



SAS FREYSSINET PRODUCTS COMPANY  
ZA DU MONAY - BP 18  
71210 SAINT EUSEBE France  
Tel. +33.3.85.73.69.00

**FREYSSINET PRODUCTS CO.**

PRODUCT DESCRIPTION

## Expansion Joints SX



Ref. : EJ-006  
Revision : A  
April 2022



# FREYSSINET

SUSTAINABLE TECHNOLOGY



## COPYRIGHT

This document is the exclusive property of FREYSSINET.

It is confidential and may not be used, reproduced or communicated either in whole or in part, in any form or manner without the prior written agreement of FREYSSINET. All drawings and pictures aren't contractual.

## REVISION INDICES FOLLOW-UP TABLE

Rev	Date	Modification	Prepared by	Checked by	Approved by
0	26/11/2018	First issue	D. FREUND	R. MARTIN	E. THIBOEUF
A	13/04/2022	General modification	E.THIBOEUF	C.GAUCHERAND	P.SALMON

# Sommaire

<b>1. INTRODUCTION</b>	<b>6</b>
1.1. Scope of the document	6
1.2. Freyssinet expansion joints	6
1.3. Scope of use for SX joints	6
1.4. Design	6
1.5. Manufacturing	7
1.6. Installation	7
1.7. Surveillance	7
<b>2. APPLICABLE DOCUMENTS</b>	<b>8</b>
2.1. Specific documentation	8
2.2. Standards for components	9
2.3. Standards for manufacturing	10
2.4. Standards for quality control	10
<b>3. SX DESCRIPTION</b>	<b>11</b>
3.1. Overview	11
3.2. Dimensions	12
3.3. Mouvement Capacity	13
3.4. Drawings	14
3.5. Layout drawings of elements	14
3.6. Layout drawing within the structure	15
3.7. Technical data sheet	15
3.8. Components	16
3.8.1. Main elements	16
3.8.1.1. Rubber	16
3.8.1.2. Steel inserts	16
3.8.2. Fixing joint with rebate	17
3.8.2.1. Socket	17
3.8.2.2. Threaded rod or screw	17
3.8.2.3. Nut	17
3.8.2.4. Washer	17
3.8.2.5. Oblong washer	17
3.8.2.6. PVC spacer tube	17
3.8.2.7. Filling the reservations (Tigitar A or similar)	17
3.8.3. Fixing joint without rebate	18

3.8.3.1.	Fixing grout (Tigipox Grout or similar) .....	18
3.8.3.2.	Threaded rod or screw .....	18
3.8.3.3.	Nut .....	18
3.8.3.4.	Washer .....	18
3.8.3.5.	Oblong washer .....	18
3.8.3.6.	Filling the reservations (Tigitar A or similar) .....	18
3.9.	Accessories .....	19
3.9.1.	Waterproofness .....	19
3.9.2.	Steel sidewalk joint .....	19
3.9.3.	Element cut .....	20
3.9.4.	Upstand (Terminal) .....	20
3.9.5.	Sidewalk upstand (Kerb) .....	21
3.9.6.	Stainless steel screws .....	21
3.9.7.	CR mixt. ....	21
3.9.8.	Drain .....	22
3.9.9.	Levelling beams (Installation arms) .....	23
3.9.10.	Formwork tools .....	24
3.9.11.	Adjustment tools .....	25
3.9.12.	Paving mortar .....	25
4.	<b>DESIGN</b> .....	26
4.1.	Calculation .....	26
4.2.	Testing .....	26
4.3.	Warranty .....	27
4.3.1.	Scope of the warranty .....	27
4.3.2.	Exclusions .....	27
	It is further understood that Supplier shall bear no liability for: .....	28
4.3.3.	The Beneficiary's duties .....	28
5.	<b>PROJECT MANAGEMENT AND MANUFACTURING</b> .....	29
5.1.	Project process .....	29
5.2.	Manufacturing .....	31
5.2.1.	Production sites .....	31
5.2.2.	Manufacturing process for sidewalk cuts, upstands and sidewalks upstands .....	31
5.3.	Quality .....	31
5.3.1.	Quality - ISO 9001 .....	32
5.3.2.	Security - OHSAS 18001 .....	32
5.3.3.	Environment - ISO 14001 .....	32

5.4.	Quality documentation.....	33
6.	<b>REFERENCES</b> .....	34

## Table of illustrations

Figure 1 : 2D image of simple module joint.....	11
Figure 2 : 2D image of double module joint.....	11
Figure 3 : 3D image of SX220 joint.....	11
Figure 4 : Range of SX joints movements.....	13
Figure 5 : Example of a general drawing of a SX joint.....	14
Figure 6 : Layout drawing for a SX joint.....	14
Figure 7 : Layout drawing of a SX joint with structure geometry.....	15
Figure 8 : Rubber.....	16
Figure 9 : Steel inserts.....	16
Figure 10 : Position of the steel inserts in the elastomer.....	16
Figure 11 : 3D view of fixing elements.....	17
Figure 12 : Filling the anchors with pure bitume.....	17
Figure 13 : 3D view of fixing elements.....	18
Figure 14 : Filling of anchors with pure bitume.....	18
Figure 15 : Water tightness with single module element.....	19
Figure 16 : Water tightness with double module element.....	19
Figure 17 : Cut element.....	20
Figure 18 : Different upstand options.....	20
Figure 19 : Sidewalk upstand.....	21
Figure 20 : Detail of drain assembly (3D view).....	22
Figure 21 : Levelling beam of the SX joint.....	23
Figure 22 : Formwork tool of the SX joint (Different possibilities).....	24
Figure 23 : Adjustement tool of the SX joint.....	25
Figure 24 : Test assembly.....	26

## LIST OF TABLES

Table 1 : Standards for components.....	9
Table 2 : Manufacturing standards.....	10
Table 3 : Quality control standards.....	10
Table 4 : Dimensions of the elements.....	12
Table 5 : mouvements.....	13
Table 6 : Quality documentation.....	33



## 1. INTRODUCTION

### 1.1. Scope of the document

This document is intended to describe the product in term of design, manufacturing and inspection, as well as the interaction between the different parts involved in a project.

### 1.2. Freyssinet expansion joints

Freyssinet Group is the world leader in specialized civil engineering, working in two fields: structures and soil. The structural activities include pre-stressing, cable-stayed structures and strengthening of structures. As part as these activities, Freyssinet supplies structural fittings like bearings (elastomeric, mechanical and pot bearings), seismic devices, dampers and expansion joints for bridges and buildings.

Freyssinet Group is organized in geographical zones around the world with strong local roots, with 70 subsidiaries in more than 50 countries. It is a subsidiary of Vinci Construction, world leader in construction and associated services, which combines almost 2,500 companies in more than 100 countries all around the world.

The expansion joints developed by Freyssinet are designed to answer the European and world normative requirements but also the environmental requirements specific to this type of devices. FPC is the industrial branch of the Freyssinet Group and its headquarters are situated in St. Eusèbe (France), from where the manufacturing of Freyssinet products (pre-stressing, stay cables, bridge fittings, etc.) is organized and controlled.

To cope with the increasing demand of all the Freyssinet subsidiaries in the world, FPC has developed an important network of production facilities all over the world, implementing the same Quality Control System worldwide, in accordance with International Quality Standards.

As a result of this group strategy of procurement network, Freyssinet' subsidiaries have improved their services worldwide, and offer flexible and reactive solutions to their clients' needs.

### 1.3. Scope of use for SX joints

The Multiflex SX expansion joint is renowned for its user comfort, its capacity of transverse movement and its durability. It is ideal for standard (with rebate) or quick (without rebate) installation.

### 1.4. Design

SX expansion joint is designed in accordance with European Assessment Document. The calculation note checks SX mechanical's characteristics under static and fatigue loads.

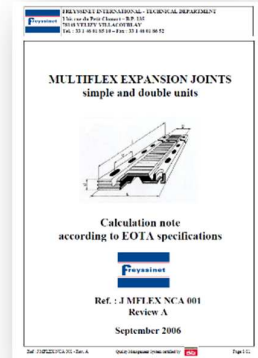
Tests under static and waterproofness have been performed so successfully.

