Differential Pressure Method

The differential pressure method is currently used for most leak tests in industrial series production.

Method:

The test specimen is sealed, and the test chamber, consisting of the test specimen, test fixture, connecting lines, and the test device, is pressurized or evacuated with air, or less commonly with nitrogen or other gases, and then sealed off. The pressure change caused by a leakage is measured and evaluated in comparison to a sealed reference volume.

Test Procedure:

The test procedure is divided into the steps of “Filling”, “Stabilization”, “Testing”, and “Venting”. The steps are usually time-controlled.

During the filling time, the entire test and reference volume of the device is filled with compressed air or vacuum by switching the corresponding valves.

After the filling time is complete, the filling valves are closed, and the entire test and reference volume can stabilize (stabilization time). During this time, thermodynamic effects and turbulences caused by the filling process should dissipate. The isolation valve is open during the stabilization time.

After the stabilization time ends, the isolation valve is closed, and the test pressure is monitored. During the subsequent testing time, only the pressure difference between the test volume and the reference volume is measured and evaluated.

In the “Venting” step, the test and reference volumes are returned to ambient pressure.

Test medium:

Compressed air, less commonly nitrogen or other gases. (Overpressure or vacuum)

detectable leak rates:

> 0.1 cm^3/min, depending on test pressure and test volume

Advantages:

- Due to the special measurement method, the measurement resolution is independent of the test pressure range and is 0.1 Pa for current differential pressure devices.
- Thanks to the test sequence defined with precise timings in the test device and the pressure monitored in all test steps, all tests are conducted under reproducible conditions.
- The evaluation is operator-independent.
- Test devices using the differential pressure method are generally equipped with interfaces that enable integration into an automated process.
- The exact measurement of the pressure change allows for the quantification of the leak rate. This allows for the utilization of permissible tolerances.
- The test results can be automatically documented, provided the devices are equipped with a suitable interface.

Disadvantages:

- Temperature changes during the actual measurement period cause a pressure change that influences the test result.
- For elastic test specimens, the pressure change caused by leakage can be partially compensated by the specimen’s elasticity.

Notes:

- Test pressure changes are directly proportional to the test volume at a constant leak rate. When testing large-volume parts, leaks therefore cause only small pressure changes, which can be difficult to detect using the differential pressure method. It must therefore be attempted to keep the test volume
- as small as possible.
- A test setup using the differential pressure method should be checked at regular intervals for the plausibility of its measured values, using a known part or a dummy.

Information Sheet