BSRIA Airtightness

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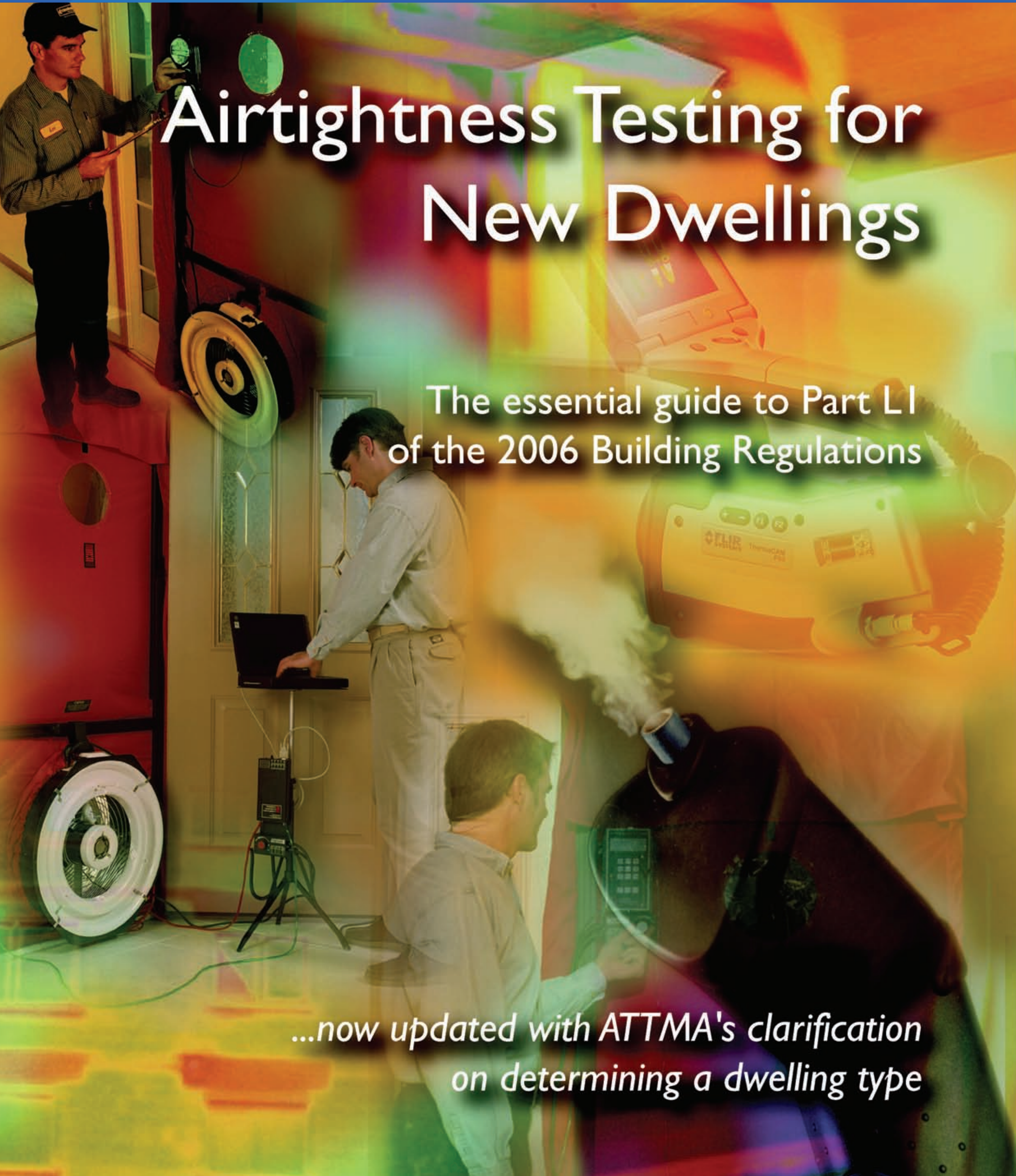
Airtightness Testing for New Dwellings

The essential guide to Part L1 of the 2006 Building Regulations



...now updated with ATTMA's clarification on determining a dwelling type

The contents of this guide

Introduction

This BSRIA document outlines the requirements of the approved *Building Regulations* for 2006 as they apply to new dwellings. The methodology of airtightness testing techniques is presented along with diagnostic methods such as smoke testing and thermographic surveys.

The 2002 *Building Regulations* required all commercial and industrial buildings with a gross floor area greater than 1000 m^2 to be tested for airtightness to a minimum standard of 10 $m^3/(h.m^2)$ at 50 Pascals (Pa). Not only does *Approved Document Part L2A* of the *Building Regulations* for 2006 extend this requirement to all sizes of commercial and industrial buildings, *Approved Document Part L1A* is also extended to include airtightness testing of new dwellings.

The *Approved Document Part L1A* for work in new dwellings will require, with few exceptions, type-testing of all new dwellings to an airtightness standard of no greater than 10 $m^3/(h.m^2)$ at 50 Pa. For some dwellings where the carbon emission rate is difficult to meet for architectural reasons, then the airtightness target under the SAP calculations may need to be reduced to 7, 5 or even 3 $m^3/(h.m^2)$ at 50 Pa to meet the overall carbon emission rate required by the *Regulations*.

Buildings containing rooms for residential purposes such as nursing homes, student accommodation and similar are not considered as dwellings. In such cases, *Approved Document Part L2A* will apply.

Building contractors who elect to adopt the accredited construction details route to demonstrating compliance with the *Regulations* will still be required to undertake airtightness testing, albeit with a potentially smaller sample of dwellings.

Chris Knights and Nigel Potter
October 2007

Airtightness Testing for New Dwellings
– a practical guide for builders

BSRIA October 2007 Printed by ImageData Group

Who is this document for?

Building surveyors

To ensure new houses are sufficiently airtight, surveyors will need to specify the appropriate forms of construction as a matter of routine. By applying the BSRIA guidance, building surveyors will help to reduce building failures and save costs

House builders

The requirement for constructing low air-permeability dwellings is here to stay, and is likely to become more arduous in later editions of the *Building Regulations*. Housebuilders will need to adopt quality assurance regimes to ensure that air tightness testing becomes a routine task

Building control

Building control officers will require test certificates from qualified testing organisations in order to fulfil their requirements under the *Building Regulations*.

How do I comply with the Building Regulations?

Uncontrolled ventilation in dwellings through leakage paths around doors and window frames accounts for a significant proportion of heat loss, particularly as the insulation values of walls and glazing has improved. In order to control this energy loss, the *Building Regulations* will regulate the overall leakage of the building structure by testing, using a pressurising/depressurising fan method. This document specifically covers the methods used to comply with the airtightness component of the *Regulations*.