## 1.5. Manufacturing

Freyssinet designs and manufactures his own expansion joints. By this way, we are able to guarantee to all of our customers the same level of excellence and quality in our products and services.

Corrosion protection of the metal parts is assured by a covering of elastomer capable of resisting oil, hydrocarbons, salt and sand without suffering climatic variations due to sunbeams or snow.

This complete control over our products and systems means that we can adapt our solutions to a wide range of applications and extreme operating conditions.



## 1.6. Installation

The SX joint is particularly fast and simple to install, it may be directly installed without reservation in the structures. The comfort for use is insured by the materials used, specially studied to lower the impact of the wheels and absorb the irregularities of the driving surface. All metallic parts are totally coated by elastomer, guaranteeing an exceptional resistance to corrosion. The life expectancy and smooth running of the joints are linked to the quality of their installation. It is installed by successive elements strongly anchored in the structures by socket or by sealing with resin. The installation manual is available on request.



## 1.7. Surveillance

Expansion joints are essential elements of a bridge. Their durability depends on the traffic and the environmental conditions. SX joints do not require heavy maintenance.

However, for optimum service life, it is recommended to follow maintenance operations on the operation of the structure, the surroundings of the joint, the condition of the joint, the condition of the fasteners and the integrity of the membrane. The operations of maintenance and surveillance must be carried out by qualified staff and can be carried out by specialized teams from the Freyssinet group within the framework of a maintenance contract. Freyssinet decided to draft a procedure of follow-up and maintenance according to the European directives which allows to extend the service life of the expansion joints.



## 2. APPLICABLE DOCUMENTS

### 2.1. Specific documentation

The use of the SX expansion joint is inseparable from the following documents (Last version) :

- Installation Procedure - J-MLFSX-PR-F-001
- Service manual - J-MFLEX-MM-F-001
- Calculation Note - J MFLEX NCA 001\*\* as per EOTA
- Calculation Note - J MFLEX NCA 002\*\* as per BS5400

\*Documents not supplied and certain documents only available in English or French version

\*\*Non-communicable document and some of them are only in French or English

## 2.2. Standards for components

Description	Applicable standards	Material
<b>Principal elements</b>		
Steel element	NF EN 10025	S235 JR minimum
Rubber	Freyssinet specification	Mix - NR/SBR (1)
<b>Fixing joint with rebate</b>		
Threaded rod or Screw	ISO 4014 / DIN 931 NF EN 25-136 / DIN 976	Class 10.9
Oblong washer	NF EN 10083	S235 JR or C40+N or A4
Washer	ISO 7089 / DIN 125	Hardness 300HV
Nut	ISO 4032 / DIN 934	HR Class 10
PVC Specer	NF EN 50086	P.V.C.
Socket	NF EN 1563 / ASTM A536	EN GJS-400-15 / 65-45-12
Tigitar A resin	Freyssinet specification	Freyssinet specification
<b>Fixing joint without rebate</b>		
Thread rod	NF EN 25-136 / DIN 976	Class 10.9
Oblong washer	NF EN 10083	S235 JR or C40+N or A4
Washer	ISO 7089 / DIN 125	Hardness 300HV
Nut	ISO 4032 / DIN 934	HR Class 10
TIGIEPOX GROUT resin	Freyssinet specification	Freyssinet specification
Tigitar A resin	Freyssinet specification	Freyssinet specification
<b>Accessories</b>		
Drain	EN 10088	Freyssinet specification
Pavement joint (PL)	Freyssinet specification	Freyssinet specification
Upstand (Terminal)	Freyssinet specification	Freyssinet specification
Upstand with sidewalk (Kerb)	Freyssinet specification	Freyssinet specification

Table 1 : Standards for components

FPC has analysed all standards to meet their specific requirements. FPC uses equivalences for the choice of its materials in order to optimize the costs while respecting the specifications dictated by the standards

<sup>1</sup> NR : Naturel Rubber

SBR : Synthetic Rubber type styrène Butadiène

### 2.3. Standards for manufacturing

Description	Applicable standard
Elastomer manufacturing	Freyssinet specifications
Steel structure manufacturing	EN 10025

*Table 2 : Manufacturing standards*

### 2.4. Standards for quality control

Description	Applicable standard
Visual examination of elastomer	Freyssinet specifications
Quality of elastomer mix	Freyssinet specifications

*Table 3 : Quality control standards*

## 3. SX DESCRIPTION

### 3.1. Overview

Belonging to the mat family of joints, this joint is made up of vulcanised moulded elastomeric elements 1 to 2 meters in length (depending on the model) bonded to metal inserts designed to accommodate moving loads and distribute stress in the fixing. They are connected to each other on-site by means of a high-quality adhesive joint to form a continuous, tight and sustainable joint. The movement capacity of each model depends of the skew angle of the structure.

The Multiflex SX expansion joint is ideal for standard (with rebate) or quick (without rebate) installation. The movement capacity varies from 80 to 350mm depending on the model. The range proposes two types of design:

Single module joints: with this type of joint, the gap is bridged by a central insert supported by two elastomer strips absorbing the applied deformations. This design covers the movement range up to 180 mm (figure 1).

Double module joints: with this type of joint, gap bridging and deformation functions have been separated:

- Running loads are brought to the gap by a strengthened central insert
- The movement is taken up on either side by modules designed in the same way as a single module joint (figure 1). This design covers the range of movements from 220mm to 350mm (figure 2)

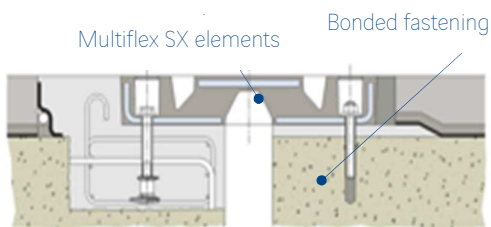


Figure 1 : 2D image of simple module joint

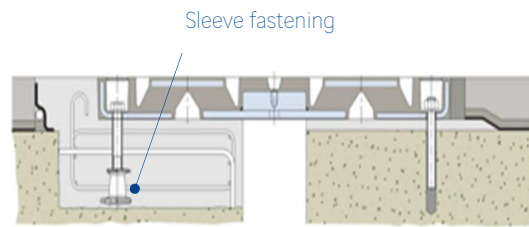


Figure 2 : 2D image of double module joint

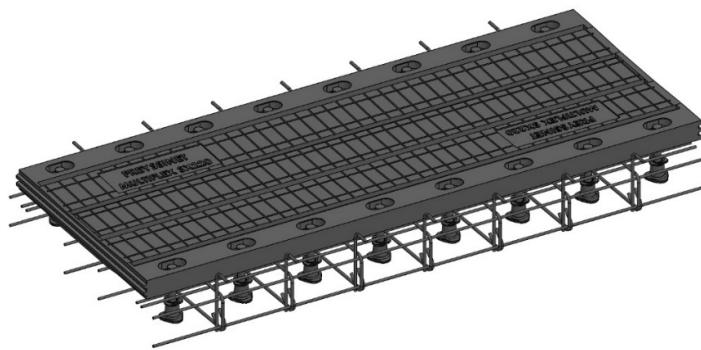
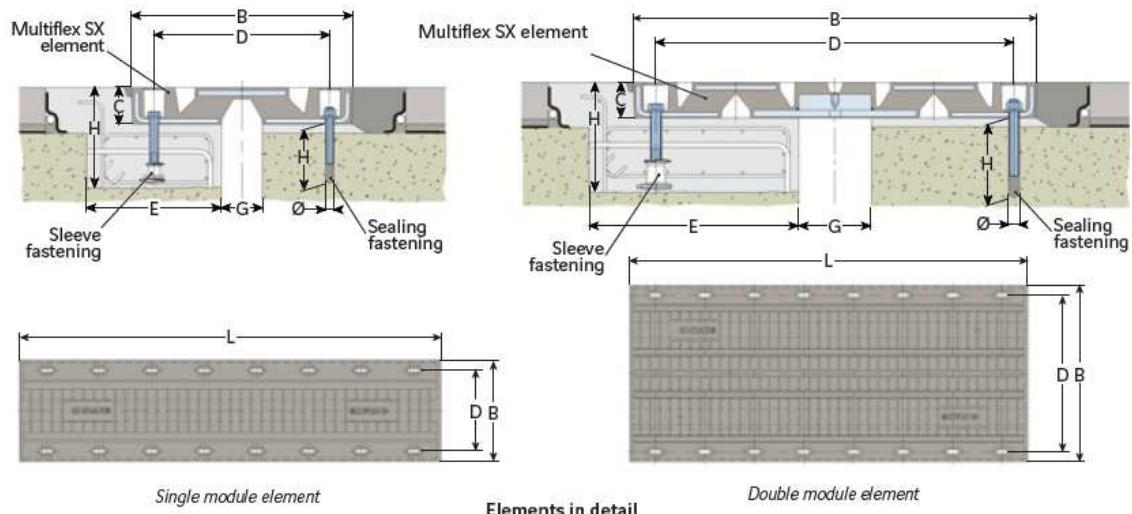


