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General Part

Technical Assessment Body issuing the European Technical Assessment: Itecons - Instituto de Investigação e Desenvolvimento Tecnológico para a Construção, Energia, Ambiente e Sustentabilidade	
Trade name of the construction product	Projoint Plus 4010 Projoint Plus 4010 DP2 Projoint Plus 3010 Projoint Plus 3010 DP2 Projoint Plus S Projoint Plus S DP2
Product family to which the construction product belongs	Structural Metallic Products and Ancillaries Product area code:20
Manufacturer	JRP Flooring Products, S.A. Rua dos Covões, Pedrome 2495-183 Santa Catarina da Serra Portugal
Manufacturing plant	JRP Flooring Products, S.A Civil, S.A. Rua dos Covões, Pedrome 2495-183 Santa Catarina da Serra Portugal
This European Technical Assessment contains	38 pages including 2 Annexes which form an integral part of the assessment
This European Technical Assessment is issued in accordance with regulation (EU) No 305/2011, on the basis of	EAD 200089-00-0302 *In-situ Concrete Slab Permanent Joint Former*

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Specific parts

1. Technical description of the product

In-situ concrete slab permanent joint formers **Projoint Plus 4010, Projoint Plus 4010 DP2, Projoint Plus 3010, Projoint Plus 3010 DP2, Projoint Plus S, Projoint Plus S DP2** are leave-in-place formwork and joint systems supplied in mild, stainless, galvanized steel or a combination of these materials.

These joints, also referred to in this document as Projoint joints, provide continuity of reinforcement for ground supported slabs and transfer the loads through the edges of each panel of the slab to another. In addition, these joints will provide protection to slab edges and ensure continuing serviceability of the ground floor slab.

Projoint joints are composed of:

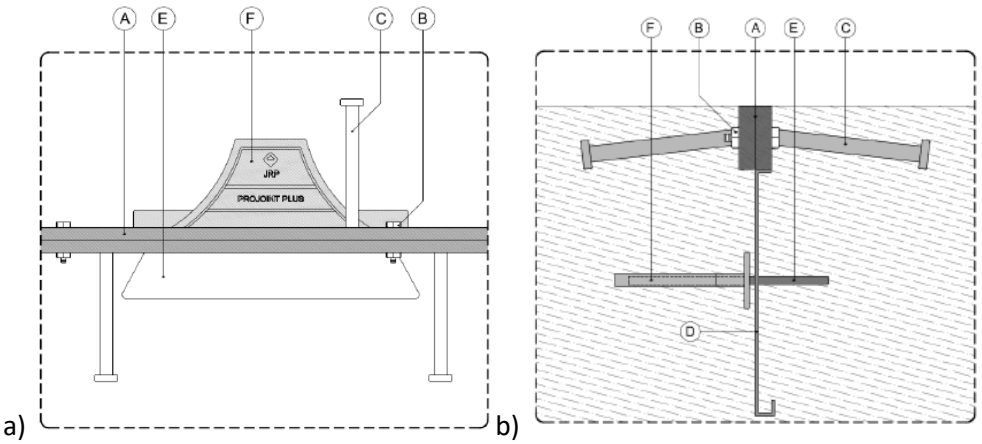
- Slab edge protection to protect edges from impacts;
- Concrete anchorage provided by shear studs;
- Divider plate to physically constrains the concrete during the casting;
- Dowels for load transfer mechanisms which are welded to the divider plate.

Projoint Plus 4010, Projoint Plus 4010 DP2 6mm and Projoint Plus 4010 DP2 8mm

Projoint Plus 4010, Projoint Plus 4010 DP2 6mm and Projoint Plus 4010 DP2 8mm are composed of the following elements:

- Calibrated double bar (A) with dimensions of 40x10 mm in S235JR steel or stainless steel or galvanized steel fixed to each other by aluminium rivets (B);
- Metallic shear connectors (C) 100 x 10 mm, automated welded to the side;
- Formwork divider plate (D) in steel, 1.5 mm minimum thickness, with variable height, welded to the lower part of one of the metal bars, with double bending of the lower face and simple bending of the upper face;
- Load transfer system composed by metallic plats (E). The load transfer system of Projoint Plus has variable geometry with 6 mm thick. In the case of Projoint Plus DP2 6mm and Projoint Plus DP2 8mm, the load transfer system has prismatic geometry with 6 mm thick or 8 mm thick, respectively. The load transfer system of the joints is made of S275JR steel or higher, eccentrically welded, spaced 500 mm apart and is covered with plastic sleeves (F).

Further information about these joints is given in Annex A. Figure 1 shows the schematic drawings of the joints described above.



a) b)

Figure 1: a) Schematic drawing of the top view of Projoint Plus 4010; b) Schematic drawing of the cross-section view of Projoint Plus 4010, Projoint Plus 4010 DP2 6mm and Projoint Plus 4010 DP2 8mm

Projoint Plus 3010, Projoint Plus 3010 DP2 6mm and Projoint Plus 3010 DP2 8mm

Projoint Plus 3010, Projoint Plus 3010 DP2 6mm, Projoint Plus 3010 DP2 8mm are composed of the following elements:

- Calibrated double bar (A) with dimensions of 30x10 mm in S235JR steel or stainless steel or galvanized steel fixed to each other by aluminium rivets or nylon fasteners (B);
- Metallic shear connectors (C) 100 x 10 mm, automated welded to the side;
- Formwork divider plate (D) in steel, 1.5 mm minimum thickness, with variable height, welded to the lower part of one of the metal bars, with double bending of the lower face and simple bending of the upper face;
- Load transfer system composed by metallic plats (E). The load transfer system of Projoint Plus has variable geometry with 6 mm thick. In the case of Projoint Plus DP2 6mm and Projoint Plus DP2 8mm, the load transfer system has prismatic geometry with 6 mm thick or 8 mm thick, respectively. The load transfer system of the joints is made of S275JR steel or higher, eccentrically welded, spaced 500 mm apart and is covered with plastic sleeves (F).

Further information about these joints is given in Annex A. Figure 2 shows the schematic drawings of the joints described above.

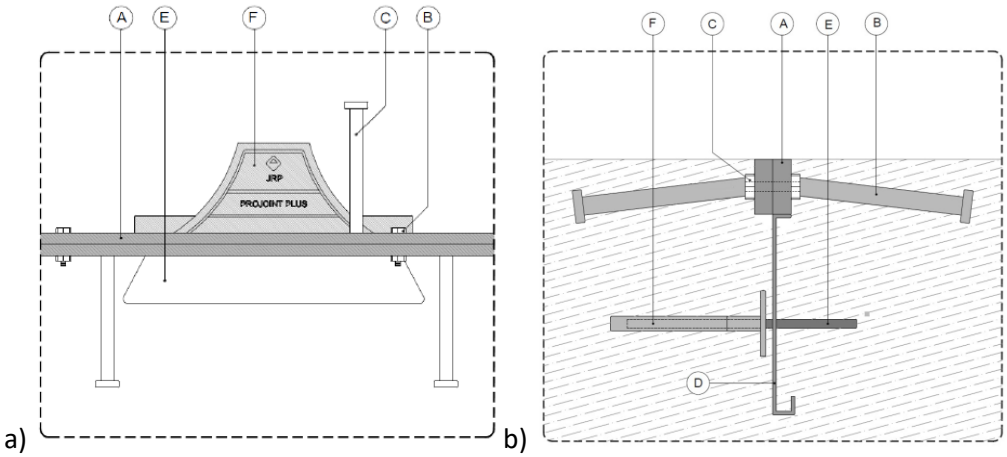


Figure 2: a) Schematic drawing of the top view of Projoint Plus 3010; b) Schematic drawing of the cross-section view of the Projoint Plus 3010, Projoint Plus 3010 DP2 6mm and Projoint Plus 3010 DP2 8mm

Projoint Plus S, Projoint Plus S DP2 6mm, Projoint Plus S DP2 8mm

Projoint Plus, Projoint Plus S DP2 6mm, Projoint Plus S DP2 8mm are composed of the following elements:

- Calibrated double bar (A) with dimensions of 30x10 mm in S235JR steel fixed to each other by aluminium rivets or nylon fasteners (C), with metallic shear connectors (B) TRW KB 100 x 10 mm, welded to the side;
- Smooth transition system (D) between adjacent panels composed of a plate S235JR with dimensions of 50x10 mm, cut sinusoidally with the height of the swell defined according to the predictability of the opening of joints, to ensure that this plate always slides and supports above the two sidebars;
- Formwork divider plate (E) in steel, 1.5 mm minimum thickness, with variable height, welded to the lower part of one of the metal bars, with double bending of the lower face and simple bending of the upper face;
- Load transfer system composed by metallic plats (F). The load transfer system of Projoint Plus has variable geometry with 6 mm thick. In the case of Projoint Plus DP2 6 mm and Projoint Plus DP2

8 mm, the load transfer system has prismatic geometry with 6 mm thick or 8 mm thick, respectively. The load transfer system of the joints is made of S275JR steel or higher, eccentrically welded, spaced 500 mm apart and is covered with plastic sleeves (G).

Further information about these joints is given in Annex A. Figure 3 shows the schematic drawings of the joints described above.

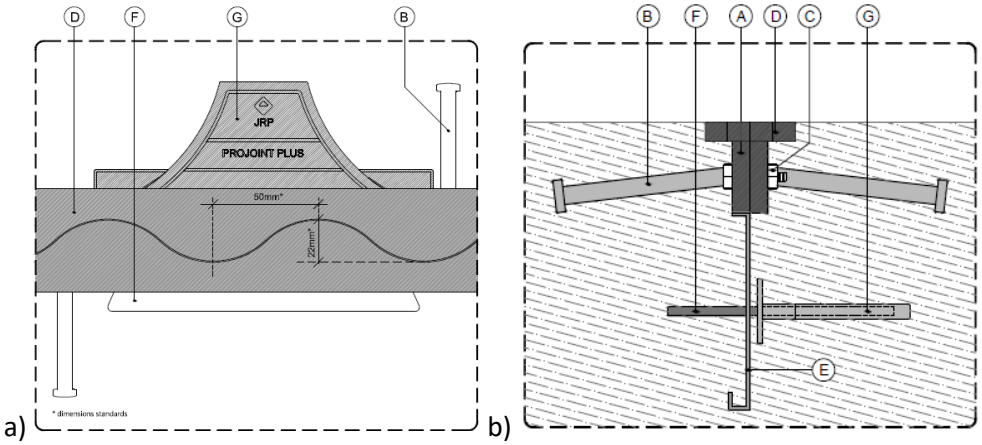


Figure 3: a) Schematic drawing of the top view of Projoint Plus S; b) Schematic drawing of the cross-section view of the Projoint Plus S, Projoint Plus DP2 6mm and Projoint Plus DP2 8mm

The components of the joints are presented in Table 1.

Table 1: Components of the joints

Component		Material
Calibrated bar	Steel	EN 10277-2 S235JR
	Stainless steel	304/316 AISI
	Galvanized steel	EN 10277 S235 JR Galvanization EN ISO 1461
Shear connectors		EN ISO 13918 S235J2+C450
Load transfer system		S275JR or higher
Plastic sleeve		Polypropylene
Divide plate		EN 10130 DC01 or EN 10111 DD11

2. Specification of the intended use(s) in accordance with the applicable European Assessment Document (hereinafter EAD)

2.1. Intended use

In-situ concrete slab permanent joint formers are leave-in-place formwork that provide continuity of reinforcement in ground supported slabs and transfer the loads from one slab to the next if required, providing a continuum in slab deformation to the required level. In addition, the joints will provide protection to slab edges and ensure continuous serviceability of the ground floor slab.

Slab edges are vulnerable to damage caused by the transit of materials handling equipment, with wider joints being more susceptible. The small hard wheels of pallet trucks and similar equipment are particularly aggressive.

The number and type of joints in a floor will depend on the floor construction method and its design. The chosen method should consider the intended use of the floor, among other factors.

JRP® joints are free-movement joints, designed to provide a minimum restraint to horizontal movements caused by drying shrinkage and temperature changes in the slab, while restricting relative vertical movement.

The provisions made in this European Technical Assessment are based on an assumed working life of 50 years as minimum according to the EAD, provided that the conditions lay down for the installation, packaging, transport and storage as well as appropriate use, maintenance and repair are met. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a mean for choosing the right product in relation to the expected economically reasonable working life of the works.

3. Performance of the product and references to the methods used for its assessment

The assessment of the Projoint joints according to the Basic Work Requirements (BWR) was carried out in compliance with EAD 200089-00-0302.

3.1. Performance of the assembled system (kit)

3.1.1. Mechanical resistance and stability (BWR 1)

3.1.1.1. Load transfer capacity

The load-transfer capacity depends mainly on the mechanism of the joint. Sub-base support may have some influence, but it is not considered in the design process. Joint mechanisms can be composed of round or square dowel bars, or plate dowels.

The transit of material handling equipment will cause some relative deflection across joints; hence, they should be designed to reduce such deflection to a negligible amount.

The load transfer capacity of the joints depends on the compressive strength of concrete and the geometry and strength of the dowels at yield. Their load transfer capacity was determined according to annex A of EAD 200089-00-0302 and the results are presented in Annex B of this ETA.

3.1.1.2. Durability

The durability of the product depends on the durability of the materials used. The part of the floor in which the joint systems are intended to be installed or applied must be assessed according to their chemical composition, thickness of material layers, intended use, concrete cover thickness and the environmental exposure to which they are subject. To assess the durability, the following cases must be considered:

- Stainless steel products can be considered fit for purpose from a durability aspect;
- Galvanized or mild steel elements with a minimum 30 mm concrete cover can be considered fit for purpose from durability aspect;
- Galvanized steel must have a minimum of 25 µm galvanized coating if not covered by a minimum of 30 mm concrete cover for floors exposed to frequently wet or corrosive conditions;
- Galvanized steel must have a minimum of 85 µm galvanized coating if not covered by a minimum of 30 mm concrete cover for continuously wet floors.

If all products assessed comply with these requirements, no further investigation regarding durability is required.

3.1.1.3. Dimensions, tolerances on dimensions and shape

Dimensional tolerances of Projoint joints steel components are ± 0.5 mm, as established by the production control.

