Ductwork Airtightness Measurements: Protocols
25 April 2019

DW/143

Peter Rogers:
BESA Chairman of Ventilation Group Technical Committee.
With regard to air leakage, the responsibilities for ensuring the achievement of a satisfactory project are divided between the ductwork contractor, production and the on-site installation team. It is essential that there is full co-operation between them.

Establish with the system designer, client or representative the class of ductwork called for in the project specification.

Leakage testing is always done under positive pressure even when the ductwork is to operate under negative pressure.
THE DUCTWORK CONTRACTOR

- Ensure that components have been manufactured and sealed in accordance with the design specification.
- Agree with the system designer the test pressure for each section of the installation.
- Decide the best way to isolate the installation into test zones.
- Make sure that test points and blanking devices can be reached with minimum difficulty.
- Prepare test sheets giving the information required for each section being tested.
• Manufacture components with a good fit to minimize the use of sealant. A poor fit cannot be remedied by the use of additional sealant.

• Seal all longitudinal seams joints.

• Special care must be taken in the fitting of access doors and panels.

• Ductwork must be handled and delivered with care to avoid the danger of breaking the seals.
ON SITE INSTALLATION TEAM

• Before installation, inspect all duct sections to make sure that factory applied seals have not been damaged during transit.

• Fix blanking plates or other temporary seal in the positions shown by the ductwork contractor.

• Agree with the client a progressive testing programme.

• Carry out a preliminary test and look for any obvious places where there may be leakage.

• Offer the test section to the client for formal acceptance and signature on the test sheet.

CLASSIFICATION, AIR LEAKAGE AND TEST PROCEDURES

• Air leakage testing of low and medium pressure ductwork is not mandatory under BESA DW/144 specification for Sheet Metal Ductwork.

• Air leakage testing of high-pressure ductwork is mandatory under BESA DW/144 specification for sheet metal ductwork.
DUCTWORK CLASSIFICATION AND AIR LEAKAGE LIMITS

Table 1  Ductwork Classification and Air Leakage Limits
(Reproduced from DW/144, Part One, Section 1.1)

<table>
<thead>
<tr>
<th>Duct pressure class</th>
<th>Static pressure limit</th>
<th>Maximum air velocity</th>
<th>Air leakage limits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive</td>
<td>Negative</td>
<td>2</td>
</tr>
<tr>
<td>Low pressure – Class A</td>
<td>500</td>
<td>500</td>
<td>10</td>
</tr>
<tr>
<td>Medium pressure – Class B</td>
<td>1000</td>
<td>750</td>
<td>20</td>
</tr>
<tr>
<td>High pressure – Class C</td>
<td>2000</td>
<td>750</td>
<td>40</td>
</tr>
<tr>
<td>High pressure – Class D</td>
<td>2000</td>
<td>750</td>
<td>40</td>
</tr>
</tbody>
</table>

Where $p$ is the differential pressure in pascals.

AIR LEAKAGE TESTING PROCEDURE

- Determine the extent of ductwork to be tested and the method selected.
- Fit blanking devices in accordance with the system test zones.
- The section of ductwork area to be tested shall have an area large enough to enable the test rig to register a measurable leakage.
- Follow the recommendations of the manufacturer of the test equipment and ensure that it has a calibration certificate.
- Due notice of tests shall be given, so that arrangements for witnessing can be made.
- **NOTE** Testing shall be completed before any insulation or enclosure of the ductwork.
HINTS ON DUCTWORK LEAKAGE TESTING

Take special care with inaccessible parts.

FRONT:
Keep length to a minimum and move your test equipment to meet this requirement. Insulate correctly and keep the duct in its final position.

In order to avoid incorrect readings of the duct pressure, a hole in the end of the duct should be connected directly to the ductwork under test.

SEQUENCE OF TEST
1. Prepare test sheet.
2. Connect test rig to duct using appropriate equipment
3. Select test point
4. Read initial pressures
5. Begin test
6. Record readings
7. Analyse results
8. Complete test

WARNING: Take care to keep packaging/sheets under test.