Figure 3 : 3D image of SX220 joint

### 3.2. Dimensions



									Recess				Element		
									Sleeve fastening		Sealing fastening				
Type	Module	Movement	B		D		G		E	H	Ø	H	C	L	Weight
			min.	max.	min.	max.	min.	max.	min.	min.	min.	min.			
SX80	single	±40	235	315	180	260	10	90	195	190	14	170	42	2,000	27
SX100	single	±50	305	405	230	330	10	110	225	190	16	170	46	2,000	35
SX120	single	±60	330	450	240	360	10	130	245	210	18	165	53	2,000	29
SX160	single	±80	390	550	290	450	10	170	265	220	18	150	78	2,000	87
SX180	single	±90	410	590	310	490	10	190	275	230	18	160	82	2,000	96
SX220	double	±110	690	910	590	810	10	230	415	250	24	180	69	2,000	152
SX250	double	±125	915	1,165	815	1,065	10	260	535	250	24	170	69	2,000	244
SX270	double	±135	755	1,025	655	925	15	285	445	260	24	180	78	2,000	179
SX320	double	±160	1,115	1,435	1,005	1,325	60	380	605	350	27	240	82	1,250	244
SX350	double	±175	930	1,280	805	1,155	45	395	525	360	27	220	100	1,000	318

Dimensions in mm

Table 4 : Dimensions of the elements

### 3.3. Mouvement Capacity

Type	Longitudinal movement (mm)	Transversal movement (mm)
SX80	+/- 40	+/- 28
SX100	+/- 50	+/- 35
SX120	+/- 60	+/- 42
SX160	+/- 80	+/- 57
SX180	+/- 90	+/- 64
SX200	+/- 100	+/- 35
SX220	+/- 110	+/- 78
SX250	+/- 125	+/- 88
SX270	+/- 135	+/- 95
SX320	+/- 160	+/- 113
SX350	+/- 175	+/- 124

Table 5 : mouvements

The design of the Multiflex SX joint makes it ideal for use on skewed structures. The graph below shows the effective movement capacity of each model as a function of the skew angle ( $\alpha$ ) of the structure.

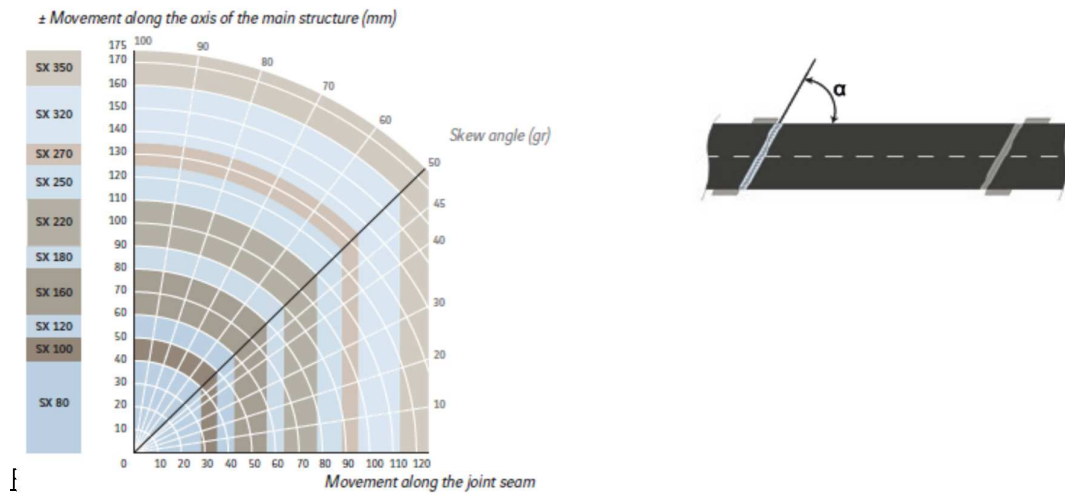


Figure 4 : Range of SX joints movements

The model having to take up  $\pm 95$  mm in the axis of the bridge with a skew of 30gr will be SX250. (see graph above).

A SX270 joint put on a line of 40gr corresponds to a movement following the axis of the structure of 220mm



General drawings (joint elements and fixing) can be given in the formats .pdf and .dwg upon request.  
3D views are also available.

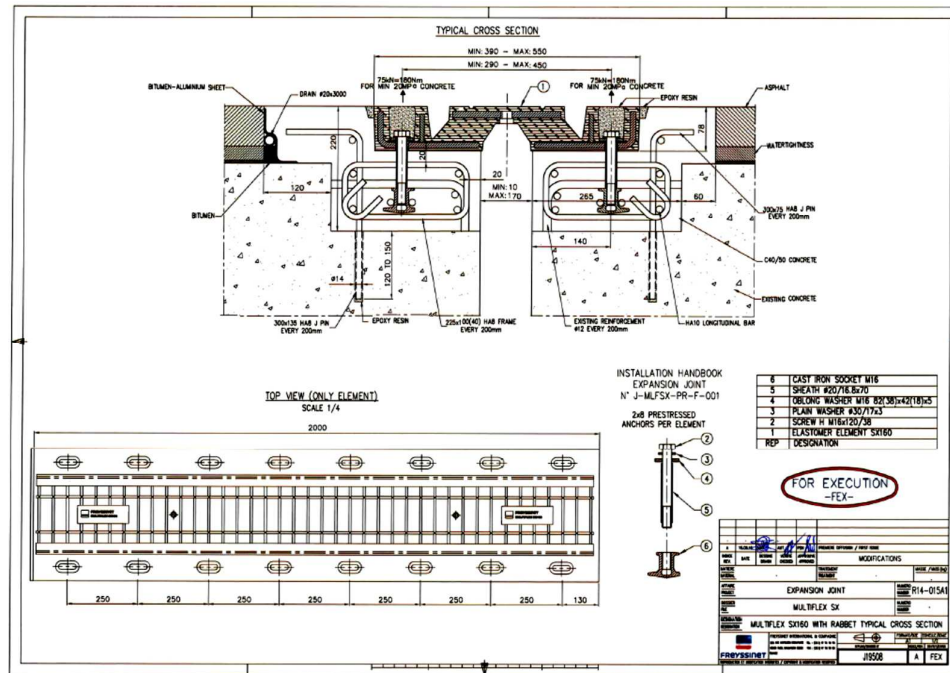


Figure 5 : Example of a general drawing of a SX joint

### 3.5. Layout drawings of elements

As an option, FPC can propose to provide a layout drawing

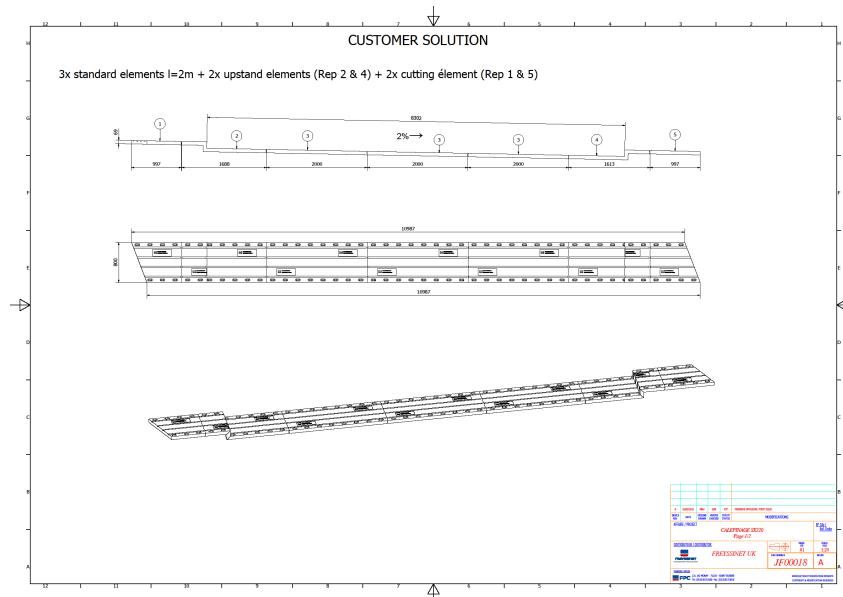


Figure 6 : Layout drawing for a SX joint

Another option FPC can propose is to supply a layout drawing of the line considering the geometry of the structure.

