

## Key points

- *Orientated Strand Board (OSB) used in construction has to be CE marked to I.S. EN 13986 and have a Declaration of Performance (DoP)*
- *I.S. EN 300 is the key European standard governing the specification of OSB panels*
- *OSB should only be used in dry or humid conditions (service class 1 and 2)*
- *The main panel types used in construction are OSB/3 and OSB/4 and are suitable for humid conditions*
- *Characteristic design values may be taken from I.S. EN 12369-1*
- *Newly manufactured OSB has a low moisture content and can absorb moisture and expand in length, width and thickness when exposed to moist air*
- *To avoid distortion of panels in-situ they should be conditioned to the ambient moisture content in service and/or have suitable expansion gaps*

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## Wood Based Panels – OSB (Oriented Strand Board)

### Introduction

This information sheet relates primarily to OSB panels used in construction and includes information on the main standards, regulatory requirements and on the different types of OSB and their application and use. Where OSB panels are used in construction the requirements of European Standard I.S. EN 13986 apply and the appropriate AVCP certification level for OSB not enhanced for fire performance is Level 2+. AVCP stands for the Assessment and Verification of Constancy of Performance, there are five levels; 1+ (highest), 1, 2+, 3 and 4 (the lowest). With an AVCP level of 2+ factory production control (FPC) should be monitored by a Notified Body and the factory should be inspected at least once a year.

The main properties referred to in this document are moisture content, durability, bending strength and stiffness.

The more important standards and technical documentation are listed below.

### Standards and technical information

I.S. EN 300:2006 ‘OSB – Definitions, classification and specifications’

I.S. EN 13986:2004+A1:2015 ‘Wood-based panels for use in construction — Characteristics, evaluation of conformity and marking.’

I.S. EN 1995-1-1 ‘Eurocode 5: Design of Timbers Structures – Part 1-1: General – Common Rules and Rule for Buildings’ I.S. EN 1995-1-2 ‘Eurocode 5: Design of Timbers Structures – Part 1-2: General – Structural fire design’

I.S. EN 12369-1:2001 ‘Wood-based Panels – Characteristic Values for Structural Design – Part 1: OSB, Particleboards and Fibreboards’

S.R. CEN/TR 12872:2014 ‘Wood-based Panels – Guidance on the Use of load-bearing boards in floors, walls and roofs’

Irish Agrément Certificate 02/0093 ‘SMARTPLY OSB (Oriented Strand Board)’

British Board Agrément Certificate 98/3488 ‘SMARTPLY Wood-Based Panel’

## OSB

Orientated Strand Board is a panel with strands of softwood timber having a length at least twice their width, covered in resin, formed into mats and laid in different alternating directions. A three layer panel will have the strands of the two outer layers laid parallel along the length of the panel with the middle layer strands laid at right angles to this. The panels are then pressed under heat and pressure until the resin is cured and the panels produced to the required thickness and density. Once the panels have been allowed to cool they are trimmed to the required size and can be conditioned and sanded if required. Additional processing such as Tongue & Groove (T&G) or UV coating may be done at this stage.

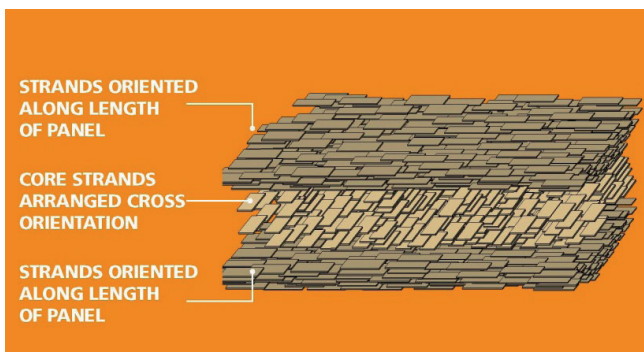


Image courtesy of SMARTPLY EUROPE DAC.

