United McGill™ Products

Leak Detective®

Calibrated Test Kits for Measuring the Leakage Performance of Duct Systems

McGill AirFlow LLC
An enterprise of United McGill —
Family owned and operated since 1951

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a McGill AirFlow™ Product

Why Test for Leakage

No duct system is airtight; all leak to some degree. If controlled, duct leakage can be less than 1/2 of 1 percent of the total system cfm. As leakage increases, more air (energy) is required to maintain design conditions, and this increases operating costs. To protect building owners against leakage and the resulting increase in operating costs, engineers are specifying the leakage parameters and verification testing.

Please refer to McGill AirFlow's *System Pressure Testing for Leaks* for a detailed discussion of leakage testing procedures.

Leak Detective Test Kits

A Leak Detective test kit from McGill AirFlow makes it easy for you to measure duct system leakage. We offer four standard sizes, each available either as a kit or mounted on a wheeled cart. Other sizes are available as non-standard items. Leak Detective carts, orifice tubes, and test kit components can be ordered individually. A standard leakage test kit contains the following equipment:

1. Calibrated orifice tube
2. Certified calibration chart
3. Fan with flow control damper
4. Inlet/outlet guard that meets OSHA safety requirements
5. Two U-tube manometers
6. Vinyl tubing
7. Dye
8. 10-ft flex duct, adapter, and clamps

The standard test kit contains a 4-, 5-, 6-, or 8-inch-diameter orifice tube calibrated for positive pressure system testing. The 4-inch orifice tube incorporates a diffuser plate that is welded upstream of the orifice plate to straighten the air as it leaves the fan's nozzle.

The fan in the 4-inch leakage test kit will operate on 110-volt, single-phase, 50- or 60-hertz current. It can also be ordered for 220-volt operation.

Typical Standard Leak Detective Test Kit (8-inch unit shown)

Leak Detective Test Kit Cart Assemblies (4-, 5-, and 8-inch units shown)

The 5-inch fan will operate on 110-volt, single-phase, 60-hertz current, but can be wired for 220-volt operation. The 5-inch fan can be ordered for 50-hertz applications.

The 6- and 8-inch kits use a 220-volt, single-phase, 60-hertz fan that is equipped with a L6-30 turn-lock plug for required 30-amp service. The fan can be ordered for 50-hertz applications but is not available for 110-volt operation.

Cart Assemblies

All three standard fans include inlet/outlet guards that meet OSHA safety requirements. We can also supply all test kits mounted on a hand cart for easy portability. All you do is wheel the durable, metal cart to a test site and connect your flexible hose to the orifice tube. Convenient holders are provided for the calibration chart and instruction booklet. You can also purchase a hand cart as a separate item and mount your existing test kit on it.

Smoke Delivery Systems

The use of smoke during the testing process can make locating sources of leakage faster and easier. As complementary accessories to our leakage test kits and cart assemblies, McGill AirFlow offers two models of smoke machines and a complete smoke delivery system. Smoke delivery systems can be purchased to be attached to your cart assembly.

Complete Leak Detective Smoke Delivery System (mounted to a 5-inch cart assembly)

Orifice Tubes

You can order our standard or nonstandard orifice tubes individually, in lieu of an entire test kit. Nonstandard orifice tubes are specially designed and calibrated according to the required volume flow. They can be calibrated for use in both positive and negative static pressure systems. When ordering a nonstandard tube, the required volume flow, test pressure, and calibration requirements should be specified.

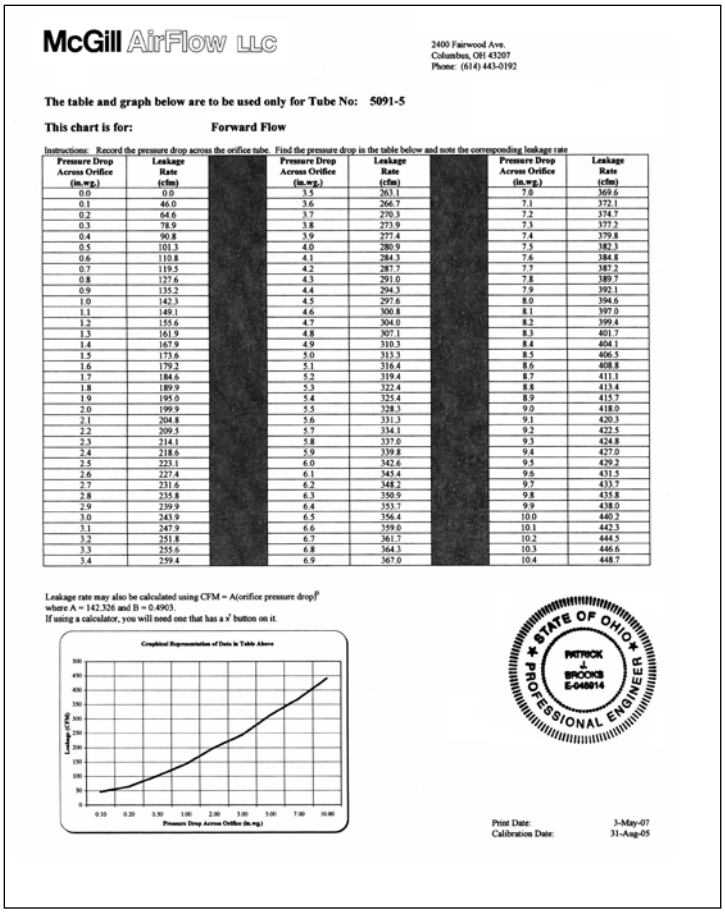
Standard 4-inch and 5-inch orifice tubes are calibrated against master tubes, which have been certified to an accuracy of 0.5 percent by an independent laboratory on equipment traceable to the National Institute for Standards and Technology (NIST). The standard 6-inch and 8-inch orifice tubes are calibrated against an orifice plate machine ground to the nearest 0.0001 inch and mounted in a ASME metering station.