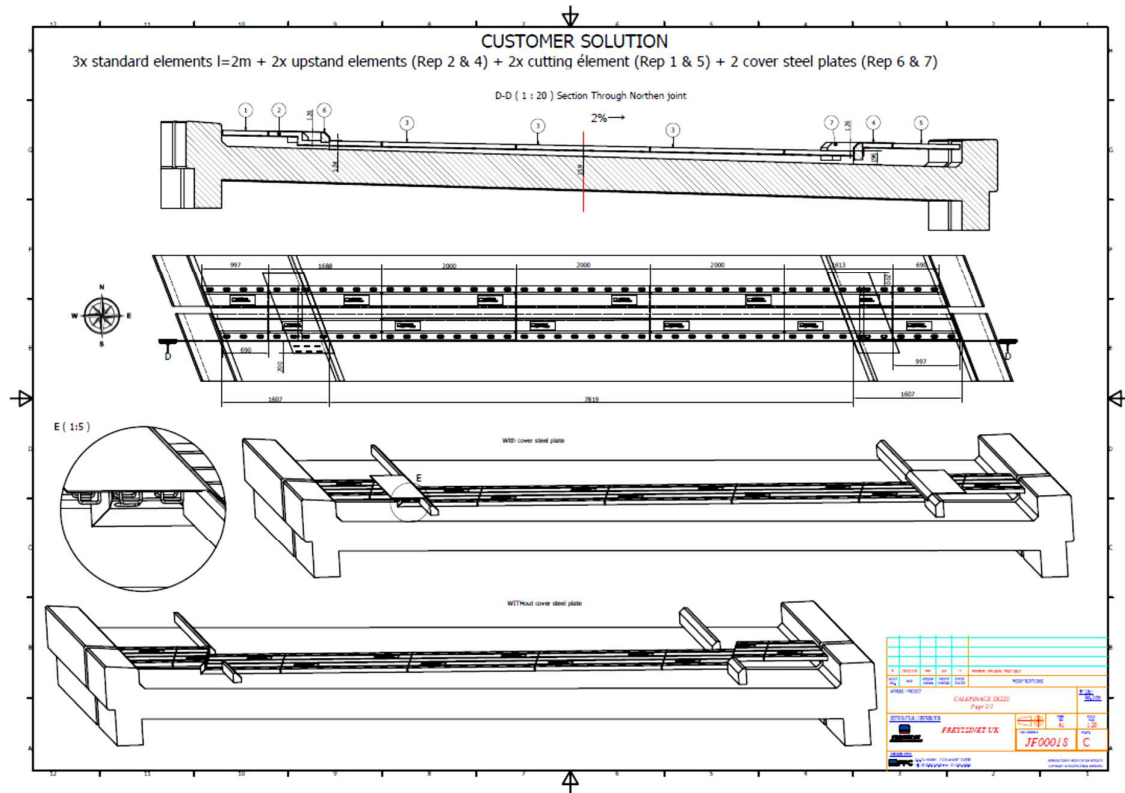


Figure 7 : Layout drawing of a SX joint with structure geometry

### 3.7. Technical data sheet

A technical data sheet is available on request (or downloadable on Eugene Spirit)

[illegible]

### 3.8. Components

#### 3.8.1. Main elements

##### 3.8.1.1. Rubber

Material: NR/SBR mixture

Characteristics:

Shore Hardness: 56-65 Shore A3 (ISO 7619-1)

Tensile strength : min 15,5 MPa (ISO 37)

Elongation at break: min 350% (ISO 37)

Adhesion to metal: min 10 N/mm (ISO 813)



Figure 8 : Rubber

##### 3.8.1.2. Steel inserts

Material: steel S235 JR minimum

Characteristics:

Yield strength  $\geq 235$  MPa

Tensile strength  $\geq 360$  MPa

Elongation at break  $\geq 12\%$



Figure 9 : Steel inserts

The Steel inserts are incorporated into the elastomer. Their role is to assure the mechanical resistance, the anchoring and the decking of the joint.

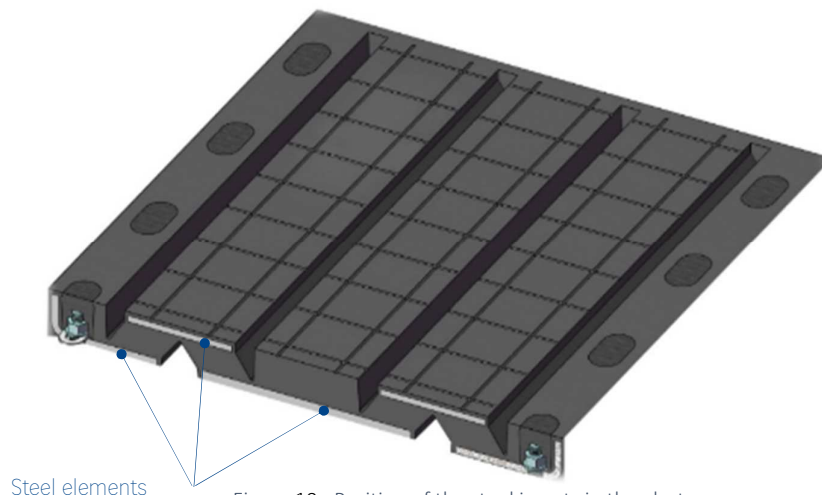


Figure 10 : Position of the steel inserts in the elastomer

### 3.8.2. Fixing joint with rebate

#### 3.8.2.1. Socket

To ensure the anchoring of the screw or the threaded rod (Depending on the type of joint and type of fixing) and the diffusion of tension forces in the concrete, we use a **cast iron socket**.

**Material:** EN-GJS-400-15

**Characteristics :**

$R \geq 400 \text{ MPa}$

$R_{e0.2\%} \geq 250 \text{ MPa}$

A% after breaking  $\geq 15\%$

#### 3.8.2.2. Threaded rod or screw

Ensures the holding of the element on its support.

#### 3.8.2.3. Nut

This element ensures tightening.

#### 3.8.2.4. Washer

The washer distributes the force on the rubber joint.

#### 3.8.2.5. Oblong washer

The oblong washer allows adjusting the element longitudinally.

#### 3.8.2.6. PVC spacer tube

The spacer tube makes it possible to keep a free length of the fastening relative to the concrete.

#### 3.8.2.7. Filling the reservations (Tigitar A or similar)

It's used for the protection and the waterproofness of the anchorages, in particular when finishing the installation to fill the reservations of the anchorage heads and the handling holes of the levelling beams.

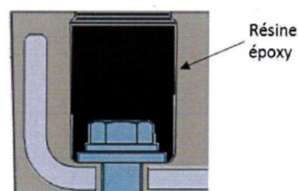


Figure 12 : Filling the anchors with pure bitume



Figure 11 : 3D view of fixing elements

### 3.8.3. Fixing joint without rebate

#### 3.8.3.1. Fixing grout (Tigipox Grout or similar)

In this case, the threaded rod is anchored in the concrete with a fixing resin TIGIGROUT.

