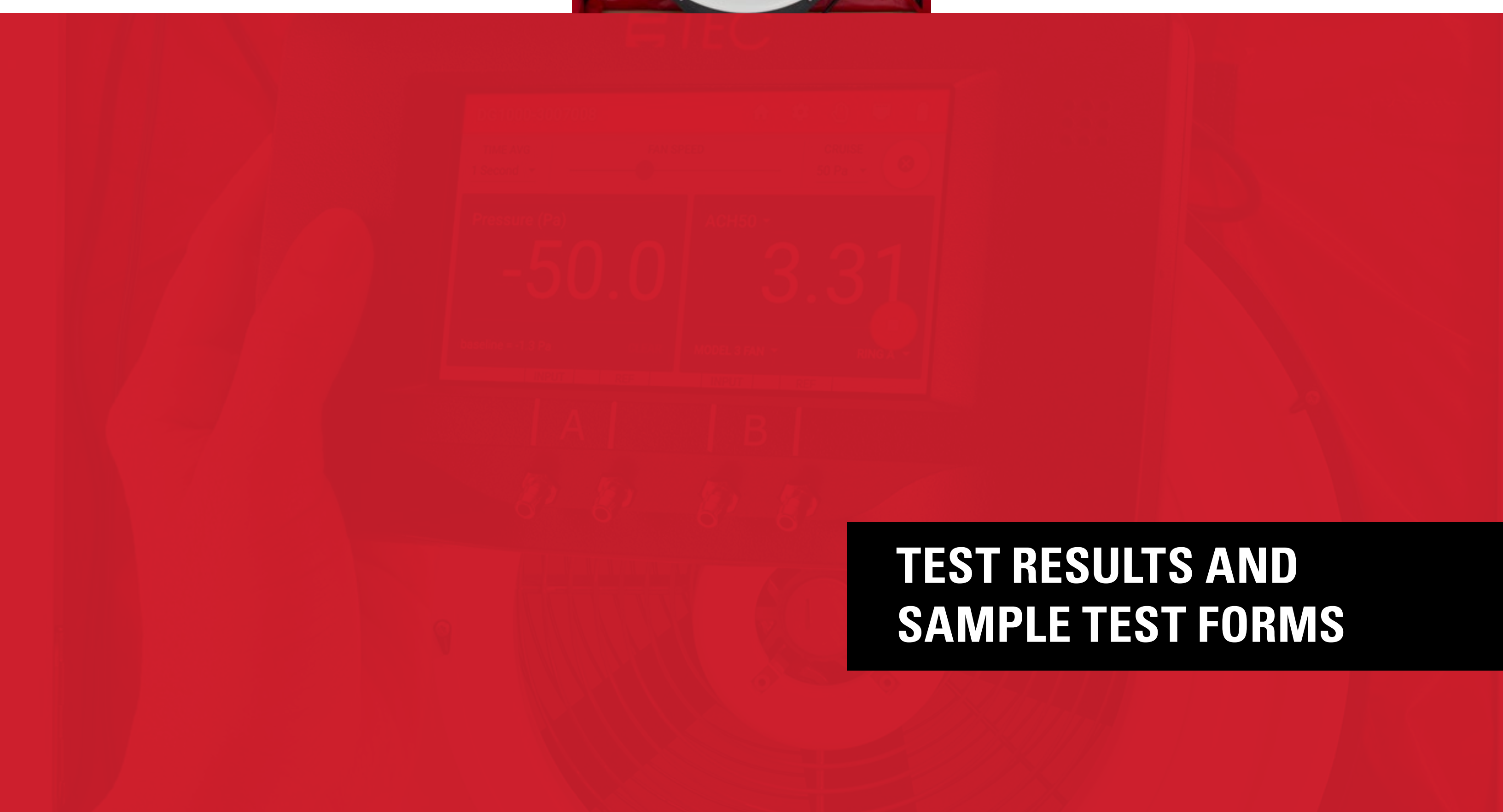
MODEL 3
MINNEAPOLIS BLOWER DOOR™



TEST RESULTS AND SAMPLE TEST FORMS

BASIC AIRTIGHTNESS TEST RESULTS

Airtightness test results can be presented in a number of standardized formats.