■ *Paragraph 37:* **A reasonable limit for the design air permeability is10 m^3 (h.m^2). Achieving the TER may need the design air permeability to be better than the limit value.**

Approved Document L1A Conservation of Fuel and Power in New Dwellings.

Air permeability

This is the same standard of airtightness as introduced in *Part L2* of the 2002 *Building Regulations* for buildings with a gross floor area exceeding 1000 m^2. Essentially, it is the amount of air required to pressurise and/or depressurise a building to 50 Pascals (Pa), normalised with respect to the building's envelope area.

Envelope area is defined as the internal surface area of the external walls, roof and footprint of a building. A building's footprint is usually defined by the area of the ground floor slab, except where the building has a basement. The roof area is normally defined as the area below the loft, where the loft is not an accommodation area (in other words not conditioned). The area of external walls is only true for detached properties. Semi-detached and terraced properties will have party-wall elements.

■ *Paragraph 54:* **In order to demonstrate that the specified air permeability has been achieved, Regulation 20B applies. This essentially means the appropriate air pressure testing is carried out with a procedure approved by the Secretary of State and results given to the Local Authority.**

Approved Document L1A Conservation of Fuel and Power in New Dwellings.

Quality of construction

While the maximum allowable building air leakage rate is 10 m^3/(h.m^2) at 50 Pa, designers may choose to create an even more airtight construction (7, 5 or even 3 m^3/(h.m^2) at 50 Pa) and to use the calculated energy saving to trade off against other building details. It is likely that terraced houses will have the greatest difficulty in meeting the Dwelling carbon dioxide Emission Rate (DER), and will require a tighter air permeability specification.

The DER should be less than the Target carbon dioxide Emission Rate (TER). Where U-values for elemental type, allowable areas of windows or doors, and quoted efficiency of heating appliances do not (in total) enable the dwelling to meet the required TER, then the target air permeability may need to be lower than 10 m^3/(h.m^2) at 50 Pa.

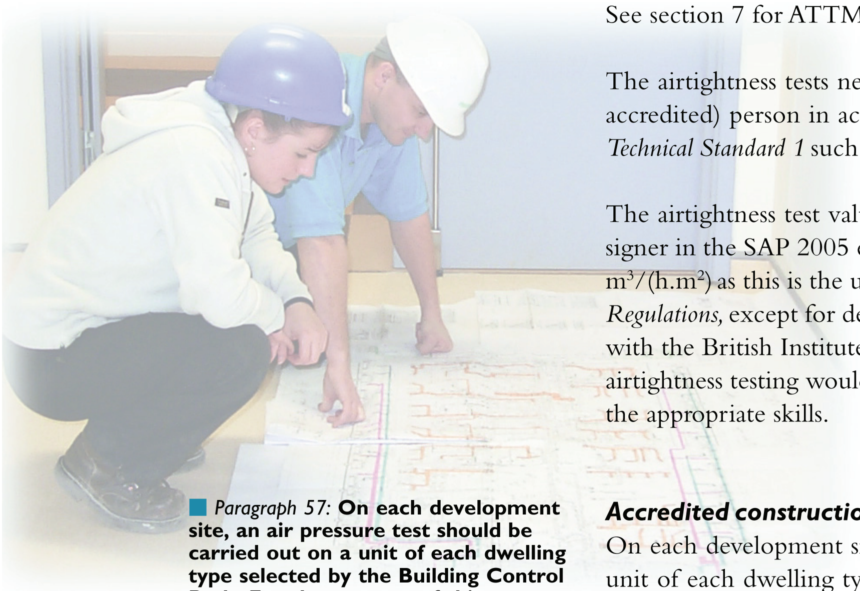
■ *Paragraph 56:* **The approved circumstances under which the Secretary of State requires testing to be carried out are set out in paragraphs 57 to 63.**

Approved Document L1A Conservation of Fuel and Power in New Dwellings.

Accredited and non-accredited construction details

Both routes to airtightness compliance will require airtightness testing of samples of each dwelling type. For the purposes of *Part L1*, a dwelling type means a dwelling of the same generic form, ie:

- Detached, semi-detached
- End terrace, mid-terrace
- Mid-floor, ground floor and top floor flats.



See section 7 for ATTMA's approved determination of a dwelling type.

The airtightness tests need to be carried out by an independent, qualified (or accredited) person in accordance with the procedures set out in *ATTMA Technical Standard 1* such as BSRIA Airtightness.

The airtightness test value (Q_{50}) to be attained will be defined by the designer in the SAP 2005 evaluation, but in any case will not be greater than 10 $m^3/(h.m^2)$ as this is the upper limit for air permeability set by the *Building Regulations,* except for developments with two or fewer dwellings. Registration with the British Institute of Non Destructive Testing (BINDT) with respect to airtightness testing would be a demonstration that the testing organisation has the appropriate skills.

Paragraph 57: **On each development site, an air pressure test should be carried out on a unit of each dwelling type selected by the Building Control Body. For the purpose of this Approved Document, a block of flats should be treated as a separate development irrespective of the number of blocks on the site.**

Approved Document L1A Conservation of Fuel and Power in New Dwellings.

Accredited construction details

On each development site, an airtightness test should be carried out on a unit of each dwelling type selected by the building control body. Each block of flats should be treated as a separate development. On a particular site, one of each type of dwelling from the first completed batch of units should be tested to confirm the robustness of each design. A development will not usually comprise many different types of dwellings, often less than ten.

However, achieving an air permeability of 10 $m^3/(h.m^2)$ at 50 Pa should not be an arduous task. This accredited construction detail route to airtightness testing will probably be preferred by most building contractors, as it has the potential to involve the fewest number of tests. As the building control body will select the dwellings to be tested, the builder must ensure that the quality of construction is consistent.

Paragraph 58: **Air pressure tests should be carried out on each dwelling type in the development to the number specified in table 3.**

Approved Document L1A Conservation of Fuel and Power in New Dwellings.

Non-accredited construction details

Paragraph 58 of the *Building Regulations* says that pre-completion pressure testing will be required in accordance with the Table 1.

Table 1: The number of pressure tests for dwellings that have not adopted accredited construction details (from table 3, paragraph 58, of *Approved Document L1A Conservation of Fuel and Power in New Dwellings).*

Number of instances of the dwelling type	Number of tests to be carried out on the dwelling type
4 or less	One test of each dwelling type
Greater than 4, but equal or less than 40	Two tests of each dwelling type
More than 40	At least 5% of the dwelling type, unless the first 5 units of the type that are tested achieve the design air permeability, when the sampling frequency can be subsequently reduced to 2%

■ *Paragraph* 59: **The specific dwellings making up the test sample will be selected by the building control body in consultation with the builder.**

Approved Document L1A Conservation of Fuel and Power in New Dwellings.

