B2 expansion joints

About us

B2 Sp. z o.o. was established in 2010. It deals with selecting, producing and installing bridge components such as:

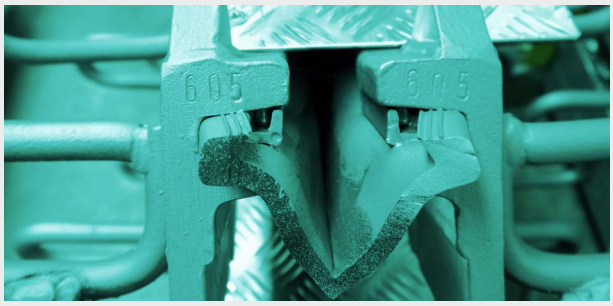
- modular expansion joint B2W, made of non-alloy steel (single seal and modular expansion joint)
- modular expansion joint made entirely of non-alloy or stainless steel (B2NS), or partly of non-alloy or stainless steel (B2NN) (single seal and modular expansion joint)
- finger expansion joint B2P
- pot bearings
- elastomeric bearings (including guide and restraint bearings)
- spherical bearings
- bridge cornice boards made of polymer concrete
- lifting structures, including bearings exchange

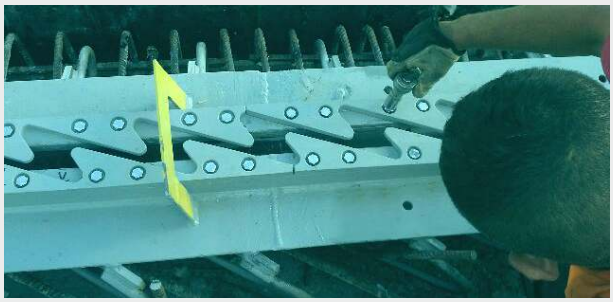
We are young company with well-experienced team. Bearings, expansion joints and cornice boards we deliver are made by the Polish production plants. They are of top quality, which is guaranteed by Production Control System.

B2 Sp. z o.o. has wide experience in supplying products both to the European Union and beyond its borders. Among others, we executed a delivery of expansion joints within the road connection between Zittau and Hradek by the Neisse River including connection to the Polish road network (road connection in Nysa Euroregion: Task II – part 3) and bridges in Göteborg, Olofström and Ludvika in Sweden and also bearings production for:

- Sweden (LKAB Ramp in Kiruna, Railway line Stenkumla-Dunsjö, Bridge over the Vindel River in Spöland, Bridge in Södertälje, Bridge in Norsborg)
- Norway (Harpe Bridge over Lågen River along E6 Frya-Vinstra highway)
- Lithuania (Road A1 Vilnius-Kaunas-Klaipeda, Road A5 Kaunas-Marijampolė-Suwalki, Akmena Bridge, pedestrian viaduct in Armino)
- Hungary (Bridge No. 61 along Budapest-Nagykanizsa E71 trunk road, Bridge No. M86 along Zalalövő bypass, railway bridge over Berettyó River, Miskolc northern bypass, railway bridge along Szolnok-Szajol railroad, bridges in Hódmezővásárhely)
- Turkey (Fen Lisesi Bridge in Ankara)
- Belgium (footbridge in Avelgem)

We cooperate with the biggest contractors in Poland and Europe such as Astaldi, Budimex/Ferrovial, Dragados, Metrostav, Mota-Engil Central Europe, Pannon Freyssinet, PORR, Salini Impregilo, Skanska, Strabag, Toto Construzioni Generali or ViaCon Baltic. We would appreciate cooperation with your company also!





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PART 1

General information

Bridge expansion joints are intended to be used in bridge structures in order to safely compensate displacements within expansion gap, which are induced by the changes of temperature, deflections and rheological effects. Thanks to being not continuous, the structure is not subjected to internal stresses, which might occur because of natural tendency to expansion and contraction of materials. This should be considered highly important issue regarding the induction of the internal forces.

However, the gap in the upper surface of the bridge structure would prove inconvenient for the traffic and would lead to excessive deterioration of the edges of adjacent structures. In order to smoothen the transition over the expansion gap, what ensures a comfortable passing and provides an acoustic comfort, there are widely used plug joints and expansion joints

Types of expansion joints and method of selection

Depending on expansion length (the distance between a fixed point and an expansion gap) different types of expansion joints should be taken into account to fulfill the certain requirements, both technical and economical.

Table 1

Type	Approximate range of application
Buried expansion joint	0÷5 mm
Asphaltic plug joint	0÷25 mm
Elastomeric cushion (mat expansion joint)	50÷300 mm
Modular expansion joint	50÷100 mm (single-seal) >100 mm (modular)
Finger joint	80÷800 mm

Recently, the last two types of expansion joints (modular and finger joints) have achieved widespread popularity in the bridge engineering, thanks to universality in application and durability when subjected to high density of road traffic. Since 2010 B2 company has been offering them to its customers, constantly improving quality, caring for meeting individual requirements and providing short delivery time of items to the purchaser.

Selection of the type of expansion joint is an essential part of designing a bridge structure. In order to design an appropriate expansion joint, which would guarantee a proper durability coupled with economical effectiveness, a number of factors should be considered to provide a suitable selection of the expansion joint. Providing that the expansion joint is designed properly, the transition over it is comfortable and silent, the expansion gap can work properly in a designed range and what is more, it is highly durable even subjected to heavy cyclical traffic load.

Calculation of movements of expansion joints

Total movements of the edge of a bridge deck should be calculated according to the following effects of actions:

$$\Delta L_{tot} = \Delta L_T + \Delta L_j + \Delta L_s + \Delta L_c \text{ [mm]}$$

ΔL_{tot} - total displacement of the bridge deck [mm]
ΔL_T - displacement due to change of temperature [mm]
ΔL_j - displacement due to deflection of the span (rotation of the edge of the deck) [mm]
ΔL_s - displacement due to shrinkage of concrete [mm]
ΔL_c - displacement due to creep of concrete [mm]

The effects caused by shrinkage and creep should be considered in reinforced and prestressed concrete structures. In composite steel-concrete structures these effects might be omitted when there is a full connection between steel and concrete via for example shear studs.

Table 2 presents formulas how to calculate particular components of the total displacement.

If the installation of the expansion joints takes place at least 3 months after casting concrete (in reinforced and pre-stressed structures) the effect of shrinkage might be omitted. Additionally, in case of pre-stressed structures, the effect of creep might be omitted if the installation of the expansion joint takes place at least 6 months after loading the member with compressive force.

