BUILDING SCIENCES

BUILDING SCIENCES LTD • BIRCHWOOD • P.O. BOX 238A • SURBITON • SURREY KT7 0UA
TEL: 01-398 2390 FAX: 01-390 5580

#4705

INTEGRITY TESTING

AND

SEALING

OF

HALON PROTECTED ROOMS

VAT NO: 462 7616 34
REGISTERED IN ENGLAND NUMBER 1992975
REGISTERED OFFICE: 11 QUEENS DRIVE, THAMES DITTON, SURREY KT7 0TW

CONTENTS

OUTLINE OF COMPANY SERVICES

Integrity Testing

Integrity Testing will be conducted in accordance with the 1989 NFPA 12A Room Integrity Procedure.

When the proposed British Standard on Integrity Testing has been finalised and published we will also conduct testing to this standard where requested.

Air Leakage Identification

We are specialists in air leakage identification and control. Where a room fails an integrity test we are therefore experienced in accurately identifying all significant air leakage areas around an enclosure envelope. By using the door fan to depressurise the room and with the aid of a smoke pencil, leakage areas can be pinpointed and the client provided with a detailed Air Leakage Report (copy enclosed).

Sealing Work

Using the Air Leakage Report mentioned above and with a selection of appropriate materials and skilled labour effective sealing can be quickly achieved. Building Sciences can provide all labour and materials for such sealing works.

Simultaneous Testing and Sealing

Where rooms must pass a test in a very short time scale or where multi room or multi site locations are involved a technique which we frequently use is to test and seal simultaneously.

This involves say, one of our testers plus two installers entering a room and using the fan to identify leaks, going around the envelope testing and sealing until the room is sufficiently tight to pass the test. This method can substantially reduce the cost/time involved when compared to the more usual test, seal, retest and possible reseal/retest programme.

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LEAKY HALON PROTECTED ROOMS

A SUITABLE CASE FOR TIGHTENING

The debate about integrity testing to NFPA vs the proposed British Standard continues and will no doubt be satisfactorily resolved in due course.

A critical matter which seems to be routinely overlooked however, is how to get rooms to an acceptable level of tightness to pass an Integrity Test, whichever of the standards is applied. This problem becomes of particular relevance in rooms in which little thought has been given to tightness or with construction details which are difficult to seal. At present the vast majority of existing and new rooms fall into this category and as a result fail the initial test.

There are many instances of rooms which have been insured for several years subsequently being fan tested with the frightening results of little or even zero predicted halon retention time. Any organisation with a halon protected room which has not recently been door fan tested, or even worse which has never been fan tested, should recognise the strong possibility that the room may not be sufficiently tight to give an acceptable hold time for the fire extinguishing gas.

However, even when the need for the prompt testing of rooms is being addressed the matter of getting the room acceptably tight is often a major problem. Most rooms, even those newly constructed and where the need for tightness is supposed to be recognised, leak excessively and require further remedial sealing measures. There are also many instances of enclosures failing repeated tests due to the continuing lack of adequate tightness. In one recent case a small computer room had been tested/sealed on three occasions over 18 months and still could not pass the test. These problems vividly demonstrate some deficiency either on the part of the people undertaking the sealing work, or the fan testing company, or both.

How can such leaky rooms be effectively tightened?

* By accurately identifying all significant areas of leakage around the room envelope.

* By then using skilled labour with appropriate materials and equipment to seal all leaks so identified.

Air Leakage Identification

The organisation undertaking the door fan test should not be there simply to pass or fail an enclosure, but in the later case should also provide a detailed survey of the significant leakage areas around the envelope being tested. There are a great many instances where after a failed test the client either has no information on where the leaks are located or at best he has been directed to a few only of the major areas.

The door fan is a powerful tool not only in establishing a measured leakage area for the room but equally importantly it is the ideal means to identify leakage points both large and small. By depressurising the enclosure with the fan and systematically going around walls/floor/ceiling with a smoke pencil visible and hidden leakage areas can readily be found. By this means the testing company can shortly after leaving the site of a failed test provide the customer with a detailed wall by wall Air Leakage Report identifying areas requiring to be sealed.

While it is difficult to guarantee that having effectively sealed all the areas so identified the room would then pass a subsequent integrity test, experience shows that this method provides a very high success rate indeed. There are a few occasions during an air leakage inspection when it is difficult to pick up all leakage points and this is usually where there is an area of the room with some particularly large leak and the resultant air flows caused by this can sometimes mask smaller adjacent leaks. Even in this event however, the leakage areas missed may not be sufficient to fail the subsequent test or, if necessary, these usually small areas can be identified and quickly sealed during the retest phase.

It is clear that many of the rooms presented for testing are not really designed with any tightness considerations in mind and more usually the need for tightness is addressed as an after built remedial measure.