#### 3.8.3.2. Threaded rod or screw

Ensures the holding of the element on its support.

#### 3.8.3.3. Nut

This element ensures tightening.

#### 3.8.3.4. Washer

The washer distributes the force on the rubber joint.

#### 3.8.3.5. Oblong washer

The oblong washer allows adjusting the element longitudinally

#### 3.8.3.6. Filling the reservations (Tigitar A or similar)

It's used for the protection and the waterproofness of the anchorages, in particular when finishing the installation to fill the reservations of the anchorages heads and the handling holes of the levelling beams

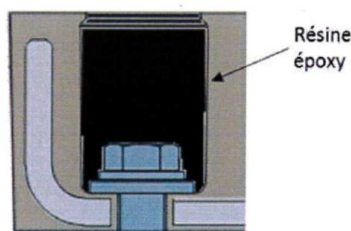


Figure 14 : Filling of anchors with pure bitume

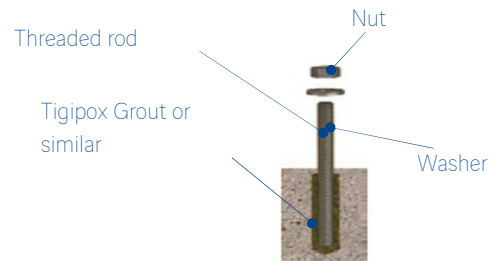


Figure 13 : 3D view of fixing elements

### 3.9. Accessories

The following options are not included in the Multiflex SX joint, they must be clearly requested by the customer if needed.

#### 3.9.1. Waterproofness

Additional water waterproofness can be provided on request through the installation of an elastomeric membrane either pinched underneath the single module element or fastened to a rail or glue underneath the double module element.

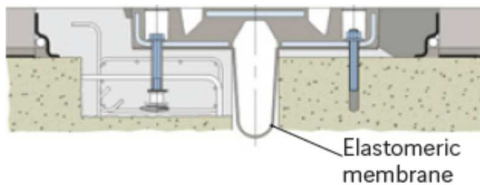


Figure 15 : Water tightness with single module element

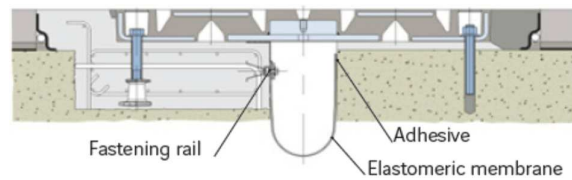


Figure 16 : Water tightness with double module element

#### 3.9.2. Steel sidewalk joint

In order to complete the general waterproofness at the pavement joint and the continuity of the joint with the pavement (or non-circulated areas), it is possible to use steel pavement joints. Several types of PL joint are available (with or without membrane, with or without fallout, with or without bias).

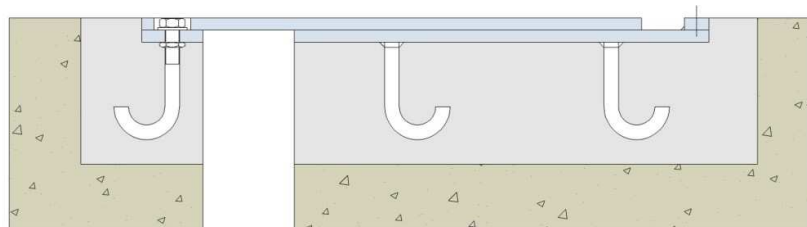


Figure 18: sidewalk joint without membrane

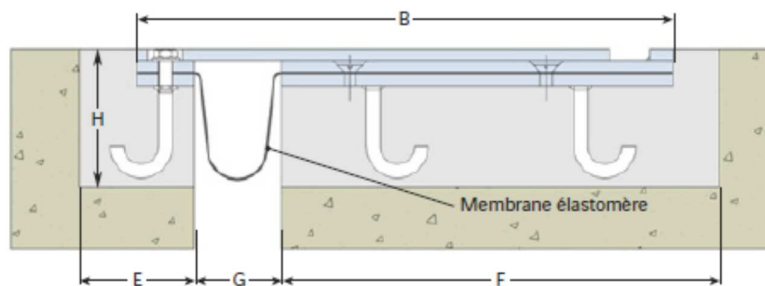


Figure 19: sidewalk joint with membrane

### 3.9.3. Element cut

It is possible, in order to avoid having to do so on site, to have elements cut (straight cut or cut at an angle). In this case, corrosion protection is applied to the cut part to protect the metal inserts.

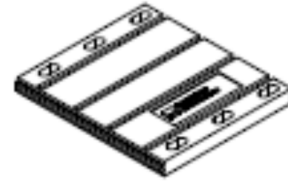


Figure 17 : Cut element

### 3.9.4. Uprand (Terminal)

Its function is to ensure the "elastomer profile measurement" and it is generally used at low points. However, there is no contraindication to using it at the high point as well. This means that the reading can't be done with an angle.

The realization of an upstand called "Terminal" requires a manufacturing plan of the latter.

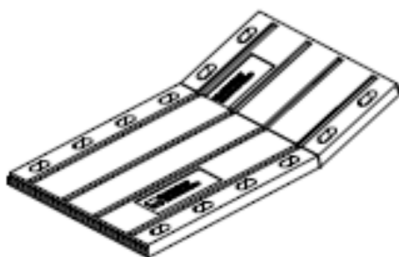
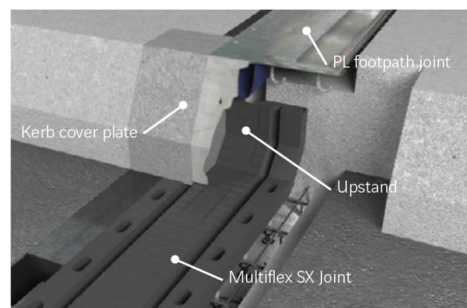


Figure 18 : Different upstand options



### 3.9.5. Sidewalk upstand (Kerb)

Its function is to ensure the "elastomer profile raise" and to ensure the junction with the sidewalk.

This means that the reading can't be done with a bias.

The completion of a sidewalk survey called "Kerb" requires a manufacturing plan.

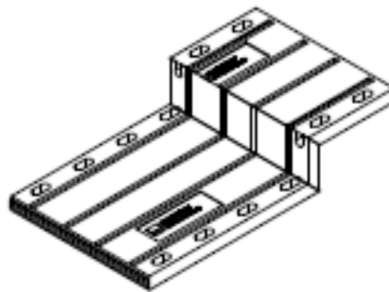
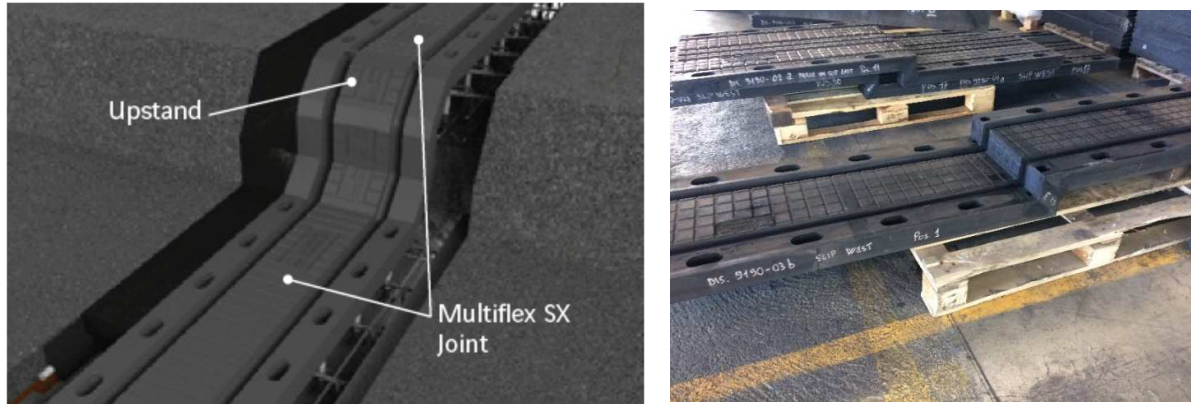


Figure 19 : Sidewalk upstand

### 3.9.6. Stainless steel screws

For joints without rebate (resin fixing), stainless steel screws can be offered.

