Day 1 – Water

Version 1.4.3

The Questions You Want Answered Today:

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Notes

Blue Team

Section 1

Digital Thermo-Hygrometer & Speedy Meter

Use and interpretation of a Digital Thermo-Hygrometer

- Digital thermo-hygrometers measure temperature and humidity.
- You will find this instrument can give you general indications of the ambient air conditions within the property, and it is often useful to compare it with the outside conditions. By doing this you may discover that a suitable drying program can include ventilation, where excess moisture from within the property can move to the outside.
- Ventilation can assist drying when the external moisture levels are lower than the internal. You will need to be able to understand psychrometry to be able to decide this. Psychrometry is a branch of physics that explains the relationships between air, water vapour, air pressure and temperature.
- It will also enable you to measure conditions within materials or voids. By measuring the ERH (Equilibrium Relative Humidity) you will gain knowledge of the moisture content of other materials in that environment.
- It is important to remember that in a room the general conditions you measure with the thermo-hygrometer are only a part of the picture.
- You could have acceptable levels of humidity and temperature within a property but still have problem areas with damp materials where moisture is trapped behind decorative finishes or boarding.

  Most modern hygrometers provide readings for temperature, humidity, dew point and specific humidity. The relationship between these readings can be appreciated by use of a psychrometric chart. [See pages 43 and 44 in this booklet.] Remember, this is the instrument with wide general acceptance as a preferred method for measuring moisture levels in dense materials such as concrete.

Use and interpretation of a Speedy Meter

- The Speedy Meter method involves taking a small quantity of the material, crushing it and mixing it with calcium carbide, which then reacts with the moisture content to release a gas.
- This occurs within a small, sealed chamber where the pressure of the gas produced indicates the amount of moisture present within the material.
- This method is regarded as being very accurate, giving an actual percentage moisture content. Knowledge and experience is required to interpret these values.
- Make sure that a COSHH risk assessment has been carried out and acted on in relation to your use of calcium carbide.

Other Moisture Measuring Processes:

- Laboratory analysis of sample materials using gravimetric measuring equipment can be used to measure moisture content in various materials. Materials are removed and weighed before and after drying of the sample. The weight loss after drying is the amount of moisture that was held within that material.

Red Team

Section 1

Radio Wave & Resistance Moisture Meters

Use and interpretation of the Radio Wave Moisture Meter

- A radio wave generated by the meter passes into the material and subsurface readings will be obtained to a nominal depth of 10 – 20 mm
- A sensor housed within the body of the meter is placed against the surface of the material.
- Radio meters work by measuring variation in radio transmission and can be useful for comparing different areas of the same material.
- Comparative readings can be taken from unaffected areas of the same material to help map the extent to which excess moisture has spread through the material being tested. However, these readings should only be taken as a comparison within areas of the same material. They are often less precise than other meters, but useful for general surveying and identifying problem areas.
- One advantage of these meters is that they are non-penetrating so they leave no marks on the surface of materials being tested.
- The function of these meters is to take comparative readings of the same materials during an initial survey of water damage.
- You will normally use other more reliable moisture measurement methods in addition to the radio meter to complete your survey.

Use and interpretation of a Resistance Moisture Meter

- The conductance moisture meter (Resistance Meter) is a penetrating meter.
- An electric current is passed between two needle probes which are placed on or pushed into the material.
- The electrical resistance of the material, which is affected by the presence of the moisture, is measured, and is shown by digital readout, by flashing lights or by variable tone.
- These meters are calibrated to give accurate readings in softwood, and reading in other materials is measured as WME [Wood Moisture Equivalent]. A reading below 18% in softwood is regarded as a safe level at which mould and fungi cannot grow. Under normal conditions a typical moisture content reading for softwood within the built environment would be in the region of 8% to 12% MC
- Readings at greater depth can be taken by attaching a range of accessories such as insulated extending probes or by using hammer electrodes that can be driven beneath the surface of softwood.
- Care must be taken to ensure that you are not misled by reading the open 'air dry' surface. In a drying environment the surface of a material may dry quite quickly, but it may take longer for the subsurface material to dry.
- Remember, this instrument is only completely reliable on softwood, and may sometimes give false high readings in concrete and similar materials.
- The presence of metals or high concentrations of mineral salts on or beneath the surface may result in false high readings being obtained.

Other Moisture Measuring Processes:

- **Data recording devices** (including Remote Monitoring) can measure and record atmospheric conditions for an extended period which provides useful information to the technician. They can measure temperature, relative humidity and some can also provide WME readings. The

equipment can keep a record of the whole drying process, providing valuable supporting data and/or reports to justify decisions made.

- **Thermal imaging** can be very useful, and this method will reveal areas of lower temperature, which may indicate dampness.

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Section 2

Heat Energy & Drying Wet Buildings

- To heat 1 gram of water by 1 degree Centigrade requires 4 watts of power for 1 second.
- When you set up a controlled drying programme you are encouraging a **'phase change'**. The objective is to convert liquid water into its gaseous form. The resulting water vapour can then be removed from the air by a dehumidifier, either by condensing or by venting to the outside.
- The energy required for evaporation of a liquid is known as the **'Latent Heat of Vaporisation'.**
- In severely affected properties every part of the building that is wet will **soak up heat energy from the surrounding atmosphere as water evaporates**. This tends to **cool the building** and arrest the drying process unless external energy is introduced. It is important to be aware of this simple science. Materials cool when water evaporates, just **like your skin when you sweat.**
- To supply enough energy to replace heat lost as a result of the drying process, the technician can employ a variety of methods.
    - They can **localise the output of warm dry air** from the dehumidifier by tenting wet surfaces.
    - They can use convection **heaters** directed across wet surfaces.
    - The **building's heating system** can help and should normally be activated, running 24 hours, to assist by adding heat energy.
    - Infa-red heaters can also be used release moisture from wet materials

- Others will use **trailer-mounted equipment** that will produce massive amounts of heat energy to maintain a building's temperature as it dries. These units can, in some cases, dry a building **within days** rather than weeks or months by providing enough heat to rapidly establish warm, low humidity conditions that encourage evaporation and accelerate drying.

