

Building Control NEWS

THE ROYAL BOROUGH OF
KENSINGTON & CHELSEA
DISTRICT SURVEYORS
NEWSLETTER



Issue 3 2004

Introduction

Welcome to issue 3 of Building Control News. We have continued with the same mix of information, fun and technical detail which I hope you enjoy. I would be very happy to receive suggestions for the content of future issues.

Many of you will have taken part in our customer satisfaction survey which has just ceased after running for the past few months. Responses are still coming in but initial results suggest that we are doing something right and our next issue will contain a full survey report. However I would be pleased to hear from you at any time if you have suggestions for improving our service.

If you like a different type of challenge then try the origami house on page 7. I managed to complete this (with a little help!) although I ended up with brain and finger ache. If you want to know more about Latent Gold please contact us.

Terry Ward

Director of Building Control

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CADOGAN HALL

Cadogan Hall has emerged from a two-year intensive programme of works transformed into a concert, exhibition and arts venue.

Now the base of the Royal Philharmonic Orchestra the former First Church of Christ Scientist was built between 1904 and 1907. The architect, Robert Fellowes Chisholm, had been the Government's consultant in India responsible for civic, government and university buildings. The dramatic mixture of different styles is typical of his designs. Originally seating congregations of 1600, the church fell into decline in the 1990s and languished in neglect and uncertainty until purchased by Cadogan Estates in 2000. Cadogan Hall with its impressive galleried auditorium, large public spaces and offices was ideal for conversion into a setting for rehearsal, performance and exhibitions.

The re-use of Listed buildings, particularly for the uses proposed for Cadogan Hall, presents many challenges. Modern expectations of comfort and facilities, let alone the needs of Building and Licensing regulations, require extensive and fundamental changes.

Central to the viability of the scheme is the staging of performances and events so public safety is a crucial consideration. A dialogue established very early on with the Borough's Building Control and Licensing Officers, continuing throughout the life of the project, enabled practical, efficient solutions to be implemented without compromising the form, detail and character of the building. Accessibility, awkward to get right in a Listed Building, was also important. New lifts and discreetly located platform hoists deal with the Hall's many half levels. The public now benefits from level access.

- 2 The essence of concert hall design is acoustics. Cadogan Hall is no exception. Measures taken to prevent sound 'breaking out' of the building included making the auditorium ceiling and roof heavier and 'treating' the leaded windows of the auditorium with large secondary glazing panels. New resonator tubes on the ceiling and on the walls under the Gallery are 'tuned' to correct

(Continued on page 2)

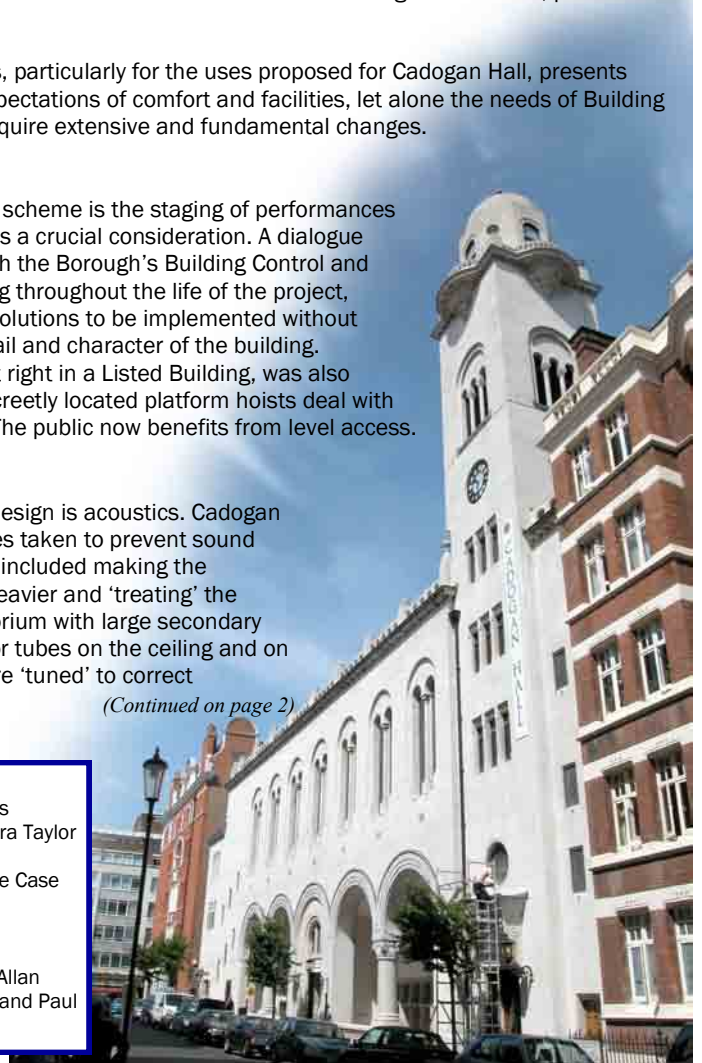
Design Team

Architect – Paul Davis & Partners
Structural Engineer – Adams Kara Taylor
Fire Consultant – Derek Pointer
Building Service Engineers - Voce Case & Partners
Builder – Walter Lilly & Co Ltd
Client – Cadogan Estates
Building Control — Garry Sharp, Allan Lye, David Gammon, Dave Best and Paul Hanson



