

**Safe and effective
solutions** for the
refrigeration industry



AERZEN
EXPECT PERFORMANCE

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Safe and effective solutions

for the refrigeration industry

Efficient, versatile, robust - the latest from AERZEN

A key component in almost every industrial refrigeration system, compressors essentially define a system's performance limits, controllability, and efficiency. Selecting the right refrigerant compressor, therefore, plays a decisive role in the design of any refrigeration system, from nitrogen cooling to ice cream production and air conditioning in buildings. With our new line of refrigeration compressors, we offer the best solutions for your application. Our versatile range uses the latest AERZEN VMY.56 series compressors. Their unique features:

- Space-saving compact design, easy maintenance
- High process reliability during continuous operation
- Reliable over a life cycle of 20 to 30 years and even longer
- Reduced power consumption - highly efficient and economical
- Wide control spectrum of 20% to 100 % for a very flexible range of applications
- Perfect coverage of the most diverse performance requirements

Compact design - attractive price

High efficiency and low costs - two of the main requirements of the new compressor development. One result is reduced energy consumption. Another is a design that is significantly lighter and more compact. To accomplish this, we literally turned the entire unit design upside down. As a result, our new standard refrigeration compressor series meets contemporary requirements for small spaces, without compromising on AERZEN's high quality performance standards. The new unit's space-saving design has many advantages, including consistently high performance, easier maintenance and, last but not least, lower costs.

Standardised? Customised? Yes and yes!

With the new refrigeration compressor line from AERZEN, you benefit from standard technologies with all the advantages they offer in terms of cost savings, compatibility, interfaces, service-friendliness and much more. What makes the new AERZEN compressors so unique? The answer is simple: the possibility of modifying these standards in order to carry out almost any customer requirement, no matter how unique. Tailor-made for your process. With us as your partner, you will benefit from around 20 years of engineering experience, during which time we have successfully solved nearly all technological challenges. Customised solutions on a standard basis: another special quality feature of AERZEN.

- What performance requirements do today's refrigeration compressors have to meet?
- How can economical standard technologies be tailored to individual customer processes?
- How flexible are modern refrigeration compressors for different applications?
- And how do they meet the industry's highest reliability and process safety requirements?

Over the following pages, we'd like to give you the answers to these questions.

LET'S TALK

"... about **safety** and **effectivity** in the refrigeration industry"

Areas of application

As versatile as the refrigeration industry itself

Whether it's for the chemical, oil and gas, or ice sport industries: AERZEN has the right cooling solutions for you. Why? Because we use our experience and expertise to meet your unique refrigeration needs, no matter how specific. And because we've been successfully supplying refrigeration compressors and complete refrigeration systems for decades. Across all industries. All over the world. Regardless of the temperature zone.

AERZEN is one of the leading specialists in developing and manufacturing compressor technology. We've been driving development with our innovations for decades. Over that time we've developed substantial expertise in various applications. In large industries such as the chemical and the oil & gas industry. In the pharmaceutical, the food industries and in the energy and civil sectors. As different as the processes and applications across these industries are, our

goal always remains the same: achieving the desired cooling performance. Safe, reliable and efficient. And compliant with all the applicable standards and regulations of the respective industries at the same time. Our new, compact refrigeration compressor line was developed with this objective in mind. The result sets high standards. In terms of versatility, reliability and energy efficiency.

Oil and gas industry

- Upstream (exploration and production)
- Refrigeration solutions for onshore production
- Refrigeration solutions for offshore production
- Gas dew point control through refrigeration technology
- Midstream hydrocarbon recovery (transport & storage)
- Refrigeration in natural gas processing
- Gas-to-liquid applications
- Vapour recovery units (VRU)
- Recovery of boil-off gas (ethylene, propylene, propane, butane, LPG, etc.)
- Loading/unloading refrigeration
- Small-scale downstream LNG liquefaction (refining and purification)
- Process cooling
- Hydrocarbon cooling
- Compression and liquefaction of hydrocarbon mixtures
- Gas liquefaction
- Separation of light substances
- LPG and condensate recovery through turboexpander
- Cooling of de-ethanizer capacitors
- Flare gas/air/steam recovery
- Nitrogen cooling
- Petrol fractionation
- Commercial refrigeration (chilled water, chilled glycol)
- Fertiliser factory, ammonia BOG & ammonia refrigeration system

Food industry

- Water/glycol cooling system
- Cold storage, cold storage warehouses
- Industrial
- Cooling systems for the food industry
- Two-stage deep-freeze solutions
- Cooling systems for soft drinks and breweries

Chemical industry

- Commercial refrigeration (chilled water, chilled glycol)
- Reaction heat dissipation in various chemical processes
- Process air treatment and dehumidification
- Solvent recovery treatment
- Crystallisation process
- Storage of liquids with low boiling point
- Tank unloading applications
- Chlorine condensers

Energy industry

- Utility cooling (chilled water, chilled glycol)
- Combustion air cooling system

Civil sector

- Ice rinks
- air conditioning for buildings



Production safety with no compromise

For every process

Demanding applications such as those in the oil and gas industry require maximum reliability and operational safety. With decades of application know-how and close working relationships with our customers, these requirements are at the heart of all of AERZEN's developments and projects. It's no accident that AERZEN refrigeration compressors set the highest standards in terms of reliability and safety.

