CIREG
Construction Insurance Risk Engineers Group

THE UK CAR UNDERWRITERS GROUP

Best Practice Guidance

The Avoidance of Water Damage on Construction Sites

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This document provides advice on the mitigation of water damage risks on buildings undergoing construction and refurbishment during both the design (pre-construction) and construction phases. The guidance is intended for commercial and multi-tenure residential developments though some of the advice may be equally applicable to housing developments and enclosed, serviced areas of civil engineering projects. This guidance is endorsed by all CIREG and UK CAR Underwriter member companies and represents industry best practice in the avoidance of water damage losses.

Disclaimer: *The guidance in this document is considered best practice loss control advice. Adoption of the provisions contained herein does not imply compliance with industry / statutory codes or guidelines nor does it guarantee that water related losses will not occur.*

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Introduction

Insurers' experience shows that water damage continues to be one of the most prevalent causes of claims on construction sites. The reasons for this are many and varied but include:

- A lack of awareness and insufficient risk management
- A lack of on-site management and assignment of responsibility
- Poor workmanship and the use of inexperienced or untrained personnel
- Increased high rise developments and vulnerable fit-out works
- A lack of understanding of the myriad of plumbing systems now available and the lack of bespoke training
- Sub-standard pipework testing regimes
- Inadequate mitigation and emergency response plans

The purpose of this document is to outline some of the ways in which the industry can tackle the root causes of the problem and also to suggest ways in which organisations and individuals can mitigate the effects should an incident occur.

The key to addressing the problem is the allocation of sufficient resources to the identification, analysis and avoidance / mitigation of the risks associated with the escape of water. The management of the water damage risk should take a prominent place in the project's risk register and for all developments a formal plan should be drawn up to address the following exposures:

- Those associated with the temporary water supply
- Those associated with the permanent distribution and drainage systems
- Those related to the weather: rain, storm, flood and ground water

The project '**Water Management Plan'** should ensure the following:

- A clearly defined 'Responsible Person' to manage the water damage risk
- A (risk assessment) process for mitigating exposures at the design phase
- The selection of competent contractors
- Quality control during installation and testing
- Mitigation measures and emergency response plans
- Regular review of the risk assessment and water management plan to ensure mitigation measures remain appropriate

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Water Management Plan

1. Management

1.1 The Principal Contractor should be the '**Responsible Person**' for the management of the water damage risk though it is recommended that he nominates an experienced individual or organisation (a '**Competent Person**') to assist in the management of the risk. Whilst the day to day management of the water damage risk may often be delegated to the M&E Contractor as the Competent Person, it remains the responsibility of the Responsible Person to ensure:

- the design and selection of plumbing systems is subject to risk assessment
- the appropriate selection and appointment of skilled contractors and labour (in accordance with Section 3)
- incorporation of written procedures (with respect to installation, testing and commissioning) into contractual terms
- verification of installation standards and adherence to codes (in accordance with Section 4)
- that independent site checks and quality control are carried out
- pressure testing and commissioning procedures are completed
- full certification of work and auditable records
- written quality systems and document controls are maintained
- the design, installation and maintenance of any temporary weathering strategy
- that risks from flooding, surface water, underground water and weather are identified and mitigated against.

1.2 The Responsible Person should ensure that a '**Water Management Plan'** is developed that clearly defines responsibilities, procedures and specific actions required to manage and mitigate the risks. The checklist in Section 7 should be used as reference to ensure that all relevant measures have been included.

1.3 The construction work should be phased so as to mitigate the extent of damage should an escape (or ingress) of water occur.

- Permanent drainage should be installed early with full functionality or, alternatively, specific measures put in place to temporarily manage the discharge of water from the building.
- Any bunds should be completed and drainage from plant rooms connected before tanks are filled. Every attempt should be made to achieve early commissioning of sump pump alarms, leak detection, water management devices and also enabling of the facility to monitor these (often the Building Management System). Any alert system should be routinely checked or remotely monitored.
- Pipework and valves should be identified and labelled as works proceed, not at completion of the project. Valve location and function should be included in the emergency procedures. When working on existing systems, the location and function of all valves should be established, and effectively communicated, prior to work commencing. The works should be phased to reduce the likelihood (and severity) of damage from burst pipes or weather-related incidents.
- Roofing and cladding should, ideally, be complete and the envelope made water-tight before internal works of any description are carried out. Where the phasing of the works makes this unachievable, the nature and extent of the fit-out works undertaken prior to weather tightness should be subject to a damage risk assessment and temporary measures implemented to protect the works
- Temporary water services should be routed in areas where any damage caused by escape of water will be minimal e.g. on the outside of the building where possible

