

**Method Statement**  
**Waterproofing Tunnel-**  
**with 2.0 MM PVC Homogenous type**

From

Joaboa Tech



Method Statement  
Waterproofing Tunnel-  
with 2.0 MM PVC Homogenous type

- PART 1**      Brochure of Product
- PART 2**      Certificate of Product
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# RAILWAY TUNNLE WATERPROOFING SOLUTION

RAILWAY WATERPROOFING  
SOLUTIONS



# COMPANY PROFILE

SHENZHEN JOABOA TECH GROUP(hereinafter referred to as JOABOA TECH) is a system supplier of functional construction materials, as well as to undertake decoration & insulation and waterproofing projects. JOABOA TECH is established in 1999, whose headquarter is located in Shenzhen, till now it has 8 production bases.

JOABOA TECH' s product ranges cover several categories and dozens of types in total, including, building waterproofing, decoration & insulation, siphon drainage, home used waterproofing series.

## Who We Are

- No. 1 Sales of Self-adhesive Bituminous Waterproofing Membranes in the World for Consecutive Years;
- Annual Sales over \$560 Million USD, 30+ Branch Companies, Hundreds of National Patents, Thousands of Agents;
- Firstly Set up Waterproofing Engineering Insurance System in Chinese Mainland;
- Pioneer of High Quality Waterproofing System;
- Presidium Member of China Building Waterproofing Association;
- Among the First Batch of National High-tech Enterprises;
- Top 10 Brand in China Building Waterproofing Industry;
- Top 500 Brand in China Building Construction Industry;
- Famous Brand Preferred by Top 500 Real Estate Companies in China;
- AAA Credit Enterprises in China Building Waterproof Industry ;

Joaboa' s products and systems are widely used in major infrastructure construction, industrial buildings and civil & commercial buildings, with landmark projects such as Hong Kong-Zhuhai-Macao Bridge, The First Affiliated Hospital of Zhengzhou University(world' s largest hospital), Office Building of National Public Security, Beijing Olympics Stadium, Shenzhen Bao' an Airport, Beijing Universal Studios, HUAWEI Bantian Base, Tencent Headquarter, Canton Fair Stadium, etc.

# SUMMARY OF RAILWAY WATERPROOFING

As an important transportation tool, Railway is an important infrastructure to support the economic and social development of the city. At present, China's railway transportation has entered a period of rapid development. Nowadays, water leakage is common condition more or less in railway transportation. The leakage problem will cause corrosion of steel bars, reduce the durability of concrete, and affect the safety of its operation and auxiliary equipment, while the waterproofing of bridge deck structures and mountain tunnels is more complicated than the ground floor waterproofing, and the controllability is worse. Therefore, the scientific and reasonable waterproofing structure and application are particularly important.



## WATERPROOFING FEATURES

### DIFFICULT CONSTRUCTION

The initial supporting layer or the surface of rock structure is uneven in the railway tunnel, the waterproofing surface substrate is poor, and the application conditions are bad, so the waterproofing application is difficult.

### LOTS OF DETAIL PARTS

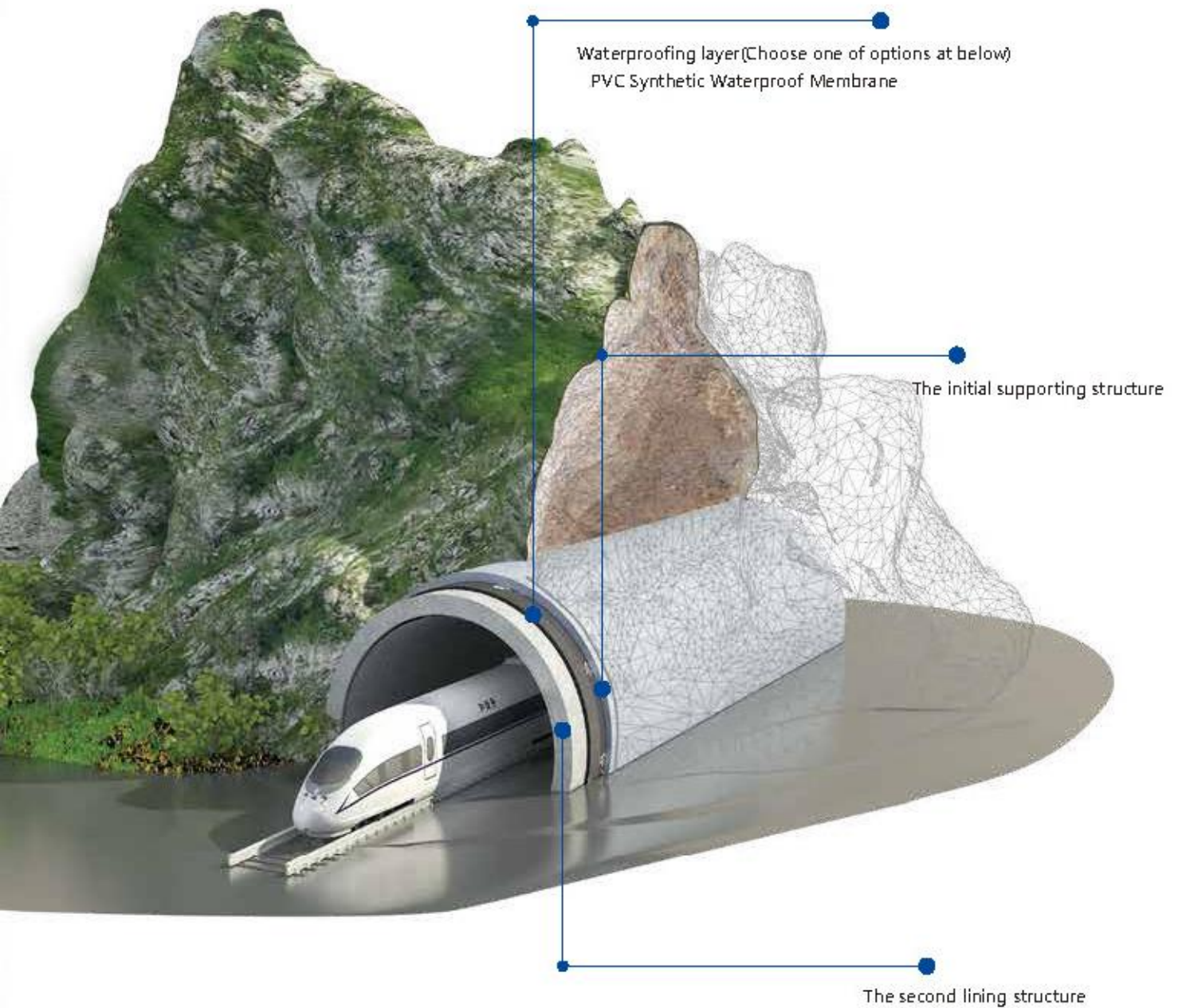
There are many joints such as deformation joints (induction joints) and construction joints in railway decks and uniform longitudinal extension structure of tunnels which make it difficult for waterproofing.