There is widespread lack of thought and understanding of just what envelope tightness really means and of the multitude of areas through which leakage can occur. The following are some typical examples of this phenomenon:

a) Large sections of drywall missing above ceilings and below floors (out of sight).

b) Cable tray penetrations unsealed or sealed above but not below (difficult access and out of sight).

c) Large conduit penetrations sealed around part of perimeter and not at all inside (out of sight and often difficult to seal).

d) Areas of walls sealed partly from outside and partly inside leaving an air path through the hollow wall (lack of understanding plus selecting easiest area to seal).

e) Large areas of panelled walls, glazing, etc with long runs of unsealed crackage (lack of understanding that while crackage width is small long runs can add up to a significant hole).

f) Ducts/pipes/etc penetrations which are lagged/clad. Often there is a large hole in the wall which is then partly covered by the cladding being run up to the wall as close as possible but usually leaving a perimeter leakage gap (out of sight).

g) All sorts of holes stuffed with loose fibrous matter. The philosophy seems to be if you can not see through the hole it must be all right. The fibre will not provide a seal but will simply act as a filter thus cleaning up the infiltrating/exfiltrating air.

h) Metal beams located at the top of walls but not sealed to the wall below. This area is frequently overlooked or is sometimes loosely filled with fibrous materials.

i) Doors with ineffective or no draughtstripping and with leakage paths around the frames.

These are just a small selection of the wide range of leakage problems found around room envelopes.

Recognising that in a typical room this type and level of leakage exists then raises the questions -

* Is the room adequately firestopped?
* Is the room tight enough to hold halon?

Air Leakage Control

Given that adequate thought and experience had been put into the design and build including the use of air barrier materials, the sealing of all major envelope joints and adequate access for effective firestopping, then the need for remedial sealing will likely be minimal. What is normally found however, is a room with extensive leakage points probably with some or all of the following characteristics.

a) Cracks, gaps and holes ranging from literally crackage up to holes several feet across.

b) Porous blockwork and masonry mortar joints.

c) A range of substrates onto which sealants must be supplied such as concrete, blockwork, brickwork, wood, metal, glass, plasterboard, Vicuclad, Supalux, fibrous materials, cladding, plastics, rubbers, etc, all of which may be dirty/dusty.

d) Very difficult access and often having to work blind on many areas.

e) Some areas where due to virtually impossible access leakage can be identified in the general area although the specific leakage area cannot be seen.

With the range of hole sizes, variety of substrates many of which cannot be made properly clean and with difficult or impossible access, the normal means of sealing with typical firestopping materials may often be impossible to achieve. In such a situation a different outlook on the basic product/application requirements is necessary. This should address the following key sealing requirements:-

1) Must be capable of achieving an air seal.

2) Capable of adhering to various substrates.

3) Will provide a long lasting seal and will not dry out or crack.

4) Capable of accommodating the anticipated expansion/contraction/movement in components.

5) Capable of being applied to very difficult to access areas.

To achieve these requirements often requires a selection of caulking compounds, blocking materials, draughtstripping, heavy bodied air barrier paint and expanding foams. With appropriate products/equipment and experienced site installers almost all significant leakage areas can be effectively sealed.

Some of the foams commonly used can be formulated to vary the fire rating but these will often not achieve the rating of main wall components. The question, however, is whether it is preferable to have the holes effectively sealed but with a lower rated material or alternatively leave the hole partly or wholly unsealed. Given this choice the decision will normally be to effect proper sealing.

It should be borne in mind that with experienced installers large holes will mainly be blocked by fire rated board leaving only the difficult and irregular penetrations to be tightened with the sealant. The volumes of sealants used to tighten a typical room will therefore be very small indeed. Also if necessary exposed sealants can be covered over with selected compounds to improve the overall fire rating of the penetration.

On new construction the testing of halon rooms is frequently an urgent matter requiring testing/approval to occur only shortly before the hand over date. In such circumstances a solution now being frequently adopted is for a tester plus say two installers to enter the room, use the door fan to depressurise and work their way around the room envelope identifying leakage points and sealing until the room is sufficiently tight to pass the test. This is a time and cost effective method of getting rooms passed within a short and predictable time frame. This method is also being used by clients with rooms with very limited access and also customers with multiple nationwide sites as a means of avoiding the lengthy delays associated with the typical programme of test, seal, test and sometimes seal/retest etc.

Summary

Rooms continue to be built to loose construction standards which are inadequate for the retention of halon and CO_2. However the know-how now exists to quickly and accurately identify air leakage areas around an enclosure envelope and to achieve effective and long lasting sealing.

For the future perhaps we can look to Canada where door fan testing of rooms has been going on for around ten years, and they are now finding that with improved construction techniques and awareness of the need for tightness many of the new rooms are requiring much less remedial sealing work than those of a few years ago.

There is already the start of a trend in the UK to follow the Canadian example of designing and building rooms to the correct tightness level. There are now examples of UK building sciences companies providing advice on construction details and buildability of enclosures at the design stage. This is now being recognised as highly desirable, particularly on large projects involving multiple rooms where the time and expense of extensive remedial sealing works would be prohibitive.