Table 2

Component of total displacement	Formula	Explaination	Standard
ΔL_T	$a_T \cdot \Delta t \cdot L_0$	a_T - coefficient of thermal expansion Δt - designed amplitude of temperature L_0 - expansion length (distance from the fixed point to the expansion gap)	EN 1991-1-5
ΔL_j	$\sum_{i=1}^{n} j_i \cdot h_i$	j_i - rotation angle of the edge of the bridge deck due to deflection h_i - height of the superstructure over the bearings n - number of spans which meet in the expansion gap, n=1 for the expansion gaps on abutment, n=2 for the expansion gaps between spans	EN 1991-1 EN 1991-2 EN 1991-3
ΔL_s	$\Delta e_s \cdot L_0$	Δe_s - strain due to shrinkage which will occur after installation of the expansion joint in the structure L_0- expansion length (distance from the fixed point to the expansion gap)	EN 1991-1-1 EN 1991-2
ΔL_c	$\Delta e_p \cdot L_0$	Δe_p - strain due to creep which will occur after installation of the expansion joint in the structure L_0 - expansion length (distance from the fixed point to the expansion gap)	EN 1991-1-1 EN 1991-2

The values of strains, which result from the rheological effects, should be determined according to appropriate standards (EN 1992).

Selection of the type of expansion joint should be performed taking into consideration, apart from longitudinal movement, the below mentioned factors:

- transversal movements
- possible methods of installation
- protection against noise
- type and construction of superstructure
- dimensions of the recess in which the anchorage might be situated

Durability of the expansion joints produced by B2

The life-time of expansion joints is determined during the test in which the resistance against repetitive dynamical loads is examined. The expansion joints which B2 offers, satisfy all the requirements imposed by Road and Bridge Research Institute in Warsaw (RBRI), which are considered to be more strict than those imposed by the European regulations in ETAG n° 032 parts 4, 6 and 8 (Table 3). Durability of B2 expansion joints exceeds 50 years.

Table 3

Type of expansion joint	Number of load cycles		Vertical test load [kN]		Contact pressure [N/mm^2]		Frequency [Hz]		Gap opening during the test [mm]	
	ETAG n° 032 method	RBRI* method	ETAG n° 032 method	RBRI* method	ETAG n° 032 metoden	RBRI* method	ETAG n° 032 method	RBRI* method	ETAG n° 032 method	RBRI* method
Single-seal (±50 mm with noise-reduction plates)	$3{,}8 \cdot 10^6$	$4{,}0 \cdot 10^6$	75	100	1,00	1,39	> 0,5	5÷7	60	100
Modular (±150 mm with noise-reduction plates)	$3{,}8 \cdot 10^6$	$6{,}0 \cdot 10^6$	75	100	1,00	1,39	> 0,5	5÷7	3 · 60	3 · 100
Finger (±325 mm)	$3{,}8 \cdot 10^6$	$4{,}0 \cdot 10^6$	75	100	1,00	1,65	> 0,5	5÷7	390	390
	-	$6{,}0 \cdot 10^6$	-	185	-	3,06	-	5÷7	-	390

*RBRI - Road and Bridge Research Institute in Warsaw – notified body number 2219, Polish accredited certifying unit number AC 052

Picture 1. B2N modular expansion joint during the dynamic test

Picture 2. B2P finger expansion joint during the dynamic test

Warranty

B2 provides 5-year quality warranty on the expansion joints. The warranty covers construction steel parts, welded joints and operating parts. However, to maintain the manufacturer's warranty it is essential that the administrator of the road (or a particular bridge) carries out regular inspections and upkeeps according to manufacturer's instruction and make it accessible for the manufacturer to get familiar with the results. The parts which should be inspected and cleaned are: elastomeric watertight profiles and parts which are connected to the structure by the bolts (noise-reduction plates and finger plates).

Documents

The expansion joints produced by B2 have been examined thoroughly and got technical approvals and other necessary documents issued by Road and Bridge Research Institute in Warsaw (RBRI). This means that they can be legally used in every bridge structure – for cars as well as for rail.

Production plants

B2 expansion joints are manufactured in two Polish factories. Each of them carries out Factory Production Control according to implemented procedures which ensure excellent quality of the products. Most of materials used to production originates from Polish suppliers.

It is possible to visit our factories and check the entire process of production. We cordially invite you!

Picture 3. Welding steel profiles

Table 4*

Type of expansion joint	Technical approval issued by RBRI	National Certificate of Conformity or National Certificate of Constancy of Performance issued by RBRI	National Declaraton of Conformity
B2W (single-seal)	AT/2010-02-2676/5	KCZ IBDiM – 144-3/2016	01/B2W-J/2017
B2W (modular)	AT/2015-02-3180	KCZ IBDiM – 189/2016	01/B2W-W/2017
B2NN, B2NS (single-seal)	AT/2013-02-3007/2	052 – UBW – 004	01/B2N-J/2017
B2NN, B2NS (modular)	AT/2013-02-3013/2	KCZ IBDiM – 208/2016	01/B2N-W/2017
B2P	AT/2011-02-2730/2	KCZ IBDiM – 122-2/2016	01/B2P/2017

* numbers of documents are actual in June 2017

Picture 4. Factory

PART 2 - Single-seal and modular expansion joints

Types

The B2 company offers single-seal and modular expansion joints in three types: **B2W**, **B2NS** and **B2NN**.

B2W expansion joints are made of alloy steel. Their watertightness is obtained thanks to elastomeric sealing profile, which is mounted in edge (nosing) steel beams by removable aluminium selvedges (fillets).

B2NN expansion joints are made of stainless steel (upper part of the profile) and alloy steel.

B2NS expansion joints are made of alloy steel only. In both of these types the cross-section of the sealing is adjusted by its shape to fill the recess without removable parts.

Depending on the number of sealing profiles, modular expansion joints are divided into:

- single-seal – which are composed of two nosing edge beams anchored both in abutment and in deck and one elastomeric sealing profile
- modular – which are composed of two nosing edge beams anchored both in abutment and in deck, at least one center beam and at least two elastomeric sealing profiles

Advantages

Modular expansion joints types B2W, B2NN, B2NS are intended to be used in bridge structures which might be loaded according to every category of traffic load referring to Polish standards (including highways and expressways). This implicates the durability under the most intensive exploitation conditions.

Our expansion joints are fully watertight and might be exactly adjusted to the geometry of a bridge and might be designed to meet individual requirements and needs of the Client. Thanks to its construction, installation of expansion joints is quick and easy.

A single-seal expansion joint might have length which exceeds 30 m. If necessary, expansion joint might be divided into parts, which would provide shorter elements (for single-seal expansion joints). This can be useful in case of transportation reasons and might simplify the installation works, however in this case welding in-situ must be performed to assemble the elements together.

Materials

Table 5

Type	Edge beam	Center beam*	Supporting elements*	L-beam	Noise-reduction plates	Sealing profile	Type of sealing element
B2W	S235JR	S355J2	Folding trellis linkage (scissor mechanism)	S235JR	S355J2 or W1.4301 or W1.4571	EPDM	Clamped by selvedges
B2NN	S355J2 or W1.4301 or W1.4571	S355J2 or W1.4301 or W1.4571	Traverse beam	S355J2	S355J2 or W1.4301 or W1.4571	EPDM	Self-locking
B2NS	S355J2	S355J2	Traverse beam	S355J2	S355J2 or W1.4301 or W1.4571	EPDM	Self-locking

* in the modular type - see fig. 3.