### 3.9.7. CR mixt

Depending on certain specificities related to the country's regulations, climate, etc., a CR mixture can be used instead of the NR/SBR mixture.



### 3.9.8. Drain

The drain allows water to drain away from the joint area.

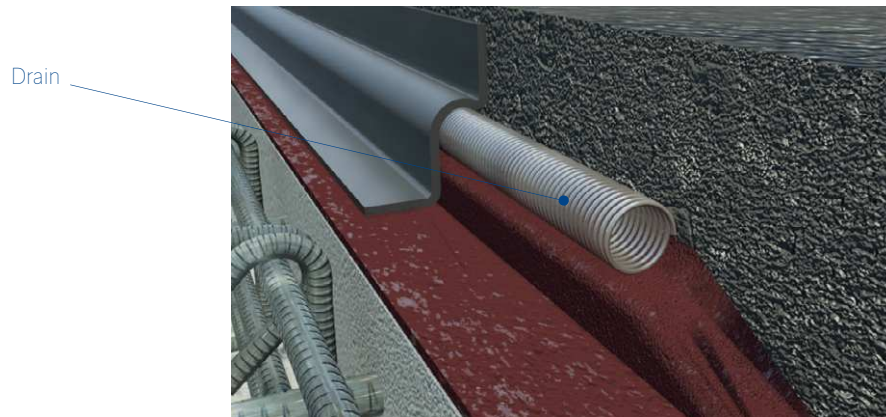


Figure 20 : Detail of drain assembly (3D view)

Some constituents of the stainless steel drain are subject to special regulations concerning transport. This is the true impression. This product may be purchased locally.

Note: The commonly used drain is the stainless steel drain but a PVC drain can also be used. (More information on simple request).

A drain installation procedure is available on request.



### 3.9.9. Levelling beams (Installation arms)

The levelling beam are used for the installation. This equipment is necessary to install the level joint between the bridge and the abutment.

To date, FPC does not offer these installation arms for sale or rental. However, the installation arms of the other joints can be used.

Levelling  
beam

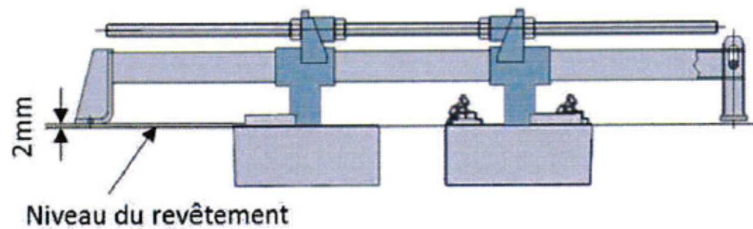


Figure 21 : Levelling beam of the SX joint

### 3.9.10. Formwork tools

For joints with non-rabbed installation, formwork tools can be used. These formwork tools are generally made by the site.

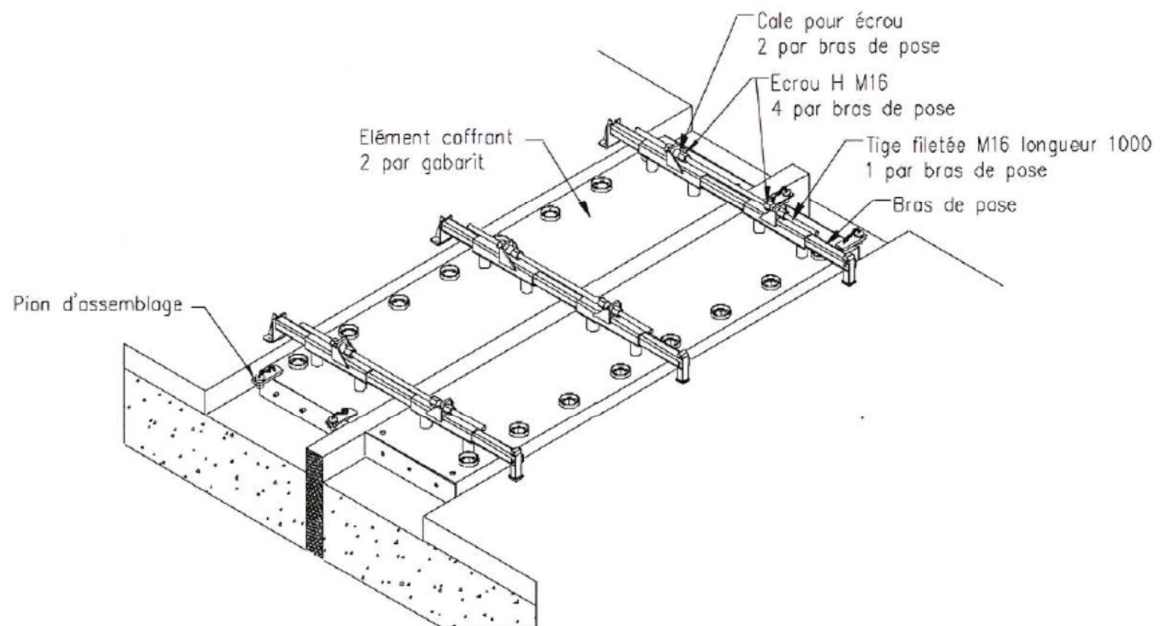


Figure 22 : Formwork tool of the SX joint (Different possibilities)

To date, FPC does not offer these formwork tools for sale or rental.

### 3.9.11. Adjustment tools

Adjustments can be made to optimize the type of Multiflex but FPC does not offer these adjustment tools for sale or rental. Except in special cases, it is preferable to use the Multiflex type from the above range.

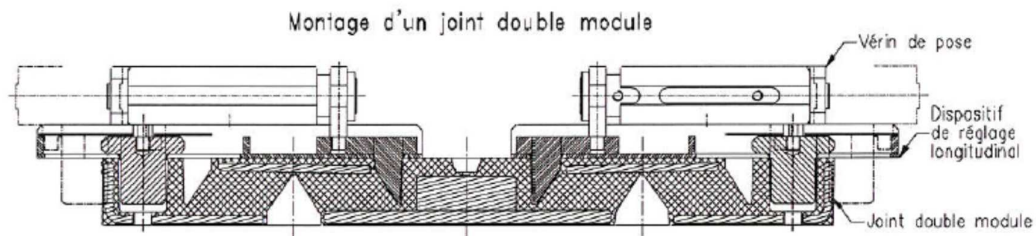


Figure 23 : Adjustment tool of the SX joint

### 3.9.12. Paving mortar

For rebate free installation, a laying mortar can be proposed. (TIGIGROUT 102FR mortar or similar).

**General note to all the products offered:** Some products listed above are subject to certain specific conditions of transport (Tigitar A, Tigipox Grout, Tigigrout 102FR etc...). FDS are available on request.

## 4. DESIGN

### 4.1. Calculation

The Multiflex SX joint is designed according to ETAG 032.