OSB is increasingly used as an alternative to plywood; advantages of OSB over plywood include no core gaps, uniformity, accurate certification (including the Declaration of Performance and CE marking) and reliable technical information and compared with many plywood sources security in the manufacturer; there is little risk of delamination if used properly.

OSB panels are manufactured across the world and are widely used for different purposes. They are made in Ireland under the SMARTPLY brand name and are the most commonly used panels in Ireland. SMARTPLY has a number of panels for different end uses and these provide a good guide to the versatility of OSB;

- SMARTPLY FRAME is an OSB/3 panel specifically engineered for off-site construction (timber frame and light gauge steel frame). The metric dimension panels are typically 2397mm x 1197mm and 2697mm x 1197mm to allow for 3mm expansion.
- SMARTPLY ULTIMA is a high-performance engineered wood panel (OSB/4) suitable for the most demanding structural applications in off-site manufacturing and construction. It is approximately 30% stronger and 20% more moisture resistant than OSB/3.
- SMARTPLY MAX is a strong, versatile OSB/3 panel suitable for structural use in humid conditions (Service Class 1 and 2), ideal for applications as diverse as roofing, flooring, site hoarding and wall sheathing. A tongue and groove version is available.

- SMARTPLY MAX FR-B is a high performance OSB/3 panel with a non-toxic flame retardant built into it during manufacture, giving it a Euroclass B reaction to fire performance.
- SMARTPLY FR/FR BUILD is similar to SMARTPLY MAX FR-B but also meets the requirements of the Structural Timber Association (STA) “Separating distances during construction”.
- SMARTPLY MAX MULTI is an OSB/3 panel which has been primed and finished on one face and all edges, making it suitable for a multitude of applications such as site hoarding and packaging. It is available in a range of colours.
- SMARTPLY PATRESS PLUS is an engineered OSB/3 panel incorporating a continuous recess, designed to accommodate ‘C’ shaped metal studs used in the construction of plasterboard partitions.
- SMARTPLY SITEPROTECT is a site hoarding panel that is pre-primed on edges and one or both faces, requiring only an exterior top coat to be applied before or on site.
- SMARTPLY STRONGDECK is a 30mm thick heavy duty T&G OSB/4 panel designed for mezzanine floors and industrial shelving. It is suitable for Service Class 2 conditions.
- SMARTPLY PROPASSIV is a certified airtight structural OSB/3 panel with integrated vapour control layer, used mainly in Passive House, NZEB and other low-energy buildings.

OSB/3 is widely used in construction for site hoarding, flooring, roof panels and for wall panel sheathing in timber and steel buildings. If an OSB manufacturer has an Agrément certificate then it should also be consulted for specific information on the panel.

SMARTPLY and most OSB panels are made from timber from sustainable forests.

## EN 300 (OSB)

EN 300 ‘OSB – Definitions, classification and specifications’ defines requirements for OSB panels including bending and stiffness values for panels classified from OSB/1 to OSB/4; the bending and stiffness values are for FPC purposes only and not for structural design.

- OSB/1 panels are for non-loadbearing use in dry conditions; typically they are used for interior fitments such as kitchen tops.
- OSB/2 panels are for loadbearing use in dry conditions.
- OSB/3 panels are for load bearing use in humid conditions.
- OSB/4 panels are for heavy duty load bearing use in humid conditions.

Note SMARTPLY no longer manufacture OSB/1 or OSB/2 panels.

Dry conditions correspond to Service Class 1 in I.S.EN 1995-1-1 and relates at 20°C to a Relative Humidity (RH) not exceeding 65% for a few weeks per year; the moisture content of most softwoods will not exceed 12%.

Humid conditions correspond to Service Class 2 in I.S.EN 1995-1-1 and relates at 20°C to a Relative Humidity (RH) not exceeding 85% for a few weeks per year; the moisture content of most softwoods will not exceed 20%.

Exterior conditions correspond to Service Class 3 and OSB should not be used in these conditions.

The Service Class information in Eurocode 5 on moisture content relates to solid softwood timber, information on moisture content for wood-based panel materials including OSB is described in S.R. CEN-TR 12872:2014 ‘*Wood based panels – Guidance on the use of load-bearing panels in floors, walls and roofs*’.

