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Management of moisture in buildings — Code of practice

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Summary of pages

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 July 2021. It was prepared by Subcommittee B/540/2, *Building performance – Moisture*, under the authority of Technical Committee B/540, *Energy performance of materials, components and buildings*. A list of organizations represented on these committees can be obtained on request to the committee manager.

Supersession

This British Standard supersedes BS 5250:2011+A1:2016, which is withdrawn.

Information about this document

This is a full revision of the standard, and introduces the following principal changes:

- guidance on moisture risk concerning problems other than just condensation has been added;
- a whole-building approach to moisture safe design, introduced in the BSI White Paper *Moisture in buildings* [1] is adopted, including prescriptive, modelling and principles based;
- approaches considering building context, coherence of design and detailing and interactions, capacity and in-service conditions have been added;
- a major revision of the content relating to floors (Clause **10**), walls (Clause **11**) and roofs (Clause **12**) with particular emphasis on managing moisture risks in buildings undergoing energy saving measures; and
- a general update of other parts of the standard.

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Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

The word "should" is used to express recommendations of this standard. The word "may" is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word "can" is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Where words have alternative spellings, the preferred spelling of The Shorter Oxford English Dictionary is used (e.g. "organization" rather than "organisation").

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Introduction

Moisture in buildings is considered to be a significant cause of many building failures, including some building-related occupant health problems. Some problems are decreasing (due mainly to the increased availability of central heating in buildings), while others could be increasing due to increased airtightness and insulation, fuel poverty, overcrowding and changing use of buildings. This British Standard contains recommendations for the management of moisture in buildings.

NOTE See UKCMB report for further information on moisture in buildings [2].

The understanding of moisture risk in buildings has developed considerably in the past few years. Not only have the mechanisms of moisture movement been explored more fully, but the types of buildings and applications being studied have widened (in particular, to include existing, retrofitted buildings). At the same time there is a growing acknowledgement of the key role of moisture in the health of occupants as well as in the condition of the building fabric. The air permeability of buildings is being reduced and traditional walls are being insulated, with the purpose of achieving the targets of greenhouse gases emission reduction, reducing fuel poverty and improving the comfort of occupants. Building use is also changing, with more sedentary lifestyles and greater moisture production from appliances such as showers and the drying of clothes inside. Predicted changes due to climate change over the next century, including milder, more humid winters and larger volumes of driving rain, are also likely to increase the number and severity of moisture problems.

In view of changing conditions and greater understanding, it is apparent that the established approach to moisture issues in standards, regulations and certification needs review and revision. The current approach is based predominantly upon the idea of a building as composed of discrete building elements in perfect conditions, not affected by their interactions with other elements or by their context or use. In reality, however, most building elements interact in multiple and sometimes complex ways with one another, the occupants and the external environment. Building materials are also affected by changes to their condition over time. A new approach is therefore required, which takes these into account and is more closely related to real world moisture problems and risks. This is the reason for this major revision to BS 5250.

The publication of the BSI White Paper *Moisture in buildings* [1] in 2017 stimulated new ways of diagnosing moisture problems, and developing remedial measures for problems in existing buildings and more robust solutions for the design and construction of new buildings. In both new and existing buildings, the gap between design and as built is now clearly understood. There are very few buildings without "in service" effects of residual moisture from construction, moisture generated in usual use or, where more serious, moisture due to building faults. The following three conditions occur:

- as designed on the drawing board;
- as built in practice; and
- in service after several years of occupancy.

The assessment of moisture risk in buildings or building elements varies according to these different conditions, requiring a different approach according to the type of building and the quality of work.

For the purpose of analysis and guidance in this British Standard, only two conditions are dealt with, combining "as built" with "in service" to represent a real world as opposed to a theoretical situation.

To summarize, there is:

- as designed in theory (ADT), which refers to buildings as though built as designed, without construction faults or degradation in use; and
- as built/in service (ABIS), referring to conditions resulting from commonly occurring problems or failures which arise either during construction or as buildings age, are altered and the materials used in their construction degrade.

Despite the recognition of possible differences between ADT and ABIS, it is important that all building materials used are durable, all designs follow best practice and all workmanship is to a high standard.

Previous methods of moisture risk assessment have dealt mainly with individual building elements and not the interactions between them or the effects on the whole building as a system. The previous focus on new buildings where design of connections was to some extent controllable meant that this approach was acceptable. Furthermore, until this century the comparatively low standards of airtightness and insulation, even in new buildings, meant that the moisture risks and consequences of high internal humidity were relatively low, making it less important to consider the issue of whole-building effects. The significant increase in airtightness and insulation in new building regulations, along with an awareness that there are often significant gaps between design and actual construction, mean that these effects now require consideration in any moisture risk assessment.