Steel parts have material certificates which endorses the conformity with standards EN 10025-2 and EN 10088-3. Sealing profiles satisfy the requirements shown in Table 6.

Picture 5. Joints warehousing

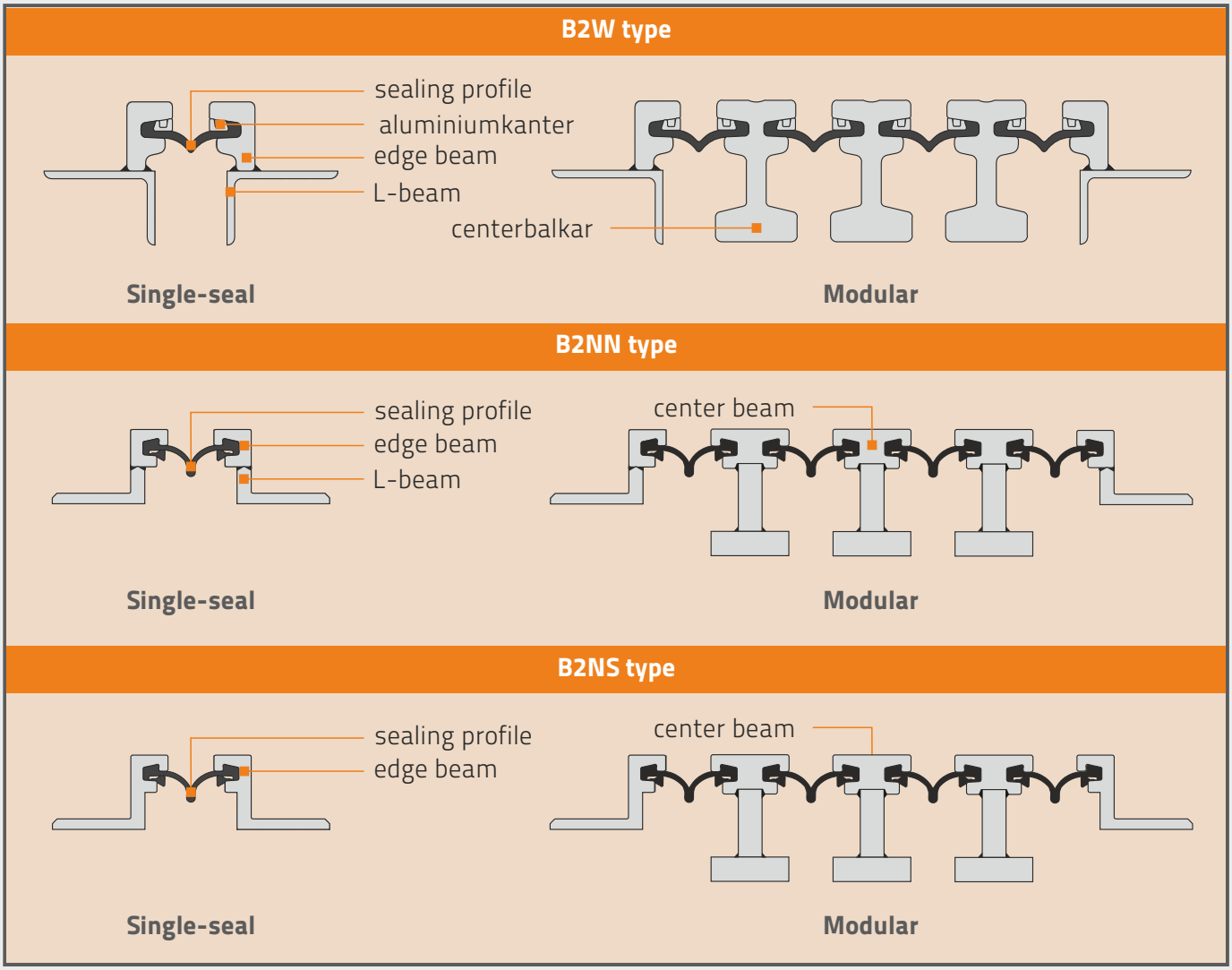


Fig. 1. Types of single-seal and modular expansion joints

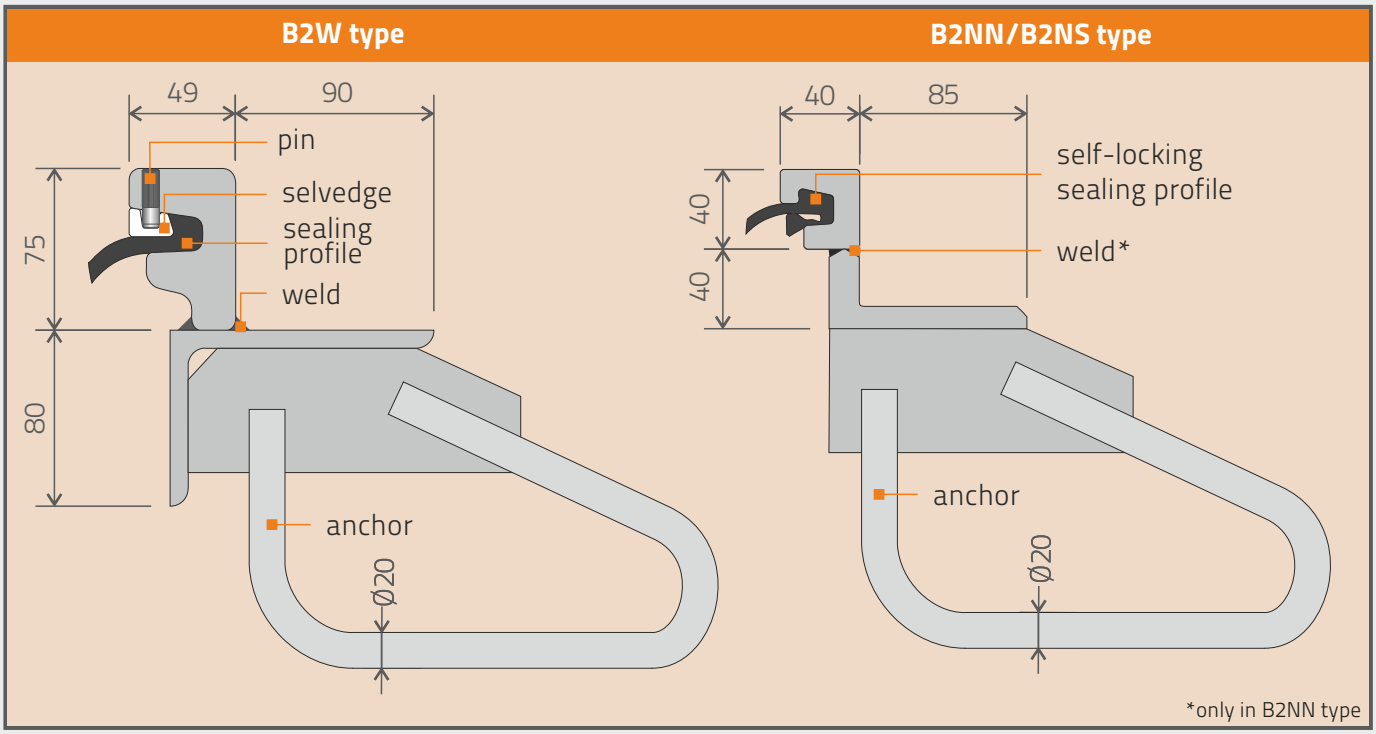


Fig. 2. Dimensions of single-seal expansion joints [mm]

