Setting Up a Three Fan Minneapolis Blower Door System for Automated Testing





A. Parts List

The following is a complete listing of items included in a Three Fan Minneapolis Blower Door System.

Standard Equipment:

1. Model 3 Blower Door Fans

Includes:

- Three 3/4 hp Model 3 fans (maximum flow of 5,250 cfm • at 50 Pa, and 4,900 cfm at 75 Pa).
- Three sets of Flow Rings (A and B, • and No-Flow Plate).
- Three Red Nylon Fan Caps can be • used in place of the Flow Ring Set to seal off fans during a Baseline reading, or when fans are not used.

2. Commercial Sized Adjustable Aluminum Frame Includes:

- Two adjustable vertical pieces that extend to 96". •
- Top and bottom adjustable horizontal pieces that • extend to 48".
- Three cross bars one lower and two upper bars. •
- Three gauge hanger bars. •
- Soft-shell frame case with shoulder strap.

3. Blower Door Fan Speed Controllers and **Commercial Mounting Board** Includes:

- Three variable speed fan controllers with auto • communication jacks.
- One commercial controller mounting board with • adjustable clamp (holds 3 controllers)

4. DG-700 Gauges with Gauge Boards

Includes:

- Two (or three) DG-700 digital gauges with both USB and • RS-232 communication ports.
- Soft-shell gauge cases.
- Two (or three) gauge boards with adjustable clamp. •

Note: The Three Fan System can be purchased with either two or three DG-700 gauges and gauge boards. A third gauge is useful to monitor additional pressures (envelope, interior, etc) during the test.

Note: A 2 fan system will be similar but will include 2 fans and speed controllers, two fan caps, 1 accessory case, a 2-hole nylon panel, and 1 upper frame cross bar.













5. Red Nylon 3-Hole Panel

The nylon panel is sealed into an exterior door opening using the adjustable aluminum frame. The panel contains 3 holes – one for each of the Blower Door fans. The panel can be used in a doorway up to 48" wide and 96" tall.

6. Commercial Fan Control Cabling

Includes:

- Three 4' control cables (tethered together).
- One 3-1 splitter.

The commercial fan control cable allows all 3 fans to be controlled (via TECLOG2) using a single DG-700 gauge.

Note: A standard 12" fan control cable is also included with each DG-700 gauge.

7. Commercial Tubing Kit

Includes:

- Red three 4' lengths.
- Green one 15' length and one 7' length.
- Blue one 18' manifold.
- White one 15' length.
- Clear one 30' length.

8. Accessory Cases

The 3 Fan System comes with two accessory cases which are used for carrying speed controllers, gauges, mounting boards, red nylon panel, tubing, cables and manuals.

9. TECLOG2 Software

The Energy Conservatory's TECLOG2 software is designed to work with up to 16 DG-700 digital pressure gauges to monitor and store data from differential pressure channels, and to provide computerized control of multiple Minneapolis Blower Door fans. The program provides easy control of data acquisition parameters and includes a feature to calculate multi-fan airtightness test results.









Optional Accessories:

DB9 to CAT5 Adapters

The DB9 to CAT5 adapters allow you to easily connect your DG-700 gauge(s) to your computer over very long distances using standard CAT5 cable (up to 3,000 feet). The male adapter attaches to the RS-232 serial port on the top of your DG-700 gauge, and the female adaptor connects to either the optional 8 port hub (see below), to an optional USB to Serial adapter, or directly to an RS-232 port on your laptop (older laptops only).



Note: Each DG-700 gauge also comes with a standard 15" USB cable for short connection distances.

8 Port DB9 to USB Hub

The Eight-Port DB-9 to USB Adapter Hub provides 8 separate RS-232 serial communication ports through a single USB connection to your computer. This allows you take advantage of the very long cable lengths available with RS-232 communication ports when connecting multiple DG-700 gauges to your computer.



This kit makes it easier to connect 2 DG-700's to your laptop over long distances by allowing you to run a single CAT5 cable rather than two separate CAT5 cables. The kit includes:

- 2 sets of the male/female DB9/CAT5 adapters.
- 3 one foot CAT5 cable
- 1 three foot CAT5 cable
- 2 CAT5 splitters
- 2 CAT5 couplers



Completed connection between two DG-700 gauges and a laptop using the CAT5 Splitter Kit and 8 Port DB9 to USB Hub





Reusable Fan Shipping Box

Heavy-duty black fan shipping box can be re-used multiple times for shipping your Blower Door fan to the job site.



Additional Tubing

Additional tubing is available in 50 and 100 foot lengths, and 500 foot rolls in the following nine colors: Blue, black, clear, green, orange, purple, red, white, and yellow.

Custom Fan Calibration

Some test protocols, such as the Army Corp of Engineers, require a custom fan calibration certificate. TEC can provide a custom fan calibration certificate for an additional cost of \$200 per fan.

