BS 9101:2017 STEEL AND ALUMINIUM RAINWATER SYSTEMS

INTRODUCTION

BS 9101:2017 - *Steel and Aluminium rainwater systems. Specification* is the new standard for the design and manufacture of metal gutters on industrial, commercial and residential buildings. This also includes the materials, tolerances, mechanical properties and surface conditions, coatings, laminated surfaces, jointing methods and fixings for rainwater systems, including fittings and accessories for assembly or support.

The standard has been written with the intention of informing users of the available specification options; but then to provide robust criteria that a gutter must meet to be classed as functional. Strict limitations have been introduced to restrict stress and deflection to acceptable levels, under water, wind and snow and, in some cases, pedestrian loadings, which take into account not only the gutter, but also its associated fixings and bracketry.

BACKGROUND - EVOLVING STANDARDS

Before BS 9101:2017, standards such as BS 8530:2010 were developed to establish the requirements for the manufacture of traditional cast systems. However, for pressed and extruded gutters methods of manufacture, including thickness of metal, shape and detailing was left to manufacturers without any overall performance requirement; and therefore, in some cases, performance could be compromised.

The industry had previously referenced BS 612 for pressed gutters, covering ‘Eaves gutters and rainwater down-pipes of metal sheet’, as this as the nearest applicable standard but this only really dealt with one particular type of metal eaves gutter used far more on the continent than in the United Kingdom.

In 2005, this was updated and defined as ‘Eaves gutters with bead stiffened fronts and rainwater pipes with seamed joints made of metal sheet’. A beaded stiffened front is defined as a rolled section rather than a pressed sheet. As such, pressed sheet gutters are covered under the new standard BS 9101:2017.

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With regards to extruded gutters, the industry used to reference BS 1474 - *Specification for wrought aluminium and aluminium alloys for general engineering purposes: bars, extruded round tubes and sections*. This was withdrawn in 1987 and, in any case, was a specification for the metal rather than what it was made into.

The new BS 9101:2017 standard covers all metal gutters with the exception of site extruded seamless gutters, and gutters conforming to BS EN 612, cast iron gutters and traditional style aluminium gutters. As a result, it is far more comprehensive and detailed to meet specific metal sheet and extruded gutters and covers gutters that are excluded from BS 8530.

TESTING

BS 9101:2017 puts particular emphasis on the design strength of the metal gutter. This is determined by loading capabilities in the form of water loading, wind uplift and snow loads, and for internal gutters, pedestrian loading from foot access to the gutter.

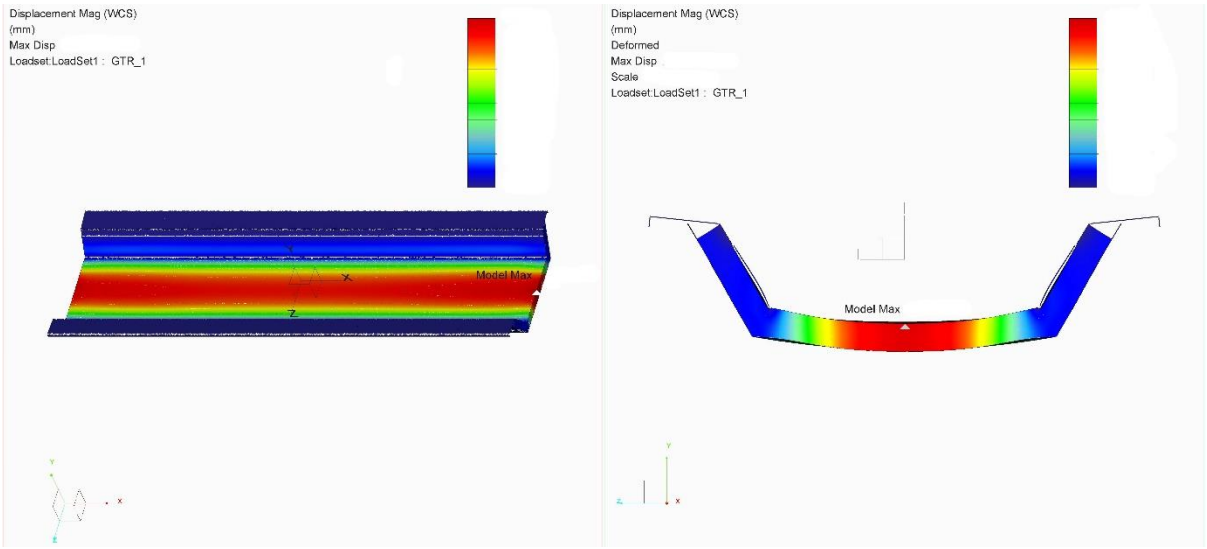
Test methods are set out in the standard for both internal and external gutters, which allow for either a Finite Element Analysis (FEA) computational assessment, or physical assessment of a sample gutter assembly. By not exceeding deflection limits under carefully considered loading cases, gutters assessed to the standard will be fully functional, regardless of the exact material type, thickness, or shape.

