ROBIT® FOREPOLING PRODUCT CATALOGUE

RoX+ 76,1 systems
RoX+ 88,9 systems
RoX+ 101,6 systems
RoX+ 114,3 systems
RoX 139,7 systems
RoX+ 168,3 systems
RoX+ GFRP 76,1 systems
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</tbody>
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Robit® Forepoling Application
Forepoling

Forepoling, also known as tube umbrella, is an application used to strengthen tunnel roof in broken rock conditions. Drilling system consists of casing tubes which are drilled through the overburden as an umbrella and filled with grouting. Robit® Casing System allows easy driving of the casing tubes into the ground with low torque demand. In modern forepoling also fibreglass casings can be used for ultra-long facebolts.

Robit® Casing Systems mostly used in forepoling are RoX+ 88,9/8, RoX 114,3/10 and RoX 139,7/10.
1. Drilling the casings
2. Injecting the grouting
3. Excavating the tunnel

Drilling the casings
Injecting the grouting
Excavating the tunnel

GROUTING HOLES - ø 12 mm

500 mm
1000 mm
1000 mm
500 mm

RING BIT
CASING SHOE
RoX+ PILOT BIT
DRILL ROD
CASING/DRILL TUBE
RING BIT ASSEMBLY
Casing tubes

- Typically one pile consist of several steel casings of 1,5 – 3 meters
- Connection by thread
- Injection valves for grouting
- Standard casing diameters: 88,9 - 114,3 - 139,7 - 168,3 mm

Preparation

- Robit® Ring Assembly is factory welded to the first casing (starter casing) by casing shoe
- Welding norm:
  - EN499: E42 6B 42 H5
  - AWS/ASME: SFA – 5.1/ E7018-1
  - DIN8529: ESY 42 76 Mn B

Required Equipment

- Almost any drill rig with standardized equipment can be used to drill tube umbrella
- Jumbo drill is commonly used
- A basket boom installed for the operators to connect casing or alternatively additional lifter
- Top hammer drilling/DTH
Typical design

- 20-40 casing tubes per advance
- Each pile 15 meters long, which gives about 12 meter tunnel advancement
- Tubes are inclined 3-5 degrees from tunnel advance direction
- Casing size and other specifications are determined by qualified tunnel engineers and geologists based on the soil conditions

Cross section of single pipe forepoling
Single pipe forepoling

Advance direction ->

15 m

12 m

3-5°
Robit® Forepoling Workflow

Robit® delivers full package of forepoling tools for drilling: pilots, ring bits, tubes, starter casings, drill rods, grouting plugs & shanks.

Threads must be inspected and if necessary greased before lifting them to jumbo’s basket (you may check thread connection by using e.g. grouting plug’s female end).

At the jobsite all tools must be stored in clean and safe place. No damages for casings or dirt for threads is allowed.

Thread the pilot to the extension rod.
Prepare a set of starter casing extension rod inside (threads well greased) and lift to the basket.

Connect the extension rod to the shank.

Wash/clean jumbo’s feed and boom from dirt.

Drive the set of pilot & rod until the ring bit assembly and lock it by rotating it counterclockwise.
Press the front support firmly against the rock before drilling. Collar the rock surface softly with the pilot until the casing assembly has drilled few centimeters - after that start rotation. Increase drill parameters step by step.

When the starter casing has been fully installed, unlock the pilot by rotating clockwise and perform sufficient flushing while moving pilot in/out of the casing. Repeat this step after every casing has been installed.

Lock the pilot again to the ring assembly, disconnect the shank from extension rod and pull it out.

Install a new set of extension casing and extension rod.
Connect the extension rod to the shank.

When the last pile of the arc has been installed...

... it’s time to pick up grouting tools.

Install the grouting plug (end cap) to the casing and inject the soil using cement or polyurethane grout.
If the tunnel face has been stabilized with Robit® RoX GFRP (fiberglass tubes) system with injected grout, it's easy to demolish for example with an excavator. Reinforce ceiling, install steel frames and shotcrete tunnel face.

