



## **Best Practice Guidance**

# **Groundwater Pumping Stations serving Type C Waterproofing Systems**

May 2016

# **Best Practice Guidance - Groundwater Pumping Stations serving Type C Waterproofing Systems**

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## 1. INTRODUCTION

The basic principal of a Type C waterproofing system is that a cavity is formed between the ground retaining elements and the internal finishes. These cavities are used to direct water to collection channels that in turn deliver water to a point where it can be discharged. This process of water management is generally achieved by the use of cavity drain membranes (CDM) and drainage channel or pipes directing to a sump and pump system to manage the disposal of the collected water. Pumped water should be discharged into suitable drainage, not a soakaway, which is capable of managing large quantities of water and not susceptible to flood or re-entry into the building.

Type C waterproofing systems will fail if water is allowed to exert a head of pressure on the system. It is essential that cavities, drainage channel and pipes, sumps and pumps remain free from any blockage that could inhibit the free movement of water. Cavities, drainage pipes, channels and sumps are susceptible to the deposition of silt, fines and other particulate matter that may enter the building from the ground. The deposition of Calcium Carbonate (free lime) can occur in circumstances where new concrete is encountered or chalky soils exist.

*For further information refer to PCA Guidance document on Free Lime.*

The drainage medium that collects water and then directs it to the collection point should be fitted with accessible maintenance points that allow ease of access for regular inspection, maintenance and cleaning to be undertaken. Sumps should be installed in locations that allow easy access for periodic servicing. Pumps and associated incoming drainage pipe work should be accessible to allow replacement of elements of the system. Discharge pipework does not require regular maintenance.

Groundwater pump stations should be considered for all basements. New-build basements and also excavation around 'dry' basements poses the risk of altering natural underground water courses. Altering natural underground water courses can affect basements that have been dry for their known life and incur possible water seepage into the basement. Basements must be protected against water ingress from ground water with a well-designed and correctly installed waterproofing system.

The need to service and maintain the drainage elements of Type C waterproofing systems is paramount to their long term success. This is highlighted in BS8102, PCA Code of Practice for Remedial Waterproofing of Structures below Ground and by the Suppliers and Distributors of products and equipment used to create waterproof basements.

Maintenance is fundamentally important to Type A and Type B waterproofing systems where external drainage forms an integral part of the waterproofing design. The service requirements of these systems are not discussed in this guidance document but should be considered with equal importance.

*For further information refer to PCA Type A & B Guidance documents.*

## 2. GROUNDWATER /SURFACE WATER

Waterproofing measures should be designed on the basis of water to the full height of the retained ground at some time during the structure's life. Protection against water ingress from the following sources should be considered:

- the water pressures acting on the external retaining wall system
- the water pressures below the base slab or raft

The water-resisting design should enable the system to withstand a pre-determined head of water or control the water before it reaches the structure.

### 3. DEFINITIONS

- **Double branches**  
used for joining double branch pipes to vertical pipe and used in vertical position to connect 32mm, 40mm and 50mm waste pipes
- **Duty/Assist**  
The Duty-Assist control is an effective method of controlling multiple pumps in parallel, to maintain the required demand. One pump is constantly 'on duty' and the second pump is to assist in high demand or as a back-up to avoid overload or if the first pump fails.
- **Free Lime**  
Calcium hydroxide (free lime) is a soluble form of lime which is created as Portland cement hydrates. Free Lime is then deposited on the new construction where water flows over a cementitious material from new concrete or cast elements.
- **Invert level**  
A measurement onsite from datum.
- **Light wells**  
An area bringing natural light to the lower floors or basement.
- **Puddle flanges**  
Used to seal around the outside of pipes that are required to pass through concrete structures. They are installed during construction. Pipes passing through concrete will not bond to the concrete and water can pass along the external surface of the pipe.
- **Reinforced concrete (RC)**  
is a composite material in which concrete's relatively low tensile strength and ductility are counteracted by the inclusion of reinforcement having higher tensile strength and/or ductility. The reinforcement is usually, though not necessarily, steel reinforcing bars (rebar) and is usually embedded passively in the concrete before the concrete sets. Reinforcing schemes are generally designed to resist tensile stresses in particular regions of the concrete that might cause unacceptable cracking and/or structural failure
- **Structural slab level (SSL)**  
The top level of the concrete slab from which the vertical levels of the building are typically dimensioned and set out. Any screed, raised floor or floor finishes are above this level.
- **Total Pumped Head**  
The total equivalent height that a fluid is to be pumped, taking into account friction losses in the pipe and vertical lift
- **Vertical Lift/ Head/Flow**  
Relating to the performance of pumps. LIFT & HEAD are used to rate the ability to move water vertically while FLOW reflects the quantity of liquid that can be moved in a given amount of time.
- **Waterbar**  
A material inserted in a joint (as between the construction joint in concrete) to prevent passage of water

**TYPE C DEFINITION - BS8102:2009 (Code of practice for protection of below ground structures against water from the ground) defines Type C (Drained protection) as:**

*"Protection against water ingress into usable spaces which is provided by the incorporation of an appropriate internal water management system".*

*For further information refer to BS8102: 2009; TBIC Design Guidance and PCA Code of Practice for Remedial Waterproofing of Structures below Ground.*

#### 4. STRUCTURES

Correct design, attention to detail and good workmanship are important for the waterproofing to be successful. Current building codes such as IStruct docs and EN1992-3: Eurocode 2 allow for a minimum expectation of quality of build.

The external basement wall must provide enough **PRIMARY** resistance to water ingress to ensure the cavity accepts through only a controlled amount of water. Type C systems do not provide a hydrostatic barrier but provide control by means of water management.

If a structure is not built correctly and is unfit for purpose it has the potential to allow exceptional and in some cases unsustainable amounts of water into the structure. This should be recognised at the design stage by the waterproofing design specialist (WDS) and a solution agreed to reduce water ingress to a manageable level.