Drying Wet Buildings

Creating a balanced drying system

- A **balanced drying system exists when all the moisture produced as a result of evaporation from wet materials is removed from the built environment by means of dehumidification**
- This may be more specifically described as **the equalisation of evaporation and dehumidification**. An ideal drying situation exists when the rate of evaporation of moisture contained in structure and contents is equal to or slightly less than the rate of moisture removal or dehumidification.

Air moving fans are - very important pieces of equipment that can help the drying process by disturbing the damp '**boundary layer' air** close to the wet surface. There are a few different designs that you can use.

- Remember to ask yourself, when using a blower on a wet surface: **Where will the water go once it leaves the wet materials**

Water Extraction Equipment such as Dehumidifiers reduce the relative humidity by extracting moisture from the air.

There are two main types of Dehumidifiers in use.

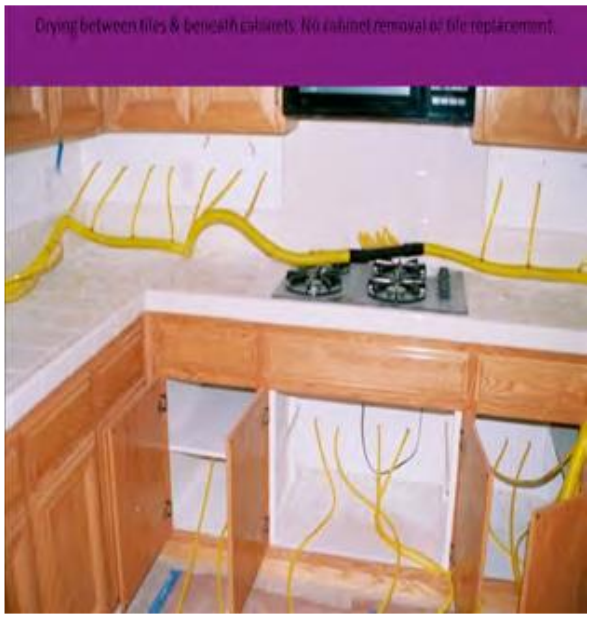
- **The refrigerant or condensing dryer, which** draws moisture laden air across a cold surface causing water vapour to condense. The cold surface is produced by a refrigerant system and the condensed water is then collected in a container or pumped to a drain. These units are very efficient in terms of electrical consumption.

- The **desiccant or adsorption dryer** works by withdrawing moisture from the air onto an adsorbent media producing very dry air to promote evaporation from wet surfaces and warm wet air, which needs to be exhausted to the outside or further condensed.
- Most **Refrigerant Dehumidifiers** do not work well at **lower temperatures** (below 15ºC) and also, will not work well at **higher temperatures** (above 30ºC). However desiccant dehumidifiers will work at **very low temperatures** and have the added advantage of being able to deliver **very low moisture content air**, which can be useful when drying mass materials. In these cases, this dry air can be delivered under a polythene envelope to create a **microclimate on the surface** of the damp material, (sometimes referred to as 'enveloping' or 'tenting').
- **Desiccant Dehumidifiers** work by adsorption of moisture from the air into a desiccant material. This material is capable of adsorbing moisture and, when heated, releasing it again. Air is drawn into the machine and passes over a **revolving wheel filled with the desiccant material**, commonly a silica compound. Water is captured in the desiccant material as air passes through it. As the wheel rotates a second heated flow of air passes through the desiccant material releasing the moisture from the wheel and the warm wet air resulting is exhausted from the machine usually taken by pipe to the outside of the building.

- Because these units usually require venting to the outside of the building there can sometimes be difficulties in deploying them (Some desiccant dehumidifiers can avoid the need for this by having an attached condensing unit)

Specialist Water Extraction Methods

- **Injection drying** is a specialist method that uses equipment to deliver air through small holes into building voids to release trapped moisture.
    - These can be useful for drying behind plasterboard or panelling to avoid costly and destructive structural dismantling that would otherwise be required to release trapped moisture.
    - The input air for the system could either be ambient air from the room or air directly from a dehumidifier, especially a desiccant. Alternatively, adaptors to fans can allow air to be forced behind panelling through gaps or purpose drilled holes, often after removal of skirting boards.



Injection drying releasing trapped moisture while tea drinking continues

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Section 2

Moisture Levels & Establishing a Satisfactory Level

Moisture Levels

Buildings in normal occupation are considered to be 'dry'

- All building materials contain moisture to some degree. This will be higher in a newly built property due to the process of construction (e.g., the water added to mortar, plaster, or concrete). As the new building dries out the stable moisture content of materials is determined by the ambient conditions, where the property is sited and the conditions produced by use of the building – for example, washing and cooking.
- When the building experiences a **water damage incident** the conditions within the property become very abnormal. The **moisture content rises sharply** and unless prompt action is taken to restore conditions to normal, irreversible damage may occur.
- **Remember**, it's not straightforward to determine what a safe normal moisture level in a building is.

Water vapour moves through the air

- **Water vapour is a gas** and gases always move from areas of higher pressure to areas of lower pressure. So, the water vapour in the air will move very quickly through the property to other rooms where the concentration is less. If these rooms are cold and unventilated high humidity conditions could occur that will lead condensation and possibly to **mould growth.** This means that one or two severely affected rooms can, indirectly, affect the whole house unless dealt with promptly.

Remember, there is **no defined and precise "dry & safe" condition** for properties - a competent person needs to **make a judgement**, based on a range of measurements and factors.