* * * * *

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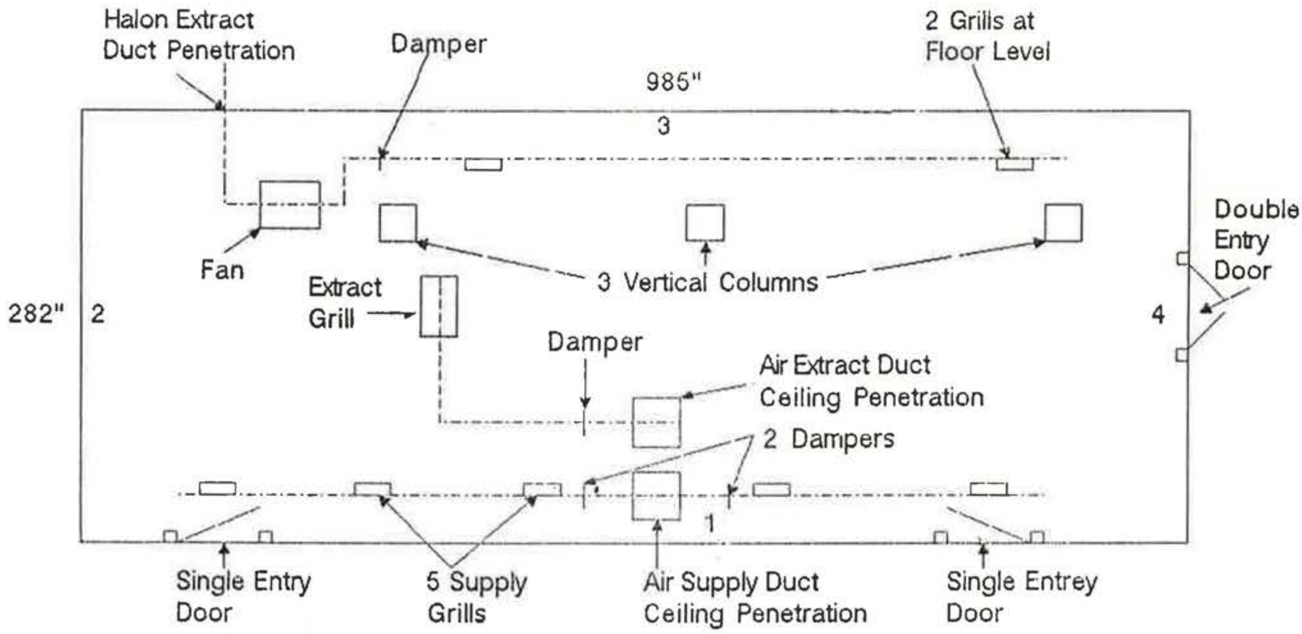
LEAKAGE TESTING REPORT

SWITCH ROOM



* Room Height: 145 inches from ceiling to floor.

* This room has a concrete floor.

Walls One, Two and Four are concrete block construction, with horizontal fire proof covered beams at the tops. The construction of Wall Three is lower wall concrete blocks, mid wall windows, upper wall panel construction.

* Air supply enters through a ceiling duct penetration along side Wall One. The ducting then splits through two dampers and runs through a high level duct with five grills alongside Wall One. These two dampers were manually closed during the test.

* Air extract is through a ceiling duct penetration alongside Wall One. The ducting flows at high level through a damper to one central room extract grill at high level. The damper was manually closed during the test.

* Halon extract is via a fan located along side Wall Three and exhausts through a duct in Wall Three. Upstream of the fan is one damper, powered closed, the high level ducting then dropping to two floor level extract grills.

Wall One

Lower Wall - (white)

* Left wall one 3 inch square conduit penetration, perimeter sealed but gap down right hand side. Reseal. Foam inside conduit.

* Left wall above door one 12 inch cable tray penetration. Bottom and sides tray sealed but interior and around cables sealed but large gaps. This area has been sealed with mortar which is not adhering to the cables/tray and is drying out. This area must be foamed to ensure sealing.

  Above cable tray the horizontal block/underside beam joint incomplete. Caulk gap.

* Single entry door, frame sealed along top but not the vertical sides. Seal. Also seal vertical sides bottom frame to skirtingboard.

* Left wall one 18 inch wide vertical cable tray, penetration through floor. Cable tray plus cables sealed but small gaps around backs cables which should be caulked.

* The above cable tray runs up right side of vertical wall column. Behind cable tray and at top right column where this meets the horizontal wall top beam there is a 1 inch by 9 inch gap. This should be foamed.

  Also behind the cable tray where the blockwall butts to the bottom side of horizontal beam there is a 0.25 inch by 2 inch gap which should be sealed.

* Right wall one 15 inch vertical cable tray floor penetration. Cable tray plus cables sealed but gaps at backs of cables. Caulk. Between cable tray and wall is inserted two blocks. The edge of the block adjoining the cable tray should be caulked and the edge of the block adjoining the wall similarly.

