Designing from the Roof Down

Flat roofs have long held a place in architects' hearts for reasons of aesthetics, cost and functionality. However specifiers should be under no illusion as to the detailing rigour that is required to achieve a long-lasting, fit-for-purpose solution. In this special four-page feature SIG Design & Technology explores best practice for the design of flat roofs and upstands.

SIG Design & Technology's technical manager Stephen Cleminson discusses the dos and don'ts of flat roof design with John Ramshaw

AT: What are the most important things to consider when designing a flat roof?

SC: "It varies dramatically really, as a flat roof is not one specific thing — there are many different types, for example, warm, cold, inverted and each with many different layers in their build-up to get right. What is key, is to look at the design holistically — how does the roof interface with other elements? Does it have plant equipment on it? Where are the outlets? How will rain-water be directed to these locations? How will it be maintained in the future? And so on. Ideally, architects should engage with a roofing expert at the earliest possible stage to discuss all aspects of the specification for a flat roof and how it interacts with other elements of the building. Changing the specification of a single element can avoid common problems associated material clashes, interface incompatibilities, interstitial condensation, insufficient U-values and practical buildability.

In practical terms, it's best to design from the top down, with careful consideration given to parapet and upstand heights at the outset. This will help to avoid problems relating to issues such as low door thresholds and lack of adequate falls for drainage later on. Whether it be for reasons of cost, time or complexity, many specifiers aim only to meet the minimum standard of 1 in 80 achieved falls for a flat roof, leaving little room for error when it comes to building tolerances and mid-span roof deflection. This can result in non-compliance and problems at a later date. Similarly, upstand heights should go beyond the minimum standard, allowing future refurbishment or extension work to accommodate predicted increases in insulation depth without compromising critical junctions around rooflights and other openings."

AT: What common mistakes do specifiers make when designing flat roofs?

SC: "Undoubtedly it's the failure to always take a holistic view. Architects should pay particular attention to project sequencing and preceding trades. For example, the dressing of roofs around openings and reveals needs to be completed before doorways, rooflights and clerestorey windows are installed. Achieving adequate long-lasting weather protection around these critical junctions can be nigh-on impossible if these elements are already in place. Procedures such as fitting balustrades and mansafe systems also need to be properly co-ordinated to avoid damaging the roof covering. Many manufacturers have conducted mansafe testing, so are well placed to advise on correct detailing and site co-ordination for different systems.

Another important consideration is whether the roof will be used for material storage or as a loading deck during construction. For a warm roof on a concrete deck, it may be worth upgrading the vapour control layer to a robust bitumen-based product, and delaying installation of the insulation and waterproof membrane. When the roof deck has served its purpose as a loading or storage platform, any necessary local repairs can be made to the VCL before the rest of the roof is installed. This approach not only avoids the cost of temporary roof protection, but also ensures that the finished roof does not look second hand or like a patchwork quilt! Obviously, it's important to carefully control access once the roof is finished."

AT: What should architects pay special attention to during the installation phase?

SC: "Specifiers should insist on full QA and QC procedures to ensure the roof is properly constructed. Hold points are also important, as they give architects the opportunity to check key elements of the roof design as they are completed, such as VCL laps. This can include photographic evidence of correct procedures. SIG Design & Technology does not sell its products to installers who have not completed one of our product-specific, SPRA-approved (Single Ply Roofing Association) training courses. SIG field technicians then support these newly accredited installers by visiting site regularly. Ultimately, we want installers to use our products with a high degree of expertise and confidence."

AT: How should flat roofs be maintained to maximise their life expectancy?

SC: "Maintenance should always be in accordance with the manufacturer's recommendations and the British Standards. Flat roofs should be inspected at least twice a year — more if they are located in areas with lots of trees. Among the biggest threats to the long-term performance of flat roofs can be leaves, saplings and other vegetation on poorly maintained installations. SIG D&T roofing warranties are issued with a maintenance plan, which must be adhered to as a means of validation. Regular scheduled inspections resulting in clearance of detritus and early detection of damage are essential to ensure flat roofs meet and surpass their guarantee period."

- An extended version of this interview together with a link to SIG Design & Technology's Flat Roof Specifier Checklist is available at http://bit.ly/roofdown

Further information
SIG Design and Technology offers a complete and impartial design and supply service which covers all eight steps to creating the perfect roof. It designs flat roofs, green roofs and zinc, copper, aluminium and stainless steel roofing and cladding.
Find out more at www.singleply.co.uk/perfectroof or call 0845 869 4887

Above right
Riverwalk in London by Stanton Williams featuring Hydrostop AH-25 liquid waterproofing.

Opposite top
SIGnature bituminous membrane roof at Layfield Primary School in Stockton-on-Tees.

Opposite below
Flat roof inspection; IKO Armourplan P single-ply membrane roof at Arnold Hill Academy in Nottingham by IID Architects.

