



# AMI 1000

Innovative CCIT solution for the pharmaceutical industry  
based on optical emission spectroscopy



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### Our know-how

Pfeiffer Vacuum is one of the world's leading providers of vacuum and testing solutions. The product portfolio comprises vacuum pumps, measurement and analysis devices, components, as well as vacuum chambers and high performance detection systems. Furthermore, we offer a unique portfolio of equipments based on three technologies that are dedicated to the pharmaceutical and medical markets. Leak testing and CCIT can be performed on a large variety of drug/container combinations.

### Integrity challenges

Contamination such as humidity, oxygen or microbiological ingress can impact drug stability throughout the product life cycle. To prevent the risks of stability failure of highly moisture-sensitive drugs (e.g. dry powder for inhalation), or the risk of biological ingress of parenteral drugs, integrity tests with a high sensitivity are required. Most test methods are very challenging in regards to time effort, complexity or the limitation of sensitivity and detection range.

### An innovative solution

Our patented O.E.S. (Optical Emission Spectroscopy) method does not require any specific tracer gas. Instead, the gas mixture present in the container headspace of the primary packaging is used to perform high sensitivity tests with high throughput. A multi-gas sensor is used to independently track the different gases (i.e. argon, nitrogen, CO<sub>2</sub>, humidity,...) escaping from a leaky container exposed to vacuum. Our method is non-destructive, deterministic, easy to use and to set up, and has higher sensitivity than other conventional methods.

### Application examples





<sup>1)</sup> The laptop is not provided by Pfeiffer Vacuum

#### Customer benefits

- Improves sensitivity, capacity and reliability of your integrity test.
- Large detection range – can replace gross leak and helium test
- Improves manufacturing productivity with equipment that is easy to use and to set up.
- Lower cost of non-quality thanks to advanced process monitoring and feedback control
- Fast return on investment

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### Ease of use

The products can be sampled directly from the production line and loaded in the test chamber without any specific conditioning. At the end of the test sequence, the result is clearly displayed and a PDF report is automatically generated at the batch closure. Full automation of the test cycle including loading/unloading of the samples can be easily implemented for in-line tests.

### Dedicated to the pharmaceutical industry

AMI 1000 equipments have been qualified by leading pharmaceutical companies as in-process control (IPC) leak testing for blister packs. Our software is CFR21 part 11 <sup>2)</sup> compliant.

### Large detection range

Different detection methods can be combined in order to cover the complete detection range. Massive leak and fine leak tests are performed within a single test sequence, any additional gross leak test (e.g. blue dye ingress) can be omitted.

### Deterministic test method

As no operator intervention is required, the measurement results are totally objective. High accuracy measurements can be achieved thanks to a calibration-validation sequence of the equipment based on certified calibrated leaks.

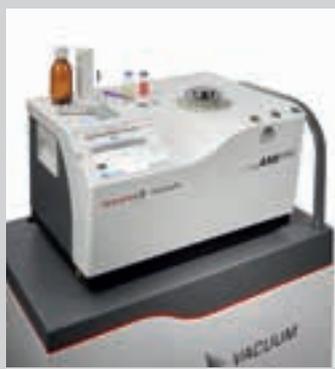
### High sensitivity, high throughput

High sensitivity tests combined with high throughput enables trend analysis to early indicate production issues. In high sensitivity mode, O.E.S is able to detect 0.2  $\mu\text{m}$  defect size on glass containers which corresponds to the sterility barrier defined as the MALL (Maximum Allowable Leakage Limit) in the USP<sup>3)</sup> <1207> guidelines.

<sup>2)</sup> Code of Federal Regulations by the United States Food and Drug Administration (FDA)

<sup>3)</sup> United States Pharmacopia

### Operation



## Versatile and high performance technology for various applications

Specific test chambers are designed according product format.



Samples	Sensitivity Orifice diameter <sup>3)</sup> Air/N <sub>2</sub> Leakage		Test duration	Advantages
	Air/N <sub>2</sub> leak	Water leak		
Blisters	0.4 µm 2 · 10 <sup>-5</sup> mbar l/s	n.a.	> 20-30 sec	Highest sensitivity test method available on the market Outgazing of the drug itself can be used for gross leak detection Applicable to peeling blisters
Syringes & Vials	0.4 µm 2 · 10 <sup>-5</sup> mbar l/s 0.2 µm 6 · 10 <sup>-6</sup> mbar l/s	2 µm	> 15 sec ~45 sec. (high sensitivity mode)	Air and water detected simultaneously Test per batch to increase the throughput MALL level can be achieved in high sensitivity mode
IV bags	0.4 µm 2 · 10 <sup>-5</sup> mbar l/s	3 µm	> 20 sec	Air and water detected simultaneously
Plastic bottles	0.5 µm 4 · 10 <sup>-5</sup> mbar l/s	n.a.	> 20 sec	Test per batch (up to 50 or 100) to increase the throughput

<sup>3)</sup>Sharp edge orifice as defined in USP <1207> guidelines

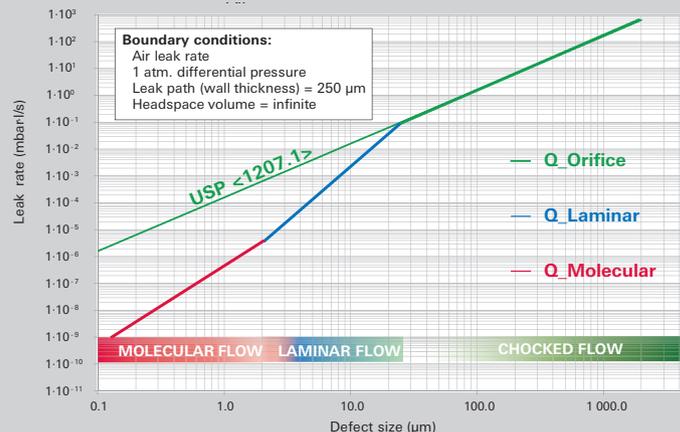
## Equivalence between defect size & air leak rate