* Upper right wall one 2 inch square conduit penetration. Inside foamed, OK. Left and right side perimeter of conduit to be sealed. Right side must be sealed at back of small cable tray and gaps exist in mortar joint between blocks behind cable tray. Caulking should be inserted into this gap as best possible.

* Right wall one single entry door. Caulk sides of frame to wall and to skirtingboard.

  Door weatherstripping OK. Large keyhole in door, severe infiltration. Because this is a large room these three keyholes in the doors may not have too bad an affect. It would, however, be better if these locks were changed to Yale type fittings.

Upper Wall - (black)

* Second panel insert from left, located in web of top wall beam, gaps in perimeter caulking at top right corner, top left corner and large gap at bottom left corner. Reseal.

* Vertical wall column to right of door, junction between bottom horizontal beam and vertical column not sealed. Seal.

* Second wall column to right of door, leakage is occurring where the bottom flanges of the horizontal beam meet the vertical column. These bottom flanges should be sealed around, either side of column.

* Panel insert in web of beam to right of above column, sealed around but gaps along top, reseal.

  Next panel along, reseal bottom left hand side and left hand corner where gaps exist.

* Centre wall, above halon bottles where crossbeam joints top wall beam. Left side of crossbeam at the top web to web connection there is a large hole which should be sealed.

* At next vertical wall column the wall toes of the horizontal wall beam are not sealed to the column. Seal.

* Upper right wall. Panel insert in web of beam. Second panel from right end. Top caulking missing from panel. Seal.

* Right wall/wall connection. Where top horizontal beam meets side wall, gaps around toes at top and bottom. Seal.

Wall 2

Lower Wall - (white)

* Centre upper wall one 2 inch square conduit penetration. Outside perimeter sealed but inside unsealed. Foam. Below conduit gap in mortar between blockwork, seal.

* Upper wall 20 inch vertical cable tray. Behind cable tray 1 inch by 18 inch hole in wall above blockwork and below horizontal beam. Seal using tube and double component foam.

* Centre wall/floor penetration. Cable tray with large cables penetrate floor. Area is sealed except for metal angle at back of panel which leaks along both its sides and along its length between the flange and the sealing material. These areas should be sealed.

* Upper centre wall just to right of vertical 20 inch cable tray, vertical gap between concrete blocks. Mortar missing, seal joint.

* Right wall one vertical wall column. At top left side column where it meets underside horizontal beam, there is a large gap in the wall partly filled by rubble. Rubble should be removed and area foamed.

* Upper right wall one 4 inch cable tray penetration. Perimeter and inside sealed but inside leaks bottom left hand side tray and below cables at right side. These areas should be caulked.

Upper Wall - (black)

* Centre wall one 3 inch cable tray penetration with single cable. Opening has been blocked with split wooden panel. Caulk exterior of panel to beam web. Caulk along centre joint in panel. Caulk around cable tray and cable.

* Centre wall one 20 inch vertical cable tray penetration through ceiling. At rear of tray gap to toe of beam blocked. Seal blocking to toe of beam and to back of cable tray. Seal edges of cable tray to ceiling. Interior of cable tray partly blocked but huge gaps. Area inside cable tray and around cables should be foamed.

* Upper right wall panel insert in web of beam. Perimeter sealed but gap at top left hand side. Reseal.

Wall Three

Lower Blockwall - (white)

* As this is an outside wall the gaps at the masonry joints on the top of the skirtingboard should be sealed along the length of the wall.

* Halon duct discharge through window panel. Perimeter discharge duct sealed except along top, which must be caulked. Above duct the top section of the window frame has not been caulked to the window top wooden batten.

* There are thirteen metal 'T' sections into the blockwork with the flat of the 'T' showing on the wall face. In some areas the toes of these 'T's have been sealed back to the blockwork. In many areas, however, there are gaps and all of these gaps should be caulked. At the bottoms of the 'T's where these run through the skirtingboard, the perimeter of the flange should be caulked to the skirting board.

* Metal window frames with intermediate 'T' bar sections. Frames are tight with the exception of the horizontal sill plates and tops where these adjoin the webs of the 'T' bars. Gaps exist at the following and should be sealed.

  Bottom left 'T' one.
  Top and bottom right 'T' two.
  Top right 'T' five.

* Right window panel, right hand side vertical frame leaks. Caulk.

Top Panel Wall

* Above top window metal frame is located a wooden beadboard. Seal top run of this horizontal board to upper panels.

  The upper panels have vertical joints which should be caulked.

* The upper panels should be caulked to the wooden beadboard at the junction of the wall/ceiling. These panels should be caulked to the underside of the beadboard. The top side of the beadboard should be caulked to the ceiling.

* Where the toe of the metal 'T's penetrate the panel wall, the metal 'T' bar should be sealed to the panels along the vertical runs.

* The upper wall/ceiling beadboard should also have all end joints sealed at the end wall/wall junctions and where these butt against the metal tops of the 'T' sections.