Establishing a Satisfactory Moisture Level

- Moisture levels in most materials can be accurately measured so you should be able to decide, from these measurements, if you have reached a satisfactory moisture level.
- However, a satisfactory moisture level depends on:
    - **Pre-existing building conditions and defects**
    - **What will be applied over the surface**
- For most building materials an appropriate moisture level is a point where rot will not occur in the material, mould will not grow and materials in contact with the surface will not deteriorate. This applies to any other materials in direct contact with affected materials or that are present within the drying environment (e.g., skirting boards attached to a wall will reach equilibrium with the moisture content of the wall surface).
- Some surface covering materials are moisture sensitive so they may be easily damaged by moisture. If these materials are to be satisfactorily installed after drying, substrates will need to be dried to an appropriate level to prevent damage. Examples of such materials requiring specific conditions for successful installation are:
    - The **adhesives** used to bond vinyl floor-covering to concrete screeds are very sensitive to moisture a–
    - **Timber floor boarding**, which can be adversely affected by elevated moisture levels in the sub floors which can result in distortion of the boards
    - **Laminate flooring**
    - **Impermeable** wallpapers and paints
- The installation of most floorcoverings is covered under various British Standards for example BS 5325 for textiles, BS 8203 for resilient materials etc.

- Your overall objective is to return the property to its pre-incident condition; however, this may not be easy to identify. It is important to compare moisture readings in the same materials in similar areas, where the property has not been affected by the incident. However, be aware that materials remote from an incident may have picked up moisture from the air if high humidity has existed for some days.
- As construction and methods of building have evolved, more modern buildings will remain 'dry' in normal circumstances.

Older property – without damp proof courses, constructed of stone or clay, or with solid as opposed to cavity walls for example – will never contain the same moisture content as those constructed to modern building standards. This may pose some drying limitations and the general inadvisability of using impermeable decorations – such as vinyl wallpaper or certain types of paint.

The Importance of removing the liquid water from a property

- It is extremely important to **remove as much liquid water as possible** from the flooded building. To rely on evaporation is too slow and energy hungry
- The simplest, first and most important action is to pump or vacuum up standing water

- Some of these vacuums contain pumps that allow continuous operation which avoids the need to stop vacuuming work while you empty the vacuum tank manually, and can allow much faster water extraction
- Powerful vacuums are also available in vehicle mounted systems powered by petrol or diesel engines
- Submersible pumps can be safely immersed in water pumping large amounts very quickly and some can handle debris without blocking. Submersible pumps can be very useful for clearing water from basement/cellar areas.

- Also remember there are special tools that allow you to squeeze water out of carpeting at the same time as vacuuming. These tools can dramatically increase the amount of water extracted from carpeting.
- Electrically powered wet vacuums can lift water into a recovery tank. These will be used along with a range of tools including floor wands and hand-held tools. The equipment is designed to be safely used with water, especially the low voltage (110 volts) models and ones fitted with a Residual Current Device (RCD).

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Section 3

Damage Limitation Actions & Decontamination of Black Water

All life needs water

- **Water is essential to all living organisms** at the cellular level and living organisms cannot thrive and develop without water. In very **dry conditions living organisms either die or transform into a spore like state**, waiting for reactivation with more water at a later date.
- The normal indoor environment has moisture levels sufficiently low to prevent the growth of organisms such as fungi and mould. **Therefore, water can be seen as a pollutant in the indoor environment** following a flooding incident, even with clean water, **as the balance is changed.**

- Immediately the dormant mould spores respond to the changed conditions and commence growing when the moisture level reaches a certain threshold. This threshold moisture level is different for different types of fungi/moulds.

Typical water damage limitation actions

Water damage requires prompt action to limit secondary damage and claims cost. After you have carried out **your triage, your** first actions should be directed at the items that are at risk of secondary damage. You will often **extract water** and **reduce humidity** in the property to prevent further deterioration from **mould growth**. Water extraction is an essential first step.

Typical actions you will take after your risk assessment and triage could be:

- Ensure **electrical supply** is safe, especially with vertical leaks.
- **Release water** held in plasterboard ceilings by puncturing small (10mm) holes to release trapped water, into containment bucket.
- **Extract or pump bulk water** from the property.
    - The use of **weighted vacuum tools on carpets** affected with clean water can sometimes assist successful restoration by reducing the drying times significantly.
    - Remember – when pumping water from **basements** or below ground level you need to be aware that this may create a hydrostatic pressure difference. Water may exist in surrounding ground or adjoining cellars/rooms at a higher level. The pressure difference could cause structural damage.

    - As a rule of thumb do not reduce depth by more than **1m per day**.
- Place furniture at risk of absorbing moisture from wet flooring onto **blocks**.
- **Open doors and drawers** of furniture to assist drying (but do not force as they will ease on drying).
- **Remove contents** likely to suffer from secondary damage to a drier environment, if available.
- Lift and **remove written off saturated items** (e.g., carpets) to outside of property.
- Take action to **control humidity** within the property.

- If documents or photographs are wet, consider arranging with customer to wrap important documents in polythene and **freeze so that they can be dealt with later**.
- Remove damp items (e.g., papers, books, fabrics) from **wood surfaces** to prevent staining.

Typical methods for decontaminating property affected by black water

- Some people recommend the **addition of bactericides** directly into the water to reduce the quantity of bacteria in the water.
- When bulk contamination needs to be removed, solid materials may require shovelling and liquid waste vacuuming or pumping.
    - Consideration needs to be given to **correct disposal** of all such contamination conforming to current waste disposal regulations.
- Once the bulk of the contamination has been removed cleaning can start. It is usually advisable to flush the surface with clean water and vacuum extract followed by application of alkaline detergent with further rinsing.
    - **Multiple applications of detergent and rinsing** may be required to ensure thorough decontamination, paying special attention to crevices and edges.
- Detergents can be more effective if allowed sufficient time to work, – this is known as the dwell time, and allowing an interval between application and removal usually gives better results.
- You may decide to remove skirting boards to enable thorough decontamination and, in some cases, **absorbent materials** such as plasterboard will have to be removed.
- At the end of your multiple cleaning process, you may carry out a **quality assessment** of the result to reassure yourself and the property owner that the cleaning has been carried out satisfactorily.
- Care should be taken to ensure that a COSHH risk assessment has been carried out on the products you intend to use and that it is compatible with the usage of the property.

