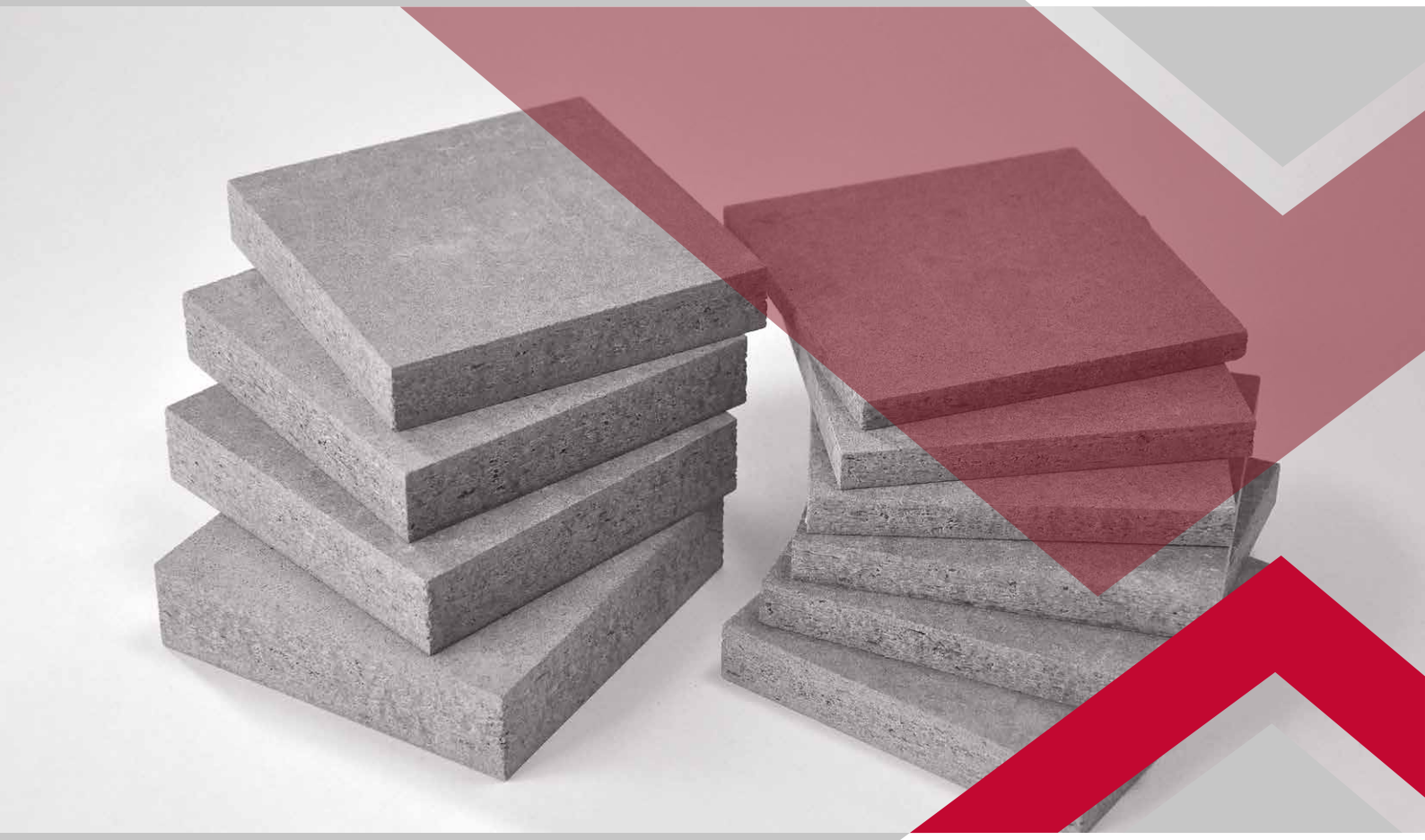
Section 1

BZSPLUS CEMENT-BONDED PARTICLEBOARDS

manufactured by CSP BZS JLLC



This manual contains general information on BZSPlus cement-bonded particleboards manufactured by CSP BZS JLLC joint venture (Belarus – Austria), as well as main recommendations for their effective application

