

CHAPTER 13: DEVELOPMENTS WITHIN COASTAL LOCATIONS

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13.1 Coastal location definition

FUNCTIONAL REQUIREMENTS

13.1 DEVELOPMENTS WITHIN COASTAL LOCATIONS

Workmanship

- i. All workmanship must be within the tolerances defined in Chapter 1 of this Manual.
- ii. All work must be carried out by a technically competent person in a workmanlike manner.
- iii. Cavities should be clear from mortar droppings to prevent moisture ingress.
- iv. Masonry walls should not be laid in extreme weather conditions.

Materials

- i. All materials should be stored correctly in a manner which will not cause damage or deterioration of the product.
- ii. All materials, products and building systems shall be appropriate and suitable for their intended purpose.
- iii. Materials should be suitable for the relative exposure of the building in accordance with the relevant British Standard. The durability of the structure will require the provision of a periodic maintenance strategy that will need to be in place for the life span of the systems and components.
- iv. The structure shall, unless specifically agreed otherwise with the Warranty provider, have a life of not less than 60 years. Individual components and assemblies not integral to the structure may have a lesser durability, but not in any circumstances less than 15 years.
- v. Whilst there is and can be no Policy responsibility and/ or liability for a roof covering, window and/ or door performance life of 60 years or less, roof coverings, windows and/ or doors shall be designed and constructed so they have an intended life of not less than 15 years.
- vi. 'Decorative Claddings': Whilst there is and can be no Policy responsibility and/ or liability for a performance life of 60 years or less for a 'cladding' which has a 'decorative function only' (i.e. with the main substrate wall construction providing the main weather proof barrier); a 'decorative' type cladding shall be designed and constructed so they have an intended life of not less than 15 years.

Design

- i. For shoreline, sea front developments and developments within 500m of the shoreline the design team must provide specific proposals with detailed plans and specifications. These must demonstrate the durability, suitability and weather tightness of the construction with particular attention to the structural frame, window and door openings, balcony / roof abutments (particularly at balcony window openings), cladding and roof fixings, together with a planned maintenance programme to ensure the construction meets the requirements of this Manual. The choice of materials and coatings must be appropriate for this environment.
- ii. For developments that are between 500m to 5km from the coastal shoreline; structures and protective coatings/claddings and detailing should be scrutinised for the potential enhanced risk of the effects of corrosion and reduced durability. The design team must provide a detailed assessment of the protection and maintenance arrangements required for a project that falls within these locations and identify suitably approved materials which are appropriate for use in the construction.
- iii. Structural elements outside the parameters of Regional Approved Documents must be supported by structural calculations provided by a suitably qualified expert.
- iv. The design and construction must meet the relevant regional building regulations.

Limitations of Functional Requirements

- i. The Functional Requirements are limited by the recommendations applied to the specific areas covered in this chapter.
- ii. These Functional Requirements do not and will not apply to create any policy liability for any remedial works carried out by the contractor or otherwise, nor to any materials used in those remedial works.

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13.1.1 Coastal location definition

For the purposes of this Technical Manual, we are considering any building works on;

- The shoreline and sites within 500m of the shoreline
- Other sites up to 5km Inland from the shoreline
- Sites located in 'tidal' estuarine areas where they are within 5km of the general UK coastal shoreline

Shoreline means:

- The foreshore
- Land adjacent to the foreshore including in particular any cliff, bank, barrier, dune beach or flat which is adjacent to the foreshore

13.1.2 Developments within coastal locations

A coastal location is considered as having an aggressive environment particularly with regard to environmental corrosion conditions as well as other risks (see 13.1.3).

13.1.3 Key risks to construction in coastal locations**13.1.3.1 Wind speed**

Coastal regions particularly in the South West, West and North Western areas of the UK are at greater risk of exposure to higher wind speeds than inland areas. Gust wind speeds in combination with rain can create particular design issues for buildings sited in shoreline locations, particularly for cladding and roof coverings and their associated fixtures and fittings.

13.1.3.2 Rain penetration

Walls, claddings, external openings including windows and doors, construction junctions and roofs exposed to the prevailing wind driven rain are vulnerable to rain penetration unless correctly designed and constructed for the conditions of the site and orientation of the elevations. The level of exposure to rain penetration in coastal locations is deemed to be 'very severe' (see Chapter 7 section 7.1).