2. Design Considerations

2.1 The selection and design of the water distribution system(s) should be based on a **comprehensive risk assessment,** taking into account the following factors:

- the loss history associated with various types of plumbing system
- the building occupancy, height and susceptibility of its contents to water damage
- the future maintenance requirements
- the competence and experience of the contractors
- design input & levels of supervision
- the presence (or absence) of mitigation features (e.g. water management devices, bunding, slab edge details, isolation valves and leak detection)

2.2 **The Design Team should be tasked with designing out features** that are known to exacerbate water damage losses and include those that may mitigate a loss should an escape of water occur.

Examples of unfavourable features include:

- combined service risers (electrical/data cabling and water services together)
- inappropriate or concealed pipework routes
- positioning of water tanks (at high level or above electrical services)
- open risers
- porous cabling
- electrical cables laid directly onto floor slabs.

Examples of favourable features include:

- drainage points on the floor slabs
- additional isolation valves
- riser upstands
- plant installed on plinths
- easy access to pipes (hatches etc.)
- mitigation features (e.g. water management devices, bunding and leak detection)
- the presence of in-built jointing system safeguards
- leaving plasterboard walls 25mm off the floor slab
- off-site (factory) fabrication and testing of pipework

2.3 The Design Team / Principal Contractor should establish the means for bringing in, handling and discharging temporary and permanent water supplies in the buildings under construction. This should include designated water discharge points/routes, and should include supply/discharge of water from roof drainage systems, sprinklers, HVAC systems and temporary welfare & accommodation facilities, where set up inside the building.

2.4 Wherever possible, a permanent supply should be installed in preference to a less reliable temporary main e.g. through utilising a fire fighting water supply. Temporary water discharge pipes should not be placed in electrical (or other water-susceptible) service risers.

3. Quality Control

3.1 Only **qualified plumbers with appropriate skill sets** should be permitted to work on water distribution systems. It is strongly recommended that at least two of the following are sought:

- a Level 3 NVQ (or equivalent)
- a Gold CSCS (Construction Skills Certification Scheme) card as issued by the Joint Industry Board for Plumbing and Mechanical Engineering Services (JIB-PMES)
- affiliation to an industry body such as the Chartered Institute of Plumbing and Heating Engineering (CIPHE).

3.2 Apprentices, trainees and those operatives holding only a blue CSCS card should be under the direct supervision of qualified plumbers. Unqualified operatives should never be engaged to work on water services unsupervised.

3.3 Where new systems are employed using different techniques or bespoke machinery, all operatives should be fully trained by the manufacturer supplying the system and training records kept to verify this training has been completed. As a minimum, operatives should have received verified training on the proposed system within the last 12 months.

3.4 **Plumbing, heating and ventilation companies should be members of recognised industry associations** such as:

- The Association of Plumbing and Heating Contractors (APHC) or
- The Heating and Ventilation Contractors Association (HVCA).

Membership of Approved Contractor Schemes (ACS) is a further indication of quality:

- CIPHE Approved Contractor Scheme
- Water Industry Approval Scheme (WIAPS).

Similar schemes are also run by some of the larger Water Authorities and are generally considered to be of equal status.

3.5 As part of the pre-qualification tender process, all companies should be required to submit details of their professional affiliations, membership of Approved Contractor Schemes and records of staff training.

3.6 At induction, all operatives should be required to produce evidence of

- Professional association membership
- Personal qualifications
- Training received in specific plumbing systems

3.7 Where foreign workers are engaged, their skills and qualifications should be compared to those of the UK construction industry. UK NARIC is an organisation that maps equivalent world-wide qualifications and, whilst this will allow a comparison of qualifications, it does not ensure that overseas workers have sufficient knowledge of UK regulations and standards. Water Authorities run training courses on the relevant UK regulations to be applied and this should be considered as a minimum requirement when overseas workers are employed.