### LARGE DEFORMATION OF THE STRUCTURAL LAYER

Long-term dynamic load will lead to large deformation of structural layer in tunnels, roads or bridge decks.



# RAILWAY TUNNEL WATERPROOFING SOLUTION



# APPLICATION TECHNOLOGY

## S-CLF Self Adhesive Membrane Application Method

Drilling



Nailing



Hanging and Paving membrane



Install the next sheet membrane



Overlap treatment



Check and acceptance



## PVC Synthetic Membrane Application Method

Smoothen concrete substrate



Install non woven geotextile



Fix the welding pad/disk



Weld PVC membrane



Overlap treatment



Final quality check





# APPLICATION METHOD

## Railway tunnel geotextile + PVC sheet application

1. Smoothing the shotcrete surface prior to waterproofing.
2. Install the non-woven geotextile( $\geq 500\text{g}/\text{m}^2$ )
3. Fix the welding pad/disk- PVC disc on installed geotextile.
4. Spot weld the PVC membrane on the PVC disc
5. Weld the long side with tunnel crawl welding machine. Make sure the 10 cm welding.
6. Weld the short side and other joints with hand welding machine.
7. Test the welding seam with air pressure device.



## Railway bridge deck coating construction

- Base Treatment: The construction surface shall be solid, smooth, dry, without visible water, dust or oil, and recess and damaged parts must be filled and smoothed.
- Ingredients: According to the specified weight ratio of part A and part B, first put the part A into the container and then add the part B, and stir well before use.
- Construction: the construction of materials is usually carried out in two times. The mixed paint shall be evenly applied on the base surface with rubber sheet or coir brush. The coating and scraping shall be repeated in two vertical directions for several times. When the first layer of coating is dry and solidified, the second layer can be applied.
- Protective layer construction: In order to increase the adhesion between the waterproof layer and the protective layer, before the last layer of coating is cured, sprinkle a little coarse sand on the surface to make the protective layer and the waterproof layer bond firmly

# PROJECT DIRECTORY



Chengdu Metro



Tianjin Metro



Wuhan Metro



Shanghai Metro



Ningbo Metro



Wuxi Metro



Shenzhen Metro



Nanjing Metro



Guangzhou-Shenzhen-Hong Kong  
Passenger Dedicated Line



Huizhou -Dongguan - Shenzhen  
Intercity Railway



Hanyi Metro



Changzhutan Intercity Railway



Lianyan Metro



Dongguan -Foshan Intercity Railway



Fujia Metro



Daya Bay Nuclear Power Gaoling Tunnel



Chongqing Sanpai Mountain Tunnel



Nanjing Jiuhua Mountain Tunnel

# CERTIFICATE



## Quality Management Systems Certificate

Certificate Number: 00221Q21657R2M

CQM hereby certifies that

Shenzhen Joaboa Technology Co., Ltd.

United Social Credit Code: 91440300728579238Y

Domicile: Floor 16th, Building 2, North Area, Excellence Meilin Central Square, Futian Dist., Shenzhen City, Guangdong,  
P.R. China

and other sites has implemented and maintains a Quality Management System  
which fulfils the requirements of the following standards

**GB/T 19001-2016/ISO 9001:2015**

***Quality management systems---Requirements***

This certificate is valid to the following product(s)/service:

Production, sales and service of waterproofing membrane, waterproofing coating

For the each site and certification scope to the attachment

Issued on: 2021-03-24

Effective date: 2021-03-24

Validity date: 2024-04-12

Registration Number: CQM-95-2005-0033-0001

The validity of the certificate can be checked on [www.cnca.gov.cn](http://www.cnca.gov.cn), *Certificate Confirmation* and CQM website



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<http://www.cqm.com.cn>

D 0062216

# CERTIFICATE

## Quality Management Systems Certificate

Attachment ( Page 1 of 1 )

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# CERTIFICATE

## Environmental Management Systems Certificate

Certificate Number: 00221E31014R2M

CQM hereby certifies that

Shenzhen Joaboa Technology Co., Ltd.

United Social Credit Code:91440300728579238Y

Domicile:Floor 16th, Building 2, North Area, Excellence Meilin Central Square, Futian Dist., Shenzhen City, Guangdong,  
P.R.China

and other sites has implemented and maintains a Environmental Management System which fulfils the requirements of the following standards

**GB/T 24001-2016/ISO 14001:2015**

***Environmental management systems-  
Requirements with guidance for use***

This certificate is valid to the following product(s)/service:

Production, sales and service of waterproofing membrane, waterproofing coating and relevant management activities

For the each site and certification scope to the attachment

Issued on: 2021-03-24

Effective date: 2021-03-24

Validity Date: 2024-04-12

Registration Number: CQM-95-2005-0033-0002

The validity of the certificate can be checked on [www.cnca.gov.cn](http://www.cnca.gov.cn), *Certificate Confirmation* and CQM website

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<http://www.cqm.com.cn>

EY 0022682

# CERTIFICATE

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EY 0022684

# CERTIFICATE



## Occupational Health and Safety Management Systems Certificate

Certificate Number: CQM21S20892R2M

CQM hereby certifies that

Shenzhen Joaboa Technology Co., Ltd.

United Social Credit Code:91440300728579238Y

Domicile:Floor 16th, Building 2, North Area, Excellence Meilin Central Square, Futian Dist., Shenzhen City, Guangdong,  
P.R.China

and other sites has implemented and maintains a Occupational Health and Safety Management System which fulfils the requirements of the following standards

**GB/T 45001-2020/ISO 45001:2018**

***Occupational health and safety management  
systems -- Requirements with guidance for use***

This certificate is valid to the following product(s)/service:

Production, sales and service of waterproofing membrane, waterproofing coating and relevant management activities

For the each site and certification scope to the attachment

Issued on: 2021-03-24

Effective date: 2021-03-24

Validity date: 2024-04-12

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## Occupational Health and Safety Management Systems Certificate

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# CERTIFICATE

Shenzhen Joaboa Technology Co., Ltd.