There are numerous publications providing good practice guidance on methods of preventing rain penetration to internal surfaces of buildings in very severe exposure locations e.g. BRE publication: Thermal insulation: avoiding risks.

13.1.3.3 Durability of materials

The durability of construction materials used in coastal locations must be suitable for the site location environment. The effects of corrosion from wind blown salt spray and higher UV exposure can significantly reduce the normal expected durability of a component, in a coastal location, to below the life expectancy required by the Functional Requirements within this Technical Manual.

13.1.3.4 Workmanship

A high number of failures of the building envelope in coastal environments are directly due to poor workmanship rather than the failure of the actual material. Examples of this are;

- Poor installation of roof tiles or slates due to lack of correct fixings required for the location.
- Poor fixing of timber claddings resulting in splitting and warping of boards leading to wind and water ingress to the inner components of the wall construction.
- Lack of adequate preparation and protective finishes to external windows.
- Inadequate provision of correct damp proofing in walls around openings e.g. poorly fitted cavity trays.
- Incorrectly positioned flashings and dpc's at balcony decks, especially around external door opening junctions.

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13.1.3.5 Maintenance

It is the designer's responsibility to ensure that exposed components forming part of the structure or water proof envelope must perform to meet the Functional Requirements within this Technical Manual.

Certain materials and particularly the finishes may, due to the environment, require an on-going maintenance requirement in order to keep a satisfactory finish, e.g. balcony timber decking. In these circumstances it will be the building owner's responsibility to ensure that regular maintenance of exposed components and finishes is undertaken to ensure they perform correctly. Maintenance plans will need to be in place during the lifetime of the building to ensure premature failure of coatings or components is avoided. Typically dark coloured finishes will fade much sooner.

Debris build up (e.g. wind blown sand) must be managed, particularly to balconies. These can lead to leaks and overflowing of blocked outlets which in turn cause damage to other parts of the structure and concentrate the potential for water ingress. Bi fold and patio type doors are known for the seals, mechanisms and drainage holes being affected by wind blown sand if not regularly maintained.

13.1.4 External wall constructions**13.1.4.1 Introduction**

The following guidance is to be read in addition to the guidance found in Chapter 7 of this Technical Manual.

Any wall element exposed to precipitation or wind driven moisture, should prevent penetration of moisture to the inner surface of any part of a dwelling so as to protect the occupants and to ensure that the building is not damaged.

All external wall constructions in a coastal environment must be designed and constructed to suit the degree of exposure to wind and rain that it may be subject to BS EN ISO 15927-3: 2009 and BS 8104: 1992 provide a range of methodologies for the assessment of wind driven rain on the walls of a building.

An alternative simplified approach is provided within BR 262 'Thermal insulation: avoiding the risks' This document is based on BS 8104 and provides a map (see below) which indicates exposure zones.

The BRE Report BR 262 provides a simplified procedure for assessing exposure to wind-driven rain for walls up to 12 m high. It is primarily intended for low rise domestic buildings but may also be considered suitable for other categories of buildings of a similar scale. This simplified guidance is based on a map which defines zones in which calculations in accordance with BS 8104, predict similar exposure conditions. The zones are numbered 1 to 4 and correspond with categories defined in the table.

Note: In table 14 of BS8104 it does give reference to the BS EN13914-1 Code of Practice for External Rendering which indicates that additional render thickness will provide additional weather resistance performance.