### 4.2. Testing

The Multiflex SX joint has been laboratory tested to validate its functionality and strength:

- Raising on one side of the joint and then tension-compression stress
- joint shear
- Combined compression and shear
- Breath capacity test
- Leak test

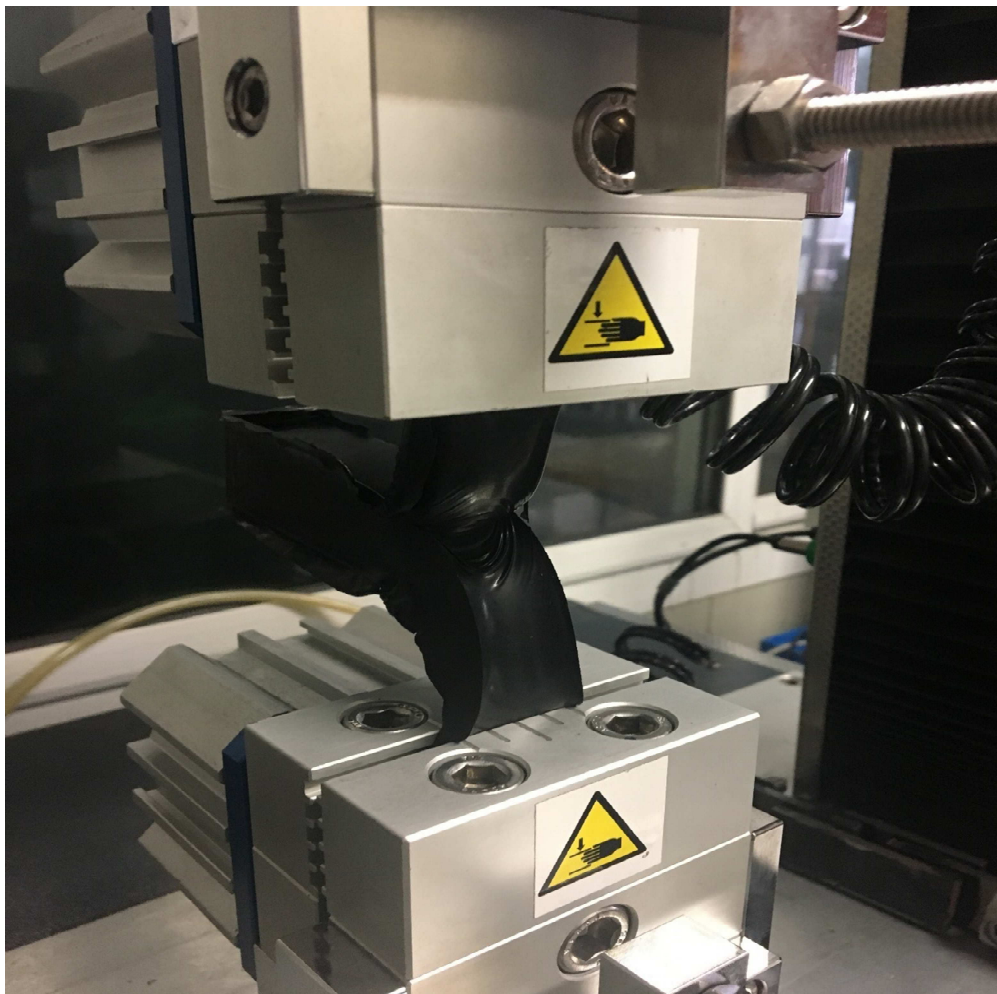


Figure 24 : Test assembly



### 4.3. Warranty

The beneficiary provisions of the present deed of warranty ("Warranty") are applicable for the sole purpose of the sales of WP1, WP2, WP3 and WP4 Expansion Joints (the "Goods") by Freyssinet Products Company (the "Supplier") to the Soletanche Freyssinet subsidiaries or any of their licensees (the "Warrantee").

#### 4.3.1. Scope of the warranty

- The Supplier warrants that the Goods supplied to the beneficiary of this Warranty are manufactured in compliance with the applicable technical specifications.
- Supplier agrees to indemnify the Warrantee from any direct damages, costs, losses or expenses arising from any fault or deficiency in materials or manufacturing provided as part of the Goods ("Defect").
- In the event the Warrantee notifies the Supplier of any Defect within two (2) years following delivery of the Goods to the Warrantee according to applicable Incoterms, the Supplier shall carry out correction work in respect of such Defects in accordance with the provisions below:
  - Liability of the Supplier under this Warranty is limited to repair or delivery of replacement Goods at the applicable delivery point, at the Supplier's option;
  - All Goods or part thereof that has/have been replaced or repaired shall bear the balance of the original warranty period as shall remain from the date of the repair or replacement of such Good or part.

#### 4.3.2. Exclusions

Notwithstanding the foregoing, the Supplier shall not be liable for Goods' failure to comply with the Warranty in any of the following events:

- The Defect arises because the Warrantee failed to follow the Supplier's oral or written instructions as to the storage, commissioning, installation, use and maintenance of the Goods as provided in the applicable manuals (in their latest version);
- The Defect arises as a result of any error or omission of any drawing, design or specification supplied by the Warrantee to the Supplier, including as a result of the Seller following any drawing, design or Goods specifications supplied by the Client
- The Warrantee materially alters or repairs the Goods without the Supplier's prior written consent;
- The Defect arises as a result of normal wear and tear (including corrosion of steel parts and ageing of rubber components);
- The Defect arises as a result of any wilful damage caused to the Goods (or part thereof) by the Warrantee or any third party, or negligence or abnormal storage or working conditions or any misuse of the Goods, including damage resulting from rough handling;
- The Defect arises from the occurrence of any unforeseen environmental conditions or by Force Majeure events (including but not limited to fires, floods, earthquakes, etc.), Act of God, and other circumstances beyond the Supplier's reasonable control;
- The Defect arises from an exposure at a temperature below -20°C or above 50°C;
- The Defect arises from overloads, stresses, impacts, sliding movements and any other parameter exceeding data provided in the applicable technical specifications;

- The Defect arises due to failure of any civil/ structural/ ancillary works associated with structure, outside the perimeter of defined scope of the System Supplier.

It is further understood that Supplier shall bear no liability for:

- Any consequential damages incurred by the Warrantee and/or its clients (Including but not limited to costs for third party inspection, liquidated damages, penalties for delay, loss of use, stand-by costs, etc.) or aesthetic damages;
- Any dismantling or reinstatement costs;
- Warrantee's or third party's labour costs;
- Specialist equipment, scaffolding, heavy tools and lifting equipment as well as power, gas and water needed for any correction work.

#### **4.3.3. The Beneficiary's duties**

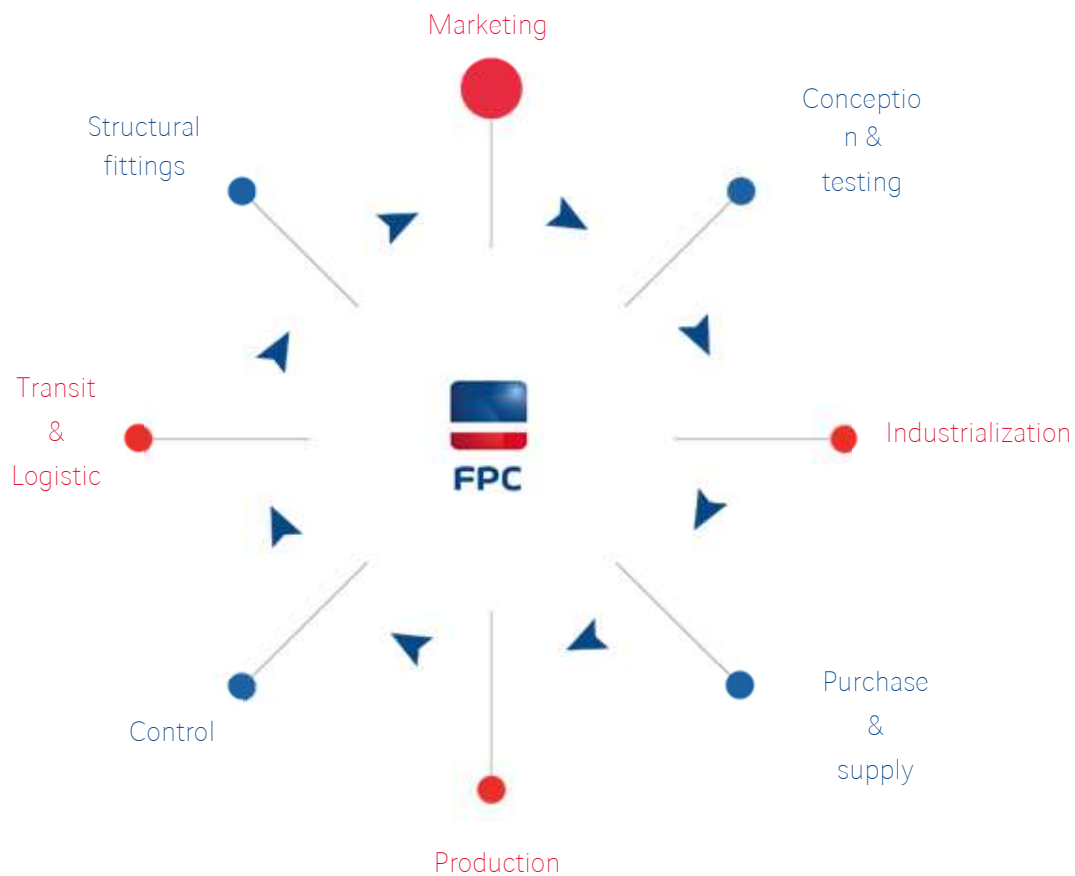
The Warrantee shall respect the rules of the art and follow the instructions provided in the installation and maintenance manuals (in their latest version)

THIS WARRANTY SHALL BE APPLICABLE AS THE STANDARD WARRANTY RELATING TO ANY OF THE GOODS SOLD BY THE SUPPLIER TO THE WARRANTEE.

