.

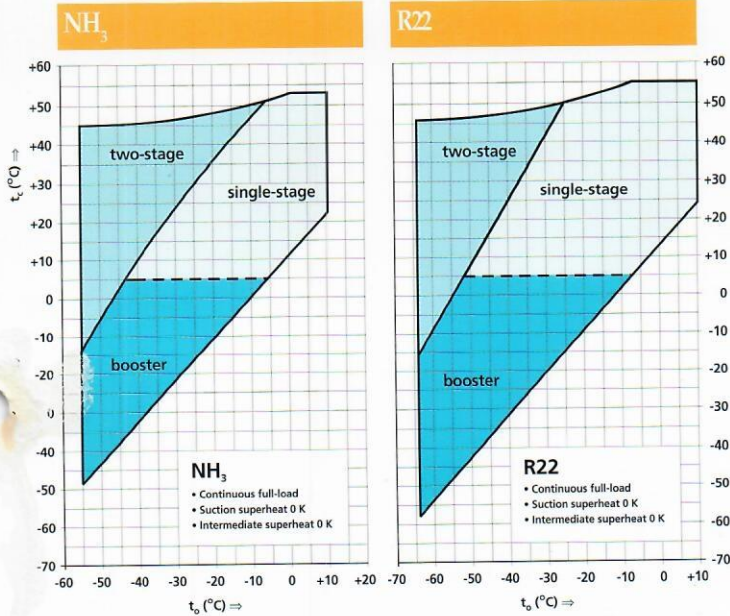
The worldwide service back up, available 24 hours, everyday ensures maximum security and safety for your installation.



Reciprocating Compressor Package RCU219

PERFORMANCE DATA

FIELDS OF APPLICATION

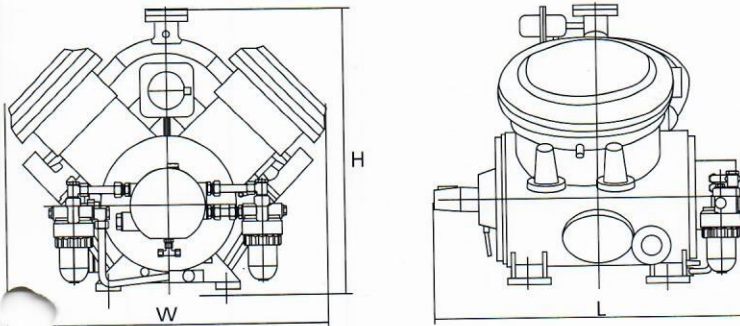


CONVERSION INFORMATION

European unit	multiplied by	US unit
Millimeter (mm)	0.03937	Inch (in)
Millimeter (mm)	0.0032808	Foot (ft)
Degrees Centigrade (°C)	$1.8 \cdot ^\circ\text{C} + 32$	Degrees Fahrenheit (°F)
Temp. Diff. Kelvin (K)	1.8	Degrees Fahrenheit (°F)
Cubic Meters per Hour (m³/h)	0.59	Cubic Feet per Minute (CFM)
Kilowatt (capacity) (kW)	0.2846	Ton (TR)
Kilowatt (power) (kW)	1.341	Brake Horsepower (BHP)
Kilogram (kg)	2.2	Pounds (lbs)

Capacities at other conditions and for different refrigerants such as R134a and R404A can easily be calculated with our COMSEL compressor selection programme which is also available on internet: www.grasso.nl

DIMENSIONS



Type	Dimensions (mm)			Mass (kg)
	L	W	H	
RC29	770	620	685	270
RC49	770	825	714	370
RC69	975	950	739	545
RC219	770	825	693	370
RC429	975	950	739	545

L = Length, W = Width, H = Height

REFRIGERATION CAPACITIES [kW AT 1450 MIN⁻¹]

Single-stage

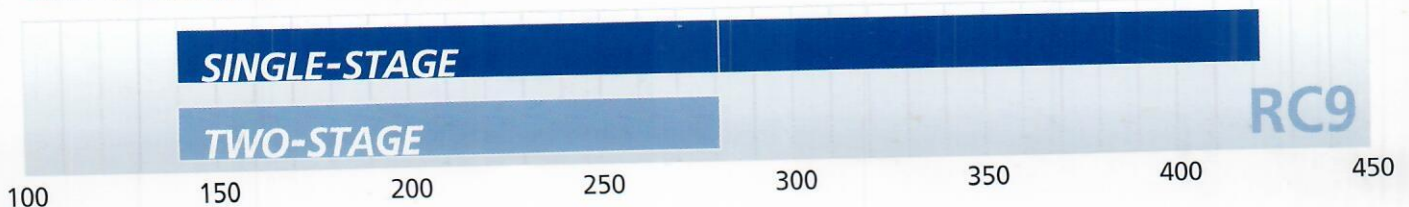
Type	NH ₃		R22	
	-15 °C	-5 °C	-15 °C	-5 °C
RC29	59.7	99.4	64.0	98.3
RC49	119.5	198.9	128.0	196.5
RC69	179.2	298.3	192.0	294.8

Two-stage (system C for NH₃, system B for R22)

Type	NH ₃		R22	
	-40 °C	-30 °C	-40 °C	-30 °C
RC219	22.6	38.6	28.6	42.8
RC429	45.2	77.2	57.3	85.5

Condensing temperature = +30 °C, Liquid subcooling = 5 K, Suction superheat = 5 K useful, Intermediate superheat = 6 K, Temperature difference interstage cooler = 10 K

SWEPT VOLUMES [M³/H AT 1450 MIN⁻¹]