The tolerances for angles between the systems components, as established in the production control, are ± 0.5°.

3.1.2. Safety in case of fire (BWR 2)

Not relevant.

3.1.3. Hygiene, health and the environment (BWR 3)

Not relevant.

3.1.4. Safety and accessibility in use (BWR 4)

Not relevant.

3.1.5. Protection against noise (BWR 5)

Not relevant.

3.1.6. Energy economy and heat retention (BWR 6)

3.1.6.1. Thermal performance

The joint systems may increase heat loss (thermal bridging) in external elements and junctions. The heat loss associated with elements (*U-values*) and junctions (*Ψ-values*) were determined in accordance with EN ISO 10211:2017 and are presented in Table 2 and Table 3.

Table 2: Thermal resistance of the slab (without R_{si} and R_{se})

Slab height (mm)	R_{slab} (m².K /W)
100	0.04
130	0.05
150	0.06
170	0.07
200	0.08

Table 3: *Ψ*-values of the joints

Slab height (mm)	*Ψ-values* (W/m)					
	Projoint Plus 3010, Projoint Plus 3010 DP2 6mm and Projoint Plus 3010 DP2 8mm		Projoint Plus 4010, Projoint Plus 4010 DP2 6mm and PROJOINT 40x10 Plus DP2 8mm		Projoint Plus S, Projoint Plus S DP2 6mm and Projoint Plus S DP2 8mm	
	Steel	Stainless steel	Steel	Stainless steel	Steel	Stainless steel
100	0.022	0.019	0.025	0.021	0.033	0.020
130	0.025	0.023	0.029	0.025	0.036	0.020
150	0.028	0.026	0.030	0.027	0.038	0.021
170	0.031	0.029	0.033	0.030	0.041	0.021
200	0.034	0.032	0.036	0.033	0.043	0.022

The heat conductivity (λ) of the materials considered in the calculation is presented in Table 4.

Table 4: Heat conductivity of the materials (λ)

Material	λ (W/(m.K))
Reinforced concrete (2400 kg/m^3)	2.5
Steel (7800 kg/m^3)	50
Stainless steel (AISI 304) (7900 kg/m^3)	17

3.1.6.2. Condensation risk

The joint systems may increase thermal bridging in external elements and junctions. If required, the risk of surface condensation for elements and junctions incorporating the systems must be determined by comparison of temperature factors, f_{Rsi}, (established in accordance with EN ISO 10211:2017) with the maximum temperature factor, $f_{Rsi,max}$ (established in accordance with EN ISO 13788:2012). Elements and/or junctions are acceptable when $f_{Rsi} > f_{Rsi,max}$. The temperature factor f_{Rsi} for the Projoints joints is presented in Table 5.

Table 5: f_{Rsi}-values

Slab height (mm)	f_{Rsi}-values (W/ºC.m)					
	Projoint Plus 3010, Projoint Plus 3010 DP2 6mm and Projoint Plus 3010 DP2 8mm		Projoint Plus 4010, Projoint Plus 4010 DP2 6mm and Projoint 4010 Plus DP2 8mm		Projoint Plus S, Projoint Plus S DP2 6mm and Projoint Plus S DP2 8mm	
	Steel	Stainless steel	Steel	Stainless steel	Steel	Stainless steel
100	0.272	0.278	0.266	0.275	0.267	0.282
130	0.301	0.307	0.307	0.309	0.296	0.314
150	0.319	0.325	0.314	0.322	0.314	0.334
170	0.337	0.343	0.332	0.340	0.332	0.352
200	0.362	0.368	0.357	0.365	0.358	0.379

3.1.7. Sustainable use of natural resources (BWR 7)

Not relevant.

4. Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

According to the Decision 1998/214/EC of European Commission as amended by the European Commission Decision 2001/596/EC, the system of assessment and verification of constancy of performance (see Annex V to Regulation (EU) No. 305/2011) is 2+.

5. Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

The ETA is issued on the basis of agreed data/information, deposited at Itecons, which identifies the product that has been assessed and judged. It is the manufacturer's responsibility to make sure that all those who use the construction product are appropriately informed of specific conditions laid down in this ETA.

Changes to the in-situ concrete slab permanent joint former or the components or their production process should be notified to the Itecons before the changes are introduced. Itecons will decide whether or not such changes affect the ETA and if so whether further assessment or alterations to the ETA shall be necessary.

Issued in Coimbra on 29.12.2022

By

Technical Assessment Unit of

Itecons – Instituto de Investigação e Desenvolvimento Tecnológico para a Construção, Energia, Ambiente e Sustentabilidade

Andreia Gil
Senior Official

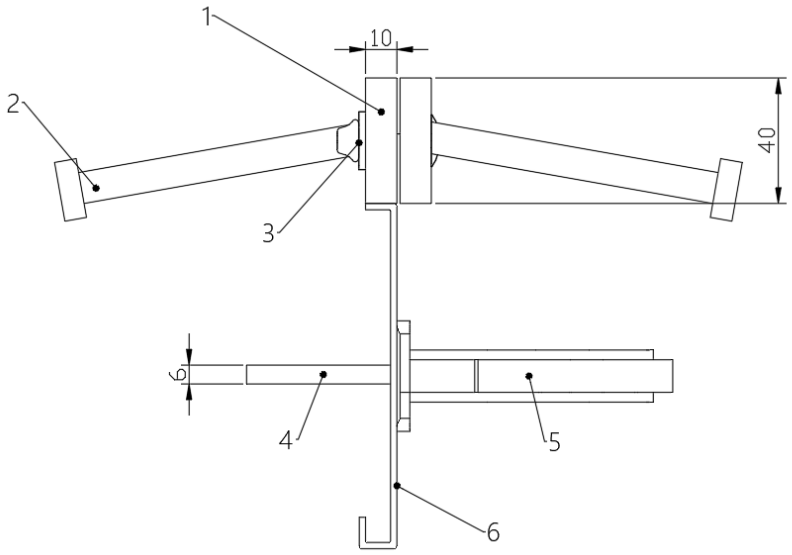
Validated document

(*Technical Assessment Unit Coordinator*) (Administration)

ANNEX A – TYPES of JOINT FORMERS

The details about the components of the joint former types are given in this section:

A1 – Projoint Plus 4010



1. Calibrated bar 40 mm x 10 mm
2. Shear studs
3. Connection system
4. Dowel – load transfer system
5. Dowel sleeve
6. Divide plate

Figure A1.1: Projoint Plus 4010 cross-section view

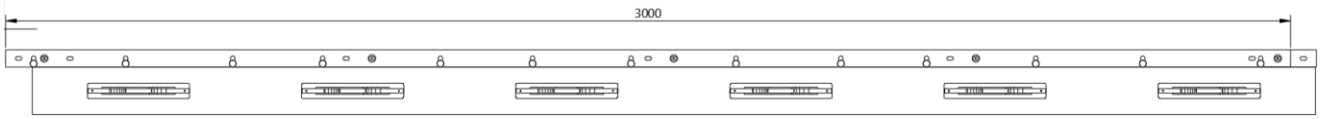


Figure A1.2: Projoint Plus 4010 front view

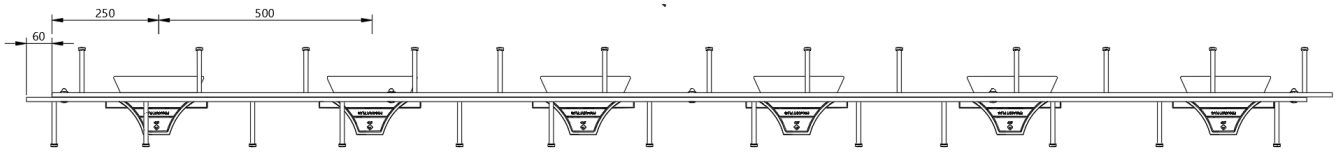


Figure A1.3: Projoint Plus 4010 top view

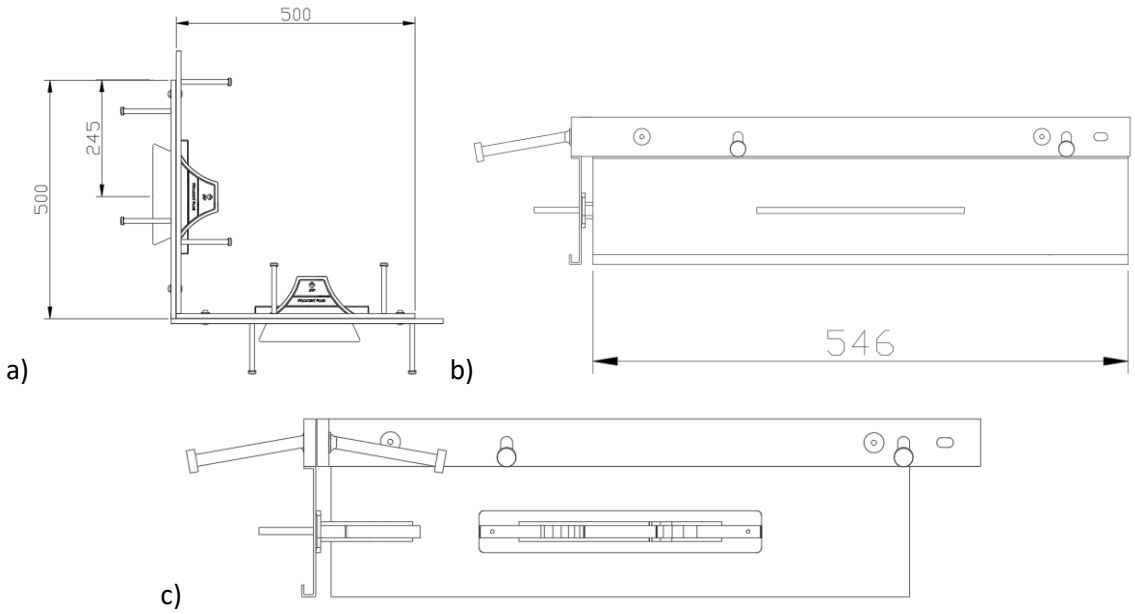


Figure A1.4: Projoint Plus 4010 L (corner) accessories: a) top plan view, b) front view and c) right-side view

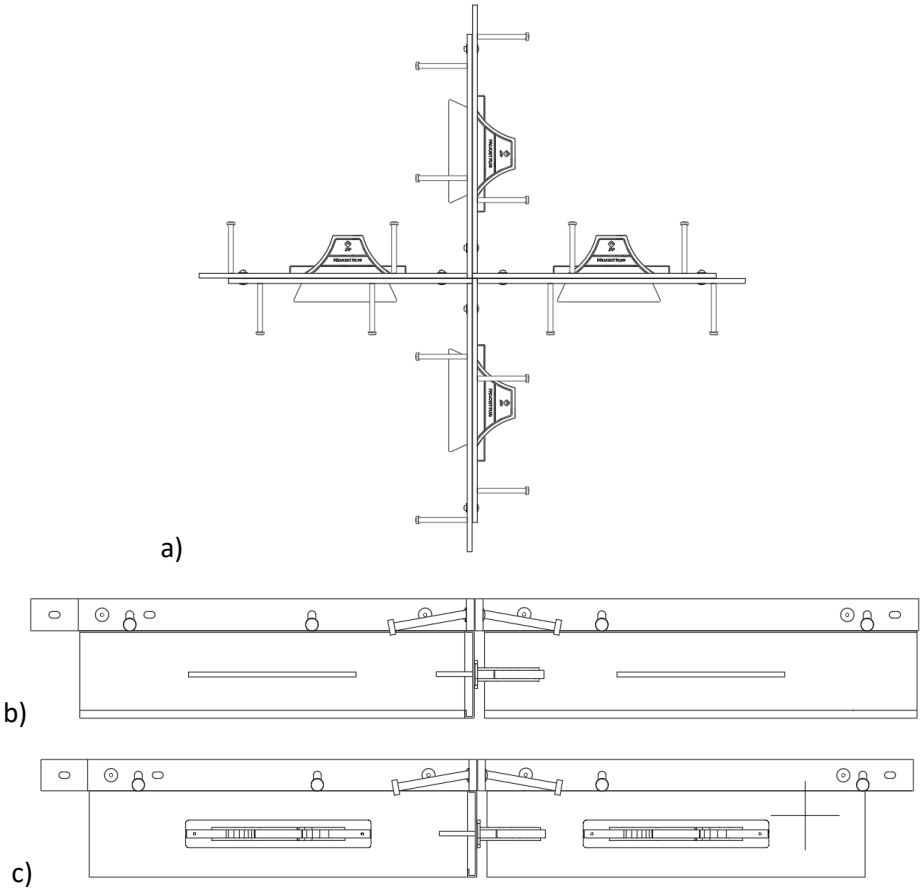


Figure A1.5: Projoint Plus 4010 X (four way) accessories: a) top plan view, b) right-side view and c) left-side view

