

# SCREW COMPRESSORS FOR PROCESS GAS AND COOLING TECHNOLOGY

Series VMY - with oil injection for process gases and refrigerants



**AERZEN**

# SERIES VMY. COMPRESSOR WITH OIL INJECTION FOR PROCESS GASES AND REFRIGERANTS.

Originally conceived to operate in closed loop refrigeration systems (NH<sub>3</sub>, refrigerants, helium), this type of compressor has acquired a strong position in the process market (chemical, petrochemical, power generation industries). The VMY-screw compressor units are designed to suit the requirements of a wide range of applications for the process gas industry.

## General

Aerzen VMY-screw compressor with oil injection and integrated volume control have been designed for intake volume flows from 500 m<sup>3</sup>/h up to 8900 m<sup>3</sup>/h and for an overpressure - single stage - up to 20 bar (series VMY .36) or 25 bar (series VMY .56). (Higher pressures on request). In vacuum operation, intake pressures up to 1 mbar abs. can be reached in a single stage.

## Fields of application

Used for the compression of natural gas, inert gases, ammonia, helium, hydrocarbons, HCL, CO<sub>2</sub>, mixed - and process gases this compressor type provides an optimal adaptation to the actual case of operation which is also due to its integrated and automatic infinitely adjustable capacity control. The cooling achieved by the oil injection enables the compressor to cope with fluctuations in flow, temperature and pressures.

## Infinitely variable capacity control

All VMY compressors, as standard production machines, are equipped with a capacity regulator allowing the flow to vary between 100 and 20 %. The slide valve for the capacity control is integrated into the compressor housing and located just below the rotors.

Hydraulically actuated, it slides parallel to the rotors towards the discharge side, uncovering an opening through which a proportionally smaller or larger volume of gas is allowed to flow back, uncompressed, to the inlet. The power required is reduced, determined by the flow rate regulation, which is nearly in proportion to the partial load volume flow. Therefore, energy saving, economic operation is achieved.

## Unloaded start

Starting under minimum torque load conditions can be achieved by a controlled „zero flow“ (idle) setting of the capacity regulator. Lubrication of the entire unit is ensured by a gear-type pump, flanged onto the compressor and driven by the female rotor. The VMY compressor housing sections and the drive shaft are sealed by means of O-rings and a mechanical seal. Allowing the standard machine to be used up to 25 bar internal static pressure. The housing cooling is effected by means of ambient air.





"THE VMY SCREW COMPRESSOR PACKAGES ARE PERFECTLY TAILORED TO THE VARIOUS REQUIREMENTS OF THE PROCESS GAS INDUSTRY".



# THE VMY-SCREW COMPRESSORS ARE AVAILABLE IN FLEXIBLE SIZES.

The VMY compressor is the ideal machine for varying operating conditions. The cooling achieved by the oil injection enables it to cope with fluctuations in flow, temperature and pressures, occurring on the inlet side as well as on the discharge side.

## Installation

As there are no reciprocating components and because all oscillating parts are dynamically balanced, there are no imbalances within the machine. Consequently, no particular foundations are required. The installation can either be rigid or flexible. The transmission of both structure borne noise and vibrations is avoided by the installation of anti-vibration mounts. Flexible connections such as bellow expansion joints or expansion loop between the compressor package and the plant piping are required.

## Noise

Due to the low rotor tip speed and oil injection, the noise level emitted is of the same magnitude as that of the electric motor. An acoustic hood can be supplied on request.