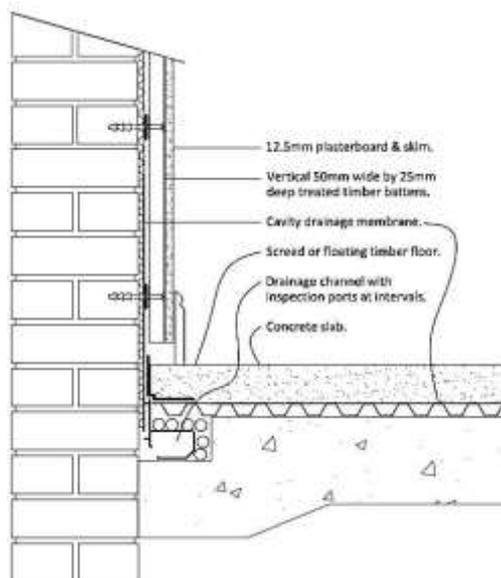
#### 5. DRAINAGE OPTIONS – DRAINAGE CHANNEL / SUB-FLOOR DRAINAGE

Known seepage through the structure should be stopped and every effort made to reduce the seepage to a controllable amount. Where seepage persists it must be managed using a fully maintainable drainage system. It is critical that the proposed drainage system provides an unimpeded flow directly to the sump and pumping system. Maintenance should be carried out without creating issues or causing internal damage.

There are two main options commonly used to collect and manage water that has entered the structure through defects within the primary waterproofing system:

##### **Perimeter Drainage Channels:**

Perimeter drainage channel systems provide a continuous drainage run of purposely designed channels, which can be installed into both existing and new build design.



##### *Example of Perimeter drainage*

The drainage channel is either placed on top of the slab/raft using correct spacer materials or within a recess located within the slab/raft at the wall floor intersection and across construction joints in front of the wall membrane so as to intercept water seepage as it enters the structure.

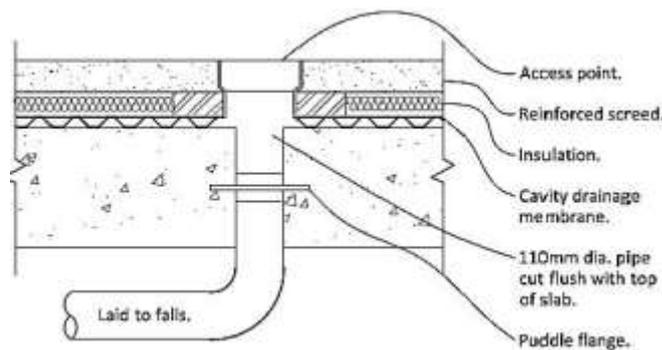
Drainage channels are installed in a continuous run directly to the sump and pumping system allowing water seepage to be controlled and managed. Two (2) inlets per sump chamber should be installed **as a minimum**. The drainage channels should be fully accessible and maintainable allowing for inspection and maintenance.

The drainage channel is designed with accessible points ideally every 10m linear with consideration given to directional changes.

#### **Subfloor drainage (Modular system):**

Sub-floor drainage pipes are installed at new-build stage or when a concrete floor is being replaced with a reinforced slab/raft. Drainage should be installed at uniform gradients, not less than 1:100, any changes of direction should be made using 45 degree bends, and the use of double branches laid on their side **should not be used**.

One vertical inlet should be provided per 12m<sup>2</sup> of floor area. Outlets to collect water from external walls and light wells should be placed no further than 2m from the wall. The modular vertical pipe and 45° bend that rises up through the slab, should be placed within the depth of the slab with waterbar or puddle flanges placed around the vertical inlet to reduce possible water seepage under pressure ingressing in and around the pipe entry.

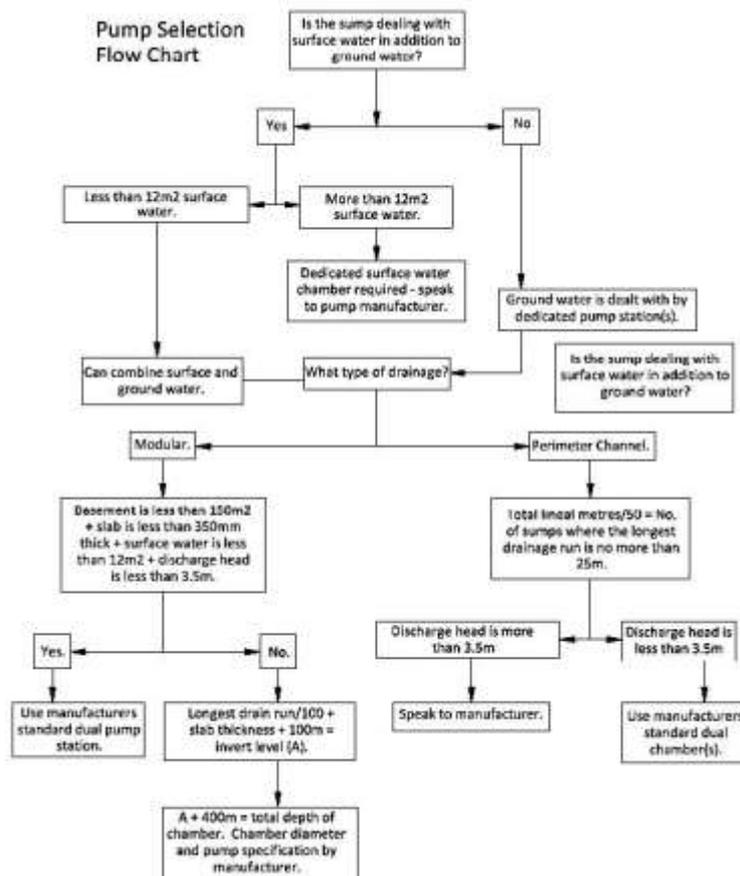


*Example of modular drainage*

The entry point on the slab around the vertical pipe should be flush with the top of the Reinforced Concrete (RC) floor slab.

Drainage should, as far as possible, be arranged so that access for rodding/jetting and CCTV inspection can be undertaken from the sump chamber. Additional access will be required where branches serving more than one outlet cannot be reached in this way. Two (2) inlets per sump chamber should be installed **as a minimum**. Free drainage from under the 20mm flooring membrane into the 110mm vertical pipe outlets must be provided.

Piped drainage systems should be tested for leakage prior to backfilling and concreting. During construction, all drainage openings should be temporarily protected against the ingress of builder's debris by using pipe caps, drain plugs or snug fitting timber covers. After the flooring has been laid and prior to handover, the cavity drainage system should be subjected to CCTV inspection to verify that it is clear of any blockages. The system should also be wet tested to confirm drainage fall etc. Modular systems follow normal drainage convention in terms of materials and the need for future serviceability.



## 6. CALCULATING NUMBER & SIZE OF SUMPS AND PUMPS

For cavity drain systems incorporating perimeter channel there should be a minimum of 1 sump per 50 linear meters of channel. For systems incorporating sub floor drainage then there should be a minimum of 1 sump per 150m<sup>2</sup> floor area.

