



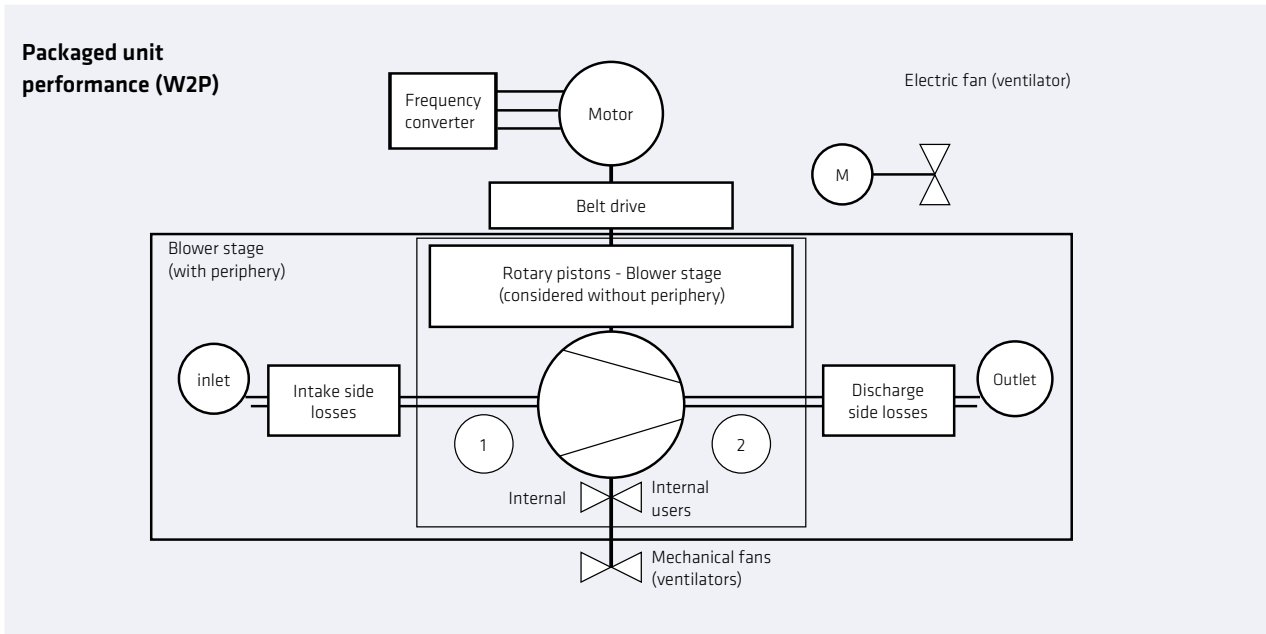
AERZEN STANDARDS ABOUT PERFORMANCE MEASUREMENT

and for calculation of the standard volume flow.



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EXPLANATIONS ON INDIVIDUAL STANDARDS ABOUT PERFORMANCE MEASUREMENT AND CALCULATION OF THE STANDARD VOLUME FLOW.



The power requirement and its characteristics.

Generally, various performances can be defined depending on the losses which need to be considered upon definition. The more complex a system, a plant or a packaged unit, the more complex a performance definition or a performance comparison may be displayed.

The following graphic shows the performances relating to blower or compressor packages.

Starting from the lowest power requirement, which means, the mechanical shaft performance at the stage, followed by the completely driven packaged unit, the power requirement increases or decreases.

- **Shaft performance at the stage (unit capacity/ without periphery)**

Describes the mechanical performance which is taken directly at the drive shaft of the stage

- **Coupling power (with periphery)**

Considers in addition to the mechanical performance, the intake and discharge side losses of the stage's periphery

- **Drive power required**

Includes in addition the performance losses due to slippage of the belt drive upon power transmission

- **Terminal power Motor**

Efficiency losses by the motor and mechanical auxiliaries of the packaged unit are being considered as well

- **Terminal power Packaged unit**

Electrical auxiliaries, which have a separate electrical connection, are being considered as well

- **Terminal power Frequency converter**

The performance losses caused by a frequency converter are being considered and, consequently, the entire drive system

Explanations for ISO 1217.

This international standard, being applied by AERZEN, specifies methods for a performance measurement, referring to the volume flow and the power requirement of positive displacement machines.

This international standard specifies the operating and test conditions which must be taken as basis for a complete performance measurement.

The test runs of compressors with fixed speed, which are produced in batches or in series and supplied according to specific performance values, are described in annexes B, C and D. The relevance of the respective annex depends on type and design of the packaged unit.

The test runs of compressors with variable speed, which are produced in batches or in series and supplied according to specific performance values, are described in annex E.

