The Energy Conservatory

# MODEL 3 MINNEAPOLIS BLOWER DOOR™ SYSTEM



## USER MANUAL

# ENERGY CONSERVATORY WARRANTY

## EXPRESS LIMITED WARRANTY

Seller warrants that this product, under normal use and service as described in the operator's manual, shall be free from defects in workmanship and material for a period of 24 months, or such shorter length of time as may be specified in the operator's manual, from the date of shipment to the Customer.

## LIMITATION OF WARRANTY AND LIABILITY

This limited warranty set forth above is subject to the following exclusions:

- With respect to any repair services rendered, Seller warrants that the parts repaired or replaced will be free from defects in workmanship and material, under normal use, for a period of 90 days from the date of shipment to the Purchaser.
- Seller does not provide any warranty on finished goods manufactured by others. Only the original manufacturer's warranty applies.
- Unless specifically authorized in a separate writing, Seller makes no warranty with respect to, and shall have no liability in connection with, any goods which are incorporated into other products or equipment by the Purchaser.
- All products returned under warranty shall be at the Purchaser's risk of loss. The Purchaser is responsible for all shipping charges to return the product to The Energy Conservatory. The Energy Conservatory will be responsible for return standard ground shipping charges. The Customer may request and pay for the added cost of expedited return shipping.

The foregoing warranty is in lieu of all other warranties and is subject to the conditions and limitations stated herein. No other express or implied warranty IS PROVIDED, AND THE SELLER DISCLAIMS ANY IMPLIED WARRANTY OF FITNESS for particular purpose or merchantability.

The exclusive remedy of the purchaser FOR ANY BREACH OF WARRANTY shall be the return of the product to the factory or designated location for repair or replacement, or, at the option of The Energy Conservatory, refund of the purchase price.

The Energy Conservatory's maximum liability for any and all losses, injuries or damages (regardless of whether such claims are based on contract, negligence, strict liability or other tort) shall be the purchase price paid for the products. In no event shall the Seller be liable for any special, incidental or consequential damages. The Energy Conservatory shall not be responsible for installation, dismantling, reassembly or reinstallation costs or charges. No action, regardless of form, may be brought against the Seller more than one year after the cause of action has accrued.

The Customer is deemed to have accepted the terms of this Limitation of Warranty and Liability, which contains the complete and exclusive limited warranty of the Seller. This Limitation of Warranty and Liability may not be amended or modified, nor may any of its terms be waived except by a writing signed by an authorized representative of the Seller.

## TO ARRANGE A REPAIR

Please call The Energy Conservatory at 612-827-1117 before sending any product back for repair or to inquire about warranty coverage. All products returned for repair should include a return shipping address, name and phone number of a contact person concerning this repair, and the purchase date of the equipment.

# SAFETY INFORMATION

- The blower door fan should only be connected to a properly installed and tested power supply. In case of emergencies, disconnect the power cord from the AC power mains outlet. During installation, use the nearest readily accessible power outlet and keep all objects away from interfering with access to the outlet.
- Disconnect the power plug from the blower door fan receptacle before examining or making any adjustments to the fan motor, blades or electrical components.
- The blower door fan is a very powerful and potentially dangerous piece of equipment if not used and maintained properly. Carefully examine the fan before each use. If the fan housing, fan guards, blade, controller or cords become damaged, do not operate the fan until repairs have been made. Repairs should only be made by The Energy Conservatory.
- If you notice any unusual noises or vibrations, stop and unplug the fan. If you can't find the source of the problem, contact the manufacturer/distributor.
- Keep people, animals and objects away from the blower door fan when it is operating.
- Press the power plug firmly into the power receptacle on the blower door fan, and the AC power mains outlet. Failure to do so can cause overheating of the power cord and possible damage.
- Do not use ungrounded outlets or adapter plugs. Never remove or modify the grounding prong. Use only approved and inspected electrical wiring and connections.
- Do not operate the blower door fan if the motor, controller or any of the electrical connections are wet.
- For long-term operation, such as maintaining building pressure while air-sealing, use a flow ring whenever possible to ensure proper cooling of the blower door fan motor. This will minimize the heating of the fan and is important in warmer weather.
- Do not reverse the blower door fan (if the fan has a flow direction switch) while the blades are turning.
- The motor is thermally protected and if you experience a motor shut down, be sure to turn off the fan speed controller so that the fan does not restart unexpectedly after the motor cools down.
- The operator should wear hearing protection when in close proximity to the fan operating at high speed.
- Adjust all combustion appliances so they do not turn on during the test. If combustion appliances turn on during a depressurization test, it is possible for flames to be sucked out of the combustion air inlet (flame roll-out). This is a fire hazard and can possibly result in high CO levels.
- If there are attached spaces (e.g. townhouses) that could contain a vented combustion appliance, either adjust those appliances to prevent them from turning on during the test, or be sure that the attached spaces are not depressurized or pressurized when the blower door is operating.
- Be sure that fires in fireplaces and wood stoves are completely out before conducting a test. Take precautions to prevent ashes from being sucked into the building during the test. In most cases it will be necessary to either tape doors shut, clean out the ashes, and/or cover the ashes with newspaper.
- Be sure you have returned the building to its original condition before leaving. This includes turning the thermostat and water heater temperature controls to their original setting. Always check to see that furnace, water heater and gas fireplace pilot lights have not been blown out during the blower door test - re-light them if necessary. Remove any temporary seals from fireplaces or other openings sealed during the test.
- If combustion safety problems are found, tenants and building owners should be notified immediately and steps taken to correct the problem including notifying a professional heating contractor if basic remedial actions are not available. Remember, the presence of elevated levels of carbon monoxide in ambient building air or in combustion products is a potentially life threatening situation. Air sealing work should not be undertaken until existing combustion safety problems are resolved, or unless air sealing is itself being used as a remedial action.

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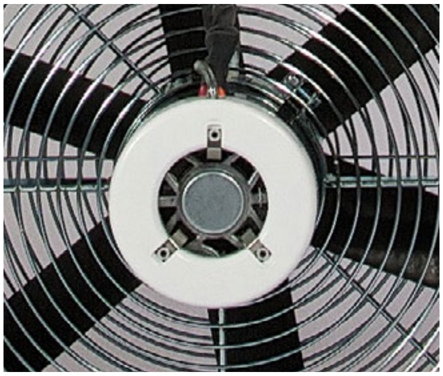
## Blower Door System Details

The blower door fan consists of a molded fan housing with a 3/4 horsepower permanent split capacitor AC motor. Air flow through the fan is determined by measuring the pressure at the flow sensor which is attached to the end of the motor. When the fan is operating, air is pulled into the inlet side of the fan and exits through the exhaust side (a metal fan guard is bolted to the exhaust side of the fan).

The blower door fan can accurately measure airflow over a wide range of flow rates using a series of calibrated flow rings which are attached to the inlet of the fan. The standard Minneapolis Blower Door System comes with two flow rings (A and B), and optional flow rings are C, D and E.

**Fan Flow Ranges**

| Ring | Flow Range in CFM |
|---|---|
| Open (no flow ring) | 6,100 - 2,435 |
| Ring A | 2,800 - 915 |
| Ring B | 1,100 - 300 |
| Ring C (optional) | 330 - 85 |
| Ring D (optional) | 115 - 30 |
| Ring E (optional) | 45 - 11 |



The table above shows the approximate flow range of the blower door fan when used with each flow ring. The greatest accuracy in fan flow readings will always be achieved by installing the flow ring with the smallest opening area, while still providing the necessary fan flow. When taking blower door measurements, stand at least 12 inches away from the fan. Standing directly in front of the fan may affect the flow readings and result in erroneous measurements.

