Rotary Twin Screw Compressors
For industrial refrigeration, gas processing and other industries
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.

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.

RECENT DEVELOPMENTS

Our leadership in technology has been maintained over many years by total commitment to continuous product development. In particular, we are committed to ensuring that products meet current and future demands for environmental protection by using CFC free refrigerants and by containment of hazardous gases. Moreover our compressors have been developed to operate at high efficiencies to conserve energy and give low operating costs.

Our compressors are capable of operation on all known refrigerants and gases. We have over 30 years of experience on CO₂ compression, and as CO₂ becomes a standard refrigerant we have a proven compressor product available.

We are also actively increasing the range of our products to match customer requirements, such as high pressure gas boosters for aeroderivative gas turbines, which now typically require gas supply at pressures above 50 bar.
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.
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 Lloyd’s 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 kits that provide all items for particular types of model and maintenance operation.

QUALITY CONTROL
We recognise the importance of a controlled manufacturing environment and Howden companies are accredited to ISO 9001:2000. Ongoing internal and external audits of quality control systems are applied to ensure continued compliance with necessary control procedures. For particular applications quality plans are prepared to meet specific customer requirements.
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.

TWIN SCREW COMPRESSORS
PRINCIPLES OF OPERATION

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

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

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

Fig 4
Compression continues until the interlobe space becomes exposed to the outlet port, through which the gas is discharged.
WRV compressors set the standard against which industry comparison is made for both gas and refrigeration applications.

Features and benefits of WRV compressors include:

**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.

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.

ALL WRV RANGE COMPRESSORS ARE OF DOUBLE WALL CONSTRUCTION AND UTILISE WHITE METAL, SLEEVE TYPE JOURNAL BEARINGS WITH PRESSURISED SHAFT SEAL.

WRV section: WRV 255, 321 & 365 will incorporate variable Vi as standard.
XRV COMPRESSORS
COMPRESSORS FOR REFRIGERATION

XRV compressors have been developed specially for the refrigeration market.

Features and benefits of XRV compressors include:

**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.

**TYPICAL OPERATING ENVELOPE – R717 REFRIGERANT**

<table>
<thead>
<tr>
<th>CONDENSER PRESSURE (BAR a)</th>
<th>EVAPORATION PRESSURE (PSI a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.3</td>
<td>20</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>

**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.
HOWDEN COMPRESSORS

WRV TECHNICAL DATA: TYPICAL PERFORMANCE

TYPICAL PERFORMANCE

GAS HANDLING

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

- Refrigerants
  - R717
  - R134a
  - R404A
  - R407C
  - R502
  - R507

- Gases
  - Ammonia
  - Butane
  - Carbon Dioxide
  - Fuel gas
  - Helium
  - Hydrocarbon
  - Ammonia (Wet & Mixed)

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

SUPERFEED CYCLE

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.
The W RV range has 6 frame sizes each with between 2 and 6 L/D ratios (all with clockwise rotation).

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 W RV5/10 range which is measured at 1500 rpm  **Swept volume at 3600 rpm except W RV5/10 which is measured at 1800 rpm.
**XRV TECHNICAL DATA: TYPICAL PERFORMANCE**

**XRV AMMONIA**

**XRV SUPERFEED EFFECT AMMONIA**

**XRV R404A**

**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.
# XRV Compressors

The company operates a policy of continuous product development and reserves the right to alter the data provided without notice.

<table>
<thead>
<tr>
<th>Compressor Specification</th>
<th>Swept Volume 50Hz</th>
<th>Swept Volume 60Hz</th>
<th>Suction Port Ø</th>
<th>Discharge Port Ø</th>
<th>Dimension A</th>
<th>Dimension B</th>
<th>Dimension C</th>
<th>Dimension D</th>
<th>Weight Approx.</th>
</tr>
</thead>
<tbody>
<tr>
<td>XRV 127-R1</td>
<td>127 m³/hr</td>
<td>293 m³/hr</td>
<td>352 mm</td>
<td>100 mm</td>
<td>50 mm</td>
<td>850 mm</td>
<td>2 ft</td>
<td>9 1/8 in</td>
<td>250 Kg 550 lb</td>
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<td>XRV 127-R3</td>
<td>397 m³/hr</td>
<td>476 m³/hr</td>
<td>397 mm</td>
<td>100 mm</td>
<td>50 mm</td>
<td>900 mm</td>
<td>2 ft</td>
<td>11 7/16 in</td>
<td>290 Kg 650 lb</td>
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<td>XRV 127-R4</td>
<td>489 m³/hr</td>
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<td>478 mm</td>
<td>100 mm</td>
<td>50 mm</td>
<td>900 mm</td>
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<td>11 7/16 in</td>
<td>290 Kg 650 lb</td>
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<td>XRV 127-R5</td>
<td>576 m³/hr</td>
<td>650 m³/hr</td>
<td>57 6 mm</td>
<td>100 mm</td>
<td>50 mm</td>
<td>900 mm</td>
<td>2 ft</td>
<td>11 7/16 in</td>
<td>290 Kg 650 lb</td>
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<tr>
<td>XRV 163/1.6S</td>
<td>593 m³/hr</td>
<td>712 m³/hr</td>
<td>125 mm</td>
<td>76 mm</td>
<td>1070 mm</td>
<td>3 6/8 ft</td>
<td>150 mm</td>
<td>200 Kg 450 lb</td>
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</tr>
<tr>
<td>XRV 163/1.93</td>
<td>710 m³/hr</td>
<td>852 m³/hr</td>
<td>125 mm</td>
<td>76 mm</td>
<td>1116 mm</td>
<td>3 8 ft</td>
<td>150 mm</td>
<td>200 Kg 450 lb</td>
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</tr>
<tr>
<td>XRV 204/1.10</td>
<td>812 m³/hr</td>
<td>974 m³/hr</td>
<td>150 mm</td>
<td>100 mm</td>
<td>1178 mm</td>
<td>3 10/16 ft</td>
<td>150 mm</td>
<td>240 Kg 540 lb</td>
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<tr>
<td>XRV 204/1.45</td>
<td>1070 m³/hr</td>
<td>1284 m³/hr</td>
<td>150 mm</td>
<td>100 mm</td>
<td>1249 mm</td>
<td>4 1/8 ft</td>
<td>150 mm</td>
<td>240 Kg 600 lb</td>
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<td>XRV 204/1.65</td>
<td>1219 m³/hr</td>
<td>1463 m³/hr</td>
<td>150 mm</td>
<td>100 mm</td>
<td>1255 mm</td>
<td>4 1/8 ft</td>
<td>150 mm</td>
<td>240 Kg 600 lb</td>
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<tr>
<td>XRV 204/1.93</td>
<td>1348 m³/hr</td>
<td>1618 m³/hr</td>
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<td>100 mm</td>
<td>1312 mm</td>
<td>4 3/4 ft</td>
<td>150 mm</td>
<td>240 Kg 600 lb</td>
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</tr>
</tbody>
</table>

* Howden compressor with anti-clockwise rotation except for XRV 127-R1

* Howden compressor with clockwise rotation

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XRV 127/1.65 Compressor
(with anti-clockwise rotation except for XRV 127-R1)

XRV 163 & XRV 204 Compressors
(all with clockwise rotation)
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.