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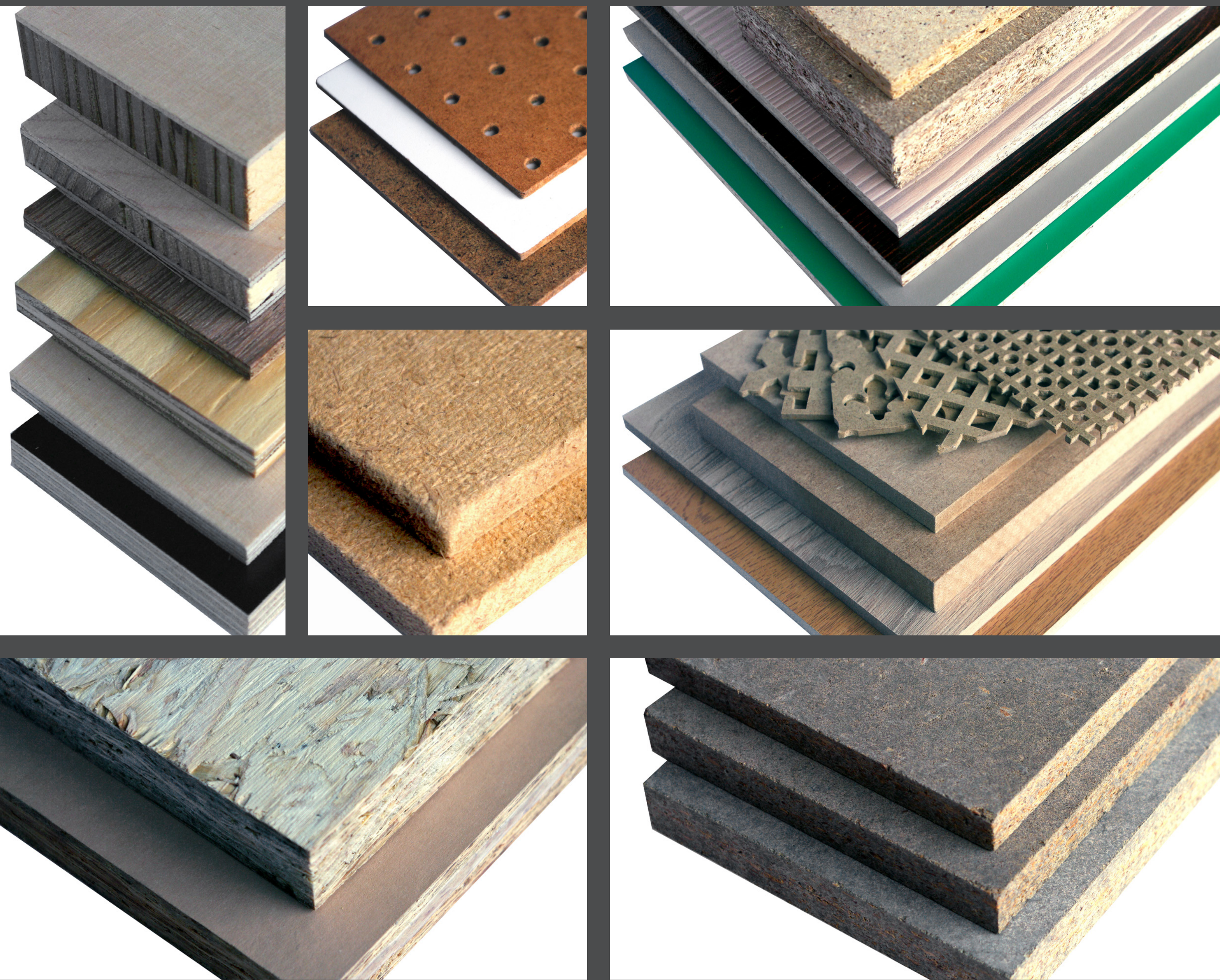
Panel Guide

Version 4



Annex 2B: OSB (oriented strand board)

Description

OSB is an engineered wood-based panel material in which long strands of wood are bonded together with a synthetic resin adhesive. OSB is usually composed of three layers, with the strands of the outer two layers orientated in a particular direction, more often than not in the long direction of the panel. While there is an orientation, it is often hard to see because there is quite a large degree of variability in this orientation among adjacent strands in the panels from any one production line, as well as between panels from different producers.