### Leak rate versus defect size

Historically, dye ingress testing has been the container closure integrity test of choice. The detection limit of this method is around 20  $\mu\text{m}$ . Since the test is strictly visual, the detection limit has experimentally been determined by using orifices of known diameter. As a consequence, tightness criteria in pharmaceutical industry are usually expressed as an equivalent hole diameter in  $\mu\text{m}$ . However, an equivalent hole diameter is not enough to define the tightness criterion of a packaging. Depending on the diameter of the hole, the leak path (length) must be considered in order to define a leak rate ( $\text{atm} \cdot \text{cc/s}$ ) which corresponds to a tightness criterion.

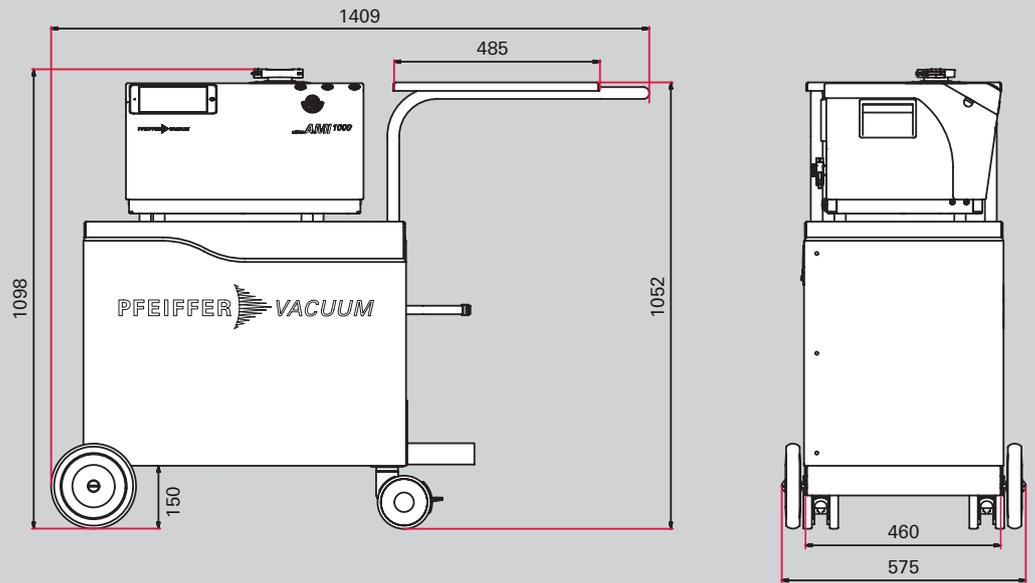
- For large diameters (typically > 100  $\mu\text{m}$ ), the leak can be generally considered as orifice (leak path of negligible length) as defined in USP <1207.1> section 3.9. This corresponds to the "CHOKED FLOW" regime and the leak rate is directly proportional to the surface of the orifice (green curve). For smaller diameters, the leak path (wall thickness) also needs to be considered. Therefore, the leak rate is not a function of the square of the equivalent hole diameter anymore. Moreover, different flow regimes must be considered for calculation of the leak rate.
- In "LAMINAR FLOW", the viscosity of the gas (depending on the gas temperature) is the parameter which determines gas-to-gas variations of media transfer through the leak.
- In the region of smallest diameters there is another flow transition. In "MOLECULAR FLOW" regime the molecular mass of the gas and its temperature are the driving parameters. As shown on the attached graph, the difference between the USP <1207> orifice calculation and the real geometry of the leak is very important for holes with very small diameters.

### General introduction (Leakrate / defect size)



$$Q_{\text{Air}} (\text{mbar} \cdot \text{l/s}) = f [\text{defect size } (\mu\text{m})]$$

## Dimensions



Dimensions in mm

## Technical data

Features	AMI 1000
Power supply	90-250 V AC / 50-60 Hz
Typical power consumption	1,200 W
CDA supply	Required for operation
Quality	(1.3.1 according to ISO 8573-1)
Pressure (min./max.)	4.5/10 bar rel. – 65/145 psig
Typical consumption	2 NI/cycle
Calibration gas supply (CDA, N <sub>2</sub> , Ar, ....)	Optional
Pressure (min./max.)	6.3/10 bar rel. – 91/145 psig
Venting gas (Ambient, CDA, Ar, ....)	Optional
Pressure (min./max.)	0/1.5 bar rel. – 0/22 psig
User interface	iPad mini 4 (WIFI remote connection) Possibility to use a customer laptop via Ethernet or wifi connections.
Software	21 CFR part 11 compliance PDF GMP test and calibration reports LDAP compatible OPC (optional) MES connection (optional)
Operating system	Windows 7
Network connection	1 x LAN
Interfaces (printer, bar code reader, data export)	2 x USB 3.0 (ext.) 1 x HDMI
Operating conditions	
Temperature (min./max.)	20–25 °C
Humidity (min./max.)	30–65 %
Dimensions (l x w x h) (Including trolley)	1,409 x 460 x 1,098 mm 55.5 x 18.1 x 43.2 inch
Weight, (Including trolley)	130 kg/287 lbs.
Noise level	< 53 dB(A)

## Order information

Please contact your local Pfeiffer Vacuum sales administration