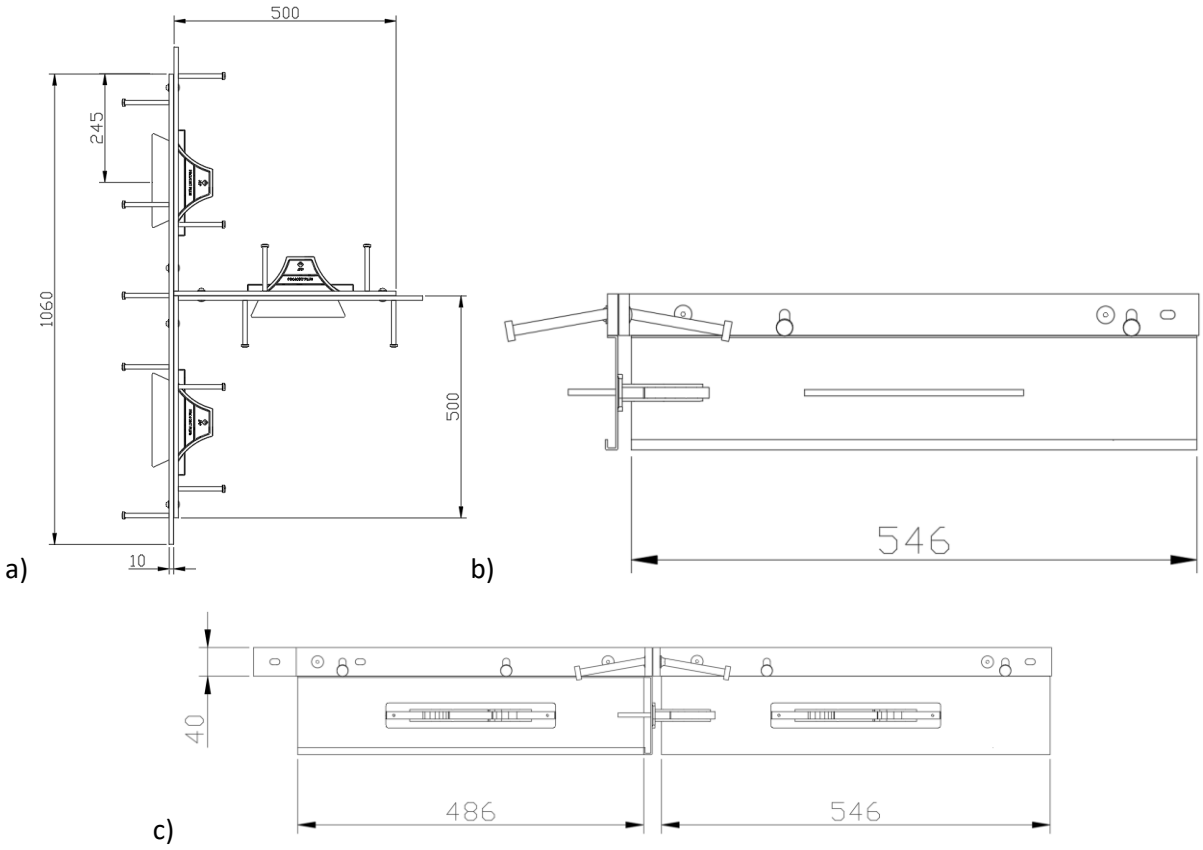
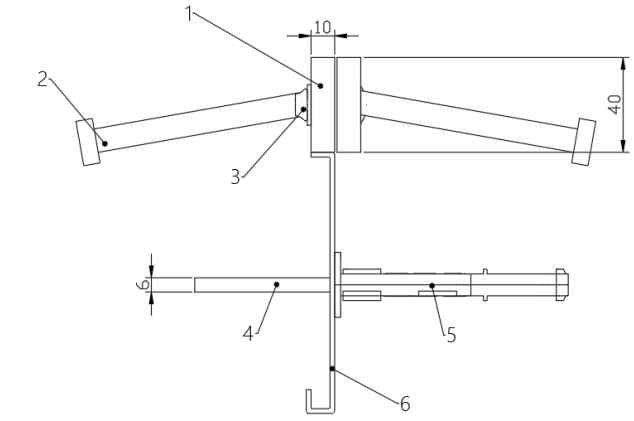
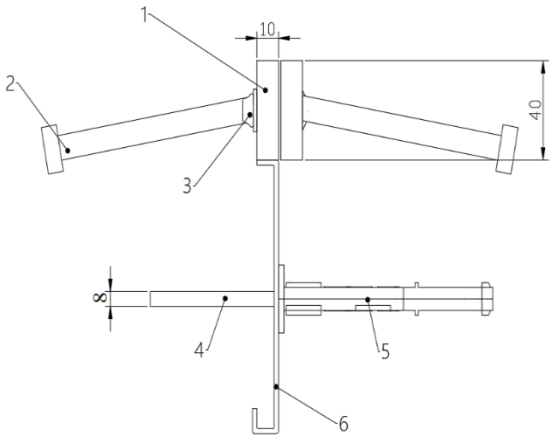


Figure A1.6: Projoint Plus 4010 T (tee) accessories: a) top plan view, b) front view and c) right-side view

A2 – Projoint Plus 4010 DP2 6mm and Projoint Plus 4010 DP2 8mm



a)



b)

1. Calibrated bar 40 mm x 10 mm
2. Shear studs
3. Connection system
4. Dowel – load transfer system
5. Dowel sleeve
6. Divide plate

Figure A2.1: a) Projoint Plus 4010 DP2 6mm cross-section view and b) Projoint Plus DP2 8mm cross-section view

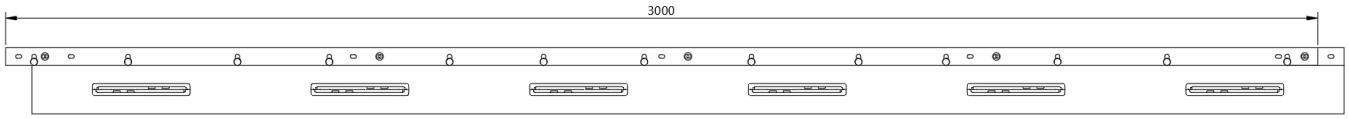


Figure A2.2: Projoint Plus 4010 DP2 6mm and Projoint Plus 4010 DP2 8mm front view

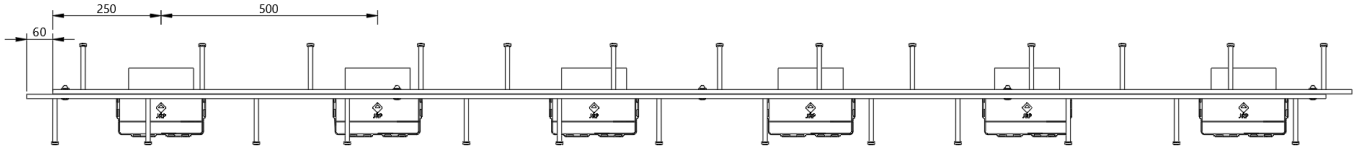


Figure A2.3: Projoint Plus 4010 DP2 6mm and Projoint Plus 4010 DP2 8mm top view

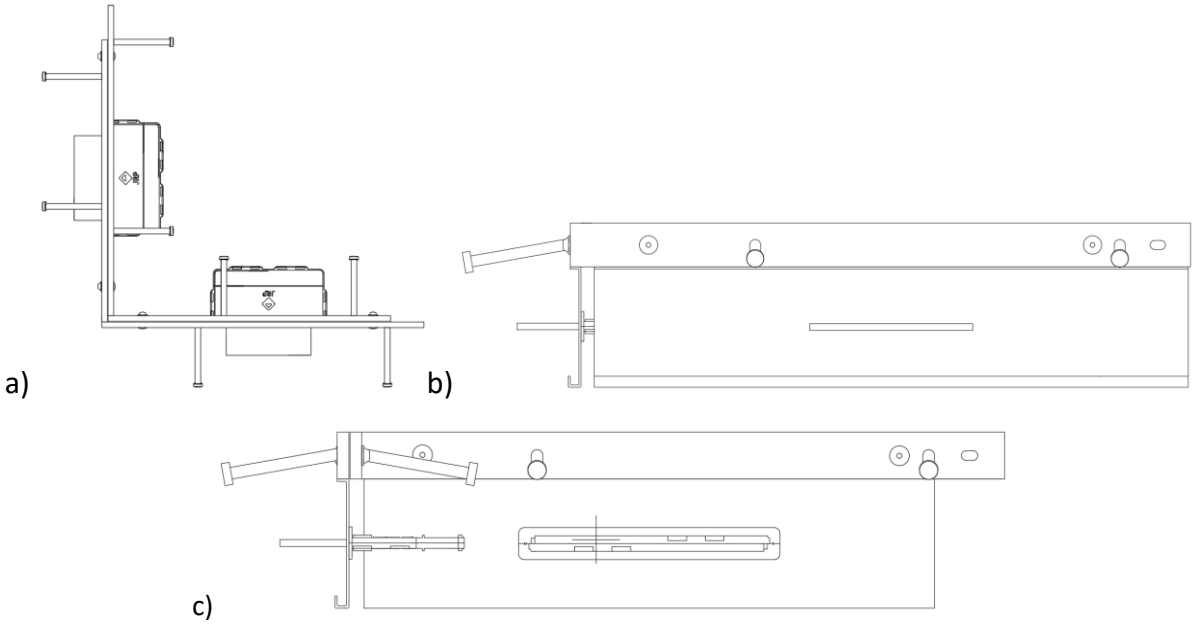


Figure A2.4: Projoint Plus 4010 DP2 6mm L (corner) and Projoint Plus 4010 DP2 8mm L (corner) accessories: a) top plan view, b) front view and c) right-side view

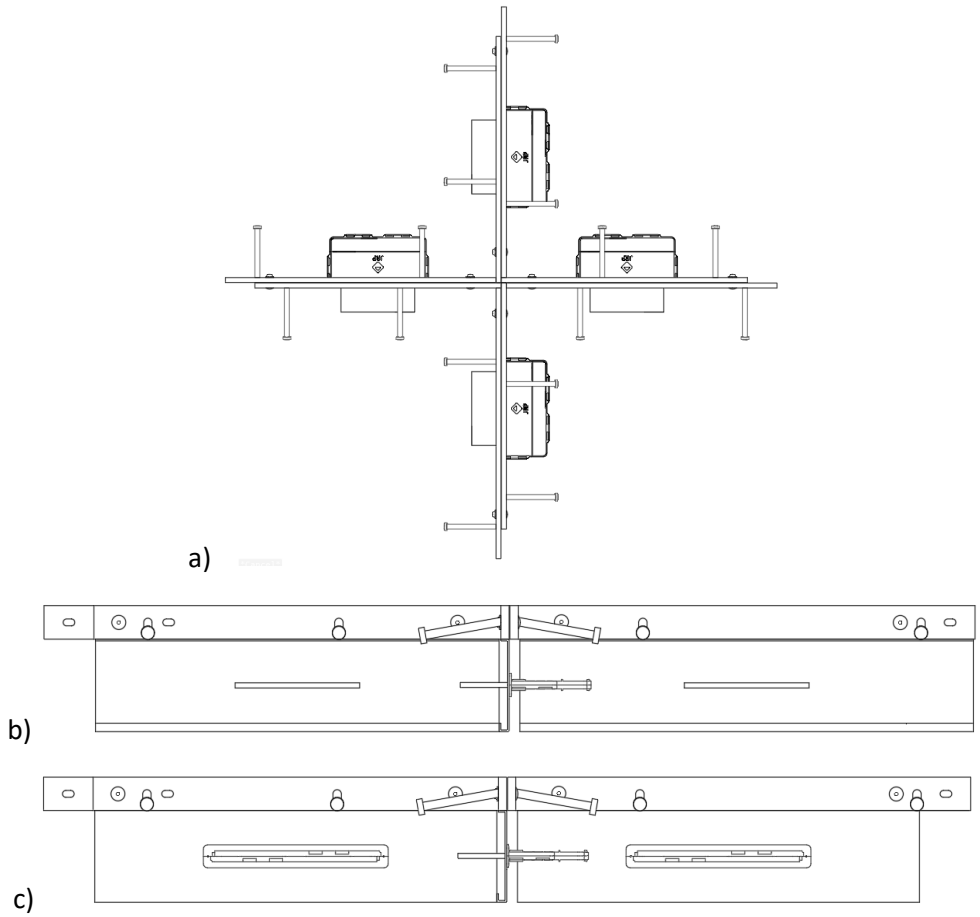


Figure A2.5: Projoint Plus 4010 DP2 6mm X (four way) and Projoint Plus 4010 DP2 8mm X (four way) accessories: a) top plan view, b) right-side view and c) left-side view

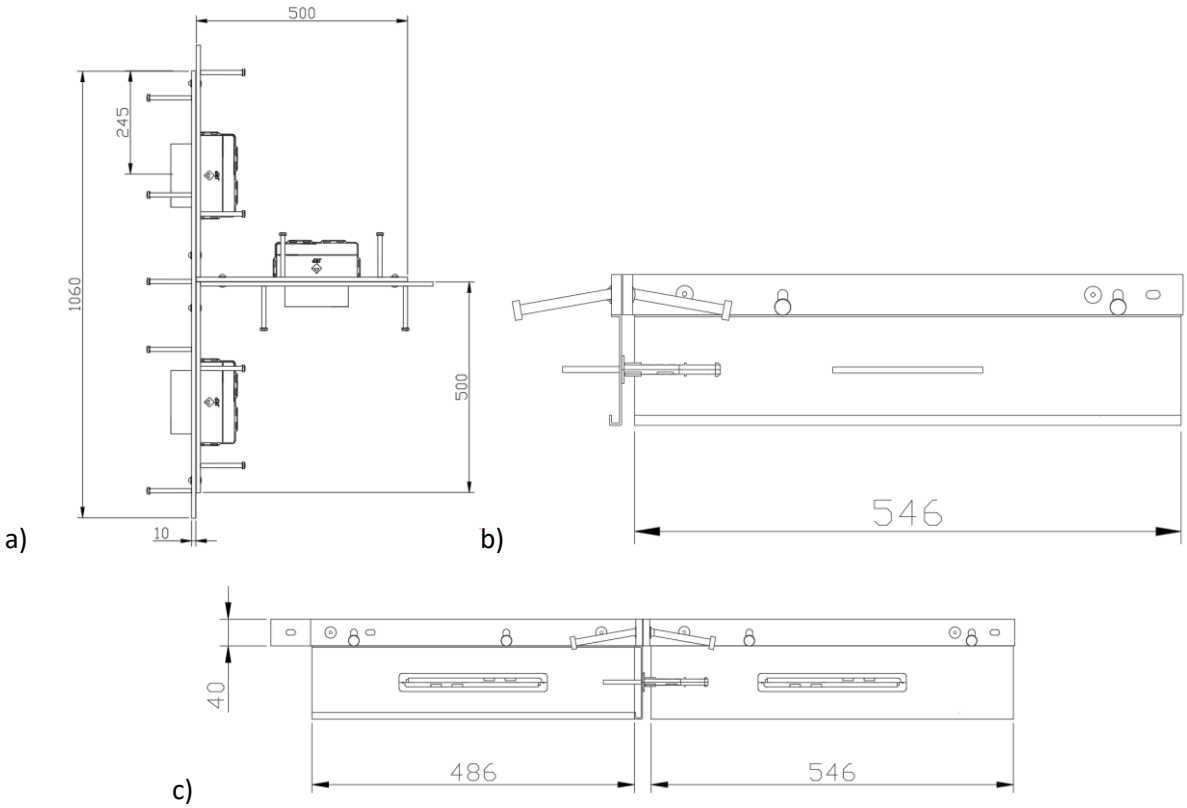
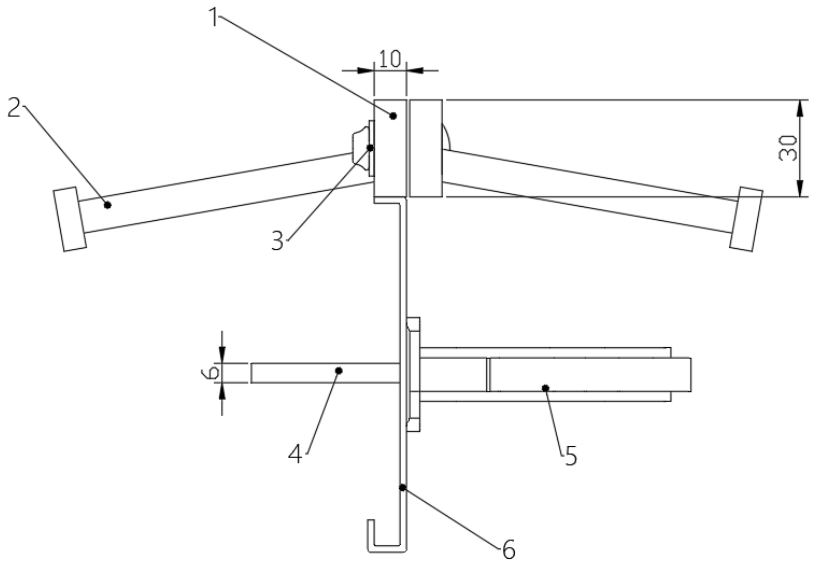