This means that alongside analysis of individual elements, there needs to be an assessment of the moisture risk of interactions with other elements and an awareness of the moisture risk to the whole structure more generally including the indoor environment.

However, because the assessment of these connective and systemic effects is still in a relatively early stage of development, moisture risk assessment still continues to be based on individual elements, but with an awareness of these more complex interactions.

This British Standard suggests three main ways to assess and manage moisture risk (see **4.2**).

- By prescriptive guidance, based on commonly used applications.
- By modelling as specified in standards such as BS EN ISO 13788, BS EN 15026 or BS EN ISO 10211 for thermal bridge analysis, where appropriate.
- By understanding and applying the principles of moisture safety in buildings, as laid out in Annex A.

Another reason why a new approach is required is the lack of integration between guidance that treats different moisture problems, such as condensation, rain penetration and rising damp. This British Standard treats all these as different aspects of the same problem, which need to be considered to obtain an understanding as to how best to manage moisture risk as a whole. This holistic approach is seen in the treatment of internally insulated solid walls. In focusing on condensation alone, previous editions of BS 5250 (up to the 2011 edition) recommended that a vapour barrier be present on the warm side of the insulation. However, when rain penetration and solar driven moisture are considered, it is clear that this vapour barrier can actually prevent drying of the wall and create rot and mould in joist ends.

In this case, the best approach is to allow moisture to move through the structure and evaporate from the internal and external surfaces.

In other cases, flat roofs for example, it is necessary to prevent moisture movement into and through the structure as far as possible. A good understanding of the materials present and their interactions with moisture is a key part of the design of building to reduce the risks of moisture damage.

It is essential that conflicts between moisture risk management and other issues such as fire safety, conservation of energy, acoustic protection, access, etc. are understood and taken into account.

A standard on the management of moisture in buildings needs to take into account these many different factors and provide an integrated approach which minimizes moisture risk to the greatest degree possible. For this reason, this British Standard takes a "whole-building approach", which addresses moisture in buildings through a combination of principles, prescriptive guidance and modelling. It does this within the framework of a joined-up process of assessment, design, construction and use. The lack of integration between these stages is the other major way in which interfaces can create moisture risks.

A whole-building approach ensures that physical interfaces (known as junctions) and the systemic effects of the whole, as well as the physical and historical context and the as built and in service conditions, are all addressed and integrated. The joined-up process ensures that the whole-building approach is integrated throughout each stage of design and construction and that feedback is given where challenges appear and changes occur.

Section 1: General

1 Scope

This British Standard gives recommendations for the management of moisture in buildings using an integrated and pragmatic approach. This includes the management of moisture risk from interstitial and surface condensation, from too high or too low internal relative humidity, and from rain penetration or high levels of ground water. It covers all states of water as gas, liquid and solid, and the interactions between these states. It describes the principal sources of moisture in buildings, its transportation and deposition and provides recommendations and guidance on how to manage those risks during the assessment, design, construction and operation of buildings.

This British Standard does not cover measures specifically dealing with flooding and escape of water. These are dealt with in BS 85500.

This British Standard is intended for use by designers, builders and users of any class of building. This standard gives guidance on risks of all sorts from high moisture levels, whether in the building fabric or in indoor air, which can endanger the health and well-being of building occupants and the integrity of the building fabric.

This British Standard is relevant to buildings of all types, whatever their form, construction and occupancy, both new and existing, and both domestic and non-domestic, except for buildings used for storage at sub-zero temperatures.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this document.[1)] For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 3533, *Glossary of thermal insulation terms*

BS 5427, *Code of practice for the use of profiled sheet for roof and wall cladding on buildings*

BS 5534:2014+A2:2018, *Slating and tiling for pitched roofs and vertical cladding – Code of practice*

BS 5864, *Installation and maintenance of gas-fired ducted air heaters of rated heat input not exceeding 70 kW net (2nd and 3rd family gases) – Specification*

BS 5925, *Code of practice for ventilation principles and designing for natural ventilation*

BS 6229:2018, *Flat roofs with continuously supported flexible waterproof coverings – Code of practice*

BS 6915, *Design and construction of fully supported lead sheet roof and wall coverings – Code of practice*

BS 8102, *Code of practice for protection of below ground structures against water from the ground*

BS 8215, *Code of practice for design and installation of damp-proof courses in masonry construction*

BS 8219, *Installation of sheet roof and wall coverings – Profiled fibre cement – Code of practice*

BS 9250, *Code of practice for design of the airtightness of ceilings in pitched roofs*

BS EN 1279 (all parts), *Glass in building – Insulating glass units*

1) Documents that are referred to solely in an informative manner are listed in the Bibliography.