- To install flow ring A, place ring A onto the inlet side of the fan housing and rotate the eight fastener clips attached to the fan housing so that they rotate over the edge of ring A and secure it in place.
- To Install flow ring B, place ring B in the center of ring A and rotate the six fastener clips attached to ring A so that they rotate over the edge of ring B and secure it in place.
- In addition to flow rings A and B, the blower door comes with a solid circular no flow plate to seal off the fan opening. The no flow plate is attached to ring B in the same manner that ring B attaches to ring A.
- The no flow plate and rings A and B can be removed separately, or all three pieces can be removed at the same time by releasing the eight fastener clips holding ring A to the fan housing.
- Installation and use of flow rings C, D and E are discussed on our website.

### Fan Speed Controller

Fan speed is adjusted using the adjustment knob on the face of the speed controller. Model 3 blower door systems come with the fan speed controller clipped onto the black mounting board supplied with the system. The Model 3 controller can be removed from the mounting board by sliding the controller clip off the board.

### Digital Gauge Options


DG-1000 Pressure and Flow Gauge


DG-700 Pressure and Flow Gauge

The DG-1000 and DG-700 are differential pressure gauges which measure the pressure difference between either of their input pressure taps and its corresponding reference pressure tap. Both gauges have two separate measurement channels which allows you to monitor the building pressure and fan pressure (air flow) signals during the blower door test. In addition, both gauges are able to directly display air flow through the blower door fan. The digital gauge is shipped in a separate padded case which is stored in the blower door accessory case. Also included is a black mounting board to which the digital gauge can be attached using either the Velcro strips (DG-700 board) or the magnets (DG-1000 board).

DG-1000 gauge board

DG-700 gauge board

Both gauges can also be used to automate control of the blower door fan using the following two features:

- Both gauges have a built-in “cruise control” feature which allow the user to control the blower door fan to maintain a constant building pressure, without using the TECTITE software or a computer.
- The gauge can be used along with TECTITE software and a computer to conduct a fully automated blower door test. When conducting automated tests, the speed of the blower door fan is computer controlled while the TECTITE program simultaneously monitors the building pressure and fan flow using the gauge’s two pressure channels. Test results are recorded, displayed on the screen, and can be saved to a file.

## Aluminum Frame and Door Panel

The adjustable aluminum door frame and nylon panel is used to seal the fan into an exterior doorway. The door frame is adjustable to fit a typical size residential door opening. The aluminum frame comes in a soft carrying case and includes:

- Two 96″ vertical pieces
- Two 45″ horizontal pieces
- One 45″ crossbar with Velcro strap
- One gauge hanger bar

### Where to Install the Blower Door Frame

- It is always best to install the blower door system in an exterior doorway of a large open room.
- Try to avoid installing the fan in a doorway where there are stairways or major obstructions to air flow very close (one to five feet) to the fan inlet.
- If the doorway leads to a porch or garage, make sure this space is open to the outside by opening doors and/or windows.
- The door frame is almost always installed from the inside of the building and may be installed in place of the prime door, the storm door or anywhere in between.
- Always open the inside door and outside storm door as much as possible during the test to prevent restrictions to airflow.

### How to Assemble the Blower Door Frame and Nylon Panel

- Remove all frame pieces from the bag and lay them out on the floor
  - » Lay the two vertical frame pieces on the floor parallel with each other, cam lever side up.
  - » Lay one horizontal piece on the floor between the bottom of the two vertical pieces, cam lever side up.
  - » Lay the second horizontal piece on the floor between the top of the two vertical pieces, cam lever side up.
  - » Set aside the crossbar with the Velcro strap for later use.

Relaxed/unlocked

Locked

- Put all cam levers into the relaxed position (lever should be pointing inward, and not be in the horizontal locked position)

- Both vertical frame pieces have a silver bar on each end, with a small silver button on the bar. Push in the silver button and slide into the end of the horizontal piece. Note: Two of the buttons will be on the side of the frame facing the floor.

- Temporarily install the frame in the doorway
  - » Stand the frame up and put into the doorway.
  - » Loosen the knobs on each cam lever.
  - » Place one foot on the bottom of the frame to hold it place, and extend the top of the frame to the top of the doorway, leaving about a fingers width of space between the top of the frame and the top of the doorway.
  - » Tighten the knobs on the vertical pieces.
  - » Extend the frame horizontally so both vertical pieces fit into the doorway, leaving about a fingers width of space between the vertical pieces and the sides of the doorway.
  - » Tighten the knobs on the horizontal pieces.

- Attach the nylon panel to the frame and install into doorway

  - » Lay the fabric panel on the floor, with the Velcro straps and blower door logo facing up.
  - » Remove the frame from the doorway, being sure the knobs on the cam levers are still tightened so the frame doesn't adjust in size.
  - » Lay the frame onto the fabric door panel, lining up the top and bottom horizontal pieces with their respective Velcro straps.
  - » Drape each side of the panel over the frame snugly and tighten the Velcro straps.
  - » Stand the frame up near the doorway and run the green tubing outside so the end is well away from the nylon panel. Extend the other end through one of the patches at the bottom corners of the nylon panel. Pull just enough of it to the inside so it can make the connection to the gauge.
  - » Readjust the frame so it fits snuggly in the door opening and tighten all four adjustment knobs. Now engage all four cam levers so the frame is secured tightly in the opening.
  - » Install the crossbar with the Velcro strap in the lowest slot above the fan hole and tighten the knob so it fits snug. Engage the cam lever.

- Insert the blower door fan into the hole in the fabric panel

  - » Set the fan down in front of the panel. For a depressurization test, the side of the fan with the guard should be facing outside. The side of the fan with the flow rings should be facing inside. (For a pressurization test, insert the fan the other way, with the guard inside the house and the flow rings outside the house.)
  - » Insert the fan bottom first into the hole, and then work the elastic around the fan until it's completely inserted.
  - » The top of the hole should rest in the middle of the electrical box on top of the fan so the plug inlet and handle are not covered.
  - » The bottom of the fan should be resting on the lower horizontal frame piece.
  - » Slip the velcro strap through the fan handle and loop it up and back around the cross bar.

- Attach the gauge mounting board
  - » The mounting board for the gauge can be attached to any door by using the C-clamp connected to the back of the board.
  - » The mounting board can also be easily attached to a horizontal surface (book shelf or desk top) by rotating the clamp 90 degrees before securing the board.
  - » The mounting board can be attached to the gauge hanger bar. Connect the gauge hanger bar to either side of the vertical pieces by inserting the hook into one of the remaining slots. Tighten the mounting board clamp onto the hanger bar.

- Attach the fan speed controller to the bottom of the gauge mounting board by sliding it on using the metal clamp on the back of the controller.
- Insert the female plug from the fan speed controller into the receptacle located on the fan electrical box. Make sure the plug is inserted completed as the plug or receptacle can overheat if it's not.
- Plug the power cord into an AC outlet that is compatible with the voltage of the fan motor and speed controller. Be sure the controller knob on the fan speed controller is turned all the way counter clockwise to the off position before plugging in the power cord.

Complete setup without gauge

Complete setup with gauge

**See one of the following guides for gauge setup and testing instructions**

Using the DG-1000 with the Minneapolis Blower Door

Using the DG-700 with the Minneapolis Blower Door

## Setting Up the Building for the Test

The following preparations are appropriate when using the blower door to determine retrofit airsealing potential, weatherization effectiveness or estimating natural infiltration rates. If the purpose of the blower door test is to document construction airtightness quality for new houses, additional preparation may be needed. Your program guidelines may require you to prepare the building differently than described below.

