



# Casing advancement systems

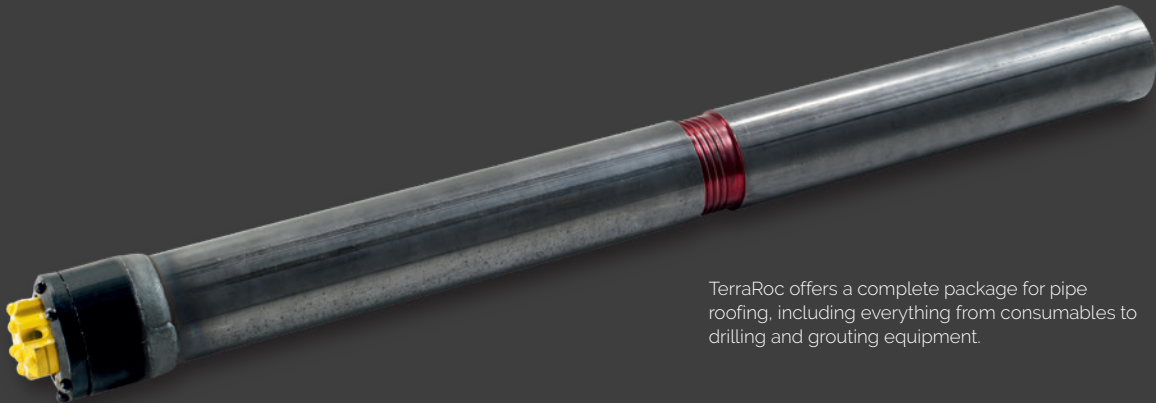
Pipe roofing solutions – catalogue





# Pipe roofing solutions – pre-support in tunnel constructions

Cities and urban areas around the world are continuously being modernized and infrastructures developed to match an increasing traffic flow. As a result, tunneling projects are moving into more challenging conditions such as soil, weak rock and shallow overburden in already developed areas. No matter what challenges a tunneling project is facing, compromises can never be made on safety and economical efficiency. This calls for innovative and reliable methods of ground support.



TerraRoc offers a complete package for pipe roofing, including everything from consumables to drilling and grouting equipment.

## Settlements from excavation

Tunnel excavation causes stresses to the ground that may result in settlements. The effect of settlements is hazardous not only to nearby buildings and structures but also to the people working inside the tunnel. The answer to these challenges is pre-support, a method of pre-reinforcing the formation ahead of the tunnel face to ensure that the excavation can proceed safely until heavier and permanent support structures have been installed.

## Pre-support increases stability

Over the last decades, technical developments have led to an increased use of different pre-support technologies preventing unwanted accidents and protecting surrounding structures from damages. Some of these methods, such as freezing and jet grouting, are known as both cost and time consuming while the method known as pipe roofing is becoming increasingly popular and has many economical

advantages. The experience gained from several tunnel projects, indicates that the pipe roof support method not only increases the stability of the tunnel itself as well as the working face, but it also significantly decreases the subsidence induced by the excavation. The popularity of this pre-support method has led to many different names. You might recognize it as Umbrella, umbrella arch, Tube umbrella, pipe canopy, fore poling or pipe roofing.

## The principles of pipe roofing

In implementing the method, steel pipes are installed ahead of the tunnel face arranged like an umbrella or canopy around the excavation line. The umbrella stabilizes and protects the ceiling and face of the tunnel by increasing the load bearing capacity of the ground. Thanks to the rigidity of the steel pipes, distribution of loads will be improved and the critical spot will be moved further ahead of the working face. The pipe roof support method is a pre-support concept



widely used in conventional tunneling, but has also gained interest as a support system for TBM tunnels. This method of supporting potentially unstable ground ahead of the excavation face provides a high degree of flexibility and is easily adapted to the encountered conditions.

#### **Cost-efficient and easy to adapt**

Requiring only standard equipment and little training of your operator crew, your investment in employing special machinery or contractors is notably reduced.

#### **Maximized safety**

By reinforcing the ground ahead of the excavation, the ground is never without support. This means that the installation of regular tunnel support can be carried out more effectively and with increased safety for the operators.

#### **Extended possibilities**

Using the same principals, installation method and equipment, perforated PVC and steel pipes can be installed for drainage purposes, bringing added value in controlling the ground water, especially in extreme conditions.