Article by Calvin Bruce
For Paul Davis & Partners

Photograph by Alastair Ferguson



Photograph by Paul Hanson

**2. Why did you choose to work for Building Control?**

It just happened when there was a vacancy at the time and I was travelling to county hall. It was also closer to home.

3. Describe your first boss in three words

Understanding, strict, fair.

4. If you could have any job in the world what would it be?

Go back to teaching. It was a very rewarding job.

5. You are currently a Manager for the Administration Department in Building Control, what's the best and worst thing about your job?

The best parts are; the atmosphere and teamwork — its a friendly office. The worst; there aren't any bad points to raise, its one of the best offices I have worked for.

6. What's your favourite food?

I'm very into Italian food, I love cooking Pasta.

7. If you could have a different holiday every month to see the world or have £20,000 cash handed over to you which one would you choose?

I would definitely take the holiday option, I would love to travel as much as possible.

1. What was your first ever job?

A teacher, teaching kids between the ages 11-13, in East Africa, Kenya.

8. What could you improve regarding your health?

Not much, I am quite content with my health at present.

(Continued from page 1)

unwelcome performance acoustic effects. As a result Cadogan Hall has a rich characterful acoustic, unique in London's serious music venues, to enhance the audience's experience of each performance.

Theatrical lighting with computer control systems can be pre-programmed to move and provide different beam colours and patterns to suit each performance. A sound system (capable of delivering 'surround sound' to the stalls) and a large screen (that can be lowered at the rear of the stage) enable events elsewhere to be shown here by live relay.

Although Cadogan Hall may appear austere there is a wealth of fine details. The leaded and stained glass designed by a Danish nobleman in 1905 and restored in all its glory, is particularly beautiful. The restoration of the former organ screen also revealed that each of its intricately carved details is different.

As Cadogan Hall approaches its centenary, Cadogan Estate's vision and investment ensures that it will play a major role in the cultural life of both the Borough and the Capital as a whole.

The Gallery

Wilbraham Hotel; Wilbraham Place
Architects John R. Harris
Struct Engineer Harold James Ptns.
Mechanical Engineer Carnell Warren
Builder Gleasons
Building Control Parvinder Virdee, Paul Hanson and David Gammon

**37 Tite Street (Single family dwelling)**

Architect Tony Fretton Architects
Struct Engineer Price & Myers
Builder Sindall Ltd
Building Control Richard Beddoe

Mckay Trading Estate, Kensal Road

Architect APT Partnership
Struct Engineer Adams Kara Taylor
Builder Wates Construction
Building Control Alan de Souza, David Best, David Gammon, Paul Hanson



The Guide

Simple guidance to the Approved Documents

No. 2 Approved Document B 2000 item 6.49

By Paul Hanson



Ventilation Ductwork and means of escape (BS 5588: Part 9)

The Problem Ductwork forms a natural path for smoke and fire to spread around a building. The construction of the ducting and any fire protection applied around the ducts, will determine the amount of time smoke and fire will take to affect protected escape routes. ADB refers to BS 5588: Part 9 which gives standards to prevent this problem.

The Solution

1. **Ductwork should be constructed** from non-combustible materials, metal or mineral based components. Ductwork constructed from plastic, timber or insulation materials are therefore not covered by BS 5588: Part 9.
2. **The same system of ductwork must not serve both floor areas and protected escape routes.** Separate systems should be provided as shown in **Diag 1**.
3. **Where ductwork passes through protected escape routes**, the ductwork needs