How high should a flat roof upstand be? SIG Design & Technology's technical manager Stephen Cleminson highlights best practice for upstand design

One of the most common questions our specification managers are asked is, 'what should the upstand be on a flat roof?'. This question is frequently followed by, 'what if I haven't got 150mm?'. This article is about why upstands exist and how you can avoid asking the second question.

Why do we need flat roof upstands?

The requirement for flat roof upstands is set out in the British Standard. British Standard BS 6229:2003 Flat roofs with continuously supported coverings (Section 7 page 12) requires that:

"The design of drainage falls should ensure that the continuity of the waterproof covering is maintained for a vertical height of 150mm above the finished roof level at all abutments, door openings and parapets."

It is worth noting that whilst BS 6229 is under review, the 150mm rule is not.

Upstands acknowledge the fact that rainwater can build up on a roof during heavy storm events. If you just took your waterproofing up to the edge of the roof and didn't have an upstand, the local construction would get saturated. If you were interfacing with rainscreen cladding without an upstand and overlap, water will just run into the building.

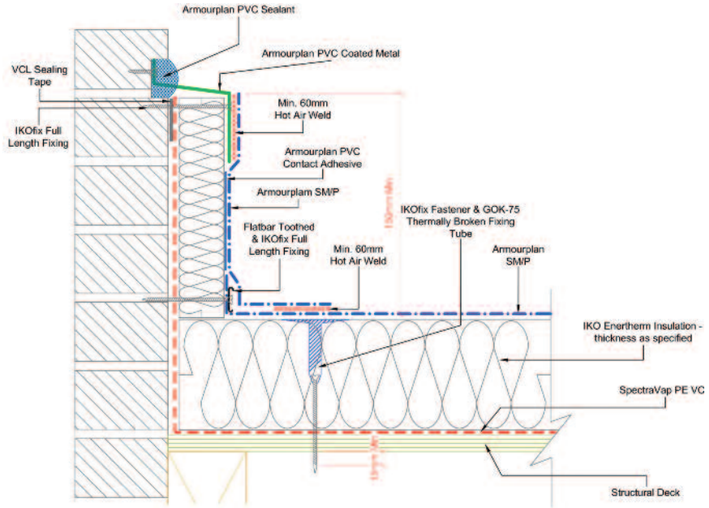
An upstand, be it against a parapet, penetration or facade, ensures that the waterproofing does its job and that exposed brickwork, external facades or other building elements are not flooded or saturated. Upstands also help protect against rainwater bouncing up off the finished roof surface. There is no great reasoning in the documentation as to why the rule is 150mm — it has probably been adopted from previous standards over the generations.

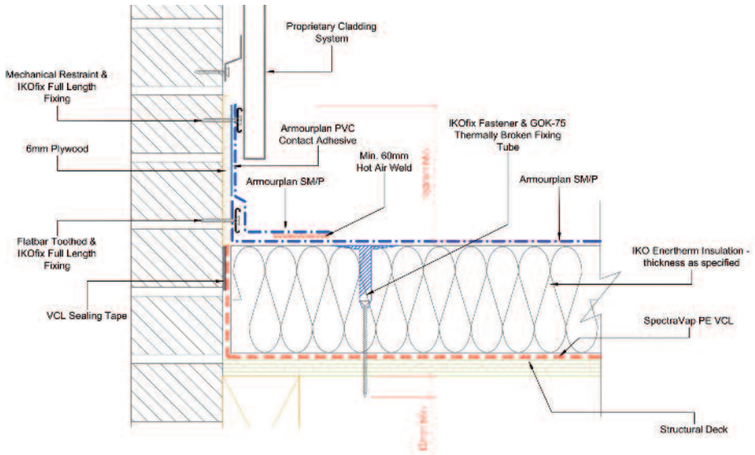
The upstand question cannot be looked at in isolation, so we need to consider the whole situation.

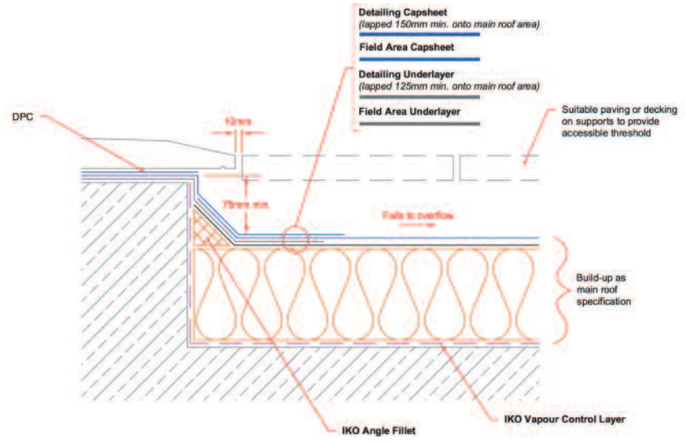
How to deal with level thresholds and exceptions to the 150mm rule?