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Section 3

Stripping Out & Vertical Incidents

Stripping out plaster and skirting

Removing plaster and wood should not be carried out routinely - It is an **expensive option** as it can greatly extend the project duration and cost, as well as adding to the destruction and the stress for the occupants of the property. You need to carefully consider if the removal of wall plaster is justified.

You should also be aware that a **render coat** may have previously been applied to prevent moisture ingress to the room from the brickwork, and is therefore impervious to external water ingress. Unless shown to be damaged it should not be removed.

Please **consider the reasons that are given** to remove wall plaster and then consider, from what you have learnt, what **alternatives** could be explored.

- Removal of wall plaster is sometimes suggested as a means of allowing the underlying wall structure to dry, without any understanding of how the internal brick or blockwork became wet. However, although the exposed wall surface may dry more freely, it must be resurfaced with

wet plaster. Additionally, a property with exposed walls is likely to be uninhabitable.

  - Consequently, there is an impact on cost for both the additional scope of work and **relocation of occupants**, so the overall benefit is questionable.

- In some cases, the wall may be slow to dry because of **low permanent paint layers**, and here a benefit can be achieved by means of puncturing the paint layer to allow moisture to escape more easily, removing the paint if practical, or using tented/envelope drying systems.

- Removal of skirting and doorframes **can be required** to enable thorough decontamination of the voids in the event of hazardous water flooding - however consider achieving the same result by **flushing behind these items with a water spray jet**. This **informed decision** will have to be made with knowledge of the incident conditions to ensure the decontamination is effective.

- In all circumstances individual property conditions need to be considered.

Vertical Incidents

- When you are dealing with an incident that affects only the ground floor of a property with no basement you have a smaller set of challenges. However, when water moves downwards through a property the challenges you face are much more complex. Although water always moves downwards, by gravity, it will find a route that you may not expect. Effectively, it will spread unpredictably horizontally before following various downward routes such as ducting, pipe work, cable runs etc. In multi-storey properties a severe leak on an upper floor could move down through the property, even bypassing some floors completely if it finds an easy route (typically through ducting carrying services).
- Careful and thoughtful investigation is required when you are dealing with vertical leaks to ensure you correctly locate affected areas

- You need to be alert to the possibility of plasterboard on walls being affected by a vertical leak even though it may not be visible
    - When plasterboard becomes damp, it will **quickly support mould growth**. So, whenever plasterboard becomes wet it needs to be **dried promptly** and if contaminated with **black water** it will routinely need to be replaced.

Timber framed properties

- These buildings are built around a timber structure with plasterboard or other boarding lining the interior face of the exterior walls. The exteriors of these buildings are usually faced with brick or masonry so it may not be immediately obvious how it is built. Test the inner face of the walls by **tapping with your knuckles** and noting how resonant it sounds. If it is a timber framed building, you should be able to identify the lower density boarding on the inner wall.
- These walls are likely to contain a layer of insulation behind the plasterboard as well as a vapour control barrier. You will need to consider the implications of the position of the **vapour control layer** within the wall.
- **Modular Construction homes**
- The rise in popularity of the construction of this type of home is resulting in many more complex drying and decontamination scenarios.
- These buildings use many composite materials throughout, coupled with insulation and vapour control barriers. This may mean that more of these materials need to be replaced. Some of these types of buildings have different insurance cover, and may even require the original manufacturer's input in recovery.

