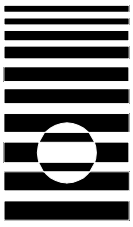
Operation and Maintenance Tips

for

Energy Conservatory Test Instruments

(revised Oct 2004)



The ENERGY CONSERVATORY

DIAGNOSTIC TOOLS TO MEASURE BUILDING PERFORMANCE

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A. Checking for Leaky Tubing

It does not happen very often, but leaky tubing can seriously degrade the accuracy of Blower Door and Duct Blaster airtightness tests. These leaks can be small enough to go undetected for years but large enough to affect fan calibration. A perfect example is the hole created when a cat bites through a piece of tubing. (Yes, this does really happen).

Procedure: Before starting, inspect both ends of the tubing to make sure they are not stretched out to the point where they will not make a good seal when attached to a gauge.

- Seal off one end of the tubing by doubling it over on itself near the end.
- Create a vacuum in the tubing by sucking on the open end (make sure the tubing is relatively clean first!). Then let the end of the tubing stick to your tongue due to the vacuum. The tubing should stick to your tongue indefinitely if there are no leaks. Waiting for 5 seconds or so is a good enough test.

B. Model 3 Blower Door Fan

1. Calibration

This section relates to the Blower Door fan itself, and not the pressure gauges. Blower Door fans manufactured by The Energy Conservatory maintain their calibration unless physical damage occurs. Conditions which could cause your fan calibration to change are primarily damaged flow sensors and movement of the motor and blades relative to the fan housing. These conditions are easily detected and should be tested for regularly.

Damaged Blower Door Flow Sensor

The flow sensor is the white ring which is permanently attached to the end of the motor opposite the fan blade. It is perhaps the most critical part of your Blower Door fan.

Procedure:

- First visually confirm that the sensor is not broken or deformed due to impact.
- Check that the clips which hold the sensor in place are properly engaged, such that the sensor is seated firmly on the end of the motor.

Next, perform a test for sensor leakage (this test is easier if you first place the fan in an elevated position such as on a bench top or table.)

- Attach your fan pressure tubing to the tap on the Blower Door fan as you normally would for testing. Leave the other end of the fan tubing open (i.e. disconnect it from the gauge).
- There are 4 intentional holes in the flow sensor. They are evenly spaced around the outer rim of the sensor. Locate these holes and temporarily seal them by covering with masking tape. Next, create a vacuum in the fan pressure tubing by sucking on the open end. Make sure that the vacuum persists for at least 5 seconds. If you can not maintain a vacuum, the sensor has a leak and should be replaced. Contact The Energy Conservatory to further diagnose the problem.

Blower Door Motor Position

If a fan has been dropped, the motor may have shifted from its proper position in the motor mount. This can degrade the fan calibration.

Procedure:

- Lay the fan on its side with the flow sensor facing up.
- Place a straightedge (such as a heavy yardstick on edge) across the inlet of the fan.
- Use a ruler to measure the distance from the bottom of the straightedge to the face of the flow sensor. This distance should be in the range $3/16^{th}$ to $5/16^{th}$ inches. If not, call The Energy Conservatory to further diagnose the problem. (see diagram on page 4)

***** Upstream Airflow Conditions***

The calibration for all Blower Door fans (including the Model 3 fan) are slightly sensitive to upstream airflow conditions (e.g. orientation of walls, doors, stairs etc. relative to the fan inlet). This is particularly true when measurements are taken using the "open fan" configuration. As a result you should try to follow these simple rules whenever possible.

- It is always best to install the fan in a doorway leading to a large open room. Try to avoid installing the fan in a doorway where there are stairways or major obstructions to airflow very close (1-5 feet) to the fan inlet.
- If you must install the fan next to a stairway or major obstruction, it is best to take measurements using one of the low-flow rings and not "open fan". We have seen "open fan" measurement errors as large as 10% to 15% when the fan is set up in a side doorway with one or two stairways in very close proximity.
- Always open the inside door and outside storm door as much as possible during the Blower Door test to prevent restrictions to airflow.

2. Blower Door Fan: Maintenance/Safety

There are several maintenance tips and procedures to ensure the proper operation of your Blower Door fan and to avoid any safety risks.