Sample size

With respect to sample size 50% of the required airtightness tests should be carried out during construction of the first 25% of each dwelling type.

This is simply to demonstrate to the building control officer – as early as possible in the building programme – that the buildings are complying with the *Regulations*. It would be prudent (for best practice) to test the first of each dwelling type on each site in order to identify and modify any details that are causing an airtightness problem.

■ *Paragraph* 62: **In addition to the remedial work on a dwelling that failed the initial test, one additional dwelling of the same dwelling type shall be tested, thereby increasing the overall sample size.**

Approved Document L1A Conservation of Fuel and Power in New Dwellings.

Remedial measures

The *Regulations* stipulate that for each dwelling that fails the initial test, remedial measures should be carried out as required by paragraph 61, and one further dwelling scheduled for testing.

It is a reporting requirement that BSRIA Airtightness company will know the design target for the dwelling's airtightness. It is the responsibility of the building control officer to ensure that all the appropriate information relating to the compliance of the Dwelling carbon dioxide Emission Rate (DER) fulfills the requirements of the *Building Regulations.* However, in practice, BSRIA Airtightness will be in a position to advise the client on the need for remedial works and re-testing requirements.

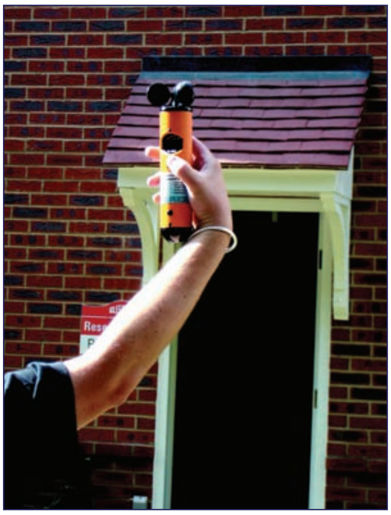
All pressure tests will be undertaken early in the build programme. If the results are satisfactory to the extent that quality control for later buildings on a development site can be relaxed, this will help to reduce the builder's costs.

Exempted areas

Note that where a conservatory is not thermally separated from the new dwelling it will be included within the building envelope. Rules for extensions are contained within *Part L1B* which is for work in existing dwellings for which no airtightness testing is required. The situation for garages is a little less clear, but if they are not conditioned spaces, they would be outside the scope of the *Regulations*.

What is a building airtightness test?

STEP 1 Set up the blower fans, close all external doors and windows and tape up other intentional openings, such as bathroom extracts.



STEP 2 Set up the instruments, carry out the airtightness test and measure the results.

STEP 3 Dismantle the blower door and fans and remove all temporary covers used to seal vents in the dwelling.

BSRIA's Airtightness testing service includes a full proposal comprising a method statement and a clear quotation. This covers site requirements, suitable proof of public liability insurance, professional indemnity insurance, a health and safety risk assessment covering substances which may be hazardous to health (such as smoke fluids), proof of staff training with regard to site safety (such as skill cards) and appropriate personal protective equipment.

An airtightness test can be undertaken in about 30-60 minutes, but may take longer in high winds or when numerous temporary seals are required.

BSRIA Airtightness will need the following information to respond to an enquiry:

- Site location
- The area of the building envelope. If unknown, building plans will be needed to determine it.
- Design air permeability (available from the SAP assessment). (To what standard is the building being tested?)
- Will the client require a smoke test or thermographic survey should the building not meet the required specification?
- Are there any specific requirements for the airtightness test (for example will it need to be performed outside working hours?)

Pre-test information

The first step is to determine what test equipment is needed, and that depends on the amount of air required to undertake the test. BSRIA Airtightness will need to know two things: the design air permeability, and the envelope area of the building. For example, if the building is required to pass *Building Regulations Part L1A* requirements, then an air permeability of less than 10 $m^3/(h.m^2)$ at 50 Pa will be required. Envelope areas will not generally be supplied by the architect and therefore will be calculated by BSRIA Airtightness from the supplied drawings and verified on site.

Calculating the envelope area

The envelope area of the building will need to be calculated using the dimensions in Figure 1 and the equations in Table 2.

Figure 1: The dimensions of an example building required to determine a building's envelope area.

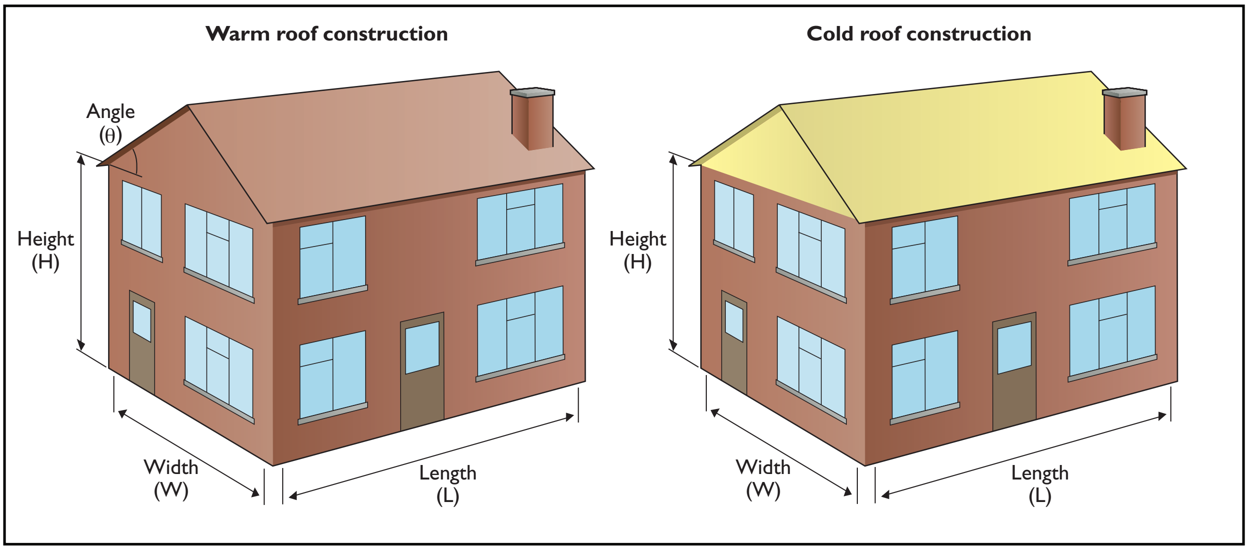


Table 2: The method of calculating envelope area based on the example building in Figure 1.