#### **Designing a pipe roof**

Engineers consider various measures for design including ground properties, overhead height, tunnel geometry, load analysis, and last but not least the surrounding structures, especially above the tunnel with regards to settlement analysis.

The most critical specifications of the pipe roof, from a design point of view are:

- (outer) diameter of the pipes
- wall thickness
- length of pipes and overlap
- spacing of the pipes

Generally, pipes with outer diameter of 76-140 mm and wall thickness of 6-10 mm are installed using standard tunneling equipment. In some specific cases, larger diameter pipes might be installed using special rigs and Down-The-Hole drilling method.

The pipe roof length is commonly 9-18 metres and due to the overlap the excavated length underneath is around 3-6 metres shorter.



# A complete package from TerraRoc

TerraRoc offers a complete package for pipe roofing, including everything from consumables to drilling and grouting equipment.

## Symmetrix – at the heart of the system

The centerpiece of the package is the well-known and well-proved Symmetrix casing advancement system. The Symmetrix system is a solution for concentric drilling and simultaneously advancing of pipes and offers several benefits in pipe roofing.

### Straightness

In pipe roofing applications, straightness is vital in both design as well as economical aspects. Symmetrix systems have proved to drill very straight holes thanks to their centric design and smooth drilling.

### Internal flushing

TerraRoc Symmetrix system, is designed so that the flushing media (mainly water in this application) transports the drill cuttings from the bit face, back inside the pipes. Considering the fact that the system is used when ground is poor or unconsolidated, internal flushing allows for drilling the pipes with no disturbance to the ground.

### Efficiency and productivity

Symmetrix systems can drill at high speed in virtually any ground. Customers can rest assured that the pipes will be installed successfully and efficiently independent of the encountered ground formation. The easiness to unlock and lock the pilot bit from the ring bit set also adds to the high productivity offered by the Symmetrix system.

### Less torque

The Symmetrix systems advances the pipes by impact energy simultaneously to drilling a hole slightly larger than the outer diameter of the pipes. This means, the pipe is not rotated while drilling, requiring less torque than alternative solutions. Customers can thereby utilize relatively small drilling rigs.

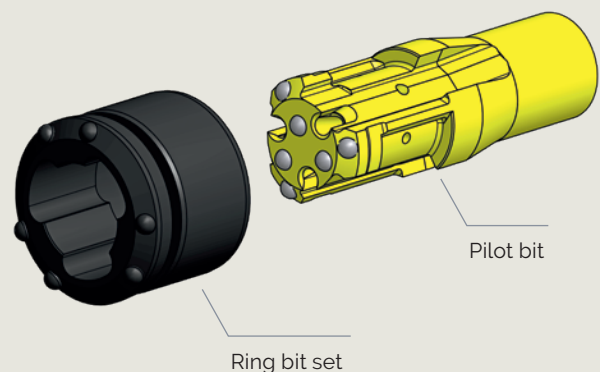


Pipe roofing application with a boomer.

## The Symmetrix system components

- a **pilot bit** which drills the center part of the hole and transfers the impact energy to the ring bit.

- a **ring bit set**, which is an integrated ring bit and casing shoe, welded to the front of first pipe, known as the starter pipe. The ring bit, which is connected to the pilot bit through locking mechanism, drills the void needed to advance the pipe into the ground simultaneous to drilling.







### Steel pipes

The pipes included in the Pipe Roof System offer are:

- **Starter pipe.** The first pipe section welded to the ring bit set on one end and female threaded on the other end.
- **Extension pipe.** A male-female threaded pipe section used to extend the pipe to desire length.
- **End pipe.** The end pipe can be either an extension pipe or a pipe section with no thread at the rear (mouth) depending on the used practice for grouting.

### Threads

All pipes have trapezoidal thread with double start and 10mm entrance and thread ran out to assure easy make up of the joints.