* Along length of wall there are crossbeams which penetrate the side wall panelling. Around each beam penetrations there are large gaps around perimeter. Some gaps in webs can be caulked, others which are much larger will have to be foamed.

Wall Four

Lower Wall - (white)

* Centre wall, one double entry door. Caulk sides of frame to wall and to skirtingboard. Fit weatherstripping and door bottom sweep to doors. If possible replace large keyhole with Yale type fitting.

* Centre wall above door, one 1.25 inch square conduit penetration. Perimeter sealed but not inside. Seal.

* Upper right wall four conduit penetrations in top/bottom grill cover assemblies. It is difficult to assess what is happening through these conduits, three seem to be quite still with little air movement whereas the third one, number three from the left appears to show some infiltration. It is suggested that all four conduits be opened and if the interiors are not sealed this should be undertaken. Around these four conduits there are various joints where the mortar between the blockwork has broken down. Seal where necessary. Where these four conduits pass through the wall the configuration is metal top channel, metal bottom channel with side wood inserts. At the two sides of each conduit the vertical wood joint should be sealed and the horizontal toes of the channels caulked to the wooden panel.

* One 0.75 inch conduit connection at right wall/wall line. Seal around right side.

Upper Wall - (black)

* Left wall where large crossbeam butts to wall, gap lower left web of beam to blockwall. Seal. Seal similar right side beam.

Ducting Systems

Air Supply Ducting

* Left hand damper, seal perimeter of housing to duct.

* Halon extract system. Joints in ducting between damper and exterior grill leak. All ducting joints should be caulked.

Ceiling

* Around centre of ceiling there are three cable tray/ducting penetrations. These penetrations are fairly well sealed but do leak in areas. As these are at ceiling level and should be above halon level, no sealing work is required.

* The ceiling is penetrated by a supply and extract duct. The perimeters of these penetrations do leak but again should be above halon level so no sealing is required.

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RECOMMENDATIONS ON REMEDIAL SEALING WORKS

It is critical to the initial and continuing effectiveness of remedial sealing that it is undertaken by skilled personnel using appropriate products and methods. We have seen many examples of the wrong products being used with unprepared substrates by untrained personnel. This can often negate the effectiveness of much of the work particularly for efficient longer term sealing.

Where Building Sciences Limited advise on the required remedial sealing areas and materials but are not contracted to undertake such sealing, we cannot accept responsibility for the quality or effectiveness of the materials and works performed.

Where necessary Building Sciences will recommend sealing materials for specific areas/applications and identify the suppliers of such materials. The Client should arrange for these suppliers to visit site to make final recommendations on the products to be used and to advise the Client's labour on applications techniques.

It is essential that the products used for sealing are approved as acceptable to comply with any appropriate Fire Regulations. We recommend that the Consulting Engineers are advised of the products involved and/or a visit to site arranged by the Borough Building Control Officer to discuss the materials to be used and the locations and areas of the sealants involved. If advised by the Building Control Officer, have an officer of the Fire Brigade visit.

The filling/sealing of cracks, gaps and holes in the building envelope.

The following guide lines generally apply:

Less than 0.25" gap	-	caulking
0.25" up to around 1"	-	single component foam
Above 1"	-	two component foam

General Comments

For all products we look to form an effective and continuous air barrier with material providing good and long lasting adhesion, capable of taking any reasonable level of expansion/contraction/ movement amongst the substrates and capable of being painted (if necessary) and with no unacceptable long term odour problem. It must also be able to form a lasting seal without drying out or cracking.

Substrates

There are (particularly for caulking products) different products for differing substrates. Not only the material of the substrate is important but also such aspects as is it porous, is it painted, etc. Suppliers will advise on the correct product for the application.

Smells

Odours are emitted from products, particularly caulking (some products) and it is important that in rooms which are regularly occupied products with minimal odour production are used. Many products will produce odours for say 24 hours after application only and these are usually acceptable to most occupants.

Care must be taken not to use some exterior grade products which can create long term odour problems indoors.

Preparation

This is one of the most neglected areas. The product suppliers will advise on the required degree of cleanliness of the surfaces and on the need for and type of primer which may be required. It is critical for the long term effectiveness of sealing that their instructions are followed.

Some products are more forgiving than others if the substrates are not to be perfectly clean. Again the manufacturers can keep this in mind when recommending the most appropriate product for the application.

Fire

It is essential that you obtain the necessary approvals for the use of these materials in respect to Fire Regulations.

Foams

The single component Multifoam 1 polyurethane foam we recommend is already widely used in the building industry for the 'foaming in place' of window and door frames. Typically this should be reasonably quick curing being tack free in around 20 minutes and one hour trimable. The combustion characteristics of this foam are classed as:

FH_2-10mm according to BS6334 method and DIN4102 B2 according to German Standard DIN4102.