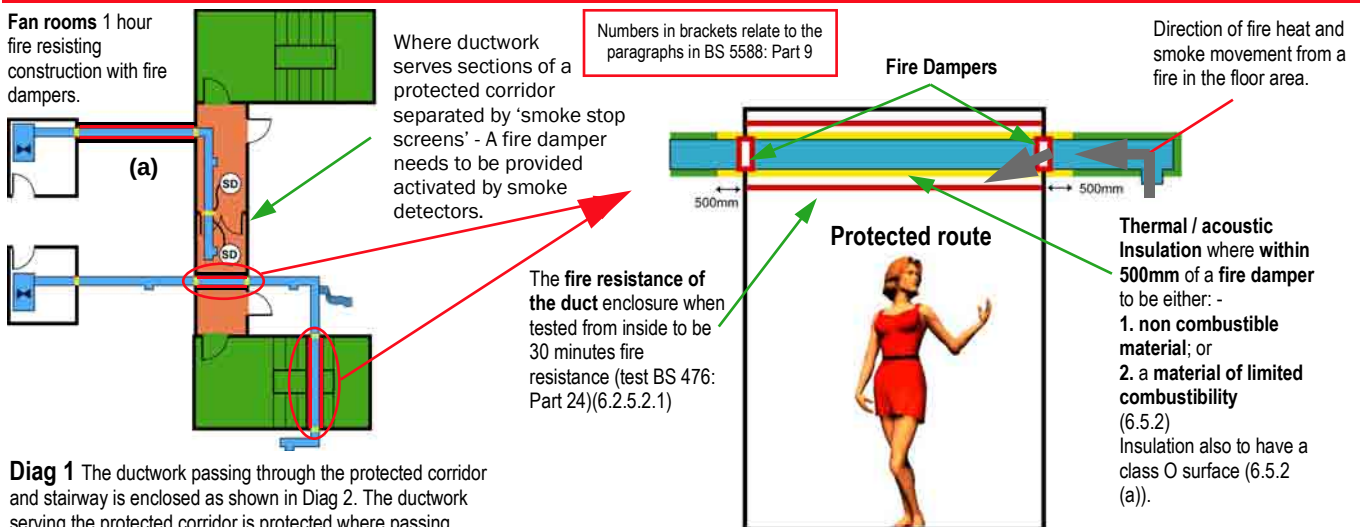
to be **enclosed with fire resisting construction** (known as method 2) or the **duct itself be fire resisting** (known as method 3). This will prevent smoke spread into the route (see **Diag 1**).

3. Fire dampers be provided in the enclosure of any partition or floor which needs to be fire resisting (see **Diag 2**).

4. Non domestic kitchen extract ducts require separate ductwork enclosed with fire resisting construction where passing through areas outside the kitchen. Fire dampers are not suitable because the build up of grease would make them unable to close.

This guide is intended to cover the main areas affecting means of escape. In BS 5588: Part 9 other areas to consider are:-

External outlets/inlets 6.4.1; Ductwork serving special risks 6.4.6; Fire/smoke dampers in hotels/sleeping risks/hospitals/entertainment premises 6.3.3.2.1, 6.3.3.2.2, 6.3.3.2.3, and 6.3.3.2.4; Components 6.5.2—6.5.4; Vertical shafts 13.4.2; Compartment floors 6.2; Recirculation 6.6



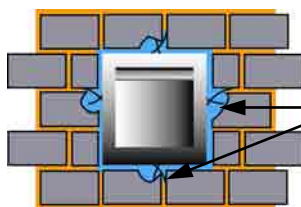
Diag 1 The ductwork passing through the protected corridor and stairway is enclosed as shown in **Diag 2**. The ductwork serving the protected corridor is protected where passing through the floor area (a). A separate fan room is provided for the system serving the protected route.

Diag 2 Section of protected lobby corridor or stairway.

Fire Dampers

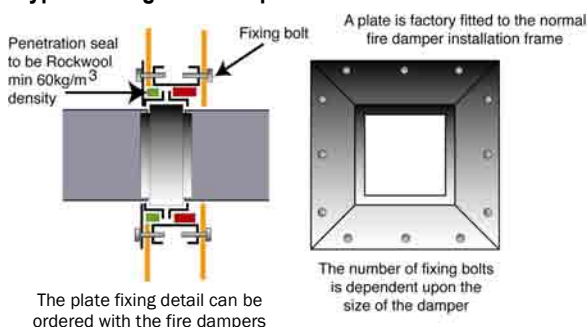
- ◆ Should be securely fixed independent of the ductwork.
- ◆ If the penetration is a brick/block wall or concrete wall/floor use the industry standard HEVAC/HVCA Specification No. HVC 6/3/83 (See illustration below).
- ◆ Access panels should be provided for maintenance and resetting dampers (6.3.6)

Typical fixing detail for brick & block walls



The tabs on the damper frame shall be bent out and solidly built into the mortar joints between the brickwork or blockwork

Typical fixing detail for partitions



The above is known as method 2 and is most common. For method 3, the ductwork itself would be fire resisting from the inside

Myths

Myth 16 gauge metal ductwork (or ductwork complying with DW142/144) is fire-resisting and therefore does not need any further protection where passing through protected routes.

Reality It is unclear where this originated from, but the claim was always unsupported by any fire test, until 1998 when 'Fire Protection' a Bishop Stortford-based manufacturer tested such ductwork to BS 476: Part 24 and found the ductwork failed the insulation criteria after 6 minutes, and collapsed after 11 minutes.
Source H&V News 24.10.98.

Myth Fire or Smoke dampers (known as method 1) are suitable to protect, protected escape routes, without any (method 2 or 3) fire protection to the duct.