B. Setting Up the Frame and Panel

Installation of the commercial aluminum frame and 3-hole panel is very similar to installation of the standard Minneapolis Blower Door frame and panel (see instructions in Chapter 3 of the Blower Door operation manual).

- First fit the frame loosely into the door opening without the cross bars (frame weatherstripping should just be touching the sides of the door jam). Tighten the adjustment knobs.
- Remove frame from opening and attach panel to frame using velcro tabs – attach short velcro tabs on bottom of panel first and then pull panel tightly over the frame. Now attach remaining velcro tabs to secure panel tightly to frame. To orient the panel, be sure the green patch containing a bulkhead for attaching tubing is located in the lower right corner when the panel is installed on the frame.
- Green Patch
- Insert frame and panel into door opening. Install the lower cross bar and two upper cross bars into the slots on vertical frame pieces. Each cross bar should be centered in the fabric space between the fan holes (about 2 inches above the hole).
- Tighten the frame into the opening by engaging the cam levers on the frame. Because the frame and panel will be holding 3 fans, it is very important that the frame be installed very tightly into the door opening. If the frame does not fit tight enough, disengage the cam levers, re-adjust the frame (using the adjustment knobs) to fit tighter in the opening, and then re-engage the cam levers. You should be able to pull tightly on the frame without dislodging it from the door opening.

C. Installing the Fans

Once the frame and panel are securely installed in the door opening, install the three fans in the holes in the red nylon panel. Start with the lower fan and work your way up. Secure each fan to the cross bar just above it by slipping the Velcro strap from the cross bar through the fan handle and looping it up and back around the cross bar. Pull the strap tight and engage the Velcro.

For a depressurization test, the side of the fan with the Flow Rings and Flow Sensor should be located inside the building. For a pressurization test, the fan installation is reversed with the Flow Rings and Flow Sensor located outside of the building.

Note: The red nylon fan caps can be used in place of the Flow Ring Set to seal off fans during a Baseline reading, or when fans are not used.



D. Installing the Speed Controllers

Slide the 3 fan speed controllers onto the commercial mounting board using the clips on the back of the controller enclosures. Use the C-clamp on the back of the mounting board to attach the board to the left side of the lowest cross bar. <u>Be sure the speed control knobs are set to off.</u>

Plug the fan connect cord from each of the controllers into the 3 fans. Connect the lower controller to lower fan, middle controller to middle fan, and upper controller to upper fan.

Plug each of the controller's power cords into separate wall circuits that are compatible with the power requirements of the fan and speed controller. <u>Because an 110V Blower Door fan</u> can draw a maximum of 12-14 amps, you should plug each fan into different electrical circuits. Outlets can be tested to determine if they are on separate circuits using a voltage meter as follows:

- Plug fan 1 into any wall outlet.
- Check voltage at proposed outlet for fan 2
- Turn on fan1.
- If voltage on proposed fan 2 outlet does not change, it is on a separate circuit.
- Repeat for proposed fan 3 outlet by turning on fan 1 and then fan 2 to look for voltage changes

Extension cords should be #14 gauge or better.



E. Installing the DG-700 Gauges for Automated Testing

Attach each of the DG-700 gauges to one of the black gauge boards using the Velcro strips found on the back of the gauge. Attach the first gauge and board to the <u>left side</u> of the middle cross bar using the C-clamp on the board. Attach the second gauge and board to the <u>right side</u> of the middle cross bar.



F. Attaching the Fan Control Cable

Now plug the commercial fan control cable (single plug on the three way splitter) into the fan control output jack on top of the <u>left side gauge</u>. We will use the fan control output jack on the <u>left side gauge</u> to control all 3 fans via the TECLOG2 software. When using this setup, all 3 fans are controlled together and cannot be independently adjusted (this works well for large building testing).

If you have more than 2 gauges, the location of these additional gauges will be determined by which pressure signals they are measuring.

We now need to need to insert the 3 remaining plugs on the commercial fan control cable into the 3 communication jacks on the side of the fan speed controllers (the order in which they are connected does not matter).

Controllers are activated by turning them to the "just on" position (turning the controller knob on and then all of the way down). If you do not need all three fans, simply turn those controllers to the off position.



G. Tubing Connections

For multi-fan Blower Door systems, we recommend that all ports on the DG-700 gauges have tubing connected at all times to protect from noisy readings caused by air currents.

Fan Flow / Red tubing (three 4' lengths)

- On the <u>left side gauge</u>, connect one of the red tubing lengths from the **Channel B Input** tap to the pressure tap on the lower Blower Door fan.
- On the <u>right side gauge</u>, use the remaining two lengths of red tubing to connect the **Channel A Input** tap to the middle fan, and the **Channel B Input** tap to the top fan.

Outside Building Reference / Green tubing (one 7' length and one 15' length)

- On the <u>left side gauge</u>, connect the 7' green tube from the **Channel A Reference** tap to the <u>indoor side</u> of the pressure tap on the green patch, located at the lower right corner of the red nylon panel.
- Connect the one end of the 15' green tube to the <u>outdoor side</u> of the pressure tap on the green patch. The other end of this tube should be placed on an outside wall of the building, away from the air flow of the Blower Door fans.