Separate fiberglass from the excavated soil and recycle it.

Start a new section by supporting the tunnel face with Robit® RoX GFRP system.
- Pilot Bits
- Ring Assemblies
- Drill Rods
- Starter Casings
- Extension Casings
- Grouting Plugs (end caps)
- Adapters
- Grouting Valves
- Forepoling Drilling Systems
Robit® Patented Spiral Locking System

Automatic spiral locking (Patented):

1.) Drive the pilot bit through the casing tube
2.) Rotate to locked position in the ring bit
3.) Robit® Casing System is READY TO DRILL
4.) Finish drilling by rotating the pilot bit in opposite direction and pulling it out
Robit® Dimensions Explanation

Casing System dimensions

- Inner diameter (ID)
- Outer diameter (OD)
- Wall thickness
- Outer diameter of pilot bit
- Inner diameter of pilot bit
- Outer diameter of casing
- Wall thickness of casing

Top Hammer Pilot bit

Casing

Thread R32-C51

Outer diameter of pilot bit
Robit® RoX in Brief: system parts

Single-use system for top hammer drilling

Robit® Single Casing Systems can be used with traditional top hammer machinery. Typically Robit® Single-Use system for Top Hammer is used in applications with relatively short hole requirement 12-15 m and where the casing is left in the ground, such as:

- forepoling or tube umbrella
- anchoring
- micropiling

Drilling parameters example: Jumbo drill

<table>
<thead>
<tr>
<th>Product</th>
<th>RoX+ 139,7/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock / Ground conditions</td>
<td>All rock and ground formations</td>
</tr>
<tr>
<td>Application</td>
<td>Tube Umbrella, Forepoling</td>
</tr>
<tr>
<td>Top hammer thread</td>
<td>C45</td>
</tr>
<tr>
<td>Rotation speed</td>
<td>30 - 40 RPM</td>
</tr>
<tr>
<td>Torque</td>
<td>1000 - 1200 Nm</td>
</tr>
<tr>
<td>Percussion</td>
<td>75 - 100 bars</td>
</tr>
</tbody>
</table>

NOTE
Parameters may vary depending on ground / rock conditions, application and machinery
Robit® RoX GFRP in Brief: system parts

Single-use system for top hammer fiberglass casing

Robit® has developed a system for fiberglass casings. A unique casing shoe works as a shock-absorber protecting the casing from the drilling forces. Fiberglass casing brings several benefits:

- Lighter casings – easier to handle
- Lower material cost – more economic drilling
- Easy to excavate – drill and blast in overburden conditions
- Can be used as face bolts to stabilize the tunnel face

Robit® Fiberglass system is available for top hammer applications.

### Geometrical characteristics

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Section</td>
<td>1700 mmq.</td>
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<tr>
<td>External diameter</td>
<td>ø 76 mm</td>
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<tr>
<td>Internal diameter</td>
<td>ø 60 mm</td>
</tr>
<tr>
<td>Thickness</td>
<td>8 mm</td>
</tr>
<tr>
<td>Weight/m</td>
<td>3.2 kg</td>
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</table>

### Technical characteristics

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Glass content in weight</td>
<td>50%</td>
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<tr>
<td>Specific weight</td>
<td>1.8 g/cc</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>600 MPa</td>
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<tr>
<td>Flexural strength</td>
<td>600 MPa</td>
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<tr>
<td>Elastic modulus</td>
<td>20000 MPa</td>
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</tbody>
</table>

**NOTE**
Parameters may vary depending on ground / rock conditions, application and machinery.
Forepoling Drilling Systems - RoX+ 88,9/8

1. RoX+ 88,9/8 (02-238-088-0024) pilot bit C38

2. RoX+ 88,9/8 ring bit assembly & starter casing
   - Steel casing Ø88,9/8 including RoX+ 88,9/8 ring bit assembly
   - 1 side male threaded, L=3000 mm with grouting holes + valves

3. Extension Casing
   - Steel casing Ø88,9/8, L=3000 mm with grouting holes + valves
   - 2 side male-female threaded, L=3000 mm

