www.howden.com

Rotary Twin Screw Compressors

For industrial refrigeration, gas processing and other industries

Revolving Around You™

Howden manufactures oil injected and oil free rotary twin screw compressors, and supplies bare shaft oil injected screw compressors for use in the refrigeration, gas processing and other industries.

Rotary twin screw compressor technology was developed in the 1930s by a Swedish company, SRM, in collaboration with Howden. We manufactured the world's first operational screw compressor and further developed the technology in the 1960s with the introduction of the oil injected twin screw compressor. This has revolutionised designs of refrigeration and gas handling plants worldwide.

Today, in thousands of installations worldwide, our oil injected screw compressors provide high integrity, low maintenance solutions for liquid chilling, direct refrigeration and gas compression applications.

Revolving Around You™

World pioneers of rotary twin screw compressors

Compressor package systems

Howden Compressors is a specialist manufacturer of twin screw compressors. We supply oil injected bare shaft compressor units to independent packagers worldwide who design and supply gas and refrigeration systems on a local basis.

For high specification process critical applications we can offer this packaging service by use of our own specialist knowledge and capabilities through our Howden global companies.

Manufacturing excellence

We are committed to manufacturing the highest quality compressors in the industry. We employ state of the art machine tools to attain the highest possible accuracy and tolerances so as to produce compressors with high efficiency and outstanding reliability.

Rotors

All rotors for Howden twin screw compressors are machined from solid bar or forgings on highly accurate cutting machinery. The standard material is carbon steel, but forgings or special alloys can be used for more arduous applications. Following machining and balancing to ISO standards, male and female rotors are paired for assembly to ensure the ideal combination for maximum efficiency.

Casings

Casings are precision machined from castings using state of the art horizontal machining centres to achieve the essential close tolerances. Cast iron is the normally casing material; alternative casing materials are spheroidal graphite iron or various grades of steel.

The main casing and the inlet and outlet end covers are flanged, bolted and dowelled through flanges to ensure correct alignment. Removal of the end covers provides ready access for maintenance when required.

Compressor assembly and testing

All oil injected twin screw compressors are factory assembled by skilled engineers. The casing components are hydraulically tested to a minimum of 1.5 times maximum operating pressure to ensure integrity. Additionally, all oil injected compressors are tested with air under water following final assembly. The compressors are then mechanically run on air test rigs to confirm that volumetric efficiency, absorbed power, oil flows and vibration levels meet the stringent acceptance standards.

Best practices

Lifetime quality and care

Today in thousands of applications worldwide, Howden screw compressors provide high integrity, low maintenance solutions for liquid chilling, direct refrigeration and gas compression.

Design specifications

Our twin screw compressors are designed to match the exacting specifications required by our customers. They comply with International standards and codes, e.g., API 619. Compressors are generally Lloyds approved, and installations have been accepted by many major authorities such as Lloyds, Bureau Veritas, Norske Veritas, RINA, DSRK, Bureau de Mines, ABS, Germanischer Lloyd and NKK.

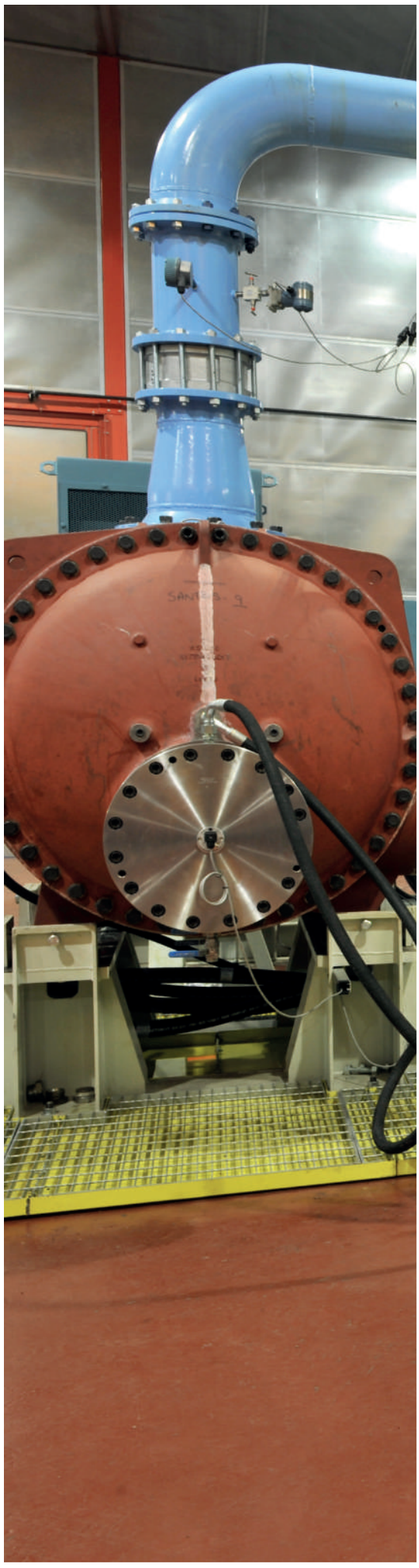
Testing

Howden has extensive test facilities. Comprehensive testing ensures that the test performance data, particularly relating to the computer selection programs for standard gases and refrigerants, are as accurate as possible. Project specific tests, such as to API 619, can be carried out to customer requirements. Our thorough testing gives confidence that the unit will perform reliably throughout its life.

Aftersales

We provide a lifelong spare parts and maintenance service through our global network. Spare parts are authenticated with our 'Original Spare Parts' certificate and it is recommended that only these parts are used. Parts are generally supplied in pre-packaged in kits that provide all items for particular types of model and maintenance operation.

Comprehensive testing ensures that the test performance data are as accurate as possible.



Twin screw compressors

Principles of operation

Design concept

Compression is achieved by the intermeshing of two helical rotors contained in a suitable casing. Figures 1–4 give details of the compression cycle.

