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# GUIDANCE FOR SPECIFIERS AND MANUFACTURERS ON I.S. EN 771-3: AGGREGATE CONCRETE MASONRY UNITS

## Introduction

'I.S. EN 771-3 Specification for masonry units – Part 3: Aggregate concrete masonry units' is the Irish standard adopting the harmonised European standard (Euronorme (EN)) for aggregate concrete masonry units, both dense and lightweight for which the main intended uses are common, facing or exposed masonry in load bearing or non-load bearing building and civil engineering applications. As a harmonised standard, products manufactured under this standard must be CE marked. In accordance with the Construction Products Regulations 2011 (CPR); this requirement had effect from 1st July 2013.

There are many product requirements and characteristics listed within the product standard and elsewhere in National Building Regulations Technical Guidance Documents (TGDs), and in Standard Recommendation 325 (S.R. 325), which together constitute Nationally Defined Parameters (NDPs) for the product. Collectively, these parameters must be addressed and declared appropriately in order to comply with product certification and CPR requirements.

This Guidance is developed in response to specific queries from both specifiers regarding the correct and permissible methods of specifying the product, and from manufacturers on the requirements for product declaration under the CPR on the required Declarations of Performance (DoPs). It does not purport to be a legal, definitive or entirely comprehensive interpretation of the standard or associated legislation or statutory requirements but attempts to highlight in one document the various relevant requirements in place across several publications, of which many specifiers and manufacturers may not be fully conversant with. Specifiers and users should satisfy themselves as to the suitability of products for intended uses prior to purchase or use, as there may be some variation between manufacturers with regard to certain product properties, as would be expected.

The requirements set out below are for product put on the market for use in the Republic of Ireland. Specifiers and users importing product from other jurisdictions are reminded of the statutory requirements with regard to necessary compliance with the Irish Standard. Furthermore, Article 15 of the CPR may be relevant for such importation and/or distribution of imported products.

## Construction Products Regulations 2011

The CPR of 2011 made CE marking of construction products for which harmonised standards exist a statutory requirement across all Member States (MS). By harmonised standard is meant that there is acceptance across the EU as to the nature, type and typical requirements of such a product when manufactured in a factory setting, using Factory Production Controls (FPCs) in



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compliance with those set out in the individual standard. Each such standard then complies with a requirement for Assessment and Verification of Constancy of Performance (AVCP) at one or more attestation levels based on the proposed use of the product, linked to safety in use, with each MS having the discretion to increase the attestation level required where a perceived risk to the population or property may exist.

Within the Republic of Ireland, it is required that concrete blocks which are to be used for structural purposes, under either the Building Regulations or Eurocode 6-Design Code for Masonry (EC 6 adopted as I.S. EN 1996), shall be Category 1 blocks, and this requires an AVCP system of 2+ (see below). This involves sampling procedures, testing, statistical analysis of results, and the declaration of particular properties to a 95% confidence level.

#### AVCP system 2+

AVCP level 2+ requires that an independent Notified Body, accredited under the CPR, carries out auditing of the product standard FPCs in place within the manufacturing operation to ensure the integrity of the particular production control process. This is different to the UK, including Northern Ireland, where the attestation level remains at AVCP system 4, which is self-declaration without external auditing of FPCs by a Notified Body. Thus, there is a marked objective difference in the confidence that may be placed in products produced with 2+ certification of the manufacturing processes, and this was the underlying reason for it being prescribed in S.R. 325 as a product requirement in the Republic of Ireland, where Category II blocks, with attestation system 4, are only deemed suitable for other uses not coming under the Building Regulations or I.S. EN 1996.

#### Guidance

The Position Paper: Guidance for AVCP system 2+ (Approved Guidance NB-CPR/15/568r6 issued 17th June 2015) provides non-legally binding advice with regard to the aims, objectives and assessment process principles under system 2+, and the responsibilities of both the manufacturer and the certification body. While system 2+ is clearly certification of the process without being product certification, the objectives of the certification process should be seen as 'achieving construction products meeting the defined requirements'. The CPR requires that product characteristics are addressed within the product standard FPC regime and that product values are declared on the product DoP, thereby informing the product customer and specifier. This latest guidance requires that certifying bodies use the DoP as a starting point for assessment of supporting FPCs.

In the Position Paper from SG10-EN771-3 to EN 771-6 Evaluation of conformity for masonry units (Approved Guidance NB-CPD/SG10/12/091), detailed guidance is given for the assessment and manufacturing FPC control principles required within I.S. EN 771-3, which acknowledges that conformity criteria depend on the individual factory production control criteria.

## Aggregates for Concrete

Dense aggregates for concrete, including concrete blocks, should comply with the requirements of I.S. EN 12620:2002 + A1:2008 – Aggregates for Concrete, and its associated standard recommendation S.R. 16, of which S.R. 16:2016 is the current standard recommendation in place at time of writing. This document provides limits on key parameters of aggregates for different usage, including magnesium sulfate limits in concrete blocks as a measure of resistance to freeze/thaw attack (see Table B.5, S.R. 16:2016).