The building set-up and test procedures below are recommended specifically by The Energy Conservatory. These procedures generally conform to the Canadian General Standards Board (CGSB) standard CGSB-149.10-M86 "Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method," and American Society for Testing and Materials (ASTM) standard E779-10 "Standard Test Method for Determining the Air Leakage Rate by Fan Pressurization." However, our procedures include options and recommendations that are not contained within the CGSB and ASTM standards. If you need to perform a blower door airtightness test that exactly meets the CGSB, ASTM or some other test procedure (e.g. RESNET), you should obtain a copy of the applicable standard and follow the specific set-up directions contained in the standard.

### Adjustable Openings

- Close all storm and prime windows.
- Close all exterior doors and interior attic or crawlspace hatches which are connected to conditioned spaces. Also close exterior crawl space hatches and vents if they are normally closed most of the year.
- Open all interior doors to rooms that are conditioned. The object here is to treat the entire building as one conditioned space and to subject all of the leaks in the building to the same pressure difference. Because few house basements can be completely sealed from the house and usually some conditioning of the basement is desirable, they are typically included as conditioned space.
- Tape plastic over window air conditioners if they appear to be a source of air leakage into the building and they are typically removed during a large part of the year.

### Combustion Appliance/Exhaust Devices

- Adjust all combustion appliances so they do not turn on during the test. This is commonly done by temporarily turning off power to the appliance, or setting the appliance to the "Pilot" setting. If combustion appliances turn on during a depressurization test, it is possible for flames to be sucked out of the combustion air inlet (flame rollout). This is a fire hazard and can possibly result in high CO levels.
- If there are attached spaces (e.g. townhouses) that could contain a vented combustion appliance, either adjust those appliances to prevent them from turning on during the test, or be sure that the attached spaces are not depressurized or pressurized when the Blower door is operating.
- Be sure that fires in fireplaces and woodstoves are completely out. Take precautions to prevent ashes from being sucked into the building during the test. In most cases it will be necessary to either tape doors shut, clean out the ashes, and/or cover the ashes with newspaper.
- Turn off all exhaust fans, vented dryers, air conditioners, ventilation system fans and air handler fans.

## After the Test

Be sure you have returned the building to its original condition before leaving. This includes turning the thermostat and water heater temperature controls to their original setting. Always check to see that furnace, water heater and gas fireplace pilot lights have not been blown out during the blower door test (re-light them if necessary). Remove any temporary seals from fireplaces, woodstoves or other openings sealed during the test. In addition, combustion safety tests should usually be performed before leaving the house.

## Finding Air Leaks

There are many techniques that are used to find air leaks with the blower door. Air leaks between the interior and exterior of the building often follow long and complicated leakage paths. Typically, the air sealing goal is to find where the leaks cross the exterior envelope of the building and to concentrate sealing activities on those areas.

- Using Your Hand
  The easiest method and one that is used most often is to depressurize the building and walk around the inside, checking for leaks with your hand. When you are looking for leaks, let the blower door fan run at a speed which generates between 20 and 30 Pascals of building pressure. You should get in the habit of always using the same pressure so you will get a good feel for what is a big leak and what is not. An entire room can be checked quickly if there is a door between it and the rest of the house. Standing just outside of the room, close the door most of the way, leaving about a one inch crack. A large blast of air coming through this crack indicates large leaks between that room and the outdoors.

- Using a Chemical Smoke Puffer
  In houses, many of the most important leaks are found between the house and the attic or between the house and a ventilated crawlspace. These leaks usually will not be easy to find unless you physically go into the attic or crawlspace. The use of a handheld smoke puffer is often helpful in these areas. With the house depressurized (and the crawlspace or attic access door shut), you can squirt small puffs of smoke toward suspected leakage sites from the attic or crawlspace and watch to see if the smoke gets sucked into the leak. With a piece of tubing attached to the smoke puffer, you can often reach deep into corners or in hard to reach spots. A smoke puffer or a pressure pan is a necessity when looking for leaks in the forced air ductwork.

- Using an Infrared Camera
  The ideal technique for finding leaks is to use an infrared scanner with a blower door. This procedure usually involves performing two infrared scans from the interior of the building; one before turning on the blower door and one after the blower door has been depressurizing the building for five to 10 minutes. As long as the air being sucked in through the leaks is either warmer or colder than the interior of the house, the area surrounding the leakage path will change temperature and show up on the infrared scanner screen. Even if there is little temperature difference between inside and outside, an infrared scan may still be possible if the attic space has been warmed from solar radiation on the roof or the crawlspace has been cooled from the ground. A temperature difference of about five to 10 degrees is sufficient to expose the important leaks. This technique often allows you to find significant leaks without having to enter the attic or crawlspace.

- Other Diagnostic Techniques
  Many important air leaks in a building are not direct leaks to the outside. Air leaks often follow complicated paths through building cavities and through unconditioned zones (such as attics, crawlspaces or garages) on their way into or out of the building. Attic bypasses, found in many houses, are a good example of a series leak. Air leaving the house first must flow through the ceiling/attic boundary and then through the attic/roof boundary before exiting the house.

  Diagnostic procedures have been developed to analyze series leakage. These procedures, called zone pressure diagnostics (ZPD), are widely used by weatherization professionals to prioritize airsealing efforts in houses by estimating the amount of air leakage from attached zones (e.g. attics, crawlspaces, garages and basements). ZPD techniques typically combine blower door airtightness test results with zone pressure measurements made both before and after an opening or hole has been added to one surface of the zone being tested.

  Duct leakage to the outside can add to your overall airleakage values during a blower door test. One method of finding those leaks is using a pressure pan. You may also quantify the leakage to the outside by using the blower door subtraction method.

## Using the Can't Reach 50 Factor: One-Point Test

If you were performing a one-point test and the blower door fan was unable to depressurize the building by approximately 50 Pascals because one of the flow rings was installed, remove the ring and repeat the test (removing the flow ring will increase the maximum air flow available from the fan). If you were not able to depressurize the building by approximately 50 Pascals (with the "open fan" running at full speed) because the building is extremely leaky, use the following instructions:

### For DG-1000 and DG-700 Users

No adjustments to the test procedure above are necessary other than to make sure the gauge was in the PR/ FL @50 mode during the one-point test. If you can not achieve the target test pressure of 50 Pascals because the building is extremely leaky, a CFM50 leakage estimate will automatically be displayed on Channel B. The leakage estimate shown on Channel B is determined by continuously adjusting the measured air flow from the blower door fan to a test pressure of 50 Pascals, using the real-time Channel A building pressure reading and the can't reach 50 factors shown below.

| Building Pressure (Pa) | CRF Factor |
|---|---|
| 48 | 1.03 |
| 46 | 1.06 |
| 44 | 1.09 |
| 42 | 1.12 |
| 40 | 1.16 |
| 38 | 1.20 |
| 36 | 1.24 |
| 34 | 1.28 |
| 32 | 1.34 |
| 30 | 1.39 |
| 28 | 1.46 |
| 26 | 1.53 |
| 24 | 1.61 |
| 22 | 1.71 |
| 20 | 1.81 |
| 18 | 1.94 |
| 16 | 2.10 |
| 14 | 2.29 |
| 12 | 2.53 |
| 10 | 2.85 |

**Example:** With the fan running full speed, you are able to achieve a building pressure of 28 Pascals with a measured fan flow of 5,600 cfm. The corresponding CRF Factor for a building pressure of 28 Pascals is 1.46. The estimated flow needed to achieve the target pressure of 50 Pascals is
5,600 x 1.46 = 8,176 cfm.

$$\text{Can't Reach Fifty Factor} = \left\{ \frac{50}{\text{Current Test Pressure (Pa) (Channel A)}} \right\}^{0.65}$$

**Potential Errors In one-point CFM50 Estimate from Using the CRF Factors**
The table below show the potential errors in the one-point CFM50 leakage estimates from using the CRF factors. There are two main sources of error:

- The actual test pressure (Channel A) not being equal to the target pressure of 50 Pascals.
- The actual exponent of the leaks being measured differing from the assumed exponent of 0.65.