Reality Although Smoke dampers are an excellent idea in theory there is currently no officially recognised standard for minimum levels of smoke leakage from ducts into protected routes. Fire dampers will leak smoke excessively and heat distortion to ductwork will allow smoke to leak into protected routes.

Myth Fire dampers can be fixed into brick or blockwork by the use of cement mortar around the damper installation frame.

Reality Cement mortar alone is not sufficient to hold the damper in place in fire conditions. The tags on all four sides of the damper installation frame, need to be bent out and solidly built into the joints between bricks or blocks with the mortar.
Source HEVAC/HVCA Specification No. HVC 6/3/83 (fire damper fixing).



The launch of LABC Hallmark means we are now able to provide a solution to the new house Developer / Builder who needs to purchase a 10 year Housing Guarantee. The new LABC Hallmark 10-Year Housing Guarantee, is provided by The Premier Guarantee underwritten by Liberty - an 'A' rated security insurance company which is approved by the Council of Mortgage Lenders and represents the best value for money in the market today.

The interest in the new product has been phenomenal. Andrew Bedford CEO of Berkeley Burke (UK) Ltd who administer the scheme said, 'We are receiving around ten calls a day requesting information on the new scheme. My colleagues and I are seeing as many builders as possible and have been all over the UK

promoting the scheme'.

The scheme is open to most types of building and includes:

1. Speculative house-building
2. Flats/apartments
3. Mixed developments, i.e. retail and residential
4. Conversions (conditions may apply)

There is also a facility for Self-Builders, which must be arranged by the homeowner and for completed housing where no warranty has been arranged.

LABC Hallmark wants to be seen as the choice of the quality builder and the scheme is designed to attract the best by offering low cost registration - £650, plus VAT and the most competitive house guarantee premiums in the UK. Chris Powell of Berkeley Burke commented 'The builders joining the scheme have confirmed savings up to 20%'.

The normal entry requirements to join the scheme are as follows:

- ♦ The builder or developer must be involved full time with the building industry.
- ♦ They must have a minimum of 3 years' trading under the same name as a limited company or partnership/sole proprietor.

They must either be registered with one of the existing building guarantee providers or be able to have confirmation from an architect that they have provided an Architects' Certificate on a previous development.

99% of builders conforming to this will be eligible to the scheme.

If you want any further information or want LABC Hallmark to contact a builder please contact either Chris Powell, Chris Harper or Andrew Bedford of LABC Hallmark on 0116 204 2988.

No sound testing in new homes from 1st July 2004

If you are to build new dwellings after 1st July 2004 then there is a choice between adopting robust standards or pre-completion testing to prove that the sound resisting walls and floors provide reasonable resistance to sound.

Details of the robust details scheme are available at www.robustdetails.com.

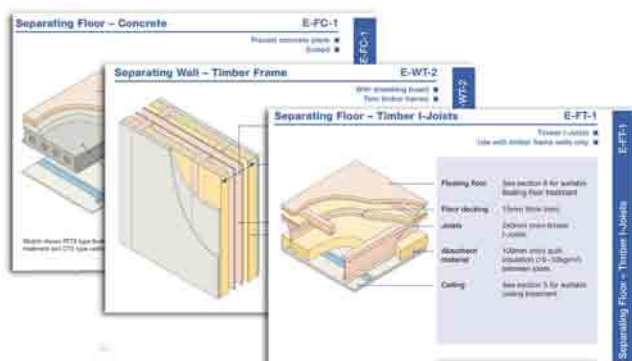
The basic idea is to build to details of a high standard. Each plot has to be registered separately before works start and a certificate of compliance is sent to Building Control on

completion.

For conversions to form dwellings or the formation of rooms for residential purposes such as hotels, boarding houses, hostels or halls of residence, the only option available is for pre-completion testing.

This all seems complicated. If you would like further details or information please contact:

John Allen
020 7361 3802
john.allen@rbkc.gov.uk



Winner of Building Control NEWS Photography competition

Following due consideration of all the photographs entered, we are pleased to announce that the adjacent photograph submitted by Calvin Bruce of Paul Davis & Partners is the winner. The photograph is of one of the refurbished stained/leaded light windows at Cadogan Hall. (also featured in the cover article).

The photo has been turned into a desktop wallpaper image and is downloadable from our website. www.rbkc.gov.uk/Planning/buildingcontrol



The Gallery

College House 272-280 Kings Road
Architect Michael Squire and Partners
Struct Engineer Price & Myers
Builder Kajima Construction Europe UK Ltd
Building Control Steve Denton and Paul Hanson



A colossal mutant insect is pupating in a West London school playground as if sheathed in membranous wings, its head is made of hoops of ETFE foil and its abdomen is a smooth bright blue shell that cantilevers over the ovipositor.

The building contains a high-powered telescope in a rooftop-rotating dome, a laboratory and a mini-biosphere in the ETFE clad conservatory where pupils can learn from living plants.