*for the following scope:*

**Production, sales and service of waterproofing membrane, waterproofing coating**

For the each site and certification scope to the attachment

*has implemented and maintains a*

*Quality Management System*

*which fulfils the requirements of the following standard:*

**ISO 9001:2015**

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**Registration Number: CN-00221Q21657R2M**



Alex Stoichitoiu  
President of IQNet

Ji XiaoDong  
General Manager of CQM



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For the each site and certification scope to the attachment

*has implemented and maintains a*

*Environmental Management System*

*which fulfils the requirements of the following standard:*

**ISO 14001:2015**

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*has implemented and maintains a*

*Occupational health and safety Management System*

*which fulfils the requirements of the following standard:*

**ISO 45001:2018**

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***Expires on: 2024-04-12***

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□ FM certificate for PVC/TPO from Joaboa  
The highest international standard



- excellent properties
- strong tensile strength
- high elongation
- low shrinking rate
- good low temperature flexibility
- long lifetime
- stable properties



# 2.0mm PVC-H test report



卓宝科技  
JOABOR TECH

No.	Test Items		Actual Measurement	Test Method	Equivalent to EN standard	
1.	Thickness, mm		2	GB/T 328.5-2007	EN 1842-2	
2.	Tensile Properties	Tensile Strength MPa	Longitudinal Direction	21	GB/T 328.9-2007	EN 12311-2
			Horizontal Direction	18.5		
		Elongation at Break, %	Longitudinal Direction	290		
			Horizontal Direction	298		
3.	Dimension Stability		Longitudinal Direction	1.5	GB/T 328.13	EN 1107-2
			Horizontal Direction	0.14		
4.	Dimension Change Rate after Heat Treatment, %		Longitudinal Direction	1.66	GB/T 328.13	EN 1107-2
			Horizontal Direction	0.15		
5.	Low Temperature Flexibility		-25°C, no cracking	GB/T 328.15	EN 495-5	
6.	Watertightness		Impermeable	GB/T 328.10-2007	EN 1928	
7.	Hydrostatic resistance		No leakage	GB/T 328.25-2007	EN 12730	
8.	Anti-impact Property		Impermeable	GB/T 20624.3	-	
9.	Peel Strength of Overlapping Parts, N/mm		Membranes are damaged	GB/T 328.21-2007	EN 12316-2	
10.	Tear strength, N/mm		Longitudinal Direction	130	GB/T 328.19-2007	EN 12310-2
			Horizontal Direction	122		
11.	Right-angled Tearing Strength, N/mm		Longitudinal Direction	70	GB/T 328.19-2007	EN 12310-2
			Horizontal Direction	64		
12.	Welding seam strength (Shear resistance of Joint), N/mm		24.3	GB/T 328.23-2007	EN 12317-2	
13.	Water Absorption (70°C, 168h), %		<1.0	GB 12952-2011	-	

# 2.0mm PVC-H test report



卓宝科技

JOABOR TECH

No.	Test Items		Actual Measurement	Test Result	Equivalent to EN standard
14.	Chemical Resistance (Salt Treatment)	Visual Test		No bubbling, cracks, delamination, bonding and holes	GB 12952-2011 GB/T 328.9-2007 GB/T 328.15 - EN 12311-2 EN 495-5
		Retention Rate of	Longitudinal Direction	100	
		Tensile Strength, %	Horizontal Direction	92	
		Retention Rate of	Longitudinal Direction	90	
		Elongation, %	Horizontal Direction	99	
Low Temperature Flexibility		-20°C, no cracking			
15.	Chemical Resistance (Alkali Treatment)	Visual Test		No bubbling, cracks, delamination, bonding and holes	GB 12952-2011 GB/T 328.9-2007 GB/T 328.15 - EN 12311-2 EN 495-5
		Retention Rate of	Longitudinal Direction	99	
		Tensile Strength, %	Horizontal Direction	95	
		Retention Rate of	Longitudinal Direction	100	
		Elongation, %	Horizontal Direction	101	
Low Temperature Flexibility		-20°C, no cracking			
16.	Chemical Resistance (Acid Treatment)	Visual Test		No bubbling, cracks, delamination, bonding and holes	GB 12952-2011 GB/T 328.9-2007 GB/T 328.15 - EN 12311-2 EN 495-5
		Retention Rate of	Longitudinal Direction	88	
		Tensile Strength, %	Horizontal Direction	96	
		Retention Rate of	Longitudinal Direction	124	
		Elongation, %	Horizontal Direction	104	
Low Temperature Flexibility		-20°C, no cracking			
17.	Thermal Aging Treatment (80°C, 672h)	Visual Test		No bubbling, cracks, delamination, bonding and holes	GB/T 18244 GB/T 328.9-2007 GB/T 328.15 - EN 12311-2 EN 495-5
		Retention Rate of	Longitudinal Direction	98	
		Tensile Strength, %	Horizontal Direction	99	
		Retention Rate of	Longitudinal Direction	101	
		Elongation, %	Horizontal Direction	198	
Low Temperature Flexibility		-20°C, no cracking			
18.	Artificial climate accelerates aging (1500h)	Visual Test		No bubbling, cracks, delamination, bonding and holes	GB/T 18244 GB/T 328.9-2007 GB/T 328.15 - EN 12311-2 EN 495-5
		Retention Rate of	Longitudinal Direction	95	
		Tensile Strength, %	Horizontal Direction	93	
		Retention Rate of	Longitudinal Direction	93	
		Elongation, %	Horizontal Direction	93	
Low Temperature Flexibility		-20°C, no cracking			