Actual Exponent "n"

| Test Pressure in Pa (Channel A) | 0.5 | 0.55 | 0.6 | 0.65 | 0.7 | 0.75 |
|---|---|---|---|---|---|---|
| **10** | 21.4% | 14.9% | 7.7% | 0.0% | -8.4% | -17.5% |
| **15** | 16.5% | 11.3% | 5.8% | 0.0% | -6.2% | -12.8% |
| **20** | 12.8% | 8.8% | 4.5% | 0.0% | -4.7% | -9.6% |
| **25** | 9.9% | 6.7% | 3.4% | 0.0% | -3.5% | -7.2% |
| **30** | 7.4% | 5.0% | 2.5% | 0.0% | -2.6% | -5.2% |
| **35** | 5.2% | 3.5% | 1.8% | 0.0% | -1.8% | -3.6% |
| **40** | 3.3% | 2.2% | 1.1% | 0.0% | -1.1% | -2.3% |
| **45** | 1.6% | 1.0% | 0.5% | 0.0% | -0.5% | -1.1% |
| **50** | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **55** | -1.4% | -1.0% | -0.5% | 0.0% | 0.5% | 0.9% |
| **60** | -2.8% | -1.8% | -0.9% | 0.0% | 0.9% | 1.8% |
| **65** | -4.0% | -2.7% | -1.3% | 0.0% | 1.3% | 2.6% |

For example, the table shows that for a one-point 50 Pa blower door building airtightness test, a 2.5% error would be introduced if the leakage estimate was determined at an actual test pressure of 30 Pa (Channel A), and the actual exponent of the leaks was 0.60 rather than the assumed value of 0.65.

## Testing in Windy Weather

During strong or gusty winds, building pressure readings can vary significantly. As wind gusts contact a building, the actual pressures within the building will change (10 to 20 Pa changes are common in windy weather). Under these conditions, you will need to spend more time watching the gauges to determine the "best" reading. Use of the time-averaging functions can help stabilize readings in windy conditions.

While conducting a multi-point blower door test over a wide range of building pressures will tend to even out some of the error introduced from moderate wind fluctuations, significant wind related error can still exist. Under very windy conditions, it is sometimes impossible to manually collect accurate and repeatable test data. Under these conditions, conducting a fully automated test using a DG-1000, and software or apps, may be the only way to collect accurate and repeatable test results. During an automated test hundreds of simultaneous measurements of building pressure and fan flow are quickly collected greatly reducing the variability of tests results due to wind.

## Blower Door Fan Calibration

**Model 3 (110V) Calibration Parameters**

| Fan Configuration | Calibration Parameters |
|---|---|
| Open Fan | Flow (CFM) = 506.8 x (Fan pressure in Pascals)$^{.4879}$ |
| Ring A Installed | Flow (CFM) = 190.1 x (Fan pressure in Pascals)$^{.4876}$ |
| Ring B Installed | Flow (CFM) = 60.67 x (Fan pressure in Pascals)$^{.4955}$ |
| Ring C Installed | Flow (CFM) = 21.37 x (Fan pressure in Pascals)$^{.5132}$ |
| Ring D Installed | Flow (CFM) = 7.216 x (Fan pressure in Pascals)$^{.4942}$ |
| Ring E Installed | Flow (CFM) = 2.726 x (Fan pressure in Pascals)$^{.5267}$ |

**Model 3 (230V) Calibration Parameters**

| Fan Configuration | Calibration Parameters |
|---|---|
| Open Fan | Flow (CFM) = 498.9 x (Fan pressure in Pascals)$^{.4918}$ |
| Ring A Installed | Flow (CFM) = 190.1 x (Fan pressure in Pascals)$^{.4889}$ |
| Ring B Installed | Flow (CFM) = 60.35 x (Fan pressure in Pascals)$^{.4958}$ |
| Ring C Installed | Flow (CFM) = 20.47 x (Fan pressure in Pascals)$^{.5178}$ |
| Ring D Installed | Flow (CFM) = 6.870 x (Fan pressure in Pascals)$^{.5022}$ |
| Ring E Installed | Flow (CFM) = 2.817 x (Fan pressure in Pascals)$^{.5139}$ |

All fan flows indicated on TEC gauges or flow tables are corrected to a standard air density of 0.075 lbs/cubic foot, and are not the actual volumetric flow going through the fan. The indicated flows are corrected to standard air density according to the CGSB Standard CAN/CG-SB-149.10-M86.

**Issues Affecting Fan Calibration**

Model 3 door fans maintain their calibration unless physical damage occurs. Conditions which could cause the fan calibration to change are primarily damaged flow sensors, movement of the motor and blades relative to the fan housing, and leaks in the sensor or tubing running from the flow sensor to the fan pressure tap. These conditions are easily detected and should be tested for on a regular basis. See the Fan Field Check Guide to learn more.

## Flow Conversion Tables: Model 3 (110V)

**Flow (CFM)**

| Fan Pressure (Pa) | Open Fan | Ring A | Ring B | Ring C |
|---|---|---|---|---|
| 16 | | | | 89 |
| 18 | | | | 94 |
| 20 | | | | 99 |
| 22 | | | | 104 |
| 24 | | | | 109 |
| 26 | 2484 | 931 | 305 | 114 |
| 28 | 2576 | 965 | 316 | 118 |
| 30 | 2664 | 998 | 327 | 122 |
| 32 | 2749 | 1030 | 338 | 127 |
| 34 | 2832 | 1061 | 348 | 131 |
| 36 | 2912 | 1091 | 358 | 134 |
| 38 | 2990 | 1120 | 368 | 138 |
| 40 | 3065 | 1149 | 377 | 142 |
| 42 | 3139 | 1176 | 387 | 145 |
| 44 | 3211 | 1203 | 396 | 149 |
| 46 | 3282 | 1230 | 404 | 152 |
| 48 | 3351 | 1255 | 413 | 156 |
| 50 | 3418 | 1281 | 421 | 159 |
| 52 | 3484 | 1305 | 430 | 162 |
| 54 | 3549 | 1330 | 438 | 165 |
| 56 | 3612 | 1353 | 446 | 169 |
| 58 | 3675 | 1377 | 454 | 172 |
| 60 | 3736 | 1400 | 461 | 175 |
| 62 | 3796 | 1422 | 469 | 178 |
| 64 | 3855 | 1444 | 476 | 181 |
| 66 | 3914 | 1466 | 484 | 183 |
| 68 | 3971 | 1488 | 491 | 186 |
| 70 | 4028 | 1509 | 498 | 189 |
| 72 | 4083 | 1530 | 505 | 192 |
| 74 | 4138 | 1550 | 512 | 195 |
| 76 | 4193 | 1571 | 519 | 197 |
| 78 | 4246 | 1591 | 525 | 200 |
| 80 | 4299 | 1610 | 532 | 202 |
| 82 | 4351 | 1630 | 539 | 205 |
| 84 | 4402 | 1649 | 545 | 208 |
| 86 | 4453 | 1668 | 551 | 210 |
| 88 | 4503 | 1687 | 558 | 213 |
| 90 | 4553 | 1706 | 564 | 215 |