The futuristic design by Studio E Architects combines high level and low-tech elements. The ETFE roof will have a thin photovoltaic film applied at a later date as a retro fit and will shade/generate electricity.

The curvilinear blue shell was constructed much like a boat hull with 3 no layers of 6 mm orientated strand board glue-laminated together and moulded to double-curved shapes. The panels were then screwed to a framework of curved ribs and layers of resin and fibreglass were applied to give a glossy blue impervious finish

The architect has designed a sustainable development and consequently addresses:

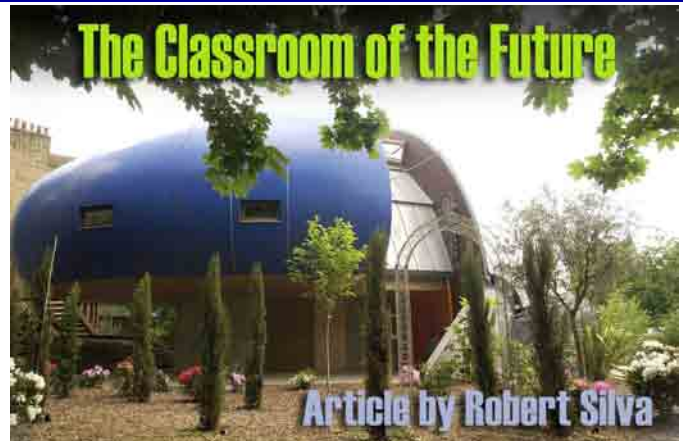
- a) Economics – Value for money.
- b) Society – Provide a setting that is life enhancing.
- c) Environment. – Demonstrate effective methods of energy efficiency.

Specific design measures that promote the goal of sustainable development on the classroom of the future are:

- 1) The use of natural ventilation.



- 2) The use of sun to help heat the building.
- 3) The use of energy efficient heating.
- 4) The use of daylight.
- 5) The adoption of high insulation standards.
- 6) Efficient use of artificial lighting.
- 7) The use of legible and responsive controls for ensuring energy efficiency.
- 8) The use of building



integrated renewable energy.

- 9) The use of materials of low embodied energy and from abundant sources.

- 10) The inclusion of plants.

- 11) Minimise waste.

The structure is a two-storey building with a variety of classroom spaces offering different learning opportunities. The roof includes an opening element to allow a telescope to be used from within a rotating dome.

The ground floor structure is a simple suspended insitu concrete floor slab supported on a series of ground beams and span between the heads of the 17 No 450mm diameter piles. The first floor is supported on a steel grillage that cantilevers over the concrete core structure and the floor itself is constructed of lightweight Masonite timber joists.

The classroom roof is constructed from a pre-fabricated timber panellised system and is patented by Cowley Structural Timberwork. The frame is constructed by connecting 1200mm long curved timber sections. Finally, the garden roof is constructed of ETFE pillows between structural steel hoops.

CONCLUSION

The architect has used a good opportunity to design a sustainable development. The new school building demonstrates value for money and provides a setting that is both life – enhancing and forms an integral part of the society offered by the school and the community it serves.

Design Team

Architect – Studio E Architects Ltd
Structural Engineer – Techniker
Building Service Engineers - Max Fordham LLP
Quantity Surveyor - MPA
Timber Shell Sub-Contractors - Cowley Structural Timberwork
Client - Paul Rincon, Head Teacher, Royal Borough of Kensington and Chelsea
Building Control - Robert Silva and Paul Hanson

Equality

We wish to provide excellent services to all of our customers. As part of this we have been reviewing each aspect of the service we provide, to ensure that there is no discrimination against customers through race, gender or disability.

We think there are three areas where we could do better.

- Ensuring the service is fully accessible. We have staff that are able to help with a range of different languages. In addition we may translate some key documents and extend our sign language skills.
- We are monitoring key areas of our service so that we have information about the range of customers we serve so that we can measure our progress.

- Provide training to all staff.

We are interested in what you think. Is there something important that we have missed?

Please contact John Allen on 020 7361 3802 or by fax, e-mail etc.

Access for all; Part M seminars

April saw the last of a series of lunchtime seminars on the subject of access to buildings. The seminars were an introduction to the changes in Part M of the Building Regulations.

The seminars were attended by over 140 design professionals from across the London. Following the buffet lunch, John Jackson donned his now traditional waistcoat and began the seminar by guiding the audience through the background to the changes.

A number of slides were shown illustrating how in practice access has been provided to buildings in the borough. The main changes were then described, with examples showing how to achieve compliance. John indicated the overall philosophy of the new document is to consider access for all

The modernisation of the Royal Court Theatre included better accessibility. "The restaurant has become a distinctive rendezvous in its own right. People want to be there." Ian Rickson Director - Royal Court Theatre.

rather than referring to 'disabled people'.