- **Air Leakage at 50 Pascals**
  - » **CFM50**
    CFM50 is the airflow (in cubic feet per minute) from the blower door fan needed to create a change in building pressure of 50 Pascals (0.2 inches of water column). A 50 Pascal pressure is roughly equivalent to the pressure generated by a 20 mph wind blowing on the building from all directions. CFM50 is the most commonly used measure of building airtightness and gives a quick indication of the total air leakage in the building envelope. When conducting a one-point test at 50 Pascals of building pressure, you are directly measuring CFM50.
  - » **Percent Reduction in CFM50**
    Performing a one-point CFM50 test before and after airtightening work will allow you to determine the reduction in building airtightness. Reductions in CFM50 as large as 40 to 50 percent are often achieved in high level weatherization programs working on leaky houses. To determine the percent reduction in CFM50, subtract the after-tightening test result from the before-tightening test result. Divide this difference by the before-tightening result and multiply by 100.

$$\%\ \text{Reduction} = \frac{\text{CFM50 (before)} - \text{CFM50 (after)}}{\text{CFM50 (before)}} \times 100$$

- **Normalizing Air Leakage for the Size of the House**
  In order to compare the relative tightness of buildings, it is useful to adjust (or normalize) the results for the size of the building. This allows easy comparison of various size buildings with each other, or with program standards. There are many aspects of building size which can be used to normalize including volume and surface area of the building envelope.
  - » **Air Change per Hour at 50 Pascals (ACH50)**
    One way to compare different size buildings is to compare the measured air leakage at 50 Pascals (e.g. CFM50) to the conditioned volume of the building. Air Change per Hour at 50 Pa (ACH50) is calculated by multiplying CFM50 by 60 to get air flow per hour, and dividing the result by the volume of the building. ACH50 tells us how many times per hour the entire volume of air in the building is replaced when the building envelope is subjected to a 50 Pascal pressure.

$$\text{ACH50} = \frac{\text{CFM50} \times 60}{\text{Building Volume (cubic feet)}}$$

  - » The airtightness of existing homes can vary dramatically based on the construction style, age and region. The chart below shows the relative tightness of homes based on the ACH50.

0 - 1.5 ACH	Very tight
1.5 - 3 ACH	Tight
3 - 5 ACH	Moderately tight
5 - 7 ACH	Loose
7 - 10 ACH	Very loose
10 + ACH	Extremely loose

Refer to the International Energy Conservation Code (IECC) tor climate zone specific maximum allowable ACH50 values.

» **Air Leakage at 50 Pascals per Unit of Surface Area**
This parameter is calculated by dividing the measured air leakage at 50 Pascals (e.g. CFM50) by the surface area of the building. This is the measured Air Leakage at 50 Pascals (e.g. CFM50) divided by the surface area of the building.
Note: Residential buildings above five stories and commercial buildings are typically tested at 75 Pascals.

$$\text{CFM50 per Square Foot of Surface Area} = \frac{\text{CFM50}}{\text{Square Feet of Surface Area}}$$

- **Optional Correction for Air Density Based on Temperature**
To increase the accuracy of a one-point test, the fan flow measurements can be corrected for differences in air density caused by air temperature. During a depressurization test, the blower door system is measuring the air flow through the blower door fan. But what we really want to know is the air flow coming back into the building through air leaks. When the inside and outside temperature are different, the air flow leaving the building through the fan is actually different from the air flow back into the building (due to differences in air density). In extreme weather conditions, this difference in air flow can be as great as 10 percent. If you wish to manually adjust your test results for differences in air density, a table of air density correction factors can be found in the Blower Door Manual, starting on page 17.

- **Optional Correction for Air Density based on Elevation**
Some standards will also require a correction based on elevation above sea level. The formula for this conversion can be found in the Blower Door Manual, on pages 17 and 18.

Sample completed form
(From TEC Auto Test app)

Envelope Leakage Test

Testing Company:

Name:
Address:

Technician:

Name: Erik S.
Credentials: BPI Building Analyst Certification 3/18/2015.
Email: info@energyconservatory.com

Building Information:

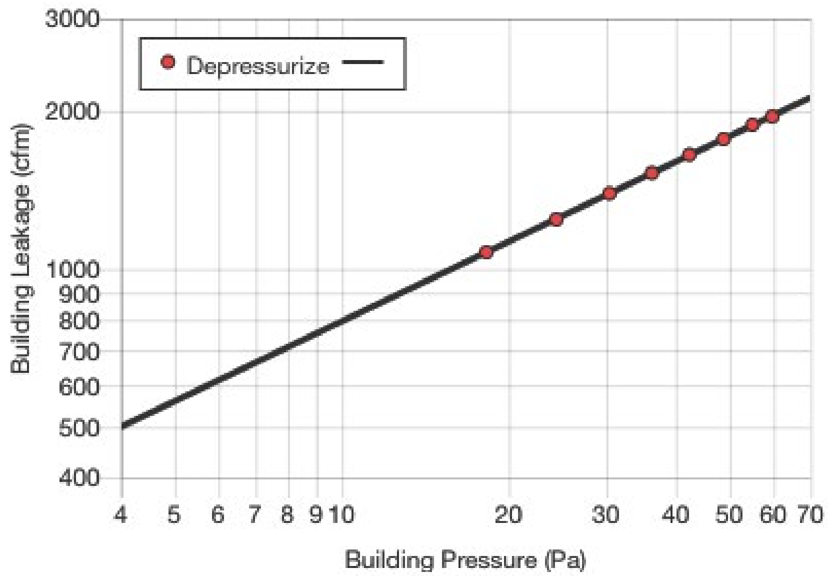
Project ID: Example
Address: 2801 21st Ave S
Suite 160
Minneapolis, MN 55407
Geo-Tag Data: Latitude: 44.951044
Longitude: -93.241572
Timestamp: 2016-09-02 14:04:04