### Welding

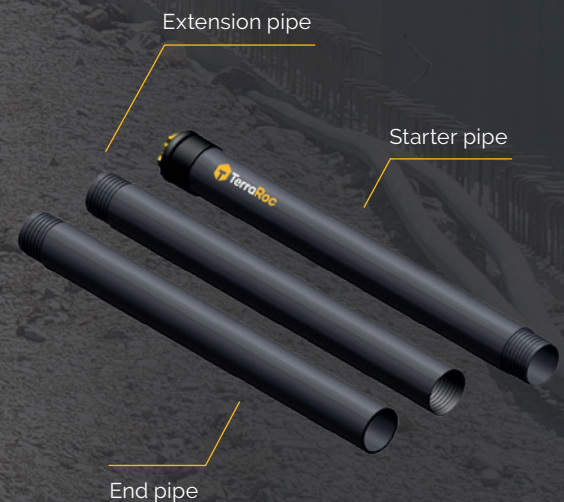
The Symmetrix ring bit set is welded to the front of the starter pipe using an automated robot to enhance the quality of welding and quality consistency.

### Optional injection valves

Pipes can be delivered with 12 mm or 16 mm injection valves for respectively 3-5 bar or +10 bar injection.

### Accessories

To complete the offer, a range of different tools and accessories including suitable wrenches, centralizers and injection caps can be provided when necessary.





# Specifications



## Pipe Roof System – range

TerraRoc offers systems with pipe diameters ranging from 76.1 to 139.7 mm and wall thickness ranging from 6.3 to 10.0 mm.

## Pipe quality and steel grade

Pipes or casings in the TerraRoc Pipe Roof standard assortment are made out of high-quality, first hand steel pipes longitudinally welded with removed welding seam. This ensures a completely round shape and good straightness along the pipe. Steel grade and other characteristics are shown in below table.

### STEEL GRADE AND PROPERTIES

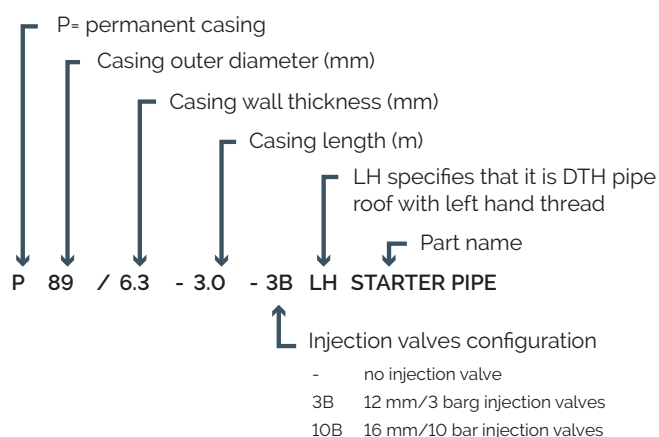
EN 10025	DIN 17100	Yield min. (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation min. (%)	C max	Mn max	P max	S max	Si max
S355	St 52-3	355	490 - 630	22	0.2	16	0.035	0.035	0.55

Note: Other Steel Grades can be provided upon request.