100 % fulfilled industry safety standards

Our refrigeration compressors and cooling units are key technical components in many of our customers' systems. Reliable operation over thousands of hours is, therefore, a must. After all, an unexpected breakdown can bring entire production chains to a standstill and lead to major losses. Top quality design and "good engineering practice" are essential to guaranteeing our customers maximum operational safety. AERZEN's compliance with all relevant standards is also a decisive factor. It goes without saying that AERZEN machines comply with the relevant EU directives (2006/42/EU, 2014/68/EU, 2006/95/EU, DIN EN ISO 12100). Our pressure vessels and piping are manufactured in accordance with the relevant rules of the Pressure Equipment Directive (PED).

Moreover the electrical design of our machines complies with the regulations of the international standards body IEC.

Safety first, in accordance with ATEX

ATEX stands for "ATmosphère EXplosible", the European directive for equipment and protective systems in potentially explosive atmospheres. Many of our refrigeration compressors and cooling units are used in such potentially dangerous areas, or the refrigerants used (R290, etc.) present an explosion hazard. This is why our machines are also available in fully explosion-proof versions in accordance with ATEX 2014/34/EU. After all, the principle of "safety first" applies to all AERZEN applications - to protect people, processes and investments.

Far beyond the standard. Customised refrigeration solutions

It goes without saying that all standard AERZEN machines are built in accordance with European directives and standards. What makes our products special, however, is that they also meet very specific and individual requirements. We're able to achieve this thanks to our exceptionally broad portfolio of additional components combined with many years of experience in implementing customised solutions. Examples include the design of ASME pressure vessels and TEMA and API conformity.

Taking advantage of digitalisation

Our cooling units can be equipped with digital extras, e.g. with our high-level monitoring systems, various temperature or vibration sensors and much more. Gain full transparency over the operating and machine conditions of your refrigeration systems in real time and take advantage of our completely new analysis options and digital services including time-based maintenance and predictive maintenance. As an optional extra, our machines can also

be equipped with a remote access. This represents an additional benefit for your plant and process safety. Our highly qualified service specialists are able to monitor your plant from anywhere in the world thanks to this online monitoring system.



One series

A versatile range of applications

Our refrigeration compressor range combines simplicity with versatility. Standardised technology with nearly limitless flexibility. Top performance with the highest efficiency values. Every AERZEN machine represents decades of experience and application know-how in almost every refrigeration application. This has resulted in simple, compact solutions - optimised in every detail for your cooling process.

Compact versatility with many advantages

Our idea was to create a standardised product range that serves simple, recurring applications better than any previous machine, e.g. the supply of industrial cooling water. The result is a new oil-injected compressor line with 10 stages whose application possibilities extend far beyond standard industrial applications. Highly flexible and optimised in many areas, including its more compact design, reduced weight and improved transportability. We also improved maintenance convenience, as all components are significantly more accessible, despite the new space-saving design.

From the compressor to the complete system

The new compacts from AERZEN are intelligently designed, ready-to-install machines that can be immediately integrated into your refrigeration systems. Even in their standard version, AERZEN cooling units cover a wide range of applications. They can be modified to meet even very special and individual requirements. From standard refrigeration compressor units to complete refrigeration systems: reliable, highly efficient and extremely cost-effective.

Limitless versatility - Additional components

AERZEN's range of optional accessories for its cooling units is practically limitless. Don't have access to water for cooling the machine? Then simply use our direct air-cooled oil cooler or even a separate cooling system with intercooling. Want to increase operational safety? Then double the oil cooler and oil filter, or go even further and make the entire instrumentation and machine control redundant. What about oil consumption? Oil consumption can be reduced by using additional separator elements or even an additional external oil separator. Anything we haven't covered? Let's talk - we have the right solution for you.

Refrigerant - Ecologically sound

Freon-based refrigerants increase the greenhouse effect when they enter the atmosphere. Unfortunately, many refrigeration systems that use these substances are still in operation. With AERZEN you can rely on: Our refrigeration compressors and cooling units use only environmentally friendly refrigerants with a low GWP value, R290, R717 and R1270, for example.

Efficiency - Triple guaranteed

AERZEN refrigeration compressors combine two control modes for switching from one operating mode to another. On the one hand, the internal bypass of the compressor can regulate capacity, between 20 % and 100 %. Secondly, the electric motors that drive the compressors are variable frequency controlled via a frequency converter. In concrete terms this means that the drive speed can be adjusted between 1800 rpm and 3600 rpm. These two types of control ensure that the machines always perform exactly as required - no more and no less. In addition, all refrigeration compressors can be equipped with so-called economisers. These intelligent AERZEN components further increase the cooling systems' already high efficiency. The result is another plus for the COP (coefficient of performance), along with significantly shorter payback times.