## Summary

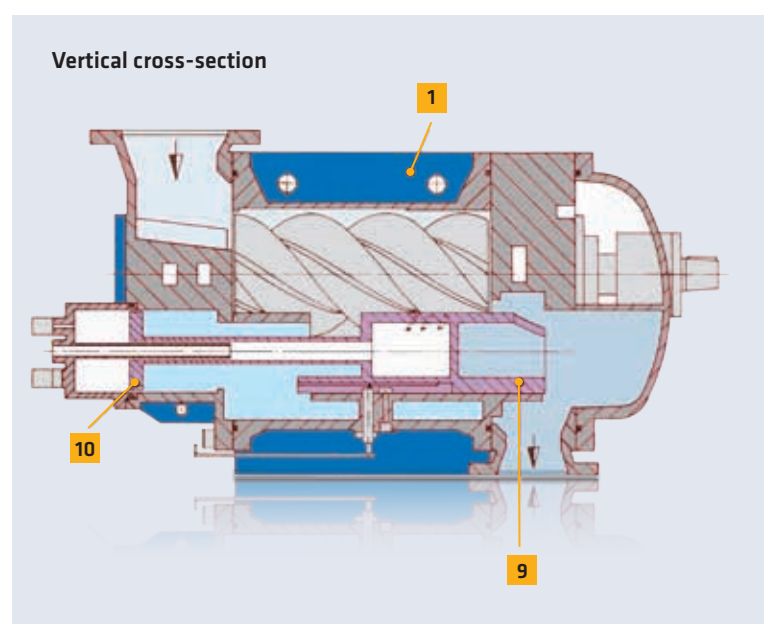
VMY compressors have been developed specially for the refrigeration- and process gas market. The main features of the VMY compressor range include:

- Four rotor diameters
- Available in three different lengths, i.e.,  
H = high differential pressure  
M = medium differential pressure  
B = low differential pressure
- All models equipped with economizer and SOC connections for best selection of substantial capacity gain in each individual application
- Externally flanged oil pump
- Infinitely variable capacity control
- Worldwide more than 3000 installed in refrigeration
- Acceptance test DNV, GL, LRS and BV
- Design acc. to API 619 with deviations

## Design and principle of operation of the compressor stage

The gas flows through the VMY compressor from top to bottom. The rotors are positioned horizontally in the housing. The gas compression takes place in progressively reduced chambers formed between the lobes of the intermeshing rotors and the cylindrical walls of the compressor housing.

The male rotor directly drives the female rotor; there are no timing gears. The oil injected into the compression chamber provides ample lubrication and removes most of the heat of compression. The clearances between the rotors and the housing are filled with oil, preventing backflow and thereby improving the volumetric efficiency. Radial loads are handled by sleeve bearings. These are generously dimensioned to deal with the heaviest loads and being located adjacent to the compression chamber their short span prevents rotor deflection under high differential pressures. The rotors are axially located by anti-friction bearings. The high axial loading exerted on the male rotor is greatly reduced by means of a hydraulic compensating piston.



**Series VMY .36**

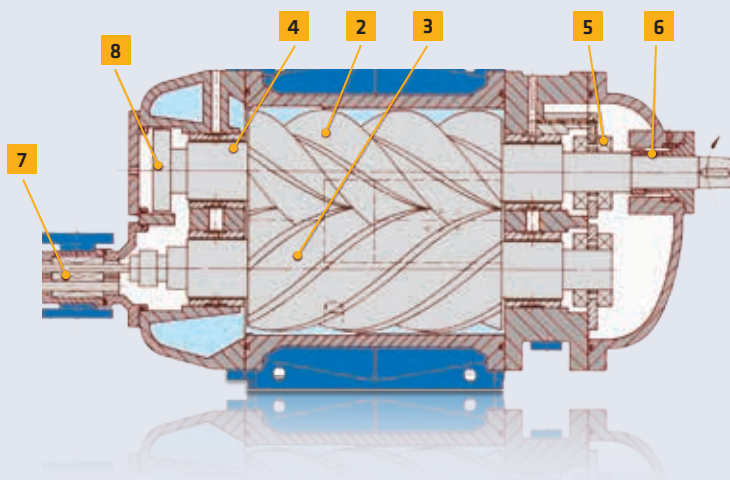
**Intake volume flows Q<sub>1</sub> (m<sup>3</sup>/h)**

Operating pressure [bar]	Q <sub>1</sub> [m <sup>3</sup> /h]	VMY 236			VMY 336			VMY 436			VMY 536		
		B	M	H	B	M	H	B	M	H	B	M	H
8	Q <sub>1</sub> [m <sup>3</sup> /h]	1045	800	595	2170	1635	1240	4150	3150	2420	8910	6620	5185
16	Q <sub>1</sub> [m <sup>3</sup> /h]	-	780	575	-	1575	1195	-	3050	2355	-	6400	5025
20	Q <sub>1</sub> [m <sup>3</sup> /h]	-	-	565	-	-	1180	-	-	2355	-	-	4950

Intake volume flows at 20 °C, 1,0 bar, 2950 rpm, air

Dimensions, weights and performance data are non-binding examples!