Warm roof construction			Cold roof construction		
Area	*Calculation (m²)*	*Result*	*Area*	*Calculation (m²)*	*Result*
Floor area	L x W (5 x 4)	20	*Floor area*	L x W (5 x 4)	20
Roof area	(L x W) / COSθ (5 x 4)/ COS 25	22·07	*Roof area*	L x W (5 x 4)	20
Wall area	2 x H x (W + L) + 0·5 (W x W) x (TANθ) 2 x 6 x (5 + 4) + 0·5 x (4 x 4) x (TAN 25)	111·73	*Wall area*	2 x H x (W + L) 2 x 6 x (5 + 4)	108
Total	153·8 m²		*Total*	148 m²	

Once the appropriate envelope area has been determined, the fan flow-rate required at 50 Pa needs to be calculated in order to correctly size the fans needed for the test.

Calculating the air flow rate

The required air flow rate is calculated by multiplying the air permeability specification by the envelope area. The method for the example building is shown in Table 3.

The appropriate test equipment can be selected once the required flow rate has been calculated. Any equipment specific to the site – such as multiple blower fans – will be identified and communicated to the client, along with the general test requirements. A primary objective should be to ensure that the building is ready for the airtightness test before the engineer visits the site.

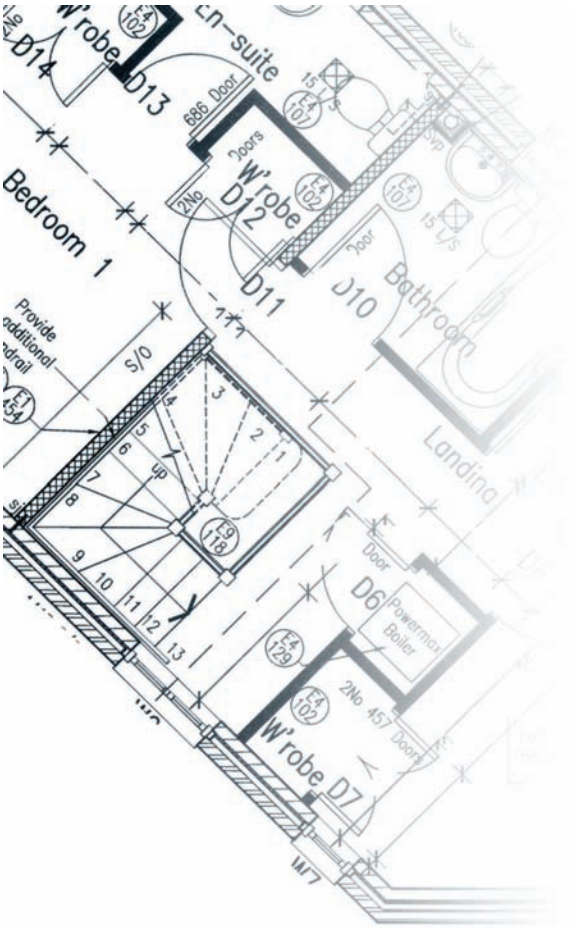
A checklist of required conditions will be submitted so that there is no doubt about who is required to do what. The client should also be prepared for an extended test if the building fails, or, more commonly, if the building isn't quite ready when the test engineers arrive on site.

The airtightness test

Before the equipment is installed, the BSRIA Airtightness engineer will walk around the building and ensure that all the pre-test requirements have been met. A checklist will be used to ensure that no detail is missed. To ensure that any pressure test requirements that have not been fully met can be rectified prior to the airtightness test.

Table 3: An airflow rate calculation based on the example building in Figure 1.

Cold roof construction		Warm roof construction	
Equation (Design air permeability x envelope area)	*Resultant flow*	*Equation (Design air permeability x envelope area)*	*Resultant flow*
10 m³/(h.m²) x 148 m² (10 x 148)	1480 m³/h or 0·41 m³/s	10 m³/(h.m²) x 153·8 m² (10 x 153·8)	1538 m³/h or 0·43 m³/s



Once all these conditions have been satisfied, the airtightness test equipment can be set up. The fan will be installed, all power supplies connected and all measurement instruments turned on for warming up.

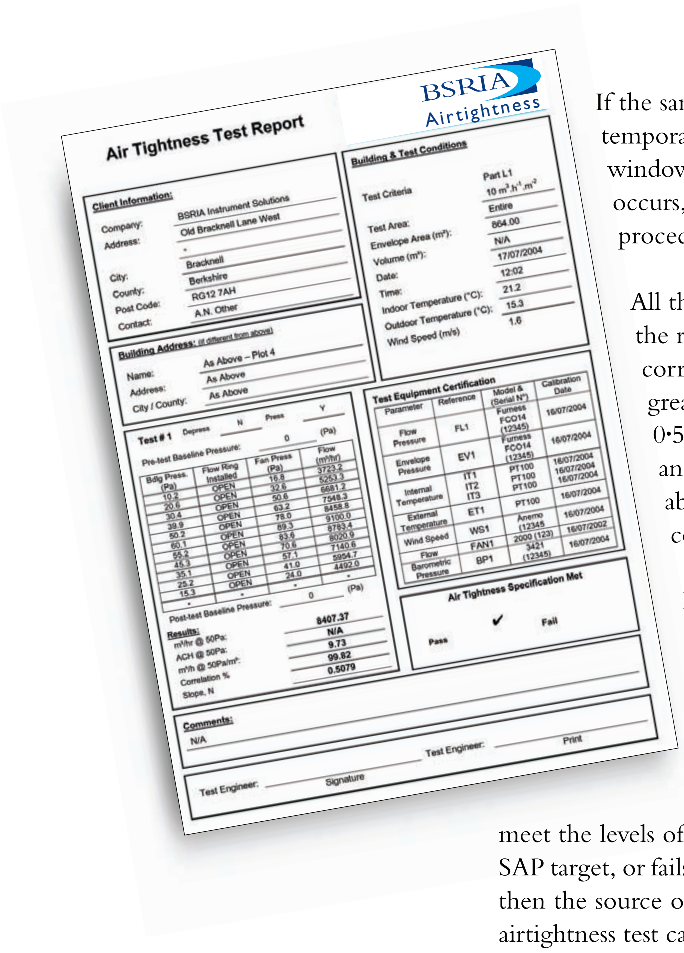
The accuracy of the airtightness test will be affected by local wind conditions. Ideally the wind speed at the time of the test should be less than 6 m/s. If the wind speed is higher than this, the test may need to be carried out on a calmer day.

An essential check is to measure the pressure difference between the inside and outside of the building, with the building and the test fans sealed. It must be less than ±5 Pascals (Pa) to satisfy the test standard. A valid test cannot be determined if outside these limits.

Once this has been checked, the airtightness test can begin. The covers from the fans will be removed, the fans switched on and the airflow rate increased until a pressure difference across the envelope is achieved of about 10 Pa.

BSRIA Airtightness test engineer will check for stability and, if satisfactory, continue to increase the pressure difference between inside and outside of the building in 10 Pa intervals (in 20, 30, 40, 50 and 60 Pa steps), recording the air flow rate at each test point.