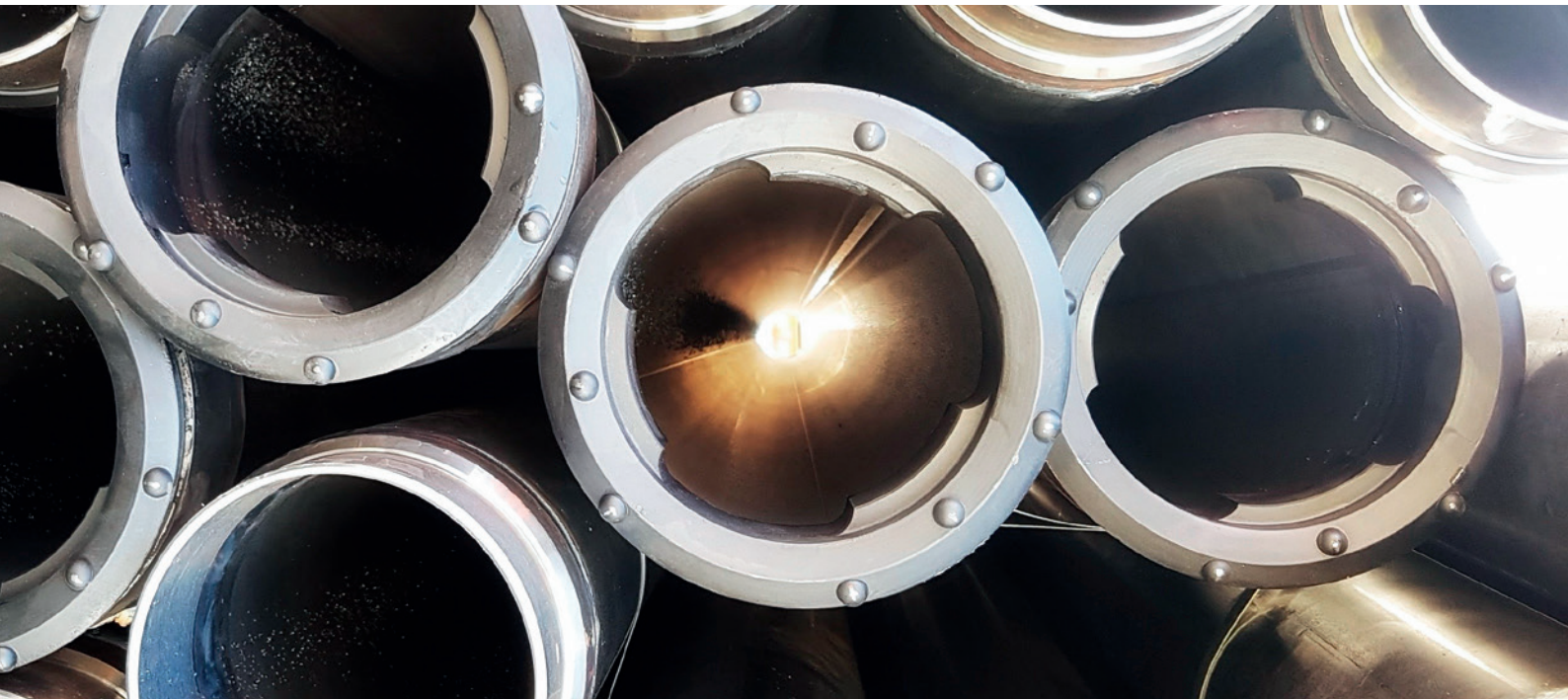
## Designation code

The product designation code to the right is applicable for the pipe products presented in the tables on the following pages. For Symmetrix pilot bit designation and detailed specifications, please refer to product catalogue (Pmi 6991 1806 01).

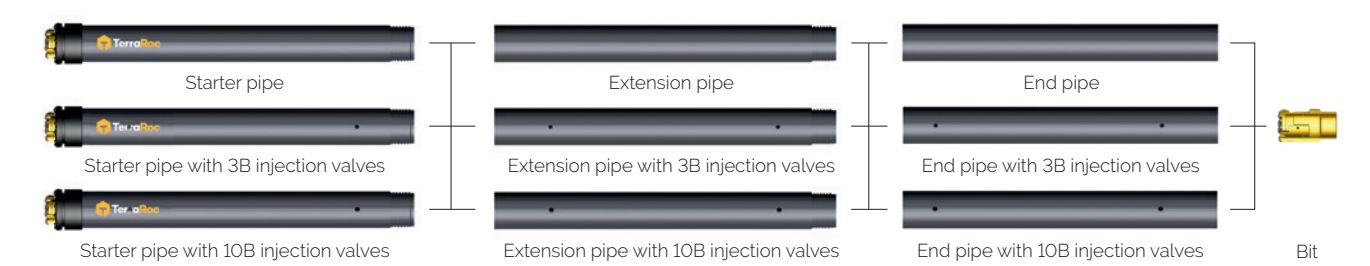
All below listed products are suited for installation of pipe roofs using top hammer drilling technique. Other length and wall.



# Tophammer Pipe roofs



Below you will see the pipe roofing products for both Tophammer and DTH drilling systems. Tophammer pipe roofs are right hand threaded and DTH pipe roofs are left hand threaded.