In general, the volume flow is defined as per 3.4.1, i.e. as "volume flow measured at the discharge nozzle and calculated back to the conditions of the suction side". Annex C applies for packaged units with fixed speed for compression of air or nitrogen. According to chart C2, the maximum permissible deviations are defined as follows:

Volume flow range (m ³ /min)	Useable intake volume flow (%)	Spec. power consumption (%)
< 0.5	± 7	± 8
0.5...1.5	± 6	± 7
1.5...15	± 5	± 6
> 15	± 4	± 5

The tolerance values of the a./m. chart include all manufacturing and measuring tolerances.

According to annex C.2.4, electrically driven compressors need to be measured as completely mounted packaged units (as specified by the customer) and evaluated by their terminal power.

For annex E (compressor with frequency converter) the same rules and tolerances apply as for compressors with fixed speed.

Explanation of ASME PTC 10 - 1997.

This standard is taken into account in North and South America. It describes the procedure for determining the thermodynamic power of axial and centrifugal compressors and fans (blowers) under specific conditions.

ASME PTC 10: Acceptable deviations with test parameters for comparable conditions:

Condition	Acceptable deviation in %
Inlet pressure	5 ±
Inlet temperature	8 ±
Specific gravitation	2 ±
Power	4 ±
Input density of the gas	8 ±

Explanations of ISO 5389

This standard defines the test conditions for compressor packages which include a centrifugal compressor and are driven by an electric motor. It applies to driving power of 75 kW to 1865 kW.

The maximum permissible deviations are defined as follows:

Volume flow (according to ISO 5167 or 9300) in %	Specific power requirement in %	Power consumption without load in %
± 4	± 5	± 10

With more than 150 years of experience as manufacturer of displacement machines, AERZEN has played a significant role in creating the ISO 1217. At present, the American standard PTC 13 is in process.

As German company, AERZEN carries out its performance tests for displacement machines as standard according to ISO 1217 as well.

Today, the majority of wastewater treatment plants are equipped with frequency converters. In case of retrofitting, we offer our customers low investment costs solutions. Here, AERZEN as machine supplier, needs to comply with various frequency converter and motor brands, performance ranges and efficiencies. Therefore, a power rating with tolerances as per ISO 1217 annex E requires that the operator of the wastewater treatment plant is being provided with a new blower or compressor package and a new frequency converter. However, most plants have already been equipped with a high-quality frequency converter or it will be purchased in addition.



Aerzener Maschinenfabrik emphasises flexibility. We provide our customers with project-related and tailor-made solutions. AERZEN offers according to customer needs.

This may include:

- Individual blower and compressor stages
- Packaged units without motor
- Packaged units with motor
- Packaged units without frequency converter
- Packaged units with external frequency converter (for an installation in a separate room)
- Packaged units with internal frequency converter

It depends on the scope of supply, which standard or tolerance is used. For compressor packages which are turbo machines, the standard ISO 5389 applies in Europe, considering other tolerances. AERZEN is a company which operates on an international scale with an extensive product portfolio which provides various compressor technologies, especially oriented to the wastewater treatment plant technology. Therefore, several standards with different tolerances need to be considered. AERZEN makes best use of the standard tolerance in all cases. The standard tolerance gives you and us the certainty that every packaged unit, also in combination with an external brand, guarantees maximum energy efficiency and reliable operation. With over more than 150 years of experience as manufacturer of blowers, compressors and turbo machines as well as pro-found know-how in the field of aeration technology for wastewater treatment plants, AERZEN makes a substantial contribution to respond to the demands of the market.

After consultation, we will calculate for you the power rating according to your required standard or tolerance. Please contact us!

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Standards applied in wastewater technology concerning standard volume flow:

The calculation of the standard volume flow in the wastewater technology is subject to different standard validities.

Overview of the most important standards:

1. DIN ISO 1343: volume flow in standard state related to $T_1=273\text{ K}$, $p_1=1.013\text{ bar}$, $rF=0\%$
2. ISO 2533: volume flow in standard state related to $T_1=288\text{ K}$, $p_1=1.013\text{ bar}$, $rF=0\%$
3. ISO 1217: volume flow in standard state related to $T_1=293\text{ K}$, $p_1=1.000\text{ bar}$, $rF=0\%$

Example:

Medium			Air
Intake volume flow $t_1=20^\circ\text{C}$, $p_1=1.013\text{ bar}$, $rF=0\%$	Q_1	1500	m^3/h
Volume flow in standard state related to $T_1=273\text{ K}$, $p_1=1.013\text{ bar}$, $rF=0\%$	Q_N	1397	Nm^3/h
Volume flow in standard state related to $T_1=288\text{ K}$, $p_1=1.013\text{ bar}$, $rF=0\%$	Q_N	1474	Nm^3/h
Volume flow in standard state related to $T_1=293\text{ K}$, $p_1=1.000\text{ bar}$, $rF=0\%$	Q_N	1519	Nm^3/h

t_1 = Inlet temperature



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