### a) Pumps, type, size and number

**This guidance document advises that TWO pumps must always be used as a minimum to give back up in case of either pump failure or loss of power to one pump circuit.**

Where water ingress cannot be measured the flow rate calculation for water seepage should be based on 0.1l/s per 100m<sup>2</sup> of basement floor and wall area for basements above the water table and 0.2l/s per 100m<sup>2</sup> of floor and wall area for basements below the water table. Allow a safety factor of 5 when selecting a pump duty.

Note: Pump duties are often calculated at a low rate and it may be necessary to select the nearest pump to the duty required as submersible pump duties generally start a 1l/s.

Once the total pumped head and flow rate have been calculated, refer to the pump curves (also known as Q/H curves) and select the pump that meets the duty at the point of best efficiency (typically in the middle third of the pump curve with an allowance of 10% +/-). It is important that each pump meets the duty as these systems should not be designed on a duty/assist basis, see figure 1.

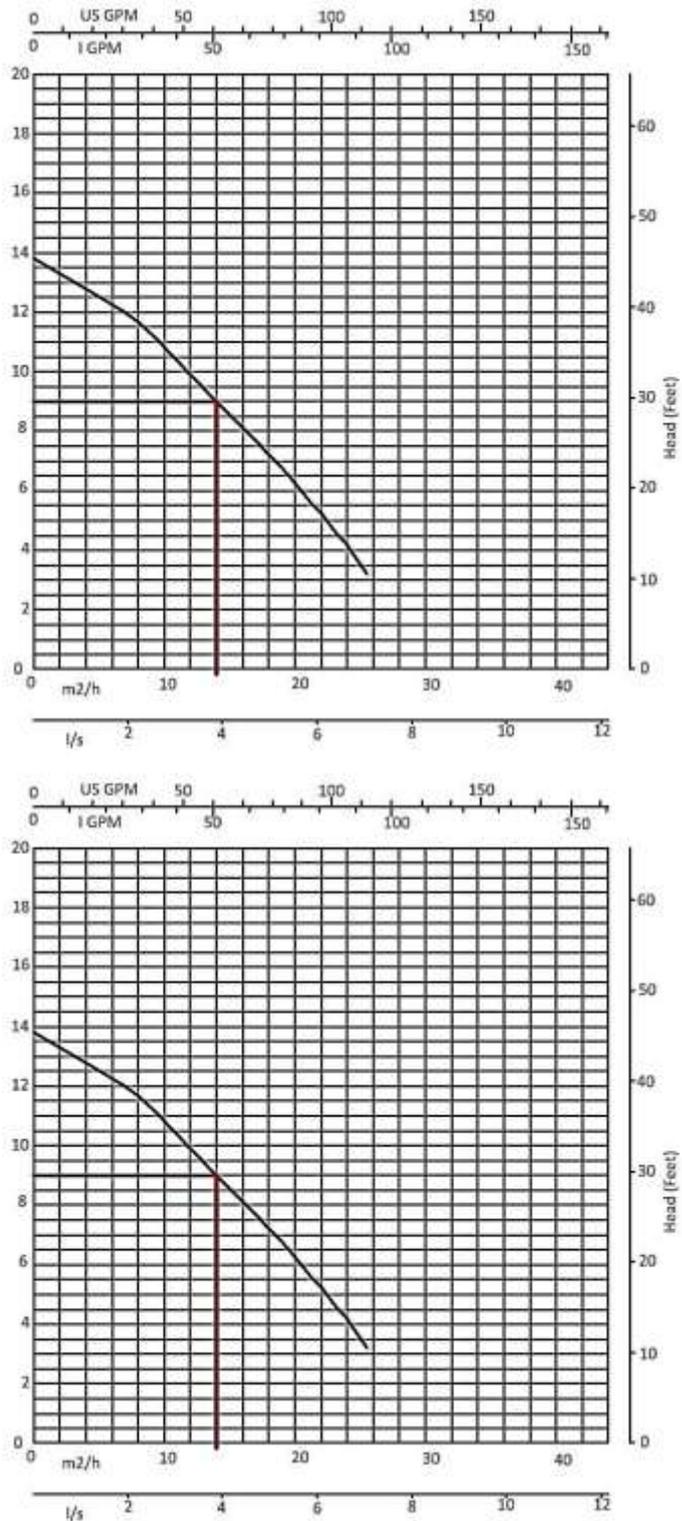


Figure 1 – pump curve graph calculator

**b) Sump size, number & type**

Typically provided as a packaged pump station, comprising of a chamber which contains two automatic submersible pumps either operated via their own built in float switches or by independent float switches connected to a control panel, internal pipework, non-return valves, gate valves and a position to fix a high level alarm float switch.

It is important the chamber is designed to withstand maximum hydrostatic water pressure and is fitted with a discharge connection, cable duct and position to create drainage inlets into the chamber that can be easily sealed, see figure 2.

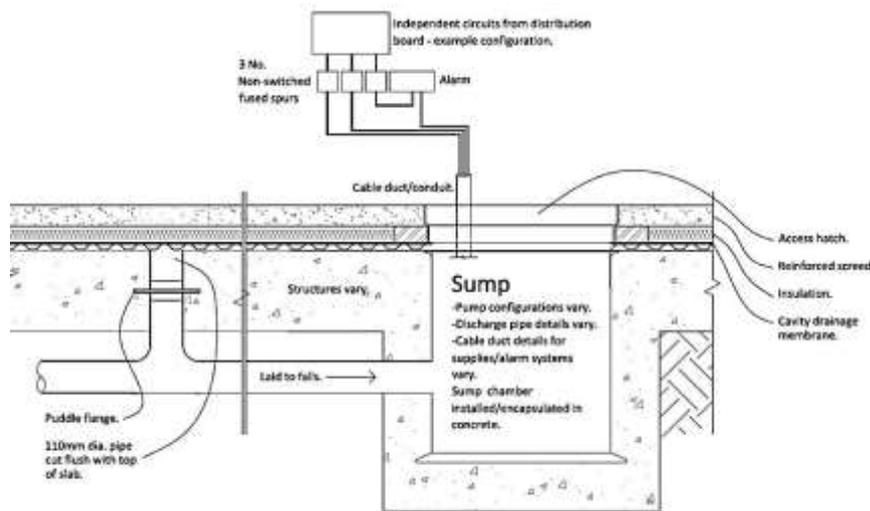


Figure 2 – sump chamber drainage detail

Pump stations are always included at the lowest point within a structure, allowing collection of penetrating water by gravity and then lifting this up to a suitable external discharge point.