## EXAMPLE FOR HOW TO CHOOSE A COMPLETE PRODUCT ON THE FOLLOWING PAGES

Pilot bit	Product number	Starter pipe	Product number	Extension pipe	Product number	End pipe	Product number	Pipe weight (kg/m)
P76/8-41-R32-PILOT	8092402214	P76/71-3.0-STARTER PIPE	8092420006	P76/71-3.0-EXT PIPE	8092420007	P76/71-3.0-END PIPE	8092420128	12.1
		P76/71-3.0-3B-STARTER PIPE	8092420008	P76/71-3.0-3B-EXT PIPE	8092420009	P76/71-3.0-3B-END PIPE	8092420129	
		P76/71-3.0-10B-STARTER PIPE	8092420010	P76/71-3.0-10B-EXT PIPE	8092420011	P76/71-3.0-10B-END PIPE	8092420130	

1. Select the pilot bit if there is more than one choice

2. Select the Starter pipe that you need.  
**There are three different options:**

- Without valve
- With 3 bar injection valve with 12 mm OD
- With 10 bar injection valve with 16 mm OD

3. Select the Extension pipe that you need.  
According to the depth of the hole you may need to order more than one piece per hole.  
**There are three different options:**

- Without valve
- With 3 bar injection valve with 12 mm OD
- With 10 bar injection valve with 16 mm OD

4. End pipe is optional, if you won't screw a injection cap, you can end your hole with an end pipe.  
**There are three different options:**

- Without valve
- With 3 bar injection valve with 12 mm OD
- With 10 bar injection valve with 16 mm OD

# Tophammer Pipe roofs

## TERRAROC PIPE ROOF, CASING OUTER DIAMETER 76.2 MM (3"), TOPHAMMER

Pilot bit	Product number	Starter pipe	Product number	Extension pipe	Product number	End pipe	Product number	Pipe weight (kg/m)
7.1 mm wall thickness with 3.0 m length								
P76/8-41-R32-PILOT	8092402214	P76/71-3.0-STARTER PIPE	8092420006	P76/71-3.0-EXT PIPE	8092420007	P76/71-3.0-END PIPE	8092420128	12.1
		P76/71-3.0-3B-STARTER PIPE	8092420008	P76/71-3.0-3B-EXT PIPE	8092420009	P76/71-3.0-3B-END PIPE	8092420129	
		P76/71-3.0-10B-STARTER PIPE	8092420010	P76/71-3.0-10B-EXT PIPE	8092420011	P76/71-3.0-10B-END PIPE	8092420130	
Available injection cap								
Part			Designation			Part number		
Injection Cap with 1" connection			P76/INJECTION CAP			809242013		

## TERRAROC PIPE ROOF, CASING OUTER DIAMETER 88.9 MM (3 1/2"), TOPHAMMER

Pilot bit	Product number	Starter pipe	Product number	Extension pipe	Product number	End pipe	Product number	Pipe weight (kg/m)
6.3 mm wall thickness with 3.0 m length								
P89/8-54-T38 PILOT	8092400954	P89/6.3-3.0-STARTER PIPE	8092420014	P89/6.3-3.0-EXT PIPE	8092420015	P89/6.3-3.0-END PIPE	8092420162	12.8
		P89/6.3-3.0-3B-STARTER PIPE	8092420018	P89/6.3-3.0-3B-EXT PIPE	8092420019	P89/6.3-3.0-3B-END PIPE	8092420163	
		P89/6.3-3.0-10B-STARTER PIPE	8092420020	P89/6.3-3.0-10B-EXT PIPE	8092420021	P89/6.3-3.0-10B-END PIPE	8092420164	
7.1 mm wall thickness with 3.0 m length								
P89/8-54-T38 PILOT	8092400954	P89/71-3.0-STARTER PIPE	8092420022	P89/71-3.0-EXT PIPE	8092420023	P89/71-3.0-END PIPE	8092420132	14.3
		P89/71-3.0-3B-STARTER PIPE	8092420026	P89/71-3.0-3B-EXT PIPE	8092420027	P89/71-3.0-3B-END PIPE	8092420133	
		P89/71-3.0-10B-STARTER PIPE	8092420028	P89/71-3.0-10B-EXT PIPE	8092420029	P89/71-3.0-10B-END PIPE	8092420134	
8.0 mm wall thickness with 3.0 m length								
P89/8-54-T38 PILOT	8092400954	P89/8.0-3.0-STARTER PIPE	8092420030	P89/8.0-3.0-EXT PIPE	8092420031	P89/8.0-3.0-END PIPE	8092420135	15.9
		P89/8.0-3.0-3B-STARTER PIPE	8092420034	P89/8.0-3.0-3B-EXT PIPE	8092420035	P89/8.0-3.0-3B-END PIPE	8092420136	
		P89/8.0-3.0-10B-STARTER PIPE	8092420036	P89/8.0-3.0-10B-EXT PIPE	8092420037	P89/8.0-3.0-10B-END PIPE	8092420137	
Available injection cap								
Part			Designation			Part number		
Injection Cap with 1" ball valve			P89/INJECTION CAP BV			8092420046		
Injection Cap with 1" connection			P89/INJECTION CAP			8092420141		