By focusing on practical areas affected by the changes, the seminars brought an awareness of the implications of the changes. A question and answer session at the end helped focus some of the main design concerns.



Increased accessibility not only provides better facilities for the general public, but also increased customers for the client. John described the example of the Grosvenor museum in Chester, where alterations were made to make the building more accessible, including a relocated shop. Visitors have increased by 15.7% and the income from the shop has increased by 43.4 %. This is particularly welcome as the museum has never had the benefit of income from an entry fee.



By Vinny Kanadia and Natalie Holness

Fancy something a little lighter than your average egg mayo sandwich ?

Try out our site snacks, quick and easy to prepare...

Greek Salad Pitta

Ingredients

- 1 Small block of feta cheese
- Olives
- Leaf of your choice
- Tomatoes
- Pitta Bread
- Olive Oil



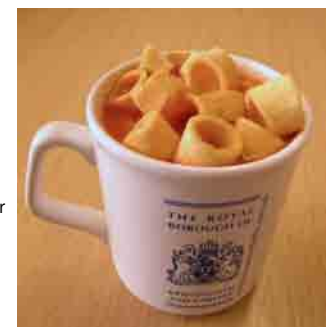
Recipe

1. Place your desired number of pitta bread in a fridge (if you have one) to chill whilst preparing the filling.
2. Slice and dice the feta cheese to a size of your preference and place in a bowl.
3. Cube the tomatoes, slice the olives in half and place with the feta cheese in the bowl.
4. Drizzle with olive oil and lightly mix.
5. Line the inside of the pitta bread with the leaf of your choice and place the filling inside.

Tomatoe hula soup

Ingredients

- 1 packet of cupa soup (tomatoe flavour)
- 1 packet of kp hula hoops original flavour or beef flavour



Recipe

1. Boil the kettle, add cupa soup contents into a mug,
2. Stir well, let it sit for 1 minute and then generously pour the packet of hula hoops into soup and stir...

Indulge in a new and exciting taste....

And **no** the hula hoops don't get soggy **ha!!!!**

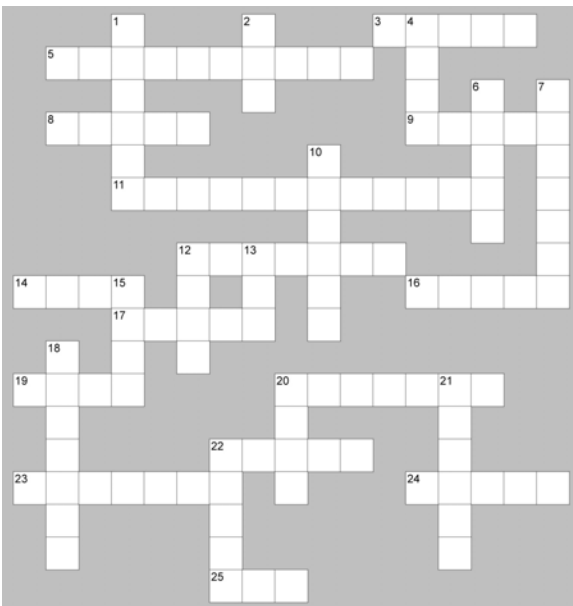
Never A Cross-word

By Dave Best

Down

1. get free (6)
2. adult male (3)
4. flexible tube (4)
6. a tempest (5)
7. uniformed band of workers (7)
10. vessel for carrying water (6)
12. small open sailing vessel (4)
13. supply with a gun (3)
15. moisture in the air (4)
18. a military post (7)
20. sticky earth (4)
21. a source of power (6)
22. written legal evidence (5)

There is one word which can precede all of the answers, what is it ?



Created with EclipseCrossword — www.eclipsecrossword.com

Across

3. leader (5)
5. refusal to comply (10)
8. stigmatize (5)
9. one who eats (5)
11. puts that fire out (12)
12. woollen sheet (7)
14. small forest (4)
16. a type of building (5)
17. to raise this will make people aware (5)
19. halt (4)
20. thin hard biscuit (7)
22. usual position (5)
23. also a boxer (7)
24. appearance of brightness (5)
25. two winged insect (3)

The solution to the crossword is available from our website:
www.rbkc.gov.uk/Planning/buildingcontrol

Symbols

Valley fold (blue)

Mountain fold (Red)

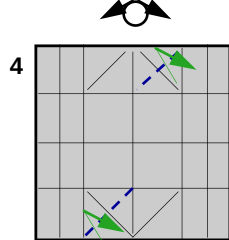
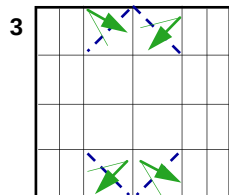
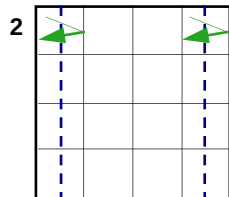
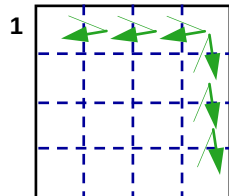
Fold and Unfold

Fold in front

Fold behind

Turn paper over

Tip: Look at the next diagram to see what the result of the fold will be. Start with Latent Gold Article face down with edge marked TOP facing upwards.



