

Assessing the appearance of new curtain walling

This Technical Note is one of three on assessing appearance. The series comprises:

TN 34 Assessing the appearance of new curtain walling

TN 35 Assessing the appearance of glass

TN 36 Assessing the appearance of metals and finishes

Introduction

The quality of curtain walling is often assessed by visual inspection and disputes sometimes arise over the associated procedures and acceptance criteria. This is particularly the case where a specification is not sufficiently detailed.

This Technical Note gives advice on assessing the appearance of new curtain walling and provides guidance on sources of information for such inspections. This Note is confined to visual aspects that are commonly queried on new construction and does not cover condition surveys after a period in service.

In this series of three notes, the aspects commonly queried are duly considered and guidance is provided in tabular format on the following:

- Factors affecting glass colour
- Tolerances in glass products
- Viewing criteria for glass types
- Surface treatments to metalwork
- Tolerances in metalwork
- Viewing criteria for metalwork

Purpose of inspection

Well-structured quality control regimes incorporate relevant checks at various stages during fabrication and erection of cladding. Whilst this helps avoid the installation of unacceptable components as early as practicable, a final inspection

of the completed cladding in situ is often required.

To maximise the prospect of the facade being built to an acceptable aesthetic standard, it is essential to ensure that the specification is sufficiently clear, precise and realistic on the tolerances and visual requirements to be complied with. This will not only improve the likelihood of compliance but will also set a benchmark for acceptance or rejection.

In setting the required aesthetic standard, the specifier should use the following tools:

- Quantified tolerances insofar as is practicable for aspects that affect visual appearance
- A requirement for control samples and mock-ups

The viewing of reference buildings using the same glass or framing materials can also be helpful in selecting materials and coatings.

Definitions

Products used in facades invariably incorporate variations in dimensions and visual appearance. Where these occur within legitimate tolerances, such variations should be deemed to be a feature or characteristic of the product or process and should not be deemed to represent imperfections or defects. Thus, in this Note, the following definitions are used:

Feature or characteristic: A variation within legitimate tolerances.

Imperfection or defect: A variation outside legitimate tolerances.

Legitimate tolerance: The greater of: the specified tolerance and the tolerance that is genuinely deliverable.

Tolerances should always reflect what is genuinely deliverable by the marketplace; requirements that are too onerous to be deliverable result in there being no effective specification.

Factors affecting inspection

The technical complexity of different manufacturing processes imposes limitations on the quality that can be achieved, even by the most respected manufacturers. Process-specific quality control criteria and tolerances have therefore been developed, including viewing criteria, and these are reflected in the associated Standards.

Disputes routinely arise when specifications endeavour to impose arbitrary viewing criteria for acceptance. It is therefore essential for the viewing criteria to be appropriate to the processes used in manufacture. This may be achieved by using the viewing criteria given in the relevant Standards.

Where assemblies, such as double glazed units, include products made to different standards (eg: laminated and toughened glass), then the viewing criteria cited in the relevant standards should be used as follows:

- Individual components of the assembly should be viewed separately according to the criteria given in the relevant Standard.
- Where assembled components are viewed through each other (eg: in a double glazed unit), the viewing criteria for the assembly should normally be taken as being the least onerous of those applying to any of

the individual components for the aspect concerned. This will apply to such aspects as viewing distances and angles of view. However, in multiple pane assemblies, the number of defects permitted may be cumulative, to allow for the permitted number in each pane.

When undertaking inspections, it is important to undertake the inspection in a manner recognised by the industry as being appropriate for vetting the product or process concerned. This will then enable those involved to establish whether the product complies with the relevant Standards and compares favourably with normal production. Use of arbitrary, project-specific viewing criteria should be avoided.

Clearly, the viewing distance affects the ability to detect different types of feature and imperfection. Very close inspection will allow detection of minor features that are unlikely to be noticed by users of the building or when undertaking formal inspections to verify Standard compliance. Conversely, at a close viewing distance, colour variations may go unnoticed.

The object of a visual inspection is to detect specification non-compliances.