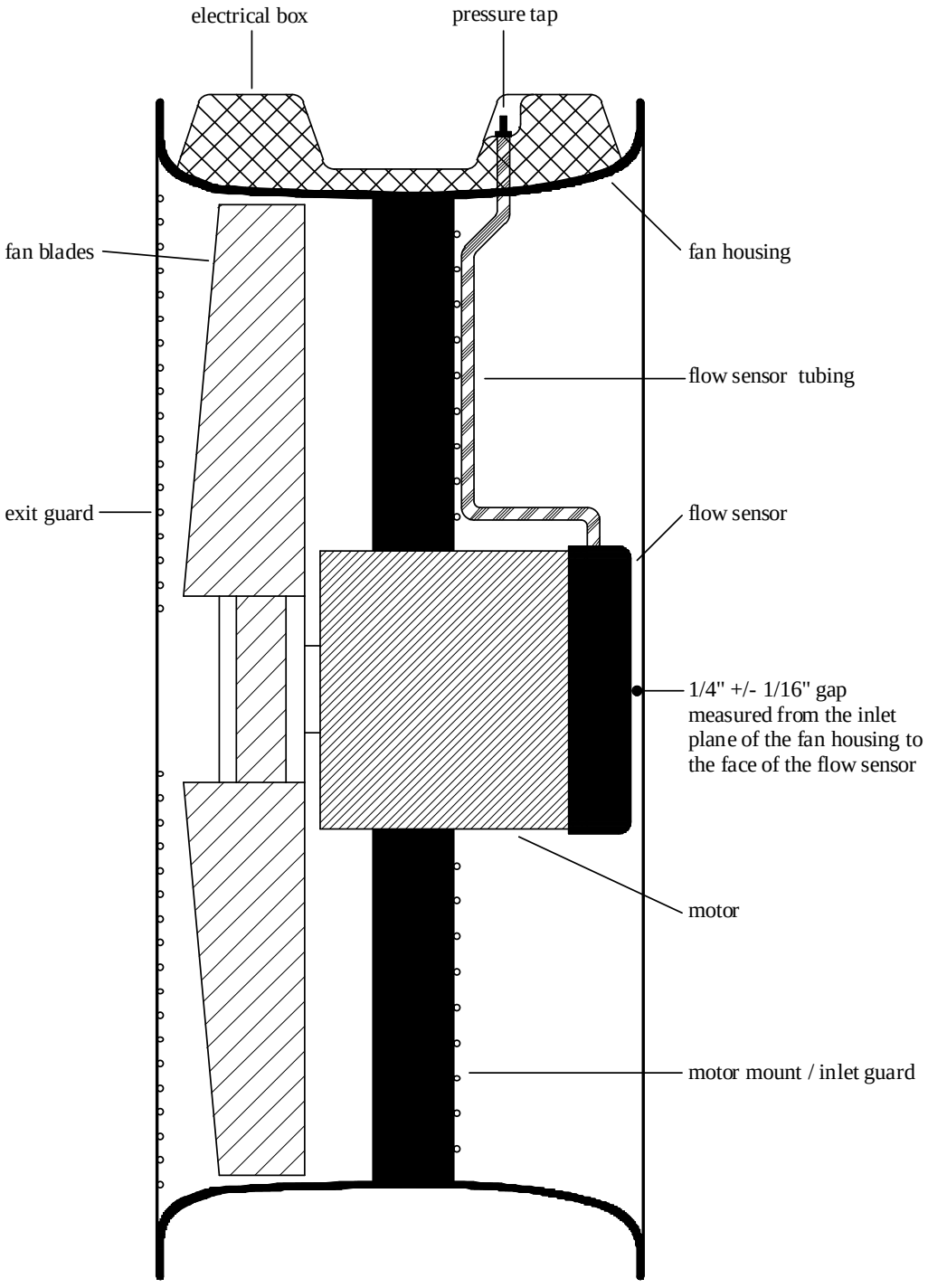
Maintenance Checks:

- Examine your motor cooling holes for excessive dust build-up. Use a vacuum with a brush attachment to remove dust.
- Inspect housing, blades and guards. Especially note clearance of blade tips relative to the fan housing. There should be about ½ inch of clearance.