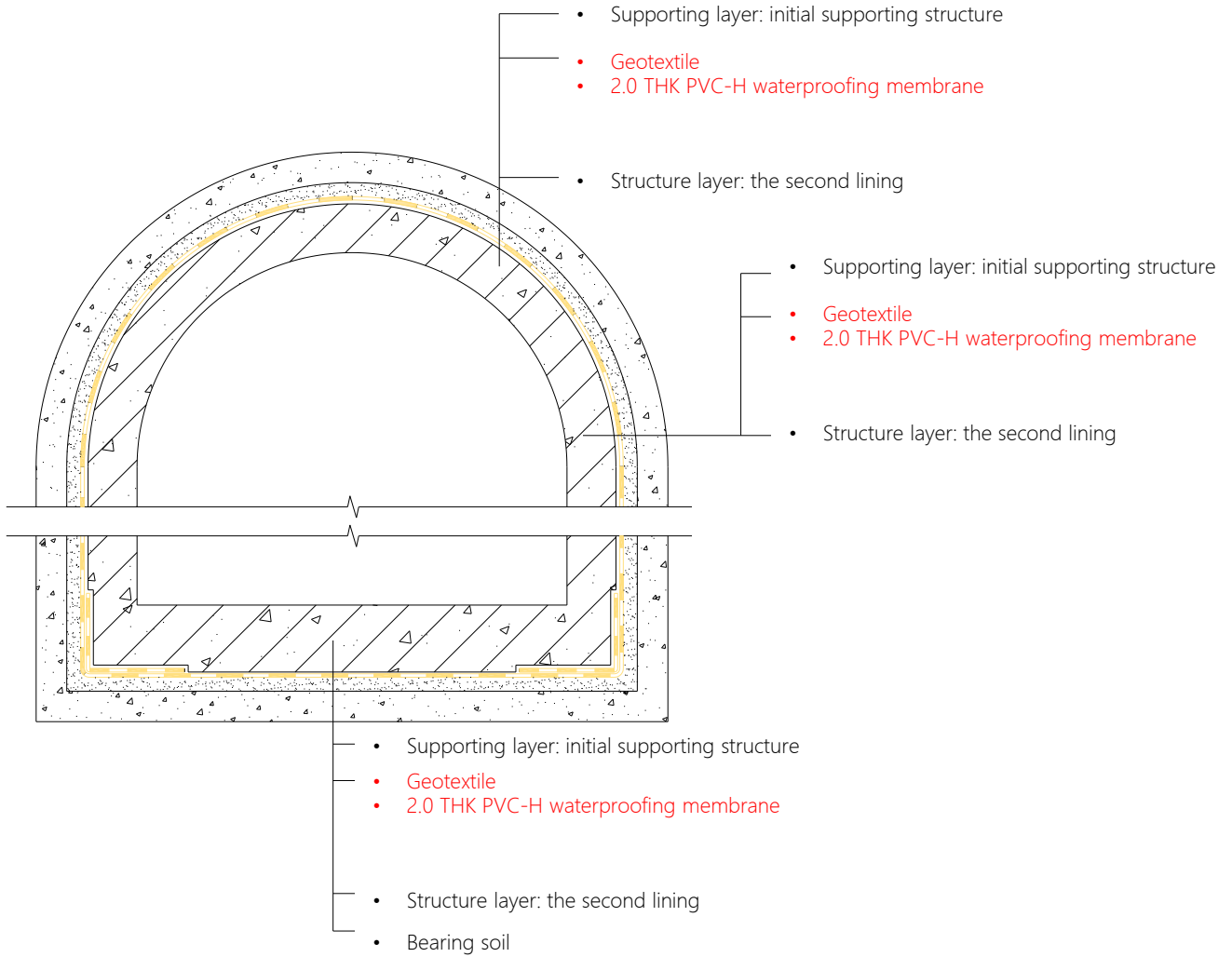
# Requirement of some accessories

Geotextile		
<b>Appearance</b>	Surface:	structured
Color	White	
Thickness	3.6 mm	
Mass per Unite Area	500 g/m <sup>2</sup>	
Physical properties		
Strength at break	16.0 KN/m	
Elongation at break	25-100%	
Bursting strength	2.7KN	
Equivalent opening size	0.07-0.2 mm	
Tear strength	0.42 KN	