## I.S. EN 771-3 Specification for masonry units – Part 3: Aggregates concrete masonry units

Currently, manufacturers of concrete masonry units do so to ISEN 771-3:2011. At the time of writing, an updated standard EN 771-3:2015 is in the process of adoption. It is understood that the primary changes are in relation to aligning the standard better with the CPR, which superseded the previous Construction Products Directive.

The current standard defines an aggregate concrete masonry unit as being manufactured from cementitious binder, aggregates and water and which may contain admixtures and additions and colour pigments and other materials incorporated or applied during or subsequent to unit manufacture.

Section 5 of the 2011 standard systematically sets out the requirements for aggregate concrete masonry units in relation to initial type testing (new manufacturer/source) and consignment testing (ongoing production). The more important parameters for declaration are those of dimensions, gross dry density, mechanical compressive strength (as discussed above), and moisture movement.

Specifically, it requires that the dimensions of the masonry units shall be declared for length, width and height in that order, in relation to the normal use of the unit in a wall.

The gross dry density of the units shall be declared in  $\text{kg/m}^3$  by the manufacturer; this declaration is relevant for the evaluation of loading, airborne sound insulation (see TGD E), thermal conductivity (see TGD L Table A for allowable calculation based on density alone), and fire resistance, all of which can be declared on the DoP using tabulated values.



With regard to the declaration of the compressive strength value, the declaration would ideally include details of the unit orientation as tested, method of bedding and mortar capping, as appropriate. This may be by text and diagram showing the strength test configuration on the DoP.

The standard requires that moisture movement is declared (shrinkage and expansion) when relevant for the intended uses and, in all cases, where subject to structural requirements. The maximum long term shrinkage co-efficient has been set out as a nationally defined parameter in Table N.A.6 of the National Annex to I.S. EN 1996-1-1, with a limit of 0.6mm/m.

Masonry units may be declared as fire resistance Class A1, in accordance with I.S. EN 13501-1: 2002 Fire classification of construction products and building elements, without the need to test where they contain a mass or volume fraction of less than or equal to 1% (whichever is most onerous) of homogeneously distributed organic materials.

Whenever there is a major change in the raw materials or in processing conditions, where the resultant product might be deemed to be a new product type, the appropriate initial type testing should be repeated.

### Standard Recommendation 325 (S.R. 325)

'S.R. 325 Recommendations for the design of masonry structures in Ireland' provides standard recommendations, in the form of national non-conflicting complimentary information, on the use of the I.S. EN 1996 series of standards (EN Eurocode 6 series). The standard recommendation in place at time of writing is S.R. 325:2013 + A1:2014, and includes design and specification of masonry, with both general and geographical recommendations.

Masonry walls are not just dependent on concrete blocks alone, and valuable assistance is given with regard to the correct specification of mortar, plaster, movement joints, and other salient details, all of which are of particular importance in areas which suffer from extreme weather conditions. It should be noted that most common blocks are not to be left exposed, and should be plastered or cladded appropriately and in a timely manner.

It mandates that the national requirement is that aggregate masonry units comply with I.S. EN 771-3 and most importantly requires that such blocks be Category 1 (see S.R. 325 Table 14), which under I.S. EN 771-3 requires AVCP system 2+, which results in a 95% confidence level in the strength value declared.

Within the current National Building Regulations TGD A (Structure), it is stipulated that solid concrete blocks shall be Group 1 (not more than 25% formed voids) to ISEN771-3 with declared mean compressive strength of 7.5 N/mm<sup>2</sup>. Similarly, it stipulates that hollow blocks shall be Group 2 to the product standard with declared mean compressive strength of 4.5 N/mm<sup>2</sup>. Strength testing is that of dry strength to test method ISEN772-1.

Note that the term 'Group' is related to block voids content and is defined in I.S. EN 1996, and is an entirely separate concept to 'Category' of block which is defined in I.S. EN 771-3.

### Strength Testing of Concrete Blocks

I.S. EN 771-3 requires that concrete blocks are compressive strength tested in accordance with I.S. EN 772-1. This test method requires that blocks are mortar capped before testing whereas the traditional test method used a soft board cover to the block. This mortar capping has the effect of increasing the recorded solid block strength such that a declared value of 7.5 N/mm<sup>2</sup> under the new test method is substantially equivalent to 5N/mm<sup>2</sup> under the old test method. Thus, there is really only a change in block strength designation resulting from the changed test method required under I.S. EN 771-3, and manufacturers substantially produce the same block as was previously designated at the lower strength, for all intents and purposes.



It should be noted that each manufacturer may choose to establish the correlation between the recorded strengths using the two test methods and that this correlation factor can consistently be applied to results achieved using the old test method, which many manufacturers continue to use, to confidently declare strengths under the new method. Such use of a proven correlation factor is expressly allowed for within I.S. EN 771-3 (see Section 8.1(a)). This is prevalent because of familiarity with the old test method and that the new test method takes much longer to conduct than the old method.