Customer Information:

Name: The Energy Conservatory
Address: 2801 21st Ave. South
Suite 160
Minneapolis, MN 55407
Phone: (612) 827-1117
Email: info@energyconservatory.com

Test Results:	**Measured Leakage:**	**3.76 ACH50**
	Leakage Target:	**3.00 ACH50**
	Compliance with Leakage Target:	**Fail**

Test ID:	Final Envelope Inspection	
Purpose of Test:	IECC 12/15 Env. Leakage	
Measured CFM50:	1,791.8 (+/- 0.2%)	Effective Leakage Area: 141.8 in²
Building Volume:	28,560.0 ft³	Enclosure Surface Area: 0.0 ft²
Flow Coefficient (C):	247.9 (+/- 1.8%)	Exponent (n): 0.506 (+/- 0.005)
Correlation Coefficient:	0.99995	
Test Standard:	ASTM E779 (single mode)	Test Mode: Depressurize
Test Characteristics:	Pre Indoor Temp: 70 °F	Post Indoor Temp: 70 °F
	Pre Outdoor Temp: 34 °F	Post Outdoor Temp: 34 °F
	Altitude: 856.0 ft	Time Average Period: 10 seconds
Test Date and Time:	2016-09-02 14:45:58	



Envelope Leakage Test (Page 2)

Test Readings:

Target (Pa)	Bldg (Pa)	Adj Bldg (Pa)	Fan (Pa)	Flow (cfm)	Config
Baseline	-1.3				
-60.0	-60.6	-59.7	-127.8	2,023.5	Ring A
-54.0	-55.9	-55.0	-118.8	1,953.1	Ring A
-48.0	-49.7	-48.8	-104.4	1,833.5	Ring A
-42.0	-43.2	-42.3	-90.6	1,711.4	Ring A
-36.0	-37.1	-36.2	-76.9	1,579.7	Ring A
-30.0	-31.3	-30.4	-63.9	1,443.4	Ring A
-24.0	-25.3	-24.4	-50.7	1,288.9	Ring A
-18.0	-19.1	-18.2	-37.7	1,115.4	Ring A
Baseline	-0.5				

Test Equipment:

Flow Device:	Model 3 Fan
	Serial #: 34655
Pressure Gauge:	DG1000
	Serial #: 3007058
	Calibration Date: 2016-04-01

Deviations from Standard:

- None

Comments:

Example envelope multi-point test.

Sample blank form

Envelope Leakage Test

Testing Company

Name:

Address:

Phone:

Technician

Name:

Credentials:

Email:

Building Information

Project ID:

Address:

Customer Information

Name:

Address:

Phone:

Email:

Test Results

Measured Leakage:

Leakage Target:

Compliance with Leakage Target: Pass Fail

Test ID:

Measured CFM50:

Building Volume:

Enclosure Surface Area:

ACH50 = (CFM50 x 60)/Volume:

CFM50/Sq Feet of Surface Area:

Test Characteristics

Indoor Temp:

Outdoor Temp:

Altitude:

Time Average Period:

Test Date:

Test Equipment

Flow Device: Serial Number:

Pressure Gauge: Serial Number: Calibration Date:

Comments:

Technician Signature: Date:

Software Information

The Energy Conservatory (TEC) offers a variety of Windows-based programs. These programs can be found and downloaded for free at software.energyconservatory.com.

TEC also offers driver support for the DG-500, DG-700 and DG-1000. The drivers are designed to work with Windows-based computers with the following operating systems:

- Windows 7
- Windows 8
- Windows 8.1
- Windows 10

The drivers are available through Windows Update, and the DG-500 and DG-700 drivers can be downloaded from TEC at software.energyconservatory.com.

TEC also offers mobile apps for Apple and Android devices that can be found in the Apple App Store or the Google Play Store.

Instructional Videos

The Energy Conservatory (TEC) offers a variety of online instructional videos, including

- Minneapolis Blower Door Quick Guide
- Minneapolis Duct Blaster Quick Guide
- Field Calibration Checks for Gauges
- Pressure and Airflow Basics
- Exhaust Fan Flow Meter
- TECLOG3
- TECTITE 4.0
- And many more

Visit www.YouTube.com/EnergyConservatory to see all of TEC's instructional videos.

More Blower Door Guides

All blower door guides are available online at energyconservatory.com/blowerdoorguides

Please refer to the guides listed below for further instructions.

- Minneapolis Blower Door Overview
- Minneapolis Blower Door Manual
- Using the DG-1000 with the Minneapolis Blower Door
- Using the DG-700 with the Minneapolis Blower Door

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