Figure A2.6: Projoint Plus 4010 DP2 6mm T (tee) and Projoint Plus 4010 DP2 8mm T (tee) accessories: a) top plan view, b) front view and c) right-side view

A3 – Projoint Plus 3010



1. Calibrated bar 30 mm x 10 mm
2. Shear studs
3. Connection system
4. Dowel – load transfer system
5. Dowel sleeve
6. Divide plate

Figure A3.1: Projoint Plus 3010 cross-section view

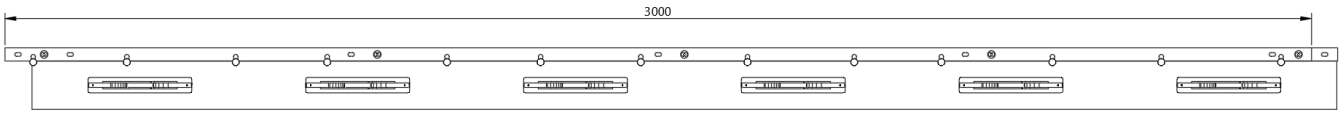


Figure A3.2: Projoint Plus 3010 front view

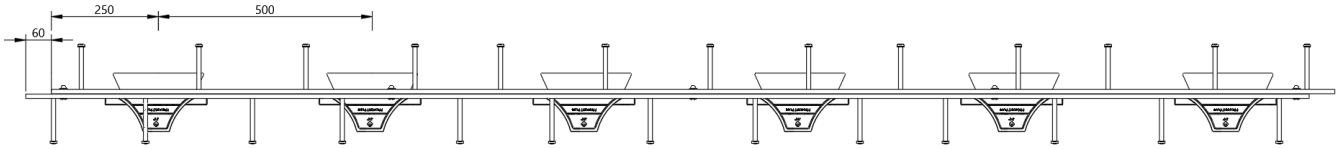


Figure A3.3: Projoint Plus 3010 top view

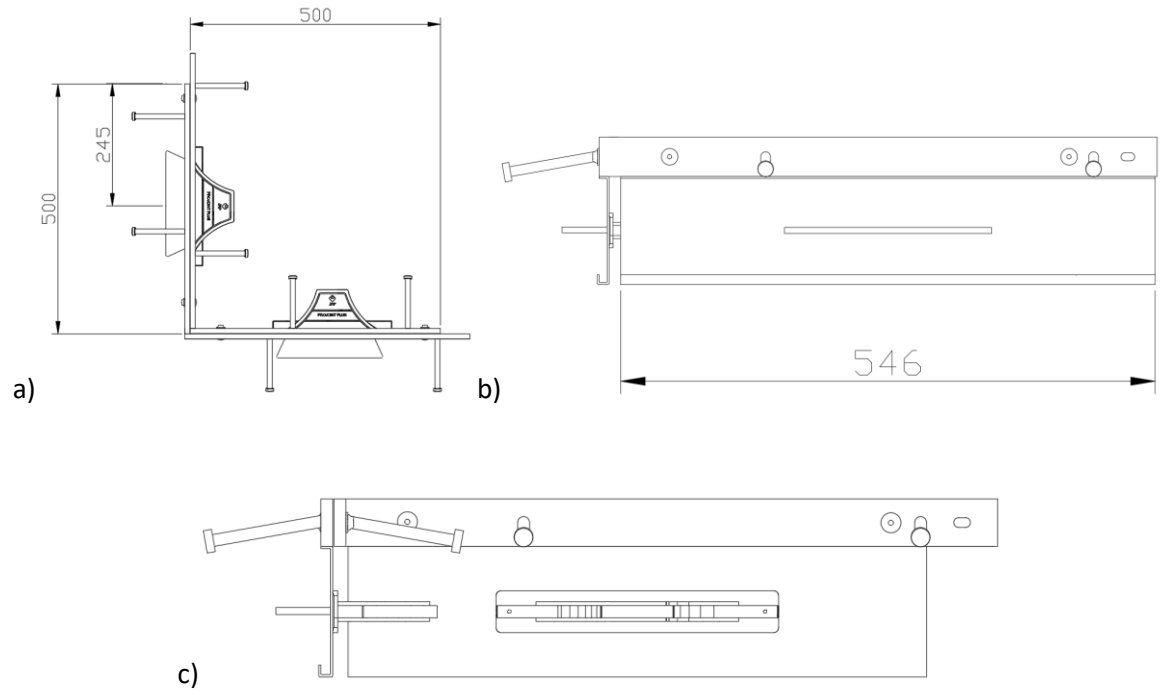


Figure A3.4 Projoint Plus 3010 L (corner) accessories: a) top plan view, b) front view and c) right-side view

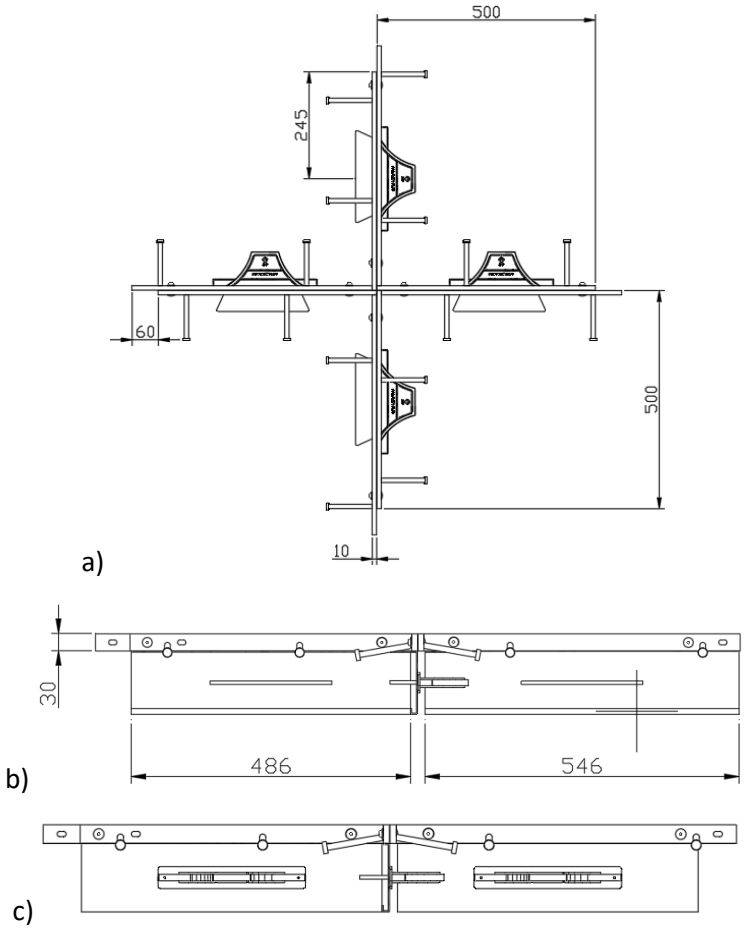


Figure A3.5: Projoint Plus 3010 X (four way) accessories: a) top plan view, b) right-side view and c) left-side view

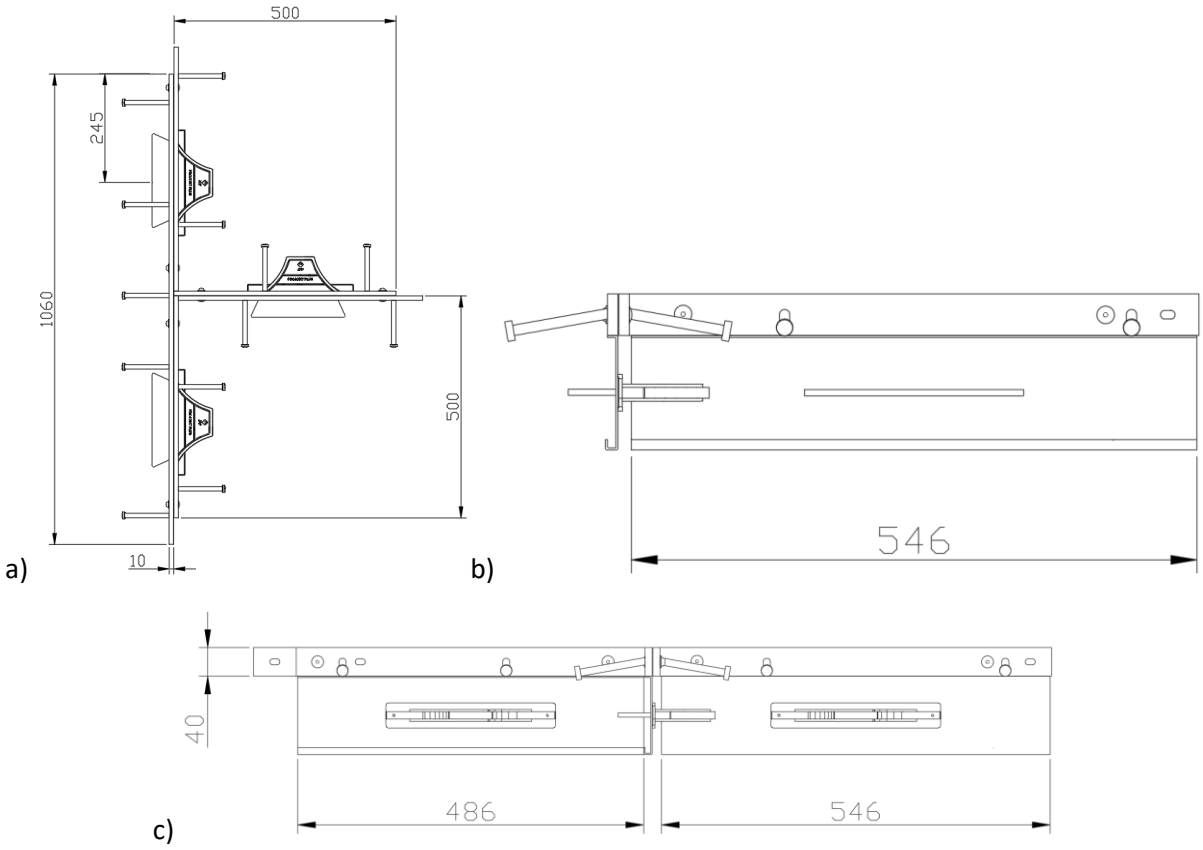
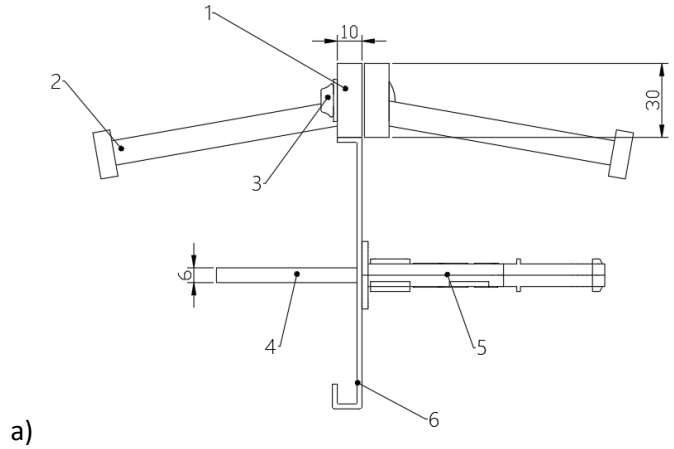
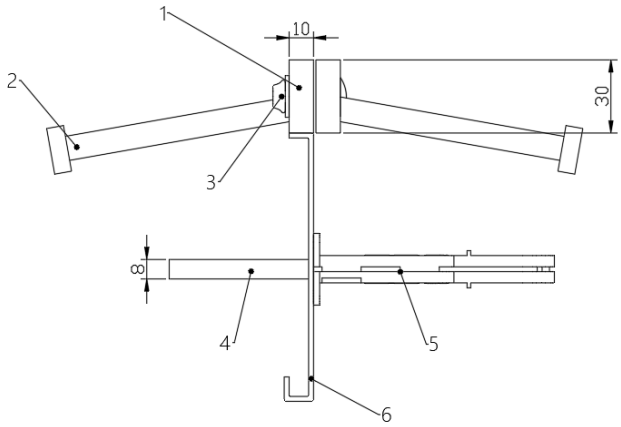


Figure A3.6: Projoint Plus 3010 T (tee) accessories: a) top plan view, b) front view and c) right-side view

A4 – Projoint Plus 3010 DP2 6mm and Projoint Plus 3010 DP2 8mm



a)



b)