## TERRAROC PIPE ROOF, CASING OUTER DIAMETER 101.6 MM (4"), TOPHAMMER

Pilot bit	Product number	Starter pipe	Product number	Extension pipe	Product number	End pipe	Product number	Pipe weight (kg/m)
7.1 mm wall thickness with 3.0 m length								
P102/8-65-T38 PILOT	8092402721	P102/71-3.0-STARTER PIPE	8092420048	P102/71-3.0-EXT PIPE	8092420049	P102/71-3.0-END PIPE	8092420142	16,5
		P102/71-3.0-3B-STARTER PIPE	8092420050	P102/71-3.0-3B-EXT PIPE	8092420051	P102/71-3.0-3B-END PIPE	8092420143	
8.0 mm wall thickness								
P102/8-65-T38 PILOT	8092402721	P102/8.0-3.0-STARTER PIPE	8092420054	P102/8.0-3.0-EXT PIPE	8092420055	P102/8.0-3.0-END PIPE	8092420165	18,5
		P102/8.0-3.0-3B-STARTER PIPE	8092420056	P102/8.0-3.0-3B-EXT PIPE	8092420057	P102/8.0-3.0-3B-END PIPE	8092420166	
Available injection cap								
Part			Designation			Part number		
Injection Cap with 1" connection			P102/INJECTION CAP			8092420060		



# Tophammer Pipe roofs

## TERRAROC PIPE ROOF, CASING OUTER DIAMETER 114.3 MM (4 ½"), TOPHAMMER

Pilot bit	Product number	Starter pipe	Product number	Extension pipe	Product number	End pipe	Product number	Pipe weight (kg/m)
6.3 mm wall thickness with 3.0 m length								
P114/10-75-T38 PILOT	8092 4017 37	P114/6.3-3.0-STARTER PIPE	8092420062	P114/6.3-3.0-EXT PIPE	8092420063	P114/6.3-3.0-END PIPE	8092420168	16.8
		P114/6.3-3.0-3B-STARTER PIPE	8092420066	P114/6.3-3.0-3B-EXT PIPE	8092420067	P114/6.3-3.0-3B-END PIPE	8092420169	
		P114/6.3-3.0-10B-STARTER PIPE	8092420068	P114/6.3-3.0-10B-EXT PIPE	8092420069	P114/6.3-3.0-10B-END PIPE	8092420170	
7.1 mm wall thickness with 3.0 m length								
P114/10-75-T38 PILOT	8092 4017 37	P114/7.1-3.0-STARTER PIPE	8092420070	P114/7.1-3.0-EXT PIPE	8092420071	P114/7.1-3.0-END PIPE	8092420145	18.8
		P114/7.1-3.0-3B-STARTER PIPE	8092420074	P114/7.1-3.0-3B-EXT PIPE	8092420075	P114/7.1-3.0-3B-END PIPE	8092420146	
		P114/7.1-3.0-10B-STARTER PIPE	8092420076	P114/7.1-3.0-10B-EXT PIPE	8092420077	P114/7.1-3.0-10B-END PIPE	8092420147	
8.0 mm wall thickness with 3.0 m length								
P114/10-75-T38 PILOT	8092 4017 37	P114/8.0-3.0-STARTER PIPE	8092420078	P114/8.0-3.0-EXT PIPE	8092420079	P114/8.0-3.0-END PIPE	8092420148	21
		P114/8.0-3.0-3B-STARTER PIPE	8092420082	P114/8.0-3.0-3B-EXT PIPE	8092420083	P114/8.0-3.0-3B-END PIPE	8092420149	
		P114/8.0-3.0-10B-STARTER PIPE	8092420084	P114/8.0-3.0-10B-EXT PIPE	8092420085	P114/8.0-3.0-10B-END PIPE	8092420150	
Available injection cap								
Part			Designation			Part number		
Injection Cap with 1" ball valve			P114/INJECTION CAP BV			8092420094		
Injection Cap with 1" connection			P11/INJECTION CAP			8092420154		