| Fan Pressure (Pa) | Open Fan | Ring A | Ring B | Ring C |
|---|---|---|---|---|
| 92 | 4602 | 1724 | 570 | 218 |
| 94 | 4651 | 1742 | 576 | 220 |
| 96 | 4699 | 1760 | 582 | 222 |
| 98 | 4746 | 1778 | 588 | 225 |
| 100 | 4793 | 1796 | 594 | 227 |
| 102 | 4840 | 1813 | 600 | 229 |
| 104 | 4886 | 1830 | 606 | 232 |
| 106 | 4932 | 1847 | 612 | 234 |
| 108 | 4977 | 1864 | 617 | 236 |
| 110 | 5021 | 1881 | 623 | 238 |
| 112 | 5066 | 1898 | 629 | 241 |
| 114 | 5110 | 1914 | 634 | 243 |
| 116 | 5153 | 1930 | 640 | 245 |
| 118 | 5196 | 1946 | 645 | 247 |
| 120 | 5239 | 1962 | 650 | 249 |
| 122 | 5282 | 1978 | 656 | 251 |
| 124 | 5324 | 1994 | 661 | 254 |
| 126 | 5365 | 2010 | 666 | 256 |
| 128 | 5407 | 2025 | 672 | 258 |
| 130 | 5448 | 2041 | 677 | 260 |
| 132 | 5489 | 2056 | 682 | 262 |
| 134 | 5529 | 2071 | 687 | 264 |
| 136 | 5569 | 2086 | 692 | 266 |
| 138 | 5609 | 2101 | 697 | 268 |
| 140 | 5648 | 2116 | 702 | 270 |
| 142 | 5688 | 2130 | 707 | 272 |
| 144 | 5727 | 2145 | 712 | 274 |
| 146 | 5765 | 2159 | 717 | 276 |
| 148 | 5804 | 2174 | 722 | 278 |
| 150 | 5842 | 2188 | 726 | 280 |
| 152 | 5880 | 2202 | 731 | 281 |
| 154 | 5917 | 2216 | 736 | 283 |
| 156 | 5955 | 2230 | 741 | 285 |
| 158 | 5992 | 2244 | 745 | 287 |
| 160 | 6029 | 2258 | 750 | 289 |
| 162 | 6065 | 2272 | 755 | 291 |
| 164 | 6102 | 2285 | 759 | 293 |
| 166 | 6138 | 2299 | 764 | 294 |

## Flow Conversion Tables: Model 3 (110V) continued

Flow (CFM)

| Fan Pressure (Pa) | Open Fan | Ring A | Ring B | Ring C |
|---|---|---|---|---|
| 168 | 6174 | 2312 | 768 | 296 |
| 170 | 6210 | 2326 | 773 | 298 |
| 172 | 6245 | 2339 | 777 | 300 |
| 174 | 6281 | 2352 | 782 | 302 |
| 176 | 6316 | 2365 | 786 | 303 |
| 178 | 6351 | 2378 | 791 | 305 |
| 180 | 6385 | 2391 | 795 | 307 |
| 182 | 6420 | 2404 | 799 | 309 |
| 184 | 6454 | 2417 | 804 | 310 |
| 186 | 6488 | 2430 | 808 | 312 |
| 188 | 6522 | 2443 | 812 | 314 |
| 190 | | 2455 | 817 | 316 |
| 192 | | 2468 | 821 | 317 |
| 194 | | 2480 | 825 | 319 |
| 196 | | 2493 | 829 | 321 |
| 198 | | 2505 | 834 | 322 |
| 200 | | 2518 | 838 | 324 |
| 202 | | 2530 | 842 | 326 |
| 204 | | 2542 | 846 | 327 |
| 206 | | 2554 | 850 | 329 |
| 208 | | 2566 | 854 | 331 |
| 210 | | 2578 | 858 | 332 |
| 212 | | 2590 | 862 | 334 |
| 214 | | 2602 | 866 | 335 |
| 216 | | 2614 | 870 | 337 |
| 218 | | 2626 | 874 | 339 |
| 220 | | 2637 | 878 | 340 |
| 222 | | 2649 | 882 | 342 |
| 224 | | 2661 | 886 | 343 |
| 226 | | 2672 | 890 | 345 |
| 228 | | 2684 | 894 | 347 |
| 230 | | 2695 | 898 | 348 |
| 232 | | 2707 | 902 | 350 |
| 234 | | 2718 | 906 | 351 |
| 236 | | 2729 | 909 | 353 |
| 238 | | 2740 | 913 | 354 |
| 240 | | 2752 | 917 | 356 |
| 242 | | 2763 | 921 | 357 |

| Fan Pressure (Pa) | Open Fan | Ring A | Ring B | Ring C |
|---|---|---|---|---|
| 244 | | 2774 | 924 | 359 |
| 246 | | 2785 | 928 | 360 |
| 248 | | 2796 | 932 | 362 |
| 250 | | 2807 | 936 | 363 |
| 252 | | 2818 | 939 | 365 |
| 254 | | 2829 | 943 | 366 |
| 256 | | 2840 | 947 | 368 |
| 258 | | 2850 | 950 | 369 |
| 260 | | 2861 | 954 | 371 |
| 262 | | 2872 | 958 | 372 |
| 264 | | 2883 | 961 | 374 |
| 266 | | 2893 | 965 | 375 |
| 268 | | 2904 | 968 | 377 |
| 270 | | 2914 | 972 | 378 |
| 272 | | 2925 | 976 | 379 |
| 274 | | 2935 | 979 | 381 |
| 276 | | 2946 | 983 | 382 |
| 278 | | 2956 | 986 | 384 |
| 280 | | 2966 | 990 | 385 |
| 282 | | 2977 | 993 | 387 |
| 284 | | 2987 | 997 | 388 |
| 286 | | 2997 | 1000 | 389 |
| 288 | | 3007 | 1004 | 391 |
| 290 | | 3018 | 1007 | 392 |
| 292 | | 3028 | 1011 | 394 |
| 294 | | 3038 | 1014 | 395 |
| 296 | | 3048 | 1017 | 396 |
| 298 | | 3058 | 1021 | 398 |
| 300 | | 3068 | 1024 | 399 |
| 302 | | 3078 | 1028 | 400 |
| 304 | | 3088 | 1031 | 402 |
| 306 | | 3098 | 1034 | 403 |
| 308 | | 3108 | 1038 | 404 |
| 310 | | 3117 | 1041 | 406 |
| 312 | | 3127 | 1044 | 407 |
| 314 | | 3137 | 1048 | 408 |
| 316 | | 3147 | 1051 | 410 |
| 318 | | 3156 | 1054 | 411 |

## Flow Conversion Tables: Model 3 (110V) continued

Flow (CFM)