The Howden twin screw compressor is a positive displacement rotary design. As such it has the characteristics and stability of reciprocating compressors but in addition offers particular advantages:

- Reduced physical size.
- Fewer moving parts.
- Low vibration.
- Extended operating life cycle.

Options

Our compressors have a range of design options.

Typical ones are:

- Twin wall construction with sleeve bearings.
- Single wall construction with roller bearings.
- Slide valve capacity control from 100% to 10% nominal.
- Inverter speed control.
- Variable volume ratio.
- Superfeed.
- Oil cooling.
- Liquid refrigeration injection.
- Specialist sealing systems.

Features and benefits

Positive displacement
Cannot surge.
High compression ratios per stage.

Rotary action
Vibration free running.

Extreme reliability & on-line availability.

Smooth gas flow, low pulsation.

Lightweight foundations.

Stiff action rotors
Ability to withstand high pressure differences.

No inlet or outlet valves
Lower maintenance costs.

Compact size & light weight
Minimal space and foundation requirement, resulting in low installation costs.

Designed for long periods of continuous running
Maximum on-line availability.

Minimal service requirements.

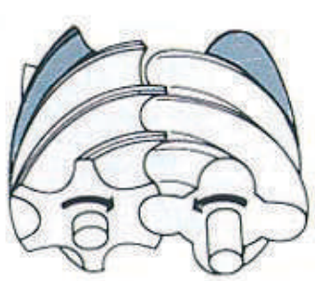


Figure 1
Gas is drawn in to fill the interlobe space between adjacent lobes.

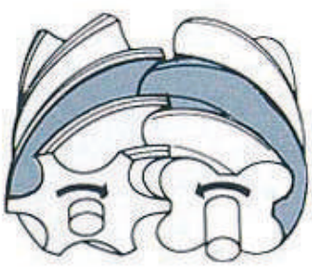


Figure 2
As the rotors mesh, the gas is trapped between the rotors and the casing.

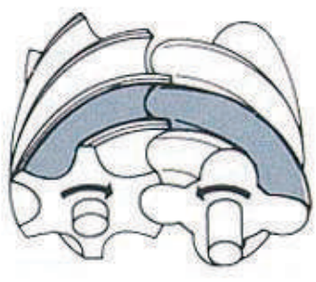


Figure 3
Continued rotation progressively reduces the space occupied by the gas, causing compression.

Figure 4
Compression continues until the interlobe space becomes exposed to the outlet port, through which the gas is discharged.

M-Range compressors

For high efficiency, flexibility and reliability

A new industrial-standard quality built screw compressor, complete with a suite of specification options, to meet the design and build needs of compressor packagers and reduce the operating costs of end users.

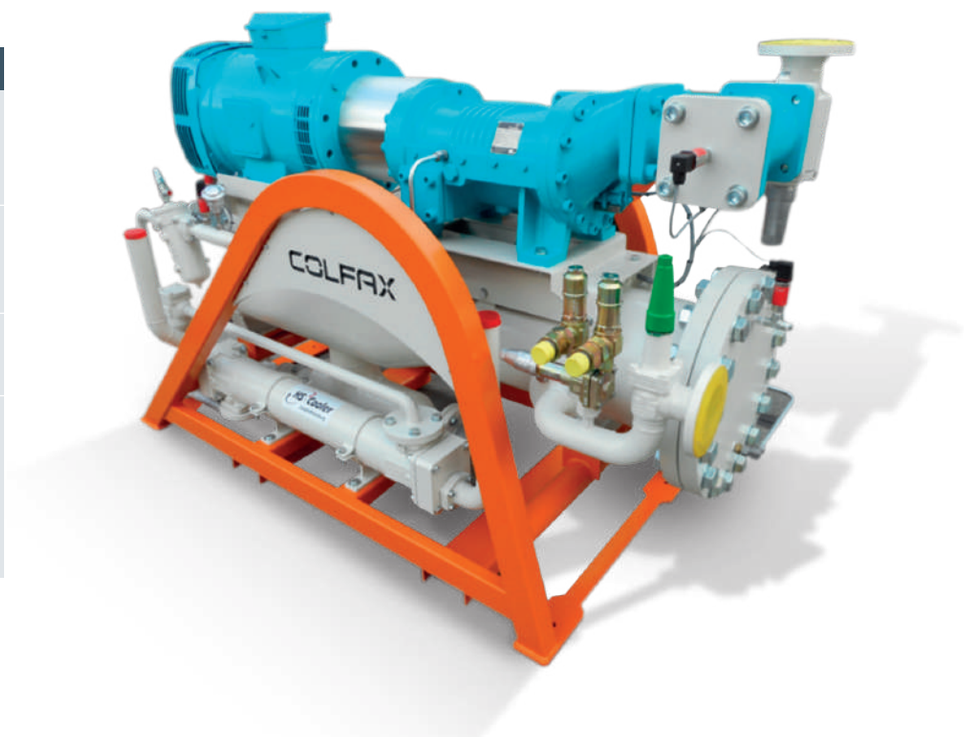
Features and benefits

Modular design for ease of packing
Flexibility for application and standard maintenance.

High quality anti-friction bearings used throughout
Accurate rotor positioning saves energy.

Advanced rotor profiles
Improved performance and efficiency.

Options for capacity control
Approximately 50%, 75% can be provided if poppet valve is selected.