4. Installation Standards

4.1 The Principal Contractor should implement a procedure for **independent certification of work** throughout the installation, testing and commissioning. This procedure may be undertaken by the Principal Contractor or the nominated Competent Person and should be documented and auditable. Self-certification by the installing Contractor is generally not acceptable.

4.2 All Contractors should be required to **work to industry recognised codes** which should be clearly defined in all work specifications and contractual documents. The main applicable codes are:

- Water Supply (Water Fittings) Regulations 2000
- BS EN 806 Pts 1-5 Specifications for installations inside buildings concerning water for human consumption and BS8558: 2011 Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages: Complementary guidance to BS EN 806
- HVCA Good Practice Guides
- CIBSE (Chartered Institute of Building Services Engineers) standards
- The HVCA Guide to Good Practice Site Pressure Testing of Pipework

4.3 There should be **strict compliance with design guidelines and manufacturers' installation manuals**. Any operatives working on a system should have received on-site training by the system supplier. Training records should be maintained by the Principal Contractor. No matter what the nature of the system, installation work must only be carried out by qualified, trained personnel or supervised apprentices.

4.4 All pipework should be subjected to a **clearly defined and fully documented Pressure Testing regime.** The test method should be in accordance with the manufacturer's guidelines (which will be specific to the system employed) and the pressure and duration should be defined by the System Designer. Failure to test an installation to the correct pressure for the required duration may nullify the manufacturer's warranty (this applies to pressures and duration being too low as well as too high). The testing regime should be witnessed by the Principal Contractor or independent third party, such as a Commissioning Manager, and include:

- A visual inspection of all the joints (particularly where the depth of insertion is critical to the integrity).

- In most circumstances, unless otherwise directed by the Designer, an initial air test followed by sectional hydraulic testing at a minimum of 1.5 times the working pressure for a minimum duration of 2 hours. (Account needs to be taken of the daily variation in mains pressures when determining the 'normal working pressures').
- Full pressure tests on systems in their entirety, including all equipment and fittings at their working pressure. A minimum commissioning period of 8 hours is recommended, which should be attended for its full duration by an operative familiar with the installation

4.5 Where plumbing systems require bespoke tools such as torque wrenches and crimping tools, these should be sourced from the appropriate supplier and routinely calibrated.

4.6 Pressurised systems should have adequate supports between joints and thrust blocks at all 90^0 turns. Pull-out tests on bolts securing the pipe supports should be carried out and test records maintained.

4.7 Joints should be marked or initialled by the installer to provide a quick visual check that all joints on a pipe run have been fully formed.

4.8 Testing and commissioning should always be attended by a person with the competence and knowledge to be able to identify problems and isolate the system.

4.9 Water **s**ystems designed to carry hot water will be subjected to enhanced thermal movements. Cold water tests may be insufficient to uncover leaks when the pipes are subsequently subject to thermal expansion induced by hot water and consequently final commissioning should be with hot water.

4.10 The Water Authority should inspect all new-builds and issue a Certificate of Compliance which should be made available for third party audit. This Certificate is not a guarantee of workmanship, only confirmation that appropriate fittings have been used in the installation.

4.11 There should be a **full audit trail** of all components used, the installation, the testing regime, commissioning procedures and approval certificates.

5. Mitigation

5.1 In all circumstances, there should be:

- A means for detecting that water is flowing when it should not be
- A means for rapidly shutting down the system when such water flow is detected

This can be achieved in a number of ways such as water management devices; early connection of Building Management Systems or robust physical monitoring and emergency response procedures. **Rapid detection and quick isolation is key to the mitigation of water damage.**

5.2 Any temporary supplies should be switched off outside working hours. It is recommended that a master valve is located in an accessible location and a designated person nominated to perform the task.

5.3 On permanent systems, where possible, the supply should be isolated when the building is unattended. Where there are multiple isolation valves, an 'Isolation Register' should be maintained to ensure all valves are routinely turned off out of working hours.

Where a boosted supply is installed and is operational, some thought should be given to whether it is possible to isolate the pumps without causing damage to the installation (consideration needs to be given to the effects of thrust pressure when these are turned back on).