1. Calibrated bar 30 mm x 10 mm
2. Shear connectors
3. Connection system
4. Dowel – load transfer system
5. Dowel sleeve
6. Divide plate

Figure A4.1: a) Projoint Plus 3010 DP2 6mm and b) Projoint Plus 3010 DP2 8mm cross section view

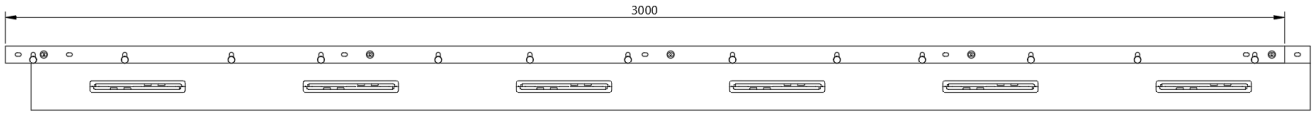


Figure A4.2: Projoint Plus 3010 DP2 6mm and Projoint Plus 3010 DP2 8mm front view

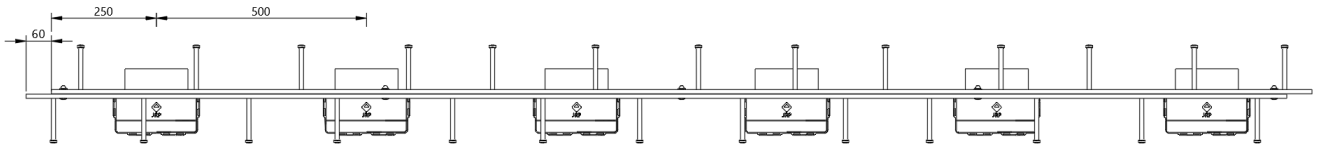


Figure A4.3: Projoint Plus 3010 DP2 6mm and Projoint Plus 3010 DP2 8mm top view

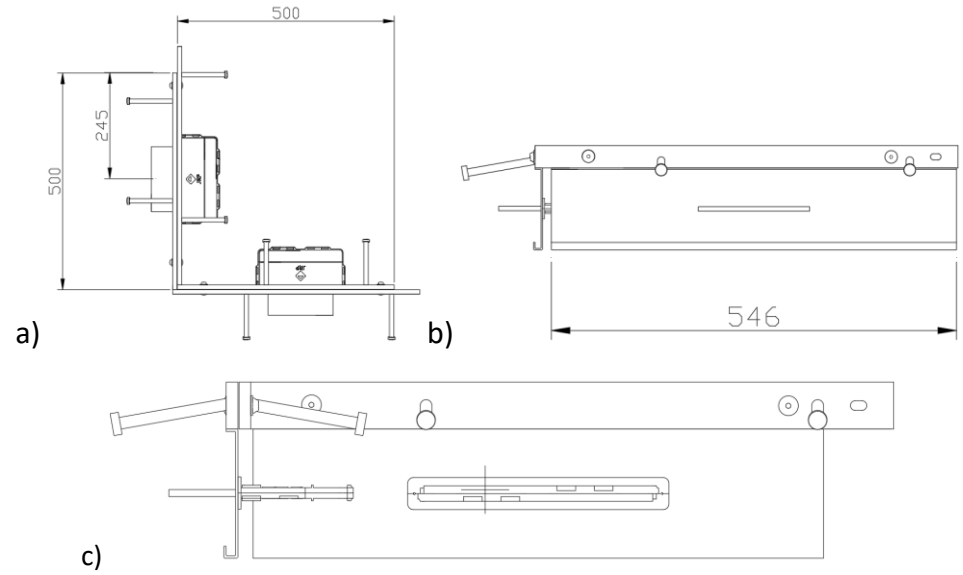


Figure A4.4: Projoint Plus 3010 DP2 6mm and Projoint Plus 3010 DP2 8mm L (corner) accessories: a) top plan view, b) front view and c) right-side view

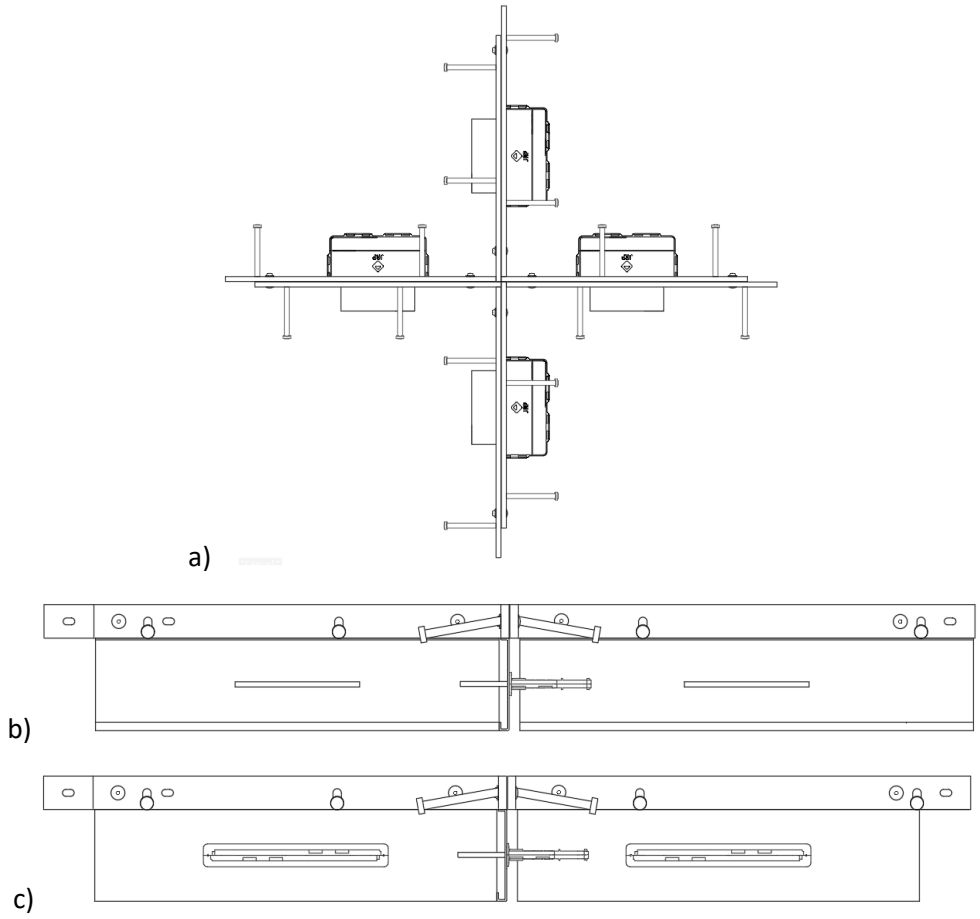


Figure A4.5: Projoint Plus 3010 DP2 6mm X (four way) and Projoint Plus 3010 DP2 8mm X (four way) accessories: a) top plan view, b) right-side view and c) left-side view

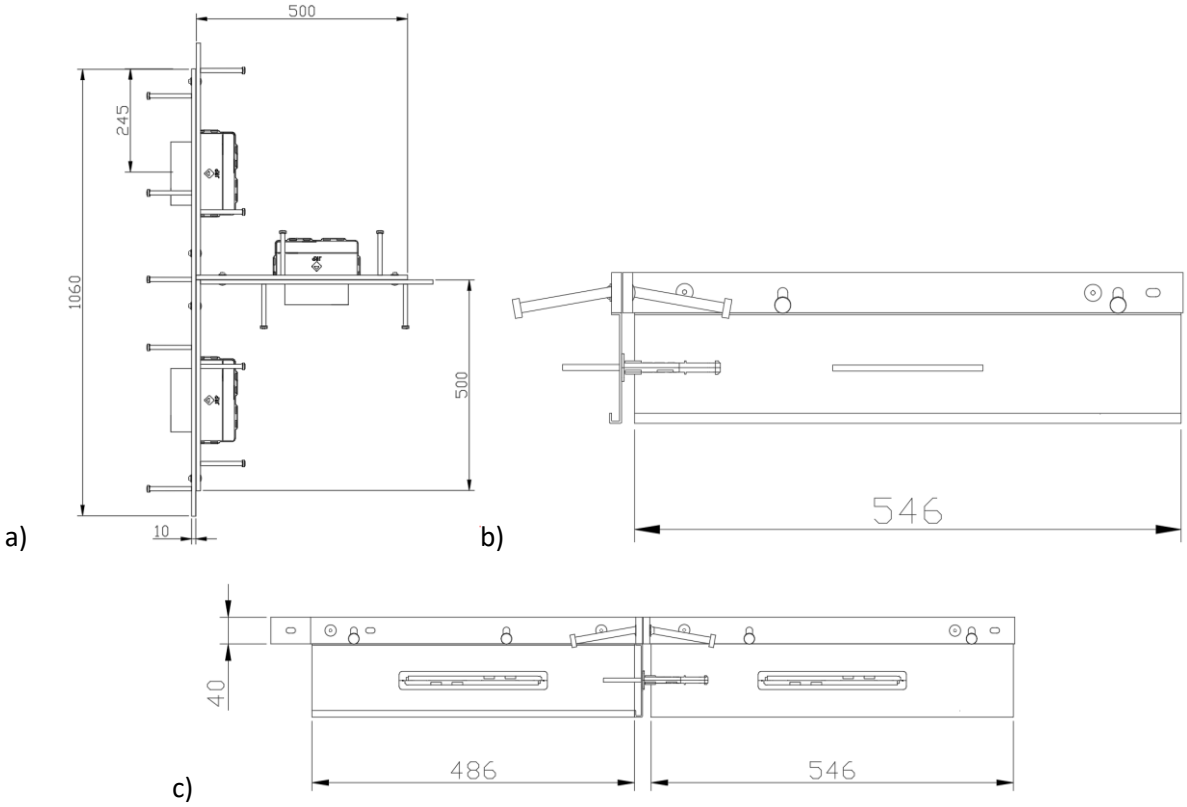
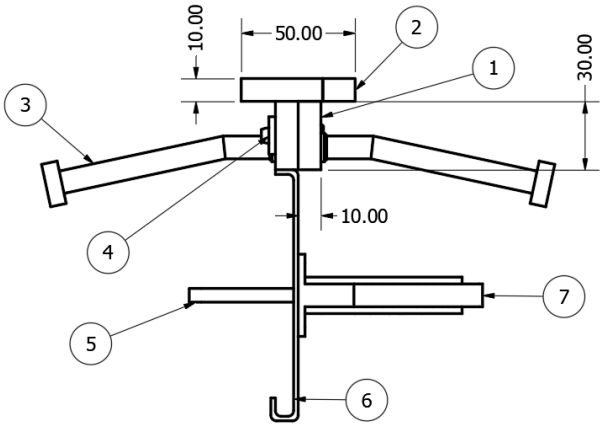


Figure A4.6: Projoint Plus 3010 DP2 6mm T (tee) and Projoint Plus 3010 DP2 8mm T (tee) accessories: a) top plan view, b) front view and c) right-side view

A5 – Projoint Plus S



1. Calibrated bar 30 mm x 10 mm
2. Smooth transition system
3. Shear connectors
4. Connection system
5. Dowel – load transfer system
6. Divide plate
7. Dowel sleeve

Figure A5.1: Projoint Plus S cross-section view

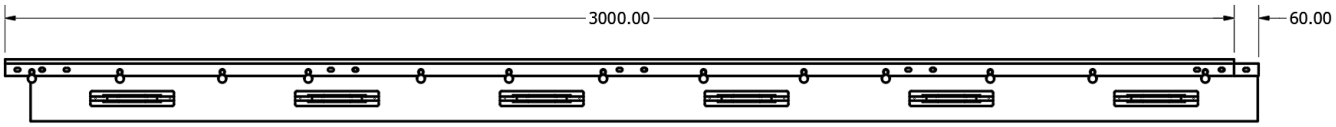


Figure A5.2: Projoint Plus S front view

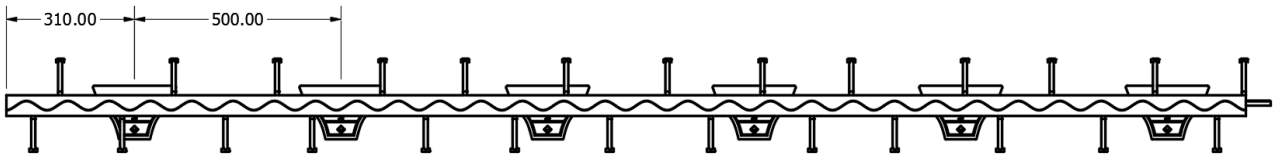
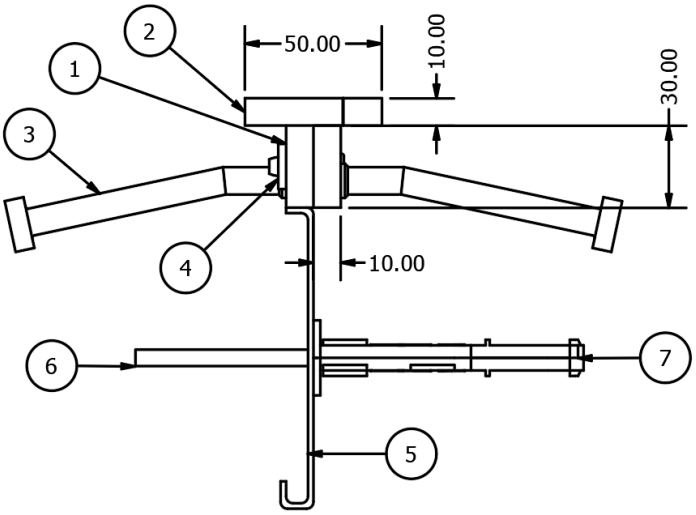


Figure A5.3: Projoint Plus S top view

A6 – Projoint Plus S DP2 6mm and Projoint Plus S DP2 8mm



1. Calibrated bar 30 mm x 10 mm
2. Smooth transition system
3. Shear connectors
4. Connection system
5. Divide plate
6. Dowel – load transfer system
7. Dowel sleeve

Figure A6.1: Projoint Plus S DP2 6mm or Projoint Plus S DP2 8mm cross-section view