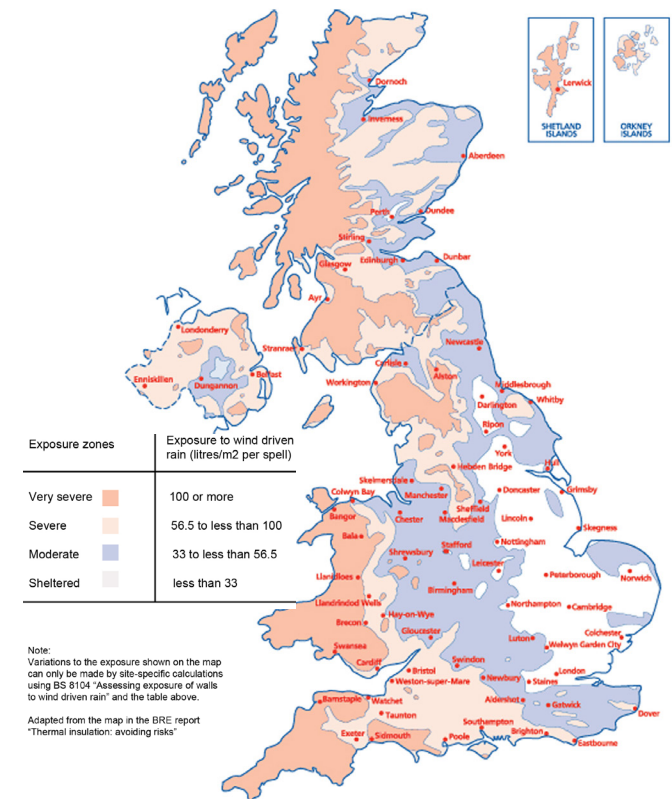


Figure 1: Map showing exposure to wind-driven rain categories

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13.1.4.2 Masonry walls

The guidance in BS EN 771 for masonry walls of bricks and/or blocks incorporating damp-proof courses and flashings in very severe exposure locations may be adopted.

Fair faced masonry cavity walls incorporating insulation material within the cavity should only be constructed as a partial cavity fill using an insulation material which has a current third party product approval certificate confirming its use for such conditions. Full fill cavity insulation is not permitted.

Masonry walls of natural stone or cast stone blocks should be constructed in accordance with the relevant recommendations of BS EN 771 and to suit the degree of exposure.

External masonry walls in severe and very severe categories of exposure will benefit from having additional protective features to avoid excessive wetting of the masonry. Features such as deep overhanging eaves, verges and projecting sills should be incorporated into the design.

The following should be avoided in very severe exposures:

- Flush sills,
- Inadequate or non-existent overhangs at verges,
- Large expanses of glazing or impermeable cladding with no effective means to shed run off water, clear of the masonry below.

- Areas of rendering abutting masonry with no effective seal at the junction to prevent water penetration to the rear of the render.

Insulated concrete formwork (ICF) structures

ICF structures rely on a suitable external cladding to provide the water proof envelope. The external cladding, if masonry, should be constructed as described earlier in this guide. Direct render applications in a very severe exposure location are not recommended unless the render system has a third party product approval for installation directly applied to the ICF in these conditions and:

- A full design specification for the render system is provided by the render manufacturer and installed by the manufacturers approved contractors.
- An insurance backed 10 year guarantee is provided.
- Detailing of all the window, door and roof junctions is provided as part of the design specification by the render manufacturer.

13.1.4.3 Rendering

External rendering to external masonry walls should conform to the relevant recommendations of BS EN 13914-1:2005.

Render angle beads should be appropriate for the environment and allow for any damage to coatings when installed. Non corrosive render beading e.g. PVC or marine grade stainless steel should be specified. Any other products used must have a current third party product approval stating they are suitable for the environmental conditions proposed.

Fixings to render angle beads must be suitable to prevent corrosion occurring.

The durability of the rendering will also be dependent upon the type of background, the type of rendering, mix proportions and the method of application.

The 'background' or substrate which is to support the render must be suitable for bonding the render and be dry in condition. Materials of differing densities should be avoided in the substrate, if this latter point cannot be avoided, the render manufacturer must provide a specification for the render application over these areas to avoid future cracking.

The choice of render and render carrier boards (if used) must be correctly specified and installed.

Wherever possible, whatever the conditions of exposure, advantage should be taken of architectural features which protect the rendering. Such protective features become more important as conditions become more severe, adequate overhangs and drips will reduce the risk of frost damage.

With traditional renders the quality of the sands used and design mix is critical as is the reliance on good mixing techniques by the applicator. Poor mixing ratios and low quality materials is often the reason traditional renders fail, therefore, for projects located in a 'coastal locations'; only a pre-blended bagged render system which has a third party accreditation such as a BBA or ETA certification and backed up with a manufacturer's specification, will be accepted.

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Whilst traditional renders are applied in several layers and normally are 20 to 25mm thick to provide a 'physical waterproofing'; in a very severe location, a detailed specification from the render manufacturer will be required to justify it is suitable for the proposed conditions and the overall thickness.