Compressor stage lubrication piping.

State-of-the-art logistics technology:
It's how we ensure availability.
Worldwide.



Operating conditions

Perfectly suited for your process

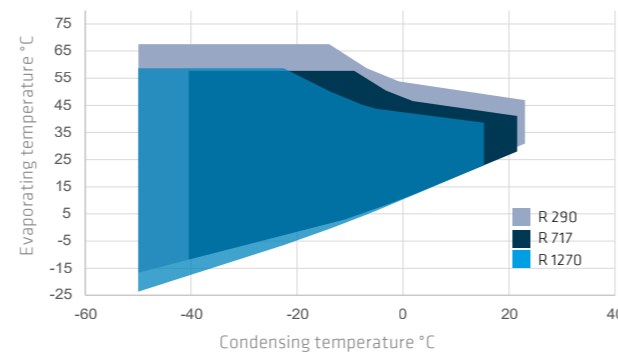
Our new compact refrigeration compressor units use the latest VMY.56 oil-injected screw compressor technology from AERZEN. Tailored to the diverse requirements of the refrigeration industry, these compressors stand for highly efficient capacity adjustments, absolute reliability and low operating costs. They form the standardised basis upon which our individually tailored refrigeration solutions are built.

Three operating levels - typical areas of application

High stage, Booster and ECO - every compressor in our refrigeration series can be run according to these three operating stages. This makes them enormously flexible for the most diverse requirements. The High stage and Booster stages are typically used to operate the upper and lower units of your freezer unit. This means that two AERZEN compressors can be used to realise a two-stage cooling system with an evaporating temperature of up to -10 °C or -40 °C.

Single-stage cooling systems with an evaporating temperature of -33 °C are implemented using a compressor via ECO operating stage. These single-stage systems are usually equipped with an economiser, which ensures optimum filling of the chambers and thus increases the efficiency of the entire system. The proven machines can be flexible configured to suit almost any temperature and pressure requirements.