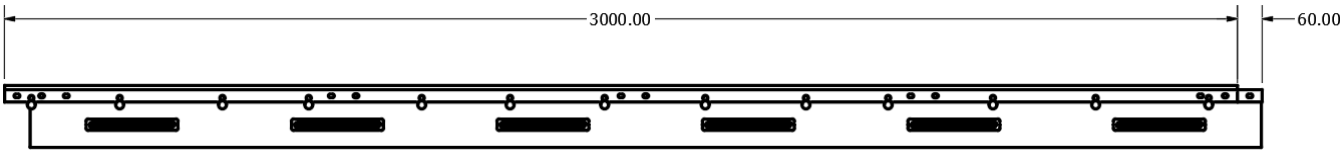


Figure A6.2: Projoint Plus S DP2 6mm and Projoint Plus S DP2 8mm front view

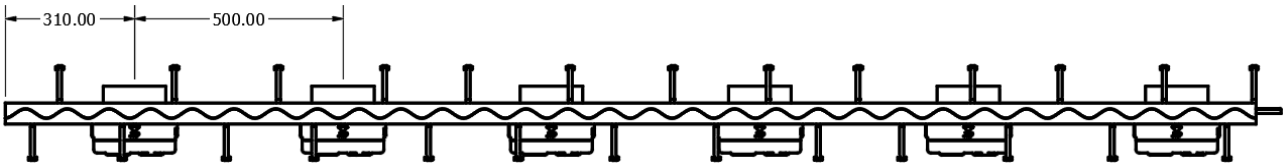


Figure A6.3: Projoint Plus S DP2 6mm and Projoint Plus S DP2 8mm top view

A7 – Dowels

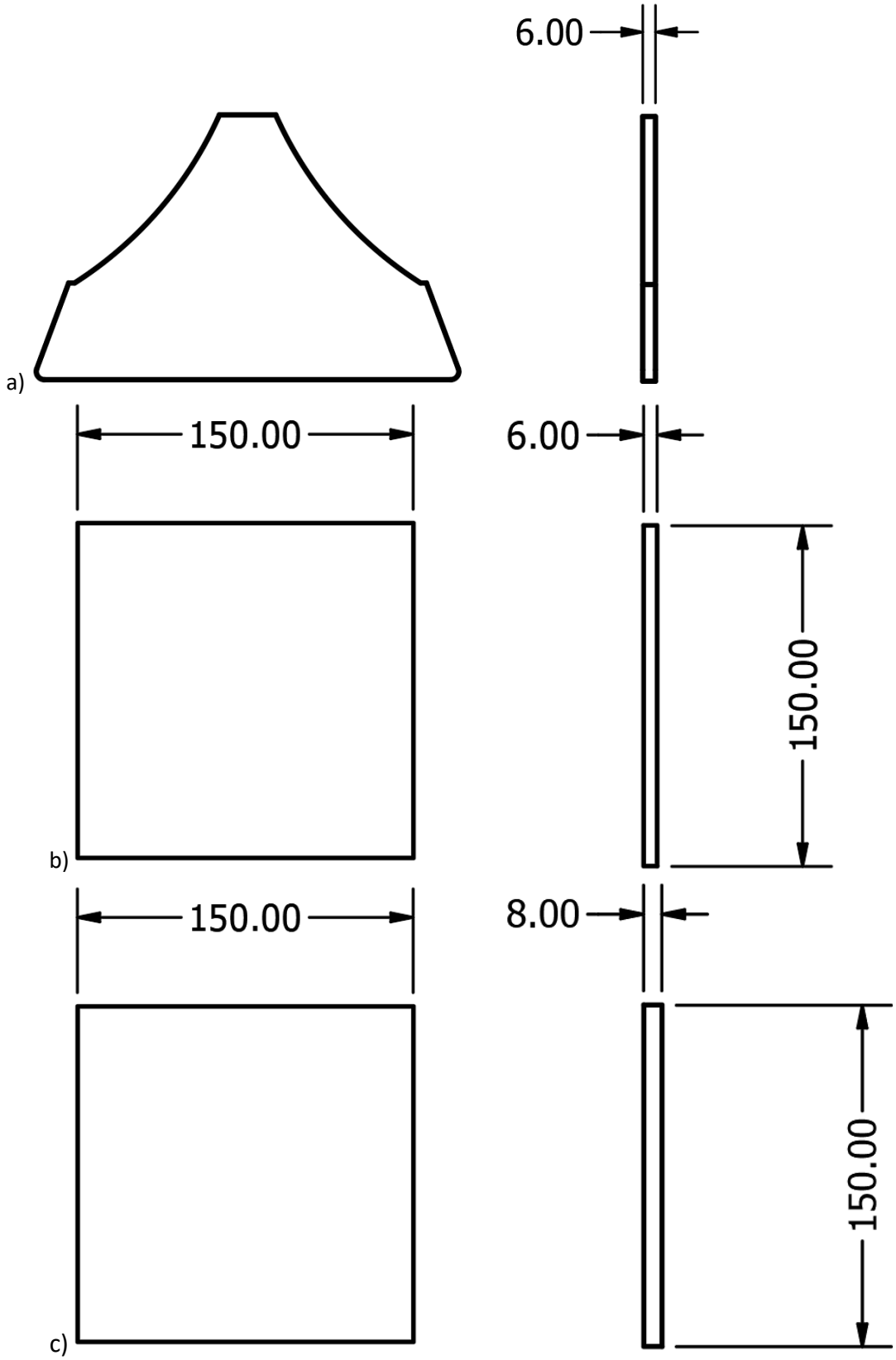


Figure A7.1: a) Projoint Dowel, b) Projoint Dowel Plus 6 mm thickness and c) Projoint Dowel Plus 8 mm thickness

ANNEX B – DOWEL LOAD TRANSFER

The methodology used for calculating the load transfer capacity of dowels was adopted from TR34, Fourth edition (2016), according to EAD 200089-00-0302, with modifications due to the variable geometry of the plate dowels. The dowels are classified as plate dowels with variable geometry (Projoint Dowel) and plate dowels with prismatic geometry (Projoint Dowel Plus 6mm and 8mm). The calculation method and the results are presented for each type of dowel separately.

B.1 Calculation parameters

Table B1.1: Characteristic strength and design strength of the concrete

Class	Characteristic compressive cylinder strength f_{ck} [MPa]	Design compressive cylinder strength f_{cd} [MPa]
C20/25	20	13.33
C25/30	25	16.67
C30/37	30	20.00
C32/40	32	21.33
C35/45	35	23.33
C40/50	40	26.67

Table B1.2: Characteristic yield strength and design yield design strength of the steel

Class	Characteristic Yield strength f_{yk} [MPa]	Design yield strength f_{yd} [MPa]
S275	275	239.13
S355	355	308.70
S420	420	365.22
S500	500	434.78

The open joints considered (2 x e): 1 mm; 2.5 mm; 5 mm; 7.5 mm: 10 mm; 15 mm and 20 mm.

B.2 PROJOINT DOWELS

Discrete plate dowels are commonly used as alternatives to traditional bar dowels. These are not to be confused with continuous plate dowels which have been found to perform poorly in service and are not recommended.

The bearing/bending capacity of each Projoint Dowel with variable geometry is given by the following equations:

$$\begin{cases} P_V = P_{max,plate} = k_3 \cdot f_{cd} \cdot \sum_{i=1}^{n} p_{b,i} \cdot \Delta x_i \quad , \quad with \ x_1 = \sum_{i=1}^{n} \Delta x_i \\ P_M = P_{max,plate} = t_p^2 \cdot p_b(x_1) \cdot \frac{f_{yd}}{4} + k_3 \cdot f_{cd} \cdot \sum_{i=1}^{n} p_{b,i} \cdot \Delta x_i \cdot d_i \Big/ e + x_1 \end{cases}$$

Where: $b_1 = 2ek_3 f_{cd} p_b$

$c_1 = 2k_3 f_{cd} P_b^2 t_p^2 f_{yd}$

e = Half of joint opening width

k_3 = 3, a constant determined empirically

$f_{cd} = f_{ck}/\Upsilon_c = \text{Concrete design compressive cylinder strenght}$

Υc = 1.50

p_b = Plate width

d_i = Distance from the centre of slice i to the point of zero shear

$p_{b,i}$ = Plate width of the slice i

t_p = Plate thickness

$f_{yd} = f_{yk}/\Upsilon_s = \text{design yield strength}$

Υs = 1.15

$\Delta xi = \text{lenght of the slice i}$

Solving the equations, the shear capacity of the Projoint Dowels is given by:

$$P_{sh,plate} = 0.9 \cdot t_p \cdot p_{b,i} \cdot 0.6 \cdot f_{yk}$$

However, the calculations revealed that the critical section is always the section where the dowel has maximum shear value, on the face of the concrete slab (section n=1). Therefore, the equation can be written as follow:

$$P_{sh,plate} = P_{sh,plate,1} = 0.9 \cdot t_p \cdot p_{b,1} \cdot 0.6 \cdot f_{yk}$$

The calculated values for $P_{sh,plate}$ and $P_{max,plate}$ using equations above are presented in following tables.

Table B2.1: Projoint Dowel 6mm S355 steel – $P_{max,plate}$

PARAMETERS		2 x *e* [mm]						
		1.0	**2.5**	**5.0**	**7.5**	**10.0**	**15.0**	**20.0**
t_p [mm]		6.0						
C20/25	x_1 [mm]	10.9	10.2	9.2	8.3	7.5	6.2	5.2
	p_b [mm]	126.2	124.3	120.8	117.2	113.4	105.5	97.5
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**61.0**	**55.9**	**48.3**	**41.9**	**36.4**	**27.8**	**21.5**
C25/30	x_1 [mm]	9.7	9.0	8.0	7.2	6.4	5.2	4.4
	p_b [mm]	129.0	127.0	123.5	119.7	115.7	107.5	99.2
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**68.8**	**62.6**	**53.5**	**45.9**	**39.5**	**29.6**	**22.7**
C30/37	x_1 [mm]	8.9	8.2	7.2	6.4	5.6	4.5	3.8
	p_b [mm]	131.1	129.1	125.5	121.6	117.5	109.0	100.4
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**75.8**	**68.5**	**58.0**	**49.2**	**42.0**	**31.1**	**23.5**
C32/40	x_1 [mm]	8.6	7.9	6.9	6.1	5.4	4.3	3.6
	p_b [mm]	131.8	129.8	126.1	122.2	118.0	109.4	100.8
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**78.5**	**70.7**	**59.6**	**50.4**	**42.9**	**31.6**	**23.8**
C35/45	x_1 [mm]	8.2	7.5	6.5	5.7	5.1	4.0	3.3
	p_b [mm]	132.8	130.7	127.0	123.0	118.8	110.1	101.3
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**82.3**	**73.9**	**61.9**	**52.1**	**44.1**	**32.2**	**24.2**
C40/50	x_1 [mm]	7.6	7.0	6.0	5.2	4.6	3.6	2.9
	p_b [mm]	134.2	132.1	128.3	124.2	119.9	111.0	102.0
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**88.2**	**78.7**	**65.4**	**54.6**	**45.9**	**33.2**	**24.7**

Table B2.2: Projoint Dowel 6mm S355 steel – $P_{sh,plate}$

PARAMETERS	2 x *e* [mm]						
	1.0	**2.5**	**5.0**	**7.5**	**10.0**	**15.0**	**20.0**
t_p [mm]	6.0						
p_b [mm]	155	150.7	143.7	137.1	130.8	118.9	108
$\boldsymbol{P_{sh,plate}}$ **[kN]**	**178**	**173**	**165**	**158**	**150**	**137**	**124**

Table B2.3: Projoint Dowel 6mm S420 steel – $P_{max,plate}$

PARAMETERS		2 x *e* [mm]						
		1.0	**2.5**	**5.0**	**7.5**	**10.0**	**15.0**	**20.0**
t_p [mm]		6.0						
C20/25	x_1 [mm]	11.8	11.1	10.1	9.2	8.4	7.0	6.0
	p_b [mm]	123.9	122.0	118.7	115.2	111.5	103.9	96.0
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**65.7**	**60.5**	**52.8**	**46.2**	**40.4**	**31.2**	**24.4**
C25/30	x_1 [mm]	10.6	9.9	8.9	8.0	7.2	6.0	5.0
	p_b [mm]	126.9	125.0	121.5	117.8	114.0	106.0	97.9
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**74.3**	**68.0**	**58.7**	**50.7**	**44.0**	**33.4**	**25.8**
C30/37	x_1 [mm]	9.6	9.0	8.0	7.1	6.4	5.2	4.3
	p_b [mm]	129.2	127.2	123.6	119.8	115.9	107.6	99.3
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**82.0**	**74.6**	**63.7**	**54.6**	**47.0**	**35.2**	**26.9**
C32/40	x_1 [mm]	9.3	8.7	7.7	6.8	6.1	4.9	4.1
	p_b [mm]	129.9	127.9	124.3	120.5	116.5	108.2	99.7
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**84.9**	**77.0**	**65.6**	**56.0**	**48.0**	**35.8**	**27.3**
C35/45	x_1 [mm]	8.9	8.2	7.3	6.4	5.7	4.6	3.8
	p_b [mm]	131.0	128.9	125.3	121.4	117.3	108.9	100.3
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**89.1**	**80.5**	**68.2**	**57.9**	**49.5**	**36.6**	**27.7**
C40/50	x_1 [mm]	8.3	7.7	6.7	5.9	5.2	4.1	3.4
	p_b [mm]	132.4	130.4	126.7	122.7	118.5	109.8	101.1
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**95.6**	**85.9**	**72.2**	**60.9**	**51.6**	**37.8**	**28.4**

Table B2.4: Projoint Dowel 6mm S420 steel – $P_{sh,plate}$

PARAMETERS	2 x *e* [mm]						
	1.0	**2.5**	**5.0**	**7.5**	**10.0**	**15.0**	**20.0**
t_p [mm]	6.0						
p_b [mm]	155	150.7	143.7	137.1	130.8	118.9	108
$\boldsymbol{P_{sh,plate}}$ **[kN]**	**211**	**205**	**196**	**187**	**178**	**162**	**147**