Disputes can arise where the end-product has visual aspects that are inherent features of the manufacturing process used but are not desired by the Architect or Client. Such disputes tend to arise where the various parties have not communicated sufficiently at the outset on what is being sought and what can practically be delivered. There is no substitute for good communication at the outset.

To limit the risk of disputes, it is prudent for all potential visual irregularities to be reviewed at the outset and a consensus arrived at as to what is acceptable and how that acceptability will be assessed. Most problems start when someone perceives a defect on site but there are

no agreed criteria for assessing whether it is defective or not.

As part of the inspection procedure, viewing distances should be agreed, possibly with a time limit on the duration of the inspection to prevent insignificant defects being recorded (BS EN 1096-1 for coated glass limits inspection to 20 seconds). For the same reason, some may suggest that the inspector should not inspect the surfaces closely and then walk back to the official viewing distance; some may also consider that the inspection should be carried out by someone independent of any members of the team who have already adversely pre-judged the materials concerned.

Timing of inspection is difficult. Inspection should be carried out as soon as possible to give the greatest scope for remedial work. However inspection may be delayed by the presence of protective coverings and to minimise damage occurring after the inspection has been carried out.

Lighting conditions will also affect appearance and some of the relevant Standards indicate the conditions in which the glass should be viewed. Care should be taken to ensure that the lighting conditions are appropriate. Strong light at an angle to the surface will highlight irregularities in the surface. The spectral distribution of natural light changes during the day and may affect the perception of colours. When inspecting glass the relative amounts of reflected light and transmitted light can also be important.

Specification

On modern buildings, the glass incorporated in the facades often involves use of more than a dozen processes. Many of these processes are very complex and there are practical limitations on what can be achieved. Each process therefore has attendant features that the manufacturers limit within the constraints imposed by the

rigours of commercial, large volume production.

With key processes, such as floating, toughening, heat soaking, laminating, and double-glazed unit ('DGU') assembly, the features that may be inherent in the products are limited by Standards. Since manufacturers contribute to the development of such Standards, the publications tend to reflect a quality that the leading manufacturers feel able to commit to.

On individual projects, it may be possible to specify tighter tolerances for certain aspects of manufacture. However, many of the processes occur on too large a scale to cater for bespoke requirements. Thus, the specification should stipulate that for the main processes, the materials are produced and processed to the relevant Standards.

If the specification endeavours to impose tighter tolerances or requirements than the Standards stipulate, then those aspects should be duly identified at an early stage and an explicit commitment to comply obtained from the supplier. If this cannot be obtained, another solution needs to be found.

For any process not governed by a Standard, the specification should also require the supplier to submit (via the appropriate supply chain) details of the processor's in-house standards and tolerances that will apply to the process concerned. Again, this exercise should be undertaken at an early stage.

Samples

Assessment of appearance may be carried out by comparison of samples with acceptable properties. Samples may range from sections of framing or hand-held glass samples to a full scale mock up of a section of cladding.

Samples need to be of appropriate quality. Samples are sometimes produced with great care and show the

highest quality to gain the specifier's approval. It may then be uneconomic to work to the same standard for the whole project and the specifier may reject the work. Samples made to more realistic quality may reduce the contractor's chance of winning the contract. Both specifier and contractor need to understand the purpose of the sample.

Ideally samples should show the limits of acceptable quality (eg: maximum amount of orange peel, maximum and minimum levels of gloss etc). However, it is often impractical to manufacture samples to show the extreme tolerances that may arise. In such situations, the control samples should be accompanied by a statement on the maximum tolerances that may occur. A factory visit and referral to reference buildings may also assist in selecting from any options available and in gaining confidence as to the quality of the end product.

Summary

Requirements for assessing the appearance of curtain walling should be set out clearly in the specification. Where possible assessment should be based on measurable parameters. Where assessment is based on visual inspection the inspection procedures must be clearly stated.

Whether the assessment is based on objective measurement or visual inspection, the assessment criteria should be stated. The assessment criteria should be achievable and criteria given in Standards should be used where appropriate. Where visual assessment is used for subjective assessments samples should be specified to give reference values.

References and bibliography

BS EN 1096-1:1999 - Glass in building - Coated glass - Definitions and classification.

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