Range of application

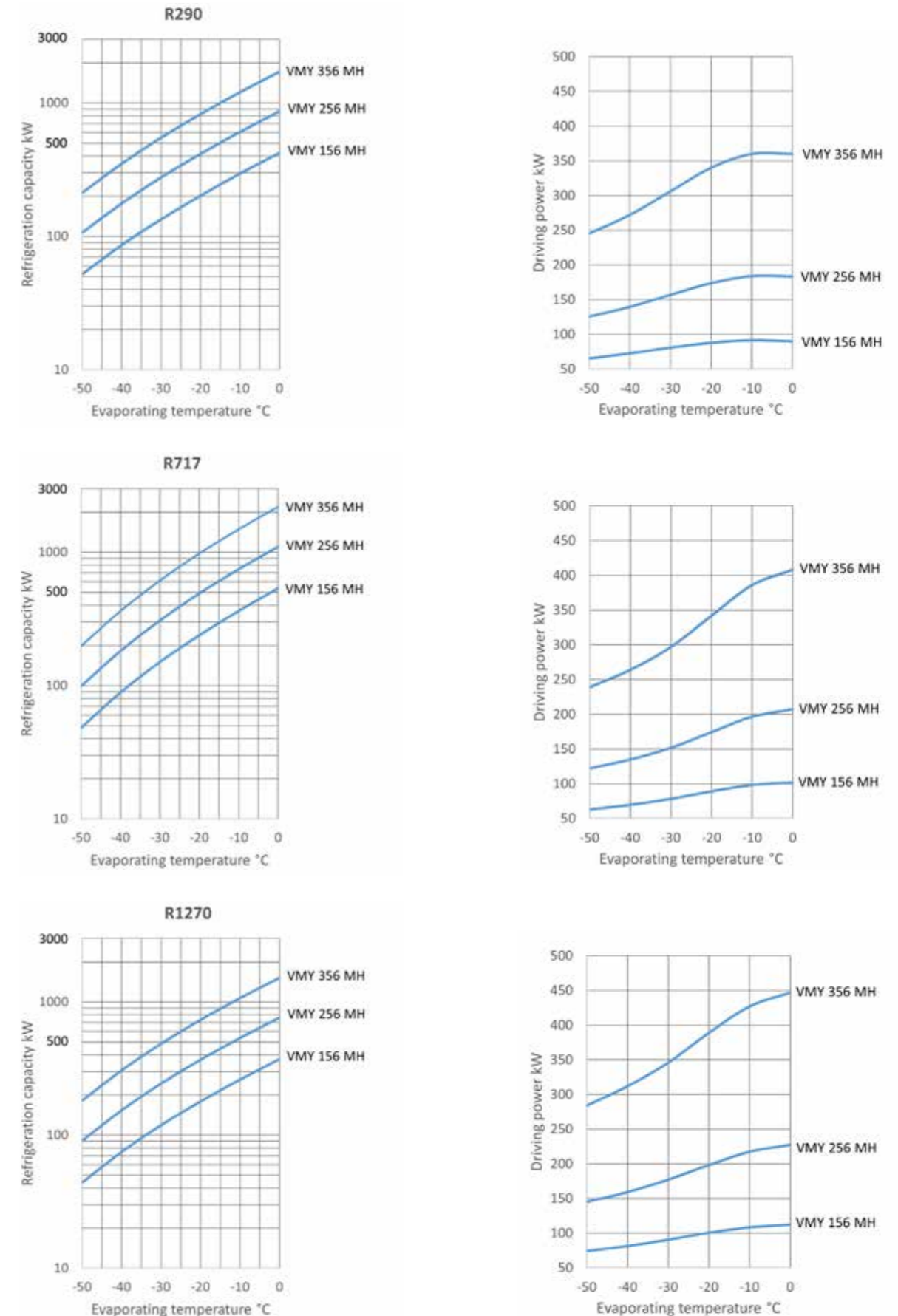


Overview AERZEN refrigeration units

| Refrigerant | Model VMY | | | | | | | | |
|-------------------------|---|---------|--------|------------|---------|--------|------------|---------|--------|
| | R 717 | | | R 290 | | | R 1270 | | |
| Working cases | High Stage | Booster | ECO | High Stage | Booster | ECO | High Stage | Booster | ECO |
| Evaporating temperature | -10° C | -40° C | -33° C | -10° C | -40° C | -33° C | -10° C | -40° C | -33° C |
| Condensing temperature | +35° C | -10° C | +35° C | +35° C | -10° C | +35° C | +35° C | -10° C | +35° C |
| Cooling capacity kW | | | | | | | | | |
| Min | 58 | 17 | 20 | 47 | 23 | 19 | 59 | 26 | 24 |
| Max | 1183 | 343 | 508 | 965 | 413 | 454 | 1194 | 522 | 578 |
| Power supply | 400 V/50 Hz | | | | | | | | |
| Oil | Only provided or authorised by AERZEN | | | | | | | | |
| Ambient temperature | -25° C/ +45° C | | | | | | | | |
| Cooling water | Quality acc. to „Code for design of industrial recirculating cooling water treatment“ | | | | | | | | |

All data charts are valid for 35°C condensation temperature.

Performance charts



VMY compressors





Ideal for variable volume flows

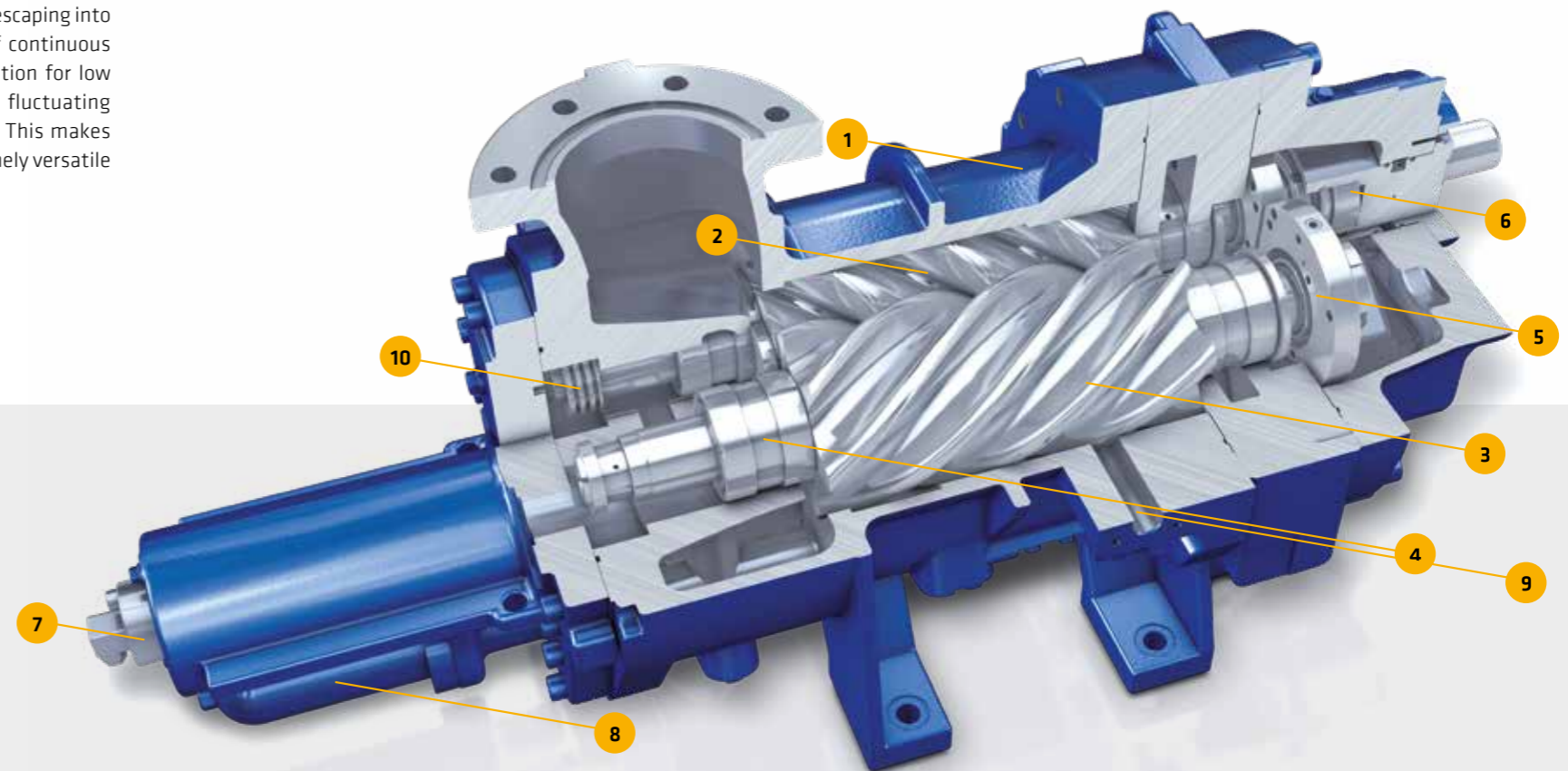
While the VMY series compressors have made a name for themselves in closed cooling circuits, they demonstrate the same performance and effectiveness in open process systems, as required in the chemical, petrochemical or power generation industries. VMY compressors are the ideal machines for gases with low molecular weights, for high compression ratios and versatile configuration requirements.