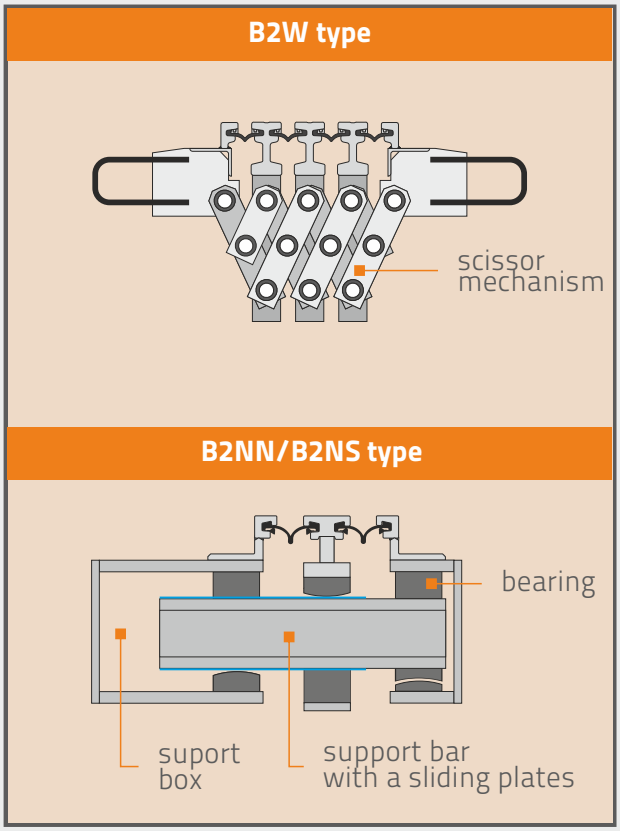


Fig. 3. Supporting elements

Sealing profiles

Watertightness is provided by elastomeric sealing profile which is mounted to edge steel beams. Depending on the type of expansion joint, two kinds of seals are in use:

- mounted by aluminum selvedges and pins (in B2W type) - see Fig. 2
- self-locking (in B2NN and B2NS types) - see Fig. 2

Each type might vary by the cross-section shape:

- standard – with V-shaped cross-section
- reinforced – with hollow cross-section which increases the stiffness

Decision which shape should be used is up to contractual technical requirements or to Client's wish. However, the reinforced type requires more treatment during maintenance and eliminates the possibility to use the drainage inlet.

The advantage of elastomeric sealing used in B2W expansion joints is a possibility to replace it in easy way. The sealing might be pulled out after reaming the pins and removing the aluminum selvedges. On the contrary, seals used in B2NN and B2NS type do not require any additional tighting elements.

Picture 6. Scissor mechanism

Table 6

Parameter	Test method	Measured values	Unit
Hardness	ISO 48	63±5	IRHD
Tensile strength	ISO 37	≥ 10	MPa
Elongation at break	ISO 37	≥ 350	%
Tear resistance	ISO 34-1 A	≥ 6	N/mm
Density	ISO 2781	1,16	g/cm^3
Thermogravimetric analysis	From 50 °C to 750 °C (heating rate 10 K/min)	pass	as per sample
Compression set, 24h/70 °C/25%	ISO 815	≤ 25	%
Rheometric characteristics	-	pass	-
Brittleness temperature	ISO 812	≤ -30	°C
Resistance to ozone ageing, min. 72h, temp. min. 40 °C, ozone concentration min. 50 pphm, initial elongation min. 20%	ISO 1431-1	no visible cracks	-

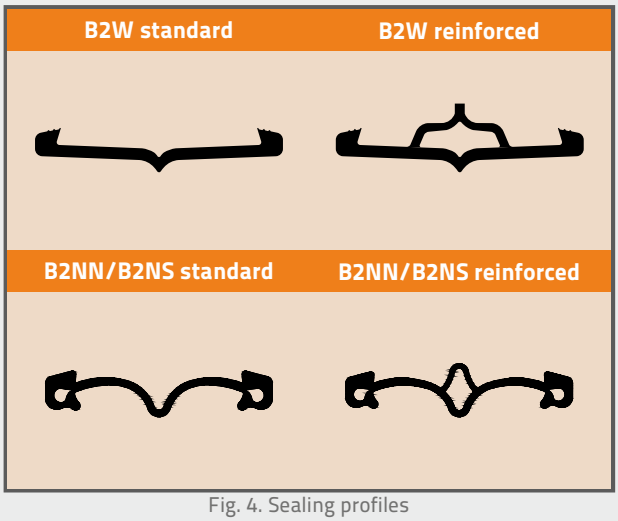


Fig. 4. Sealing profiles

Noise-reduction plates

In order to lower emission of noise generated by the traffic the noise-reduction plates are used optionally. Their sinusoidal-like shape excludes the reason of noise, namely their shape do not allow to hit the edge profile in a right angle by a tyre, which would influence on propagation of sound waves.

Each type of expansion joint (B2W, B2NN, B2NS) might be equipped with noise-reduction plates, which are made of stainless or alloy steel (see Table 5). Minimal thickness of them is 15 mm but it is advised to use 20-mm-thick plates in bridges which are subjected to traffic of heavy vehicles. The shape of the noise-reduction plates might be designed according to a specific skew angle of a bridge structure.

Noise-reduction plates are fixed to edge profiles with bolts. It is not recommended to use welding instead, as this disables the possibility to replace the elastomeric sealing profile if necessary.

Several countries imposed the obligation to use the noise-reduction plates referring to a range of movements of individual module of the expansion joint. B2 expansion joints, which accommodates movements of ±50 mm and its multiple are always equipped with noise-reduction plates as a standard. These expansion joints are distinguished by symbol "SL" (see Table 7).

Aside from a silencing function, the noise-reduction plates reduce also dynamic effects caused by traffic (by closing the gap). It prolongs their durability and lessens the wear of undercarriage as well as improves the comfort of driving.