General Operational Notes and Tips:

- Do not reverse the fan (using the flow direction switch) while the blades are turning. Turn off the fan and wait for it to come to a complete stop before reversing the flow direction.
- For long-term running such as maintaining house pressure while air-sealing, use a smaller ring whenever possible to ensure good airflow over the fan. This will minimize the heating of the fan and is especially important in warmer weather. In particular, do not operate the fan for long periods of time on low speed with open fan.
- Do not run the fan for long periods of time in reverse.
- If the motor gets too hot you may experience a shut-down due to the thermal overload protection. If this happens, make sure to turn off the controller so that the fan does not restart unexpectedly after it cools down.
- Make sure to push the power plug firmly into power receptacle on fan. Failure to do so can cause overheating of the cord and possible damage.
- For shipping, save the original box and packing material. Also, do not use "packing peanuts". They slip between the wires on the fan guards and need to be removed.

MODEL 3 120/240 Vac BLOWER DOOR



C. Series A and B Duct Blaster Fans

1. Calibration

This section relates to the Duct Blaster fan itself, and not the pressure gauges. Duct Blaster fans manufactured by The Energy Conservatory, maintain their calibration unless physical damage occurs. There is not much that can go wrong with the Duct Blaster to change its calibration.

As is the case with the Blower Door, a critical parameter is the position of the flow sensor relative to the fan inlet. Since the flow sensor is rigidly mounted to the motor, it is the motor position that you want to measure.

Duct Blaster Motor Position

If a Duct Blaster fan has been dropped, the motor may have shifted from its proper position. This can degrade the fan calibration.

Procedure:

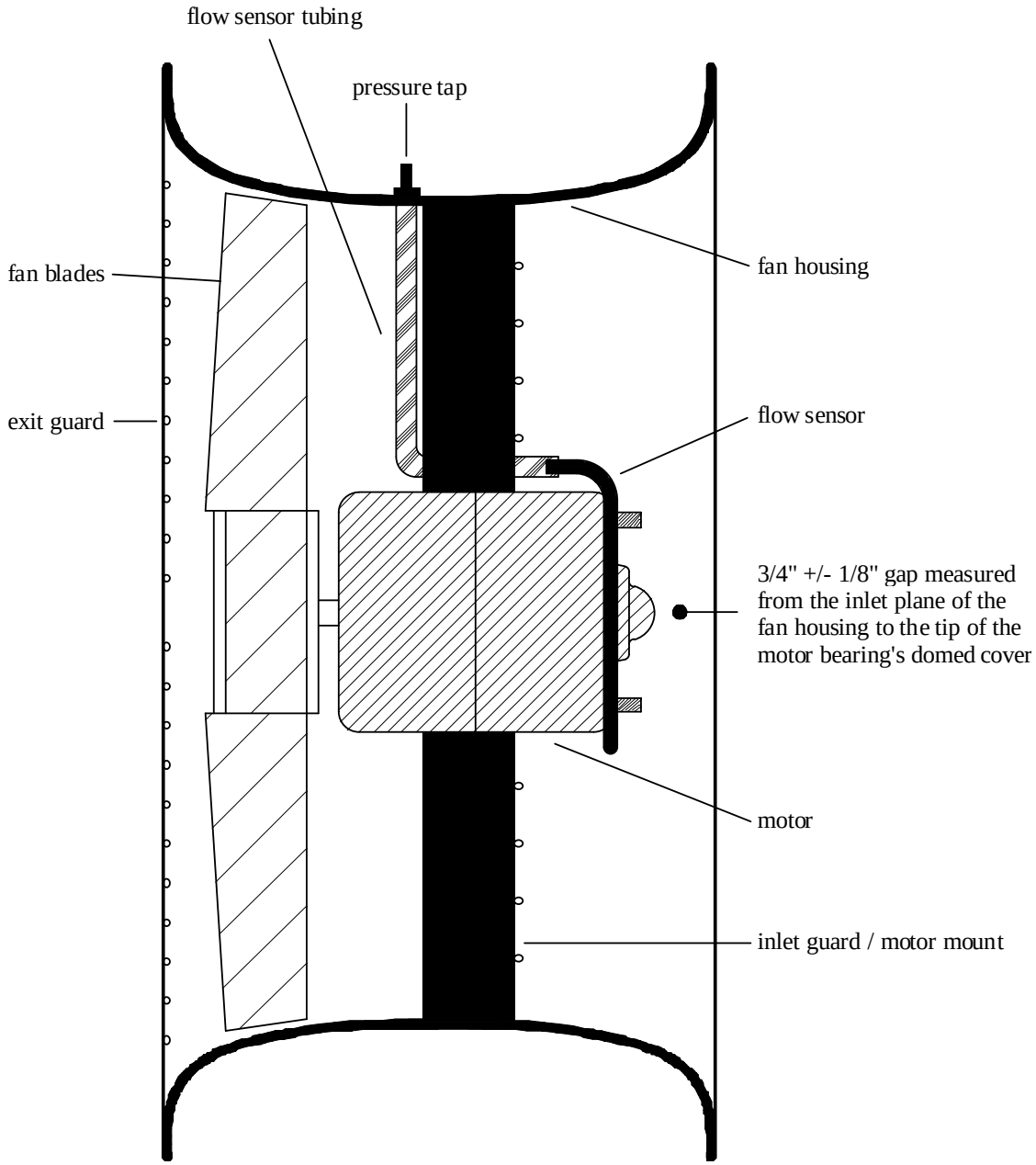
- Lay the fan on its side with the flow sensor facing up.
- Place a straightedge (such as a heavy yardstick on edge) across the inlet of the fan.
- Use a ruler to measure the distance from the bottom of the straightedge to the tip of the motor bearing's domed cover. This distance should be in the range $5/8^{th}$ to $7/8^{th}$ inches. If not, call The Energy Conservatory to further diagnose the problem. (see diagram on page 6)