The double component polyurethane foam recommended comes in portable pre engineered disposable packages requiring no on-site formulation and suitable for use in the many relatively small and difficult to access areas found around rooms/buildings. The product name is Froth-Pak and comprises polyols and isocynate held in separate containers and mixed at the spray gun nozzle. This product has not been tested to a British Standard fire rating, but is widely used in the UK. This is rated to the American standard ASTM D1692 Book 35 whereby on all five samples tested the flame went out before the end of the 60 second burn time and the average extent of burning was 25.2mm.

While site formulated, machine sprayed double component polyurethanes are available, this is not usually a practical or cost effective option due to the relatively small areas and difficult access involved in air leakage sealing works.

Colours

Consideration must be given to the colour required for caulking as this is often the 'highly' visible product around door and window frames, baseboards, etc. Consideration should also be given to whether the product needs to be paintable.

Large Holes

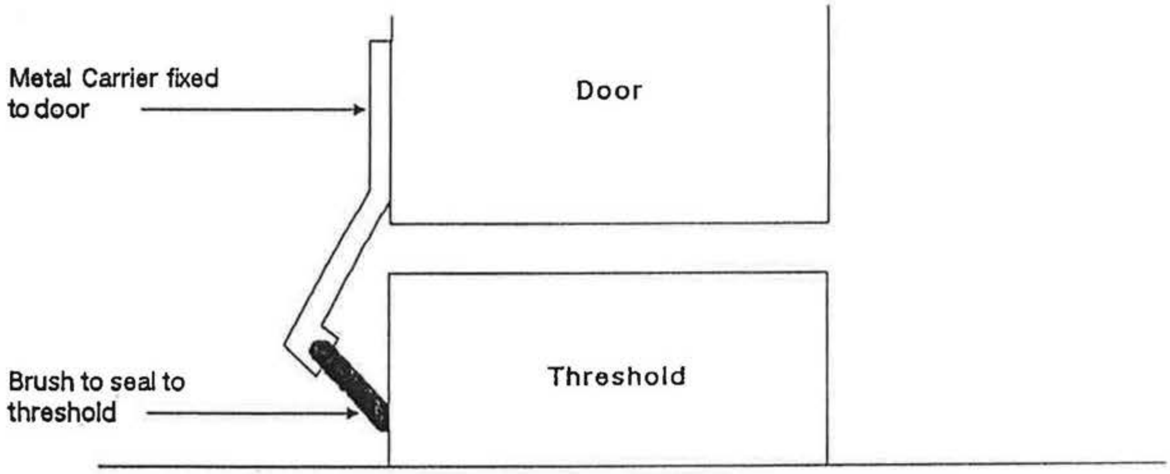
The treatment of very large holes needs to be considered on a case by case basis. However, as an example a large hole in plasterboard with some penetration might be tackled by cutting two pieces of plasterboard to approximately fit around the penetration, insert into position from each side of the penetration and fix in place and seal around the perimeter of the penetration with single or double component foam.

Cable (or Cable Tray) Holes

Where foam is used to seal cable openings or conduits going through walls, consideration may wish to be given to future cabling needs. If necessary a sleeve can be foamed in place alongside the existing cables and plugged. This plug can be removed to allow the running of future cables.

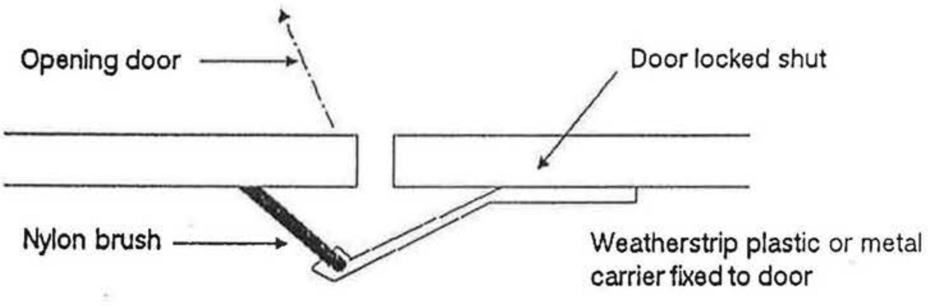
Doors

Sometimes doors have no threshold. As a result any Door Bottom Sweeps (DBS) will brush against the floor for the full sweep of the door as it is opened and closed. On doors which are regularly used this will result in significant wear/ deterioration of the DBS. It is recommended that hardwood thresholds are fitted below doors to permit the following type of sweep arrangement to be used.



If it is decided not to fit thresholds then the brushes will wear excessively. In this case these brushes should be examined at least every six months to assess their continuing effectiveness.

Regarding double wooden doors of rooms which have no centre jambs and therefore weatherstripping (W/S) the gap between the doors has to be carefully considered. With wooden doors the edges can sometimes be rebated and brush inserts fitted. For some types of metal doors '0' Tube or custom formed silicone gaskets can be considered. Alternatively, we suggest that one 'nominated' door in each set is considered as 'locked closed' and is only opened very occasionally for plant machinery access. With this arrangement the following could apply.