| Fan Pressure (Pa) | Open Fan | Ring A | Ring B | Ring C |
|---|---|---|---|---|
| 320 | | 3166 | 1057 | 412 |
| 322 | | 3176 | 1061 | 414 |
| 324 | | 3185 | 1064 | 415 |
| 326 | | 3195 | 1067 | 416 |
| 328 | | 3204 | 1070 | 418 |
| 330 | | 3214 | 1074 | 419 |
| 332 | | 3223 | 1077 | 420 |
| 334 | | 3233 | 1080 | 422 |
| 336 | | 3242 | 1083 | 423 |
| 338 | | 3252 | 1086 | 424 |
| 340 | | 3261 | 1090 | 425 |
| 342 | | 3270 | 1093 | 427 |
| 344 | | 3280 | 1096 | 428 |
| 346 | | 3289 | 1099 | 429 |
| 348 | | 3298 | 1102 | 431 |
| 350 | | 3307 | 1105 | 432 |
| 352 | | 3317 | 1109 | 433 |
| 354 | | 3326 | 1112 | 434 |
| 356 | | 3335 | 1115 | 436 |
| 358 | | 3344 | 1118 | 437 |
| 360 | | 3353 | 1121 | 438 |
| 362 | | 3362 | 1124 | 439 |
| 364 | | 3371 | 1127 | 441 |
| 366 | | 3380 | 1130 | 442 |
| 368 | | 3389 | 1133 | 443 |
| 370 | | 3398 | 1136 | 444 |
| 372 | | 3407 | 1139 | 446 |
| 374 | | 3416 | 1142 | 447 |
| 376 | | 3425 | 1145 | 448 |
| 378 | | 3434 | 1148 | 449 |
| 380 | | 3443 | 1151 | 450 |
| 382 | | 3452 | 1154 | 452 |
| 384 | | 3460 | 1157 | 453 |
| 386 | | 3469 | 1160 | 454 |
| 388 | | 3478 | 1163 | 455 |
| 390 | | 3487 | 1166 | 457 |
| 392 | | 3495 | 1169 | 458 |
| 394 | | 3504 | 1172 | 459 |
| 396 | | 3513 | 1175 | 460 |
| 398 | | 3521 | 1178 | 461 |
| 400 | | 3530 | 1181 | 462 |
| 402 | | 3538 | 1184 | 464 |
| 404 | | 3547 | 1187 | 465 |
| 406 | | 3556 | 1190 | 466 |
| 408 | | 3564 | 1193 | 467 |
| 410 | | 3573 | 1196 | 468 |
| 412 | | 3581 | 1198 | 470 |
| 414 | | 3590 | 1201 | 471 |
| 416 | | 3598 | 1204 | 472 |
| 418 | | 3606 | 1207 | 473 |
| 420 | | 3615 | 1210 | 474 |
| 422 | | 3623 | 1213 | 475 |
| 424 | | 3632 | 1216 | 477 |
| 426 | | 3640 | 1218 | 478 |
| 428 | | 3648 | 1221 | 479 |
| 430 | | 3657 | 1224 | 480 |
| 432 | | 3665 | 1227 | 481 |
| 434 | | 3673 | 1230 | 482 |
| 436 | | 3681 | 1233 | 483 |
| 438 | | 3690 | 1235 | 485 |
| 440 | | 3698 | 1238 | 486 |
| 442 | | 3706 | 1241 | 487 |
| 444 | | 3714 | 1244 | 488 |
| 446 | | 3722 | 1246 | 489 |
| 448 | | 3730 | 1249 | 490 |
| 450 | | 3739 | 1252 | 491 |
| 452 | | 3747 | 1255 | 492 |
| 454 | | 3755 | 1258 | 494 |
| 456 | | 3763 | 1260 | 495 |
| 458 | | 3771 | 1263 | 496 |
| 460 | | 3779 | 1266 | 497 |
| 462 | | 3787 | 1268 | 498 |
| 464 | | 3795 | 1271 | 499 |
| 466 | | 3803 | 1274 | 500 |
| 468 | | 3811 | 1277 | 501 |
| 470 | | 3819 | 1279 | 502 |

### Flow Conversion Tables: Model 3 (110V) continued

Flow (CFM)

| Fan Pressure (Pa) | Open Fan | Ring A | Ring B | Ring C |
|---|---|---|---|---|
| 472 | | 3827 | 1282 | 503 |
| 474 | | 3834 | 1285 | 505 |
| 476 | | 3842 | 1287 | 506 |
| 478 | | 3850 | 1290 | 507 |
| 480 | | 3858 | 1293 | 508 |
| 482 | | 3866 | 1295 | 509 |
| 484 | | 3874 | 1298 | 510 |
| 486 | | 3882 | 1301 | 511 |

| Fan Pressure (Pa) | Open Fan | Ring A | Ring B | Ring C |
|---|---|---|---|---|
| 488 | | 3889 | 1303 | 512 |
| 490 | | 3897 | 1306 | 513 |
| 492 | | 3905 | 1309 | 514 |
| 494 | | 3913 | 1311 | 515 |
| 496 | | 3920 | 1314 | 516 |
| 498 | | 3928 | 1317 | 518 |
| 500 | | 3936 | 1319 | 519 |

### Flow Conversion Tables: Rings D and E (Model 3 (110V))

Flow (CFM)

| Fan Pressure (Pa) | Low-Flow Ring D | Low-Flow Ring E |
|---|---|---|
| 15 | 28 | 11 |
| 20 | 32 | 13 |
| 25 | 35 | 15 |
| 30 | 39 | 16 |
| 35 | 42 | 18 |
| 40 | 45 | 19 |
| 45 | 47 | 20 |
| 50 | 50 | 21 |
| 55 | 52 | 22 |
| 60 | 55 | 24 |
| 65 | 57 | 25 |
| 70 | 59 | 26 |
| 75 | 61 | 26 |
| 80 | 63 | 27 |
| 85 | 65 | 28 |
| 90 | 67 | 29 |
| 95 | 68 | 30 |
| 100 | 70 | 31 |
| 105 | 72 | 32 |
| 110 | 74 | 32 |
| 115 | 75 | 33 |
| 120 | 77 | 34 |
| 125 | 78 | 35 |
| 130 | 80 | 35 |
| 135 | 81 | 36 |

| Fan Pressure (Pa) | Low-Flow Ring D | Low-Flow Ring E |
|---|---|---|
| 140 | 83 | 37 |
| 145 | 84 | 37 |
| 150 | 86 | 38 |
| 155 | 87 | 39 |
| 160 | 89 | 39 |
| 165 | 90 | 40 |
| 170 | 91 | 41 |
| 175 | 93 | 41 |
| 180 | 94 | 42 |
| 185 | 95 | 43 |
| 190 | 96 | 43 |
| 195 | 98 | 44 |
| 200 | 99 | 44 |
| 205 | 100 | 45 |
| 210 | 101 | 46 |
| 215 | 103 | 46 |
| 220 | 104 | 47 |
| 225 | 105 | 47 |
| 230 | 106 | 48 |
| 235 | 107 | 48 |
| 240 | 108 | 49 |
| 245 | 109 | 49 |
| 250 | 110 | 50 |
| 255 | 112 | 50 |
| 260 | 113 | 51 |

### Flow Conversion Tables: Rings D and E (Model 3 (110V)) continued

**Flow (CFM)**

| Fan Pressure (Pa) | Low-Flow Ring D | Low-Flow Ring E |
|---|---|---|
| 265 | 114 | 52 |
| 270 | 115 | 52 |
| 275 | 116 | 53 |
| 280 | 117 | 53 |
| 290 | 119 | 54 |
| 295 | 120 | 54 |

| Fan Pressure (Pa) | Low-Flow Ring D | Low-Flow Ring E |
|---|---|---|
| 300 | 121 | 55 |
| 305 | 122 | 55 |
| 310 | 123 | 56 |
| 315 | 124 | 56 |
| 320 | 125 | 57 |

## Air Density Correction Factors: Depressurization

Inside Temperature (F)

