

# Leakage test for air ducts



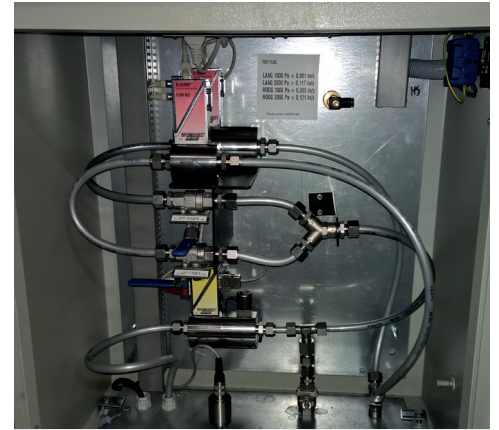
Application note A053-GP06-0217D



**Air and liquid tightness of devices is of utmost importance. This is especially in the heating, ventilation and air-conditioning (HVAC) sector, where exhaust pipes of central heating systems should not leak combustion gases. And also air ducts installed in buildings, transporting huge amounts of air, have to be airtight to some extent.**

To comply with this directive, Bronkhorst has developed a leakage test method. First only for air ducts, later also for exhaust pipes of central heating systems, and also employed for a liquid-tight oil pumps in the automotive sector. This test can be applied to closed systems as well as open systems, temperatures and high pressures, to make the reaction steps as effective as possible and it is related to quality control: more and more ISO certifications require the documentation of quantitative leakage data.

- ◆ Air ducts
- ◆ Exhaust pipes



*Housing of the flow pressure solution  
(photo: Bergschenhoek)*

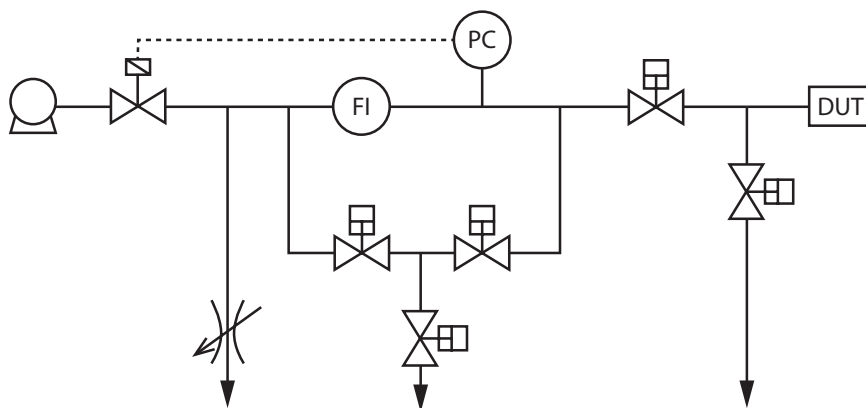
## Application requirements

The basic principle is simple: consider a 'device under test', which may be everything, ranging from a small hole to a volume of 10 liters. Apply a pressure by a pressure controller (PC) to that device, and measure any gas leakage using a mass flow meter (MFM). The use of the specific PC and MFM depends on the setting/measuring range.

### Important topics

- ◆ Test to check or guarantee leak tightness
- ◆ Temperature stabilization

## Process solution



*Flow scheme*

A practical realisation of the measuring principle is as follows. Place the device under test (DUT) under a certain gas pressure as specified by the customer, as the leakage rate under that specific condition has to be known. Suppose this initial pressure is 5 bars, then we need to know what incoming flow is necessary to balance the outgoing leakage, in order to keep the pressure stable.

A pressure controller (PC) sets the pressure and the gas flow is measured by a thermal mass flow meter (MFM). Even a liquid-related application can be tested in this way by performing gas flow measurements. In the case of testing air ducts, the gas is pressurised air delivered by the customer's compressor. Normal air can be used, from which water and oil have been removed prior to testing.

However, there are some catches. In order to eliminate the pressure drop over the MFM, the PC needs to be as close to the DUT as possible, so the PC and its valve need to be separated physically. Furthermore, as normally several DUT's are tested in succession, two shut-off valves have to be placed between the setting/measuring equipment and the DUT, to reduce testing time and to improve stability. Moreover, especially for cases with a very small leakage rate, a safe bypass has to be added to ... ►

... the setup in order to fill the DUT quickly. Using such a safe bypass avoids approving a defect product. The solutions to all these 'catches' are shown in the flow scheme.

Temperature stabilisation prior to conducting a measurement is essential. For example, due to gas expansion a temperature variation of 2 °C already results in a volume change of 0.7 %. Any leaks smaller than this volume change cannot be measured when the temperature fluctuates. ■



(photo: Bergschenhoek)

## Recommended Products



### EL-FLOW Prestige

EL-FLOW Prestige is the next generation of Bronkhorst Mass Flow Meters / Controllers for gases. Nearly all core components have been redesigned and many improvements and innovations have been incorporated. Introducing the "Differential Temperature Balancing" technology, which ensures a superb sensor stability.

- ◆ High accuracy (standard 0,5% Rd plus 0,1% FS)
- ◆ Rangeability in digital mode up to 1:150
- ◆ Extremely fast and dynamic response
- ◆ An on-board gas conversion model
- ◆ Multi-Gas / Multi-Range functionality
- ◆ Pressure ratings 64 / 100 bar
- ◆ Analog I/O-signals, RS232-connection; optional on-board fieldbus interface)



### EL-FLOW Select

EL-FLOW® Select Series Mass Flow Meters/Controllers are thermal mass flow meters of modular construction with a 'laboratory style' pc-board housing. Control valves can either be integrally or separately mounted, to measure and control gas flows from lowest range 0,014...0,7 mln/min up to highest range 8...1670 ln/min.

- ◆ High accuracy (standard 0,5% Rd plus 0,1% FS)
- ◆ Rangeability in digital mode up to 1:187,5
- ◆ Fast response (down to 500 msec), excellent repeatability
- ◆ Optional Multi-Gas / Multi-Range functionality: freely programmable ranges and gas types
- ◆ Pressure ratings 64 / 100 bar (Multi-Gas / Multi-Range functionality up to 10 bar)
- ◆ Compact, modular construction



### EL-PRESS

The EL-PRESS series digital electronic pressure transducers and controllers for gases and liquids have a well-proven compact thru-flow design. The instruments include a diaphragm type piezo-resistive pressure sensor for pressure measurement/control from: lowest ranges 2 ... 100 mbar absolute, gauge or differential up to highest ranges 8 ... 400 bar absolute / gauge or 0,3 ... 15 bar dif.

- ◆ Thru-flow design
- ◆ Compact arrangement
- ◆ Stable control, even at varying process volumes
- ◆ High pressure capability up to 400 bar
- ◆ Metal sealed and/or down-ported versions available
- ◆ High accuracy and repeatability



### E-8000

Bronkhorst offers Power Supply / Readout and Control Modules for use with digital Mass Flow Meters / Controllers, Pressure Meters/ Controllers and other transmitters and transducers with RS-232 communication. The E-8000 Series have one or two colour TFT displays per module for indication of measured/totalised values and a push button menu.

- ◆ Bright, wide angle, 1.8" display (TFT technology)
- ◆ User friendly operation
- ◆ Programmable alarm functions
- ◆ Fluid selection (up to 8 fluids/curves)
- ◆ Indication/operation/configuration of measured value, setpoint, totalised flow, fluid/tag number, control characteristics, fieldbus settings

## Contact information



Leakage tests  
for air ducts  
A053-GP06-0217D

GP: General Purpose  
06: Leak detection

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