**Horizontal cross-section**



**Main components**

- 1** Cylinder
- 2** Male rotor
- 3** Female rotor
- 4** Radial bearing
- 5** Axial bearing
- 6** Mechanical seal
- 7** Oil pump
- 8** Balancing piston
- 9** Capacity control slide valve
- 10** Hydraulic piston

# HOW INDIVIDUAL AND RELIABLE DO YOU WANT YOUR PROCESS SOLUTION?

Customised engineering and an extensive series of process gas blowers as well as our special quality standards ensure maximum process reliability and sustainable plant availability. With more than 10,000 references worldwide, the engineering knowledge from over 150 years of experience and a distinctive consulting competence, AERZEN implements your requests flexibly and individually.

## VMY-package

The gas and the oil injected into the compressor stage are discharged into the oil reservoir where due to the drop in flow speed, most of the oil is separated from the gas. The remaining oil is separated in the enclosed oil/gas separator. Depending on requirements and expenditure oil carryover down to  $\leq 1$  ppm can be achieved, the standard package is designed for oil carryover down to  $\leq 5$  ppm. The gear type oil pump mechanically driven by the compressor stage circulates the oil from the reservoir, it is filtered and cooled before it enters the lubrication points, i.e. bearings, mechanical shaft seal and oil injection point, as well as the volume slide, hydraulic control unit. Due to the compressor stage mounted onto the oil reservoir as well as the lateral arrangement of the components (cooler, separator, etc.) a compact installation of the unit can be guaranteed. All components are mounted on a common base frame. Thereby shortest assembly periods can be guaranteed for the unit at site.

The unit design can be effected acc. to the following guidelines:

- DIN I EURO - standards
- NACE
- AD - regulations
- TEMA - standard
- ASME - standard
- API - guidelines

## Control and instrumentation

The monitoring and fuse protection of the operating data are effected via pressure transmitter and resistance thermometer. The measuring values are indicated via a display in the control cabinet. Control devices can be supplied by various well-known manufacturers.

## Scope of supply VMY package

- starting strainer
- compressor stage
- oil supply, existing of:
  - oil reservoir, designed as oil separator
  - oil pump
  - double oil filter
  - oil temperature control valve
  - oil cooler water-cooled, alternatively air-cooled
- separate oil separator
- base frame
- control and instrumentation