The expected accuracy of all our orifice tubes at the time of shipment is 2 percent of the indicated flow rate. All tubes are supplied with calibration charts and tables certified by a professional engineer (see Figure 1).

Calibration Services

We can recalibrate McGill AirFlow orifice tubes and calibrate tubes that you supply. All types of tubes can be calibrated for positive pressure, negative pressure, or a combination of positive and negative pressure.

Figure 1 Orifice Tube Calibration Chart



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The table and graph below are to be used only for Tube No: 5091-5

This chart is for: Forward Flow

Instructions: Record the pressure drop across the orifice tube. Find the pressure drop in the table below and note the corresponding leakage rate

Pressure Drop Across Orifice (in.wg.)	Leakage Rate (cfm)	Pressure Drop Across Orifice (in.wg.)	Leakage Rate (cfm)	Pressure Drop Across Orifice (in.wg.)	Leakage Rate (cfm)
0.0	0.0	3.5	263.1	7.0	369.6
0.1	46.0	3.6	266.7	7.1	372.1
0.2	64.6	3.7	270.3	7.2	374.7
0.3	78.9	3.8	273.9	7.3	377.2
0.4	90.8	3.9	277.4	7.4	379.8
0.5	101.3	4.0	280.9	7.5	382.3
0.6	110.8	4.1	284.3	7.6	384.8
0.7	119.5	4.2	287.7	7.7	387.2
0.8	127.6	4.3	291.0	7.8	389.7
0.9	135.2	4.4	294.3	7.9	392.1
1.0	142.3	4.5	297.6	8.0	394.6
1.1	149.1	4.6	300.8	8.1	397.0
1.2	155.6	4.7	304.0	8.2	399.4
1.3	161.9	4.8	307.1	8.3	401.7
1.4	167.9	4.9	310.3	8.4	404.1
1.5	173.6	5.0	313.3	8.5	406.5
1.6	179.2	5.1	316.4	8.6	408.8
1.7	184.6	5.2	319.4	8.7	411.1
1.8	189.9	5.3	322.4	8.8	413.4
1.9	195.0	5.4	325.4	8.9	415.7
2.0	199.9	5.5	328.3	9.0	418.0
2.1	204.8	5.6	331.3	9.1	420.3
2.2	209.5	5.7	334.1	9.2	422.5
2.3	214.1	5.8	337.0	9.3	424.8
2.4	218.6	5.9	339.8	9.4	427.0
2.5	223.1	6.0	342.6	9.5	429.2
2.6	227.4	6.1	345.4	9.6	431.5
2.7	231.6	6.2	348.2	9.7	433.7
2.8	235.8	6.3	350.9	9.8	435.8
2.9	239.9	6.4	353.7	9.9	438.0
3.0	243.9	6.5	356.4	10.0	440.2
3.1	247.9	6.6	359.0	10.1	442.3
3.2	251.8	6.7	361.7	10.2	444.5
3.3	255.6	6.8	364.3	10.3	446.6
3.4	259.4	6.9	367.0	10.4	448.7

Leakage rate may also be calculated using CFM = A(orifice pressure drop)^B
where A = 142.326 and B = 0.4903.
If using a calculator, you will need one that has a y^x button on it.

Graphical Representation of Data in Table Above

Leakage (CFM)

Pressure Drop Across Orifice (in.wg.)

STATE OF OHIO
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E-048914
PROFESSIONAL ENGINEER

Print Date: 3-May-07
Calibration Date: 31-Aug-05

Choosing a Leak Detective Test Kit

Figures 2 and 3 are graphs showing the approximate operating limits of each Leak Detective test kit. The graphs plot static pressure versus volume flow. At a given test pressure, each kit can deliver air volumes (cfm) up to the maximum value indicated by the curve.