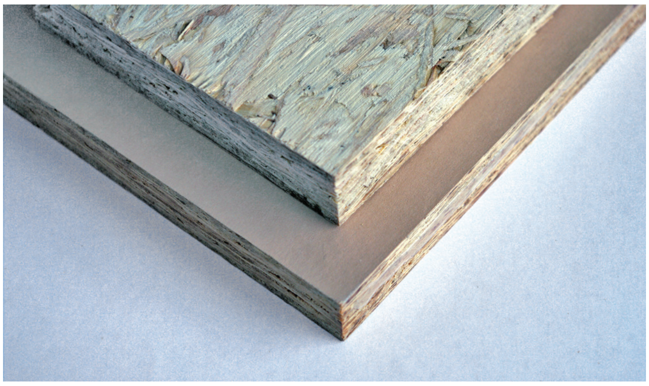


Figure A2.2: OSB

Composition

The timbers used in OSB manufacture include both softwoods (spruce, pine) and hardwood (aspen). Wood strands are cut tangentially from debarked logs which are held longitudinally against rotating knives. The ribbon of flakes produced is usually about 75mm wide and this breaks up on handling to produce individual flakes which are 75mm along the grain and from 5mm to 50mm across the grain.

After drying, these flakes are generally sprayed with a synthetic resin binder and wax, though one or two mills employ powdered resins. One of the important points in OSB manufacture is the removal of fines prior to resin application: this results in the use of lower amounts of resin in OSB (2% to 3%) compared with other resin-bonded panel products.

The three main adhesives used in the production of OSB are phenol-formaldehyde (PF), isocyanates (MDI or PMDI) and melamine-urea-formaldehyde (MUF). These are either used on their own or the core and the surface layers may use two different types of adhesive.

All these resins confer a measure of moisture resistance to the panel.

Before pressing, the strands in the mat are aligned either in each of the three layers of the panel or, more frequently, in only the outer two layers. The degree of orientation varies widely within any one panel, and also in panels from different manufacturers; in panels from different manufacturers it is possible to obtain ratios of property levels in the machine- to cross-direction of 1.25:1 to 2.5:1, thereby emulating the ratios found in plywood.

Appearance

OSB is readily identified by its larger and longer wood strands, compared to particleboard. The orientation of the surface strands is not always visually apparent, especially in small pieces of panel. The panel tends to have a number of holes on the surface due to the overlap of strands, but a smoother surface can be obtained by sanding. However, OSB will never possess the smoothness of surface found in fibreboards and particleboards: rather its merits lie in the field of mechanical performance which is directly related to the use of longer and larger strands of wood.

OSB varies in colour from a light straw colour to a medium brown depending on species used, resin system adopted and pressing conditions employed.

Density, mass and panel size

Panel density (and therefore panel mass) varies depending upon the product, being affected by the timber species and the process used in manufacture. Typical densities are 600 kg/m^3 to 680 kg/m^3. For example, a 2400mm × 1200mm × 12mm panel will weigh approximately 20kg.

Panel sizes commonly available are:

- 2440mm × 1200mm
- 2440mm × 1220mm
- 3660mm × 1220mm

in thicknesses of 6mm, 8mm, 9mm, 11mm, 15mm, 18mm, 22mm, 25mm and 38mm.

Other sizes are available or can be produced to order. Panels are produced with either square or T&G edges.

Applications

Because of its lay-up and composition, OSB is primarily a panel for construction and is widely used for flooring, flat roof decking and wall sheathing. Different grades of the product are available for different levels of loading and different environmental conditions. Guidance on the use of OSB in these load-bearing applications is given in *DD CEN/TS 12872*. Generally, for the same loading conditions, a thinner panel of OSB can be used than a load-bearing particleboard.

There are currently 'deemed to satisfy' tables for domestic floor and roof applications in *BS 8103-3 Structural design of low-rise buildings. Code of practice for timber floors and roofs for housing*[1]. However there is no deemed to satisfy route for non-domestic floor applications at present.

Large quantities of OSB are also used for sarking and industrial packaging and in the construction of site hoardings and pallet tops.

Specification

OSB manufactured in Europe for construction purposes must now be specified in accordance with *BS EN 300 Oriented strand boards (OSB). Definitions, classification and specifications*[2]. As explained in PanelGuide *Section 2*, OSB that is used in construction must comply (by law) with the Construction Products Regulation (CPR) by compliance with the harmonised European standard (hEN) for wood-based panels (*EN 13986*, implemented in the UK as *BS EN 13986 Wood-based panels for use in construction. Characteristics, evaluation of conformity and marking*); this standard calls up *BS EN 300* which contains the requirements for the following four grades (technical classes):

- OSB/1 – General purpose boards, and boards for interior fitments (including furniture) for use in dry conditions
- OSB/2 – Load-bearing boards for use in dry conditions
- OSB/3 – Load-bearing boards for use in humid conditions
- OSB/4 – Heavy-duty load-bearing boards for use in humid conditions.