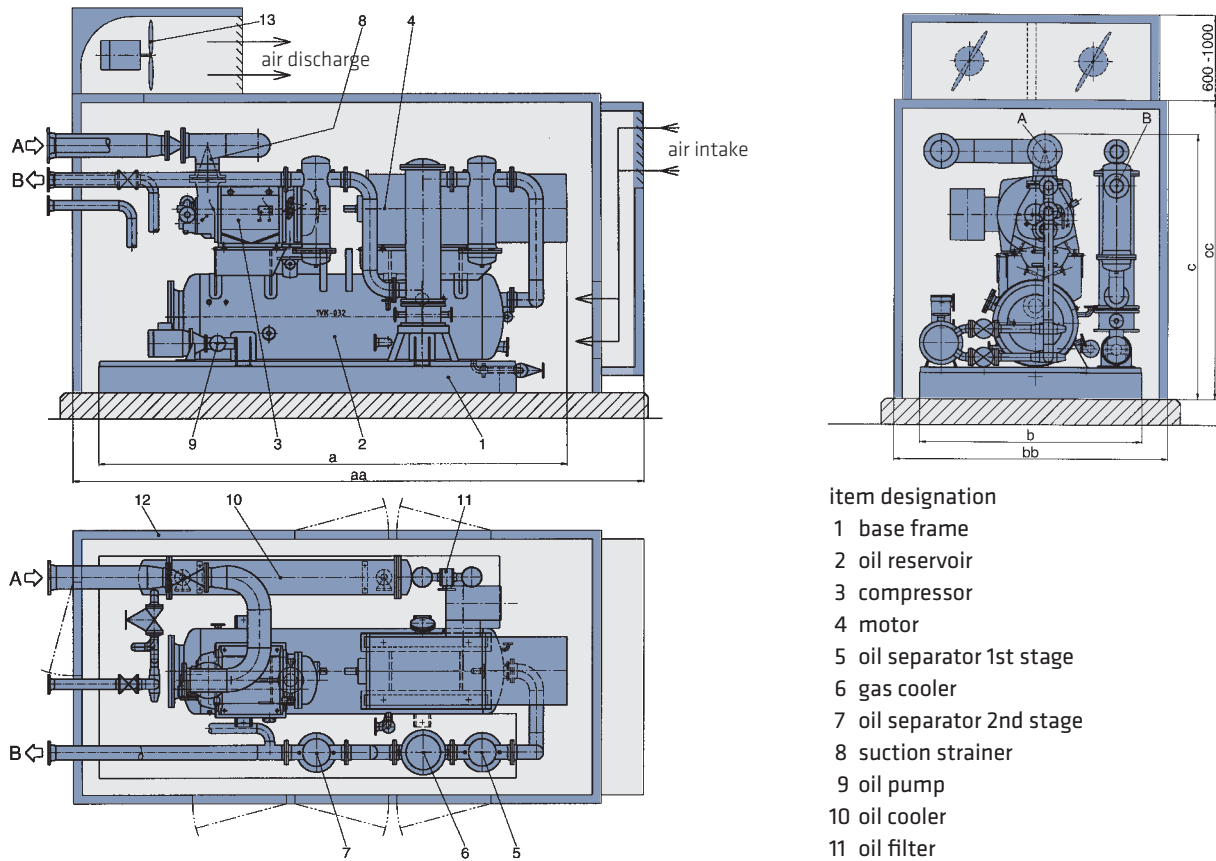
## Options:

- integrated gas cooler
- fine separation  $\leq 1$  ppm remaining oil content
- acoustic hood
- driving motor



VMY 336 M - Verdichtung von Erdgas

### Dimensions and connection points data



- item designation
- 1 base frame
  - 2 oil reservoir
  - 3 compressor
  - 4 motor
  - 5 oil separator 1st stage
  - 6 gas cooler
  - 7 oil separator 2nd stage
  - 8 suction strainer
  - 9 oil pump
  - 10 oil cooler
  - 11 oil filter
  - 12 acoustic hood
  - 13 ventilation fans

Dimensions, weights and performance data are non-binding examples!

\* without acoustic hood, without motor

Type	a	b	c	aa	bb	cc	Gas intake	Gas discharge	Weight* [kg]
VMY 236	4000	1500 - 2100	2400	5000	2100 - 2800	2800	DN 150	DN 80	6000
VMY 336	4500	1500 - 2200	2700	5000	2100 - 2800	3100	DN 200	DN 100	8000
VMY 436	5000	1800 - 2300	3000	6000	2500 - 2900	3500	DN 250	DN 150	11000
VMY 536	5500	2000 - 2600	3300	6000	2500 - 3200	3600	DN 300	DN 200	14000

# THE VMY .56 SERIES HAS BEEN SPECIALLY OPTIMISED FOR THE REFRIGERATION INDUSTRY.

Since the beginning of the production of VMY screw compressors more than 5000 screw compressors for refrigeration applications in the food industry, pharmaceutical industry, chemical and petrochemical industry, for ship refrigeration as well as heat pumps and as expander for the energetic recovery of waste heat have been delivered. In addition to AERZEN reliability, the VMY .56 series is characterised by further advantages:

## 1. Especially developed bearings:

The especially robust bearings consist of four radial slide bearings and four angular contact ball bearings. The driven rotor has a balancing piston for reduction of the axially occurring gas forces. The axial bearings are separated by intermediate discs, so that every axial bearing separately can be supplied with fresh oil. This type of bearings has been taken over especially based on our experiences for decades in process gas technology and guarantees long bearing lifetimes, allowing nominal lifetimes of the axial bearings of 100.000 hours LH10 and more under standard refrigeration technical conditions with ammonia.