Building Pressure / White tubing (one 15' length)

• On the <u>left side gauge</u>, connect one end of white tubing to the **Channel A Input** tap and run the other end to an <u>inside location</u> away from the turbulent air streams near the Blower Door system.

Fan Flow Reference / Blue Manifold (one 18' length with two T's)

- The Blue Manifold is used to connect the fan pressure reference taps together. The end of the blue manifold with the two short tubing pieces should be connected to the **Channel A** and **B Reference** taps on the <u>right side gauge</u>. The remaining short tubing piece should be connected to the **Channel B Reference** tap on the left side gauge.
- <u>When conducting a depressurization test</u> of the building, run the remaining end of the blue manifold to an inside location away from the turbulent air streams near the Blower Door system.
- <u>For a pressurization test</u> of the building, connect the remaining end of the blue manifold to the <u>indoor side</u> of the pressure tap on the <u>blue patch</u>, located at the center right side of the red nylon panel.



Tubing Connections – Depressurization Test

H. Connecting the DG-700 Gauges to Your Computer for Automated Testing

Since November 2009, all DG-700 gauges are equipped with both a USB and a DB9 RS-232 Serial Communication Port (DB-9) Either of these ports can be used to create a 2-way communication link between the gauge and a computer. (DG-700 gauges sold prior to November 2009 do not have a USB port). Below are examples of different ways to connect the DG-700 Gauges to your computer when conducting an automated test.



USB Serial Fan Control Communication Communication Output Jack Port Port

Connection Options:

a. Standard USB Communication Port (included with the system) In order to create a communication link using the USB communication port on your gauge and a USB port on your computer, you will need the standard15' USB (A-mini B) cable that came with your Blower Door System. You will also need to install the appropriate USB Driver for the DG-700 gauge that comes with the USB cable. The USB cable option is limited by the 15' cable length. <u>This is</u> the preferred option for standard single fan testing.



b. DB9 RS-232 Serial Communication Port (optional accessories)

There are 3 options for creating a communication link using the DB9 RS-232 port on your gauge and a USB port on your computer. The necessary parts for all 3 options are available for purchase from The Energy Conservatory.

Option #1 - DB9 to CAT5 Adapters, CAT5 cable, and an 8 Port Hub

DB9 to CAT5 adapter sets (one for each DG-700 gauge) along with an 8 Port DB9 to USB Hub lets you take advantage of long

lengths of standard CAT5 cable (up to 3,000 ft) to create communication links with multiple DG-700 gauges. <u>This is the preferred option in large buildings using multi-fan systems.</u> The 8 Port Hub comes with all necessary drivers for your computer.





Option #2 - DB9 serial cable, and USB to Serial adapter

This option combines a standard 6' serial cable (to connect to the DG-700) and a USB to Serial adapter (to connect to your computer). Insert the male end of the serial cable into the top of your DG-700 serial port, and then connect the female end of the serial cable into the USB RS-232 adapter. Insert the USB end of the Serial adapter into your computer. You are limited by the 6' length of the serial cable. The USB to Serial adapter comes with all necessary drivers for your computer.





Option #3 - DB9 to CAT5 Adapters, CAT5 cable, and a USB to Serial adaptor

Like Option #1 above, DB9 to CAT5 adapter sets let you take advantage of long lengths of standard CAT5 cable (up to 3,000 ft) to create communication links with between the DG-700 gauge and the computer. This configuration requires a separate USB to RS-232 Serial adapter for each DG-700 that you will create a communication link with. The USB to Serial adapter comes with all necessary drivers

Serial adapter comes with all necessary drivers for your computer.

Note: If your computer has a DB9 RS-232 port(s), you can connect the DB9 to CAT5 adapter directly to the computer and omit the USB to Serial adapter.





Typical Set-Up of a Three Fan Minneapolis Blower Door System For an Automated Depressurization Test Using the TECLOG2 Software

Left Side Gauge:

- Channel A measures the building envelope pressure.
- **Channel B** measures fan flow from bottom fan.
- Commercial fan control cable plugged into the fan control jack.
- DB9/CAT5 adapter plugged into RS-232 port.



- CAT5 Splitter Kit being used to connect single CAT5 cable run to USB Hub for two gauges.

- CAT5 Splitter Kit being used to combine CAT5 cables from the two gauges into a single CAT5 cable run.

Right Side Gauge:

flow from top fan.

into RS-232 port.

Channel A measures fan

- Channel B measures fan

- DB9/CAT5 adapter plugged

flow from middle fan.

- Three fan speed controllers on one mounting board clamped to the lower cross bar.
- 3 plugs from commercial fan control cable inserted into fan control jacks.
- Each fan speed controller is plugged into a separate electrical circuit.