Selection of a grade of load-bearing panel is dependent upon the ambient climatic conditions together with the level of loading that is anticipated.

Guidance on the selection of the different grades of OSB is given in tabular format in PanelGuide *Sections 2.4 to 2.14*.

Physical properties

Climate

Like other wood-based panel products, OSB is hygroscopic and its dimensions change in response to a change in humidity. A 1% change in moisture content typically increases or decreases the length, width and thickness of the different grades of OSB by the amounts set out in *Table A2.8*.

As a guide, OSB can be expected to attain the moisture content under specified conditions shown in *Table A2.9*.

When it leaves the factory, OSB generally has a moisture content of about 2%. Therefore, it must be conditioned to bring it into equilibrium with its environment before it is fixed. This is usually achieved by loose stacking the panels in the room where they will be used prior to fixing them. The time required for the panels to achieve equilibrium moisture content will vary depending upon the temperature and relative humidity in the building. The likely equilibrium moisture content of OSB in various conditions is shown in *Table A2.10*.

Table A2.8: Dimensional change for a 1% change in OSB panel moisture content (DD CEN/TS 12872)

Panel type	Dimensional change at 1% change in panel moisture content		
	Length %	Width %	Thickness %
OSB/2	0,03	0,04	0,7
OSB/3	0,02	0,03	0,5
OSB/4	0,02	0,03	0,5

Table A2.9: Expected moisture content of OSB

Relative humidity at 20°C	Approximate equilibrium moisture content
30%	5%
65%	10%
85%	15%

Table A2.10: Likely equilibrium moisture content of OSB in various conditions

In a building with continuous central heating	5% to 7%
In a building with intermittent central heating	8% to 10%
In an unheated building	up to 15%

When components are factory produced for installation on site, it is essential that the site conditions are suitable to receive the components, with wet trades completed and the building dried out.

OSB with enhanced moisture resistance (OSB/3; OSB/4) is not waterproof; the term 'moisture resistant' applies to the adhesive binder which (within limits defined by *BS EN 300*) will not break down in the presence of moisture. Physical wetting of all grades of OSB should be avoided. When wet, OSB will increase appreciably in thickness.

Biological attack

OSB will not normally be attacked by wood-boring insects common in temperate climates, but panels made using aspen and spruce are susceptible to fungal attack under prolonged wet conditions; panels made from pine have moderate resistance to attack.

General guidance on the use of preservative treatments for panel products can be found from the WPA Manual *Industrial wood preservation specification and practice. Commodity Specification C11*. This guidance assists with making the right choice of preservatives for the end use and the panel product to be treated, as not all panel products need to be treated for particular end uses or are indeed suitable for some treatments. It also stresses that the preservative and/or the panel manufacturer should be consulted before any treatment is carried out, as treatment may alter the physical and/or visual properties of the panel product.

Water vapour 'permeability'

The value of the water vapour resistance factor (μ) for OSB varies with the method of determination (*BS EN ISO 12572 Hygrothermal performance of building materials and products. Determination of water vapour transmission properties*[3]) as set out in *Table A2.11* which is an extract from *BS EN 12524 Building materials and*

Table A2.11: Water vapour resistance factor (μ) for OSB

Mean density	Vapour resistance factor	
Kg/m^3	Wet cup μ	Dry cup μ
650	30	50

products. Hygrothermal properties. Tabulated design values[4] and *BS EN 13986*.

Thermal conductivity

The thermal conductivity (λ) of OSB as determined according to *BS EN 12664 Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Dry and moist products of medium and low thermal resistance*[5] is 0.13 W/m.K for a mean density of 650 kg/m^3 as set out in *BS EN 13986*.

Reaction to fire

Under the Euroclass system for characterising the reaction to fire performance of materials, as taken from *European Commission Decision 2007/348/EC*, an untreated OSB may be assumed to achieve the performance requirements shown in *Table A2.12*.

If the manufactured product does not satisfy any of these minimum requirements and a reaction to fire claim is to be made in a DoP for CE marking purposes, then it must be tested and classified according to *BS EN 13501-1*. However if no claim is made in the DoP for CE marking purposes it is still possible to use the British standard system to make a separate claim.[6]

Further information on the reaction to fire testing in both the BS and EN systems is provided in PanelGuide *Section 2.2.3*.