Table B2.5: Projoint Dowel 6mm S500 steel – $P_{max,plate}$

PARAMETERS		2 x *e* [mm]						
		1.0	**2.5**	**5.0**	**7.5**	**10.0**	**15.0**	**20.0**
t_p [mm]		6.0						
C20/25	x_1 [mm]	12.9	12.2	11.1	10.2	9.4	8.0	6.8
	p_b [mm]	121.4	119.6	116.3	112.9	109.4	102.0	94.4
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**71.0**	**65.7**	**57.8**	**50.9**	**44.8**	**35.1**	**27.7**
C25/30	x_1 [mm]	11.5	10.9	9.8	8.9	8.1	6.8	5.8
	p_b [mm]	124.6	122.7	119.3	115.8	112.1	104.4	96.5
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**80.4**	**73.9**	**64.4**	**56.1**	**49.0**	**37.8**	**29.4**
C30/37	x_1 [mm]	10.5	9.9	8.8	7.9	7.2	5.9	5.0
	p_b [mm]	127.0	125.1	121.6	117.9	114.1	106.1	98.0
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**88.9**	**81.3**	**70.1**	**60.6**	**52.5**	**39.9**	**30.8**
C32/40	x_1 [mm]	10.2	9.5	8.5	7.6	6.9	5.6	4.7
	p_b [mm]	127.8	125.9	122.4	118.7	114.8	106.7	98.5
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**92.0**	**84.0**	**72.2**	**62.2**	**53.8**	**40.7**	**31.2**
C35/45	x_1 [mm]	9.7	9.1	8.1	7.2	6.4	5.3	4.4
	p_b [mm]	128.9	126.9	123.4	119.6	115.7	107.5	99.1
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**96.6**	**87.9**	**75.2**	**64.5**	**55.5**	**41.7**	**31.9**
C40/50	x_1 [mm]	9.1	8.4	7.4	6.6	5.9	4.7	3.9
	p_b [mm]	130.5	128.5	124.9	121.0	117.0	108.5	100.0
	$\boldsymbol{P_{max,plate}}$ **[kN]**	**103.7**	**93.9**	**79.7**	**67.9**	**58.1**	**43.2**	**32.8**

Table B2.6: Projoint Dowel 6mm S500 steel – $P_{sh,plate}$

PARAMETERS	2 x *e* [mm]						
	1.0	**2.5**	**5.0**	**7.5**	**10.0**	**15.0**	**20.0**
t_p [mm]	6.0						
p_b [mm]	155	150.7	143.7	137.1	130.8	118.9	108
$\boldsymbol{P_{sh,plate}}$ **[kN]**	**251**	**244**	**233**	**222**	**212**	**193**	**175**

B.3 Projoint Dowel Plus

Discrete plate dowels are commonly used as alternatives to traditional bar dowels. These are not to be confused with continuous plate dowels which have been found to perform poorly in service and are not recommended.

The shear capacity of the Projoint Dowels Plus is given by:

$$P_{sh,plate} = 0.9 \cdot t_p \cdot p_b \cdot \frac{f_{yk}}{\sqrt{3}} \approx 0.9 \cdot t_p \cdot p_b \cdot 0.6 \cdot f_{yk}$$

Where: t_p = Plate thickness

p_b = Plate width

f_{yk} = plate steel design yield strength

The bearing/bending capacity per plate dowel is given by:

$$P_{max\ plate} = 0.5\ [(b_1^2 + c_1)^{0.5} - b_1]$$

Where: $b_1 = 2ek_3 f_{cd} P_b$

$c_1 = 2k_3 f_{cd} P_b^2 t_p^2 f_{yd}$

e = half of joint opening width

k_3 = 3, a constant determined empirically

$f_{cd} = f_{ck}/\Upsilon_c =$ concrete design compressive cylinder strength

Υc = 1.50

P_b = Plate width

t_p = Plate thickness

$f_{yd} = f_{yk}/\Upsilon_s =$ design yeld strength

Υs = 1.15

The calculated values for $P_{sh,plate}$ and $P_{max,\ plate}$ using equations above are presented in the following tables.

Table B3.1: Projoint Dowel Plus 6mm S275 steel – $P_{max,plate}$ and $P_{sh,plate}$

PARAMETERS		**2 x *e* [mm]**						
		1.0	**2.5**	**5.0**	**7.5**	**10.0**	**15.0**	**20.0**
t_p[mm]		6.0						
p_b [mm]		150.0						
C20/25	b_1 [mm]	6.0E+03	1.5E+04	3.0E+04	4.5E+04	6.0E+04	9.0E+04	1.2E+05
	c_1 [mm]	1.5E+10	1.5E+10	1.5E+10	1.5E+10	1.5E+10	1.5E+10	1.5E+10
	$P_{max,plate}$ [kN]	**59.3**	**55.2**	**49.0**	**43.7**	**39.1**	**31.8**	**26.5**
C25/30	b_1 [mm]	7.5E+03	1.9E+04	3.8E+04	5.6E+04	7.5E+04	1.1E+05	1.5E+05
	c_1 [mm]	1.9E+10	1.9E+10	1.9E+10	1.9E+10	1.9E+10	1.9E+10	1.9E+10
	$P_{max,plate}$ [kN]	**65.9**	**60.8**	**53.3**	**46.9**	**41.5**	**33.2**	**27.3**
C30/37	b_1 [mm]N]	9.0E+03	2.3E+04	4.5E+04	6.8E+04	9.0E+04	1.4E+05	1.8E+05
	c_1 [mm]	2.3E+10	2.3E+10	2.3E+10	2.3E+10	2.3E+10	2.3E+10	2.3E+10
	$P_{max,plate}$ [kN]	**71.9**	**65.8**	**57.0**	**49.6**	**43.5**	**34.3**	**27.9**
C32/40	b_1 [mm]	9.6E+03	2.4E+04	4.8E+04	7.2E+04	9.6E+04	1.4E+05	1.9E+05
	c_1 [mm]	2.5E+10	2.5E+10	2.5E+10	2.5E+10	2.5E+10	2.5E+10	2.5E+10
	$P_{max,plate}$ [kN]	**74.1**	**67.6**	**58.3**	**50.6**	**44.2**	**34.7**	**28.2**
C35/45	b_1 [mm]	1.1E+04	2.6E+04	5.3E+04	7.9E+04	1.1E+05	1.6E+05	2.1E+05
	c_1 [mm]	2.7E+10	2.7E+10	2.7E+10	2.7E+10	2.7E+10	2.7E+10	2.7E+10
	$P_{max,plate}$ [kN]	**77.3**	**70.3**	**60.2**	**51.9**	**45.2**	**35.2**	**28.4**
C40/50	b_1 [mm]	1.2E+04	3.0E+04	6.0E+04	9.0E+04	1.2E+05	1.8E+05	2.4E+05
	c_1 [mm]	3.1E+10	3.1E+10	3.1E+10	3.1E+10	3.1E+10	3.1E+10	3.1E+10
	$P_{max,plate}$ [kN]	**82.2**	**74.3**	**63.0**	**53.9**	**46.5**	**35.9**	**28.8**
$P_{sh,plate}$ [kN]		**133.6**						

Table B3.2: Projoint Dowel Plus 6mm S355 steel – $P_{max,plate}$ and $P_{sh,plate}$

PARAMETERS		2 x *e* [mm]						
		1.0	**2.5**	**5.0**	**7.5**	**10.0**	**15.0**	**20.0**
t_p[mm]		6.0						
p_b [mm]		150.0						
C20/25	b_1 [mm]	6.0E+03	1.5E+04	3.0E+04	4.5E+04	6.0E+04	9.0E+04	1.2E+05
	c_1 [mm]	2.0E+10	2.0E+10	2.0E+10	2.0E+10	2.0E+10	2.0E+10	2.0E+10
	$P_{max,plate}$ [kN]	**67.8**	**63.6**	**57.3**	**51.7**	**46.8**	**38.8**	**32.7**
C25/30	b_1 [mm]	7.5E+03	1.9E+04	3.8E+04	5.6E+04	7.5E+04	1.1E+05	1.5E+05
	c_1 [mm]	2.5E+10	2.5E+10	2.5E+10	2.5E+10	2.5E+10	2.5E+10	2.5E+10
	$P_{max,plate}$ [kN]	**75.4**	**70.2**	**62.5**	**55.8**	**50**	**40.8**	**34**
C30/37	b_1 [mm]N]	9.0E+03	2.3E+04	4.5E+04	6.8E+04	9.0E+04	1.4E+05	1.8E+05
	c_1 [mm]	3.0E+10	3.0E+10	3.0E+10	3.0E+10	3.0E+10	3.0E+10	3.0E+10
	$P_{max,plate}$ [kN]	**82.2**	**76.1**	**67**	**59.2**	**52.6**	**42.3**	**34.9**
C32/40	b_1 [mm]	9.6E+03	2.4E+04	4.8E+04	7.2E+04	9.6E+04	1.4E+05	1.9E+05
	c_1 [mm]	3.2E+10	3.2E+10	3.2E+10	3.2E+10	3.2E+10	3.2E+10	3.2E+10
	$P_{max,plate}$ [kN]	**84.8**	**78.3**	**68.6**	**60.4**	**53.5**	**42.8**	**35.2**
C35/45	b_1 [mm]	1.1E+04	2.6E+04	5.3E+04	7.9E+04	1.1E+05	1.6E+05	2.1E+05
	c_1 [mm]	3.5E+10	3.5E+10	3.5E+10	3.5E+10	3.5E+10	3.5E+10	3.5E+10
	$P_{max,plate}$ [kN]	**88.4**	**81.3**	**70.9**	**62.1**	**54.8**	**43.5**	**35.6**
C40/50	b_1 [mm]	1.2E+04	3.0E+04	6.0E+04	9.0E+04	1.2E+05	1.8E+05	2.4E+05
	c_1 [mm]	4.0E+10	4.0E+10	4.0E+10	4.0E+10	4.0E+10	4.0E+10	4.0E+10
	$P_{max,plate}$ [kN]	**94.2**	**86.1**	**74.4**	**64.7**	**56.6**	**44.5**	**36.2**
$P_{sh,plate}$ [kN]		**172.5**						

Table B3.3: Projoint Dowel Plus 6mm S420 steel – $P_{max,plate}$ and $P_{sh,plate}$

PARAMETERS		2 x *e* [mm]						
		1.0	**2.5**	**5.0**	**7.5**	**10.0**	**15.0**	**20.0**
t_p[mm]		6.0						
p_b [mm]		150.0						
C20/25	b_1 [mm]	6.0E+03	1.5E+04	3.0E+04	4.5E+04	6.0E+04	9.0E+04	1.2E+05
	c_1 [mm]	2.4E+10	2.4E+10	2.4E+10	2.4E+10	2.4E+10	2.4E+10	2.4E+10
	$P_{max,plate}$ [kN]	**74.0**	**69.8**	**63.4**	**57.6**	**52.6**	**44.1**	**37.6**
C25/30	b_1 [mm]	7.5E+03	1.9E+04	3.8E+04	5.6E+04	7.5E+04	1.1E+05	1.5E+05
	c_1 [mm]	3.0E+10	3.0E+10	3.0E+10	3.0E+10	3.0E+10	3.0E+10	3.0E+10
	$P_{max,plate}$ [kN]	**82.3**	**77.1**	**69.3**	**62.4**	**56.3**	**46.5**	**39.1**
C30/37	b_1 [mm]N]	9.0E+03	2.3E+04	4.5E+04	6.8E+04	9.0E+04	1.4E+05	1.8E+05
	c_1 [mm]	3.5E+10	3.5E+10	3.5E+10	3.5E+10	3.5E+10	3.5E+10	3.5E+10
	$P_{max,plate}$ [kN]	**89.8**	**83.6**	**74.4**	**66.3**	**59.4**	**48.4**	**40.3**
C32/40	b_1 [mm]	9.6E+03	2.4E+04	4.8E+04	7.2E+04	9.6E+04	1.4E+05	1.9E+05
	c_1 [mm]	3.8E+10	3.8E+10	3.8E+10	3.8E+10	3.8E+10	3.8E+10	3.8E+10
	$P_{max,plate}$ [kN]	**92.6**	**86.0**	**76.2**	**67.7**	**60.5**	**49.0**	**40.7**
C35/45	b_1 [mm]	1.1E+04	2.6E+04	5.3E+04	7.9E+04	1.1E+05	1.6E+05	2.1E+05
	c_1 [mm]	4.1E+10	4.1E+10	4.1E+10	4.1E+10	4.1E+10	4.1E+10	4.1E+10
	$P_{max,plate}$ [kN]	**96.6**	**89.5**	**78.8**	**69.7**	**62.0**	**49.9**	**41.2**
C40/50	b_1 [mm]	1.2E+04	3.0E+04	6.0E+04	9.0E+04	1.2E+05	1.8E+05	2.4E+05
	c_1 [mm]	4.7E+10	4.7E+10	4.7E+10	4.7E+10	4.7E+10	4.7E+10	4.7E+10
	$P_{max,plate}$ [kN]	**102.9**	**94.8**	**82.8**	**72.7**	**64.2**	**51.2**	**42.0**
$P_{sh,plate}$ [kN]		**204.1**						

Table B3.4: Projoint Dowel Plus 6mm S500 steel – $P_{max,plate}$ and $P_{sh,plate}$