TO THE EXTENT PERMITTED BY LAW, THIS WARRANTY EMBODIES THE ENTIRE UNDERSTANDING OF THE SUPPLIER AND THE WARRANTEE, AND SUPERSEDES ANY PRIOR WRITTEN OR OTHER AGREEMENT BETWEEN THE SUPPLIER AND THE WARRANTEE, IN RELATION TO ANY WARRANTY RELATING TO THE GOODS.

## 5. PROJECT MANAGEMENT AND MANUFACTURING

FPC coordinates all project phases. Support services also participate in the process

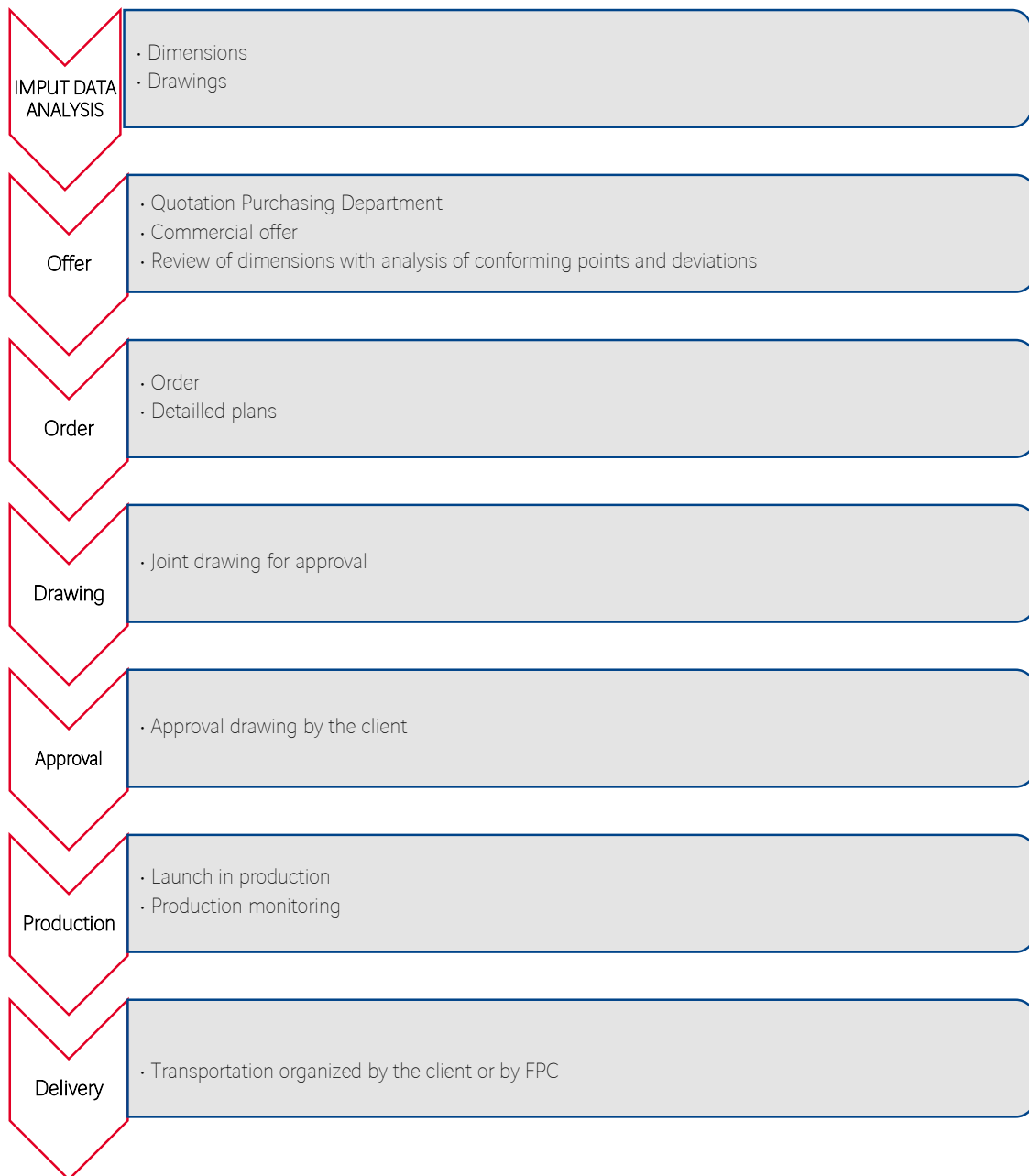


### 5.1. Project process

For each project where there are cuts, raises and sidewalk raises, the following process must be considered. The time frame for each step must be anticipated.

After receipt of the dimensions, the following process is applied:





Before starting any manufacturing process, the approval drawing signed from customer is required. This step is absolutely mandatory for the good continuity of the project.

## 5.2. Manufacturing

### 5.2.1. Production sites

SX elements, sections, curbs and sidewalk curbs are manufactured in Italy. A detailed presentation of the production site is available on request.



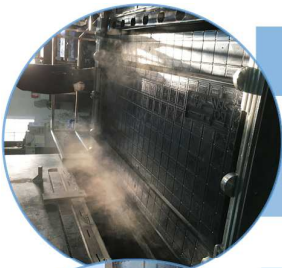
### 5.2.2. Manufacturing process for sidewalk cuts, upstands and sidewalks upstands



Launch in production

Supply of standards elements

Element cutting and assembly



Corrosion protection (If necessary)

Vulcanization (If necessary)

Control



Logistics / transportation



### 5.3.1. Quality - ISO 9001

FPC is certified ISO 9001:2015

### 5.3.2. Security - OHSAS 18001

FPC is certified OHSAS 45001:2018

### 5.3.3. Environment – ISO 14001

FPC is certified ISO 14001:2015



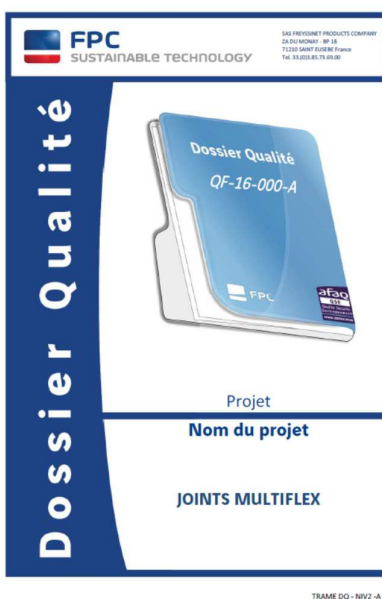
## 5.4. Quality documentation

Different levels of quality documentation can be provided (Level 0 to Level 2). The definition of each level is available in the price list of the quality files sent with the offer. The level of quality documentation must be determined at the beginning of the project.

Item	Documentation	Level 0	Level 1	Level 2
General Documentation	Delivery note	X	X	X
	ITP	-	-	X
Rubber + Metal insert	Material certificate	-	X	X
	ITP	-	-	X
Socket	Material certificate 3.1	-	X	X
	ITP	-	-	X
Final control	Dimensional inspection report	-	-	-

Table 6 : Quality documentation

\*All documents can be shown during an audit.



## 6. REFERENCES

The list of references for FPC projects is available on request but can also be consulted on the FPC website.