For door W/S in general it is critical that the arrangement of the W/S products around the door perimeters are arranged to give a continuous seal.

Small beads of Caulking

Where small beads are to be used, as in caulking angles and tees to roof plasterboard, there are sometimes problems in some areas with adhesion. Say one hour after caulking these areas the runs should be reviewed and upgraded as necessary.

RECENT CUSTOMER LIST

* Mail Newspapers
* Laing Management Contracting
* Express Newspapers
* John Laing Construction
* Safeway
* Bowmer and Kirkland
* Wormald
* Taylor Woodrow
* The Economist
* Lloyds Bank
* Unilever
* British Telecom
* Norwest Holst
* Bovis
* Crown House Engineering
* Mercury Communications

BUILDING ENVELOPE NEWS

An information service for building owners and managers, architects and engineers concerned with comfort, structural integrity, energy savings and building preservation.

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BUILDING ENVELOPE NEWS – WHAT'S THAT?

In several countries building envelope tightness is not only a matter of concern but also a matter of statute.

While widely ignored in the UK, we believe that attention is now turning to this important matter which is now recognised as significantly contributing to the following building problems:

(Continued on Page 3)

WHO NEEDS TIGHT ROOMS?

Well lots of organisations do, for example:

* Pressurised clean rooms
* Computer rooms
* Pharmaceutical processes
* Operating theatres
* Halon rooms, etc.

It is still surprising how many so called tight rooms are just built to normal standards with little thought to the required tightness.

Building Sciences have been involved with many such rooms but a recent instance highlights the problem. Two very large computer rooms had to be pressurised to 20 Pascals. This was not being achieved in spite of extensive site rectification work. Problems included:

- Rooms initially too leaky
- Common air plenum floor void outside room too leaky, spilling air into adjacent rooms
- Adjacent rooms too leaky to equalise room pressure to under floor plenum.

By tightening the room envelope not only was an acceptable positive pressure achieved but also a significant reduction in space conditioning costs.

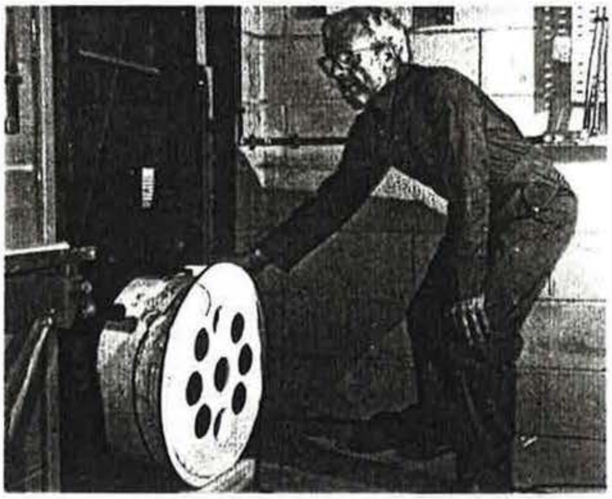
(Continued on Page 2)

HIGH WINDS HIGHLIGHT WATER LEAKAGE

Last winter's high winds have highlighted problems some building occupiers have been living with for ages – water penetration. When penetration occurs only during windy conditions then the problem may be the leaky building envelope and not simply a deficiency in exterior weatherproofing. In this situation water is being driven into the building due to discontinuities in the envelope pressure plane, caused by many unintentional cracks, gaps and holes in the walls.

Building Sciences have recently conducted a number of 'water tests' where by using a door fan to depressurise an area of a building to around 60 Pascals, to simulate a 25 mph outside wind and by playing a hose on the exterior wall, water penetration can be encouraged and leakage areas identified. After considering the design details of the walls a decision can be made whether interior or exterior sealing is the best solution to the particular problem.

Until recently fan doors have been relatively unknown in the UK except for integrity testing of halon protected rooms. They are, however, quite widely used in other countries as a diagnosic tool in the building air leakage identification and control field.



Door Fan Speed Being Adjusted to Give Desired Depressurisation

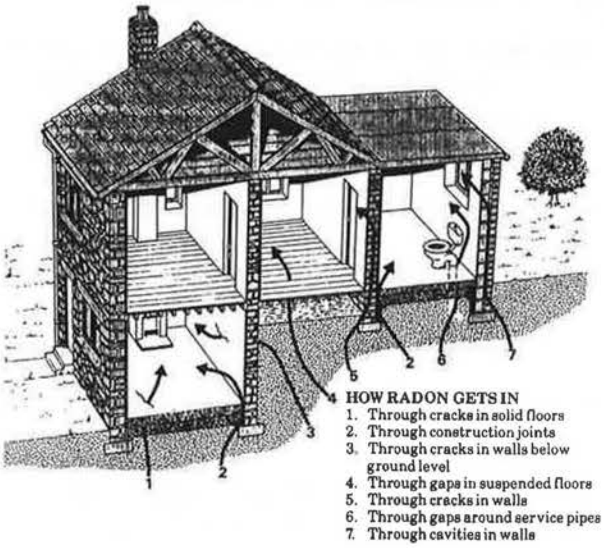
BUILDING OCCUPIERS AT RISK FROM RADON GAS

Earlier this year the Government agreed to halve the recommended safety level for inhailing Radon Gas as proposed by the National Radiological Protection Board. The environment minister said the Government accepted the Board's advice to halve the action level from 400 Bequerels per square metre to 200 Bqs.