Picture 7. B2W 80/4S modular expansion joint

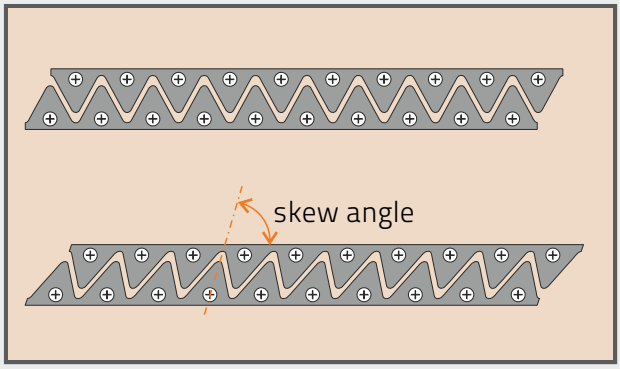


Fig. 5. Noise-reduction plates

Picture 8. Modular expansion joint equipped with noise-reduction plates

Nominal movements

Each type B2W, B2NN and B2NS might be designed and produced as a single-seal or modular expansion joint. In standard types of expansion joints single-seal expansion joint accommodates movements up to ±40 mm and accordingly modular expansion joints accommodate movements up to multiple of ±40 mm (±80 mm, ±120 mm, etc.). For expansion joints, which have the noise-reduction plates installed, the range of movements of a single module is up to ±50 mm (Table 7).

It is possible to produce joint with accommodate movements up to multiple of ±50 mm and without noise-reduction plates on Client's wish (depending on the national requirements).

Table 7

Number of seals	Without noise-reduction plates		With noise-reduction plates	
	B2 joint symbol*	Total range of movements [mm]	B2 joint symbol*	Total range of movements [mm]
1	80/1S	±40	100SL/1S	±50
2	80/2S	±80	100SL/2S	±100
3	80/3S	±120	100SL/3S	±150
4	80/4S	±160	100SL/4S	±200
5	80/5S	±200	100SL/5S	±250

* Including B2W, B2NN and B2NS types

Anti-corrosion protection system

Expansion joints made of alloy steel are protected against corrosion in two optional ways:

- with metallization and paint coatings – where the raw steel is covered with metallic (zinc) spraying and afterwards with one or several paint coatings, which act as a sealer
- with paint coatings – where the raw steel is covered with one or several paint coatings

In both cases B2 company bases on reputable products of such companies as Tikkurila or Sika.

Expansion joints which are fully or partially made of stainless steel are protected against corrosion additionally with standard paint coatings.

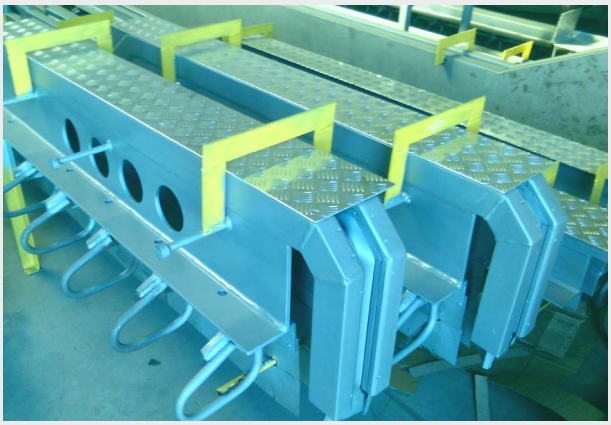
The expansion joints manufactured by B2 are protected against corrosion in categories C3, C4 and C5-M according to EN 12944-2. It is possible to design individually and modify the anti-corrosion protection system on Client's wish. Anti-corrosion protection system on steel surfaces which are not fully covered by concrete and are inside the zone where the carbonation may occur, are protected with layers of total thickness at least 260 µm.

Picture 9. Metallization process

Transportation

Expansion joints, whose length is larger than 13 m, need to be shipped by an oversize cargo, what means rise in total cost of shipping. However, it is possible to manufacture and deliver expansion joints with length up to 35 meters.

On client's request, long expansion joints might be divided into shorter parts and prepared to perform welding in-situ to obtain a continuous, watertight profile on the whole breadth of the bridge structure. Normally, a single cargo consists of 8 single-seal or 4 double-seal expansion joints.profileer.



Picture 10. Expansion joints equipped with cover plates

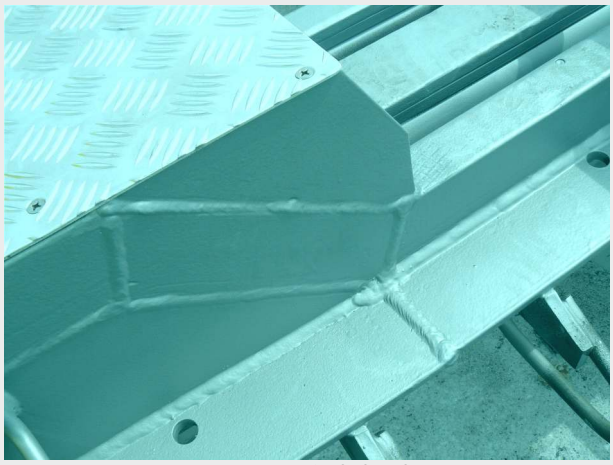
Optional equipment

On Client's request, expansion joint might be optionally equipped with sealing profiles with inlets, which would be responsible for draining off the water to the drainage system.

NOTE sealing profiles with inlets require more frequent maintenance and cleaning. Obstructed inlets can retain water on the level of road surface, which will cause expiration of warranty.

Additionally, expansion joint might have extra silencing membrane, which is mounted to its lower elements, under the road surface level. The membrane reduces the level of noise under the superstructure, which is emitted due to traffic.

It is possible to use supplemental protection on the pavements and the cornices by mounting covering plates made of aluminum or stainless steel. Moreover, it is possible to adjoin formwork to lower L-profiles which helps pouring and compacting concrete in the area of the recesses under the edge profiles of expansion joint.



Picture 11. Curb detail

Installation

The expansion joints might be installed in a bridge structure in an easy and quick way provided that the recesses are properly prepared. This is possible due to a simple construction of them and do not affect progress in the subsequent and simultaneous works.

In bridge superstructures made of concrete (including prestressed and composite steel-concrete with concrete deck) the expansion joints is situated axially in the expansion gap. Then it is leveled to adjust to the elevation of the designed road surface and subsequently concrete is casted into the previously prepared recess by pouring the anchoring loops, which stiffens the connection of expansion joint.

In bridge structures whose superstructure is made of steel, the installation has to be divided into two stages. Firstly, the edge profile "F" is welded to the special cantilevers joined to the superstructure (this can be done in the steel construction factory or on site) and then, in second stage, the edge profiles, which are to be mounted in the abutment, are adjusted to the designed elevation of road and to previously welded profiles. Then the anchoring loops are poured by concrete.

When necessary, another non-typical solution of installation might be reconciled individually on Client's request.

Picture 12. Installation of modular expansion joint

Picture 13. IInstallation of single-seal expansion joint

In case of renovation of bridge structures or when traffic management plan requires specific means, expansion joints might be installed in a few parts. However, it is not advised to perform joining modular expansion joints on site.

Picture 14. Single-seal expansion joint after installation

Maintenance

Modular expansion joints have to be properly upkept and maintained during their lifetime, which would ensure required durability. It is recommended to clean the sealing profile at least twice a year, firstly after winter and secondly after summer. In case of sealing profiles with inlets, they must be cleaned at least fourfold (4 times) a year. Proper service and keeping sealing profiles clean protects them against accidental damages and enlarges durability.