2. Maintenance

Similar to the Blower Door fan, there are several maintenance tips and procedures to ensure the proper operation of your Duct Blaster fan and to avoid any safety risks.

- Examine your motor cooling holes for excessive dust build-up. Use a vacuum with a brush attachment to remove dust.
- For shipping, save original box and packing material.
- Blade tip clearance is tight on a normal Duct Blaster. Dropping the fan can cause the blades to hit. Before attempting to make an adjustment yourself, contact The Energy Conservatory.
- The Duct Blaster housing is a two-part housing. If the fan is dropped, check that the seam between the two halves is still intact.

DUCT BLASTER SERIES A & B



D. Digital Pressure Gauges

1. Calibration

Recommended Calibration Interval

- **once per year**. Digital pressure gauges (DG-700, DG-500, DG-3 or DG-2) should be sent back to The Energy Conservatory for re-calibration.

It is also a good idea to perform gauge comparisons between calibrations, especially when damage is suspected (e.g., when a gauge has been dropped).

Digital Gauge Comparison

This technique is used to compare the readings of two digital gauges when they are both connected to the same pressure source. When two gauges are being compared, you should expect them to agree within their specifications:

- **DG-700 and DG-500:**

  +/- 1% of reading or 0.15 Pa, whichever is greater (0-1,250 Pa)

- **DG-3 and DG-2:**

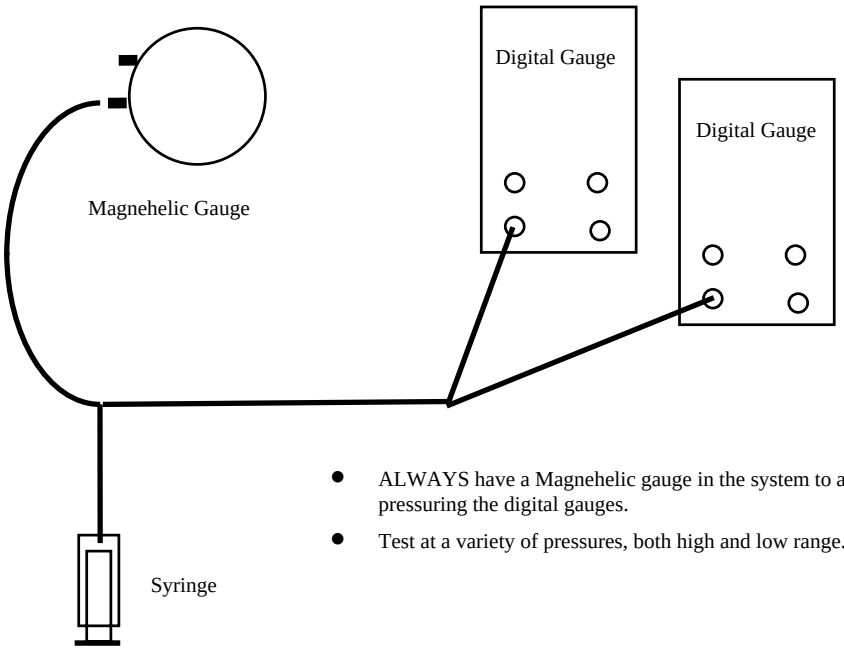
  Low Range: +/- 1% of reading or 0.2 Pa, whichever is larger (0-200.0 Pa)
  High Range: +/- 1% of reading or 2 Pa, whichever is larger (0-800 Pa)
  +/- 2% of reading (800-1,000 Pa)

Parts needed: 2 digital gauges, one Magnehelic gauge, 2 “T” fittings, one syringe and five 1 foot sections of tubing.