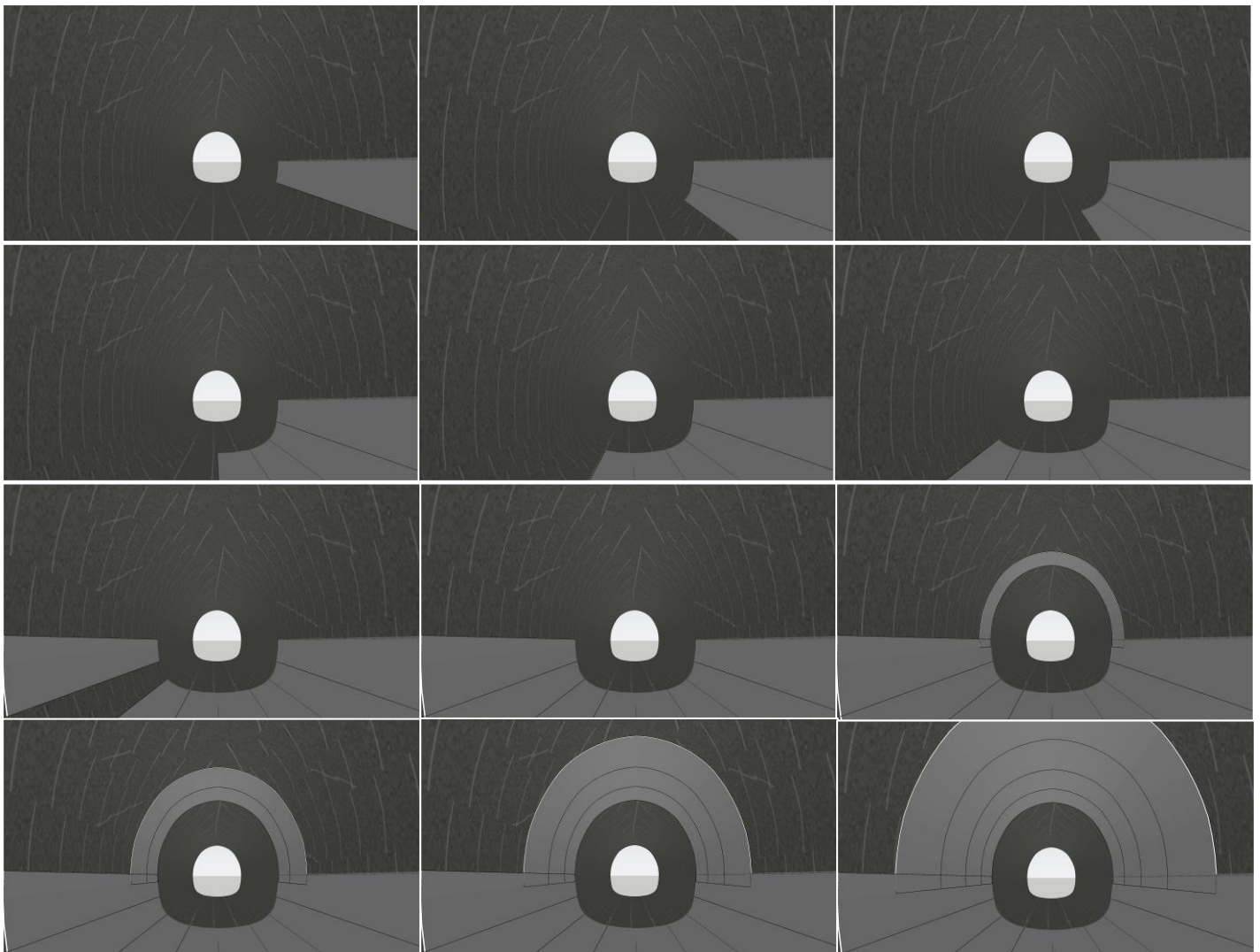
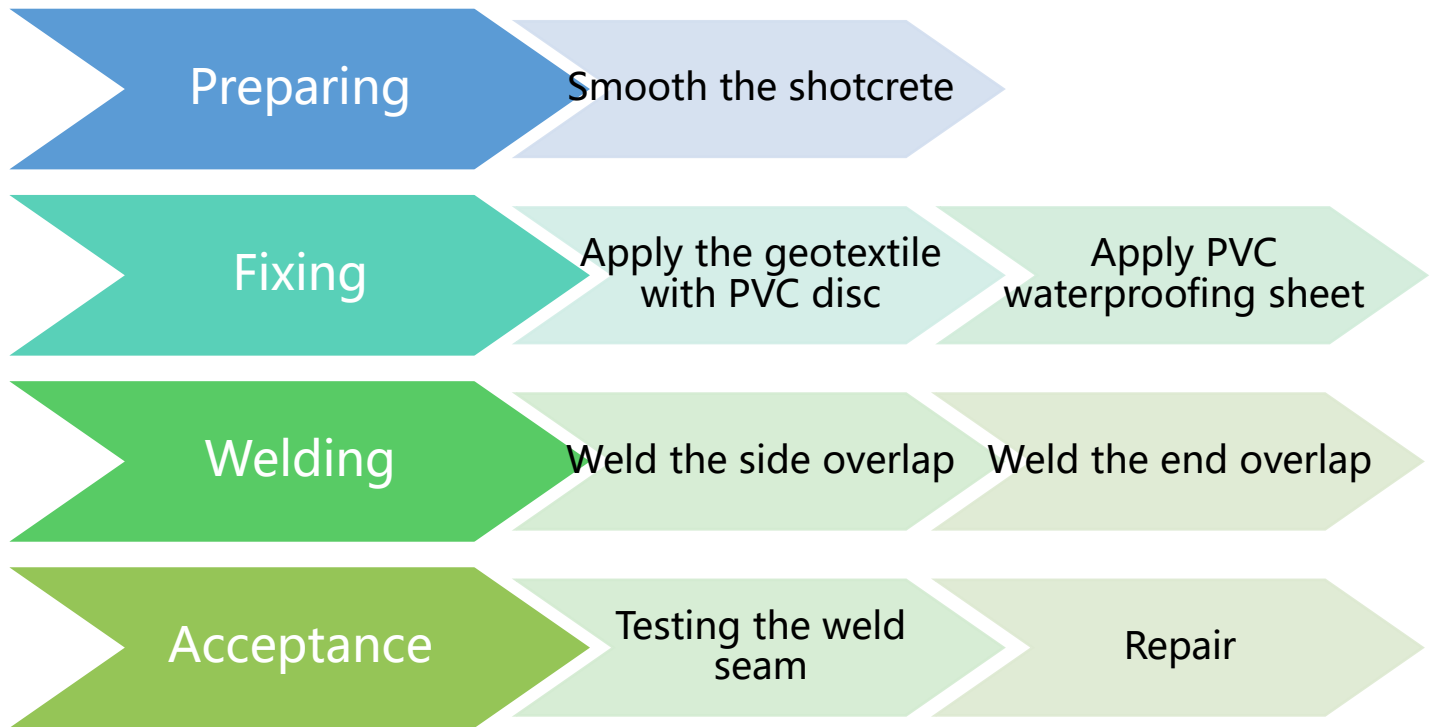
PVC disc		
<b>Appearance</b>	Surface:	smooth
Color	Dark grey/ Grey/ Green	
Thickness	3.6 mm	
Technical Data		
Diameter	100 mm	
Height	6 mm	
Thickness	2 mm	
Hole diameter	4 mm	

# Method Statement

## Waterproofing structure for tunnel



## □ Application Process



- Apply the invert part first
- Then the Arch wall and Vault

# Method Statement

## □ Application tools and accessories



hand hold welding machin



Tunnel Crawl welding machine



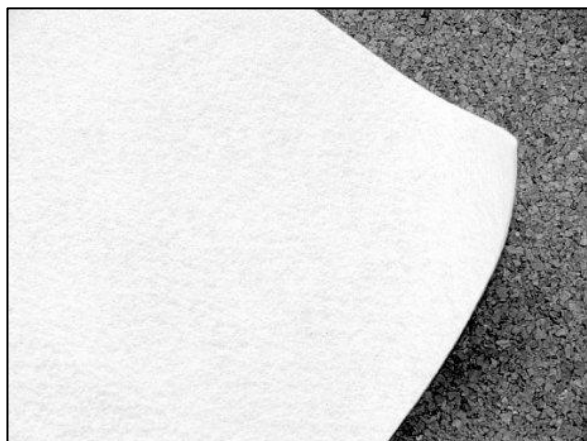
Electric drill



Churn drill



Air pressure device



Geotextile 500g/m2



PVC anchor



PVC disc



Roller

## Summary

1. General
2. Standard
3. Installation procedure of Joaboa Tech waterproofing system
  - Acceptance of the substrate
  - Installation of the regularization layer and disks
  - Installation of the waterproofing signal layer membrane
  - Installation of the waterbar
  - Re-injectable hoses installation
- Protection layer installation
4. Welding
  - Single welding
  - Double welding
5. Inspection
  - Visually inspection
  - Single welding test
  - Double welding test
6. Repairs

## 1. General

The waterproofing system consists of a homogeneous PVC-H flexible sheet applied by disks on the polypropylene regularization layer and protected (where required) by PVC-H protection layer. The waterproofing system shall be partitioned by waterstop placed along the construction joint and welded, dividing the tunnel in watertight section able to confine water inflow coming from the possible damages occurred during the construction phases. The following document describes the installation procedure for the Joaboa waterproofing system.