Additional control should be carried out over:

- noise-reduction plates (if applicable)
- silencing membranes (if applicable)
- folding trellis linkage (in B2W modular expansion joints)
- supporting traverse coupled with its bearings (in B2NS and B2NN modular expansion joints)

After each control, there should be drawn up a report, which should be brought to the notice of the manufacturer afterwards. Neglecting the maintenance and service will cause the loss of manufacturer's warranty.

Natural effect of exploitation is wearing of rubber elements and anti-corrosion coating. It shall not be qualified as a defect of the product.

PART 3 - B2P finger expansion joints

Construction

Finger joints consist of a few segments (finger plates) made of steel and located across the road surface. The opposite cantilever segments interrelate owing to specially designed comb-like shape of plates. This shape allows for smooth, quiet and pleasant transition of vehicles over the expansion gap. The elements are flush with the running surface.

Underneath the cantilever segments the draining watertight membrane (gutter) is installed. The membrane is equipped with inlet (draining pipe) with diameter of 200 mm, which is connected to the drainage system of the bridge structure. It allows the water to be drained off quickly and easily. Due to the location of the membrane there is no risk that water would disturb the drivers of vehicles.

The draining pipe might be located under the pavements, which is useful in order to maintain and inspect the inlet and drainage without disturbing the road traffic.

Materials

Table 8

Part	Material	Standard
Finger plates	S355J2	EN 10025-2
Anchoring bolts	class 10.9	ISO 898-1
Watertight membrane	EPDM	see Table 9

Steel parts have material attests which show the conformity with standard EN 10025-2.

Draining gutter (elastomeric membrane) fulfills the requirements tabulated in the Table 9.

Table 9

Parameter	Standard	Result	Unit
Shore hardness (durometer type A)	ISO 868	60±5	°Sh A
Tensile strength	ISO 37	≥ 7	MPa
Minimum elongation at break	ISO 37	≥ 300	%
Resistance to ageing in air, temperature 70 °C during 168-hour test, change of value of hardness Shore, durometer type A	ISO 188	+10	°Sh A

Movements

Finger joints are recommended to be used in the bridge structures in which designed movements of the edge of a deck range from 100 to 800 mm (Table 10). Moreover, the geometry of finger plates allows to compensate transversal movements up to ±8 mm.

Advantages

B2P finger joints show the best features in the field of noise muffling in comparison with other types of expansion joints which compensate the same designed movements of a bridge structure. Their dedicated usage should be considered in the bridge structures which must satisfy strict requirements of low-noise emission. Thanks to its construction, no additional elements need to be used to reduce the emission of noise, neither in the level of road surface nor underneath the expansion joint. The construction provides silent transition of road traffic itself. The finger plates have width of 1 meter and might be individually designed and installed in every type and every geometry of the road cross-section.

There is a possibility to use this kind of expansion joints in skewed and curved bridges, but it must be individually designed to enable movements along the main axis of movements. Coupled with properly designed layout of bearings finger joints might be used in every kind of bridge structure regardless of the geometry of it.

In case of possible remedial works, owing to their segmental construction, there is no need to occupy more than one traffic lane because each segment of the expansion joint as well as the draining membrane might be substituted individually. This solution is highly convenient for public roads which carry high density road traffic as well as in routes in which passage of vehicles cannot be disrupted.

To anchor the segments smaller recesses are re-quired comparing to modular expansion joints for the same designed movements. Thanks to this, collisions with anchoring blocks in post-tensioned structures might be avoided and in composite steel-concrete structures the anchorage zone might be designed in more convenient way regardless of a thin concrete bridge deck.

Finger joints can be used in bridge structures subjected to the highest load of road traffic (incl. highways and expressways). This provides expected durability even though the expansion joint is subjected to heavy traffic and exploited intensively. Acc. to the tests conducted by RBRI in Warsaw the B2P expansion joints are resistant to periodical dynamic loads. Total number of tested cycles reached 10 million, which exceeds the most strict requirements of ETAG n° 032 (see part 6, table 6.P.1).

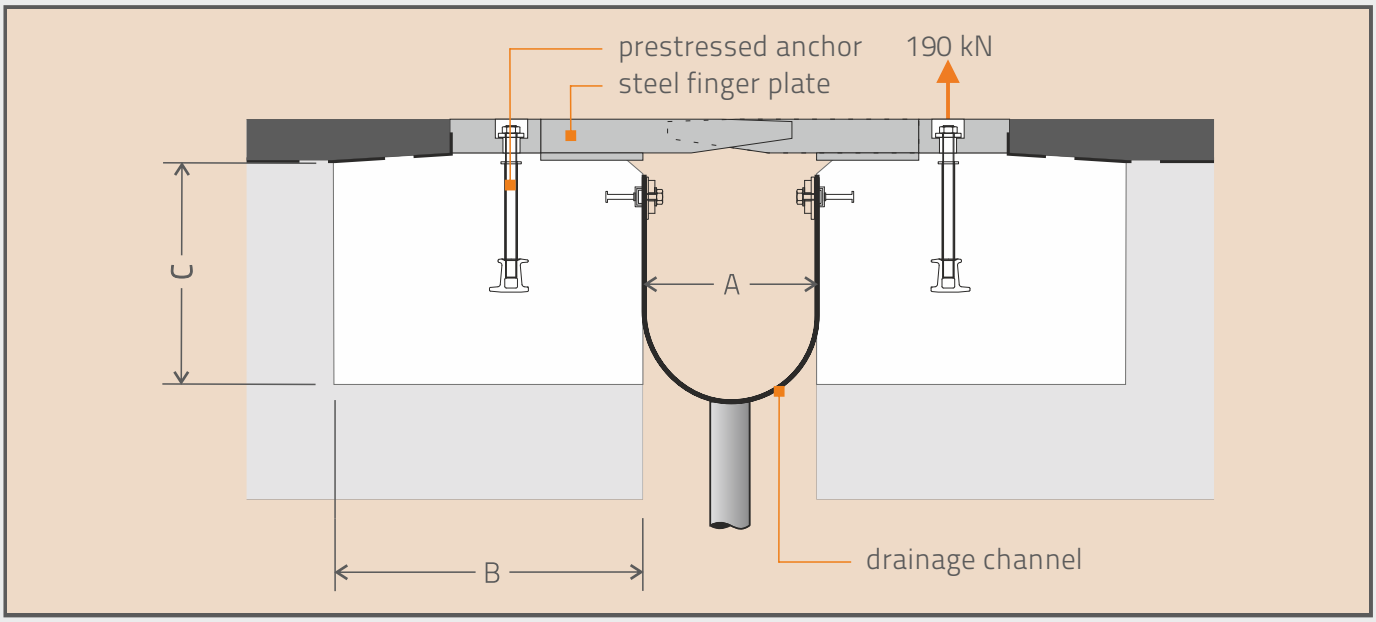


Fig. 6. Cross section of the finger joint

Table 10

Type	Nominal movements [mm]	Dimensions of the expansion joint [mm]		Dimensions of recess in structure [mm]		Dimensions of finger plates [mm]		
		A_{min}	A_{max}	B	C	W	H	L
B2P 180	±90	50	230	250	350	305	50	992
B2P 200	±100	50	250	250	350	315	50	992
B2P 250	±125	50	300	270	350	380	50	992
B2P 300	±150	50	350	310	350	445	50	992
B2P 350	±175	50	400	340	350	500	60	992
B2P 400	±200	50	450	390	350	570	65	992
B2P 450	±225	50	500	420	350	630	65	992
B2P 500	±250	50	550	460	350	695	70	992
B2P 550	±275	50	600	500	350	755	75	992
B2P 600	±300	50	650	530	400	810	80	992
B2P 650	±325	50	700	550	400	870	90	992
B2P 700	±350	50	750	580	400	930	100	992
B2P 750	±375	50	800	600	400	990	110	992
B2P 800	±400	50	850	650	400	1055	120	992