Tests are usually conducted up to 60 Pa. Once the leakage rate has been recorded at 60 Pa, the flow rate should be decreased taking further measurements at 55, 45, 35, 25 and 15 Pa. BSRIA Airtightness will also make sure that the readings are equivalent to those recorded when the air pressure was being increased.



Air Tightness Test Report

BSRIA Airtightness

Client Information:

Company: BSRIA Instrument Solutions
Address: Old Bracknell Lane West
City: Bracknell
County: Berkshire
Post Code: RG12 7AH
Contact: A.N. Other

Building Address: (if different from above)

Name: As Above – Plot 4
Address: As Above
City / County: As Above

Building & Test Conditions

Test Criteria: Part L1, 10 $m^3.h^{-1}.m^{-2}$
Test Area: Entire
Envelope Area (m^2): 864.00
Volume (m^3): N/A
Date: 17/07/2004
Time: 12:02
Indoor Temperature (°C): 21.2
Outdoor Temperature (°C): 15.3
Wind Speed (m/s): 1.6

Test # 1

Pre-test Baseline Pressure: 0 (Pa)

Bldg Press. (Pa)	Flow Ring Installed	Fan Press (Pa)	Flow (m^3/hr)
10.2	OPEN	16.8	3723.2
20.6	OPEN	32.6	5263.3
30.4	OPEN	50.6	6681.2
39.9	OPEN	63.2	7548.3
50.2	OPEN	78.0	8458.8
60.1	OPEN	89.3	9100.0
55.2	OPEN	83.6	8783.4
45.3	OPEN	70.6	8020.9
35.1	OPEN	57.1	7140.6
25.2	OPEN	41.0	5954.7
15.3	OPEN	24.0	4492.0

Post-test Baseline Pressure: 0 (Pa)

Results:

m^3/hr @ 50Pa: 8407.37
ACH @ 50Pa: N/A
m^3/h @ 50Pa/m^2: 9.73
Correlation %: 99.82
Slope, N: 0.5079

Test Equipment Certification

Parameter	Reference	Model & (Serial N°)	Calibration Date
Flow Pressure	FL1	Furness FCO14 (12345)	16/07/2004
Envelope Pressure	EV1	Furness FCO14 (12345)	16/07/2004
Internal Temperature	IT1 IT2 IT3	PT100 PT100 PT100	16/07/2004 16/07/2004 16/07/2004
External Temperature	ET1	PT100	16/07/2004
Wind Speed	WS1	Anemo (12345	16/07/2004
Flow	FAN1	2000 (123)	16/07/2002
Barometric Pressure	BP1	3421 (12345)	16/07/2004

Air Tightness Specification Met

Pass ✔ Fail

Comments:

N/A

Test Engineer: Signature
Test Engineer: Print

If the same values are not recorded, then it is possible that the temporary seals may have failed. Large variations could be due to windows or doors opening during the test. If any of the above occurs, then the building will be re-checked and the test procedure repeated.

All the above data is then be input to the computer program and the results analysed against the known envelope area. The correlation coefficient of the line fit should have an r^2 value greater than 0•98, and the slope of the line should lie between 0•5 and 1•0. Values outside of these limits render the test invalid and the test should be repeated without exception. If the above are satisfactory then the measured airtightness should be compared with the set criteria.

If the dwelling passes the airtightness test, then it will be awarded a certificate stating that it has met the requirements of the *Building Regulations*. A set of test results will also be provided to the client. No further action will be required. The certificate should be submitted to the building control officer as evidence of a satisfactory pressure test (this must be done within seven days). If the dwelling fails to meet the levels of airtightness required by the designer in accordance with the SAP target, or fails the *Building Regulations* upper limit of 10 $m^3/(h.m^2)$ at 50 Pa, then the source of leakage will have to be identified and rectified and another airtightness test carried out to prove compliance.

If the building...	
✔ Passes	✘ Fails
All temporary seals should be removed and the building returned to its pre-test state. A draft copy of the results may be provided to the client. A full report should be compiled and forwarded to the client promptly, and a copy of the results must be forwarded to the building control body within seven days of the test	A draft copy of the results may be provided to the client. A smoke test or thermographic survey may be performed as required. If any issues that have been located can be rectified promptly a re-test may be performed

What equipment is used for an airtightness test?

▶ The compact and lightweight test equipment is easy to transport.

▶ A trained technician can easily fit pressure test equipment to most types of door installed in new dwellings.

▶ The few number of component parts in airtightness test equipment aids rapid assembly on site.

Equipment certification
All equipment will have been serviced on a regular basis and be complete with a current certificate of calibration from a UKAS accredited calibration laboratory such as BSRIA Instrument Solutions.

What equipment is required?
A wide variety of equipment is available to suit most pressure testing applications. BSRIA Airtightness utilises the following equipment:

A fan system, including a **variable-speed fan**, and **fan plates** (used for higher accuracy when testing a small or a very airtight building)

A **fan mounting system** (using a mountable in-door frame)

Measurement tubing for air flow rate into the building and to measure the pressure difference between the inside and outside of the dwelling across the envelope

Micromanometers: one per fan for flow pressure, one to measure the pressure difference across the envelope, and a spare micromanometer to verify the instruments (certain systems only need one multi-function instrument)

An **omni-directional anemometer** for measurement of wind speed to ensure the test conditions are valid

A **multi-input thermometer** for the measurement of internal and external temperatures

A **barometer** for the measurement of barometric pressure

A **transformer**, which may be required if the site voltage is not the same as required by the equipment

A **camcorder** or **camera** to record areas of smoke leakage

A **thermal imaging camera** to locate leaks should the building fail the pressure test

A **laptop for processing data**.

A smoke generator suitable for testing air leakage from a domestic dwelling.

Assessing the results of an airtightness test?

The diagnosis of air leaks in a building can be identified in three ways. Local leakage can usually be identified using a smoke pencil, which is a simple hand-held device used to find leaks around window frames, window sills and other visible or accessible joints. To identify hidden or inaccessible gaps in the building envelope a smoke test can be performed using smoke generators positioned inside the dwelling. A thermographic survey can also be conducted using an infrared thermographic camera.

How does BSRIA carry out a smoke test?