There are typically five determinates to the size of sumps within a cavity drainage system

- i. Type of drainage system used - Either modular pipe system (110mm) or perimeter channel (typically 50mm x 75mm section).
- ii. Incoming flow rate (determines pump size)
- iii. No. of pump starts per hour (to extend battery back-up life where fitted)
- iv. Invert level - the point the incoming drainage pump enters the chamber in relation to the top of the chamber, normally Structural slab level (SSL)
- v. Perimeter channel

A perimeter drainage system is laid flat and reliance is on the hydrostatic 'wall of water' to create flow to enable water collected in the perimeter channel to reach the sump. Therefore each pump station needs to be NO more than 25m from the furthest drainage point, see example figure 3.

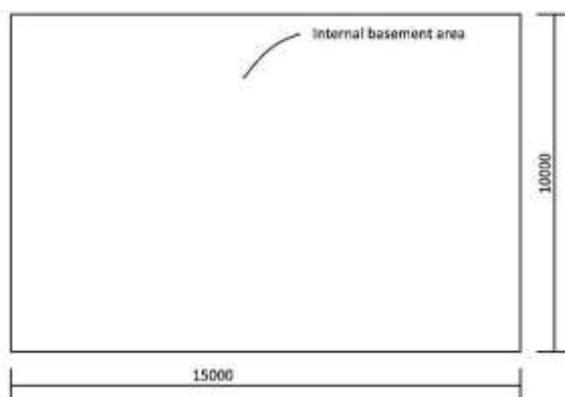


Figure 3 - Perimeter Drainage

Figure 3 shows a dimension of 15m + 10m = 25 linear metres from furthest drainage point to sump. Chamber selection for this application is self-selecting. The total floor area will always be 150m<sup>2</sup> or

less and ingress will be limited by the structure in accordance with BS8102. Therefore a pump station of minimum dimensions 600mm diameter x 600mm deep fitted with two pumps capable of an individual duty of 1.5l/s at the calculated head will meet all requirements.

### c) Modular pipe system

This drainage system is a combination of vertical and horizontal 110mm pipes, allowing groundwater to drain from any point of the slab and directed towards the pump station. Allowance should be made for one drainage point every 12m<sup>2</sup>, evenly spaced throughout the basement floor area. see *figure 4 below*:

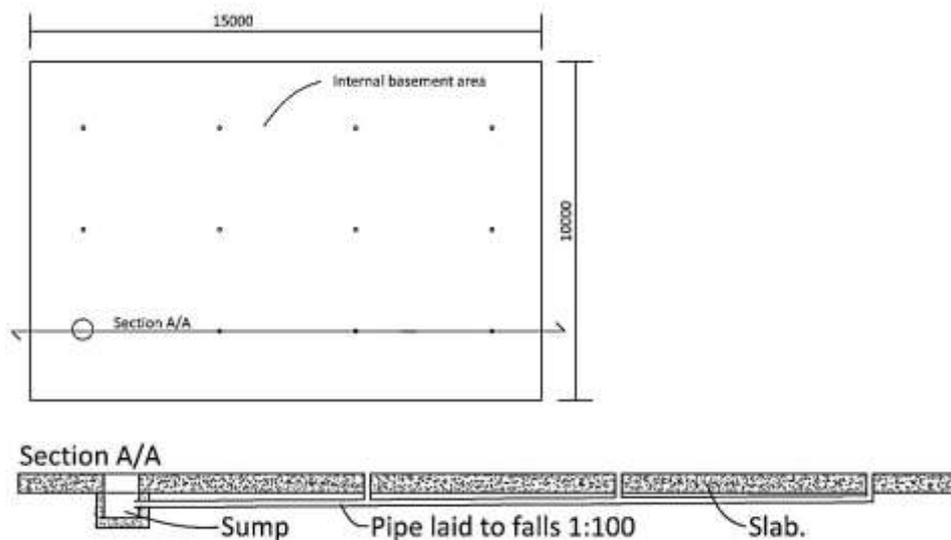


Figure 4 – Modular drainage system

In this example the total floor area is 150m<sup>2</sup>. Groundwater ingress should be limited by the structure in accordance with BS8102: 2009, therefore the size of the pump station is determined by capacity below the invert taking into account;

- Any storage required between the lowest invert and the alarm float activation point to give 24 hour storage in case of power failure.

**Note: Storage can be ignored if a battery backup is installed, providing it can operate the pumps for a 24 hour period.**

- The capacity required to limit the number of pump starts to 3/hr.

To calculate invert

Total pipe run divide by 100 (to give 1:100 fall) = 13.5m/100 = 135mm

+ distance from underside of slab = 125mm

+ diameter of pipe = 110mm

Total = 135mm + 100mm + 110mm = 370mm

## 7. POWER BACK-UP PROTECTION (PUMPS)

Battery backup systems should be included to protect in the event of power failure. The battery backup unit must be able to power either pump installed in the ground chamber for a 24hr period – (Allowing up to max. 3 activations per hour).

The unit should be connected in series with the pumps (*see figure 5*) fed by two independent spurs. The unit should include lamp indication to show the power is on & lamps and an audible signal to indicate the unit is running off battery power. Also indication that the battery requires change.

Note: Options on battery capacities and especially emergency generation should be provided to the client on a cost vs risk basis especially as the client will be aware of the regularity and duration of power failures affecting their property.

**Emergency Generation should be considered in areas of likely risk of extended power cuts.**

Note 1 – The siting of Generators should be considered at design stage and sited away from the risk of maximum flood levels.

Note 2 – Exhaust and Carbon Monoxide detection should also be considered at design stage.

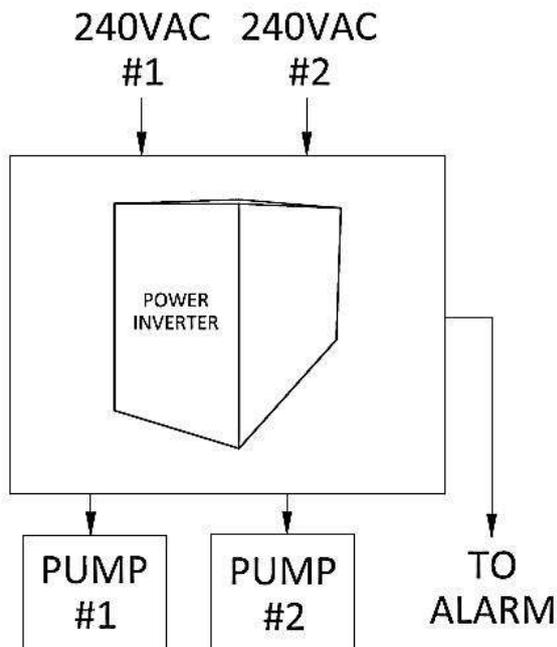


Figure 5 – showing 2 x PUMPS WITH 2 x SUPPLY/BACK UP

Where power backup is omitted, the consequence and risk of power supply failure should be fully understood and formally agreed by all parties.