Where panels are to be used in construction I.S. EN 13986 applies and override the Factory Production Control requirements in I.S. EN 300. OSB panels used in construction must have each individual panels marked in accordance with EN 13986.

Marking in I.S. EN 300 refers to I.S. EN 13986 and ‘other boards’; typically those not used in construction and/or for panels used outside the single market.

## I.S. EN 13986 - General

I.S. EN 13986 is a harmonised European standard that covers wood-based panels for use in construction including plywood, OSB, particle panels and fibre panels for use in construction. CE marking (Annex ZA in I.S. EN 13986) applies to panels being placed on the single market but the section on marking (as distinct to CE marking) could be taken as applying to panels for all CEN member states (which includes states not in the EU).

EN 13986 is a harmonised standard and therefore OSB panels used in construction must be CE marked and have a Declaration of Performance (DoP). The performances declared in the DoP should be identical to those in the CE mark; if a particular performance is declared then it must be declared in both.

Note. CEN is the European Committee for Standardization

I.S. EN 13986 has 7 tables listing the performance characteristics for panels and the relevant test standards for determining a wide range of properties and characteristics; it does not set down performance requirements, these are in other product standards. The tables are divided into structural and non-structural panels for use in dry, humid and external use; the seventh table relates to panels used for sheathing and decking where specific properties may need to be determined for the design requirements in I.S. EN 12871. The first 6 tables are summarised below:

Performance Requirement	Table for conditions of use		
	Dry	Humid	External
Structural	1	2	3
Non-structural	4	5	6

I.S.EN 13986 should be consulted for details of the tables referred to above.

Section 5 of I.S. EN 13986 lists the test standards for the different properties related to the above tables.

All tables refer to clause 5.1 for bending strength and clause 5.2 for bending stiffness; these refer to testing to I.S. EN 310. Clause 5.13 refers to testing to I.S. EN 789 for ‘strength and stiffness for structural use’ and is only applicable for panels to be used structurally and it is not referenced in Tables 4, 5 and 6.

I.S. EN 13986 is for panels used in construction while the product standards (I.S. EN 300) cover other uses.

I.S. EN 13986 allows two approaches for a manufacturer to declare their panels properties;

- Testing to I.S. EN 310 enables basic properties to be determined and then controlled through FPC using the same standard. I.S. EN 300 lists the values that panels should achieve during testing under FPC; this enables the panels to be classified (OSB/1, OSB/2 etc.) and then the characteristic design values can be obtained from I.S. EN 12369-1.
- Testing to I.S. EN 789 enables the manufacturer to declare specific characteristic design values unique to their panel although they can use the test values to classify their panels as above.

The test standards above are different but one of the main differences is in the number of panels that need to be sampled and tested. In both cases FPC testing requirements are the same.

## Panel marking

Where used in construction I.S. EN 13986 requires each panel to be CE marked, the following should appear on a panel:

1. The CE symbol
2. The identification number of the notified body
3. The identification mark of the manufacturer
4. The reference number of the Declaration of Performance
5. The dated reference of EN 13986
6. The description of the panel as the nominal thickness and ‘PT’ if treated by the manufacturer. Note that OSB panels should be used only in Service Classes 1 or 2 and therefore are not usually treated. Further advice on durability may be obtained from the manufacturer.
7. Information on the performance of essential characteristics;
8. Technical class (e.g. OSB/3)
9. Reaction to fire class e.g. Euroclass B
10. Release of formaldehyde (E1 or E2)

Items 7, 9 and 10 could have NPD (no performance declared) in the Declaration of Performance and therefore these should not appear in the panel marking. The full CE mark, which is not much more than the above may be placed on panels' packaging or contained in accompanying documentation.

An example of panel marking under EN 13986 is shown below:

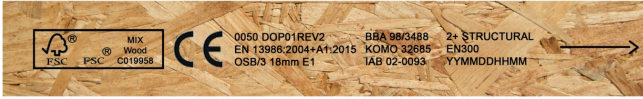


Image courtesy of SMARTPLY EUROPE DAC.