Procedure:

- Turn on the digital gauges. If testing a DG-3 or DG-2, set it to High Range. With no pressure signal applied, both gauges should read 0 Pa.
- Using the two T fittings and short sections of tubing, hook up the gauges and syringe as shown on Page 8.
- Pull out on the syringe slowly until you get the desired reading on the digital gauges.
- Record your results and repeat at a range of pressures.
- If testing a DG-700 or DG-500, test both Channel A and Channel B separately. This is not necessary with a DG-3 or DG-2 gauge because these gauges have only 1 pressure sensor.

Digital Gauge Comparison Setup



- ALWAYS have a Magnehelic gauge in the system to avoid over-pressuring the digital gauges.
- Test at a variety of pressures, both high and low range.

2. Maintenance

- Operating temperature range: 32 F to 120 F.
- Storage temperatures -10 F to 160 F (best to keep it warm during cold weather).
- Avoid conditions where condensation could occur, for example taking a gauge from a hot humid environment into a cool environment.
- Do not store gauge in the same container as your chemical smoke. The smoke can and does cause corrosion.
- Do not ignore low battery indicator (readings can start being in error immediately).
- Use alkaline batteries only.
- Avoid exposing the gauge to excessive pressures, such as caused by tubing slammed in a door.
- Leave gauge on whenever tubing is connected (there is automatic over-pressurization protection when the gauge is on).

E. APT System and Sensors

1. Calibration

Recommended Calibration Interval:

- **Data Boxes - once per year**. Data boxes should be sent to The Energy Conservatory for recalibration.
- **CO Sensors - once every 6 months** (if the CO sensor is being used for safety purposes, more frequent calibration checks may be warranted).
- **Temperature and RH Sensors - once per year.** Calibration adjustments must be made using software calibration parameters (no physical adjustment possible).

2. Maintenance

The APT hardware and sensors are sensitive instruments that need to be handled with care.

Data Boxes

- Do not drop the Data Box.
- Best to store in warm dry environment to prevent internal condensation and pressure sensor drift as internal temperature changes.
- Periodically provide full charge to NICAD battery (full charge may take up to 24 hours).
- When operation of data box is in question, try running TECLOG program to see if problem persists.

CO Sensors

- Avoid exposure to large CO levels (over 2,000 ppm may permanently damage the sensor).
- After high level of CO exposure, keep sensor plugged in and operating to facilitate return to baseline reading.
- Do not store sensor below 32^{o}F. Best to store in warm dry environment to prevent internal condensation.
- Do not touch sensor element (new CO sensor boxes have top which prevents touching of sensor element).
- Do not hang sensor by the phone cord connection if possible (although the sensor is lightweight, the connections were not designed to be weight bearing).

Temperature and RH Sensors

- Do not immerse RH sensor in water or subject to prolonged condensation.
- Use reasonable judgement in handling and storing sensors.

F. Magnehelic Pressure Gauges

1. Calibration

Recommended Calibration Interval:

- **once every 3-5 years**.

See the comparison procedure in Section D for digital gauges. A similar procedure can be used to compare two Magnehelic gauges or to compare a Magnehelic gauge to a digital gauge. Make sure that your Magnehelic gauge is in a vertical position for this measurement and has been properly zeroed.

The manufacturer's (Dwyer Instruments) accuracy specifications are:

- 60 Pa Gauges: +/- 2.4 Pa.
- 125 Pa Gauges: +/- 4 Pa.
- 500 Pa Gauges: +/- 10 Pa.

2. Maintenance

- Do not drop the gauges.
- Make sure gauge is warm and in vertical position before using.
- When warming up the diaphragm by blowing into the tubing, use caution to prevent damage to diaphragm.