Radon is a naturally occurring radioactive gas which seeps into buildings from rocks underground and is thought to cause 2,500 deaths per year from lung cancer, and in a recent report is also being linked with leuckaemia.

Radon comes from the radioactive decay of radium which in turn comes from the decay of uranium. The main risk areas are currently identified as Devon, Cornwall, Somerset, Deeside in Scotland, Northamptonshire and Derbyshire.

Concentrations of radon in the open air are very low, but when it enters enclosed spaces, such as buildings, it can reach high concentrations.



How Radon Gets In

Positive steps are being taken to mitigate this building envelope leakage problem, mainly by:

Identifying and sealing off the radon entry routes

Venting the under floor area to the outdoors by passive or active means.

Information on the problem and recommended remedial actions is available from the Department of the Environment and the National Radiological Protection Board.

Building Envelope News – Whats That? (From Page 1)

* Comfort and air quality problems
* Interstitular condensation due to deposition of moisture in exfiltrating air.
* Wind driven rain penetration due to discontinuities in the building envelope pressure plane.
* High heating/cooling costs
* Impaired performance of mechanical systems

The focus of Building Envelope News is to provide a digest of news, ideas and events related to the building envelope industry. Our intent is to use plain language to communicate with those who may have responsibilities which can be impacted by the design, construction or the maintenance of the envelope.

ARTICLE REPRINTS AVAILABLE

Readers can obtain photocopies, free of charge from Building Sciences of the following articles:

'Air and Vapor Barriers' – discussion of cause and affect of air leakage in commercial buildings.

'Mind the Gap' – air leakage or where the building trades have not met properly.

'Building Air Leakage' – the problems of uncontrolled air leakage for building managers and occupiers.

'Building Envelope News' is offered to anyone buying or performing services related to the building envelope. If others in your organisation would like to be on the mailing list, just contact Building Sciences on 081 398 2390 and their names will be added.

NORTH AMERICAN FORUM

In North America there has been significant attention to the building envelope for many years now. Periodically Building Envelope News will include key articles on the North American building sciences scene.

The following article demonstrates the commitment of the Canadian building sciences industry to providing a satisfactory air barrier system and also to innovative building methods while focusing on the buildability of the wall assembly.

Mock – Up Wall Key to 'Buildability' at Empire Plaza

Empire Plaza is a luxury residential condominium tower nearing completion at the south end of University Avenue in Toronto's financial district. It is an upmarket project which called for commercial construction techniques incorporating residential features.

Designing a curved frontage like this, combined with the need for operable residential windows, presented a challenge to all concerned.

Since the building has an unusual curved frontage, these combined requirements presented the builder, Toddglen Construction, with some interesting challenges. Richard Taylor, project partner with Young & Wright Architects decided to call in Michel Perreault of J C Perreault & Sons, to develop a wall assembly. "This design would have to be 'truly buildable', incorporate granite cladding on the outside and a good air seal on the inside, interface with residential operable windows, and be cost effective!"

"Young & Wright were committed to achieving a full air barrier system, as required by Code, which in residential buildings is not typically provided," added Taylor. "We felt it was very important to explore a number of exterior envelope options, through an inter – active process with the construction manager and the subtrades involved. We believe this to be the best recommendation to our client to achieve acceptable results."

The agreed approach was to take Perreault's design and construct a sample mock – up wall panel, approximately eight feet by ten feet. This wall would be structurally tested and improved at the prototype stage to ensure smooth construction during the project.

"A number of trades had to work together to assemble this 'non – package' solution", explains the building science consultant. "It is not like a conventional prefabricated curtain wall, and we had to ensure that the trades could create the desired effect."

"Some components were hung to the slab, others were installed in between the slab, such as the drywall. Although the result is not a load bearing wall, it cannot be described as a true curtain wall, which is usually prefabricated."

Adds Perreault "we were faced with a complex structure frame (curved with indentations) without the cost effectiveness of repetitions. There were also tolerance problems – they have to be much greater on a curved structure."

"Our approach was: if we're going to use granite, lets use a system where the granite is supported by the structure. Steel studded drywall had to be installed anyway as a room finish, so we decided to create another structure out of these components.

"The windows had to be held to something very strong; in this case, the frame which holds the granite. The drywall frame was then attached to the granite frame."

What special considerations were there for the air barrier? "One of the key elements was the ability to achieve continunity at least cost possible. Applying drywall between the structural concrete frame was the most economical because we had to use drywall for acoustical and fire reasons anyway. It was the obvious choice."