Industrial-standard build compressors backed-up by the highest quality product manufacture and testing

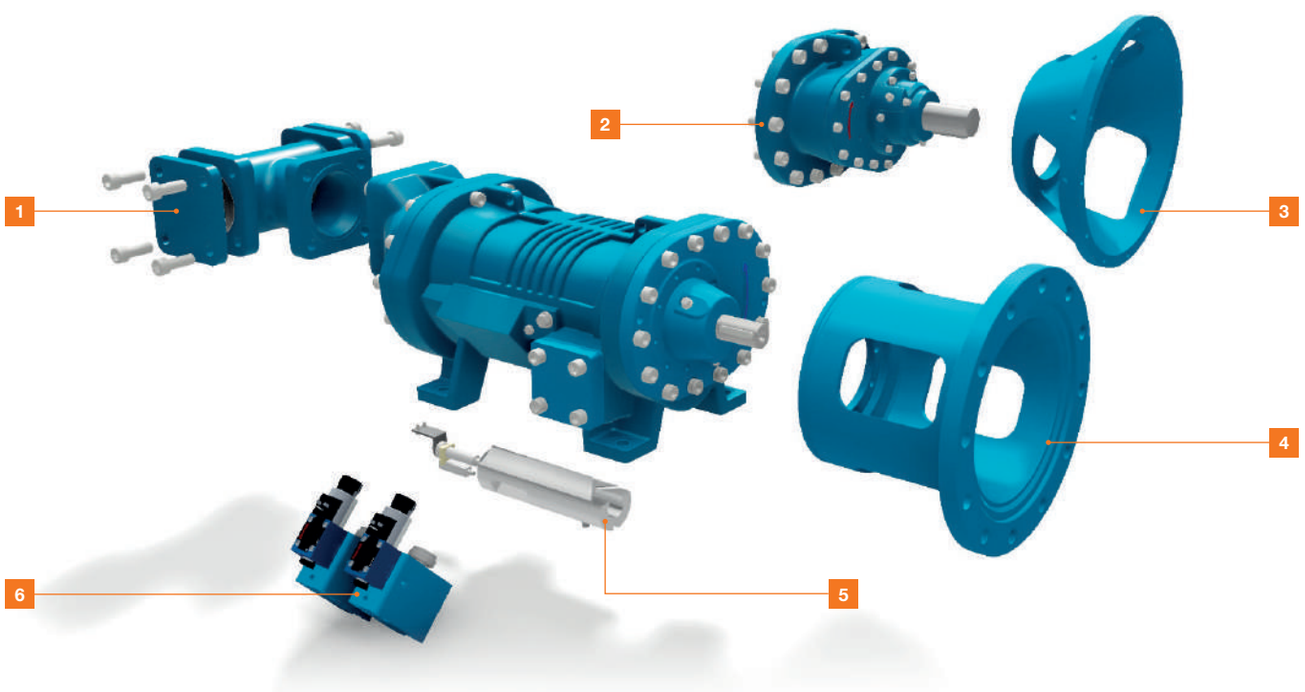
We are committed to manufacturing the highest quality compressors in the industry and employ state-of-the-art machine tools to attain the highest possible accuracy and tolerances achieving Howden's renowned industrial-standard build quality. Howden recognises the importance of a controlled manufacturing environment and are accredited to ISO 9001:2000. Ongoing internal and external audits of quality control systems are applied to ensure these standards are maintained.

Comprehensive in-house testing ensures that the test performance data is as accurate as possible. The M127 compressor is subjected to dynamic testing in order to proof the functionality of all the components, as well as three major types of static tests: rotor pairing & dynamic balancing, leakage and hydrostatic.

Industrial-standard and energy efficient screw compressor

Options

The M127 is available with a range of options which can be selected to suit particular or specific applications. Offering Howden certified accessories together with the compressor enables the packager to reduce the supply chain network.



1. Suction Strainer

The suction strainer ensures that any particles of dirt or corrosion is captured before the gas enters the compressor.

2. Gear Box

All M127 variants are designed to be driven from the discharge end of the compressor. This allows it to be directly coupled to engine drives of up to 150kW (200HP) without any reversal and with the correct direction of rotation.

3. SAE-Flange

The SAE-Flange is made from high grade grey iron and designed to be easily mounted or dismounted from the machine with minimal disruption.

4. D-Flange

To simplify mounting and ensure correct alignment between the compressor and the prime mover, the machine is designed to be coupled directly to the motor, using either a D-Flange or a SAE-Flange.

5. Vi Control

When required the machine can be equipped with variable Vi control to optimise performance at varying pressure ratios.

6. Poppet Valve

Poppet valve enabled variants are used to control the capacity of the machine when operating conditions do not allow the use of variable frequency or speed drives.

M127 technical data

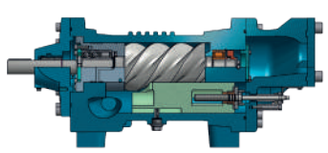
Typical performance

The M127 compressor is engineered with a suite of specification options which meet the design and build needs of compressor packagers as well as reduce the operating costs for end users.

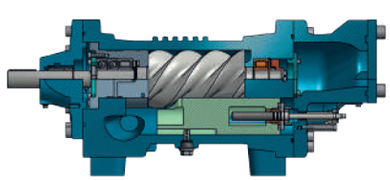
M127 illustrative performance:

Operating speed (rpm)	Theoretical displacement m^3/hr	Nominal capacity in kW for R717		
		Booster -40°c/-10°c	High Stage -10°c/+35°c	Single stage economised (-40°c/+35°c)
3000	294	48kw	168kw	43kw
3600	353	58kw	205kw	54kw
4000	392	66kw	230kw	62kw
4500	441	75kw	262kw	71kw
5000	490	84kw	293kw	81kw

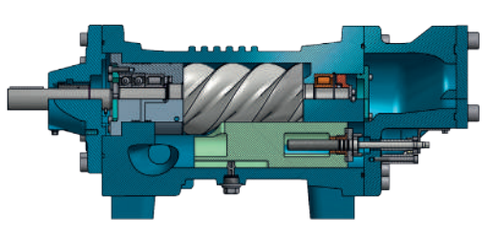
Operating speed (rpm)	Theoretical displacement m^3/hr	Nominal capacity in kW for R134a		
		Booster -40°c/-10°c	High Stage -10°c/+35°c	Single stage economised (-40°c/+35°c)
3000	294	35kw	103kw	27kw
3600	353	42kw	125kw	34kw
4000	392	47kw	140kw	38kw
4500	441	53kw	158kw	44kw
5000	490	60kw	177kw	50kw



M127

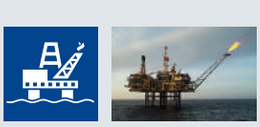


M163



M204

Key markets for the M127

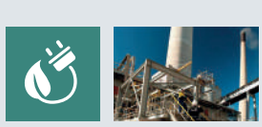


Oil and Gas

The M127 is an ideal small volume capacity machine for the natural gas field extraction applications. Either using variable speed drive or bolt on reduction gearbox the fluctuations in field pressure can be satisfied. Foot mounting or flanged mounting the compressor/drive provides a packaged compact assembly.