## 2. Oil supply:

The compressor has a main oil connection via which the bearings, the mechanical seal and the balancing piston can be supplied through internal oil channels. This leads to reduced piping expenditure as well as less leakage possibilities.

The main oil consumers such as mechanical seal, bearings and balancing piston are supplied by a flanged-on gear wheel oil pump. Consequently oil supply of the moved components is guaranteed permanently while the compressor is in operation.

## 3. Rotors:

In case of male rotor drive the rotors are made of forged steel and in case of female rotor drive made of surface-hardened special steel and designed for long lifetimes. The 4 + 6 profile for female rotor drive developed by Aerzener Maschinenfabrik distinguishes itself by a high reliability. The first rotors made of this material and with this drive system on the female rotor side are now working for more than fifteen years. This reliability of the rotor profile made us count on the female rotor drive also in future.

## 4. Vi setting:

The VMY 56 series is equipped with a manual Vi, being steplessly adjustable between 2,2 and 5,0. Consequently e.g. summer-/winter operation can be run without any problems and without having to realize an expensive control system. Or in case of optimal absorbed power at coupling the stage can be used as Swing machine. Optionally an automatic Vi is also available.

## 5. Economizer:

The compressor has two Economizer connections, which guarantee an optimal filling of the chamber and as a result reduce the operation costs.

## 6. Special suction-sided inlet contour:

By means of the development of a special suction-sided inlet contour the inflow conditions could be improved in order to guarantee an optimal COP.

## 7. Housing material:

As standard the housing is made of high-quality material EN-GJS-400-18-LT (GGG 40.3).

## 8. Capacity slide valve lubrication:

Specially drilled bores between the housing and the capacity slide valve arrange for lubrication of the capacity slide valve. Thus the wear in this area is reduced to an absolute minimum, in order to guarantee a long lifetime of the compressor.