2021

CSP BZS
JOINT LIMITED LIABILITY COMPANY

Contents

1. Cement-bonded particleboards manufacturer in the Republic of Belarus — **CSP BZS** Joint Limited Liability Company

CSP BZS JLLC is one of the leading Belarusian manufacturers of construction materials and the only cement-bonded particleboard plant (CBPB) in the Republic of Belarus.

Until recently, the demand of the Belarusian market for CBPB was satisfied by the products manufactured in the Russian Federation. However, today's challenges, when the focus is put on quality and competitive power of the product, call for pursuing new opportunities for development.

Construction of the plant started on October 5, 2012 in Krichev, one of the largest administrative centers of Belarus. The town is located in Mogilev region, 318 km from Minsk, the capital of the Republic of Belarus.

Krichev has advantageous location, owing to major highways passing through the town: Krichev – Orsha – Lepel and Zvenchatka (border of the Russian Federation) – Krichev – Bobruisk – Ivatsevichi, as well as the major railway junction of the lines Roslavl (Russian Federation) – Mogilev and Orsha – Unecha (Russian Federation).

The plant was commissioned on October 5, 2015.

The plant is a complex, consisting of an office and a production building, a debarking area, a gas boiler room and storage areas for timber, cement, chemicals and finished products.

The center of the plant complex is the new production building with an area of about 16 thousand m^2, which contains cement-bonded particleboard production line supplied by Binos GmbH (Germany).

The location of the plant was not chosen randomly. It was conditioned by proximity to the forests, since the plant mainly uses timber from the neighboring forestries, and to the major supplier of cement — Krichev Cement Plant.

Aluminum sulfate and water glass are supplied by the manufacturers from Gomel and Domanovo agrotown. One of the main advantages of the boards is that they are made of only high-quality Belarusian raw materials.

Construction of the plant was initiated by Belzarubezhstroy JSV (Republic of Belarus) and VST Building Technologies AG (Austria).

Joint Stock Venture Belzarubezhstroy was founded in 2007 to fulfill the export potential of Belarusian construction works and services. Shortly afterwards the company became a well-known Belarusian brand, recognized in the international market primarily owing to a number of successful projects that the company delivered in the Latin America. One of the company's main objectives is incorporation of the latest and most efficient technologies, compliance with the crucial principles of efficiency in all its aspects, construction of architectural projects using power, resource and material-saving technologies.

VST Building Technologies AG was established in 2002 with its headquarters located in the suburb of Vienna in Leopoldsdorf bei Wien. The company is a leading developer of solutions for high-rise construction with a high level of competence in permanent formwork technology.

CSP BZS JLLC positions itself as the company using innovative technologies and solutions, complying with the high production standards.

During the five years of operation of the plant, cement-bonded particleboards manufactured under BZSPlus trademark became a competitive product and earned well-deserved appreciation of the customers.

Aside from the Republic of Belarus, the boards are supplied to 18 countries: **Russia, Ukraine, Lithuania, Latvia, Estonia, Romania, Poland, Hungary, Slovakia, Czech Republic, Italy, Germany, Denmark, France, Belgium, Portugal, the Netherlands, Great Britain.**

Cement-bonded particleboards 2.

History of creation of cement-bonded particleboard technology

Cement and wood are the main materials used for construction throughout the history of humankind. For a long time these materials were used separately; research of physical and chemical binding between cement and wood began only in the early 1920's.

By the end of 1920's, a mixture of cement and wood chips was already widely used, and in early 1940's people learned to mold boards out of cement & wood chip mixture.

The first fiberboards consisting of pressed mixture of cement and long wood fibers were manufactured in 1940. Later on, shorter wood fibers were used for manufacturing the boards, which became the prototype of the modern cement-bonded particleboards. The first company to manufacture the present-day cement-bonded particleboards was established in 1967 in Switzerland.