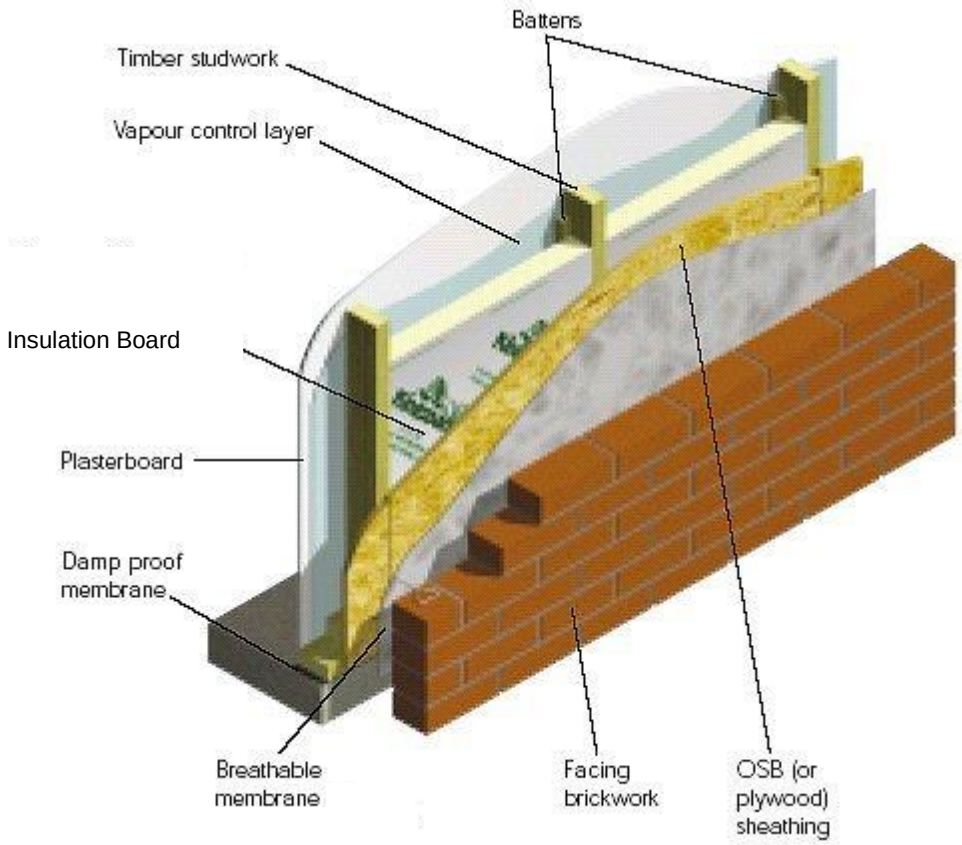


Figure 1 Cross Section of Timber framed wall

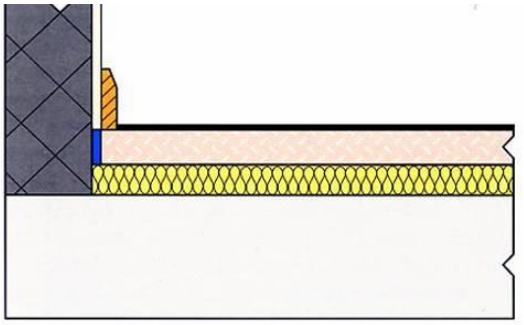
Insulated floors, often referred to as "floating floors"

Ground floors in modern buildings are normally insulated and since the 1990s most ground floors in new buildings were insulated to meet increasing insulation requirements.

- "Floating floors" should be installed with **a layer of insulation, followed by a vapour barrier, and then the surface material**. The surface material could be a **cement screed or a boarding material**.

- There should be a gap between the surface material and the surrounding walls, hence the term “floating” A boarding surface material, when over a floating floor, will not have any fixing nails or screws. A cement screed floating floor may be harder to identify.
- **Look for gaps at the edges, ask the property owner or tap the floor and judge its resonance**. If unsure, you may have to drill a pilot hole into the screed. Beware of water pipes or cables.

Figure 2 Cross Section of an Insulated Floating floor



N.B. Some, but not all, buildings that feature a block and beam construction introduce ventilation using air bricks. In the majority of cases, the presence of air bricks indicates a suspended flooring system. Some of these types of floors also have underfloor heating. The presence of a manifold inside a cupboard, or near the heating boiler, would also be a clue that there may be under floor heating.

Great care should be taken to identify the type of construction. Inspection of not only the interior, but also the exterior of the building is essential.

Questions YOU may want to ask a DR & R technician

- What type of meter did you use and in what mode?
- What readings did you get and from where?
- Have you left readings for the next visit or technician?
- What will happen if we don't take off the render/plaster?
- Would a targeted drying approach be helpful in this situation?
- Why have you chosen this particular drying system?
- When the incident was first triaged what actions were decided upon?
- What reasons do you have for suggesting this?
- What other solutions have you considered?

Remember you may hold a BDMA qualification, but others may have different or no qualifications.

Knowledge Review 1

Q1. To obtain a surface reading from a concrete floor when British Standard 8203 2001 for drying is specified you would:

A. Drill a 50mm hole, insert a humidity sleeve and measure the RH value after 24 hrs.

B Use a resistance meter and two masonry pins driven into the concrete.

C. Use a surface mounted humidity box that must be left in position for 72 hours before readings are taken.

Q2. When taking measurements with a resistance meter and masonry pins 15mm into concrete which of these statements can be relied on?

A. You record a high moisture level. The slab is wet and drying should continue.

B. You record a very low moisture level. The slab is dry and drying can now stop.

Q3. Which of these statements is correct? Radiometer readings:

A. Are accurate to a nominal depth of 10- 20 mm in all materials.

B. Can be relied on to tell you when 'safe' moisture levels have been reached.

C. Can give comparative readings throughout areas of the same material.

Q4. Which one of these statements is incorrect?

A. The standard resistance meter gives a reading close to the surface only.

B. Readings at a greater depth may be obtained by attaching extended insulated or hammer probes.

C. Resistance meter readings are calibrated to be accurate in all types of material.

Q5. Which of these statements is incorrect?

A. Resistance meter probes must penetrate the material being tested.

B. An advantage of using a radio meter for initial surveying is that it does not puncture or mark the surface of the material being tested.

C. It is helpful to employ both types of meter during a survey.

D. Temperature and RH values may be determined using radio and resistance meters.

Q6. After water damage many building materials are adversely affected because:

A. These materials normally have no water content at all.

B Water will dissolve many building materials

C The moisture content within the materials rises to an abnormally high level.

Q7. Two rooms in a property are severely affected following a flood. Water vapour pressure in this area is high. Without intervention what might you expect to happen?

A. The rest of the property would remain unaffected as vapour pressure is lower there.

B. Water vapour at lower pressure will flow into rooms where vapour pressure is high thus lowering the vapour pressure to an acceptable level.

C. Water vapour from the rooms where the vapour pressure is high would travel throughout the property to areas of lower pressure with the probability of damage occurring in areas remote from the original site of the flooding.

Q8. The primary purpose of air moving fans during the drying process is to:

A. Move saturated (boundary layer) air in contact with wet surfaces aiding evaporation of absorbed moisture.

B. Create a cooling effect throughout the property during hot weather

C. Remove moisture from the air.

Q9. When installing air moving equipment which of the following is most important?

A. Make adequate provision to extract the evaporating moisture produced by this equipment from the air.

B. Fit each fan with trunking to direct airflow precisely.

C. Use the most powerful machinery available.

Q10. Injection drying equipment can be operated by:

A. Blowing ambient air into cavities and voids with a variety of air movers.

B. Blowing dry air from a dehumidifier into cavities and voids.

C. Either of these methods.

Q11. Which of the following is correct?

A. Exhaust air from a desiccant must always be vented to the outside of a property and these machines can never be used unless this is possible.

B. Desiccant dehumidifiers will work efficiently at very low temperatures.

C. Refrigerant and desiccant dehumidifiers are always interchangeable.

Q12. Which of the following is incorrect?

A. Timber framed building construction is lightweight and will always dry out quickly following flood incidents.

B. Timber framed buildings may not be easy to identify immediately.

C. There may be interstitial vapour barriers that could trap moisture, often on the 'warm' side of insulated floors and walls

Q13. Which of these statements do you agree with?