Extremely reliable, highly flexible

AERZEN's oil-injected VMY screw compressors are insensitive to volume, temperature or pressure fluctuations. This makes them particularly ideal for use in batch processes (discontinuous operation). All units and stages of the 15 VMY models are equipped with a slider for volume flow control. The volume flows are controlled with a significantly flexibility of between 100 % and 20 %, allowing them to be optimally adapted to the respective processes. The rotor drive is not effected by means of timing gears (as with oil-free compressors), but by means of direct power transmission

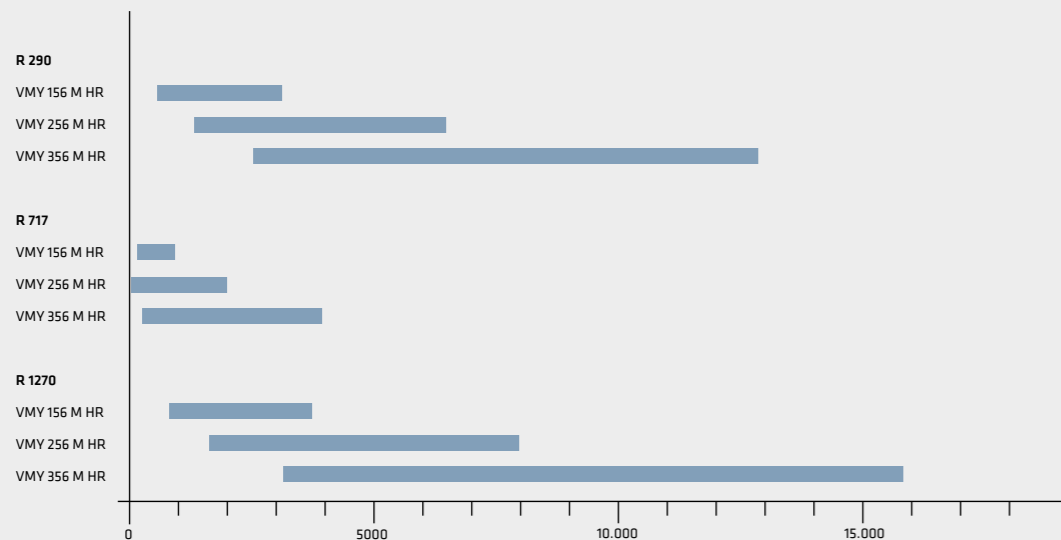
of the driven rotor. The oil injection quantity regulates the outlet temperature and, in case of humid gases, it is ensured that the oil is always compressed above the specific dew point temperatures. This reliably prevents water from escaping into the oil/gaseous mixture. Designed for years of continuous operation, VMY compressors are the ideal solution for low molar weights, for coolants, and generally for fluctuating operation conditions under high pressure ratios. This makes the renowned AERZEN compressors both extremely versatile as well as economical.

| | | | |
|--|---|--|---|
|  <p>Oil-injected compressor</p> |  <p>Volume flows from 233 to 8.910 m³/h</p> |  <p>Neg. pressure: -900 mbar g Pos. pressure: 25 bar g (Higher pressure upon request)</p> |  <p>Conveying media: Neutral and flammable gases, oilcompatible, mixed and process gases, as well as all common coolants</p> |
|--|---|--|---|



- | | | | | |
|--------------|------------------|-------------------|--------------------|-------------------|
| 1 Housing | 3 Female rotor | 5 Axial bearing | 7 Displcmt. sensor | 9 ECO connection |
| 2 Male rotor | 4 Radial bearing | 6 Mechanical seal | 8 Vi setting | 10 Balance piston |