In the 1970's cement-bonded particleboards surged in popularity: one after another, CBPB manufacturing plants were built around the world. In the late 1980's CBPB plants were also put into operation in the USSR (the territory of today's Russian Federation).

Cement-bonded particleboards

Cement-bonded particleboard is a versatile construction material with unique properties. These boards combine strength and durability of cement with flexibility and workability of wood.

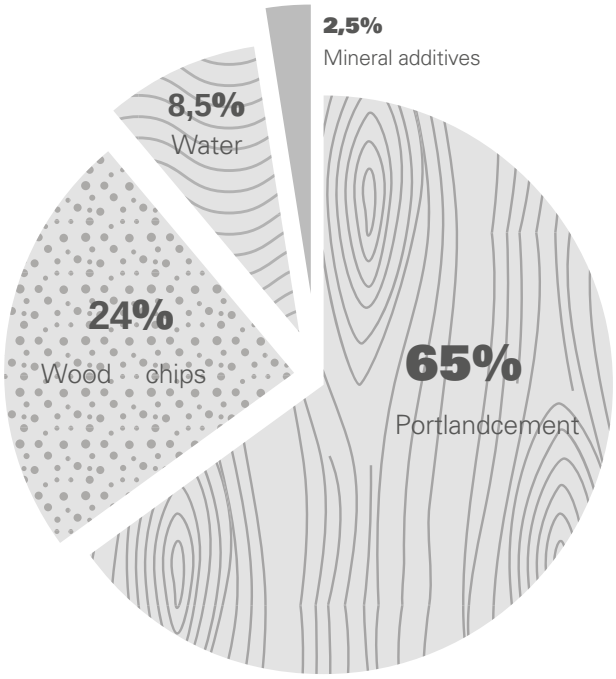
Owing to their technical properties and quality characteristics, cement-bonded particleboards are widely used in construction, repairs, restoration and renovation works, as well as in architecture and interior design.

The boards are made by pressing a sheet of mixture of softwood chips, Portland cement, mineral additives and water.

Using of CBPB allows to significantly reduce the time and cost of construction and repair works; it also helps to minimize the cost the building maintenance due to the durability, strength and other useful properties of this material.

Cement-bonded particleboards are successfully used both for large scale projects and for the construction of single-family homes.

Percentage composition of the mixture by mass:



3. Manufacturing process

Timber debarking
Round timber, free of any metal inclusions, is fed into a debarking machine for bark removal.

Storage of debarked logs
After debarking, the logs should be conditioned for about three months to achieve uniform moisture content and reduce sugar and tannins content.

Chipping
Conditioned wood is fed into a chipper to produce thin flat chips. Then the chips are crushed in a hammer mill into smaller and thinner particles. These particles are separated by size into two fractions, which are held in two separate storage bins.

Preparation of cement-particle mixture
The next step is mixing of the components of the core and surface layers of cement-bonded particleboard in two mixers. The components are added in the following order: wood chips, residual water and aluminum sulfate solution, water glass solution, cement.

Mat forming
The mixture is placed on the metal sheets using dosing hoppers. Cement-particle mat is spread in four layers – two surface layers of fine particles and two core layers of coarse chips.

Weight control station
The next step is checking the mat weight and its compliance with preset tolerance. If the mat weight is outside the preset tolerance limit, it is transported back to the core layer bunker of the forming machine.

Pressing and curing
The metal sheets with mats are stacked in the clamping stands, which are then put into the press. After the press is open, the clamping stand is moved to the curing cabinet, where it stays for more than 8 hours at the temperature of 60-70^{o} C.

Destacking area
After the curing cabinet, clamping stands return to the press for destacking, where the boards are removed from the sheets.

Metal sheets return area
Metal sheets are cleaned and covered with emulsion spacer fluid. Then they return to the forming conveyor, where the four-layer cement-particle mat is laid over them.