Notable features:

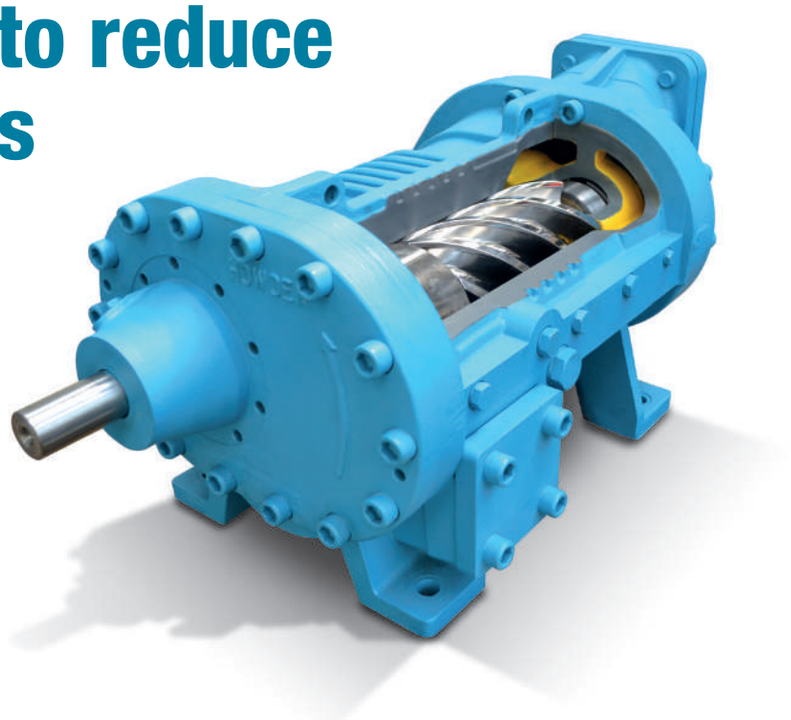
- Clockwise rotation with gears
- Acceptable increased oil supply temperature
- Simple lubrication system
- Operating at variable speeds
- Non-pumped lubrication



Waste heat recovery expanders

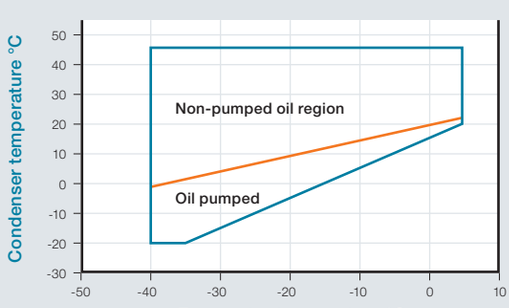
The M127 basic design compressor is also used as an expander, which uses waste heat from internal combustion engines exhaust and cooling jacket, chemical industries, food processing, wet steam from geothermal aquifers (natural and man-made) etc, to generate useful power. This involves reversing the direction of rotation of the rotors.

M127 is an integral component to reduce energy costs

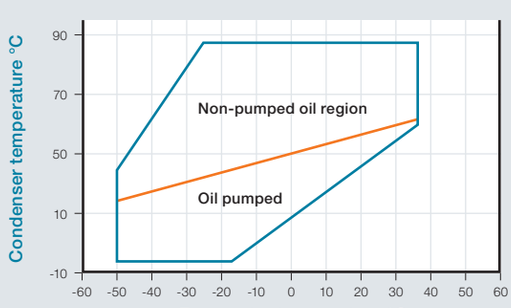


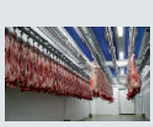
Pressure envelopes

R717



R1234ze





Industrial refrigeration

The M127 industrial-standard screw compressor's main field of operation is industrial refrigeration, able to handle a range of natural and alternative refrigerants. Suitable for central plant, multiple and stand alone or chiller packages providing finite control following closely product loading with increased performance.

Notable features:

- Internal capacity control mechanism
- Non-pumped lubrication
- Operating at variable speeds
- Smaller footprint

Full aftermarket support

Howden's compressor products are supported throughout their lifetime with original spare parts and aftermarket services provided via our global compressor service network. Our technical experts can offer you advice and support with all aspects of compressor maintenance from spares and repairs through to full service re-build.

WRV compressors

Versatile process compressors for all applications

WRV compressors set the standard against which industry comparison is made for both gas and refrigeration applications.

Features and benefits

Plain-shell type journal bearings
Long operational life span.