Safer than Houses

Article by John Jackson — Origami diagrams by Paul Hanson

Another reason for choosing LABC

Building guarantees on new houses have been available for many years. Now you can have similar protection for any new or substantially refurbished commercial property with **LATENT GOLD**.

LATENT GOLD provides the protection companies need and adds value to the property. Latent Gold will;

- Pay for expensive rectification work
- Avoid the need for uncertain and expensive litigation to recover losses
- Provide speedy rectification
- Make the building more attractive to lenders





LATENT GOLD
And The Royal Borough of
Kensington & Chelsea
Building Control 020 7361 3838
Call Bland Bankart on 0116 254 6221 for a quote

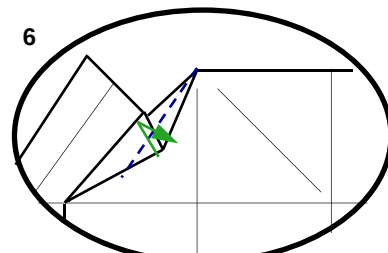
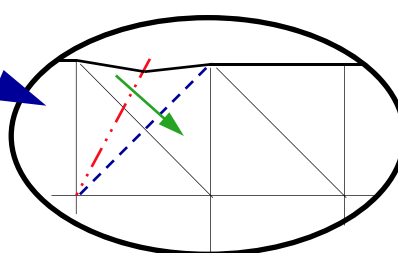
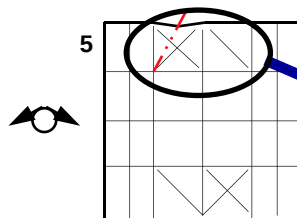
In the past, two major drawbacks in the arrangement of Latent Defects insurance was the need for additional inspections of the property and associated costs. The LATENT GOLD policy addresses these issues.

LATENT GOLD utilises the inspection service provided by Local Authority Building Control. Other checks or inspections are not usually required. The subsequent saving in administration costs and time makes the LATENT GOLD product very competitive.

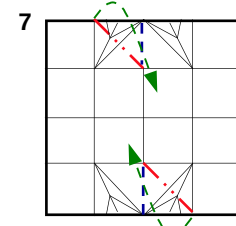
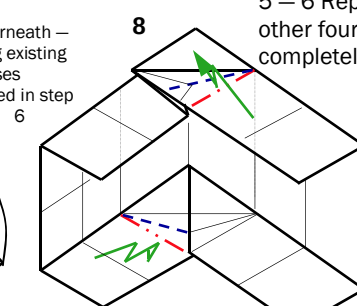
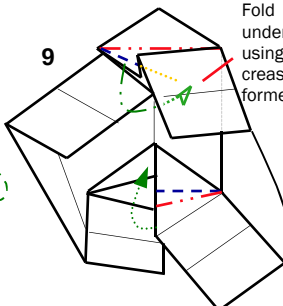
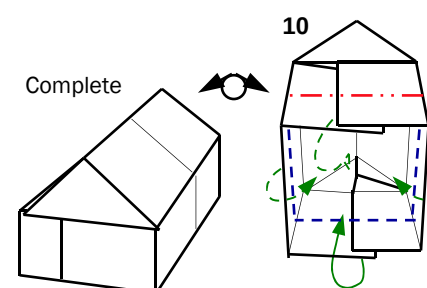


Arranging LATENT GOLD is simple. Firstly, select Local Authority Building Control to provide your building control service. Then, call **Bland Bankart on 0116 254 6221** for a LATENT GOLD quotation.

The above article can be folded into an origami house. This model dates back to the 16th century. Step 10 includes an additional strengthening fold documented by Kunihiko Kasahara in his book Origami Omnibus. Cut out the page along the green lines and fold following the instructions. The grey side of the paper in diagram 4 refers to the LATENT Gold article side of the page. The colour of the crease pattern refers to the type of fold; see the symbols above.



5 — 6 Repeat the folds in 5 & 6 on the other four squares then unfold completely. (shown completed in 7)



If the above has sparked an interest in origami; you may wish to visit the web site of the British origami Society www.britishorigami.org.uk

Requirement Part G3 Hot water storage

Building Regulations Schedule 1 Part G3 deals with unvented hot water storage systems (UVHWSS) because unless installed correctly the cylinder could explode, or cause danger from hot water discharge.

What are unvented hot water storage systems?

These are systems relying on storage cylinders fed directly from cold water mains and which do not incorporate a vent pipe to relieve excess built-up pressure to atmosphere. The pressure for the hot water system is derived from mains pressure supply rather than pressure from a cold-water storage tank.