PARAMETERS		2 x *e* [mm]						
		1.0	**2.5**	**5.0**	**7.5**	**10.0**	**15.0**	**20.0**
t_p[mm]		6.0						
p_b [mm]		150.0						
C20/25	b_1 [mm]	6.0E+03	1.5E+04	3.0E+04	4.5E+04	6.0E+04	9.0E+04	1.2E+05
	c_1 [mm]	2.8E+10	2.8E+10	2.8E+10	2.8E+10	2.8E+10	2.8E+10	2.8E+10
	$P_{max,plate}$ [kN]	**81.0**	**76.8**	**70.3**	**64.4**	**59.1**	**50.2**	**43.2**
C25/30	b_1 [mm]	7.5E+03	1.9E+04	3.8E+04	5.6E+04	7.5E+04	1.1E+05	1.5E+05
	c_1 [mm]	3.5E+10	3.5E+10	3.5E+10	3.5E+10	3.5E+10	3.5E+10	3.5E+10
	$P_{max,plate}$ [kN]	**90.2**	**84.9**	**76.9**	**69.8**	**63.5**	**53.2**	**45.1**
C30/37	b_1 [mm]N]	9.0E+03	2.3E+04	4.5E+04	6.8E+04	9.0E+04	1.4E+05	1.8E+05
	c_1 [mm]	4.2E+10	4.2E+10	4.2E+10	4.2E+10	4.2E+10	4.2E+10	4.2E+10
	$P_{max,plate}$ [kN]	**98.4**	**92.2**	**82.7**	**74.4**	**67.2**	**55.5**	**46.6**
C32/40	b_1 [mm]	9.6E+03	2.4E+04	4.8E+04	7.2E+04	9.6E+04	1.4E+05	1.9E+05
	c_1 [mm]	4.5E+10	4.5E+10	4.5E+10	4.5E+10	4.5E+10	4.5E+10	4.5E+10
	$P_{max,plate}$ [kN]	**101.5**	**94.8**	**84.8**	**76.1**	**68.5**	**56.3**	**47.1**
C35/45	b_1 [mm]	1.1E+04	2.6E+04	5.3E+04	7.9E+04	1.1E+05	1.6E+05	2.1E+05
	c_1 [mm]	4.9E+10	4.9E+10	4.9E+10	4.9E+10	4.9E+10	4.9E+10	4.9E+10
	$P_{max,plate}$ [kN]	**105.9**	**98.7**	**87.8**	**78.4**	**70.3**	**57.4**	**47.8**
C40/50	b_1 [mm]	1.2E+04	3.0E+04	6.0E+04	9.0E+04	1.2E+05	1.8E+05	2.4E+05
	c_1 [mm]	5.6E+10	5.6E+10	5.6E+10	5.6E+10	5.6E+10	5.6E+10	5.6E+10
	$P_{max,plate}$ [kN]	**112.8**	**104.6**	**92.4**	**81.9**	**73.0**	**59.0**	**48.8**
$P_{sh,plate}$ [kN]		**243.0**						

Table B3.5: Projoint Dowel Plus 8mm S275 steel – $P_{max,plate}$ and $P_{sh,plate}$

PARAMETERS		2 x *e* [mm]						
		1.0	**2.5**	**5.0**	**7.5**	**10.0**	**15.0**	**20.0**
t_p[mm]		8.0						
p_b [mm]		150.0						
C20/25	b_1 [mm]	6.0E+03	1.5E+04	3.0E+04	4.5E+04	6.0E+04	9.0E+04	1.2E+05
	c_1 [mm]	2.8E+10	2.8E+10	2.8E+10	2.8E+10	2.8E+10	2.8E+10	2.8E+10
	$P_{max,plate}$ [kN]	**80.0**	**75.8**	**69.3**	**63.5**	**58.2**	**49.4**	**42.4**
C25/30	b_1 [mm]	7.5E+03	1.9E+04	3.8E+04	5.6E+04	7.5E+04	1.1E+05	1.5E+05
	c_1 [mm]	3.4E+10	3.4E+10	3.4E+10	3.4E+10	3.4E+10	3.4E+10	3.4E+10
	$P_{max,plate}$ [kN]	**89.1**	**83.9**	**75.9**	**68.8**	**62.6**	**52.3**	**44.3**
C30/37	b_1 [mm]N]	9.0E+03	2.3E+04	4.5E+04	6.8E+04	9.0E+04	1.4E+05	1.8E+05
	c_1 [mm]	4.1E+10	4.1E+10	4.1E+10	4.1E+10	4.1E+10	4.1E+10	4.1E+10
	$P_{max,plate}$ [kN]	**97.2**	**91.0**	**81.6**	**73.3**	**66.2**	**54.5**	**45.8**
C32/40	b_1 [mm]	9.6E+03	2.4E+04	4.8E+04	7.2E+04	9.6E+04	1.4E+05	1.9E+05
	c_1 [mm]	4.4E+10	4.4E+10	4.4E+10	4.4E+10	4.4E+10	4.4E+10	4.4E+10
	$P_{max,plate}$ [kN]	**100.3**	**93.7**	**83.7**	**75.0**	**67.4**	**55.3**	**46.3**
C35/45	b_1 [mm]	1.1E+04	2.6E+04	5.3E+04	7.9E+04	1.1E+05	1.6E+05	2.1E+05
	c_1 [mm]	4.8E+10	4.8E+10	4.8E+10	4.8E+10	4.8E+10	4.8E+10	4.8E+10
	$P_{max,plate}$ [kN]	**104.7**	**97.4**	**86.6**	**77.3**	**69.2**	**56.4**	**46.9**
C40/50	b_1 [mm]	1.2E+04	3.0E+04	6.0E+04	9.0E+04	1.2E+05	1.8E+05	2.4E+05
	c_1 [mm]	5.5E+10	5.5E+10	5.5E+10	5.5E+10	5.5E+10	5.5E+10	5.5E+10
	$P_{max,plate}$ [kN]	**111.5**	**103.3**	**91.1**	**80.7**	**71.8**	**57.9**	**47.9**
$P_{sh,plate}$ [kN]		**178.2**						

Table B3.6: Projoint Dowel Plus 8mm S355 steel – $P_{max,plate}$ and $P_{sh,plate}$

PARAMETERS		2 x *e* [mm]						
		1.0	**2.5**	**5.0**	**7.5**	**10.0**	**15.0**	**20.0**
t_p[mm]		8.0						
p_b [mm]		150.0						
C20/25	b_1 [mm]	6.0E+03	1.5E+04	3.0E+04	4.5E+04	6.0E+04	9.0E+04	1.2E+05
	c_1 [mm]	3.6E+10	3.6E+10	3.6E+10	3.6E+10	3.6E+10	3.6E+10	3.6E+10
	$P_{max,plate}$ [kN]	**91.3**	**87.1**	**80.5**	**74.4**	**68.9**	**59.5**	**51.8**
C25/30	b_1 [mm]	7.5E+03	1.9E+04	3.8E+04	5.6E+04	7.5E+04	1.1E+05	1.5E+05
	c_1 [mm]	4.4E+10	4.4E+10	4.4E+10	4.4E+10	4.4E+10	4.4E+10	4.4E+10
	$P_{max,plate}$ [kN]	**101.7**	**96.5**	**88.3**	**81.0**	**74.4**	**63.2**	**54.4**
C30/37	b_1 [mm]N]	9.0E+03	2.3E+04	4.5E+04	6.8E+04	9.0E+04	1.4E+05	1.8E+05
	c_1 [mm]	5.3E+10	5.3E+10	5.3E+10	5.3E+10	5.3E+10	5.3E+10	5.3E+10
	$P_{max,plate}$ [kN]	**111.10**	**104.8**	**95.2**	**86.6**	**78.9**	**66.3**	**56.4**
C32/40	b_1 [mm]	9.6E+03	2.4E+04	4.8E+04	7.2E+04	9.6E+04	1.4E+05	1.9E+05
	c_1 [mm]	5.7E+10	5.7E+10	5.7E+10	5.7E+10	5.7E+10	5.7E+10	5.7E+10
	$P_{max,plate}$ [kN]	**114.6**	**107.9**	**97.7**	**88.6**	**80.6**	**67.3**	**57.1**
C35/45	b_1 [mm]	1.1E+04	2.6E+04	5.3E+04	7.9E+04	1.1E+05	1.6E+05	2.1E+05
	c_1 [mm]	6.2E+10	6.2E+10	6.2E+10	6.2E+10	6.2E+10	6.2E+10	6.2E+10
	$P_{max,plate}$ [kN]	**119.6**	**112.3**	**101.2**	**91.4**	**82.8**	**68.8**	**58.0**
C40/50	b_1 [mm]	1.2E+04	3.0E+04	6.0E+04	9.0E+04	1.2E+05	1.8E+05	2.4E+05
	c_1 [mm]	7.1E+10	7.1E+10	7.1E+10	7.1E+10	7.1E+10	7.1E+10	7.1E+10
	$P_{max,plate}$ [kN]	**127.5**	**119.2**	**106.7**	**95.7**	**86.2**	**70.9**	**59.4**
$P_{sh,plate}$ [kN]		**230.0**						

Table B3.7: Projoint Dowel Plus 8mm S420 steel – $P_{max,plate}$ and $P_{sh,plate}$

PARAMETERS		2 x *e* [mm]						
		1.0	**2.5**	**5.0**	**7.5**	**10.0**	**15.0**	**20.0**
t_p[mm]		8.0						
p_b [mm]		150.0						
C20/25	b_1 [mm]	6.0E+03	1.5E+04	3.0E+04	4.5E+04	6.0E+04	9.0E+04	1.2E+05
	c_1 [mm]	4.2E+10	4.2E+10	4.2E+10	4.2E+10	4.2E+10	4.2E+10	4.2E+10
	$P_{max,plate}$ [kN]	**99.6**	**95.3**	**88.6**	**82.5**	**76.9**	**67.0**	**58.8**
C25/30	b_1 [mm]	7.5E+03	1.9E+04	3.8E+04	5.6E+04	7.5E+04	1.1E+05	1.5E+05
	c_1 [mm]	5.3E+10	5.3E+10	5.3E+10	5.3E+10	5.3E+10	5.3E+10	5.3E+10
	$P_{max,plate}$ [kN]	**111.0**	**105.7**	**97.4**	**89.9**	**83.1**	**71.5**	**62.0**
C30/37	b_1 [mm]N]	9.0E+03	2.3E+04	4.5E+04	6.8E+04	9.0E+04	1.4E+05	1.8E+05
	c_1 [mm]	6.3E+10	6.3E+10	6.3E+10	6.3E+10	6.3E+10	6.3E+10	6.3E+10
	$P_{max,plate}$ [kN]	**121.2**	**114.9**	**105.1**	**96.3**	**88.4**	**75.1**	**64.5**
C32/40	b_1 [mm]	9.6E+03	2.4E+04	4.8E+04	7.2E+04	9.6E+04	1.4E+05	1.9E+05
	c_1 [mm]	6.7E+10	6.7E+10	6.7E+10	6.7E+10	6.7E+10	6.7E+10	6.7E+10
	$P_{max,plate}$ [kN]	**125.0**	**118.3**	**107.9**	**98.6**	**90.3**	**76.4**	**65.4**
C35/45	b_1 [mm]	1.1E+04	2.6E+04	5.3E+04	7.9E+04	1.1E+05	1.6E+05	2.1E+05
	c_1 [mm]	7.4E+10	7.4E+10	7.4E+10	7.4E+10	7.4E+10	7.4E+10	7.4E+10
	$P_{max,plate}$ [kN]	**130.5**	**123.2**	**111.9**	**101.9**	**93.0**	**78.1**	**66.6**
C40/50	b_1 [mm]	1.2E+04	3.0E+04	6.0E+04	9.0E+04	1.2E+05	1.8E+05	2.4E+05
	c_1 [mm]	8.4E+10	8.4E+10	8.4E+10	8.4E+10	8.4E+10	8.4E+10	8.4E+10
	$P_{max,plate}$ [kN]	**139.2**	**130.8**	**118.1**	**106.9**	**97.0**	**80.7**	**68.2**
$P_{sh,plate}$ [kN]		**272.2**						

Table B3.8: Projoint Dowel Plus 8mm S500 steel – $P_{max,plate}$ and $P_{sh,plate}$

PARAMETERS		2 x *e* [mm]						
		1.0	**2.5**	**5.0**	**7.5**	**10.0**	**15.0**	**20.0**
t_p[mm]		8.0						
p_b [mm]		150.0						
C20/25	b_1 [mm]	6.0E+03	1.5E+04	3.0E+04	4.5E+04	6.0E+04	9.0E+04	1.2E+05
	c_1 [mm]	5.0E+10	5.0E+10	5.0E+10	5.0E+10	5.0E+10	5.0E+10	5.0E+10
	$P_{max,plate}$ [kN]	**108.9**	**104.7**	**97.9**	**91.6**	**85.9**	**75.6**	**67.0**
C25/30	b_1 [mm]	7.5E+03	1.9E+04	3.8E+04	5.6E+04	7.5E+04	1.1E+05	1.5E+05
	c_1 [mm]	6.3E+10	6.3E+10	6.3E+10	6.3E+10	6.3E+10	6.3E+10	6.3E+10
	$P_{max,plate}$ [kN]	**121.4**	**116.1**	**107.8**	**100.1**	**93.1**	**80.9**	**70.9**
C30/37	b_1 [mm]N]	9.0E+03	2.3E+04	4.5E+04	6.8E+04	9.0E+04	1.4E+05	1.8E+05
	c_1 [mm]	7.5E+10	7.5E+10	7.5E+10	7.5E+10	7.5E+10	7.5E+10	7.5E+10
	$P_{max,plate}$ [kN]	**132.6**	**126.3**	**116.4**	**107.4**	**99.2**	**85.3**	**74.0**
C32/40	b_1 [mm]	9.6E+03	2.4E+04	4.8E+04	7.2E+04	9.6E+04	1.4E+05	1.9E+05
	c_1 [mm]	8.0E+10	8.0E+10	8.0E+10	8.0E+10	8.0E+10	8.0E+10	8.0E+10
	$P_{max,plate}$ [kN]	**136.8**	**130.1**	**119.6**	**110.1**	**101.5**	**86.8**	**75.0**
C35/45	b_1 [mm]	1.1E+04	2.6E+04	5.3E+04	7.9E+04	1.1E+05	1.6E+05	2.1E+05
	c_1 [mm]	8.8E+10	8.8E+10	8.8E+10	8.8E+10	8.8E+10	8.8E+10	8.8E+10
	$P_{max,plate}$ [kN]	**142.9**	**135.5**	**124.1**	**113.8**	**104.6**	**88.9**	**76.5**
C40/50	b_1 [mm]	1.2E+04	3.0E+04	6.0E+04	9.0E+04	1.2E+05	1.8E+05	2.4E+05
	c_1 [mm]	1.0E+11	1.0E+11	1.0E+11	1.0E+11	1.0E+11	1.0E+11	1.0E+11
	$P_{max,plate}$ [kN]	**152.4**	**144.0**	**131.1**	**119.5**	**109.2**	**92.1**	**78.6**
$P_{sh,plate}$ [kN]		**324.0**						