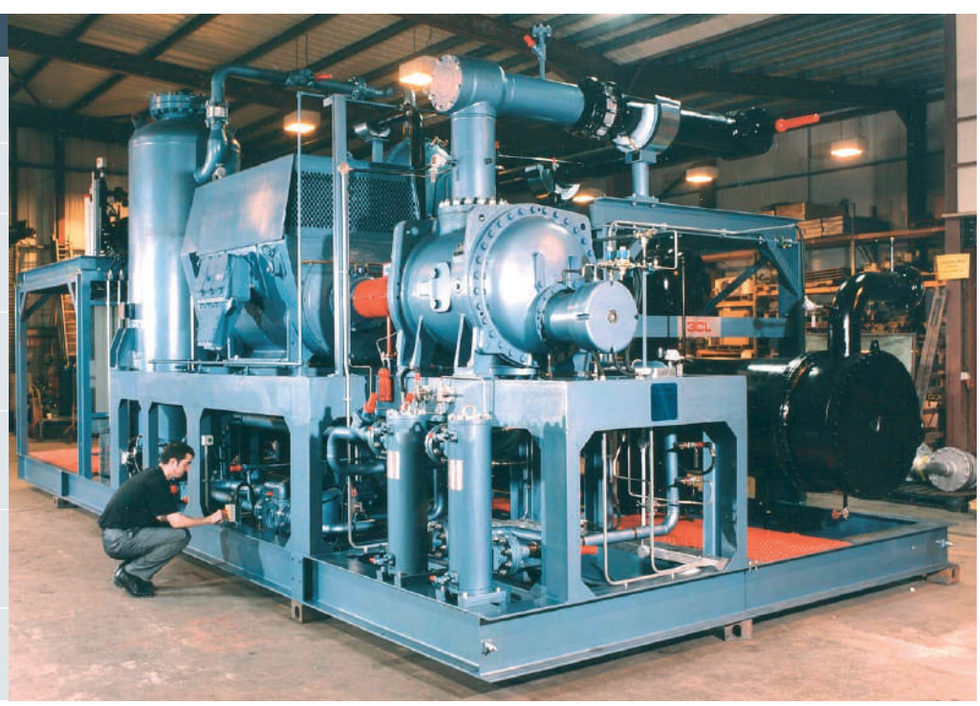
Double wall construction
Suitable for high pressure application.

Optional Material of Construction
Flexibility to match project specification (e.g. API 619).

Oil injected seal/bearing construction
High quality gas seal from simple construction.

Range of capability
Probably the most comprehensive range of capacity available.

Installed compressors
More than 25,000 WRV compressors installed worldwide.



All WRV range compressors are of double wall construction and utilise white metal, sleeve type journal bearings with pressurised shaft seal.

A full range of Vi options from 2.1 to 5.8 is offered for each compressor while slide valve capacity control is a standard feature on all compressors.

Many options to standard design are available, some of which are indicated below:

Option C: 'Condition controlled' version with reduced Oil flow for dense gases and temperature control.

Option M: 'Mirror' version for reverse rotation with double ended motor drive and two stage design.

Option H: 'Higher pressure' version for high discharge pressure.

Option X: 'Extra high' discharge design.

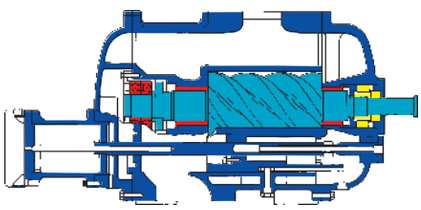
Option T: 'Tilting pad' thrust bearing design, e.g. to comply with API 619.

Option S: 'Steel casings' for high pressure or to match specification.

Option N: 'Nodular cast iron design' again for specific project specification.

WRVI section:

WRV 255, 321 & 365 will incorporate variable Vi as standard.



Howden oil injected screw compressor range performance envelope		
XRV	Model 127	1 L/D Ratio – direct drive and 3 gears
XRV / WRV	Model 163	2 L/D Ratios
XRV / WRV	Model 204	4 L/D Ratios
WRV	Model 255	6 L/D Ratios
WRV	Model 321	4 L/D Ratios
WRV	Model 365	2 L/D Ratios
WRV	Model 510	3 L/D Ratios
WRV	Model 580	1 L/D Ratio
GTV	Model 228	1 L/D Ratio

M127 | XRV 127 | XRV 163 | XRV 204 | GTV 228 | WRV 163 | WRV 204 | WRVi 255 | WRVi 321 | WRVi 365 | WRVT 510 | WRVT 580

XRV compressors

Compressors for refrigeration

XRV compressors have been developed specially for the refrigeration market.

Features and benefits

Ease of installation
Ideal for horizontal separator applications.

Use of roller bearings
No oil pump for over 90% of installations.

Variable Vi
Available with either adjustable or fully automatic vi system.

Stepless capacity control
Combined with variable vi, gives maximum energy saving.

Ease of service
Separate end covers give easy access to rolling elements.

Variable volume ratio

Two forms of variable volume control are available.

1. Adjustable volume ratio (MVI)
2. Automatic variable volume ratio (AVI)

Compressor selections need to take account of the peak operating conditions likely to be encountered.

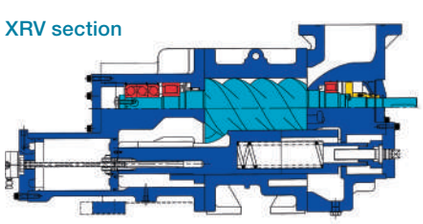
However, actual operating conditions may vary, resulting in lower efficiencies. Control of capacity and volume ratio can maintain high efficiency levels.

The Howden variable Vi concept, coupled to slide valve capacity control, offers alternative control methods.

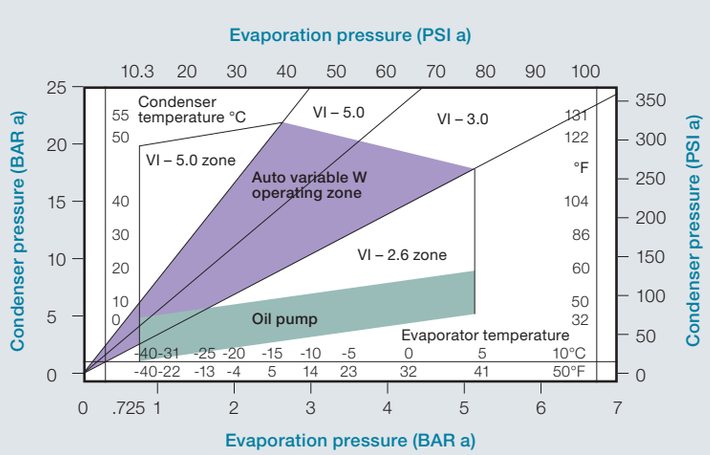
Where the pressure ratio across the compressor is consistently high or changes in pressure ratio are infrequent (e.g. the change from winter to summer conditions) then the MVi manually adjustable system will be entirely satisfactory.