Conditioning area
The boards are cleaned on both sides and laid on a pallet for conditioning during 5–10 days.

Drying and trimming
The boards are passed through the drying tunnel to bring them to the required moisture content. After drying, the boards are trimmed on all sides and stacked on pallets.

Finished product storage area
When a stack reaches a specific number of the boards, the pallet is transported to the finished product storage area.

Applications of cement-bonded particleboards 4.

CBPB provides optimal thermal performance of buildings and structures. This construction material is perfect for wall sheathing in low-rise buildings, special purpose constructions and high humidity areas. Cement-bonded particleboard surface does not require considerable treatment or finishing. The structures finished with CBPB can withstand rather challenging operating conditions. Physical properties of this material and its unparalleled technical characteristics provide durability, integrity and protection of the interior areas. Cement-bonded particleboards can be used for easy and fast leveling of walls or floors; they are suitable for shell and core fit out, as well as facade cladding of the building. CBPB can make any building warm and comfortable, and to increase its service life considerably.

CBPB is used for permanent formwork for construction of buildings; construction of framed buildings; insulated facade systems; exterior finishing of buildings; interior finishing of low and high humidity areas; repair, renovation and restoration works.

Applications of cement-bonded particleboards

Exterior construction works and exterior finishing:
- prefabricated framed structures;
- facade cladding of residential and administrative buildings, gas stations, shops, mobile accommodation containers, warehouses and storage sheds;
- thermal insulation of industrial and agricultural buildings and structures;
- adding floors to existing buildings;
- permanent and reusable formwork for monolithic construction;
- prefabricated residential and administrative buildings, etc.;
- floating screed for floor and roof constructions;
- insulated sandwich panels;
- construction of mobile buildings;
- fences, noise barriers, sound absorbing and shielding walls along highways;
- temporary fencing of construction sites;
- saunas, shower cabins, garages, cellars, barns, toilets and other non-residential structures;
- elements of outdoor billboards and advertising panels;
- landscaping elements, flower beds, walkway paving and paving of open pool areas.

Interior finishing:
- interior cladding of timber or metal frame buildings;
- permanent formwork for monolithic reinforced concrete interior walls, partitions, slabs, elevator shafts, frame elements;
- ceilings and partition walls;
- subflooring for installation of floor finish;
- acoustic and fire rated partitions and floors;
- suspended ceilings;
- stairs in apartments;
- cladding of columns, joists, shafts and pipelines;
- lining of wet areas;
- ventilation ducts;
- window sills.

5. Main advantages of BZSPlus cement-bonded particleboards

Main advantages of BZSPlus cement-bonded particleboards:

- Environmental and health safety – the boards do not contain formaldehyde resins, phenol and phenolic compounds, asbestos and other toxic, harmful and hazardous substances;
- rot resistance; mold and fungus resistance; termite, insect and rodent resistance;
- resistance to gasoline, oils, urea, weak acid and alkali solutions, disinfectant solutions;
- durability;
- high strength and wear resistance;
- good acoustic and thermal insulation properties;
- has workability of wood, but offers higher strength;
- fire resistance and low flammability;
- resistance to cyclic temperature and humidity effects;
- suitable for interior and exterior applications in residential and non-residential buildings;
- suitable for various types of surface finish: paint, plaster, wallpaper, ceramic tiles, wood and plastic panels, etc.;
- suitable for all climatic regions.

6. Types of BZSPlus cement-bonded particleboards and their main physical and mechanical properties

The company produces two types of cement-bonded particleboards in compliance with EN 13986+A1:2015:

- BZSPlus cement-bonded particleboards suitable for interior and exterior applications as structural elements, without surface finish, B-s1, d0 reaction to fire class;
- BZSPlus+ cement-bonded particleboards suitable for interior and exterior applications as structural (≥ 16 mm) and non-structural (< 16 mm) elements in dry and humid conditions, without surface finish, A2-s1, d0 reaction to fire class.