A. Older properties that do not conform to modern building regulations are always damp.

B. This situation can always be rectified by applying an injected damp proofing treatment.

C. Absence of damp-proof courses or cavity walling in older properties imposes a significant limitation on the types of wall covering that can be used successfully.

D. There is no defined and precise 'dry and safe 'condition for properties, a competent person needs to make a judgement, based on a range of measurements and factors.

E. Cellars are never a problem; people rarely go in them anyway.

F. Not all owners of older properties are aware of the challenges such properties present, or the limitations faced when living in them.

Q14. Which of the following do you recognise as a description of permeance?

A. The permeance of a building material is the amount of water used during its manufacture.

B. The permeance of a building material is a measure of how readily it absorbs water or allows water vapour to pass through it.

C. The permeance of a building material is a measure of the actual amount of water contained in one metric tonne of the said material.

Q15. Which of the following are correct?

A. Materials with a low permeability do not absorb moisture quickly.

B. Materials with a high permeability do not absorb moisture quickly.

C. Materials with high permeability get wet easily, but can also dry easily.

D. A material with a low degree of permeance can severely slow drying if the underlying substrate is wet. [i.e. vinyl as in tiles and other floor coverings, or in wallpaper]

Q16 'It doesn't matter where this water came from, it won't make any difference to how I set about removing it'. Do you agree?

A. Yes, I agree with this statement.

B. No because if the incident involves black water, it may pose a health risk to myself and others, and the site will require thorough decontamination.

C. No because black water always stains everything and takes longer to clear up.

Q17 When dealing with a black water incident which of these actions would you think is usually the most important?

A. Immediate installation of dehumidifiers.

B. Thorough multi cleaning of all affected areas.

C. Immediate installation of air movers.

Q18 Water flow from the upper storey(s) of a building through the structure is affected primarily by:

A. Gravity.

B. Seasonal variations in temperature.

C. Relative humidity.

Q19. Which of the following is of particular importance during the survey of a vertical leak?

A. Internal decorations.

B. The presence of cable runs, ducting, and pipe work running between floors.

C. Thickness of carpets and other floor coverings, and the number of contents in the affected rooms.

Q20. What is the key problem that may occur if grey water leakages are neglected?

A. The water will evaporate before you can extract it.

B. It may be difficult to see because of its colour.

C. Microorganisms and nutrients contained in it will multiply effectively changing it into black water with increased risks to health.

Q21. During what part of the year would you expect the most severe problems associated with unattended water damage incidents?

A. During a cold snap in January.

B Conditions are much the same all year round so it doesn't matter.

C. During the warm summer months of July and August.

Q22. Which of the following statements are correct?

A. Skirting boards and most rendering on walls is simple and cheap to replace and should routinely be ripped out following any flood incident.

B. The removal of door linings and skirting boards may be required to effect complete decontamination following black water flooding.

C. There is no way that walls can be successfully dried without removal of plasterwork and skirting boards.

D. Removal of rendering is sometimes suggested to allow the underlying wall structure to dry. If this course of action is undertaken, there are significant implications in terms of costs and time.

E. There are alternatives to ripping out in many cases, which are successful and cost effective as they minimise disruption and possible consequential loss.

F. In all circumstances, individual property conditions need to be considered.

Q23. Identifying the presence of plasterboard in a building affected by an escape of water can be important because:

A. Mould will quickly develop on it if it becomes wet.

B. It retains odour.

C. It is a trouble-free material and always easy to restore, even if wet for a long time.

Q24. Water may be considered a pollutant in the domestic environment when:

A. It is more than an inch deep over the floor.

B. The relative humidity and equilibrium moisture levels are sufficient to support the growth of fungi or mould.

C. Humidity levels within the buildings are higher than those in the air outside.

Q25 Remediating Water Damage:

A. Involves few significant hazards and low levels of risk

B. Is covered by three generic Risk Assessments produced by the H &S executive.

C. May involve serious hazards to health

Q26. Understanding Psychrometry:

A. Is not really something that needs to concern me in my work as a technician.

B. Informs technicians how different drying equipment works

C. Enables Technicians to monitor and interpret moisture levels within the built environment and take effective steps to return structures to their pre incident condition following water damage.

Q27 WME Stands for:

A. Water Measuring Equipment

B. Wood Moisture measuring Equipment

C. Water Metering Equipment

D. Wood Moisture Equivalent.

Q28. Which of the following could occur to wooden structural components following water damage?

A. Expansion

B. Shrinkage

C. Delamination

D. Splitting

E. Ripped out to allow removal of moisture from voids

F. Have sealing compounds applied before completely drying out leading to further damage

G. None of the above

H. All of the above

Q29 Water damage incidents can be classified by source. List these classifications. Two additional factors complete the list. What are they?

A

B.

C.

D.

E

F.

Q30 'Safe' moisture levels in materials are reached:

A. When the technician decides they look dry

B. When a resistance meter reading of less than 20% is observed

C. Depends on the material being tested, the pre-determined drying goals, and possibly its position within the structure

Answers to Knowledge Review 1

1.C	**12.A**	**23.A**
2.B	**13.C D F**	**24.B**
3.C	**14.B**	**25.C**
4.C	**15.A C D**	**26.C**
5.D	**16.B**	**27.D**
6,C	**17.B**	**28.H**
7.C	**18.A**	**29. a Clean [water],** **b Grey [water]**
8.A	**19.B**	**c Black [water]** **d Red [water]**
9.A	**20. C**	**E Time [since the incident]** **f Vertical or Overhead leak**
10.C	**21. C**	
11.B	**22. B D E F**	**30. C**

Further Information

Meters in Action

The concrete floor is dry, has never been flooded, and has a sound damp proof membrane.

The meter on the left is being used in "resistance meter mode" and could be thought to indicate that the floor is damp (at 23% compared to a "dry" WME reading of less than 18%). Because we know that this floor is dry it is a false high reading.