Storage and handling

Careful storage and handling is important to maintain panels in their correct condition for use; OSB must therefore be protected from rain and accidental soaking. During transport, it is particularly important to keep edges well covered. Panels should be stored flat in an enclosed, dry building. When handling panels, the edges and corners should be protected against damage.

Detailed guidance on the storage and handling of wood-based panel materials is given in *DD CEN/TS 12872* and PanelGuide *Section 4*.

Working with OSB

OSB can be cut by a hand saw or power saw and machined (routed, spindled, planed and bored) with normal woodworking machinery. Tungsten carbide cutting edges are recommended for use with power tools.

Further information on working with OSB is included in PanelGuide *Section 4.4*.

Mechanical joints and fixings

Wherever possible, fittings that depend upon face fixing should be selected; fittings that depend upon the expansion of a component inserted into the panel edge should be avoided.

Conventional woodworking fixings and techniques can be applied to OSB which provides good holding power for screw fixings into the panel faces; generally, edge fixing is not recommended. Parallel core screws should be used because they have greater holding power than conventional wood screws. A high ratio of overall diameter to core diameter is desirable.

Table A2.12: Reaction to fire classification without further testing of untreated OSB

Product	EN Product standard	End use condition(6)	Minimum density (kg/m^3)	Minimum thickness (mm)	Class (7) (excluding floorings)	Class (8) (floorings)
OSB(1),(2),(5)	BS EN 300	Without an air gap behind the wood-based panel	600	9	D-s2,d0	D_{fl}-s1
OSB(3),(5)	BS EN 300	With a closed or an open air gap not more than 22mm behind the wood-based panel	600	9	D-s2,d2	-
OSB(4),(5)	BS EN 300	With a closed air gap behind the wood-based panel	600	15	D-s2,d0	D_{fl}-s1
OSB(4),(5)	BS EN 300	With an open air gap behind the wood-based panel	600	18	D-s2,d0	D_{fl}-s1
OSB(5)	BS EN 300	Any	600	3	E	E_{fl}

1) Mounted without an air gap directly against class A1 or A2-s1, d0 products with minimum density 10 kg/m^3 or at least class D-s2, d2 products with minimum density 400 kg/m^3
(2) A substrate of cellulose insulation material of at least class E may be included if mounted directly against the wood-based panel, but not for floorings
(3) Mounted with an air gap behind. The reverse face of the cavity shall be at least class A2-s1, d0 products with minimum density 10 kg/m^3
(4) Mounted with an air gap behind. The reverse face of the cavity shall be at least class D-s2, d2 products with minimum density 400 kg/m^3
(5) Veneered phenol- and melamine-faced panels are included for class excl. floorings
(6) A vapour barrier with a thickness up to 0,4mm and a mass up to 200 g/m^2 can be mounted in between the wood-based panel and a substrate if there are no air gaps in between
(7) Class as provided for in Table 1 of the Annex to Decision 2000/147/EC
(8) Class as provided for in Table 2 of the Annex to Decision 2000/147/EC
NOTE: The classes given in this table are for unjointed panels, T&G jointed panels installed according to *DD CEN/TS 12872* and fully supported joints installed according to *DD CEN/TS 12872*

Pilot holes for all screw fixings are required. Typically, the holes should be 85% to 90% of the screw core diameter. Fixings into the panel face should not be within 8mm of edges and 25mm of the corners.

Nails and staples can be used for lightly loaded fixings or to hold glued joints while the adhesive sets.

Further information on fixing OSB is included in PanelGuide *Section 4.5*.

Adhesive-bonded joints

A wide variety of jointing methods can be used, provided the following simple guidelines are observed:

- Ensure the joint parts are accurately machined.
- Use sharp cutters to avoid tearing or burnishing the surfaces to be bonded.
- Use a high solids content adhesive with low flowing properties such as polyvinyl acetate or urea-formaldehyde.
- Locate mating pieces accurately and hold them under pressure while the adhesive sets.
- Limit the width of grooves machined in OSB to about one-third of the thickness of the panel. The depth of groove is typically about one-half of the panel thickness.
- Allow adhesive-bonded joints to condition for several days before sanding and finishing; this avoids the appearance of sunken joints and is essential with high-gloss finishes.
- For an efficient tongued and grooved joint, ensure the fit of the joints is not too tight as this can cause a split along the edge.
- For tongued and grooved flooring apply the glue liberally to both the tongue and the groove to ensure the entire joint is bonded.
- When attaching lipping, ensure the tongue is machined on the solid wood piece.

Finishing

Where smooth surfaces are required, pre-sanded panels should be specified.

Additional information on finishing OSB is provided in PanelGuide *Section 4.7*.