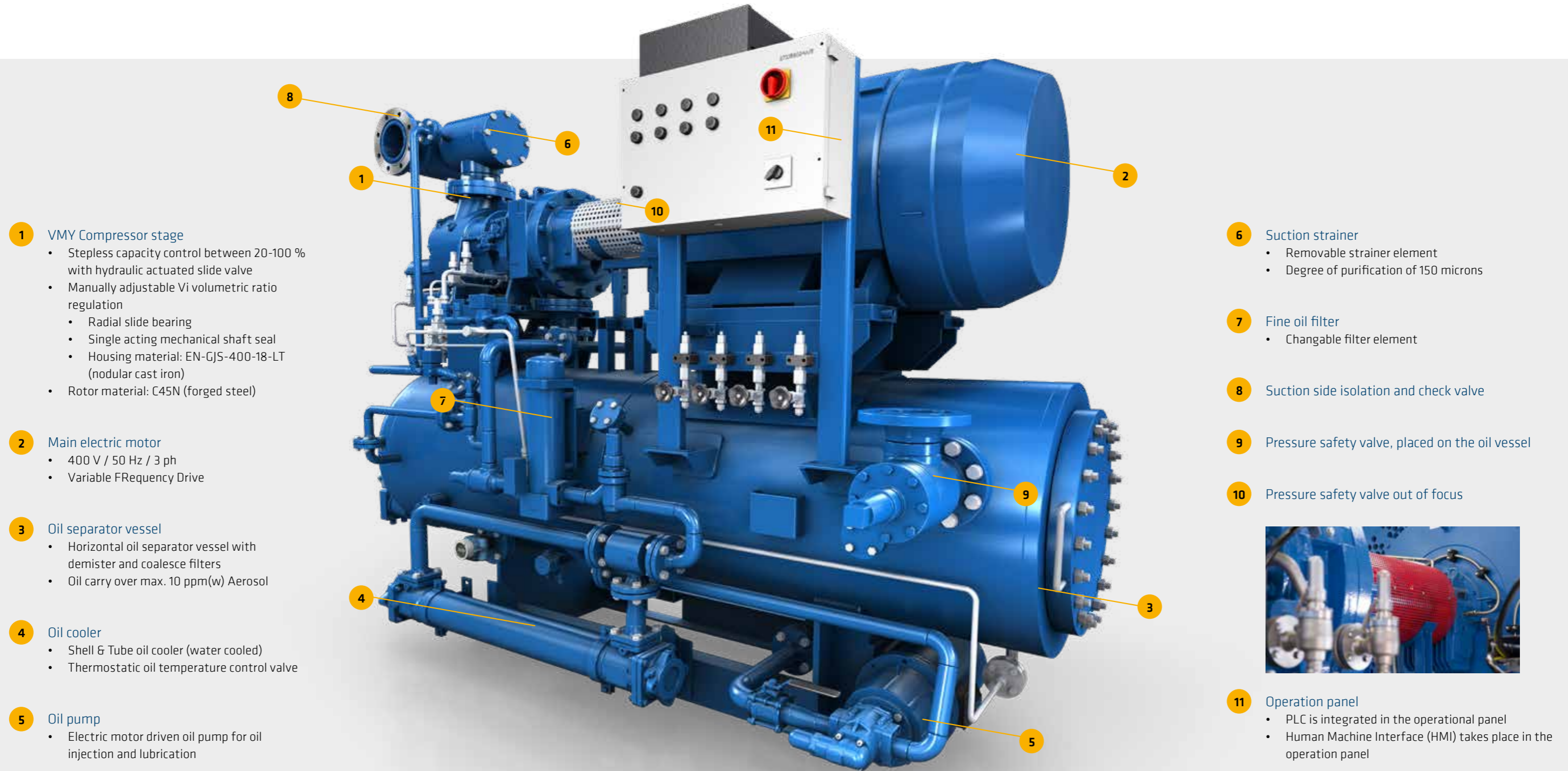
Mass flow kg/h



Compact in design

Great for refrigeration applications

Compact design with horizontal oil reservoir - AERZEN refrigeration compressor units always fit your application thanks to their smaller footprint, lower operating costs and better maintenance conditions. Any questions?



- 1** VMY Compressor stage
 - Stepless capacity control between 20-100 % with hydraulic actuated slide valve
 - Manually adjustable Vi volumetric ratio regulation
 - Radial slide bearing
 - Single acting mechanical shaft seal
 - Housing material: EN-GJS-400-18-LT (nodular cast iron)
 - Rotor material: C45N (forged steel)

- 2** Main electric motor
 - 400 V / 50 Hz / 3 ph
 - Variable FRequency Drive

- 3** Oil separator vessel
 - Horizontal oil separator vessel with demister and coalesce filters
 - Oil carry over max. 10 ppm(w) Aerosol

- 4** Oil cooler
 - Shell & Tube oil cooler (water cooled)
 - Thermostatic oil temperature control valve

- 5** Oil pump
 - Electric motor driven oil pump for oil injection and lubrication

- 6** Suction strainer
 - Removable strainer element
 - Degree of purification of 150 microns

- 7** Fine oil filter
 - Changable filter element

- 8** Suction side isolation and check valve

- 9** Pressure safety valve, placed on the oil vessel

- 10** Pressure safety valve out of focus

- 11** Operation panel
 - PLC is integrated in the operational panel
 - Human Machine Interface (HMI) takes place in the operation panel



Refrigeration compressor units

Technical data

Versatility for a high degree of customisation: AERZEN's standardised refrigeration compressor units are designed for three specific application scenarios. This allows us to configure customised solutions for any refrigeration application, however specific.