BZSPlus cement-bonded particleboards:

BZSPlus boards color	gray
maximum board size	3200 x 1200 mm
board thickness	8, 10, 12, 16, 18, 20, 22, 24 mm
surface	smooth
surface finish	without finish
additional services	• board cutting (straight cut across the board length and width), • edge milling – tongue and groove

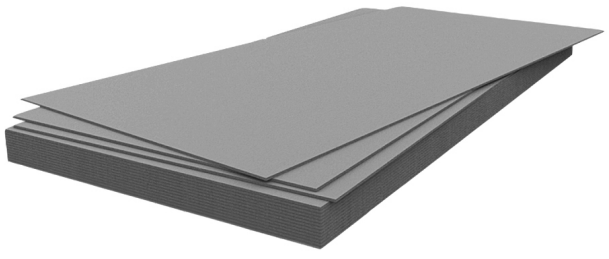
Maximum dimensional tolerances of BZSPlus boards:

Parameter	Maximum tolerance, (mm)
Length	± 5.0
Width	± 5.0
Thickness	
8, 10 mm	± 0.7
12 mm	± 1.0
16, 18 mm	± 1.2
20, 22, 24 mm	± 1.5
Maximum length and width tolerance after cutting (additional services)	± 3.0
Edge straightness tolerance measured on a length of 1000 mm	≤ 1.5
Edge squareness tolerance measured on a length of 1000 mm	≤ 2.0

Main physical and mechanical properties of BZSPlus cement-bonded particleboard

Parameter	Standard	Standard value	Actual mean value
Density, kg/m^3	EN 323	min 1000	1350
Bending strength, N/mm^2	EN 310	min 9.0	13.0
Bending modulus of elasticity, N/mm^2	EN 310	min 4500	6300
Moisture content, %	EN 634-1	9 ± 3	11
Durability — thickness swelling after 24 h, %	EN 317	max 1.5	0.5
Tensile strength perpendicular to panel surface, N/mm^2	EN 319	min 0.5	0.8
Moisture resistance — thickness swelling after cyclic test, %	EN 321	max 1.5	0.15
Moisture resistance — tensile strength perpendicular to panel surface after cyclic test, N/mm^2	EN 321	min 0.3	0.5
Reaction to fire	EN 13501-1		B-s1, d0
Formaldehyde content, mg/m^3	EN 717-1		< 0.002 (E1)
pH value			11 - 13

BZSPlus+ cement-bonded particleboard:



BZSPlus+ boards color	gray
maximum board size	3200 x 1200 mm
board thickness	8, 10, 12, 14, 16, 18, 20, 22, 24 mm
surface	smooth
surface finish	without finish
additional services	• board cutting (straight cut across the board length and width), • edge milling – tongue and groove

Maximum dimensional tolerances of BZSPlus+ boards

Parameter	Maximum tolerance, (mm)
Length	± 5.0
Width	± 5.0
Thickness	
8, 10 mm	± 0.7
12, 14 mm	± 1.0
16, 18 mm	± 1.2
20, 22, 24 mm	± 1.5
Maximum length and width tolerance after cutting (additional services)	± 3.0
Edge straightness tolerance measured on a length of 1000 mm	≤ 1.5
Edge squareness tolerance measured on a length of 1000 mm	≤ 2.0