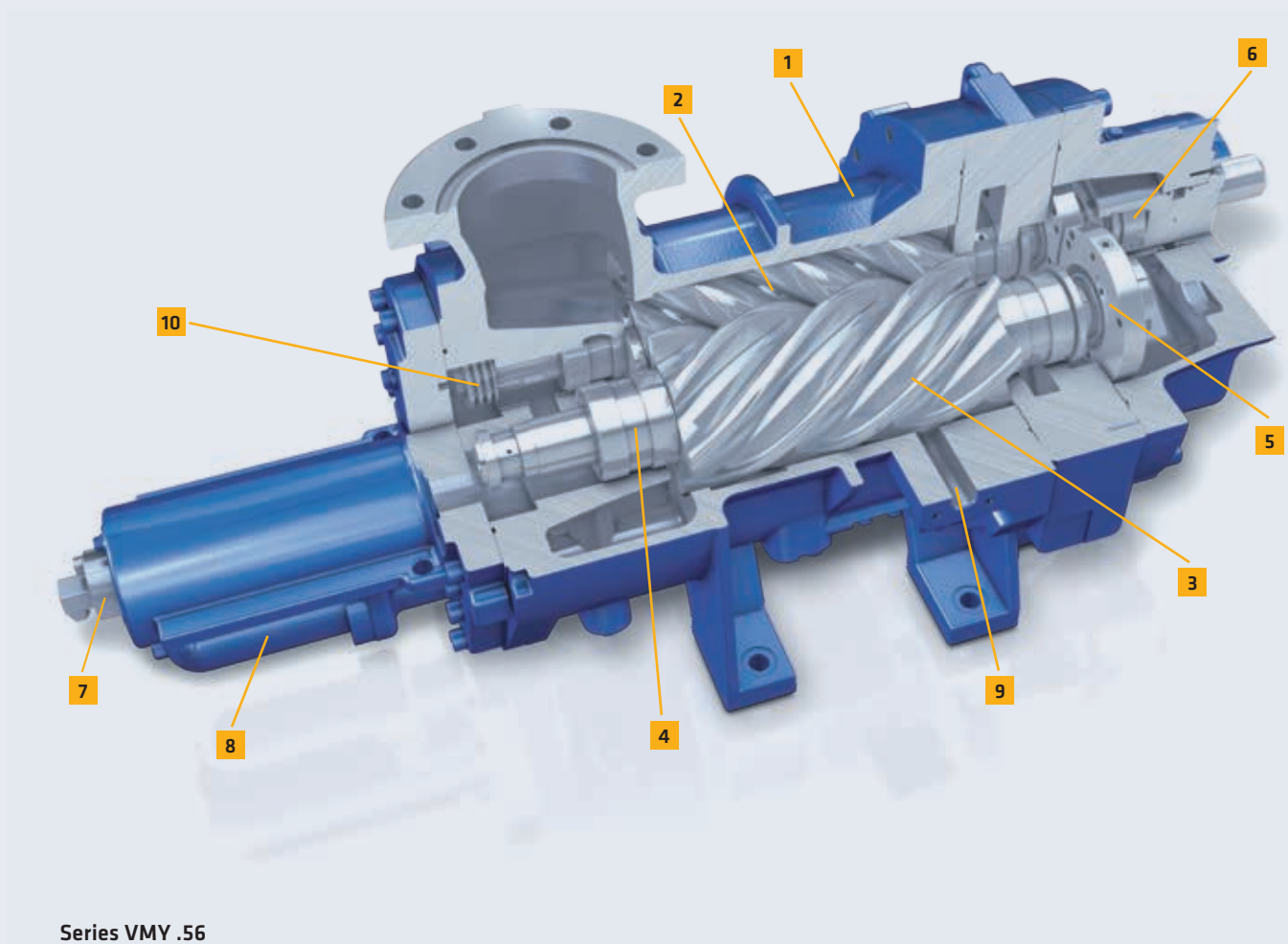
## 9. Increased safety:

On the compressor a measuring point for the oil pressure has been provided. This always guarantees, that the compressor is supplied with oil sufficiently. This considerably contributes to the increase of the plant safety.

## 10. Robust displacement sensor:

The displacement sensor being easy to calibrate was especially developed for screw compressors.





**Series VMY .56**

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

# THE NEW GENERATION OF REFRIGERATION- AND PROCESSGAS COMPRESSORS STANDS FOR AN EFFICIENT PERFORMANCE ADAPTATION.

VMY .56 offers a concept of economy, environmental attention and flexibility; slide valve or speed control as well as regulation of the internal pressure ratio are just examples. With 3 sizes, and by operating the main or secondary rotor, 6 different intake quantities can be realised.

## Operational lifetime and costs

The newly designed rotor profile – another step in development of the existing 4+6 D-Profile – as well as the bearing quality, consequently tested for long lifetime (up to 100.000 hours LH10), prolongate maintenance periods and lower operational costs.

## Quality

Now that decades of experience in the manufacture of compressors have been connected with the latest concepts of production and development a refrigeration compressor has been designed that can be operated with all refrigerants presently known. With its certified quality Aerzener Maschinenfabrik is always prepared to meet the customer's particular demands.

## Compressor size

Depending on the compressor size a modular system of equipment is available so that the customer's requirements can be met exactly. As both, male and female rotor drive can be chosen any required conveying volume flow can be achieved on a well-tested serial machine.

No costly and complicated case to case developments have to be made.

## Smooth operation, Low noise

No pending masses influence the operation of these machines. All moving parts are rotating and have been dynamically balanced so that no free inertia forces occur.