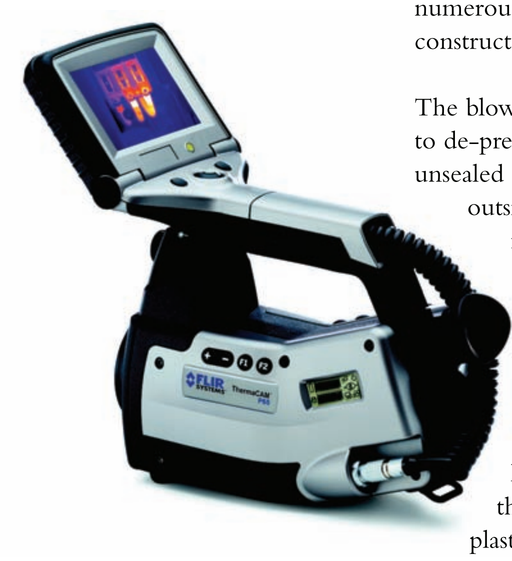
Smoke tests require smoke generators to be installed into the dwelling along with pressure test fans. The pressurisation fans should be switched off and covered, and the smoke generators should be filled with special oil to generate the smoke. They should be switched on and operated until the dwelling is full of smoke.

Once enough smoke is generated, the pressurisation fans should be uncovered and switched on to give a pressure difference of between 20 and 30 Pa across the building fabric. Video, photographs or similar images will be taken to record where smoke is escaping from the building. This information is usually more than sufficient for the building contractor to identify the problem areas.

Note that the point where smoke exits the building will not necessarily indicate the precise point of air leakage inside the building. For example, the point at which air enters a cavity may not be the same location where smoke is escaping. In these circumstances localised smoke tests are advantageous but may take longer, particularly when testing large dwellings. Note that smoke oil is readily available that does not damage a building or its contents.

Thermography as a tool for building diagnostics

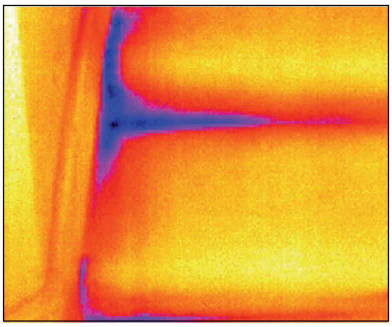
The applications for infrared thermography in the building industry are numerous: locating leaks, finding badly insulated areas and to identify construction problems such as thermal bridges.



The blower door equipment required for the air tightness test can also be used to de-pressurise the building. This will cause outside air to enter through any unsealed areas. Where there is a temperature difference between the inside and outside of the building, the effect of any infiltration on the building fabric can easily be seen by an infrared camera. Once identified, these leakage paths can be fixed before coverings and fittings make it difficult and expensive to eliminate any construction faults.

Infrared thermography also provides valuable information on installation defects and any problems with thermal insulation that could result in energy losses. While thermography mainly identifies locations of air entry and exit, it will also detect air leakage paths through wall cavities and ceilings, and behind thin materials such as plasterboard. As with smoke testing, the path through the structure may be tortuous because of air movement through cavities.

Air can leak from the most unlikely places, as here at the edge of a staircase.



Conditions and equipment

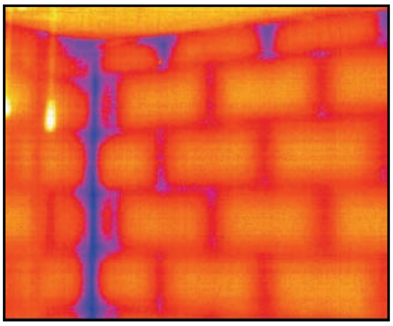
BSRIA Airtightness equipment for thermographic testing for air leakage will meet the following specifications:

- A **radiometric infrared camera** with at least 19 000 pixels, and a temperature resolution of less than 0·5°C
- An **omni-directional anemometer and thermometer** as per the airtightness test.

Thermographic testing for air leakage requires strict environmental conditions, including:

- A **temperature difference** across the building envelope, typically at least 10°C. Depending on camera sensitivity, 5°C is often more than adequate. This is usually achieved by running the central heating for several hours
- A **pressure difference** across the building envelope, so that the side being viewed is at a lower pressure, at least 30 Pa recommended
- A **low wind speed** of less than 3 m/s is recommended
- **Minimal thermal radiation** on the side being observed, for example no solar radiation and minimal hot surfaces such as radiators facing an internal surface to be surveyed. This is best achieved by working at night
- A **dry surface**, and one that has not changed in temperature significantly in the preceding half hour
- For lightweight structures, a **constant ambient temperature** of ±3°C for the preceding hour; for brick, concrete and stone, this must be for three hours.

Air can leak through the mortar joints of brickwork, and in the junctions between walls.



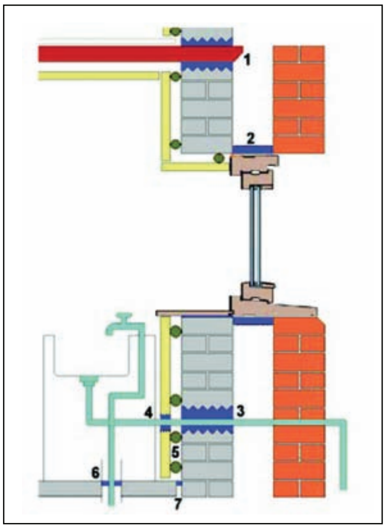
A thermographic image can show cold bridging, areas where insulation is missing, and gaps in the fabric where air is leaking, as shown by the red areas in the picture below.

How does BSRIA carry out a thermography test?

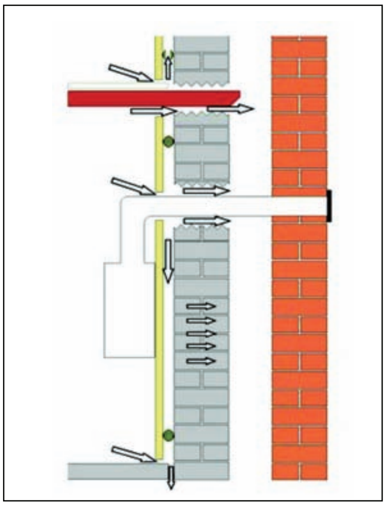
The infrared camera should be set up for the correct background temperatures, distance and emissivities. The infrared camera should be in focus, and reflections should be avoided. The inside and outside of the building will be scanned with the camera for temperature anomalies that exist prior to the building being depressurised. All such locations are noted and recorded.

Once the building has been depressurised, the building should be scanned and new thermal anomalies recorded. BSRIA will check for local sources of heat, check whether they were there before pressurisation and eliminate the possibility of other causes. The location of each anomaly will then be checked against the construction details. A report will be issued showing thermograms, locations of anomalies, and detailing the conformance to the environmental conditions as set out above.

Airtightness "Building tight"



▶ 1. Joist penetration sealed
2. Cavity closer sealed
3. Pipe penetration is sealed at blockwork face
4. Pipe penetrations sealed at dry-lining
5. Continuous dabs along dry-lining
6. Mains water sealed through duct
7.Wall to slab joint sealed



▶ Failure to ensure the integrity of blockwork and dry-lining will result in multiple egress points.