## 2. Installation procedure of Joaboa waterproofing system

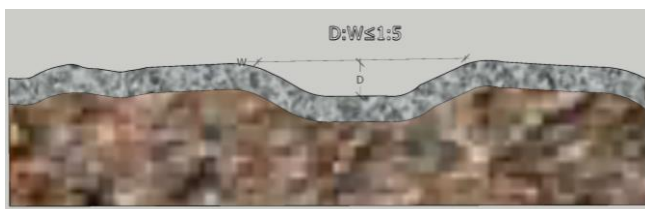
The waterproofing system installation procedure shall be in compliance with the following steps:

- Acceptance of the substrate;
- Installation of the regularization layer and disks;
- Installation of the waterproofing membrane;
- Installation of the waterbar (partitioning);
- Installation of the re-injectable hoses (backup system and crown injection point)
- Installation of the protection layer (where required);

### ➤ Acceptance of the substrate

Prior to commencing membrane installation works, a final inspection of the tunnel surfaces to be lined shall be completed. An "Acceptance of Membrane Substrate Surface" checklist shall be completed to record and identify that the area of membrane installation is compliant with the following substrate requirements:

- Shotcrete surfaces shall be prepared applying an additional shotcrete smoothing layer in order to remove local peaks and troughs.
- Surfaces on which waterproofing systems shall be installed shall be clean, free from loose aggregate, sharp protrusions, projecting tying wire, release agents and other items which are likely to damage or affect the waterproofing system.
- The shotcrete surfaces are prepared so as to achieve the smoothness and regularity required to preserve the membrane integrity. The substrate shall be in compliance with the following relationship:



D: Depth between the peaks  
W: Width of the troughs

$D:W \leq 1:5$

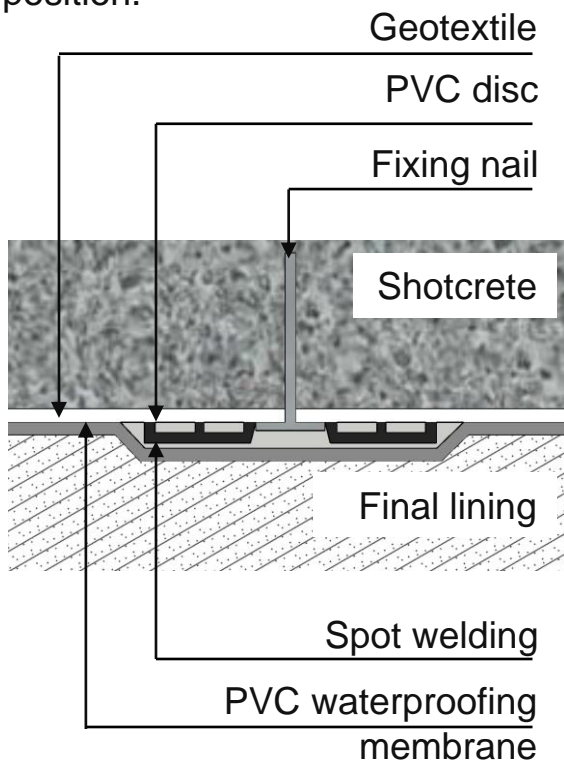


## ➤ Installation of the regularization layer and disks

The geotextile regularization layer shall be applied to the shotcrete surface using steel fixings (nails + washer). The regularization layer shall be laid with sufficient slack to avoid overstress during the concrete's pouring. Geotextile layer shall be joined with the next one using a spot welding, and the overlap shall be 100 mm. We recommended to not exceed the width of 100 mm overlap in order to avoid "pocket effect" in the overlap area.



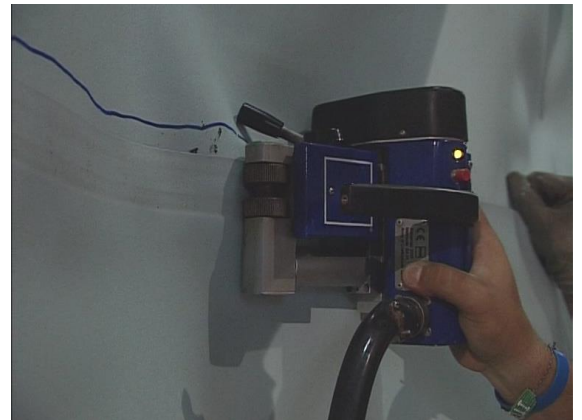
The diameter of the washer shall be checked before the installation phases in order to verify that the diameter of the nail is compatible with the internal diameter (26 mm) of the disk. The average of the fixing point number shall be 4 disks per square meter. The number and distribution of fixing point shall be evaluated by application team leader and it depends on substrate profile, overlaps, waterstops and anchoring position.



## ➤ Installation of the waterproofing membrane

The waterproofing membrane shall be installed around the perimeters of the excavation to cover the geotextile following the procedure below:

- Waterproofing membrane shall be attached to the disk by a spot welding. Check always the position of the PVC sheet according to the previously one installed in order to provide the correct overlap width (automatic welding machines working range). The waterproofing membrane shall be laid with the signal layer towards the inside and with sufficient slack to prevent overstressing during concrete pouring.
- Join the waterproofing sheet using the Tunnel Crawl welding machine with the parameters correctly set. Make sure the 10cm overlap.



- Weld the end side and other joints with hand welding gun.