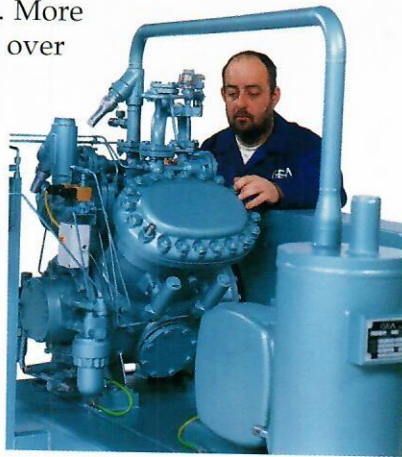


THE COMPANY GRASSO

Grasso Products B.V. and Grasso GmbH Refrigeration Technology, both members of the multinational GEA AG, are one of the world's leading manufacturers of innovative reciprocating and screw compressors, packages, complete industrial refrigeration and freezing systems, freezers and components for industrial refrigeration plants and freezing systems as well as for air conditioning systems. More than 90% of which are exported all over the world.

The programme comprises:

- reciprocating compressors and packages, single- and two-stage, open and semi-hermetic, 38 types, with swept volumes ranging from 130 to 1600 m³/h (77 to 942 CFM)
- single- and two-stage screw compressor packages, 15 screw compressor models, with swept volumes ranging from 230 to 3250 m³/h (135 to 1913 CFM)
- Liquid-Chillers for air conditioning or process cooling, refrigerant ammonia, reciprocating



compressor types, ranging from 75 to 700 kW (21 to 200 Tons) and screw compressor types, ranging from 200 to 3300 kW (57 to 939 Tons)

- electronic control units
- refrigeration valves and components
- self-limiting Automatic Purger of non-condensable gases
- pressure vessels
- turn-key refrigeration systems for industrial refrigeration, cold stores, air conditioning and marine refrigeration plants
- assembly, installation and maintenance of refrigeration systems

Grasso with its head office in The Netherlands and factories in The Netherlands and Germany has sales offices in The Netherlands, Germany, United Kingdom, France, Italy, Portugal, Poland, Russia, Ukraine, the United States, South-Africa, the Philippines, Australia, Chile, China, Thailand, India, Indonesia, Lithuania and Slovakia.



Please contact your office:

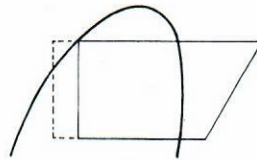
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Single-stage

n = 1450 rpm

↓t ₀ (°C)	↓Δt ₀ (K)	→ t _c (°C)						
			+20	+25	+30	+35	+40	+45
+ 5	5	Q _o (kcal/h)	261 300	249 700	237 700	225 600	213 200	200 600
	15		258 200	247 000	235 500	223 900	211 900	199 800
	25		255 900	245 100	234 000	222 800	211 200	199 500
	—	P _e (kW)	38.5	43.2	48.0	52.9	57.7	62.3
0	5	Q _o (kcal/h)	218 600	208 300	197 700	187 000	176 100	165 000
	15		216 200	206 300	196 000	185 700	175 200	164 500
	25		214 300	204 700	194 800	184 900	174 600	164 200
	—	P _e (kW)	37.9	42.2	46.5	50.7	54.8	58.6
- 5	5	Q _o (kcal/h)	181 100	172 000	162 700	153 200	143 600	133 800
	15		179 100	170 400	161 400	152 200	142 900	133 400
	25		177 700	169 200	160 400	151 600	142 500	133 300
	—	P _e (kW)	36.9	40.7	44.4	47.9	51.2	54.0
-10	5	Q _o (kcal/h)	148 500	140 500	132 200	123 900	115 400	106 800
	15		147 000	139 200	131 200	123 200	114 900	106 500
	25		145 700	138 200	130 400	122 600	114 500	106 400
	—	P _e (kW)	35.5	38.7	41.7	44.5	46.8	48.6
-15	5	Q _o (kcal/h)	120 200	113 100	105 800	98 400	90 900	83 300
	15		119 000	112 100	105 000	97 900	90 500	83 200
	25		118 000	111 300	104 500	97 500	90 300	83 100
	—	P _e (kW)	33.6	36.1	38.4	40.2	41.5	42.3
-20	5	Q _o (kcal/h)	95 800	89 500	83 100	76 600	69 900	63 200
	15		94 800	88 700	82 400	76 100	69 600	63 100
	25		94 000	88 100	82 000	75 800	69 400	63 000
	—	P _e (kW)	31.1	32.9	34.3	35.2	35.6	35.3
-25	5	Q _o (kcal/h)	74 800	69 300	63 600	57 800	51 900	46 000
	15		74 100	68 700	63 100	57 500	51 700	45 900
	25		73 500	68 200	62 800	57 200	51 600	45 900
	—	P _e (kW)	28.1	29.1	29.6	29.6	29.1	28.1
-30	5	Q _o (kcal/h)	57 000	52 100	47 000	41 900	36 600	—
	15		56 500	51 600	46 600	41 600	36 500	—
	25		56 000	51 300	46 400	41 400	36 400	—
	—	P _e (kW)	24.4	24.6	24.3	23.6	22.7	—
-35	5	Q _o (kcal/h)	42 000	37 500	33 000	—	—	—
	15		41 500	37 200	32 700	—	—	—
	25		41 200	36 900	32 500	—	—	—
	—	P _e (kW)	20.2	19.8	19.0	—	—	—
-40	5	Q _o (kcal/h)	29 300	25 300	—	—	—	—
	15		29 000	25 100	—	—	—	—
	25		28 800	24 900	—	—	—	—
	—	P _e (kW)	15.9	15.2	—	—	—	—