It is the belief of BSRIA Airtightness that to ensure compliance with ADL1A the developer needs to consider two air barriers, these being:

1) Internal blockwork face

2) Dry-lining

Our investigations have shown that in the majority of cases a bare block work shell is capable of exceeding the requirements set out in Part L1A with scores as low as $3m^3$ $(hr.m^2)$ being achievable.

This can only be achieved if the following precautions have been taken:

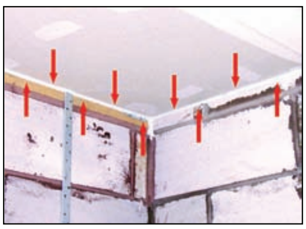
The blockwork must provide a continuous barrier, therefore there should be no gaps in the coursing. Where the blockwork barrier is breached the penetrations should be sealed so that the integrity of the shell is restored. Examples of this will include joist penetrations (joist should be mastically sealed) and service penetrations (again mastically sealed). The responsibility for these requirements will normally fall upon the Developer who will delegate to the appropriate trades i.e bricklayers, plumbers etc. In instances where the responsibility for performing these sealing works has not been clearly stipulated failures often occur. The blockwork itself must also provide a square edge to the cavity closers, failure to do this will result in difficulty sealing the blockwork to the cavity closure, which should be mastically sealed to prevent air entering the cavity. Roof trusses and plates should also be mastically sealed to ensure the integrity of the shell is maintained. We would recommend that the dry-liner should be permitted to tack the top floor ceilings, and 1st floor ceiling in 2.5 storey dwellings, to the trusses before any other trade commences work, this allow the shell envelope to be completed as long as the developer ensures that the perimeter of the ceiling is mastically sealed to the blockwork, obviously the block must be as square as possible to minimise the size of gap that will have to be filled.

At this point the developer should be able to inspect the dwelling and see that the shell integrity is satisfactory. This must be done prior to any internal finishes being installed. At this point the only air leakage present in the dwelling will be through the blockwork itself.

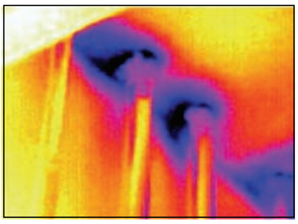
When dry-lining takes place it is imperative that the requirement to ensure a continuous solid dab is adhered to, this will significantly reduce the volume of air that can reach the internal blockwork face and will therefore aid in preventing leakage through the blockwork itself, it should be noted that the

▶ Mastic seal around joists.

▶ Cavity closure mastically sealed.

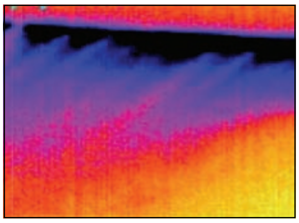


▶ Mastic seal between plasterboard and blockwork creates air cap for the dwelling.



Leakage through plumbing penetrations.

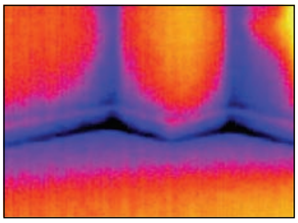
dry-wall adhesive is not an impermeable product. Continuous solid dabs must also be present around all electrical outlets and any other such penetrations, a common issue is providing a suitable seal around flexible radiator pipe penetrations. At any point where a penetration goes through both the dry-lining and blockwork it is imperative that not only the dry-lining integrity is restored, but also the shell integrity is restored. An example of this would be the boiler flue penetration, which should be sealed at the blockwork face and the dry-lining, the seal between the block work and the dry-lining should also be restored.



Leakage through floor/wall detail.

Items that penetrate the top floor ceiling should also be considered, whilst the requirements of the regulations will mean boxing in of down-lights will probably not be necessary any plumbing entering the loft space should be sealed and loft access hatches should be sealed at their perimeter (a seal is often in place in the access hatch frame, but this should not be relied upon to make an adequate seal)

Internally the SVP boxing is a common major issue and it is advisable that where the SVP penetrates the top floor ceiling a seal should be made between the plasterboard and the SVP. This will mean that no additional sealing works will be required at penetrations to the SVP boxing at lower levels.



Leakage through SVP boxing.

½ storey dwellings variations

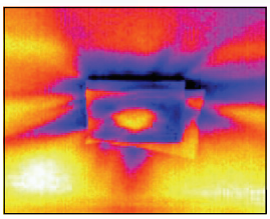
In many cases the plasterboard of the "room in the roof" will be used to make the air seal. It is therefore important that the plasterboard is sealed to the floor around the entire perimeter of the room.

Apartment variations

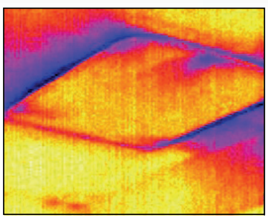
Apartments are inherently more airtight particularly where a block and beam system is employed, it is important to ensure that the walls are sealed to the beams and the beams are adequately sealed.

Table 5: Common air leakage point checklist.

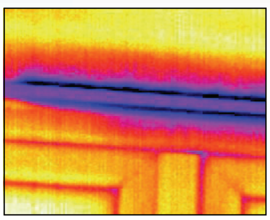
Item	Action
Joist penetrations	Well pointed and mastically sealed – Products such as joist boots can be used, but should not be necessary
Windows/cavity closers	Must be mastically sealed to the blockwork
Blockwork	Must have no gaps in the coursing
Service penetrations	Must be sealed at both the block work face and at the dry-lining face.
Dry-lining	Must have a continuous ribbon around the perimeter. Must also provide a continuous seal around electrical penetrations and alike
Loft access panels	The hatch surround must be sealed to the ceiling
Extractor penetrations	Should be sealed so that no air can enter the cavity or the void between the dry-lining and the blockwork face
Penetrations in ceiling	It is often the case that penetrations in a ceiling void, such as kitchen extracts, ***void*** are not sealed at the internal blockwork face. These must be sealed, it is impossible to prevent air reaching these penetrations at a later stage



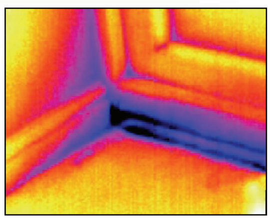
Extractor fan.



Loft access.



Trickle vent.



Door threshold.

Airtightness "FAQ's"

Quotations

Q: What information do you require to provide a site specific quotation?

A: In order for us to provide an in-depth quotation detailing "which types" and "how many" dwellings you will be required to test we will require the following information:

1. Site layout detailing the different designs of houses you have on the development. Plans and sections for each house type on the development must be supplied
2. Floor layouts and sections for each apartment block on the development
3. Which route of compliance you are adopting (i.e. using accredited construction details) If this is not supplied we will quote for both routes
4. If you would like us to suggest which plots to test then a build program should also be provided

Pre-Testing Information

Q: What information will you require prior to attending site?