Main physical and mechanical properties of BZSPlus+ cement-bonded particleboard

Parameter	Standard	Standard value	Actual mean value
Density, kg/m^3	EN 323	1350 - 1430	1400
Bending strength, N/mm^2	EN 310	min 9.0	13.0
Bending modulus of elasticity, N/mm^2	EN 310	min 4500	6300
Moisture content, %	EN 634-1	9 ± 3	10
Durability - thickness swelling after 24 h, %	EN 317	max 1.5	0.5
Tensile strength perpendicular to panel surface, N/mm^2	EN 319	min 0.5	0.8
Moisture resistance - thickness swelling after cyclic test, %	EN 321	max 1.5	0.15
Moisture resistance - tensile strength perpendicular to panel surface after cyclic test, N/mm^2	EN 321	min 0.3	0.5
Reaction to fire	EN 13501-1		A2-s1, d0
Reaction to fire for floor boards	EN 13501-1: 2018		A2fl –s1
pH value			11–13
Formaldehyde content, mg/m^3			<0.002 (E1)
Weighted acoustic reduction factor, Rw, dB			8 mm — 33 24 mm — 38
Diffusion water vapor transmission rate, g, mg.m^{-2}.h^{-1}			2884.2437
Vapor permeability, W, mg.m^{-2}.h^{-1}.Pa^{-1}			1.2068
Diffusion conductivity coefficient, δ, mg.m^{-1}.h^{-1}.Pa^{-1}			0.0145
Vapor diffusion resistance factor, μ			48
Thermal conductivity factor, λ_{10}, W.m^{-1}.K^{-1}	EN 12667		0.234
Radiological parameters:			12.5
mass activity index		0.5	0.18
K 40, Bg.kg^{-1}			201
Ra 226, Bg.kg^{-1}		150	18.7
Th 228, Bg.kg^{-1}			11.3

The company provides additional services of cutting 8 to 24 mm thick boards and edge milling (tongue and groove) of 16 to 24 mm thick boards.

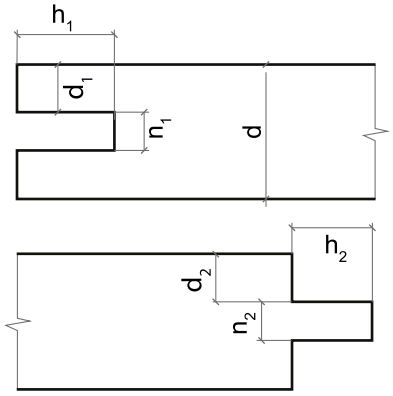
The boards are cut across the length and width using a professional HOLZ-HER sliding table saw. There are no limitations on the length and width of the cut boards.

CELASCHI tenoning machines are used for milling of cement-bonded particleboard edges and cutting tongue and groove joints. This joint is a traditional fitting method where a projecting ridge (tongue) of one element fits into the slot (groove) of the corresponding shape of the other element.

Main requirements for milling:

- The required thickness of cement-bonded particleboards for milling is 16 to 24 mm.
- There is no minimum length requirement for milling two edges of cement-bonded particleboards.
- If four sides of cement-bonded particleboard are milled, the maximum board length is 3050 mm, and the minimum board size is 600 x 600 mm.

Diagram and dimensions of tongue and groove. Tolerances for different board thicknesses (mm):



Board thickness (d)	16	18	20	22	24	Tolerance
Groove width (n_1)	6	6	8	8	8	0 / +0.5
Tongue thickness (n_2)	5.5	5.5	7	7	7	-0.5 / 0
Groove depth (h_1)	10	10	10	10	10	0 / +2
Tongue length (h_2)	8.5	8.5	8.5	8.5	8.5	-2 / 0
Distance from board surface to the groove (d_1)	5	6	6	7	8	±0.5
Distance from board surface to the tongue (d_2)	5.25	6.25	6.5	7.5	8.5	±0.5

The company manufactures 1200 x 600 mm boards with four machined edges for floor construction and repairs.

8. Packaging, transportation and storage of cement-bonded particleboards

Cement-bonded particleboards are put on wooden pallets suitable for handling with forklifts. The boards are protected from weather exposure with polyethylene foil, tied and secured to the pallet with polypropylene (PP) strips. The boards can be additionally tied lengthwise at the customer's request.