With lower pressure ratios, or where condensing conditions vary frequently, the Howden automatic control AVi system can be offered.

XRV section



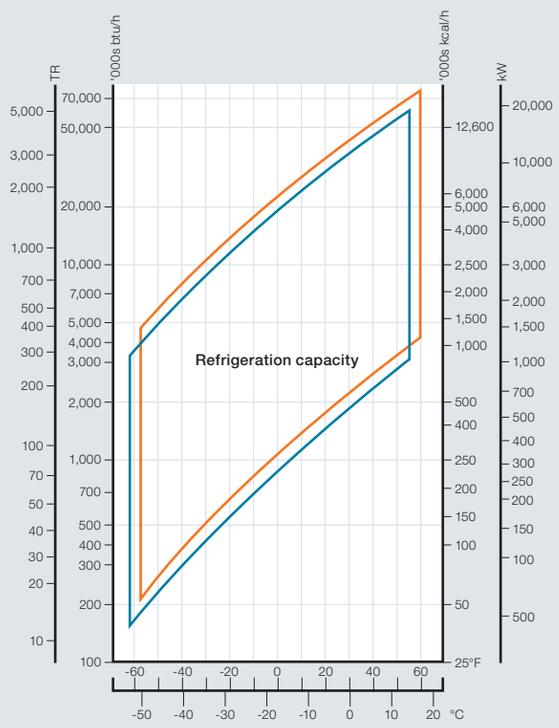
Typical operating envelope – R717 refrigerant



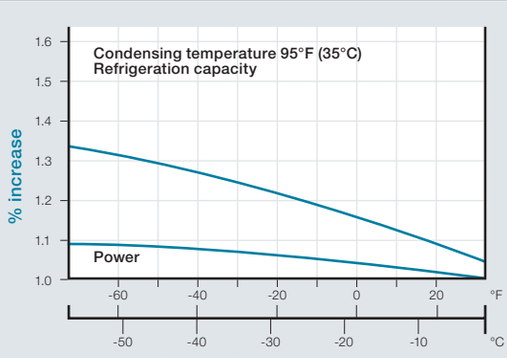
WRV technical data

Typical performance

WRV ammonia



Typical effect of superfeed



Typical performance

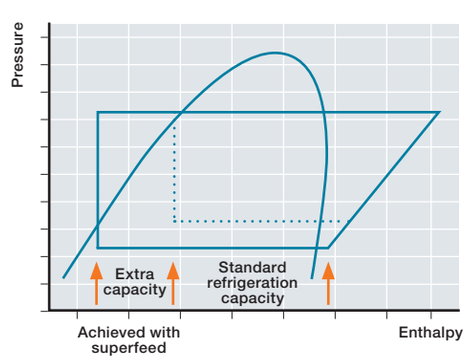
Gas handling

Typical gases or refrigerants handled by the Howden range of oil injected screw compressors include:

Refrigerants	Gases	
R717	Ammonia	Hydrogen
R134a	Butane	Methane
R404A	Carbon Dioxide	Natural Gas
R407C	Fuel gas	Nitrogen
R410A	Helium	Propane
R502	Hydrocarbon	Propylene
R507	Ammonia	Town Gas

Note: In some cases, for example in refineries, hydrocarbon gases will be used as refrigerants.

Superfeed cycle



Superfeed

The Howden superfeed system is a development of the oil injected screw compressor design. All oil injected compressors are equipped with an additional gas port, located along the length of the compression chamber. Feeding refrigerant to this port from a superfeed/economiser vessel within the refrigeration system offers increased evaporator capacity of up to 20 percent, with virtually no increase in absorbed power.

Key to graphs

- Full duty 50 Hz (excluding Superfeed) Condensing temperature 35˚C (95˚F)
- Full duty 60 Hz (excluding Superfeed) Condensing temperature 35˚C (95˚F)

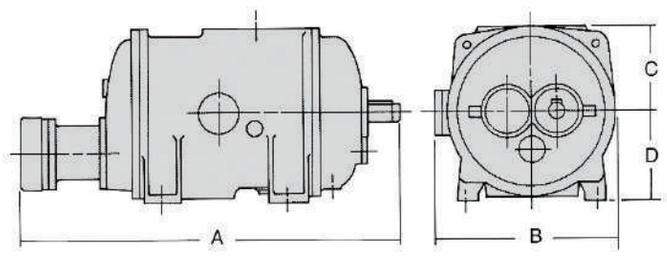
Notes

Refrigeration capacity based on 5.6˚C (10˚F) superheat at compressor suction and no sub-cooling of condensed liquid.

No allowance has been made for pressure losses between the evaporator and the compressor suction flange.

Model range WRV321

The WRV range has 7 frame sizes each with between 1 and 6 L/D ratios (all with clockwise rotation).