Health and safety

In panel or processed form, OSB does not present any health or safety risk. Contact with wood products can cause irritation effects but the most significant risks come from mishandling the material.

Dust

OSB will generate dust when it is machined which, like any other wood dust, is classified as a potentially hazardous substance and must be controlled. There is no evidence that exposure produces health effects that are different in nature to those associated with exposure to similar levels of dust from other wood sources.

Dust from cutting operations can be controlled adequately by complying with the Control of Substances Hazardous to Health (COSHH) Regulations 2002. Under these Regulations OSB dust has a Workplace Exposure Limit (WEL) of 5 mg/m^2 expressed as an 8-hour time-weighted average. Exposure must be reduced as far as possible below this limit, usually with properly designed and maintained dust extraction equipment fitted to woodworking machines.

Extraction equipment is often not practicable or even available when using portable or hand-held tools, so a suitable dust mask should be worn. If possible, work in a well-ventilated place.

Further information on dust and dust masks is given in PanelGuide *Section 6.3*.

Formaldehyde

Free formaldehyde in the workplace atmosphere has a WEL of 2 parts per million (ppm). However, studies indicate that anyone machining OSB in mechanically ventilated situations is exposed to levels of free formaldehyde significantly below this.

Two classes of 'in service' formaldehyde potential are specified in *BS EN 13986* Class E1 and Class E2, E2 being the higher of the two. The test methods available for determining the formaldehyde potential are *BS EN 717-1*, *BS EN 120* and for coated OSB, *BS EN 717-2*.

Table A2.13: OSB – common hazards and methods of control

Activity	Hazard	Control
Manual handling (in full panel form)	Large panel sizes present a risk of strain or crush injuries if not handled correctly	• Store carefully in uniform stacks on a flat level base • Use mechanical handling equipment • Adopt correct manual handling procedures
Carpentry work Activities likely to produce high dust levels include: • Sanding by machine and hand • Sawing, routing and turning • Hand assembling machined or sanded components	• Wood dust in general (including dust from OSB) has health risks – it may cause dermatitis and allergic respiratory effects • Wood dust is flammable	• Off site: preparation under exhaust ventilated plant • On site: enclosure and exhaust ventilation • Dust extraction on portable tools • Good ventilation • Respiratory protection equipment (RPE) Note: Any health hazards arising from the use of OSB at work can and should be controlled by compliance with the requirements of the Control of Substances Hazardous to Health (COSHH) Regulations 2002

Manufacturers in the UK and Ireland do not offer standard grades of OSB with Class E2 formaldehyde content.

Uncoated OSB manufactured using isocyanate resins does not require testing for formaldehyde and is automatically rated as Class E1. Further information on formaldehyde is given in PanelGuide *Section 6.4*.

Hazards and control

In panel or processed form, OSB is non-classifiable under the COSHH Regulations. However, there may be handling hazards.

COSHH Regulation 6 requires an assessment to be made (and normally recorded) of health risks associated with wood dust or formaldehyde, together with any action needed to prevent or control those hazards.

Table A2.13 presents the most common hazards and identifies control methods to minimise the risk of harm actually occurring.

References

1 BS 8103-3. Structural design of low-rise buildings. Code of practice for timber floors and roofs for housing, BSI

2 BS EN 300. Oriented strand boards (OSB). Definitions, classification and specifications, BSI

3 BS EN ISO 12572. Hygrothermal performance of building materials and products. Determination of water vapour transmission properties, BSI

4 BS EN 12524. Building materials and products. Hygrothermal properties. Tabulated design values, BSI

5 BS EN 12664. Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Dry and moist products of medium and low thermal resistance, BSI

6 BS EN 13501-1. Fire classification of construction products and building elements. Classification using test data from reaction to fire tests, BSI

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Contact details for the PanelGuide project partners are:

Wood Panel Industries Federation
Autumn Business Park
Dysart Road
Grantham
Lincs
NG31 7EU
Tel: 01476 512 381
Email: enquiries@wpif.org.uk
Website: www.wpif.org.uk

Timber Research and Development Association
Chiltern House
Stocking Lane
Hughenden Valley
High Wycombe
Bucks
HP14 4ND
Tel: 01494 569 603
Email: information@trada.co.uk
Website: www.trada.co.uk

National Panel Products Division
Timber Trades Federation
The Building Centre
26 Store Street
London
WC1E 7BT
Tel: 020 3205 0067
Email: ttf@ttf.co.uk
Website: www.ttf.co.uk

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the official publisher for TRADA

Email: publications@bmtrada.com
Website: www.bmtradagroup.com