## I.S. EN 1995-1-1

The main design standard for timber and timber products is I.S. EN 1995-1-1 (commonly called Eurocode 5 which has 3 parts, the other two covering fire design and bridges). Specific design guidance for OSB is given in the standard and relates mainly to the design properties modified by  $K_{mod}$  and  $K_{def}$  which are dependent on the service class. OSB can only be used structurally in Service Classes 1 and 2.

The standard also gives the characteristic embedment strengths for OSB for lateral loads in a timber connection; the embedment strength is given directly for nails and bolts and indirectly for screws and staples, no information is given for dowels.

## Conditioning and expansion gaps

Irish Standard Recommendation S.R. CEN/TR 12872:2014 'Wood-based panels – Guidance on the use of load-bearing panels in floors, walls and roofs' gives information on the effect of moisture on panels including OSB.

If the relative humidity (RH) of the environment exceeds 85% (at 20°C) for any significant time (according to EC 5 for more than a few weeks a year) then timber products will fall into service class 3.

The equilibrium moisture content of most panels will be between 11% and 17% in service class 2 while the moisture content of solid timber will be between 12% and 20%.

According to the Irish Agrément Board's certificate for SMARTPLY (02/0093) the moisture content of the panels should never exceed 20%, implying that the panels may be able to withstand a RH a little over 85%. Checking British Board of Agrément (BBA) certificates for a number of manufacturers of OSB/3 panels (using similar resins) they warn that prolonged exposure to a RH of 90% might result in the recommended moisture content being exceeded.

S.R. CEN-TR 12872 also gives typical expansion rates for OSB as shown below:

Panel Specification	Dimensional change at 1% change on panel moisture content		
	Length %	Width %	Thickness %
OSB/2	0,03	0,04	0,07
OSB/3 and /4	0,02	0,03	0,05

Note. The European decimal point (comma) has been used.

Therefore with a 1200mm wide panel the change in width for an 8% change in moisture would be;

$$8 \times (0,03/100) \times 1200 = 2,9\text{mm}$$

SMARTPLY recommend allowing a 3mm gap for expansion and more information is given in their Agrément certification; other manufacturers may have different recommendations in their commercial documentation.

External timber frame walls would usually have higher end moisture contents than floors and roof sarking panels would be similar.

Note. This refers to a gap between two panels; an expansion gap in the length of the panel is usually less constrained by contact with other materials.

Expansion gaps help reduce the distortion of panels in-situ and damage to the finish; they can also reduce the risk of the panels bowing due to the ends and edges being constrained.

Thinner panels such as 9mm OSB/3 wall sheathing, will normally be at a lower than ambient moisture content at time of delivery and will rapidly pick-up moisture from the atmosphere when the packs are opened in the factory. These panels are therefore at an increased risk of expansion and distortion if used in panel manufacture without an adequate conditioning period.

As panels can be manufactured with the moisture content as low as 2% (I.S. EN 300 requires panels to be between 2% and 12%) then conditioning of panels to reflect the ambient moisture content becomes important; usually it is recommended that panels be conditioned over 48 hours. Expansion gaps can be estimated using the table above taking into account the environmental conditions likely to occur in use as well as the moisture content of the panels at time of initial laying of a floor or manufacture of timber frame panels.

Note: SMARTPLY OSB T&G panels have an expansion gap 'built in' to the joint design. When installed, this gap should be visible on the underside of the floor assembly. The top surfaces should be gently butted together and joints should be glued for maximum performance.

## Technical Information

Information on the various brands of OSB is commonly available in commercial documentation and on the internet and can include technical information on the specific OSB products. Agrément certification includes requirements relating to national building regulations. Where an OSB manufacturer has an Agrément certificate for a product, the OSB must also comply with the requirements of I.S. EN 13986 and the Construction Products Regulations (CPR).

Having an Agrément certificate does not negate the requirement for OSB to be CE marked and have a DoP.