Testing is carried out on gutter types, rather than every profile, with the worst case in each range to be tested (usually the biggest gutter for any particular metal thickness or bracket design). Careful balancing of these parameters can allow innovative products to be developed in a way that a simple prescriptive standard could never hope to.

FEA is a computer-based method of analysing the behaviour of engineering structures and components under certain conditions. It is an advanced engineering tool that is used in design and to augment or replace physical testing.

The standard can be applied to all the different metals, profiles and sizes of gutters as it is based on an overall system strength test compliance. The strength test can be applied to virtually all product designs without the need for physical prototypes to be constructed, resulting in cost savings and a reduction in material wastage.

FEA analysis allows stresses and deflections to be calculated for any combination of gutter assembly parts, and is a complete and equivalent alternative to physical test methods. Many companies will carry out this work in house, using Autodesk Inventor® or similar products. For companies who do not wish to do this in-house, or wish to have third party approval, MGMA has details of consultancy companies who can offer this service on a project by project basis.



Example of FEA analysis of inboard industrial gutter

To ensure companies are using the software correctly, BS 9101:2017 includes benchmark testing. This allows the FEA user to check their set-up against known values, and thus ensure all settings are correct in the FEA software being used.

Examples of physical testing

BS 9101 also includes physical testing as an alternative to the use of finite element analysis.

The physical test methods are designed to replicate the effects of water loading, wind uplift and snow loading, by the use of sandbags and weights to apply point or uniformly distributed loads, depending on the test case.

In common with the FEA approach, ultimate loading tests will provide for loadings with a factor of safety applied.

Key to the successful set up of a physical test rig will be a very solid mounting substrate, as larger gutters will be subject to very significant forces. A full list of test cases and methods are presented in BS 9101. MGMA will again be able to provide details of third-party organisations who can carry out this testing.

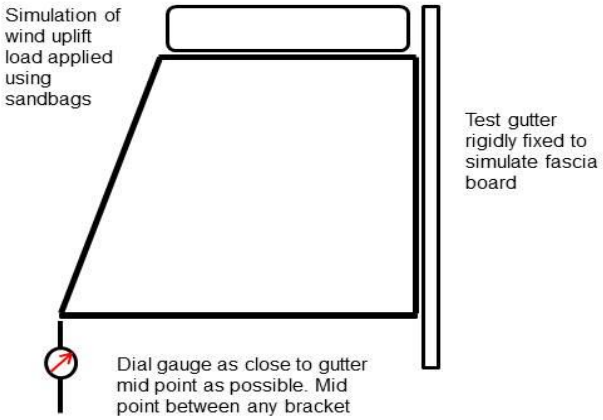


Figure 1 Test equipment for wind uplift test

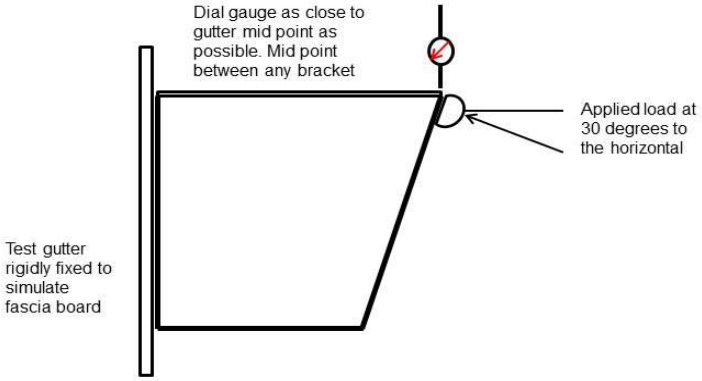


Figure 2 Test equipment for snow load test

CONCLUSION

The Metal Gutter Manufacturers Association has been at the forefront of the development of this new standard for the design and manufacture of metal gutter systems; the first standard in this field.

This new standard will prove invaluable to bespoke and proprietary metal gutter manufacturers, construction consultants, architects and installers of commercial and domestic buildings to ensure that metal gutters are correctly specified and manufactured.

Further advice and guidance is available from any MGMA member company whose details can be found on the MGMA website at www.mgma.co.uk.

REFERENCES

BS 7543, *Guide to durability of buildings and building elements, products and components*

BS EN 1991-1-3:2003+A1:2015, *Eurocode 1 – Actions on structures – Part 1-3: General actions – Snow loads*

BS EN 12329, *Corrosion protection of metals – Electrodeposited coatings of zinc with supplementary treatment on iron or steel*

BS EN ISO 2081, *Metallic and other inorganic coatings – Electroplated coatings of zinc with supplementary treatments on iron or steel*

ISO 4355:2013, *Bases for design of structures – Determination of snow loads on roof*

PD 6484, *Commentary on corrosion at bimetallic contacts and its alleviation*

The new British Standard BS 9101:2017 is available from http://shop.bsigroup.com/

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