## 8. ALARM SYSTEMS

A high level alarm should always be fitted to pump stations and give an audible signal when the duty pump has failed. The unit should include lamps to show power on, alarm activated and alarm previously activated (an alarm situation may have occurred and self-corrected i.e. temporary pump blockage). The alarm should not have the option to extinguish unless manually muted. The alarm should be situated in an area where it will be heard and a facility to 'test' the alarm system without lifting the float switch should be fitted. Ideally, the float switch should be connected to a normally closed circuit to preventing the alarm from failing if the float cable is cut (similar to burglar alarm circuits).

Where systems are installed within "occasionally" occupied properties a telemetric alarm must be considered. The telemetric alarm system will ring / text a number of nominated key holders advising of the alarm activation. These key holders should include the contractor and / or pump service engineer who can then take necessary action to resolve the fault. As many installations are within basements consideration should be given to hard wired telemetric alarms rather than wireless to ensure good signal strength for the alarm.

## 9. MECHANICAL & ELECTRICAL INSTALLATION OF PUMP STATIONS

It is important that pump stations are installed correctly as it may be difficult to make changes once the structure has been completed. The information below is for reference only and should be found in the **manufacturer's installation manual or structural engineer's design**.

a) The chamber must sit within the excavation on a slab.

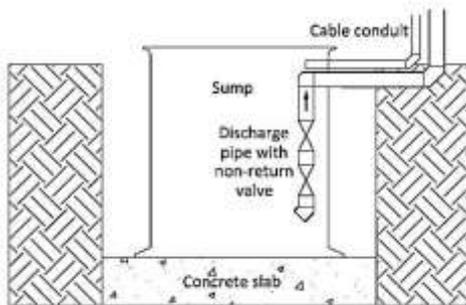


Figure 6 - standard sump on a slab

b) Pipe work, Discharge pipe work, cable ducts, incoming pipework and/or channels to be connected and run to a point above SSL.

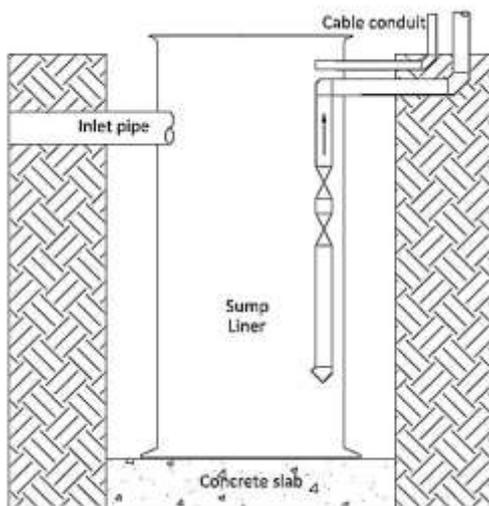


Figure 7 - standard sump with services & pipework

c) Chamber filled with water to prevent floatation and backfilled with concrete (even heavy tanks can float if not held down when backfilled with concrete).

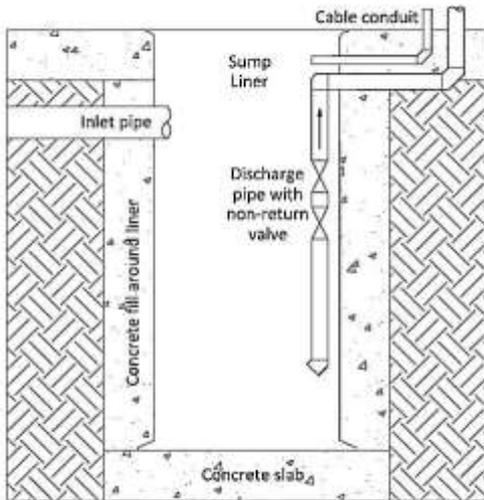


Figure 8 - standard sump chamber filled with water to prevent floatation and backfilled with concrete

d) Both pumps installed within the chamber with alarm float.

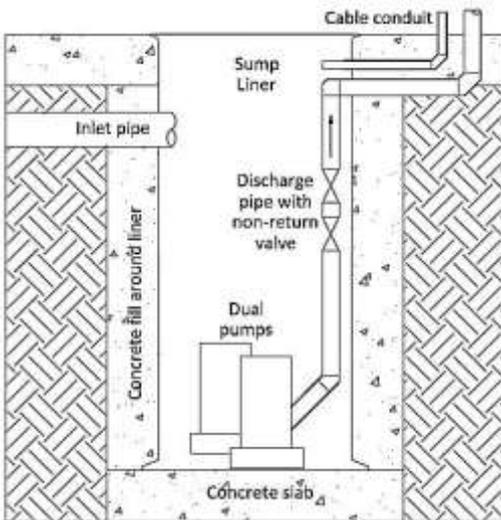


Figure 9 - standard sump with 2 x pumps and alarm float

e) Cables pulled through and connected to individual spurs connected to dedicate RCBO's (fig 10 shows two pumps controlled via integral floats with a high level alarm and battery backup fitted).