Polymer modified, ready to use factory produced renders contain high quality raw materials and a range of admixtures (notably water repellents) which reinforce the waterproofing properties of the renders. The thickness of these renders may vary depending upon the particular application and guidance should be sought from the render manufacturer.

For these types of renders, a third party product approval certification will be required to identify the scope of approved use. It should be noted that a number of third party product approval bodies have a limitation of 75litres/m² applied, which equates to a 'severe' rating only. Therefore in 'very severe' locations any 'polymer modified' type render intended to be used must be supported by the render manufacturer's fully detailed specification and should only be applied by the render manufacturer's approved contractors. A 10 year insurance backed guarantee will also be required.

Note: adding additional water repellent which is not within the render manufacturer's specification into the mix on the worksite should not be carried out, it may even be harmful to pre-prepared render systems as it can lead to faults in the finish.

13.1.4.4 External cladding systems including rain screens

The materials used within the construction should be capable of withstanding weathering, atmospheric pollution and potential chemical attack for the intended design life.

The system must have a current third party product approval confirming the specification is suitable for a coastal environment.

The supplier and designer should provide evidence to satisfy the following;

- Evidence of the minimum design life of the enclosure as a whole for the particular environment location (with maintenance considered to allow for components that may have a lesser design life but are expected to be periodically replaced)
- Confirmation of what routine maintenance, repair and replacement is likely during the design life and who will be responsible for this.
- Details to confirm that the potential for electrolytic corrosion will be avoided within the system.
- The surfaces of the cladding system should be capable of resisting the action of chemicals with which it is likely to come into contact during its design life.

Components which should have a design life to meet the relevant Functional Requirements of the Technical Manual (60 years for components forming part of the structure, 15 years for components not integral to the structure) are;

- Secondary framing and its fixings
- Panels and their fixings
- Thermal-insulating components and materials
- Vapour barriers
- Flashings
- Window sub frames
- Door frames
- Fixed window frames
- Opening windows
- Doors
- External shading devices
- Window and door equipment
- Glazing
- Gaskets and compression seals
- Sills and closure pieces
- Inlet and extract grilles

Components which are likely to have a shorter design life of only a few years and will need to be periodically replaced as part of a planned maintenance programme are;

- Gun and knife-applied sealants
- Site-applied external finishes

The cavity behind a rain screen is deemed to be a moist zone and materials selected must not corrode, deteriorate or affect the performance of the cavity barrier during its design life.

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13.1.4.5 Window and door openings

Reliance on effective weather proofing around openings must not be placed on mastic sealants alone and agreement for solutions should be sought from both Building Control and the Warranty provider prior to installation. A combination of appropriate durable external sealant and a continuous damp proof course will be required.

Cavity trays will require stopped ends and correctly positioned drainage to the external air via either full height open perpend or in very severe exposures appropriately specified proprietary ventilators (weeps)

Very severe exposure locations will require checked masonry reveals and robust DPC detailing.

External openings in solid wall / ICF structures will require specific DPC detailing with the use of a compriband or similar third party approved DPC solutions linked to internal vapour control layers to prevent water ingress to the internal finishes.

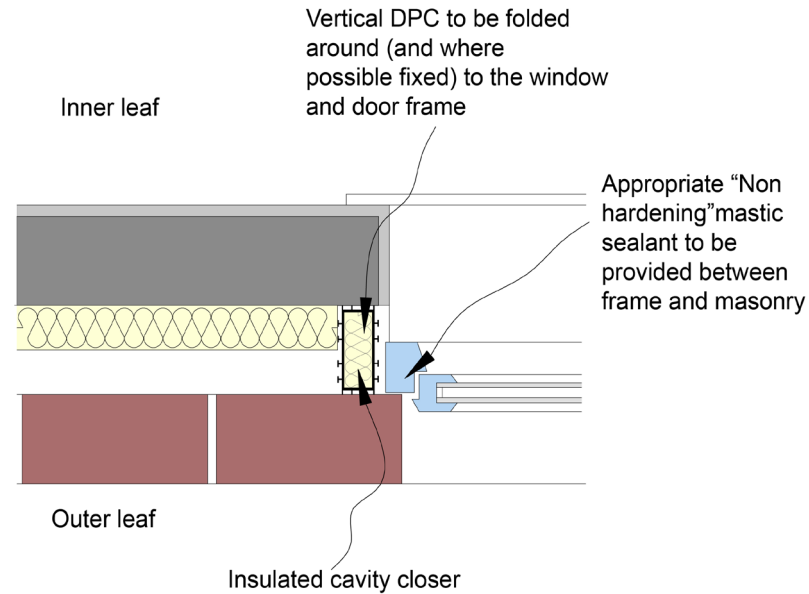


Figure 2: Traditional cavity wall with a checked rebate detail (insulation value of wall construction to meet relevant standards)