A: We will ask for the following information to be supplied:

1. Dwelling plans and sections (preferably in CAD format)
2. The Design Air Permeability, available from the SAP calculation (we are happy for you to send the SAP calculations and we will extract the relevant information) Without this information will not be able to advise you on whether you have achieved the required standard or not.
3. Site Agent contact details. As this will be a new experience for most site agents we will call the site to answer any questions your agent may have and ensure they understand at what stage the dwelling needs to be at to perform a test.
4. Clarification on whether power, either 110V or 240V, is available at the plot to be tested.

Q: Can you provide any information that will give helpful guidance to our site agents on both the testing process and common air leakage areas?

A: Yes please contact us for further information

The Actual Test

Q: At what stage should we program testing?

A: Testing is typically performed post second fix. With the following criteria being met:

1. All service penetrations have been sealed

2. Trickle vents have been installed

3. Loft access hatch is in place

The Actual Test (Continued)

Q: What is your typical response time for testing?

A: Our typical lead in time is 7 days or a guaranteed 72hrs with our preferred supplier agreement (Please contact us for further details)

Q: What do we need to prepare for your visit to site?

A: Nothing, we will perform all the necessary temporary sealing required to undertake the test, all we require is access to the dwelling.

Q: Does the dwelling have to be empty for the test?

A: No – Other trades can be working in the dwelling during the test provided that they do not open any external windows or doors.

Q: Will the testing damage any of the internal finishes?

A: No – The testing is a completely clean process.

Q: How long does a test take?

A: A test usually takes 1hr to complete

Q: Will we know whether we have passed or failed at the time of testing?

A: Yes – As soon as the test has been completed we are able to advise of the result

Q: If we fail to meet the required standard can you advise us on the required remedial works which should be undertaken?

A: Yes – We will provide every assistance to ensuring you achieve your target.

Q: How many tests can you perform in a day?

A: We can perform up to 8 tests a day provided, all the dwellings pass and no further investigatory work is required

Q: How long will it take to receive our test certificate(s)?

A: Test certificates are usually supplied in 48hrs (24hrs via email)

Airtightness testing procedure - Booking a test

To arrange a test call the testing hotline on **0800 5871000**. You will be asked to provide the following information:

- Site address
- Site contact
- Plots that require testing

If BSRIA does not already have them you will also be asked to provide the following documents either electronically or via mail:

- Floor plans, sections and elevations for the plots to be tested
- Design air permeabilities for the plots to be tested

You should also advise of any site-specific requirements you may have, for example:

"There will be no access to power on the site or from the dwelling, you will need a generator"

You will be asked to confirm that the dwelling is ready for testing, such as:

- All service penetrations have been sealed
- Loft access hatch is in place
- External doors have had their seals fitted
- Boiler flue penetration has been sealed
- Extract fans have been fitted
- Trickle vents have been installed
- Plumbing is complete with water in the traps
- Electrical outlets have been fitted
- All top floor light fittings are in place
- Windows have been adjusted

Note: If the dwelling is not ready when BSRIA arrives it will not be tested

You will be asked when you would like the test. **Typically 3 days notice is required with our preferred supplier aggreement in place**. It would of course be beneficial to both parties if more notice was given, this will help to ensure that all the information required by BSRIA prior to attending site is available and will give you greater choice over the exact day you have the test. We would suggest you try to give 7-10 days notice.

The test

BSRIA will undertake all the necessary dwelling preparation prior to the test. The test will usually take 1hr per dwelling. A result will be available at the time of testing and a draft report will be left with the site manager, an official report will be sent within 24hrs of the test.

If you have any concerns over testing, it is important that you call BSRIA prior to scheduled testing date

ATTMA - Determination of dwelling type

Dwelling Types

Various generic forms of dwelling are considered as separate discreet types. Examples include:

- Detached
- Semi-detached
- End-terrace
- Mid-terrace
- Ground-floor flat
- Mid-floor flat
- Top-floor flat

The number of storeys will also define different dwelling types, such as 1, 2, 3, etc.

BSRIA Airtightness provides free testing regimes to ensure compliance with ADL1A. In order for BSRIA to provide a regime the following information will be required:

- General site arrangement
- Build program
- Floor plans / sections for each house type
- Floor plans / sections for each apartment block

Further to the confusion arising from the definition of a dwelling type, DCLG has asked the Air Tightness Testing & Measurement Association (ATTMA) to clarify how dwelling types should be defined. The table below explains the new criteria for establishing dwelling types and thus the number of dwellings that will require testing on-site. This should still be read in conjunction with ADL1A and notice taken of the documents requirements to treat each apartment block as a separate development. This table is included within ATTMA TS1, which is a supporting document to ADL1A

Definition of Dwelling Types

For dwellings to be considered to be of the same type:

They must contain the same construction details for each of the main elements, for example, walls, floors and roofs.

They must have similar floor areas. Small variations in gross floor area do not constitute a different dwelling type. For the purposes of this Technical Standard the difference in gross floor area between the largest and smallest within a dwelling type should be no greater than 15%.

They must have a similar number of significant penetrations (SP) defined as the sum of the total number of window frames and entrance door frames (including patio door frames) in the external façade. Flues are also counted as significant penetrations. A dwelling can't be considered as the same dwelling type if the total number of significant penetrations varies by more than ±1. *(For example, if a dwelling type contains 6 SPs then dwellings with 8 or more SPs can not be considered as the same dwelling type neither can 4 or less SPs be considered as the same dwelling type).*

For the purposes of this Technical Standard a cold roof construction will be considered as a different dwelling type from a warm roof construction, since in the latter case the loft space will be included in the airtightness tests. Similarly a cold floor (flat above an access road) will be considered as a different dwelling type.

Where there are a number of dwellings within a dwelling type, there may be variations in their design air permeability due to SAP calculation differences. In order for all those dwellings within that type to conform to Part L1A then the lowest dwelling design air permeability must be used as the acceptance criteria, regardless of which plot is tested. Alternatively, the dwelling type should be subdivided according to their design air permeability resulting in more dwellings of that type being tested.

Booking Hotline: 0800 5871000

Airtightness Services for Building Regulations

Stress-free compliance to Parts L1 and L2

- Airtightness testing of domestic and commercial buildings
- Design review, consultancy and site inspections
- Identification of air leakage paths using smoke
- Visual inspections and thermal imaging
- Testing equipment sales, hire and calibration
- Nationwide service
- 72-hour response

UKAS accredited, founder member of ATTMA (Air Tightness Testing & Measurement Association) and BINDT registered for L1 and L2 (British Institute of Non-Destructive Testing)

UKAS TESTING 1053

ATTMA

BINDT THE BRITISH INSTITUTE OF NON-DESTRUCTIVE TESTING

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