4. Extension M/F Rod C38 - round 39 - C38, L=3050 mm (06A-07-0492) or 3660 mm (06A-07-0491)

Optional

5. Grouting plug (end cap)
   - 1 side female threaded with valve

6. Shank adapter for needed rig/driver
Forepoling Drilling Systems - RoX+ 101,6

1. RoX+ 101,6/10 (02-238-101-0026) pilot bit C38

2. RoX+ 101,6/10 ring bit assembly & starter casing
   - Steel casing Ø101,6/10 including RoX+ 101,6/10 ring bit assembly
   - 1 side male threaded, L=3000 mm with grouting holes + valves

3. Extension Casing
   - Steel casing Ø101,6/10, L=3000 mm with grouting holes + valves
   - 2 side male-female threaded, L=3000 mm

4. Extension M/F Rod C38 - round 39 - C38, L=3050 mm (06A-07-0492) or 3660 mm (06A-07-0491)

Optional

5. Grouting plug (end cap)
   - 1 side female threaded with valve

6. Shank adapter for needed rig/drifter
Forepoling Drilling Systems - RoX+ 114,3/10

1. RoX+ 114,3/10 (02-238-114-0028) pilot bit C38

2. RoX+ 114,3/10 ring bit assembly & starter casing
   - Steel casing Ø114,3/10 including RoX+ 114,3/10 ring bit assembly
   - 1 side male threaded, L=3000 mm with grouting holes + valves

3. Extension Casing
   - Steel casing Ø114,3/10, L=3000 mm with grouting holes + valves
   - 2 side male-female threaded, L=3000 mm

4. Extension M/F Rod C38 - round 39 - C38, L=3050 mm (06A-07-0492) or 3660 mm (06A-07-0491)

Optional

5. Grouting plug (end cap)
   - 1 side female threaded with valve

6. Shank adapter for needed rig/drifter
Forepoling Drilling Systems - RoX 139,7

1. RoX 139,7/10 (02-245-139-0032) pilot bit C45
2. RoX 139,7/10 ring bit assembly & starter casing
   - Steel casing Ø139,7/10 including RoX 139,7/10 ring bit assembly
   - 1 side male threaded, L=3000 mm with grouting holes + valves
3. Extension Casing
   - Steel casing Ø139,7/10, L=3000 mm with grouting holes + valves
   - 2 side male-female threaded, L=3000 mm
4. Extension M/F Rod C45 - round 46 - C45, L=3050 mm (06B-07-2882) or 3660 mm (06B-07-0501)
   Optional
5. Grouting plug (end cap)
   - 1 side female threaded with valve
6. Shank adapter for needed rig/driver
Forepoling Drilling Systems - RoX+ 168,3

1. RoX+ 168,3/10 (02-251-168-0038) pilot bit C45
2. RoX+ 168,3/10 ring bit assembly & starter casing
   - Steel casing Ø168,3/10 including RoX+ 168,3/10 ring bit assembly
   - 1 side male threaded, L=3000 mm with grouting holes + valves
3. Extension Casing
   - Steel casing Ø168,3/10, L=3000 mm with grouting holes + valves
   - 2 side male-female threaded, L=3000 mm
4. Extension M/F Rod C45 - round 46 - C45, L=3050 mm (06B-07-2882) or 3660 mm (06B-07-0501)
5. Grouting plug (end cap)
   - 1 side female threaded with valve
6. Shank adapter for needed rig/drifter
Forepoling Drilling Systems - DTH-RoX+ 139,7

1. DTH-RoX+ 139,7/10 (03-541-139-0164) pilot bit, shank IR340

2. DTH-RoX+ 139,7/10 ring bit assembly & starter casing
   - Steel casing Ø139,7/10 including DTH-RoX+ 139,7/10 ring bit assembly
   - 1 side male threaded, L=3000 mm with grouting holes + valves

3. Extension Casing
   - Steel casing Ø139,7/10, L=3000 mm with grouting holes + valves
   - 2 side male-female threaded, L=3000 mm