### Declaration of Concrete Block Strengths

Compressive strength test results must be used to calculate a value for declaration with a 95% confidence limit using the available options set out in the standard (for batch results) for reporting the mean batch result which is in turn used in calculating either an overall production mean or characteristic value, to 95% confidence limits, for declaration on the associated DoP. It is likely that manufacturers will continue to declare a value in relation to the mean value (arithmetic mean of the compressive strengths) as called for in TGD A, and as used in the development of the National Annex to Eurocode 6.

As before, the Irish National Annex to I.S. EN 1996, the Irish adoption of EC6 design code for masonry, was developed using mean compressive strength values to the 95% confidence limit. Even so, some manufacturers may choose to declare characteristic values which are based on individual block test results rather than the average batch result approach used by the mean method.

It is worth noting that 100% of block strength results must be greater than 80% of the declared mean value. The declared value is a value that the manufacturer is confident of achieving, bearing in mind the precision of the test and the variability of the manufacturing process. As above, the change in strength

test method has resulted in different results for declaration for an otherwise unchanged product.

It is a matter for each manufacturer to declare appropriate values, but in general, it appears that the I.S. EN 771-3 designation of 7.5, 13 and 23 N/mm<sup>2</sup> substantially equate with the old designations of 5, 10 and 20 N/mm<sup>2</sup> respectively. Blocks must be ordered according to the new designations to comply with the current standard.

## Relevant Technical Guidance Documents References

The Building Regulations Technical Guidance Documents (TGDs) make important references to product and construction requirements as follows (at time of writing):

TGD	Area	Section	Summary of Reference
A	Structure	1.01	Calls up EN 1996 – Eurocode 6 Design of Masonry Structure
A	Structure	1.1.3.4	Wall thicknesses and I.S. EN 771-3 block strengths (min)
A	Structure	1.2.1	Specifies I.S. EN 1996 and S.R. 325 for design and construction
A	Structure	Stds. & Pubs	Calls up S.R. 325, I.S. EN 771-3, I.S. EN 12620 and S.R. 16
B	Fire Safety	App. A	National Class 0, incl. blockwork and concrete meets Class 1
B	Fire Safety	ANNEX	Class A1 met by Concrete, Aggregate concrete without testing
C	Moisture Resistance	3.2.1/2	Resistance to damage or penetration by rain/snow
D	Materials/ Workmanship	1.2	Protection and prevention of moisture passage
E	Sound	Section 3	Separating walls and associated flanking construction details
L	Energy	Appendix A	Table A1 Thermal conductivity of common building materials
L	Energy	Appendix B	B.6 Wall constructions
L	Energy	Appendix D	Thermal bridging at junctions and around openings
L	Energy	Additional Info	Acceptable Constructions Details

## Technical Guidance Document E (TGD E)

Noise attenuation requirements have more recently become a requirement under TGD E. In particular, the specification

and use of concrete blocks in the construction of a party wall requires some clarification. Specifically, best practice is to use the concrete block on the flat, well mortared, with a single interlocking course (as against the more traditional double course) as this minimises the noise transmission through the party wall. The wall must be well plastered both sides.

Importantly and additionally, the wall construction must meet a specific mass/m<sup>2</sup> threshold in order to give effect to adequate noise attenuation, when all joints are mortared well and each side of the wall has a 12mm coat of sand/cement plaster taken into account. This is generally taken as requiring that standard 450mm x 100mm x 225mm solid concrete blocks, as are most often used, have a dry density of at least 1,900 kg/m<sup>3</sup> so as to achieve the overall required density per square meter (of the party wall elevation area with blocks laid on the flat).

While most standard I.S. EN 771-3 solid concrete blocks of 7.5 N/mm<sup>2</sup> designation will have the required density, this should be checked on the DoP (or elsewhere) in advance of use, as occasionally this density may not be achieved from a particular source. Specifiers may also choose the option of specifying higher strength blocks to achieve the density requirement, which should again be checked prior to use on product declarations for that source.

## Declarations of Performance (DoPs)

Once compliance with the conditions of I.S. EN 771-3 Annex ZA has been achieved and the certification process successfully completed, the manufacturer may put the product on the market and attach the CE mark, as appropriate, to the product. A DoP should be given to customers with each consignment of product or otherwise made available through the manufacturer's website.

The contents of the DoP must be comprehensive and include details of the manufacturer, manufacturing plant location, the product designation and European standard, identification number of the (notified) certifying body (as relevant for AVCP system 2+), certificate number (as issued by the certifying body to the manufacturer for AVCP 2+) for the place of manufacture, declared values for all regulated parameters or characteristics, as well as the intended uses of the product and the normal configuration of the product in use.

It should be noted that a declaration requirement is not applicable where the MS has no regulatory requirement on that characteristic for the intended use of the product; typically No Performance Determined (NPD) is used in such cases but this option cannot be used where the characteristic is subject to a threshold level.