What are the requirements for the installation?

A hot water storage system, which does not incorporate a vent pipe to atmosphere, may only be installed by a person competent to do so and precautions shall be made to:

- (a) prevent the temperature of the water at any time exceeding 100 °C and,
- (b) to ensure that the hot water discharged from safety devices is safely conveyed to where it is visible but will not cause danger to persons in or about the building.

What information do I have to provide when submitting an application?

Under Regulations 13 and 14 of the Building Regulations 2000, persons submitting a Building Notice or Full Plans with a Local Authority must, where the work involves the provision of an UVHWSS provide a statement which specifies:

- the name, make model and type of hot water storage system to be installed
- the name of the body, if any, which has approved or certified that the system is capable of performing in a way which satisfies the requirements of paragraph G3 of Schedule 1 to the Building Regulations
- the name of the body, if any, which has issued any current registered operative identity card to the installer or proposed installer of the system.

It should be noted that The Water Supply (Water Fittings) Regulations 1999 also apply to such installations.

Who can be considered a competent person?

"Competent" persons should possess a current Registered Operative identity card for the installation of UVHWSS issued by organisations such as the Institute of Plumbing or the Construction Industry Training Board, following assessment by a recognised training body.

What requirements apply to the water heater?

UVHWSS should consist of a proprietary package or unit approved by a member body of the European Organisation for Technical Approvals or a certification body having National Accreditation Council for Certification Bodies (NACCB) accreditation and testing or have a proven independent assessment demonstrating compliance with EOTA or NACCB verification and performance.

What safety devices are required?

The Regulations require the package or unit to be fitted with:

- a non self-resetting thermal cut-out. Indirect units must be wired to a motorised valve or some other device to shut off the flow to the primary heater (heat exchanger).
- One or more temperature or combined temperature and pressure relief valves. These need to be located directly on the vessel so that stored water does not exceed 100 °C in the event of failure of the electrical controls.

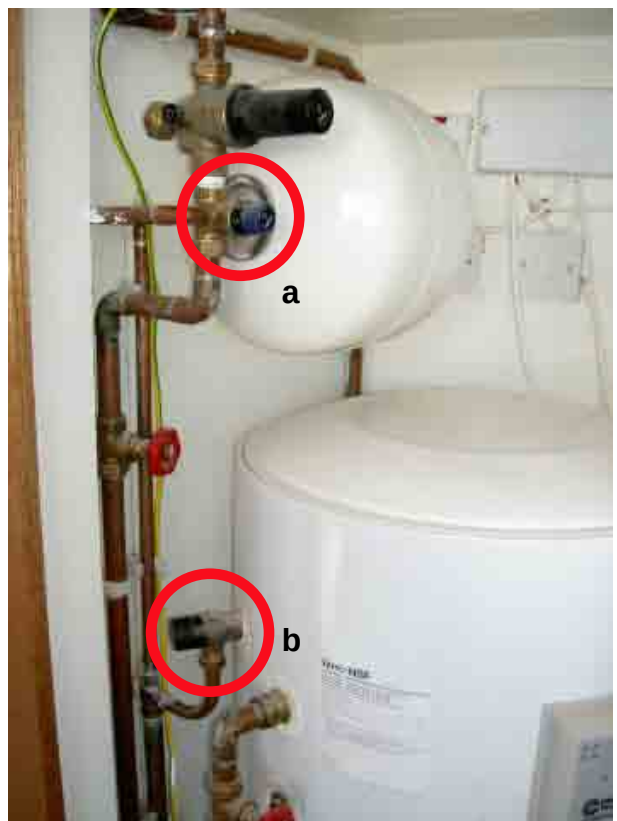
What are the requirements for the installation?

Hot water discharged from the safety devices must be conveyed visibly and safely away from the unit without endangering persons in or about the building. The package or unit is normally supplied with a tundish, which provides a visible indication of water discharging from the safety valves. The tundish needs to be within 500 mm. of the safety valves and in the same compartment as the vessel. The

discharge pipe from the tundish should be at least one size larger than the pipe to the tundish and needs to terminate in a safe place without risk to the people near the discharge. Systems with units that do not have an internal air gap must be fitted with an external expansion vessel, preferably on the cold water feed. Diagram 1 in Approved Document G shows typical discharge pipe arrangement and Table 1 in Approved Document G shows minimum dimensions for, and how to size, the pipe from the tundish to a safe discharge point.

How do I integrate this type of system into my heating design?

UVHWSS can be direct i.e. heated by electric immersion heaters or gas burners, and indirect i.e. heated by a central heating boiler through a heating system. Combination units consisting of a boiler and unvented storage vessel are also available.



This photograph shows an incorrectly installed UVHWSS

Q1: What vital fitting is missing?

Q2: What are the circled devices called?

Answers at bottom of page.