5.4 Install **water management device(s)** on the incoming riser(s) and program them to shut down the supply when water flows exceed pre-determined parameters.

- The device should be set to shut off water supplies outside working hours when very small flows are detected.
- The device should have the facility to monitor normal water usage over a time period so it can then be programmed to allow water to be shut-off at a very precise, pre-determined flow rate outside of the normal usage parameters.
- Water management devices should be installed with audible signalling to provide a warning of failure in any part of the system and with remote signalling for whenever the building is unattended (aligned with the emergency response procedures).
- The device should have an integral battery back-up to ensure that it is effective during the testing and commissioning stage when power is often isolated for long periods.

- Dependent upon the configuration of the HVAC system, consideration should also be given to installing water management devices on header tanks of enclosed systems.
- In a residential development, if fitted to individual flats, water management devices can provide protection for finished units prior to occupation.

5.5 Install and commission leak detection, with temporary alarms, in areas such as bunds, the bottom of risers, equipment rooms, around AC units and in vulnerable cable trays. In unattended buildings, alarms should be linked to pagers or other form of remote monitoring and aligned with the emergency response procedure.

5.6 Temporary rising mains for use of wet trades should be tightly controlled with lockable discharge points. Water butts can be used to ensure only limited quantities of water are available inside the building. Externally routed temporary pipes should be insulated and/or trace heated to prevent freezing. Catch basins with plumbed-in overflows should be positioned under discharge points.

5.7 In the event that severe weather conditions are forecast, unprotected pipework should be drained down.

5.8 Where risk assessment has identified a potential exposure to flood or ground water, consideration should be given to the use of permanent pumps, flood barriers and temporary flood alleviation measures. Permanent ground drains should be installed early in the construction programme.

6. Emergency Response

6.1 **Emergency procedures should be clearly defined within the Water Management Plan** and should include simple clear instructions, a call out list and plans showing the position of isolation valves.

6.2 A Method Statement for the isolation of water should be produced and updated during construction works so that is clear how isolation is to be achieved. This procedure should be tested at intervals throughout the construction process.

6.3 Security guards, where present, should be trained to provide an early emergency response and to manually shut down systems where appropriate. Un-manned sites should have personnel cover to respond to the activation of leak monitoring devices. On larger, high value or complex projects, consideration should be given to operating a 'water watch' with full time attendance by an engineer with intimate knowledge of the system.

6.4 Guards' duties should be extended to routine patrols to check for escape of water where wet services are live. Guards should be trained in how to respond when discovering an incident. Similar emergency response duties should be allocated to nominated individuals where security is not employed or not present during the day. Spill kits and pumps should be made available and stored on site.

6.5 All incidents of water escape or water damage should be fully investigated and documented. This information should be shared with the Insurance Company and remedial measures put in place to prevent a reoccurrence.

7. Water Damage Checklist

	Item	Y/N	Action
1	A Responsible Person has been nominated to manage the water damage risk		
2	A Competent Person has been nominated to assist in the management of the water damage risk		
3	A documented Water Management Plan is in place		
4	System design and selection has been subject to a risk assessment		
5	Favourable and unfavourable design features have been considered and either incorporated or eliminated		
6	Suitably competent organisations have been appointed to work on the plumbing and heating services		
7	The competence of individuals has been checked and qualifications, training and experience verified		
8	A Quality Control Procedure has been put in place for the testing and commissioning of the distribution systems		
9	Appropriate mitigation measures are in place to ensure that escape of water is detected early and services isolated without undue delay		
10	Emergency Response Procedures have been established, documented and tested		
11	Wherever possible, water systems, pumps and temporary supplies etc. are isolated when the building is left unattended		
12	The work has been sequenced so as to reduce the likelihood of weather related damage		
13	The Water Management Plan is regularly reviewed by the Project Team to ensure that all risks have been identified and that appropriate mitigation is in place		
14	The risk of damage from weather related causes has been assessed and appropriate strategies, mitigation and emergency response procedures put in place		

This Guidance is endorsed by the membership of the UK CAR Underwriters Group and the Construction Insurance Risk Engineers Group (CIREG)

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