Anti-corrosion protection system

Expansion joints made of alloy steel are protected against corrosion in two optional ways:

- with metallization and paint coatings – where the raw steel is covered with metallic (zinc) spraying and afterwards with one or several paint coatings, which act as a sealer
- with paint coatings – where the raw steel is covered with one or several paint coatings

In both cases B2 company bases on reputable products of such companies as Tikkurila or Sika. The finger joints manufactured by B2 are protected against corrosion in categories C3, C4 and C5-M acc. to EN 12944-2. The thickness of each layer might be individually customized according to the Client's requirements. Anti-corrosion protection system on steel surfaces which are not fully covered by concrete and are inside the zone where the carbonation may occur, are protected with layers of total thickness at least 80 µm.

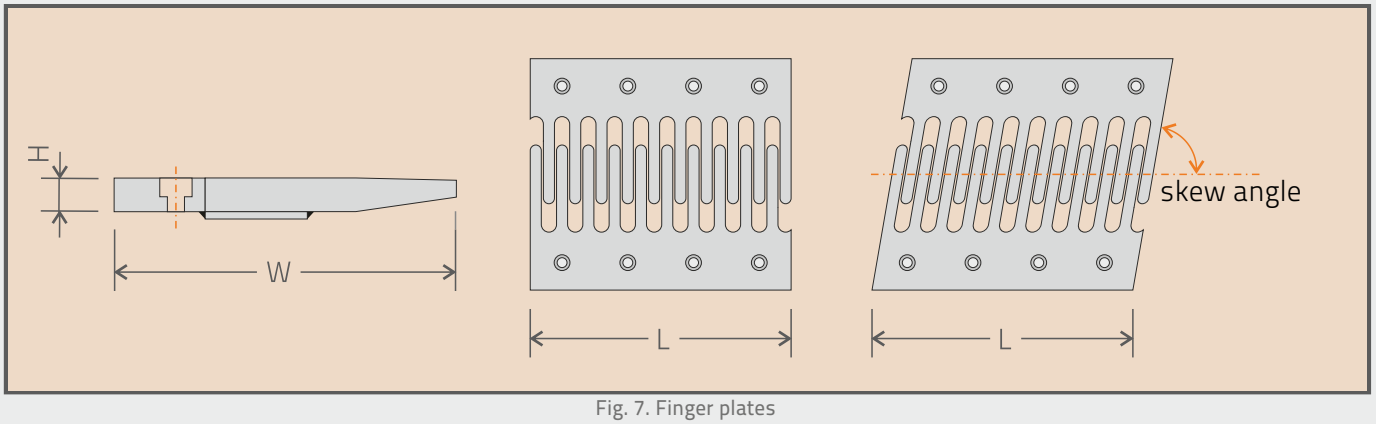


Fig. 7. Finger plates

Transportation

B2P expansion joints might be easily transported on pallets due to their segmental construction. No oversize cargo nor heavy lifts/cranes are therefore required to transport and unload the items. Moreover being packed on pallets they might be easily stored in warehouses on building site which enables better protection until their installation.

Installation

Concrete which is to be poured into the recess (in order to firmly stabilize the anchorage) should be at least in class as the bridge deck and should not be lower than C25/30. Anchorage might be also casted with polymer cement concrete (PCC), which speeds up the subsequent works. B2P expansion joints might also be easily installed in steel structures.

Installation stages:

1) Cleaning a recess
2) Preparing a formwork to cast concrete under the segments of finger joints
3) Preliminary installation of the segments taking into account temperature of installation (see T_0 in EN 1991-1-5)
4) Adjustment of anchorage and reinforcing the recess zone
5) Concreting the recess
6) Installation of draining membrane
7) Anti-corrosion protection of the concrete
8) Final installation of the segments and prestressing the bolts with force 190 kN

Installation must be performed by trained and experienced team.

Maintenance

Finger joints have to be properly maintained during their lifetime, which would ensure required durability. It is recommended to clean the draining membrane and draining pipe at least fourfold a year, after winter and after summer. Proper service and keeping sealing profiles clean protect them against accidental damages and enlarge durability. Additional control should be carried out over the fixation bolts.

After each control, there should be drawn up a report, which should be brought to the notice of the manufacturer afterwards. Neglecting the maintenance and service will cause the loss of manufacturer's warranty.

NOTE Natural effect of exploitation is wearing of rubber elements and anti-corrosion coating. It shall not be qualified as a defect of the product.

Picture 16. Preliminary installation

Picture 16. Concreting the recess

Picture 17. Installation of draining membrane

Picture 18. Bolts prestressing

PART 4 - Comparision

For small movements (±40 mm, ±50 mm) the most adequate for economic as well as for utilizing reasons is using single-seal expansion joints. Alongside with the growth of designed movements of expansion joints the advantage of finger over modular expansion joints becomes more visible. For large movements (> ±100 mm) finger joints are cheaper as material itself as well as taking into account further maintenance coupled with better acoustic parameters and technical solution in case of anchoring them in the bridge structure.

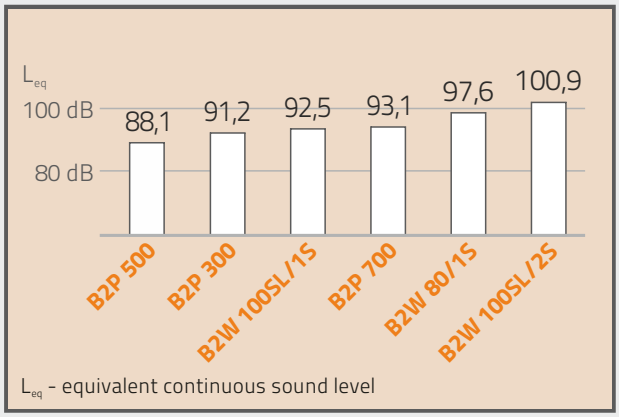


Fig. 8. Difference in emission of noise generated by traffic over different types of expansion joints