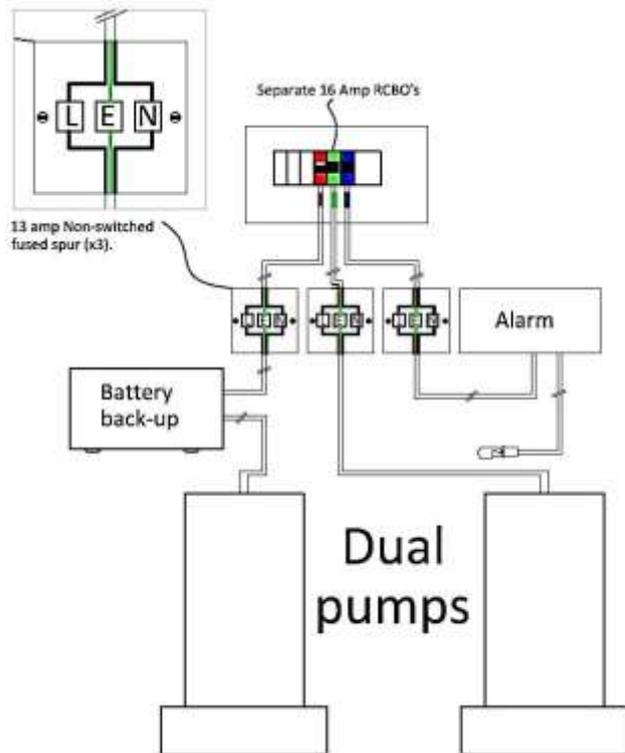
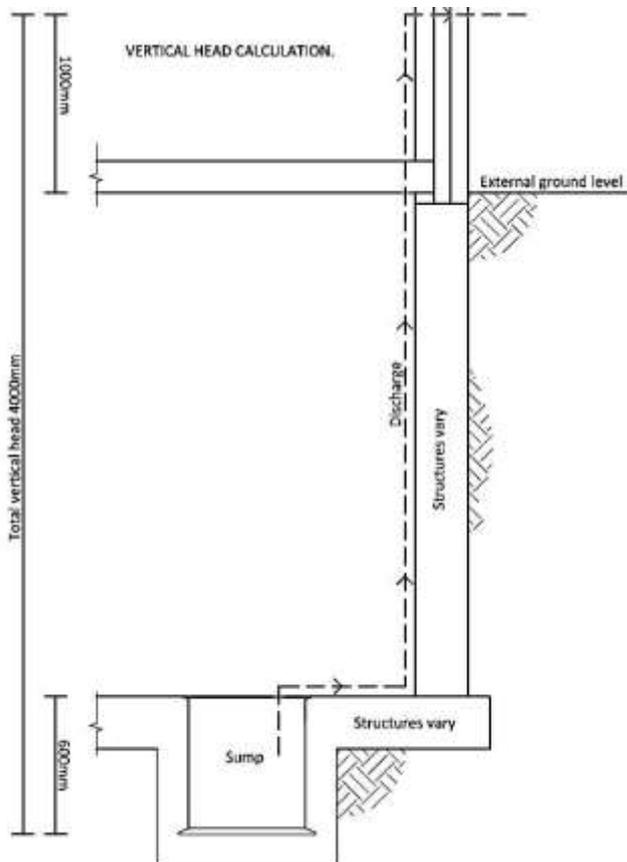


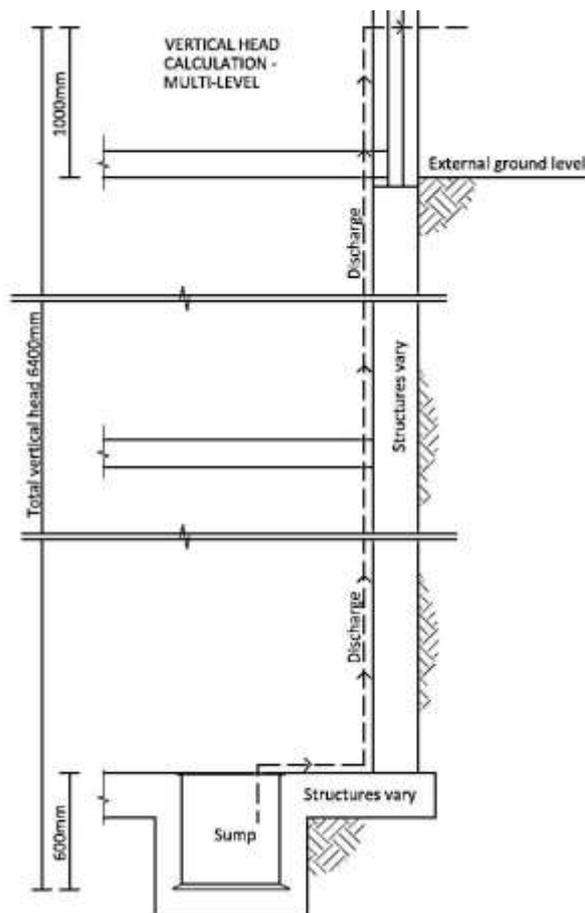
Figure 10 - 2 x pumps, alarm floats, RCBO's and battery only alarm

**10. EFFECT OF DISCHARGE PIPE AND VERTICAL HEAD ON PUMP CAPACITY**  
 i.e. Vertical Head Pressure on system, valves etc.,



Example of single level basement depicting discharge pipe – vertical head calculations

<b>PUMP HEAD CALCULATIONS</b>	
Calculations based on mid flow range of 50mm MDPE @ 2litres/second (L/S) using tables provided.	
1. Multi-Level Basement	
- 1 Non return Valve	= 0.39m
- 4 No. 90° Bends	= 4 x 0.07 = 0.28m
- Pipe Length 10m	= 1.1m ( includes vertical and horizontal pipe length)
- Vertical Lift 6.4m	= 6.4m
<b>Total head</b>	<b>= 8.17m</b>
2. Single Storey Basement	
- 1 Non return Valve	= 0.39m
- 4 No. 90° Bends	= 4 x 0.07 = 0.28m
- Pipe Length 6m	= 6 x 0.11 = 0.66m ( includes vertical and horizontal pipe length)
- Vertical Lift 4m	= 4m
<b>Total Head</b>	<b>= 5.33m</b>



Example of multiple level basement depicting discharge pipe – vertical head calculations

## 11. CALCULATING PUMP CAPACITIES/FRICTION LOSS

The friction loss information in the tables below is based on loss through commonly used pipe size/ types, along with commonly included elbows and valves. The losses are all based on the minimum, maximum and mean flow through each pipe work size.

The tables are designed for guidance only and pump manufacturers should be consulted for more detailed calculations for individual projects.