> *Correct interpretation of this reading - further investigation is required with a reliable measuring method*

The meter in the centre is measuring equilibrium relative humidity (ERH) within the concrete and showing a reading of 72.9%RH. This shows the floor to be acceptably "dry " to many British Standards

> *Correct interpretation of this reading is that it is a reliable and a generally acceptable measuring method for dense materials. However, none of the British Standards for the installation of floor coverings suggest the drilling of holes, so a humidity box is the preferred option. This should be used by the flooring contractor.*

The meter on the right is in “radio meter” mode. It could be misinterpreted that the floor is still wet as the reading with this Protimeter Radio Meter is over 200.

Correct interpretation of this reading- further investigation is required with a reliable measuring method

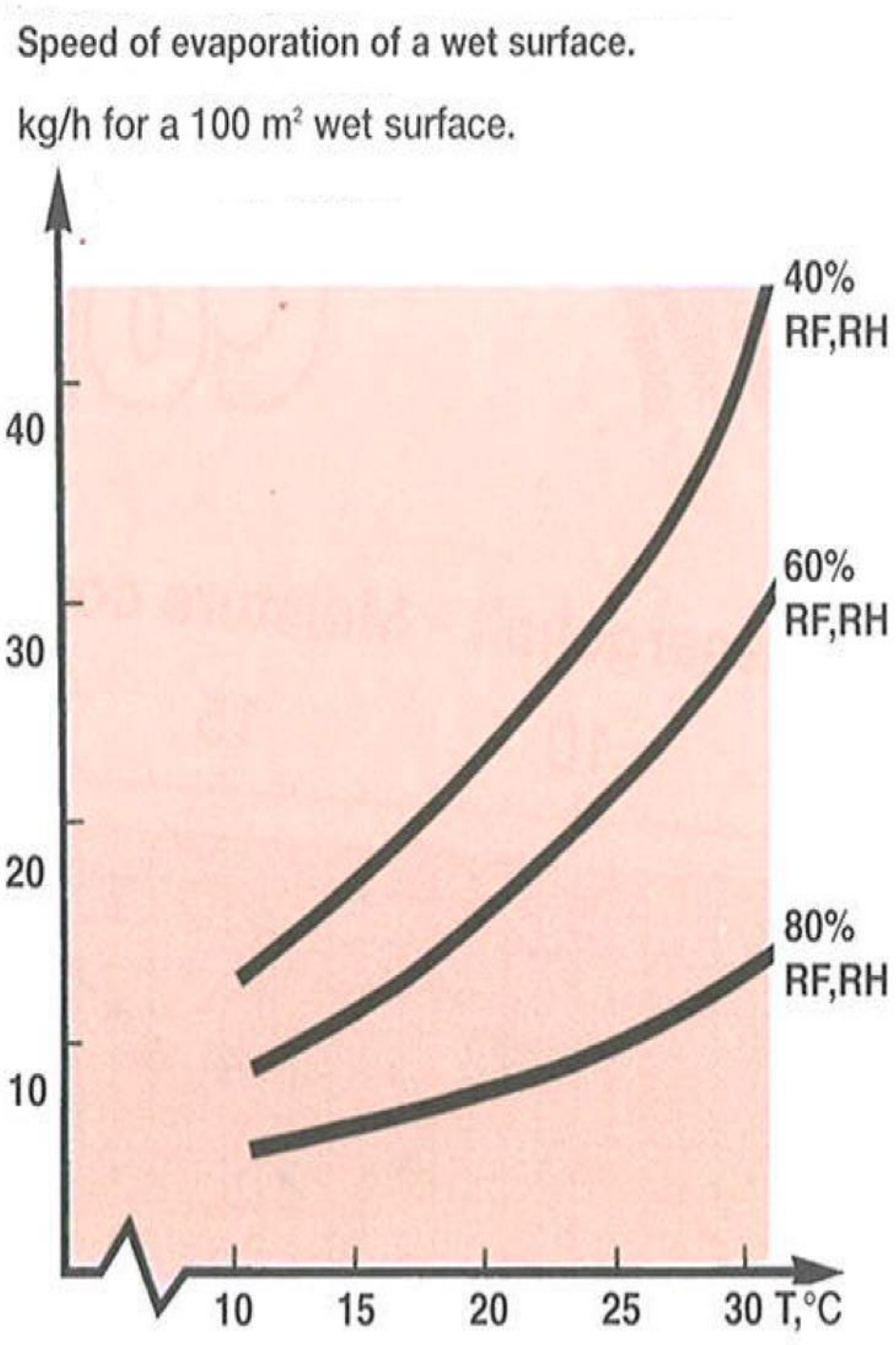


Figure 3: Image from Corroventa Sweden

The Mollier Psychrometric Chart

Drying technicians can use this chart together with a digital thermo-hygrometer to reach an understanding of the relationship between Temperature, Relative Humidity, Specific Humidity and Dew point values obtained from use of the instrument.

Temperature values on the chart are shown as horizontal lines. Relative humidity values are shown as curved lines
The bottom curved line showing 100% RH is instrumental in determining dew point temperatures
A scale showing Specific humidity values is found at the top of the chart.
A scale showing Vapour pressure is shown as a horizontal line at the bottom of the chart.

To determine Specific Humidity from temperature and relative humidity readings (Assume as an example 50% RH and 20°C)
Locate the 20°C (horizontal) line on the chart.
Locate 50% RH (curved) line on the chart.
Follow the vertical line that passes through this intersection to the top of the chart and read off the SH value in grams per kilogram (7.5g/kg).

To determine vapour pressure for the same values, follow the vertical line used to determine SH to a point at the bottom of the chart where the vapour pressure line is intersected and obtain a reading (10mmHg)

From this you can see demonstrated the direct correlation between SH and DP. The higher the SH value (the more actual moisture present in the air) the higher the vapour pressure exerted.