## ➤ Installation of the waterbar

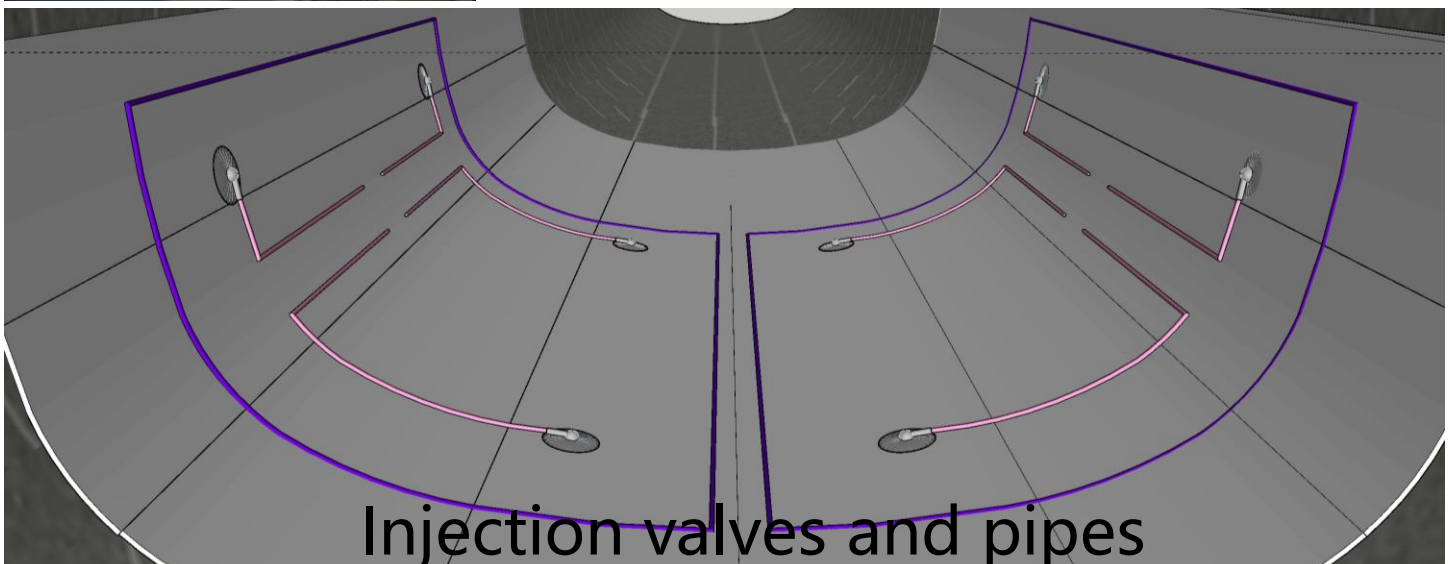
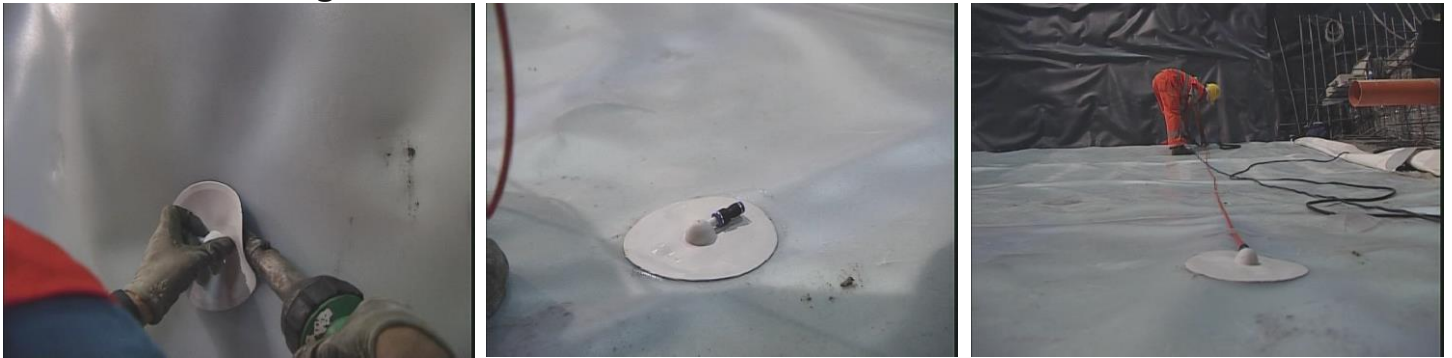
Waterstop shall be applied along the construction joint following the procedure below:

- In order to carry out the welding correctly the waterstop back and the membrane surface shall be clean and free of dust. If dirty the welding area shall be clean.
- Apply the waterstop on the PVC waterproofing membrane positioning it in the predicted section using a spot welding. The number of spot welding shall be enough to hold up the waterstop avoid to overstressing of PVC membrane;
- Realize the watertight welding on each side of the waterstop for a total width of 40-50 mm;
- I junction shall be realized using waterstop welding jig.

## ➤ Re-injectable hoses installation

Re-injectable hoses (both for backup system and crown injection point) shall be installed according both the technical data sheet and manufacturer's instruction, following the procedure below:

- Verify the position of the re-injectable hoses according to the technical drawings;
- Check the maximum length of the re-injectable hoses according to the technical data sheet instruction;
- Apply the re-injectable hoses using fixing point applied at a maximum distance of 15 cm. Fixing point shall be PVC-H tie or other type of fixing approved by the manufacturer.
- Re-injectable hoses shall be completely embedded in the final lining and connected with the surface of the concrete lining using colored (white and red) termination hoses collected in the End Box. Termination hoses and re-injectable hoses shall be connected using the related plastic connector, covering the junction using the hot shrinkage sleeve.
- Overlap between two subsequent re-injectable hoses shall be 20 cm at least;
- Each termination hoses shall be sealed using plug to avoid the clogging of the hoses in the following construction phases;
- Each termination hoses shall be marked and its position recorded in order to address the re-injectable hoses and its position even after the pour of the final lining.



## ➤ Protection layer installation

Protection layer shall be installed as a protection additional layer. The material shall be fully welded on the waterstop edge and spot weld to the waterproofing membrane where necessary to keep the material in position. In presence of watertight anchors, to avoid stress on PVC waterproofing membrane, the spot weld shall be placed on waterproofing membrane welded on anchoring plate. The number of spot welds shall be enough to allow to hold up the protection layer.

Adjacent sheets of protection layer shall be joined by a full continuous welding and the overlap shall be enough to allow correctly the welding procedure.



## 4. Welding technique

### ➤ Single welding

Single welding shall be done using a hot-air welding gun following the points below:

#### a. Nozzle care

The nozzle used must be cleaned using a wire brush and the air gap should be equal across the full width of the nozzle.

#### b. Welding temperature

Joaboa Tech PVC-H has a wide welding window. This allows the operative to work slowly on difficult details. The temperature can be adjusted easily on the back of the PID gun to suit all conditions and applications.