### 32mm MDPE & 1.25" PVC (All same capacities unless indicated)

	Min Flow - 0.6 l/s	1.4 l/s	Max Flow - 2 l/s
1m Pipe	0.03m	0.17m	0.35m
10m Pipe	0.33m	1.74m	3.52m
50m Pipe	1.67m	8.72m	17.62m
90° Elbow	0.08m MDPE 0.02m PVC	0.1m MDPE 0.08m PVC	0.17m
45° Elbow	0.05m MDPE 0.01m PVC	0.07m MDPE 0.05m PVC	0.11m
Non Return Valve	0.11m	0.26m	0.39m
Gate Valve	0.01m	0.04m	0.09m

### 50/63mm MDPE & 1.5"/2" PVC (All same capacities unless indicated)

	Min Flow - 1 l/s	2 l/s	Max Flow - 3 l/s
1m Pipe	0.02m 0.03m PVC	0.11m 0.09m 63MDPE & 2" PVC	0.24m 0.2m 63MDPE & 2" PVC
10m Pipe	0.28m 0.19m 63MDPE & 2" PVC	1.1m 0.88m 63MDPE & 2" PVC	2.42m 2m 63MDPE & 2" PVC
50m Pipe	1.41m 0.97m 63MDPE & 2" PVC	5.45m 4.4m 63MDPE & 2" PVC	12.11m 10.27m 63MDPE & 2" PVC
90° Elbow	0.02m	0.07m	0.15m 0.17m 63MDPE & 2" PVC
45° Elbow	0.01m	0.05m 50/63MDPE & 2" PVC 0.04m PVC	0.09m 50MDPE 0.1m 63MDPE 0.1m 1.5"/2" PVC
Non Return Valve	0.19m 0.29m 63MDPE & 2" PVC	0.39m 0.67m 63MDPE & 2" PVC	0.61m 1.15m 63MDPE & 2" PVC
Gate Valve	0.01m	0.04m	0.09m 0.1m 63MDPE & 2" PVC

## 12. DISCHARGE PIPE - TYPE AND PREFERRED VERTICAL THEN HORIZONTAL RUNS

### Pump Discharge Pipes:

There are two types of suitable discharge pipe work available; MDPE semi-rigid or PVC rigid pipe. The pipe work selected must be capable of coping with 1.5 times the water pressure generated by the pump(s). If in any doubt then seek / follow recommendations from the pump manufacturer. In most cavity drain systems the discharge pipe work would be MDPE – 32mm, 50mm or 63mm and PVC – 1 1/4", 1 1/2" or 2", in addition there would be inclusion of elbows and valves and these along with the pipe type and diameter and total run of pipework will influence the capacity of the cavity drain system pump.

N.B. There is no advantage to increase discharge pipework diameter beyond those shown in the table above, as this may reduce the required self-cleaning velocity.

Non-return valves must be included in the discharge pipe, usually at the connection of the discharge pipe to the pump. Non-return valves stop any remaining water within the pipework from re-entering the sump through the pump after pump discharges. If non-return valves are not included or installed incorrectly then the discharged water from the sump will simply run back down the pipes and back into the sump and could lead to continuous pumping of the same water.

As water can be retained within the discharge pipework, where this pipework runs in areas externally or prone to the effects of frost, the pipes should be appropriately lagged to prevent the water freezing within the discharge pipes and causing cracks/joints to split open.

#### **Vertical Lift (Head) calculation:**

It is important to ensure that the vertical lift for the discharge for the cavity drain system pump(s) (min. 2 pumps - see start of Section 6) is calculated correctly as this greatly influences the overall performance of the system.

The vertical lift calculation **MUST** include the depth of the sump and the total vertical height of the discharge pipe to its highest point (this is not just the floor to ceiling height but should include depths of floors through which it passes).

Refer to vertical lift (head) calculation above.

Discharge pipe runs should accommodate the vertical lift before any level of horizontal run. It is important to ensure that water does not lay in pipes if fall is not calculated correctly.

#### **Pump Capacity:**

Generally manufacturers state the maximum flow rate (capacity) of their pumps and also provide a performance curve based on the vertical head. Once the vertical head (vertical lift + friction loss) is calculated then an actual pump capacity can be read from the performance curve. The pump performance should be at the mid-point of the pump performance curve. See pump performance curve (refer to section 7). If the performance figure is either lower than required or does not align at or around the mid- point, then the pump would need to be upgraded.

**When designing a cavity drain system including pumps then the actual performance should be stated within the design.**

If there is ingress into the basement area / or a level of water ingress at times of flooding is known then an actual calculation could be made on the minimum performance level of the pumps required. It should be noted that measures to reduce ingress should be part of the cavity drain system design and also a safety factor added to the pump performance to allow for any potential increases in ingress.

### **13. SERVICE AND MAINTENANCE**

A schedule of maintenance should be incorporated in the design of the waterproofing system in accordance with the manufacturer's specifications. The first service should be considered within the first three to six months. In some circumstances it may be necessary to amend the time and scope of the service visits. Any changes to the schedule of planned maintenance must be agreed with the client so that the service schedule is amended accordingly.

Trained, competent service engineers should be employed to maintain and service Type C waterproofing systems. The person undertaking the service should have a good knowledge of the

waterproofing system and have access to details of the installed system. Copies of the original installation plans and specifications should be available for inspection. The service engineer should be properly equipped so that service operations are carried out effectively.

Maintenance of the pump unit will vary according to the type of pump configuration installed. Information relating to the servicing of individual pumps and configurations should be provided by the manufacturer. Consideration should be given to the operation of the main and back up pumps and the condition of any batteries and switchgear should be established. Seals, washers and valves may require inspection and replacement.

The inspection and alteration of electrical circuits must be undertaken by a registered electrician. Alarms and any power backup systems that are fitted should be inspected and tested.

It is important that the designer or installer provide the following information to their client:-

Maintenance Schedule for Cavity Drainage Systems

External drainage

Internal drainage

Location of drainage and access points

Sump locations

Locations of control panels, alarms and electrical supply

#### **14. ISSUES OF LEACHATES AND 'FREE LIME'**

The presence of water flowing over concrete, particularly new concrete, will often result in the leaching of free lime and mineral salts. It is important to eliminate the leaching of free lime. Crystallisation of lime will cause the pathways under the membrane to clog, and components in the pump to seize, resulting in a system failure.

*For further information refer to PCA Guidance documents on Free Lime and Dry Pack in Basements*

#### **15. LIABILITIES, WARRANTIES, GUARANTEES & INSURANCE**

The specialist contractor will design the pump and drainage system taking into account all relevant information i.e. historical ingress flow rates, local conditions etc. showing all calculations to provide a design that takes into account any reasonable prediction of future ingress. Guarantees may be limited to the agreed calculated capacity of the duty pumps of the system.

This is a term which may protect contractors and designers from unreasonable litigation in the event of a flood event or structural fault that could not reasonably have been predicted from the information available at the time of design.

The need to service and maintain the drainage elements of Type C waterproofing systems should be made explicit when the system is proposed by the contractor or designer and is paramount for the long term success of the system. This should be made in writing and can be within a report or as part of a tender submission. In some circumstances notification may be made under separate cover. Any notification should clearly state the need for servicing and maintenance and where appropriate highlight the implications if servicing is not carried out.