## TERRAROC PIPE ROOF, CASING OUTER DIAMETER 139.7 MM (5 ½"), TOPHAMMER

Pilot bit	Product number	Starter pipe	Product number	Extension pipe	Product number	End pipe	Product number	Pipe weight (kg/m)
7.1 mm wall thickness with 1.5 m length								
P140/10 100-T45 PILOT	8092403843	P140/7.1-1.5-STARTER PIPE	8092420102	P140/7.1-1.5-EXT PIPE	8092420103	P140/7.1-1.5-END PIPE	8092420155	23,2
		P140/7.1-1.5-3B-STARTER PIPE	8092420104	P140/7.1-1.5-3B-EXT PIPE	8092420105	P140/7.1-1.5-3B-END PIPE	8092420156	
		P140/7.1-1.5-10B-STARTER PIPE	8092420106	P140/7.1-1.5-10B-EXT PIPE	8092420107	P140/7.1-1.5-10B-END PIPE	8092420157	
8.0 mm wall thickness with 1.5 m length								
P140/10 100-T45 PILOT	8092403843	P140/8.0-1.5-STARTER PIPE	8092420114	P140/8.0-1.5-EXT PIPE	8092420115	P140/8.0-1.5-END PIPE	8092420158	26
		P140/8.0-1.5-3B-STARTER PIPE	8092420116	P140/8.0-1.5-3B-EXT PIPE	8092420117	P140/8.0-1.5-3B-END PIPE	8092420159	
		P140/8.0-1.5-10B-STARTER PIPE	8092420118	P140/8.0-1.5-10B-EXT PIPE	8092420119	P140/8.0-1.5-10B-END PIPE	8092420160	
10.0 mm wall thickness with 1.5 m length								
P140/10-100-T45 PILOT	8092403843	P140/10.0-1.5-STARTER PIPE	8092420120	P140/10.0-1.5-EXT PIPE	8092420121	P140/10.0-1.5-END PIPE	8092420171	32
		P140/10.0-1.5-3B-STARTER PIPE	8092420122	P140/10.0-1.5-3B-EXT PIPE	8092420123	P140/10.0-1.5-3B-END PIPE	8092420172	
		P140/10.0-1.5-10B-STARTER PIPE	8092420124	P140/10.0-1.5-10B-EXT PIPE	8092420125	P140/10.0-1.5-10B-END PIPE	8092420173	
Available injection cap								
Part			Designation			Part number		
Injection Cap with 1" ball valve			P140/INJECTION CAP BV			8092420126		
Injection Cap with 1" connection			P140/INJECTION CAP			8092420161		