HOW TO FIND LEAKS
1. Look - particular attention to access openings and cutouts
2. Listen - with the system operating, leaks should be audible
3. Feel - confirm your hand in particular if it's over a joint can help to locate leaks
4. Soap and water - paint over joints and look for bubbles
5. Smoke pellet - placed inside ductwork (obtain permission for use)

EXAMPLE OF COMPLETED TEST SHEET

SECTION 5
EXAMPLE OF A COMPLETED TEST SHEET

Based on data sheets illustrated in Fig. 1

Example of completed test sheet:

<table>
<thead>
<tr>
<th>Test Certificate</th>
<th>Internal Notes</th>
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</thead>
<tbody>
<tr>
<td>Project</td>
<td>Site Details</td>
</tr>
<tr>
<td>Test Method</td>
<td>Notes</td>
</tr>
<tr>
<td>Test Equipment</td>
<td>Comments</td>
</tr>
<tr>
<td>Data Sheet No.</td>
<td>Collection Certificate No.</td>
</tr>
<tr>
<td>Test Date</td>
<td>Test Date</td>
</tr>
<tr>
<td>Test Location</td>
<td>Test Location</td>
</tr>
<tr>
<td>Test Environment</td>
<td>Test Environment</td>
</tr>
<tr>
<td>Test Conditions</td>
<td>Test Conditions</td>
</tr>
<tr>
<td>Test Parameters</td>
<td>Test Parameters</td>
</tr>
<tr>
<td>Test Results</td>
<td>Test Results</td>
</tr>
<tr>
<td>Test Conclusion</td>
<td>Test Conclusion</td>
</tr>
</tbody>
</table>

Surface Area:

- Length (m): 4.5
- Size (m²): 2.5
- Net Area (m²): 1.75
- Total Area (m²): 5.7

Test Performance:

- Test 1: 3.45
- Test 2: 2.9
- Test 3: 1.5
- Test 4: 0.6
- Total: 8.5

Membership means more.

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Membership means more.
• ADL2A (new buildings) and ADL2B (existing buildings) state that “Ductwork leakage testing should be carried out in accordance with the procedures set out in BESA DW/144” (refers to DW/143) Specification for Sheet Metal Ductwork.

• If the system designer considers the testing of medium pressure class ductwork to be unavoidable then it is recommended that random tests are identified.
It is generally accepted that in a typical good quality system the leakage from each class of ductwork under operating conditions will be in the region of:

- Class A low pressure: 6%
- Class B medium pressure: 3%
- Class C high pressure: 2%
- Class D high pressure: 0.5%

Items of in-line plant items will not normally be included in an air leakage test.

The ductwork contractor may include such items in the test if the plant item has a manufacturers certificate of conformity for the pressure classification for the system under test.
Table 2. Air leakage rates

<table>
<thead>
<tr>
<th>Pressure differential (Pa)</th>
<th>Low pressure Class A</th>
<th>Medium pressure Class B</th>
<th>High pressure Class C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.04</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>2</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>5</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
</tr>
<tr>
<td>10</td>
<td>0.16</td>
<td>0.16</td>
<td>0.16</td>
</tr>
<tr>
<td>20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>50</td>
<td>0.30</td>
<td>0.30</td>
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</table>

Units are seconds per square metre of surface area.

Permitted leakage at various pressures
OTHER BESA PUBLICATIONS

OTHER DUCTWORK-RELATED PUBLICATIONS

- DW/143
  A Practical Guide to Ductwork Leakage Testing

- DW/145
  Guide to Good Practice for the Installation of Fire and Smoke Dampers

- DW/154
  Specification for Plastic Ductwork

- DW/172
  Specification for Kitchen Ventilation Systems

- DW/191
  Guide to Good Practice: Glass Fibre Ductwork

- TR/19
  Guide to Good Practice: Internal Cleanliness of Ventilation Systems (incorporating DW/TM2 and TR/17)

BESA Working together
Promoting understanding between mechanical services and ductwork contractors

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Thank you
Any questions?