To facilitate your selection of a test kit, visit "Leak Detective Test Kit Tools" on McGill AirFlow's web site at:

www.mcgillairflow.com/textDocs/ltkDocs/LTKtoolsKIT.htm

Figure 2 CFM versus Test Static Pressure

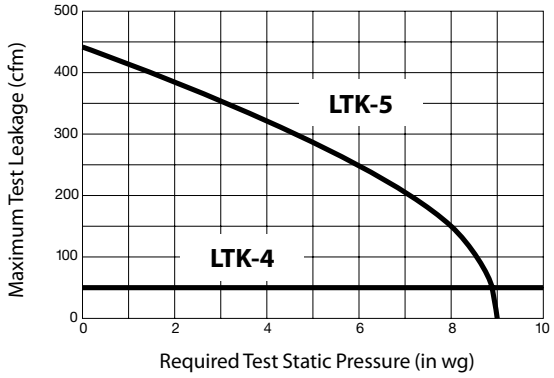
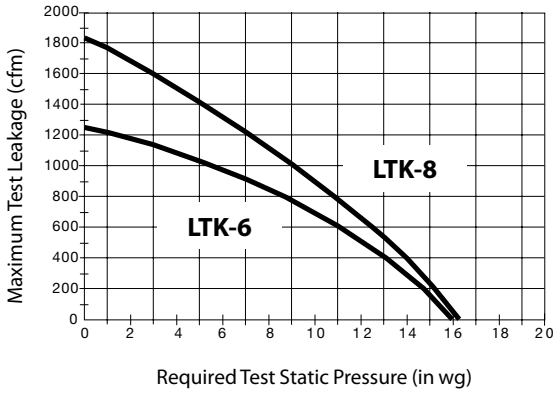


Figure 3 CFM versus Test Static Pressure



Leakage Specifications

McGill AirFlow maintains that lower allowable leakage rate specifications, as related to HVAC duct system designs, are essential in meeting the demand for lower energy costs. McGill AirFlow recommends designers of HVAC duct systems incorporate the American Air Balance Council's (AABC) *2002 National Standards for Total System Balance* — "Duct Leakage Testing" (refer to Chapter 35) for allowable leakage rates in obtaining LEED qualified and sustainable energy efficiency. McGill AirFlow further recommends specifying that the entire system, which includes all ductwork and system components (VAV boxes, fire/smoke dampers, etc.), be leak tested at the maximum system operating pressure in order to ensure conformance to the lower allowable leakage rate specifications.

Table 1 Allowable Leakage Rates

Type of System	Minimum Test Pressure[5]	Maximum Allowable Leakage
Fractional horsepower fan system; fan coils, small exhaust/supply fans	0.50-inch wg	2%
Small systems; split DX systems — usually under 2,000 cfm	1-inch wg	2%
VAV and CAV boxes and associated downstream duct[1]	1-inch wg	2%
Single-zone, multi-zone, low pressure VAV and CAV systems[2], return ducts, and exhaust duct systems	2-inch wg	2%
All constant volume ducts in chases and concealed spaces, main return ducts on VAV and CAV systems, main ducts on exhaust or supply systems	3-inch wg	1%
Supply ducts for VAV and CAV systems	4-inch wg[3]	1%
High-pressure induction system	6-inch wg[4]	0.5%

Notes
1. It is assumed that the box damper is on the inlet side of the box. If the box damper is on the outlet side of the box, then the box should be included in the upstream leakage testing. Series boxes should not be included in the test since they operate at neutral pressure.
2. When low-pressure VAV and CAV systems are used, the total allowable leakage should not exceed 2 percent, including the box and downstream ductwork. The box and downstream ductwork should be tested at the lower 1-inch wg static. This is the minimum for most systems currently used in today's design practices.
3. It is recommended that the pressure rating of the duct be equal to the fan shut-off pressure if the possibility of fan shut-off exists either in the VAV systems or in systems with smoke/fire damper control. In a VAV system, the pressure may be selected at the intersection of the minimum box total cfm and the maximum fan RPM.
4. Large induction systems may have higher-pressure requirements, i.e. 10-inch wg.
5. Test pressure should not exceed the pressure rating of the duct.

Additional Information

Construction details, dimension drawings, and standard gauges for McGill AirFlow products are available. Please contact the McGill AirFlow sales representative, sales engineering office, or regional manufacturing plant nearest you or see our web site for additional information.

Products depicted in this brochure were current at the time of publication. As a quality-conscious manufacturer, McGill AirFlow is continually seeking ways to improve its products to better serve its customers. Therefore all designs, specifications, and product features are subject to change without notice.

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An enterprise of United McGill — Family owned and operated since 1951

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