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13.1.4.6 Window and doors

The choice of windows and doors must be supported by the manufacturer's certification to confirm they meet the design weather conditions and be classified and tested in accordance with the following weather performance standards:

BS 6375-1
Weather tightness

Air permeability - BS EN 12207 – Classification & BS EN 1026 - Test method

Water resistance - BS EN 12208—Classification & BS EN 1027 - Test method,

Wind resistance - BS EN 12210— Classification & BS EN 12211 – Test method

Site testing for water penetration of the joints to windows and doors in accordance with the CWCT test methods is recommended to check the site workmanship of the building envelope as constructed. See CWCT Technical Note No. 41 for guidance on site hose testing.

In addition to the above, workmanship should follow the recommendations of BS 1186: 2. The design and construction of factory assembled windows must meet BS 644:2009. Non factory assembled units and 'bespoke' units are also expected to meet the same standard.

Window and door furniture and fittings must be resistant to the effects of the saline environment.

Where back ground ventilators (trickle vents) are installed, they must be correctly specified for the location and should be installed so as not cause potential damage to render finishes or restrict the ability to open the window / door.

13.1.5 Balconies

The following guidance is to be read in addition to the guidance found in Chapter 7 of this Technical Manual.

An adequate step or raised threshold must be provided to avoid the risk of penetrating moisture created by the high wind driven rain. A minimum of 75mm difference between the highest point of the balcony roof waterproof surface and the underside of the door sill should be provided, 150mm in all other situations. See figures 3 & 4 below:

In very severe exposure locations / elevations:

- A flush fitting balcony floor finish abutting any door unit in the external wall of the dwelling must not occur as this could lead to a concentration of water against the window frame. A minimum gap of at least 10mm will be required which should be maintainable to ensure build up of any silt or other debris is avoided.
- The balcony roof waterproof covering must be designed to fall away from any external doors opening into the building.
- Drainage outlets must be easily accessible and maintainable even if decking / balcony floor finishes are applied.

- Timber balcony guards require to be constructed from marine grade timbers.
- Fixings used in balcony decking or guarding must be appropriately specified to prevent adverse reaction with certain timbers.
- Regular maintenance of balcony floors will be required to avoid wind blown sand clogging up drainage outlets and balcony door seals and tracks.
- Balcony steelwork must be adequately protected against the potential for corrosion (see structural steel 13.1.6)

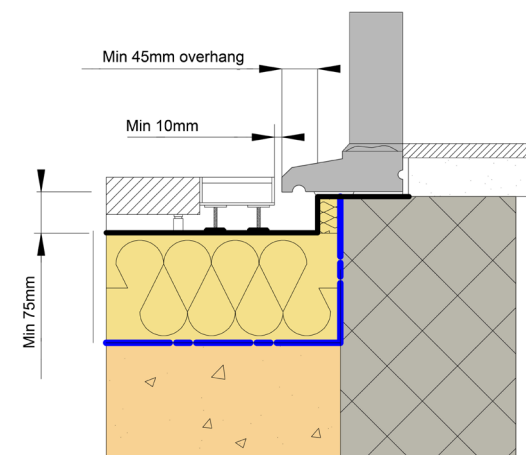


Figure 3: Upstand at door access: warm deck roof / balcony 'Level threshold'

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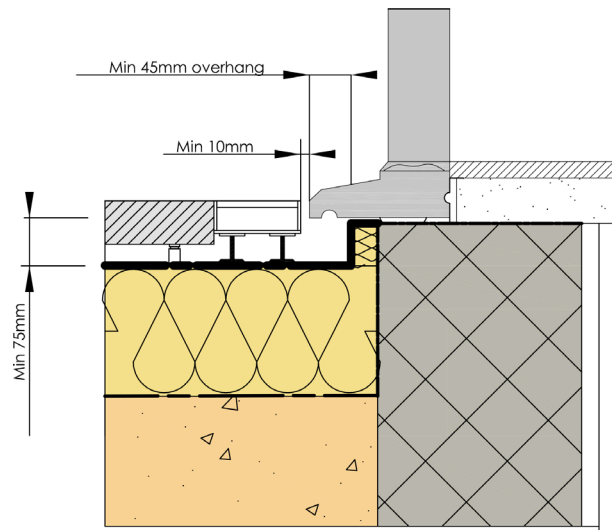