Outside Temperature (F)

| | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 |
|---|---|---|---|---|---|---|---|---|---|
| **-20** | 0.929 | 0.924 | 0.920 | 0.915 | 0.911 | 0.907 | 0.903 | 0.898 | 0.894 |
| **-15** | 0.934 | 0.930 | 0.925 | 0.921 | 0.916 | 0.912 | 0.908 | 0.904 | 0.899 |
| **-10** | 0.939 | 0.935 | 0.930 | 0.926 | 0.921 | 0.917 | 0.913 | 0.909 | 0.904 |
| **-5** | 0.945 | 0.940 | 0.935 | 0.931 | 0.927 | 0.922 | 0.918 | 0.914 | 0.909 |
| **0** | 0.950 | 0.945 | 0.941 | 0.936 | 0.932 | 0.927 | 0.923 | 0.919 | 0.914 |
| **5** | 0.955 | 0.950 | 0.946 | 0.941 | 0.937 | 0.932 | 0.928 | 0.924 | 0.919 |
| **10** | 0.960 | 0.955 | 0.951 | 0.946 | 0.942 | 0.937 | 0.933 | 0.929 | 0.924 |
| **15** | 0.965 | 0.960 | 0.956 | 0.951 | 0.947 | 0.942 | 0.938 | 0.934 | 0.929 |
| **20** | 0.970 | 0.965 | 0.961 | 0.956 | 0.952 | 0.947 | 0.943 | 0.938 | 0.934 |
| **25** | 0.975 | 0.970 | 0.966 | 0.961 | 0.957 | 0.952 | 0.948 | 0.943 | 0.939 |
| **30** | 0.980 | 0.975 | 0.971 | 0.966 | 0.962 | 0.957 | 0.953 | 0.948 | 0.944 |
| **35** | 0.985 | 0.980 | 0.976 | 0.971 | 0.966 | 0.962 | 0.957 | 0.953 | 0.949 |
| **40** | 0.990 | 0.985 | 0.981 | 0.976 | 0.971 | 0.967 | 0.962 | 0.958 | 0.953 |
| **45** | 0.995 | 0.990 | 0.985 | 0.981 | 0.976 | 0.972 | 0.967 | 0.963 | 0.958 |
| **50** | 1.000 | 0.995 | 0.990 | 0.986 | 0.981 | 0.976 | 0.972 | 0.967 | 0.963 |
| **55** | 1.005 | 1.000 | 0.995 | 0.990 | 0.986 | 0.981 | 0.977 | 0.972 | 0.968 |
| **60** | 1.010 | 1.005 | 1.000 | 0.995 | 0.991 | 0.986 | 0.981 | 0.977 | 0.972 |
| **65** | 1.015 | 1.010 | 1.005 | 1.000 | 0.995 | 0.991 | 0.986 | 0.981 | 0.977 |
| **70** | 1.019 | 1.014 | 1.010 | 1.005 | 1.000 | 0.995 | 0.991 | 0.986 | 0.982 |
| **75** | 1.024 | 1.019 | 1.014 | 1.009 | 1.005 | 1.000 | 0.995 | 0.991 | 0.986 |
| **80** | 1.029 | 1.024 | 1.019 | 1.014 | 1.009 | 1.005 | 1.000 | 0.995 | 0.991 |
| **85** | 1.034 | 1.029 | 1.024 | 1.019 | 1.014 | 1.009 | 1.005 | 1.000 | 0.995 |
| **90** | 1.038 | 1.033 | 1.028 | 1.024 | 1.019 | 1.014 | 1.009 | 1.005 | 1.000 |
| **95** | 1.043 | 1.038 | 1.033 | 1.028 | 1.023 | 1.019 | 1.014 | 1.009 | 1.005 |
| **100** | 1.048 | 1.043 | 1.038 | 1.033 | 1.028 | 1.023 | 1.018 | 1.014 | 1.009 |
| **105** | 1.053 | 1.047 | 1.042 | 1.037 | 1.033 | 1.028 | 1.023 | 1.018 | 1.014 |
| **110** | 1.057 | 1.052 | 1.047 | 1.042 | 1.037 | 1.032 | 1.027 | 1.023 | 1.018 |

To use the air density correction factor, multiply the measured fan flow by the appropriate correction factor from the Table above. For example, if the measured fan flow was 3,200 cfm, and during the test the inside temperature was 70 F and the outside temperature was 40 F, the appropriate correction factor would be 0.971. The density corrected fan flow is 3,200 x 0.971 = 3,107 cfm.

**Altitude Correction Factor = (1+(.000006 x altitude)) x CFM50**

## Air Density Correction Factors: Pressurization

Inside Temperature (F)

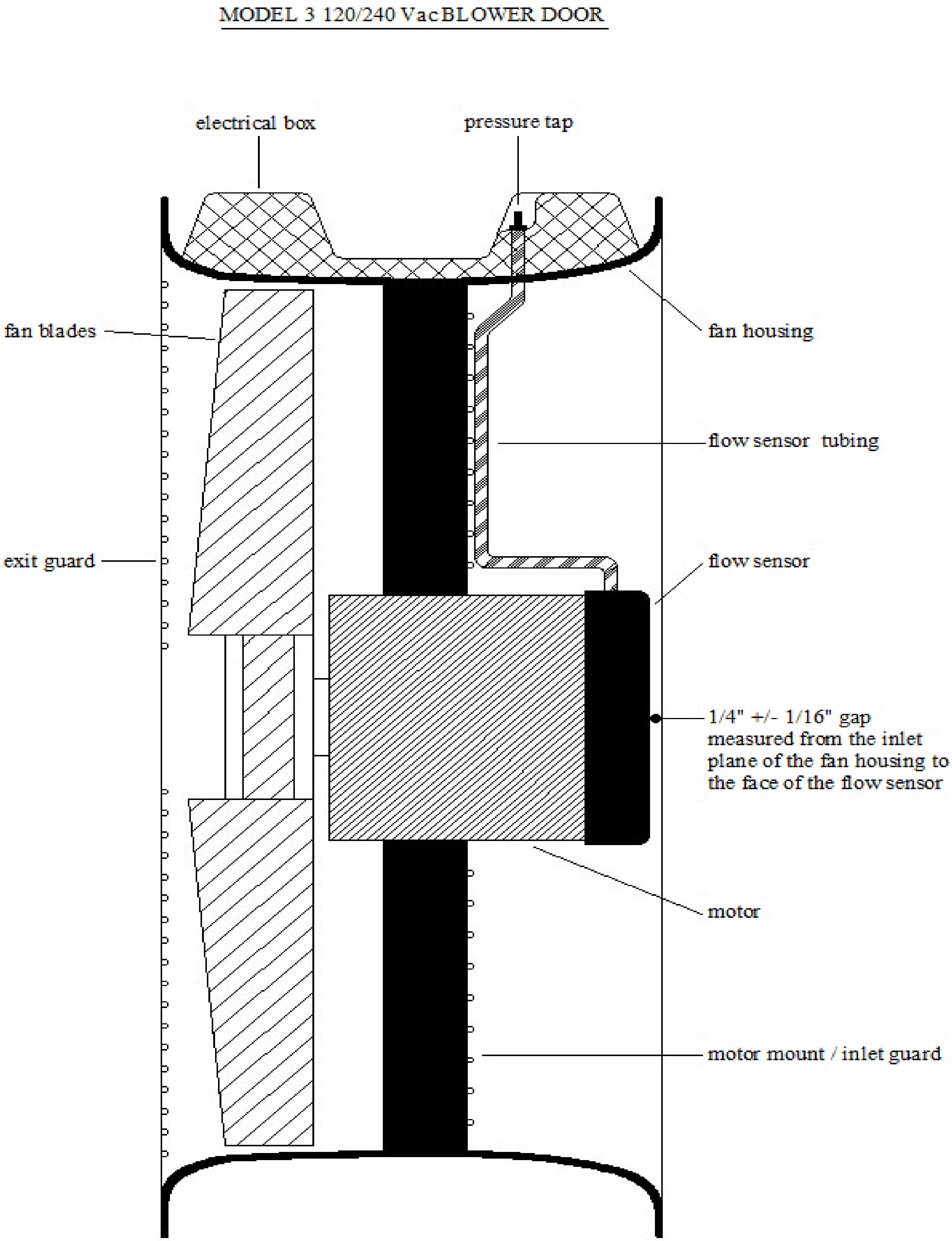
Outside Temperature (F)

| | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 |
|---|---|---|---|---|---|---|---|---|---|
| **-20** | 1.077 | 1.082 | 1.087 | 1.092 | 1.098 | 1.103 | 1.108 | 1.113 | 1.118 |
| **-15** | 1.071 | 1.076 | 1.081 | 1.086 | 1.091 | 1.097 | 1.102 | 1.107 | 1.112 |
| **-10** | 1.065 | 1.070 | 1.075 | 1.080 | 1.085 | 1.090 | 1.096 | 1.101 | 1.106 |
| **-5** | 1.059 | 1.064 | 1.069 | 1.074 | 1.079 | 1.084 | 1.089 | 1.095 | 1.100 |
| **0** | 1.053 | 1.058 | 1.063 | 1.068 | 1.073 | 1.078 | 1.084 | 1.089 | 1.094 |
| **5** | 1.047 | 1.052 | 1.058 | 1.063 | 1.068 | 1.073 | 1.078 | 1.083 | 1.088 |
| **10** | 1.042 | 1.047 | 1.052 | 1.057 | 1.062 | 1.067 | 1.072 | 1.077 | 1.082 |
| **15** | 1.036 | 1.041 | 1.046 | 1.051 | 1.056 | 1.061 | 1.066 | 1.071 | 1.076 |
| **20** | 1.031 | 1.036 | 1.041 | 1.046 | 1.051 | 1.056 | 1.061 | 1.066 | 1.070 |
| **25** | 1.025 | 1.030 | 1.035 | 1.040 | 1.045 | 1.050 | 1.055 | 1.060 | 1.065 |
| **30** | 1.020 | 1.025 | 1.030 | 1.035 | 1.040 | 1.045 | 1.050 | 1.055 | 1.059 |
| **35** | 1.015 | 1.020 | 1.025 | 1.030 | 1.035 | 1.040 | 1.044 | 1.049 | 1.054 |
| **40** | 1.010 | 1.015 | 1.020 | 1.025 | 1.030 | 1.034 | 1.039 | 1.044 | 1.049 |
| **45** | 1.005 | 1.010 | 1.015 | 1.020 | 1.024 | 1.029 | 1.034 | 1.039 | 1.044 |
| **50** | 1.000 | 1.005 | 1.010 | 1.015 | 1.019 | 1.024 | 1.029 | 1.034 | 1.038 |
| **55** | 0.995 | 1.000 | 1.005 | 1.010 | 1.014 | 1.019 | 1.024 | 1.029 | 1.033 |
| **60** | 0.990 | 0.995 | 1.000 | 1.005 | 1.010 | 1.014 | 1.019 | 1.024 | 1.028 |
| **65** | 0.986 | 0.990 | 0.995 | 1.000 | 1.005 | 1.009 | 1.014 | 1.019 | 1.024 |
| **70** | 0.981 | 0.986 | 0.991 | 0.995 | 1.000 | 1.005 | 1.009 | 1.014 | 1.019 |
| **75** | 0.976 | 0.981 | 0.986 | 0.991 | 0.995 | 1.000 | 1.005 | 1.009 | 1.014 |
| **80** | 0.972 | 0.977 | 0.981 | 0.986 | 0.991 | 0.995 | 1.000 | 1.005 | 1.009 |
| **85** | 0.967 | 0.972 | 0.977 | 0.981 | 0.986 | 0.991 | 0.995 | 1.000 | 1.005 |
| **90** | 0.963 | 0.968 | 0.972 | 0.977 | 0.982 | 0.986 | 0.991 | 0.995 | 1.000 |
| **95** | 0.959 | 0.963 | 0.968 | 0.973 | 0.977 | 0.982 | 0.986 | 0.991 | 0.995 |
| **100** | 0.954 | 0.959 | 0.964 | 0.968 | 0.973 | 0.977 | 0.982 | 0.987 | 0.991 |
| **105** | 0.950 | 0.955 | 0.959 | 0.964 | 0.969 | 0.973 | 0.978 | 0.982 | 0.987 |
| **110** | 0.946 | 0.951 | 0.955 | 0.960 | 0.964 | 0.969 | 0.973 | 0.978 | 0.982 |

To use the air density correction factor, multiply the measured fan flow by the appropriate correction factor from the Table above. For example, if the measured fan flow was 3,200 cfm, and during the test the inside temperature was 70 F and the outside temperature was 40 F, the appropriate correction factor would be 1.030. The density corrected fan flow is 3,200 x 1.030 = 3,296 cfm.

**Altitude Correction Factor = (1+(.000006 x altitude)) x CFM50**

## Schematic of the Model 3 Fan



## Blower Door Fan Maintenance and Safety

There are several maintenance tips and procedures to ensure the proper operation of the blower door fan and to avoid any safety risks.

### Maintenance Checks

- Examine the motor cooling holes for excessive dust build-up. Use a vacuum with a brush attachment to remove dust, or blow out the dust with compressed air.
- Inspect housing, blades and guards. Especially note clearance of blade tips relative to the fan housing. There should be about 1/4 inch of clearance.
- Inspect electrical wiring and electrical connections on the fan and the fan speed controller.

### General Operational Notes and Tips

- For long-term operation, such as maintaining house pressure while air-sealing, use a flow ring whenever possible to ensure good airflow over the fan.
- The motor is thermally protected and if you experience a motor shut down, be sure to turn off the fan speed controller so that the fan does not restart unexpectedly after the motor cools down.
- Make sure to press the power plug firmly into power receptacle on fan. Failure to do so can cause overheating of the power cord and possible damage.
- Do not use ungrounded outlets or adapter plugs.
- Do not operate if the motor, controller or any of the electrical connections are wet.

The blower door fan is a very powerful and potentially dangerous piece of equipment if not used and maintained properly. Carefully examine the fan before each use. If the fan housing, fan guards, blade, controller or cords become damaged, do not operate the fan until repairs have been made. Keep people and pets away from the fan when it is operating. Contact The Energy Conservatory if there are any unusual noises or vibrations while the fan is running.

## Model 3 Blower Door Specifications

| COMPONENT | SPECIFICATIONS | |
|---|---|---|
| **Model 3 Blower Door Fan** | Maximum Flow | 6,300 CFM at free air (2,973 l/s, 10,700 m3/h)<br>5,350 CFM at 50 Pa (2,524 l/s, 9,090 m3/h)<br>4,900 CFM at 75 Pa (2,360 l/s, 8.495 m3/h) |
| | Minimum Flow | 300 CFM with Ring B (141 l/s, 510 m3/h)<br>85 CFM with Ring C (40 l/s, 144m3/h)<br>30 CFM with Ring D (14 l/s, 51 m3/h)<br>11 CFM with Ring E (5 l/s, 18 m3/h) |
| | Dimensions | 20 in. (50 cm) inlet diameter, 10.25 in (26 cm) length |
| | Weight | 33 lbs. (15 kg) with Flow Rings A & B |
| | Flow Accuracy | +/- 3% with DG-700 or DG-1000, Rings D & E +/- 4% or 1 CFM |
| | Calibration | Meets ASTM Standard E779, E1554, CGSB-149.10-M86,<br>EN 13829, ATTMA Technical Standard 1, NFPA 2001, RESNET and USACE |
| | Power | 3/4 hp motor available in 110V or 220V |
| **Adjustable Frame and Frame Material** | Frame Material | Extruded aluminum |
| | Width | 28 in. to 40 in. (71 cm to 101 cm) |
| | Height | 52 in. to 96 in. (132 cm to 244 cm) |
| | Seal | EPDM flexible gasket |
| | Panel Material | Nylon with built-in vinyl window |

Specifications subject to change without notice.

## OTHER RESOURCES

### 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
- Using the DG-1000 with the Minneapolis Blower Door
- Using the DG-700 with the Minneapolis Blower Door
- Test Results and Sample Test Forms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