Capacities VMY

| Model | Nominal capacity in kW | | | Noise level db(A)/1m |
|--------------|--------------------------|-----------------------|-------------------|----------------------|
| | High stage -10/+35° C | Booster -40/-10° C | ECO -33/+35° C | |
| R717 | | | | |
| VMY 156 M HR | 290 | 84 | 99 | 93 |
| VMY 256 M HR | 595 | 173 | 204 | 93 |
| VMY 356 M HR | 1183 | 343 | 508 | 93 |
| R290 | | | | |
| VMY 156 M HR | 237 | 102 | 93 | 93 |
| VMY 256 M HR | 485 | 208 | 190 | 93 |
| VMY 356 M HR | 965 | 413 | 454 | 93 |
| R1270 | | | | |
| VMY 156 M HR | 293 | 128 | 170 | 93 |
| VMY 256 M HR | 600 | 263 | 313 | 93 |
| VMY 356 M HR | 1194 | 522 | 578 | 93 |

Dimensions and weights

| Model | Size L x W x D in mm | Dry weight in kg | Inlet connection DN | Outlet connection DN | Cooling water connection DN |
|------------|-------------------------|---------------------|------------------------|-------------------------|--------------------------------|
| VMY 156 MH | 3255 x 1275 x 5500 | 3300 | 100 | 80 | 50 |
| VMY 256 MH | 3715 x 1610 x 2650 | 4100 | 150 | 100 | 50 |
| VMY 356 MH | 3715 x 1610 x 2800 | 4650 | 200 | 125 | 50 |

Optional - Our versatile accessories

From standard refrigeration compressor units to completely customised refrigeration systems: AERZEN has the right machine for your application. Thanks to decades of experience in the field of custom-made cooling units, we can modify the

standardised versions so that they are one hundred per cent adapted to your requirements. Tailor-made to your process requirements and wishes.

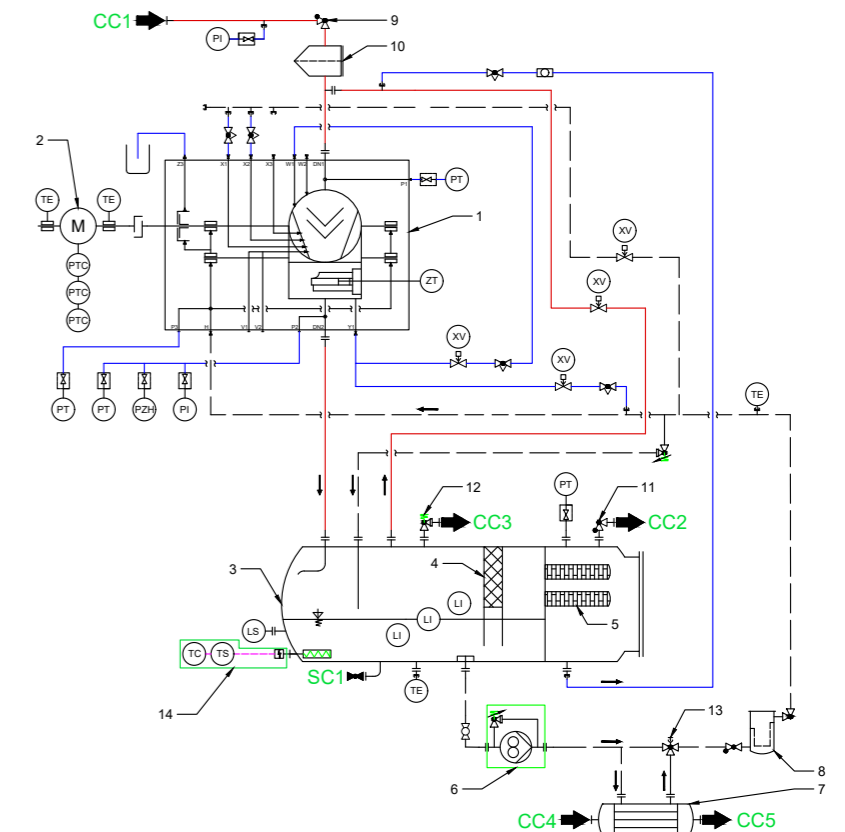


Options and Accessories

- Compressor stage
 - Automatic control of the Vi volume flow ratio
 - Double-acting mechanical shaft seal
 - Housing material: GP240GH (cast steel) or GS21-Mn5 (low temperature cast steel)
 - Rotor material: 20MnCr5 (forged steel)
 - Bearing/housing for temperature sensors and housing for vibration sensors
- Increased oil separation efficiency of up to 1 ppm(w)
- Alternative oil cooling solutions: Air-cooled or thermosyphon oil cooler, additional internal glycol cooling circuit with air cooler
- Double fine oil filter
- Discharge pressure regulating valve
- Explosion-proof design of the entire system
- Compressor with sound insulation bonnet to ensure max. 85 dB[A]/1m noise level
- Extended instrumentation according to customer requirements, machine monitoring system
- Additional components for complete system (evaporator, condenser, expansion valve, etc.)