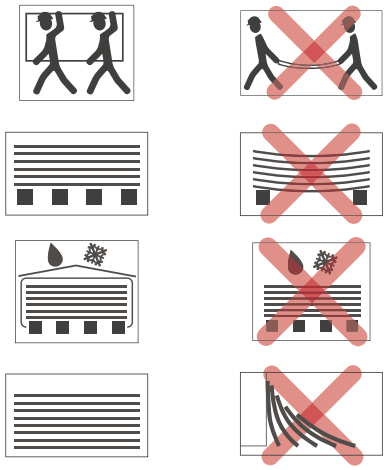
Important:
Polyethylene foil packaging is not suitable for protection from long-term exposure to weather effects in case of outdoor storage.

The boards are transported in horizontal position by all modes of transport. They must be protected against weather effects, mechanical damage and deformations. Curtain side trucks allowing loading from the side should be used for transportation of the boards by road. In case of transportation in open-bed trucks, the pallets with the boards should be covered with canvas.

When handling the palletized boards with a forklift, it is recommended to pick up the pallets from the longer side. The pallets should be placed in the truck bed in one or two rows along the bed width. It is allowed to place the pallets in the truck in two tiers; however, they must be stacked and secured in such a way, as to avoid shifting.

During storage, the top board in the stack may bend due to faster drying of the surface. This effect can be corrected by turning the board over.

The boards should be stacked and stored in horizontal position, in covered, dry areas to prevent exposure to moisture before installation.



Palletized stacks of boards of the same height can be put on top of each other in piles of the maximum height of 4 m. The boards must be put on pallets before all handling operations.

The boards can also be handled in vertical position. If carried manually, the boards must be held vertically by the ends. Conditioning time before installation — at least 2–3 days.

The boards can only be kept on the site during the installation period. They must be placed in horizontal position and covered for protection against weather effects. It is allowed to cover the stacks with polyethylene foil reaching the top part of the pallet to avoid greenhouse effect.

Main information on packaging of BZSPlus cement-bonded particleboards

BZSPlus cement-bonded particleboard (B-s1, d0)

Board thickness, mm	Board length, mm	Board width, mm	Board area, m^2	Board volume, m^3	Board average weight, kg	Number of boards per pallet, pcs	Average weight of boards per pallet, kg	Total area of boards per pallet, m^2
8	3200	1200	3.84	0.03072	41.472	76	3151.872	291.84
10	3200	1200	3.84	0.03840	51.840	61	3162.240	234.24
12	3200	1200	3.84	0.04608	62.208	51	3172.608	195.84
16	3200	1200	3.84	0.06144	82.944	38	3151.872	145.92
18	3200	1200	3.84	0.06912	93.312	34	3172.608	130.56
20	3200	1200	3.84	0.07680	103.680	31	3214.080	119.04
22	3200	1200	3.84	0.08448	114.048	27	3079.296	103.68
24	3200	1200	3.84	0.09216	124.416	25	3110.400	96.00

BZSPlus+ cement-bonded particleboard (A2-s1, d0)

Board thickness, mm	Board length, mm	Board width, mm	Board area, m^2	Board volume, m^3	Board average weight, kg	Number of boards per pallet, pcs	Average weight of boards per pallet, kg	Total area of boards per pallet, m^2
8	3200	1200	3.84	0.03072	43.008	70	3010.560	268.80
10	3200	1200	3.84	0.03840	53.760	56	3010.560	215.04
12	3200	1200	3.84	0.04608	64.512	47	3032.064	180.48
16	3200	1200	3.84	0.06144	86.016	35	3010.560	134.40
18	3200	1200	3.84	0.06912	96.768	31	2999.808	119.04
20	3200	1200	3.84	0.07680	107.520	28	3010.560	107.52
22	3200	1200	3.84	0.08448	118.272	25	2956.800	96.00
24	3200	1200	3.84	0.09216	129.024	23	2967.552	88.32

CSP BZS JLLC

137 Komsomolskaya Str.,
213500 Krichev, Republic of Belarus

tel./fax: +375 2241 27 511
e-mail: cspbzs@cspbzs.by