To determine the dew point temperature reading for the same values (50%RH and 20°C) proceed as before to the point of intersection of Temp and RH.
Follow the vertical line of intersection downwards to the point where is intersects the final curved line (100%RH)
From this second intersection point follow the horizontal line to the left of the chart and read the dew point temperature value (12°C).

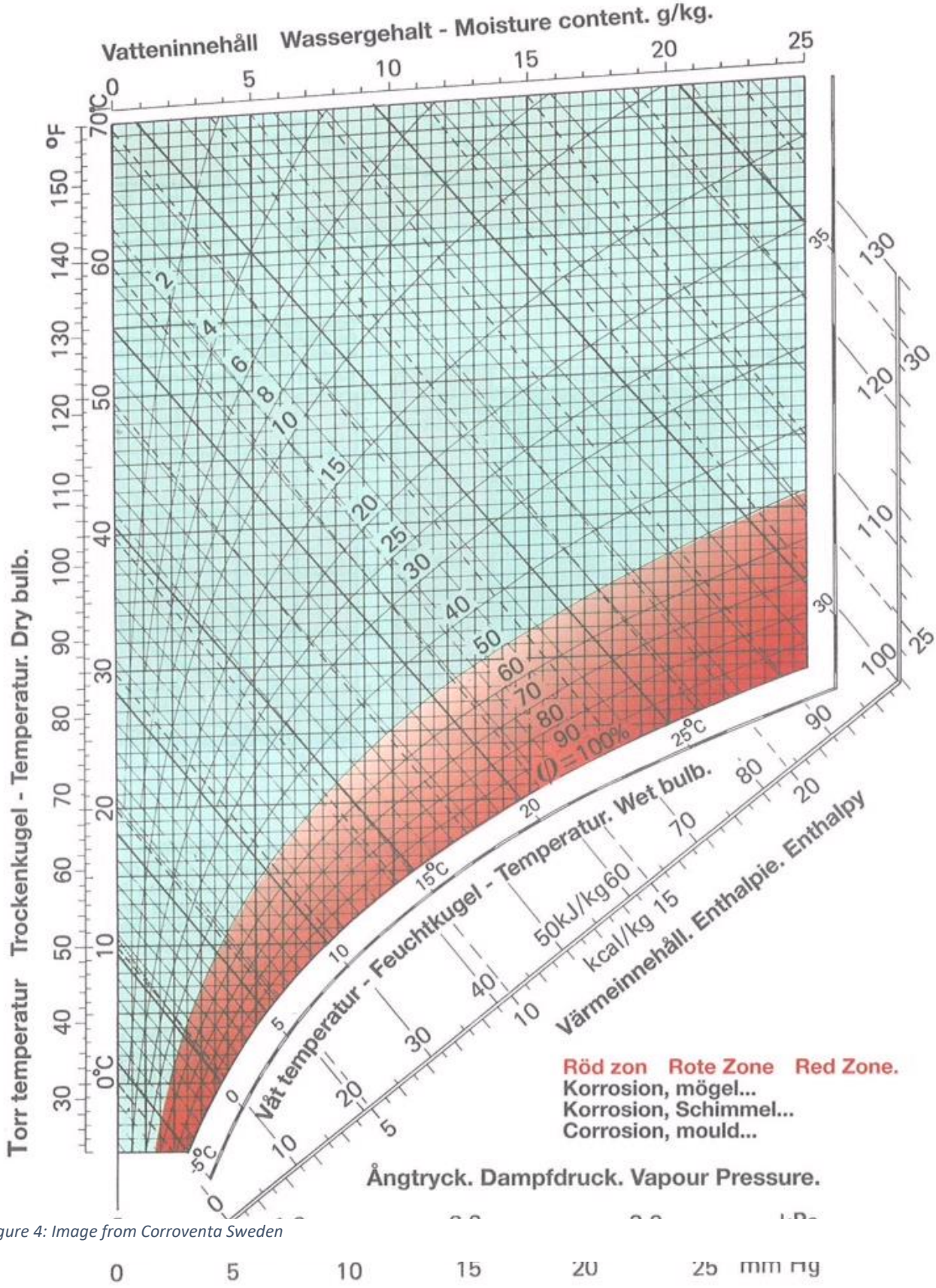


Figure 4: Image from Corroventa Sweden

When to strip out?

For Stripping Out
Increases drying where covering materials would have slowed, meaning the humidity in property returns to normal levels faster
Removal of contaminated materials reducing need to clean, or some materials that cannot be cleaned after a black water ingress
The materials may have been contaminated with odours that would be unacceptable to the occupiers
It avoids the risk of missing hidden damage/ mould present
Can save a lot of wasted time trying to dry something that will not dry satisfactorily
Some low permeance materials may also have to be removed in order to allow moisture trapped behind to be released.
Skirting boards, door frames may have to be stripped out to allow full cleaning following black water ingress
Plaster has 'blown' or gone 'live' and so needs to be removed and replaced.
If laminate floor has blown & de-laminated and water has got underneath, it will be unable to be repaired

Against Stripping Out
Costs will be kept down if the property does not need stripping out (no labour, materials or disposal costs)
Cause the premises to be uninhabitable creating further cost
Significantly increase the time it takes to complete work resulting in increased overall costs for the job with delays in tradesmen and associated alternative accommodation (or BI) costs
May be very difficult to obtain matching materials if originals are removed
Can hugely impact the customer in their health and wellbeing by being away from their home unnecessarily or for an extended period - Can be very upsetting for owners where they see their home being stripped
If building is listed it may be illegal without permission. Some modern buildings warranties are voided if they are changed or altered
Sustainability - it is better to retain as much as possible, rather than strip out and replace
Asbestos may get unnecessarily disturbed
Strip out could result in Damp proofing or other membranes being damaged or breached or resilient features being removed
Target drying methods such as tenting/ enveloping can also be used to assist drying problem areas instead of stripping out

Notes