The noise level has been minimized by means of absolutely suitable wall thicknesses and axial outlet area.

## Economy, environmental safety and flexibility

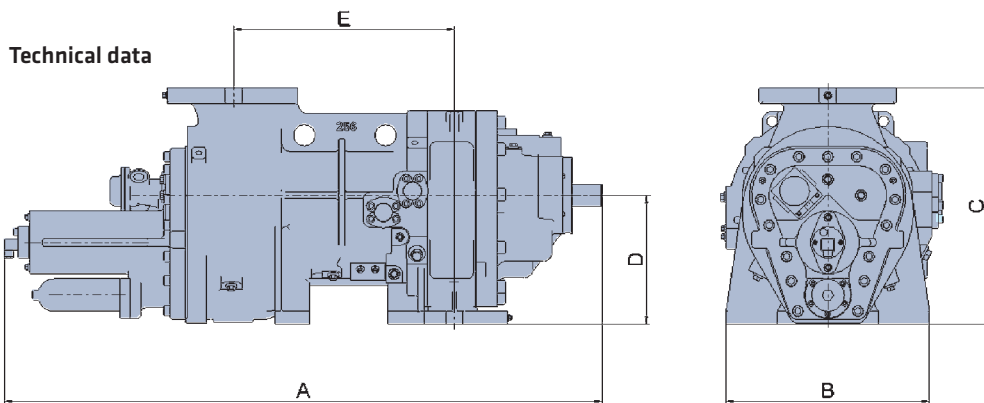
Slide valve or speed control, as well as regulation of the internal pressure ratio, those are the catchwords for a concept of economy, environmental safety and flexibility.

## Design as per API 619

Screw compressors for the refrigeration industry are delivered as per Aerzen standard. Upon request they can be supplied as per API 619 4th edition.

The deviation list can be ordered from Aerzen.





Subject to technical changes!

			VMY 156 M		VMY 256 M		VMY 356 M	
			HR	NR	HR	NR	HR	NR
L/D		-	2,1	2,1	2,1	2,1	2,1	2,1
Intake volume 3000 rpm		m <sup>3</sup> /h	444	678	911	1378	1809	2708
A		mm	1160		1395		1730	
B		mm	390		475		560	
C		mm	445		550		645	
D		mm	250		300		355	
E		mm	420		516		648	
Flange gas-intake	Nominal width	mm	100 / 4		150 / 6		200 / 8	
	PN	-	40		40		40	
Flange gas-discharge	Nominal width	mm / inc	50 / 2		100 / 4		100 / 4	
	PN	-	40		40		40	
V <sub>i</sub> - control *		-	2,2 - 5,0 (continuously adjustable)					
Weight		kg	370		660		1100	

\* Option: also available with automatic V<sub>i</sub> - control

All dimensions for information only and without responsibility!

HR = male rotor, NR = female rotor



**AERZEN. Compression as success principle.**

AERZEN began life in 1864 as Aerzener Maschinenfabrik. In 1868 we built Europe's first rotary lobe blower. The first Turbo compressors followed in 1911, the first screw compressor in 1943, and in 2010 the world's first rotary lobe compressor unit. Innovations "made by AERZEN" keep driving the development of compressor technology forward. Today, AERZEN is among the world's oldest and most significant manufacturers of rotary lobe blowers, rotary lobe compressors, rotary lobe meters, screw compressors, and Turbo blowers. And among the undisputed market leaders in many areas of application.

More than 2,000 experienced employees in over 48 affiliates the world over are working at full speed to advance compressor technology. Their technological expertise, our international network of experts, and constant feedback from our clients form the basis for our success. Products and services from AERZEN are setting standards when it comes to reliability, lasting value, and efficiency. Go ahead: challenge us!

Aerzener Maschinenfabrik GmbH  
Reherweg 28 – 31855 Aerzen / Germany  
Telefon: +49 5154 81-0 – Fax: +49 5154 81-9191  
info@aerzener.de – www.aerzen.com



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EXPECT PERFORMANCE