Contractors should clearly state the need to service and maintain the waterproofing system within any guarantees that may be issued. Failure to notify the client of the need for servicing may result in a system failure. In some circumstances the consequences of this failure may be passed to the installer/ supplier. In the event of a failure resulting from poor servicing then, subject to the

circumstances it may be considered that the company or individual responsible for maintaining the drainage elements may share some liability for any failure.

If the client, or other persons responsible for the building, fails to instigate or implement a service plan recommended by the installer, designer or supplier, then it is less likely that any failure of the waterproofing system that results from a blockage of the drainage elements or the pumping system will be the responsibility of anyone other than the client or controller of the building.

The servicing requirements for the waterproofing system should be clearly set out in the specification and/or contract and/or guarantee, supplied by the designer to the client. The client must be informed that any failure to adhere to the maintenance schedule may result in a failure of the waterproofing system.

It is imperative that the client is made fully aware that any system failure due to deviation from a planned maintenance programme will not be the responsibility of the installer and will not be covered by any guarantee that has been issued.

**Installer Guarantees:**

Typically these are where the contractor or installer guarantees their own workmanship for a period of years (currently 10 years for Structural Waterproofing).

An undertaking by the installation contractor guaranteeing both workmanship and performance of installation.

**Insurance Backed Guarantees (IBG):**

An Insurance Backed Guarantee (IBG) is a low cost, long term insurance policy (currently up to 10 years for Structural Waterproofing) which provides valuable protection for consumers when undertaking improvement projects. The principle of an Insurance Backed Guarantee is to honour the terms of the written guarantee (originally issued by the installing contractor), where that contractor has ceased to trade as defined within the policy document and is therefore unable to satisfy claims against the guarantee.

**Latent Defect Insurance (For New Build, Renovation and Repair work):**

Property owners, construction professionals and other building stakeholders will know that defects can become evident long after practical completion of building works. The rectification of these defects can be a costly undertaking and may result in expenditure which has not been budgeted, or otherwise provided for. For construction professionals, this naturally jeopardises the availability of funding, time and manpower for future projects.

Latent Defect Insurance products take approaches to protecting stakeholder's investments in construction projects. The propensity for defects to occur is minimized from the outset, as technical audits are carried out prior to and during the build. In addition to indemnifying insured parties in respect of latent defects themselves, the insurance may also confer additional benefits in the event of a valid claim, such as meeting the costs of alternative accommodation, and the fees of architects or other professionals.

**Manufacturer Warranties:**

These offer protection in the event of a product being proven not to have performed as intended, in which result the manufacturer is often limited to re-supply of the material only. It is extremely unlikely that any BS EN ISO 9001 compliant company will supply defective materials, hence why these types of warranty/guarantee are issued alongside the installer's commitment.

## 16. TRAINING/SUPERVISION

One of the most regular causations of failed waterproofing systems is defects in the installation. Conditions of certification for waterproofing systems will usually require that they are installed 'under license' of the supplier/manufacturer. In practice this does not always happen and it is not uncommon for waterproofing systems to be installed by operatives who have no relevant qualifications and/or no previous experience of installing waterproofing systems. This should not happen and in the main is the responsibility of the Main Contractor and/or Architect.

Type C waterproofing systems should be installed in accordance not only with the design, but also in accordance with manufacturers' specifications and by installers who can demonstrate relevant competence/experience and have been trained by the manufacturer or supplier of the waterproofing system. Installers should be made fully aware of the design and the manufacturer's recommendations for preparation and installation.

Qualities that should be sought after when selecting an installer include:

- Approval/accreditation by manufacturer
- Past experience in installing the subject product/system
- Quality Audit Systems
- Member of the Property Care Association (PCA)
- Product/system datasheets and guidance available onsite
- Offer "PI" (Professional Indemnity Insurance) covering relevant construction stage
- Financial ability to remedy any problems
- Relevant vocational qualifications
- Ability to interact with the rest of the design team, fulfilling the waterproofing design specialist role if not filled by others.

The Property Care Association (PCA) provides training for surveyors and designers of below ground waterproofing systems. The Certificated Surveyor in Structural Waterproofing (CSSW) is a recognized industry qualification which requires an understanding of all types of waterproofing systems and the ability to comment on them. The designer of structural waterproofing systems should have achieved the CSSW qualification, as a minimum, and also apply to become recognised on the PCA Waterproofing Design Specialist Register.

*Information about training courses and qualifications are available from the PCA website:*

[www.property-care.org](http://www.property-care.org)

## 17. STANDARDS AND CODES

The following standards, codes and specifications are directly relevant to Ground Water Pumping Stations and Type C structural waterproofing:

- BS 8102: 2009 - Code of practice for protection of below ground structures against water from the ground
- BS EN 1997-1 Eurocode 7: Geotechnical design, Part 1 General rules
- BS EN 1997-2 Eurocode 7: Geotechnical design, Part 2 Ground investigation and testing, BSI 2007
- Eurocode 2: Design of Concrete structures BS EN 1992
- BS 5454: Recommendations for Archive storage
- BS 8002: Code of Practice for earth retaining structures
- PCA: Code of Practice for Remedial Waterproofing of Structures below Ground
- Building Regulations

Other reference documents

- BRE – Basement construction and waterproofing – good building guide, GBG 72-1 BRE 2007
- PCA: Best Practice Guidance – Type C Waterproofing Systems
- UKAS - United Kingdom Accreditation Service is the national accreditation body that provides testing, inspection and certification services against internationally agreed standards.

## 18. BIBLIOGRAPHY

The Basement Information Centre (TBIC) - Basements: Waterproofing - General guidance to BS 8102:2009 known as TBIC Waterproofing Design Guide available from the Mineral Products Association (MPA) - The Concrete Centre.

- TBIC - The Building Regulations 2010 – Basements for Dwellings – Guidance Document 2014
- PCA – Best Practice Guidance – Type A Waterproofing Systems
- PCA – Best Practice Guidance – Type B Waterproofing Systems
- PCA – Best Practice Guidance – Type C Waterproofing Systems
- PCA - Guidance for the Service and Maintenance of Drained Cavity Waterproofing systems (Type C)
- PCA guidance documents on Free Lime, Dry Pack, Insulation in Basements and Ground Water
- Basements: Structural Design - Methodology (TBIC)
- Concrete Basements - Guidance on design & construction of in-situ concrete basement structures (MPA)
- BSWA - Waterproofing existing Basements (BSWA)
- ASUC Plus - Guidelines on safe and efficient basement construction

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