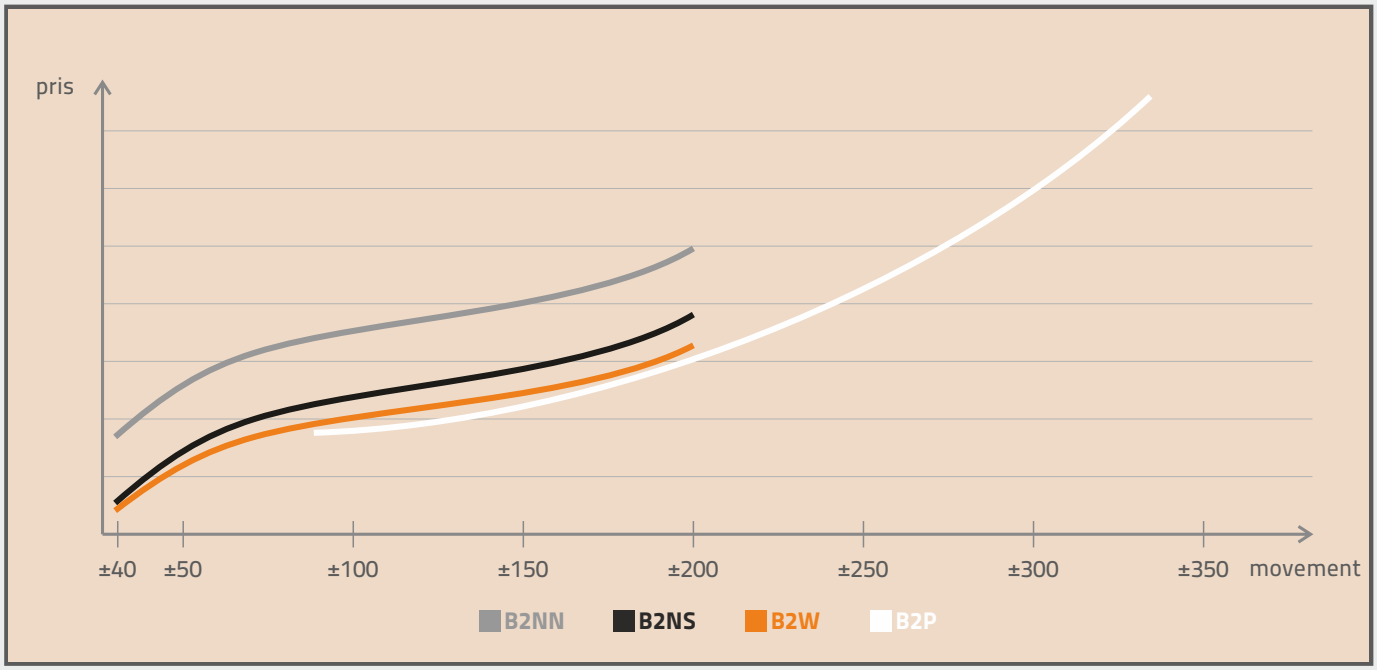


Fig. 9. Price of finger and modular expansion joints

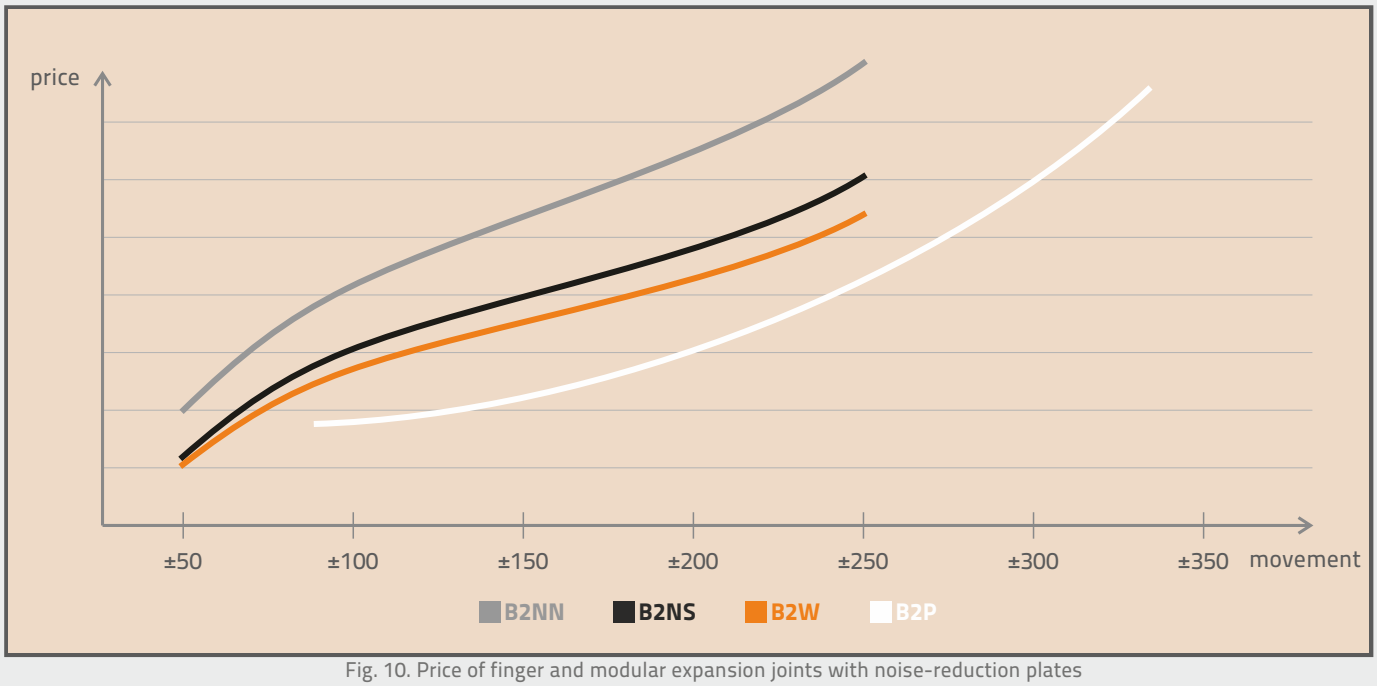
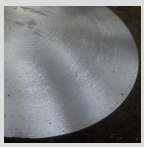
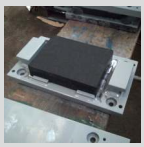


Fig. 10. Price of finger and modular expansion joints with noise-reduction plates

B2 bgrupa




B2 reference projects

A4 highway from Tarnów to Rzeszów (Poland)
B2W joints with movement from ±40mm to ±100mm
B2P joints with movement from ±150mm to ±325mm

S11 expressway, West Ring Road, Poznań (Poland)
B2NN joints with movement ±50 mm

Mazowiecki Bridge, Rzeszów (Poland)
B2P joints with movement ±175 mm

Central expressway, Gliwice (Poland)
B2W joints with movement from ±40 mm to ±200 mm

S7 expressway, Ostróda Ring Road (Poland)
B2P joints with movement from ±150 mm to ±200 mm
B2NN joints with movement ±100 mm

S8 expressway, Grota-Roweckiego Bridge, Warszawa (Poland)
B2P joints with movement from ±150 mm to ±250 mm
B2W joints with movement ±40 mm

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