Howden compressor specification	*Swept volume 50Hz		*Swept volume 60Hz		Suction port Ø	Discharge port Ø	Dimension A	Dimension B	Dimension C	Dimension D	Weight approx	
	m^3/hr	cfm	m^3/hr	cfm	mm	mm	mm	mm	mm	mm	kg	lb
WRV 163/1.45	550	325	660	390	125	75	1063	490	248	250	470	1036
WRV 163/1.80	680	400	820	480	125	75	1120	490	248	250	495	1091
WRV 204/1.10	815	480	975	575	150	100	1201	640	310	315	760	1675
WRV 204/1.45	1095	645	1315	775	200	125	1273	640	310	315	850	1874
WRV 204/1.65	1220	720	1465	860	200	125	1314	640	310	315	887	1955
WRV 204/1.93	1340	790	1610	950	200	125	1370	640	310	315	925	2039
WRVi 255/1.10	1590	935	1905	1120	200	150	1493	692	349	362	1200	2645
WRVi 255/1.30	1755	1035	2105	1240	200	150	1544	692	349	362	1270	2799
WRVi 255/1.45	2150	1270	2580	1520	255	200	1583	692	349	362	1325	2921
WRVi 255/1.65	2395	1410	2870	1690	255	200	1633	692	349	362	1422	3134
WRVi 255/1.93	2630	1550	3155	1855	255	200	1705	692	349	362	1540	3395
WRV 255/2.20	3190	1880	3830	2255	255	200	1815	692	349	362	1650	3638
WRVi 321/1.32	3830	2255	4595	2705	255	200	2005	940	471	500	2925	6447
WRVi 321/1.65	4790	2820	5745	3380	300	255	2110	940	471	500	3150	6943
WRVi 321/1.93	5260	3095	6310	3715	300	255	2200	940	471	500	3260	7186
WRV 321/2.20	6385	3760	7660	4510	350	300	2345	940	471	500	3500	7715
WRVi 365/165	6771	3985	8012	4716	350	300	2418	1125	565	590	5500	12125
WRVi 365/193	7920	4662	9372	5516	350	300	2520	1125	565	590	6100	13450
WRV 510/1.32	7660	4510	9190	5410	350	255	2920	1560	750	750	10800	23806
WRV 510/1.65	9575	5640	11490	6760	400	300	3090	1560	750	750	11500	25349
WRV 510/1.93	10510	6190	12615	7425	400	300	3233	1560	750	750	11800	26010
WRV 580/1.93	16396	9650	19630	11555	450	350	3900	1400	700	820	17000	37400

The company operates a policy of continuous product development and reserves the right to alter the data provided without notice.
*Swept volume at 3000 rpm except WRV510 range which is measured at 1500rpm **Swept volume at 3600 rpm except WRV510 which is measured at 1800 rpm.