Figure 4: Upstand at door access: inverted warm deck roof / balcony

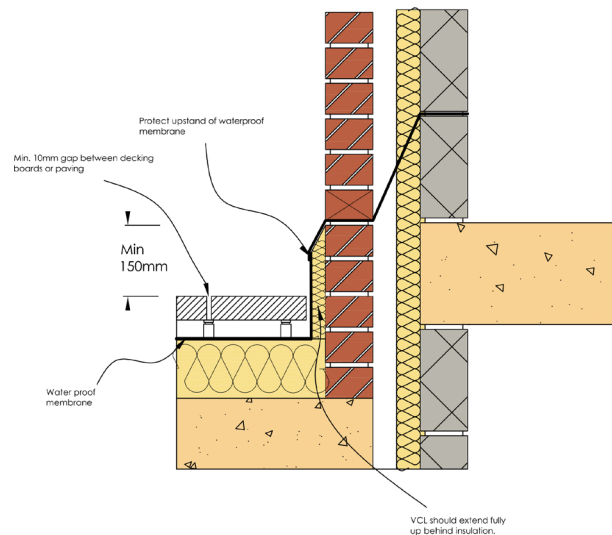


Figure 5: Upstand to decking and paving finishes e.g. balcony parapet

13.1.6 Corrosion protection and protective coatings

13.1.6.1 Corrosion protection to steelwork

All materials on buildings are subject to wear during use, this is caused by mechanical, chemical, electrochemical, thermal, microbiological and radiation related impacts. Mechanical reactions lead to wear, chemical and electrochemical reactions cause corrosion.

The following guidance is to be read in addition to the guidance found in Chapters 2 and 7 of this Technical Manual.

Corrosion is defined as the physical interaction between a metal and its environment which results in changes to the metals properties, and which may lead to significant functional impairment of the metal, the environment, or the technical system of which they form part of (BS EN ISO 8044).

Corrosion resistance is the ability of a metal to maintain its operational capability in a given corrosion system. When selecting suitable construction materials which are protected to resist corrosion during its service life, it is important to consider the building, its location, the surrounding environment, the atmosphere and climatic conditions.

There are several types of corrosion that must be considered to ensure that the material(s) selected will not corrode and lead to functional impairment.

- Uniform surface corrosion
- Electrolytic corrosion
- Crevice corrosion
- Pitting corrosion
- Stress corrosion
- Contact corrosion

Standards

- ISO 8044 -Corrosion of metals and alloys — Basic terms and definitions
- ISO 9223, Corrosion of metals and alloys — Corrosivity of atmospheres — Classification
- ISO 9224, Corrosion of metals and alloys — Corrosivity of atmospheres — Guiding values for the corrosivity categories
- ISO 12944-2:, Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 2: Classification of environments
- BRE Digest 301 – Corrosion of metals by wood
- PD6484 – Commentary on corrosion at bi-metallic contacts and its alleviation

Note:

The CWCT Technical Note 24 provides guidance on corrosion and corrosion protection to cladding.

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13.1.6.2 Protective coatings and finishes to metals

All metals must have a suitable protective coating to minimise or prevent corrosion during its life and be selected to comply with the appropriate standards and with the corrosion category described in the table below.

The classification of environmental corrosion conditions below has been taken from BS EN ISO 9223 Table 4 and BS EN ISO 12944-4 Table 1. This provides a verbal description of the corrosion categories.

