1. Application Area and Purpose

This standard is to be used when creating drawings for parts and assemblies which, depending on their intended use, must have determined leak tightness.

This standard is used to determine a maximum allowable leak rate for this class of parts, depending on their application in the vacuum and to document it in drawings and purchase orders.

In accordance with these entries leak rates and test methods to be used are determined.

2. Definitions

A part is considered **tight** if its leak rate is equal to or smaller than an assigned limit value, whereby this value depends on the application (vacuum range).

The **leak rate** is the amount of gas per time unit which leaks into the system. It is measured in units of $mbar \cdot l \cdot s^{-1}$.

A **leak rate** of $1mbar \cdot l \cdot s^{-1}$ is present when in an enclosed, evacuated container with a volume of 1 liter the pressure rises by 1 mbar per second or drops by 1 mbar per second in case of overpressure.

Methods for **measuring** leak rates are

- Helium-integral leak test
- Helium individual leak test (local measurement)
- leak test using the pressure rise method

The **vacuum range** (range of pressure the parts/assemblies are intended to be used) is subdivided in:

Rough vacuum	(GV)
Medium vacuum	(FV)
High vacuum	(HV1, HV2, HV3)
Ultrahigh vacuum	(UHV)

The required tightness of an individual part or an assembly is determined by the ultimate pressure. **Ultimate pressure** is the pressure in a dry, clean and empty vacuum chamber finally reached when pumping. Ultimate pressure is a specified value and will be checked.

3. Leak Rate

3.1 Helium integral and individual leak test

The following table shows the maximum allowable leak rates for individual parts, assemblies and some specific assemblies for the 5 vacuum ranges.
The following definitions are valid:

Individual parts are parts, which consist of only **one** raw material or **one** work piece. Surface coated parts are also included.
Test methods: Helium integral or individual leak test

Assemblies are complete units consisting of at least **two** parts and/or groups connected detachably or non-detachably.
Test method: Helium individual leak test

Vacuum Range	Ultimate Pressure	**max. Leak Rate (mbar·l·s^{-1} He)**					BLOA-Test Standard
		Vacuum Component			Non-vacuum Component used in Vacuum		
		Single part	Recipient, assembly (except mechanical feedthrough) 2)	Mechanical Feed-through	Pneumatic Cylinder	Valve	
	[mbar]	1)					
GV	> 1·10^{-2}	1	1	1	1	1	5.550-6047 5.550-6044 4) 5.550-6048 4)
FV	1·10^{-2} - 1·10^{-4}	1·10^{-3}	1·10^{-3}	1·10^{-1}	1·10^{-1}	1·10^{-1}	5.550-6046 5.550-6044 4) 5.550-6047 4) 5.550-6048 4)
HV1	1·10^{-4} - 1·10^{-6}	1·10^{-6}	1·10^{-6}	1·10^{-5}	on request	on request	5.550-6046 5.550-6044 4) 5.550-6048 4)
HV2	1·10^{-6} - 1·10^{-7}	1·10^{-8}	1·10^{-8}	1·10^{-6} 3)	/	/	5.550-6046 5.550-6041 4)
HV3	1·10^{-7} - 1·10^{-8}	1·10^{-8}	1·10^{-8}	1·10^{-6} 3)	/	/	5.550-6046 5.550-6041 4)
UHV	< 1·10^{-8}	1·10^{-10}	1·10^{-10}	/	/	/	5.550-6041

1) = He-Integral leak test
2) = He-Individual leak test
/ = not applicable
3) = e.g. intermediate suction
4) = on request

3.2 Leak test using the pressure rise method

For vacuum chambers a leak test using the pressure rise method may be required additionally to the helium individual leak test according to 3.1.

This applies specifically for vacuum chambers
- of cubicle shape
- of welded design
- with welded bars
- with welded separation planes

Typical requirement for such chambers:
- Leak rate measured with pressure rise test < 10^{-3} mbar l s^{-1}
- Leak rates for other chamber types must be determined according to technical requirements.

The BLOA-test standard 5.550-6048 must be used for measurements according to the pressure rise test.

4. Entry in drawings and in Purchase Orders

4.1 Helium integral and Helium individual Leak Test

4.1.1 Drawings

In **drawings,** the **leak rate** will be entered indirectly via the **vacuum-range** and not as a value

Example: max. leak rate of a recipient for an ultimate pressure of $1 \cdot 10^{-5}$ mbar (High vacuum range HV1): $1 \cdot 10^{-6}$ mbar·l·s^{-1}:

Enter: **HV1-tight according to LHH-N 000.320**

The entry will be placed near the header of the drawing.

4.1.2 Purchase Order to Suppliers

In purchase orders, which do **not** relate to an BLOA-drawing, the **leak rate** is entered as a **value**.

Example: max. leak rate of a valve used in medium vacuum (FV):$1 \cdot 10^{-1}$ mbar·l·s^{-1}:

Enter: **Helium individual leak rate $\leq 1 \cdot 10^{-1}$ mbar·l·s^{-1}**

The entry must be included into the order specification!

4.2 Leak test using the pressure rise method

4.2.1 Drawings

The remark "*Leak rate according to pressure rise method < 10^{-3} mbar l.s^{-1}*" is entered into drawings in addition to the entry of the individual leak rate according to 4.1.1

4.2.2 *Purchase Order to Suppliers*

The remark "Leak rate according to pressure rise method < 10^{-3} mbar l.s^{-1}"is entered in addition to the entry of the individual leak rate according to 4.1.2.