# DTH pipe roofs

## TERRAROC PIPE ROOF, CASING OUTER DIAMETER 114.3 MM (4 ½"), DTH

Pilot bit	Product number	Starter pipe	Product number	Extension pipe	Product number	End pipe	Product number	Pipe weight (kg/m)
6.3 mm wall thickness with 3.0 m length								
P114/8-75-COP34	8092402155	P114/6.3-3.0-LH-STARTER PIPE	8092420247	P114/6.3-3.0-LH-EXT PIPE	8092420248	P114/6.3-3.0-LH-END PIPE	8092420249	16,8
P114/8-75-DHD3.5	8092402156	P114/6.3-3.0-3B-LH-STRTR PIPE	8092420250	P114/6.3-3.0-3B-LH-EXT PIPE	8092420251	P114/6.3-3.0-3B-LH-END PIPE	8092420252	
		P114/6.3-3.0-10B-LH-STRT PIPE	8092420253	P114/6.3-3.0-10B-LH-EXT PIPE	8092420254	P114/6.3-3.0-10B-LH-END PIPE	8092420255	
7.1 mm wall thickness with 3.0 m length								
P114/8-75-COP34	8092402155	P114/7.1-3.0-LH-STARTER PIPE	8092420256	P114/7.1-3.0-LH-EXT PIPE	8092420263	P114/7.1-3.0-LH-END PIPE	8092420264	18,8
P114/8-75-DHD3.5	8092402156	P114/7.1-3.0-3B-LH-START PIPE	8092420257	P114/7.1-3.0-3B-LH-EXT PIPE	8092420258	P114/7.1-3.0-3B-LH-END PIPE	8092420259	
		P114/7.1-3.0-10B-LH-STRT PIPE	8092420262	P114/7.1-3.0-10B-LH-EXT PIPE	8092420260	P114/7.1-3.0-10B-LH-END PIPE	8092420261	
8.0 mm wall thickness with 3.0 m length								
P114/8-75-COP34	8092402155	P114/8.0-3.0-LH-STARTER PIPE	8092420265	P114/8.0-3.0-LH-EXT PIPE	8092420272	P114/8.0-3.0-LH-END PIPE	8092420273	21
P114/8-75-DHD3.5	8092402156	P114/8.0-3.0-3B-LH-START PIPE	8092420266	P114/8.0-3.0-3B-LH-EXT PIPE	8092420267	P114/8.0-3.0-3B-LH-END PIPE	8092420268	
		P114/8.0-3.0-10B-LH-STRT PIPE	8092420271	P114/8.0-3.0-10B-LH-EXT PIPE	8092420269	P114/8.0-3.0-10B-LH-END PIPE	8092420270	
Available injection cap								
Part			Designation			Part number		
Injection Cap with 1" ball valve			P114/INJECTION CAP LH BV			8092420274		
Injection Cap with 1" connection			P11/INJECTION CAP LH			8092420275		

## TERRAROC PIPE ROOF, CASING OUTER DIAMETER 139.7 MM (5 ½"), DTH

Pilot bit	Product number	Starter pipe	Product number	Extension pipe	Product number	End pipe	Product number	Pipe weight (kg/m)
7.1 mm wall thickness with 1.5 m length								
P140/10-100-G2-DHD340 pilot*	8092403631	P140/71-1.5-LH-STARTER PIPE	8092420277	P140/71-1.5-LH-EXT PIPE	8092420276	P140/71-1.5-LH-END PIPE	8092420278	23.2
		P140/71-1.5-3B-LH-START PIPE	8092420279	P140/71-1.5-3B-LH-EXT PIPE	8092420281	P140/71-1.5-3B-LH-END PIPE	8092420282	
		P140/71-1.5-10B-LH-START PIPE	8092420280	P140/71-1.5-10B-LH-EXT PIPE	8092420283	P140/71-1.5-10B-LH-END PIPE	8092420284	
8.0 mm wall thickness with 1.5 m length								
P140/10-100-G2-DHD340 pilot	8092403631	P140/8.0-1.5-LH-STARTER PIPE	8092420285	P140/8.0-1.5-LH-EXT PIPE	8092420286	P140/8.0-1.5-LH-END PIPE	8092420287	26
		P140/8.0-1.5-3B-LH-START PIPE	8092420288	P140/8.0-1.5-3B-LH-EXT PIPE	8092420290	P140/8.0-1.5-3B-LH-END PIPE	8092420291	
		P140/8.0-1.5-10B-LH-START PIPE	8092420289	P140/8.0-1.5-10B-LH-EXT PIPE	8092420292	P140/8.0-1.5-10B-LH-END PIPE	8092420293	
10.0 mm wall thickness with 1.5 m length								
P140/10-100-G2-DHD340 pilot	8092403631	P140/10.0-1.5-LH-STARTER PIPE	8092420294	P140/10.0-1.5-LH-EXT PIPE	8092420295	P140/10.0-1.5-LH-END PIPE	8092420296	32
		P140/10.0-1.5-3B-LH-START PIPE	8092420297	P140/10.0-1.5-3B-LH-EXT PIPE	8092420299	P140/10.0-1.5-3B-LH-END PIPE	8092420300	
		P140/10.0-1.5-10B-LH-STRT PIPE	8092420298	P140/10.0-1.5-10B-LH-EXT PIPE	8092420301	P140/10.0-1.5-10B-LH-END PIPE	8092420302	
Available injection cap								
Part			Designation			Part number		
Injection Cap with 1" ball valve			P140/INJECTION CAP LH BV			8092420303		
Injection Cap with 1" connection			P140/INJECTION CAP LH			8092420304		



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