Module description

| ID | Module |
|-----|----------------------------|
| CC1 | Compressor inlet |
| CC2 | Compressor outlet |
| CC3 | Safety valve |
| CC4 | Cooling water inlet |
| CC5 | Cooling water outlet |
| CC6 | Oil filtering and draining |
| 1 | Compressor stage |
| 2 | Main motor |
| 3 | Oil separator vessel |
| 4 | Demister |
| 5 | Cooling water filter |
| 6 | Oilpump |
| 7 | Oilcooler |
| 8 | Oilfilter |
| 9 | Suction valve |
| 10 | Suction strainer |
| 11 | Discharge valve |
| 12 | Safety valve |
| 13 | Thermostativ valve |
| 14 | Electrical oilheater |



Everything except ordinary

The service world of AERZEN

The long service life of AERZEN machines is legendary. So why is service even a topic? Because it's about more than availability and OEM original parts. The services of AERZEN secure investments, productivity, the decisive advantage in competition. And this worldwide.



AERZEN on-site service

Our service teams work where our machines are. All over the world. Onshore or offshore. Often under extreme conditions. How do we do it? With short distances. AERZEN has a dense network of service centers and decentralised parts warehouses around the globe. More than 200 excellently trained service technicians can come to your aid from there. Any time and anywhere you need us.

For rental service and other services

AERZEN's service world has a lot on offer. Specially tailored service kits for example. Replacement stages, machine diagnostics, sound optimisation. One of our most important services is AERZEN Rental and stands for a large park of rental machines. Blowers, turbos and compressors from AERZEN. In a wide range of performance classes. For all common pressure ranges. Can be used immediately and delivered turnkey on request. What does that mean for you? You are also well prepared for unexpected requirements: www.aerzenrental.com

AERZEN - A competent partner at your side

Every industry is different. Every cooling process has specific requirements. As a reliable partner for our customers in a wide range of applications, no one knows this better than we do. For us at AERZEN, adapting to versatile and changing requirements in a wide range of industries has always been a matter of course. This is what our special experience and expertise is founded on. After all, we want to offer you the best solution for your processes. In terms of performance, safety and efficiency. Right-sized for your needs. How do we do it? First we listen, then we commit all our knowledge to your project. We view open communication with you and a well-functioning flow of information in both directions as the basis for a successful partnership. Let's talk!



Contact worldwide

2,600 employees work for AERZEN. On every continent. With six sales offices in Germany alone, we're there for you. And with more than 50 subsidiaries in over 100 countries around the world. Hence we're never far away – should you ever need us.

Give us a call:
[+49 5154 81 0](tel:+495154810)

Service-Infoline

Our German Service Centre is available for customers and operators. We are happy to help you. We look forward to your call:
[+49 700 49318551](tel:+4970049318551)

Customer Net

Where you can learn more about the company and the leading compressor technologies from AERZEN? It's simple: In our Customer Net on our website, where we have stored everything that is worth knowing for you:
www.aerzen.com



LET'S TALK

Find your local contact

www.aerzen.com/worldwide

Let's talk about the best solution for your process

AERZEN refrigeration solutions are used in the most demanding industries worldwide. In sectors such as chemicals, petrochemicals, power generation, food or pharmaceuticals, the requirements for plant planning, engineering, documentation and service are just as extraordinary as the special safety and environmental guidelines to which these industries are subject. It's not the machine that determines the process - it's the process that determines the machine. That's our credo here at AERZEN. We'll work with you to find out which performance features and safety requirements determine your refrigeration system. Together we shape progress. Let's talk! We'll be happy to advise you.

AERZEN. Compression is the key to our success

The Aerzener Maschinenfabrik GmbH was founded in 1864. In 1868, we built Europe's first positive displacement blower. The first turbo blowers followed in 1911, the first screw compressors in 1943, and in 2010 the world's first rotary lobe compressor package. Innovations "made by AERZEN" keep driving forward the development of compressor technology. Today, AERZEN is among the world's longest established and most significant manufacturers of positive displacement blowers, rotary lobe compressors, screw compressors and turbo blowers. And among the undisputed market leaders in many areas of application.

In more than 50 subsidiaries around the world, more than 2,600 experienced employees are working hard on shaping the future of compression technology. Their technical competence, our international network of experts and the continual feedback from our customers are the basis of our success. AERZEN products and services set standards. In particular, with regard to reliability, stability of value and efficiency. Challenge us.



LET'S TALK
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