4. Drill pipe Ø76 or Ø89, 2½ A.P.I., L=3000 mm

Optional

5. Grouting plug (end cap)
   - 1 side female threaded with valve

6. DTH hammer 4", 2½ A.P.I., shank IR340
Forepoling Drilling Systems - RoX+ GFRP 76,1

1. RoX+ GFRP 76,1/8 (02-132-076-0021) pilot bit R32

2. RoX+ GFRP 76,1/8 ring bit assembly & starter casing
   - Fiberglass casing Ø76,1/8 including RoX+ GFRP 76,1/8 ring bit assembly
   - 1 side male threaded, L=2700 mm with grouting holes + valves

3. Extension Casing
   - Fiberglass casing Ø76,1/8 including steel coupling, L=3000 mm with grouting holes + valves
   - 2 side male-male threaded, L=3000 mm

4. Extension M/F Rod R32 - round 32 - R32, L=3050 mm (06B-07-2877) or 3660 mm (06B-07-2492)

Optional

5. Grouting plug (end cap)
   - 1 side female threaded with valve

6. Shank adapter for needed rig
## Product codes & part numbers: RoX+

<table>
<thead>
<tr>
<th>Order code</th>
<th>Casing</th>
<th>Ring bit</th>
<th>Pilot bit</th>
<th>Thread</th>
<th>Product number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[mm]</td>
<td>[in]</td>
<td>[mm]</td>
<td>[in]</td>
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<tr>
<td>RoX+ 76,1/4</td>
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<td>3</td>
<td>0.157</td>
<td>52</td>
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<tr>
<td>RoX+ 76,1/8</td>
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<td>3</td>
<td>0.315</td>
<td>47</td>
<td>1.850 90 3.543</td>
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<tr>
<td>RoX+ 88,9/4</td>
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<td>3 ½</td>
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<td>71</td>
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<td>0.315</td>
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<td>2.000 94,9 3.736</td>
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<td>RoX+ 101,6/10</td>
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<td>4</td>
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<td>65</td>
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<td>94</td>
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<td>RoX+ 219,1/12,7</td>
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<td>8 ½</td>
<td>0.500</td>
<td>167</td>
<td>6.575 234 9.213</td>
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Robit C-thread corresponds T, FI, etc.
## Product codes & part numbers: RoX+ GFRP

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<th>Casing</th>
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<th>Pilot bit</th>
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<th>Product number</th>
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<tr>
<td>RoX+ GFRP 76,1/8</td>
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<tr>
<td>RoX+ GFRP 76,1/8</td>
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<td>8</td>
<td>0.315</td>
<td>47</td>
<td>1.850</td>
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</tbody>
</table>

Robit C-thread corresponds T, FI, etc.
# Extension Rod (Male/Female) - R32 (1 ¼”), C38 (1 ½”) and C45 (1 ¾”) bit threads

<table>
<thead>
<tr>
<th>Order code</th>
<th>Length</th>
<th>Diameter</th>
<th>Thread</th>
<th>Flushing</th>
<th>Product number</th>
<th>Weight</th>
<th>Pcs/box</th>
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<td>10’</td>
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<td>06B-07-2877</td>
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<td>MF-R32-32R-R32-3660</td>
<td>3660</td>
<td>12’</td>
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<td>R32</td>
<td>06B-07-2492</td>
<td>20,9</td>
<td>32</td>
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<td><strong>Extension M/F Rod C38 - round 39 - C38</strong></td>
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<tr>
<td>MF-C38-39R-C38-3050</td>
<td>3050</td>
<td>10’</td>
<td>RND39</td>
<td>C38</td>
<td>06B-07-2199</td>
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<td>12’</td>
<td>RND39</td>
<td>C38</td>
<td>06B-07-2491</td>
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<td>10’</td>
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<td>RND46</td>
<td>C45</td>
<td>06B-07-0501</td>
<td>42,5</td>
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</tbody>
</table>
Drill Tubes - Extension Casing, Male-Female

e.g. for RoX+ 114,3

Standard right hand thread

A

70

750

1500

3000