VOC emission control

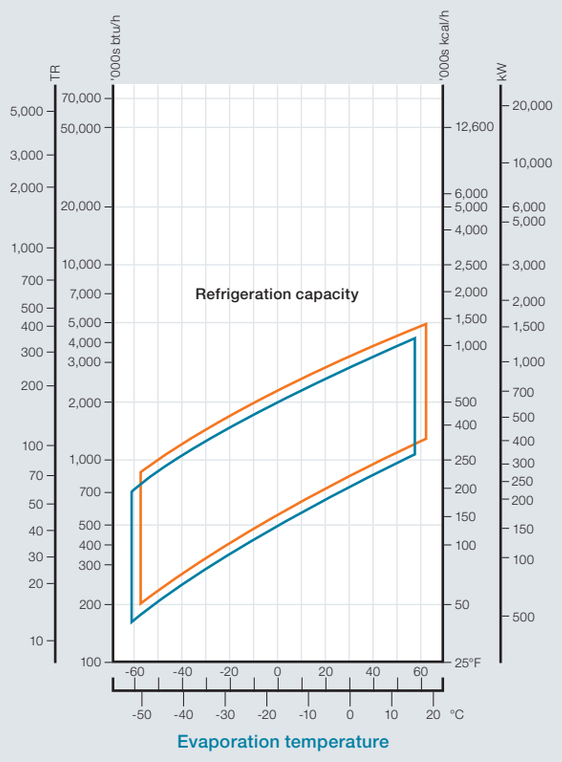
Gas turbine installation

Helium refrigeration

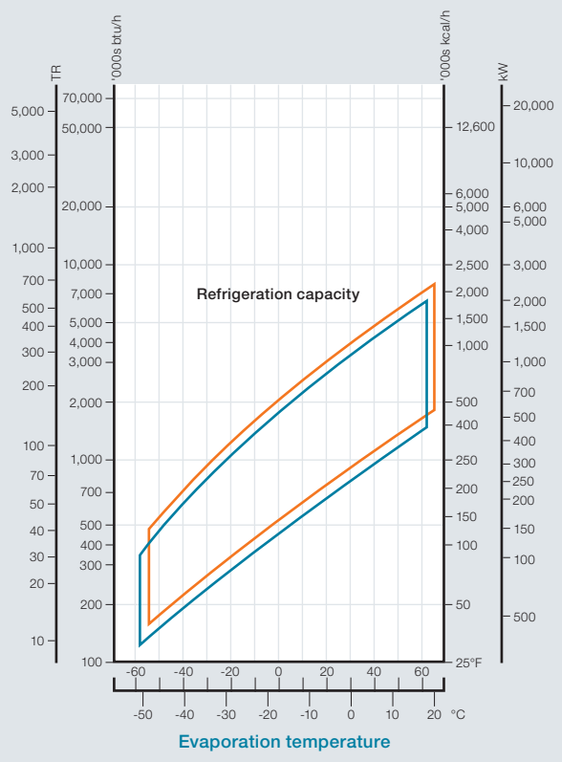
XRV technical data

Typical performance

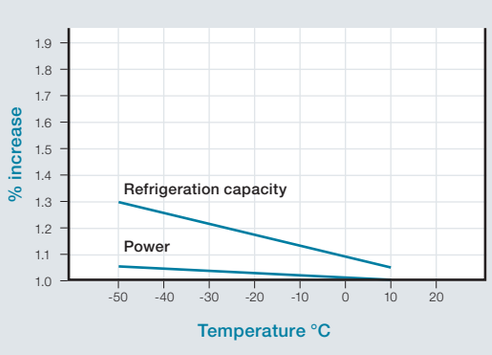
XRV ammonia



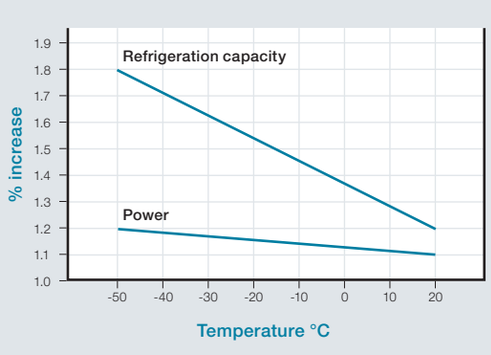
XRV R404A



XRV superfeed effect ammonia



XRV superfeed effect R404A



Key to graphs

- Full duty 50 Hz (excluding Superfeed) Condensing temperature 35˚C (95˚F)
- Full duty 60 Hz (excluding Superfeed) Condensing temperature 35˚C (95˚F)

Notes

Refrigeration capacity based on 5.6˚C (10˚F) superheat at compressor suction and no sub-cooling of condensed liquid.

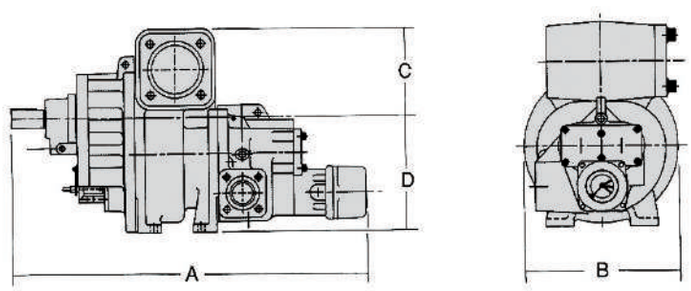
No allowance has been made for pressure losses between the evaporator and the compressor suction flange.

Model range XRV 163

XRV compressors

XRV 127/1.65 Compressor

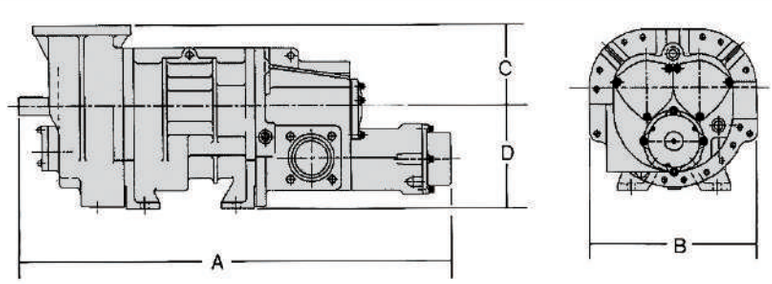
(with anti-clockwise rotation
except for XRV 127-R1)



Howden compressor specification	*Swept volume 50Hz		*Swept volume 60Hz		Suction port Ø	Discharge port Ø	Dimension A	Dimension B	Dimension C	Dimension D	Weight approx	
	m^3/hr	cfm	m^3/hr	cfm	mm	mm	mm	mm	mm	mm	kg	lb
XRV 127-R1	293	172	352	207	100	50	850	390	299	201	250	550
XRV 127-R3	397	234	476	280	100	50	900	390	209	291	250	550
XRV 127-R4	489	288	586	345	100	50	900	390	209	291	250	550
XRV 127-R5	576	340	–	–	100	50	900	390	209	291	250	550

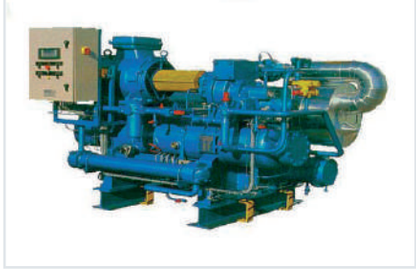
XRV 163 & XRV 204 Compressors

(all with clockwise rotation)



Howden compressor specification	*Swept volume 50Hz		*Swept volume 60Hz		Suction port Ø	Discharge port Ø	Dimension A	Dimension B	Dimension C	Dimension D	Weight approx	
	m^3/hr	cfm	m^3/hr	cfm	mm	mm	mm	mm	mm	mm	kg	lb
XRV 163/1.65	593	350	712	420	125	76	1070	430	200	250	364	802
XRV 163/1.93	710	418	852	500	125	76	1116	430	200	250	388	855
XRV 204/1.10	812	478	974	573	150	100	1178	516	240	305	636	1400
XRV 204/1.45	1070	630	1284	756	150	100	1249	516	240	305	660	1454
XRV 204/1.65	1219	717	1463	860	150	100	1255	516	240	305	690	1520
XRV 204/1.93	1348	793	1618	952	150	100	1312	516	240	305	736	1621

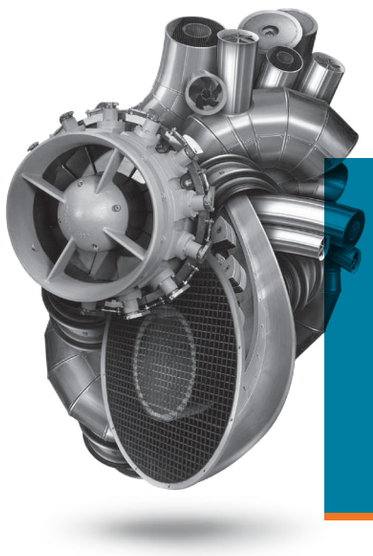
Marine freezing unit



Glycol chiller

Ethyleneglycol chiller unit

www.howden.com



At the heart of your operations

Howden people live to improve our products and services and for over 160 years our world has revolved around our customers. This dedication means our air and gas handling equipment adds maximum value to your operations. We have innovation in our hearts and every day we focus on providing you with the best solutions for your vital operations.

Howden

Howden Compressors

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