The basic setting temperatures for hand welding Joaboa Tech PVC-H are as follows 400/450 °C.

It is necessary to carry out a welding test in order to determine the correct temperature setting in line with weather and building site conditions.

Use a 40 mm nozzle for main, straight-line welding and a 20 mm nozzle for detail work.

## c. Welding procedure

- *Spot welding*

To hold the membrane in place, spot-weld the overlap every 40 cm. Spot-weld the membrane in the internal part of overlap.



Spot welding



Welding

- *Welding*

Position the hot-air welding gun with the nozzle angle at 45° to the welding line. With the roller at 1 cm from the nozzle, apply pressure to the top sheet in a continuous back-and forth flowing movement.

### ➤ **Double welding**

When using automatic welding equipment, ensure the welding machine has been adjusted correctly for welding PVC-H (alignment and temperature) and the standard nozzle is clean with even air flow.

The basic setting temperature, speed and pressure for automatic welding Joaboa Tech PVC-H is as follows:

- Temperature: 480-500 °C;
- Speed: 1.8-3.0 m/min;
- Pressure: 190 N.

Temperatures, speed and pressure can be affected by working condition (electrical equipment, cable dimension and length, etc.) and environmental and climatic conditions on site (jobsite and substrate temperature, etc.).

**Make trials before application.**



## 5. Inspection

Before to pour the final lining the following inspection and test shall be carried out:

- Visually inspection;
- Single welding test;
- Double welding test.

### ➤ Visually inspection

- All the membrane surface shall be inspected visually highlighting the damaged area and replacing

### ➤ Single welding test

Single welding can be tested using two different procedure:

- Hook test (for waterproofing membrane, patch and waterstop);
- Vacuum bell test (small size area).

#### a. Hook test (for waterproofing membrane, patch and waterstop)

The test is carried out on cooled membrane with a metal seam probe. The probe is run along the welded edge using sufficient pressure to identify defective seams. Due to the thickness of the waterstop, we recommend to test the waterbar after 24 hours from welding execution.



#### b. Vacuum bell test (small size area and flatness permitting)

For the testing of areas of membrane of limited size such as special configurations of joints or local repair with patches, vacuum equipment shall be employed. This equipment consists of a vacuum bell which, after being fitted tightly over the area to be tested, is evacuated by pumping in order to detect leaks in the membrane.



## Requirements:

- Test shall be carry out with a pressure of 0.3 bar for 2 minutes;
- Vacuum bell test can be carried out only if the surface of the membrane that have to tested is totally horizontal, in order to provide the correct watertight of the gasket bell (flatness permitting).

## Test procedure:

- Apply soap solution over seam edge within the range of vacuum bell
- Press vacuum bell over area, treated with soap solution and build-up vacuum;
- Visual check of seam under vacuum (bubbling soap solution shows a leak);
- Remove vacuum bell and clean seam with clean rags;
- Any leaks must be rectified with hand held welding guns and 20mm silicone rollers at normal welding temperatures.

### ➤ **Double welding test**

The automatic welding machines produce a double seam welding. At both ends of the double seam the channel between the two welds to be tested is clamped shut and a manometer and needle is installed. A foot-pump is then connected to the valve and the appropriate test pressure developed.

The standard test parameters are as follows:

- Test duration: 10 minutes;
- Test pressure: 2 bars.

The seam is considered watertight if the initial pressure in the test channel drops by not more than 10 % during the test period. The pressure values are recorded, specifically the initial pressure and the final pressure.



## 6. Repair

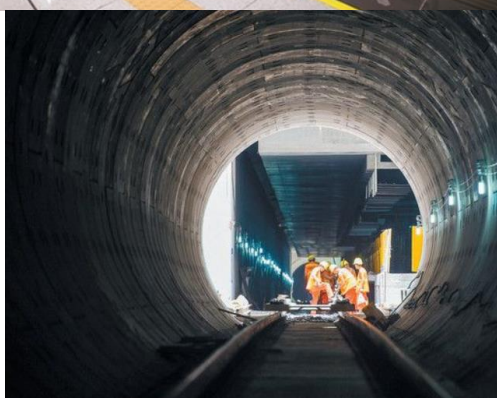
Due to the signal layer any damages occurred on the waterproofing membrane are easily to detect and repair.

All the repairs shall be carried out following the procedure below:

- Identify the number, position and dimension of the damaged area;
- Cut a disc of membrane that covers completely the damaged area (we recommend to cut a disk with a diameter exceeding 50 mm the edge of the damage);
- Using a pencil, trace around the disc onto the membrane surface;
- The surface of the membrane shall be clean and free of dust. If necessary clean the membrane surface with a cloth;
- Once the solvents have flashed off, and the membrane is completely dry, weld the new patch by starting in the center and working out, checking the integrity of the weld as you progress.



# Landmark projects



## Shenzhen Metro Line 4



## Shenzhen Metro Line 7

Location	Shenzhen, China
Finishing time	2015
Length	29.962km
Material	FM Approved PVC Waterproofing Sheets
Construction area	Undercut tunnel

Location	Shenzhen, China
Finishing time	2018
Waterproofing cost	Over 48 million THB
Material	FM Approved PVC Waterproofing Sheets
Construction area	Undercut tunnel

## Shenzhen international convention center vehicle depot project



Location	Shenzhen, China
Finishing time	2017
Waterproofing cost	Over 48 million THB

# Landmark projects



## Dongfeng Liuzhou automobile co., ltd.

Location	Guangxi, China
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Finishing time	2017
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Waterproofing area	12000 m <sup>2</sup>
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Material	FM Approved PVC Waterproofing Sheets
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Location	Guangxi, China
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Finishing time	2018
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Waterproofing area	30800 m <sup>2</sup>
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Material	FM Approved PVC Waterproofing Sheets
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## LiuDong passenger car parts production base



# Landmark projects



## Chengdu aircraft industrial group, No. 11 workshop of phase III,

Location	Chengdu, China	Location	Yunnan, China
Finishing time	2017	Finishing time	2017
Waterproofing area	9000 m <sup>2</sup>	Waterproofing area	20000 m <sup>2</sup>
Material	FM Approved PVC Waterproofing Sheets	Material	FM Approved PVC Waterproofing Sheets

## Roofing system engineering for coating workshop of rulli automobile co., ltd. In Baic group