Corrosion Category C	Corrosion Level	Indoor Environment -	Outdoor Environment
C1	Very Low	Heated spaces with low relative humidity and insignificant pollution, e.g. offices, schools museums	Dry or cold zones with a very low pollution environment or times of wetness
C2	low	Unheated spaces with varying temperature and humidity, low pollution and where condensation may occur e.g. storage depots, light industry, sports halls	Temperate zones to dry or cold zones with a low pollution environment e.g. Rural areas and small towns more than 10km from the coast or an estuary.
C3	Medium	Spaces with moderate frequency of condensation and pollution from production processes e.g. Residencies, Food processing plants, laundries, breweries, dairies.	Temperate zones with a medium pollution environment or small effects from chlorides, e.g. Urban and industrial areas with moderate sulphur dioxide pollution, coastal areas and estuaries with low salinity (approximately 5-10km)
C4	High	Spaces with a high frequency of condensation and pollution from production processes e.g. Boatyards, industrial processing plants and swimming pools	Temperate zones, atmospheric environment with medium pollution and medium effects from chlorides e.g. polluted urban areas, industrial areas, coastal areas and estuaries with moderate salinity (approximately 1-5km) and areas exposed to de-icing salts
C5	Very High	Spaces with very high frequency of condensation and pollution from production processes, e.g. Buildings with high levels of pollution and condensation	Temperate to sub-tropical zones, high pollution area or a substantial effect from chlorides, e.g. Industrial areas, coastal areas (approximately 500m-1km), sheltered positions on the coastline (without salt spray)
CX	Extreme	Spaces with almost permanent condensation or periods of exposure to extreme humidity effects and with a high concentration of pollution	Tropical zones with high sulphur dioxide pollution including the effects of chlorides, e.g. industrial areas with high humidity and an aggressive atmosphere, coastal (approximately 0-500m) and offshore areas with high salinity (occasional salt spray)

Table 1: Reproduced from BS EN ISO 9223 Table 4 and BS EN ISO 12944-4 Table 1.

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Note: For warranty purposes:

- Steel used on sites with an atmospheric corrosivity of C4 or C5 to BS EN ISO 12944, including sites within 500m from a coastal shoreline, should be galvanised to a rate of 710 g/m².
- Decorative finishes must be compatible with the protective coat specification. Refer to BS EN 12944 'paints and varnishes: corrosion protection of steel structures by protective paint systems' and the manufacturers recommendations.
- Any section of previously galvanised or other protected steel which is then cut or drilled must be provided with appropriate remediation to the exposed parts of steel to ensure adequate corrosion protection is maintained.
- The designer should specify the protective coating system where any steelwork is to be welded.
- Surface preparation should be to BS EN 12944-4.
- Steel lintels used in both leaves of an external wall should be austenitic stainless steel, and in addition, protected by a separate damp proof system / cavity tray (as described in Chapter 7).
- The use of Intumescent paint to achieve fire protection should be compatible with any corrosion protective coating applied. The manufacturer's guidance should be followed.

Fixings:

Fixings that are exposed to weathering, moisture and corrosive environments or applications where concentrations of corrosive agents may accumulate should be made from high grade austenitic stainless steel (e.g. A4) or a protective coating suitable for the corrosion category described in Table 1.

13.1.6.3 Durability

ISO 12944 also classifies three different durability ranges 'low, medium & high' for protective paint systems. Therefore, in severe and very severe environments, external paints and varnishes, and other protective coatings must be chosen to have a 'high' durability rating.

Whilst the durability range is not a 'guarantee time', consideration has to be made to the Functional Requirements of this Technical Manual: If the component does not form part of the structure, then a minimum 15 year service life will be required. Otherwise, 60 years service life is required, if forming part of the structure.

Due to the environment, certain materials and particularly the finishes may require on-going maintenance in order to keep a satisfactory finish e.g. balcony timber decking. In these circumstances it will be the building owner's responsibility to ensure that regular maintenance of exposed components and finishes is undertaken to ensure they perform correctly. Maintenance plans will need to be in place during the lifetime of the building to ensure premature failure of coatings or components is avoided.

13.1.7 Roofs

In addition to the guidance found in Chapter 7 of this Technical Manual;

- For clay, concrete and slate roofing a full roof fixing specification from the slate or tile manufacture must be provided and the exposure and orientation of the site taken into account..
- All fixings must be durable for the environment location.

For metal cladding:

1. The designer must establish the environment's corrosivity when specifying metal cladding for roofs in coastal locations as well as the potential for wind uplift and movement in a cladding system during severe wind conditions, particularly over party wall positions.
2. The designer should ensure capillary action at the overlapped joints is prevented which with high saline water could also cause pitting corrosion to take place, leading to the failure of the roof panels.