We are often asked, "How do I deal with level thresholds, when IKO and SIG state 150mm upstand minimum?" BS 6229:2003 goes on to say:

"For inverted roofs, those with overlaid paving, or garden roofs, the finished roof surface is the upper surface of the ballast, paving slabs or growing medium."



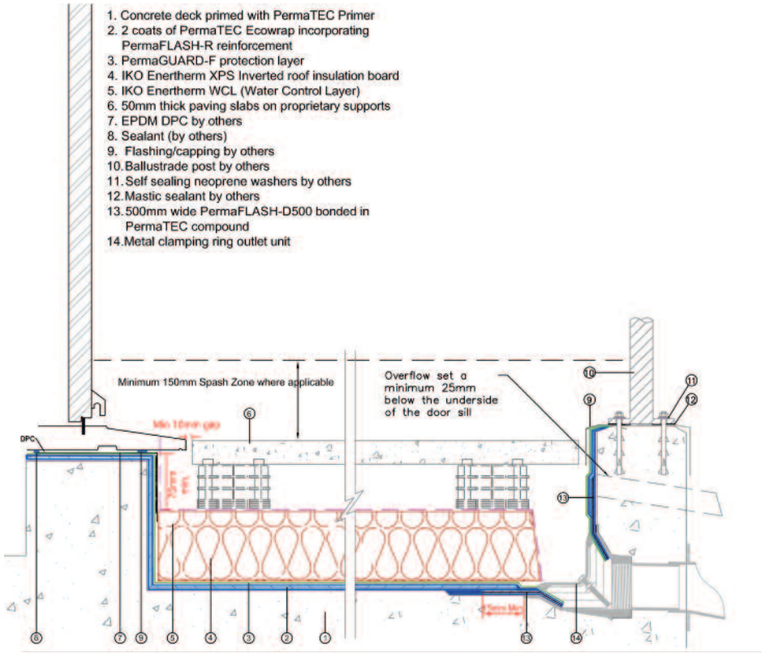




Above
Upstand examples at Arnold Hill Academy in Nottingham by IID Architects.

Right
Balcony level access threshold balustrade section — hot melt (detail: IKO/SIG Design & Technology).

Opposite (top to bottom)
150mm upstand to brickwork with chased joint — single ply (detail: IKO/SIG SIG D&T);
150mm upstand to cladded abutment — single ply (detail: IKO/SIG D&T);
skirting to upstand: NHBC accessible threshold (built-up roofing BUR) (detail IKO/SIG D&T).



The SPRA (Single Ply Roofing Association) Design Guide 2016 describes an exception regarding balconies and terrace access (p29: Access to Balcony or Terrace):

The requirement of a 150mm waterproofing upstand is fundamental to reliable detailing. However, working with building insurers and the residential sector, SPRA is aware of the requirement for unimpeded access to balconies and roof-level terraces in many designs. In this situation only, the requirement has been reduced to 75mm at the opening, provided that the following conditions are met:

- *Rapid removal or rainwater across the width of the opening, by including a proprietary drainage channel in front of the threshold.*
- *The waterproof membrane extends 150mm height in the door reveal and roof/abutment wall adjacent.*
- *The waterproof membrane flashing extends fully below the door frame bottom rail and is sealed to it.*
- *A horizontal gap of minimum 10mm is maintained between frame front edge and drainage channel.*

The NHBC, which set standards and warrantee new homes, also provides special guidance. In NHBC Standards 2016 Chapter 7.1 Flat roofs and balconies it acknowledges the need for flush thresholds, and in cases such as disabled access that there are exceptional circumstances. However, certain other criteria need to be achieved where these reductions are noted.

At a door threshold, NHBC has agreed that locally a 75mm upstand height is acceptable, but either side must step up, and drainage must fall away from the "pinch point". Note also the requirement from NHBC for an overflow if the waterproofing covers an enclosed area with an upstand all around — such as on a balcony or roof terrace with a parapet. The overflow must be a minimum 25mm below the top of the 150mm upstand height.

What if you don't have 150mm for a flat roof upstand?

If your design does not allow for a 150mm upstand in all cases where the exceptions don't apply, you run the risk of falling foul of building control or third-party insurers such as FM or NHBC. If they don't sign off the waterproofing there can be issues obtaining mortgages, for example.

If you find yourself without the requisite 150mm you may consider introducing mitigation, changing the insulation type and/or arrangement, or converting the upstand into a raincheck. Examples of these options and their effects are discussed in more detail online (see link below).

- Many thanks to IKO plc for giving us permission to publish some of its details. Remember that these are standard details and may not be suitable for your project. Consult us for design advice.
- An extended version of this interview together with links to SIG Design & Technology's Holistic Approach to Roof Design and 8 Steps to the #PerfectRoof is available at http://bit.ly/upstands