OPTIMAS

SOFRASAR TUNNEL

Supporting Tunnel Infrastructure Teams for over 30 years

support@optimas.com

Supporting **tunnel infrastructure** teams with industry knowledge, technical expertise and **fastening solutions** for over **25 years**.

OUR NUMBERS TELL THE STORY

1,500
dedicated Optimas team members serving

+5,000
customers around the world

more than **15**
Tunnel projects supplied each year

7 MILLION
segments assembled with our products

2,000 KM
of Tunnel supplied in the last 20 years

95%
of Tunnel products are made in France

supporting you

365
days a year

Zero-defect culture

RESEARCH & DEVELOPMENT

Innovation is at the heart of Optimas Sofrasar **Tunnel Solutions**

This is how we work with our customers:

Anticipation, attentiveness and adaptation form the very foundations of Research & Development. We understand our partners' issues and always form an appropriate solution.

Our engineers are constantly monitoring technology to provide new technical and efficient solutions and meet customer requirements.

Innovation requires cost, both in time and in budget. We're always training and adapting, and we devote more than 5% of our turnover to innovation.

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LOGISTICS EXPERTISE

Optimas maintains a high level of operational control, across **all levels of logistics**. From local truck deliveries to air freight, **we can support you** every step of the way from delivery to your job site

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QUALITY MANAGEMENT & CERTIFICATIONS

Products **designed and manufactured** by the Optimas' Tunnel team meet increasingly **strict** mechanical **performance criteria**.

All of our products are produced according to an elaborate control plan, from design to production. These parts are also subject to visual and dimensional checks alongside periodic mechanical tests which guarantee a very high level of quality.

Quality Management ISO 9001:2015

Environmental Management ISO 14001:2015

Quality Management VDA 6.2

Occupational Health and Safety Management ISO 45001

Quality Management IATF 16949

TUNNEL REPRESENTATIVES

Optimas has a **large network** of representatives and **partners across the globe**, allowing for **consistent** proximity and **attentiveness** to customers

OPTIMAS

SERVING A WIDE RANGE OF INDUSTRIES

AGRICULTURAL, LAWN & GARDEN

APPLIANCES & EQUIPMENT

AUTOMOTIVE

CONSTRUCTION & MINING

ELECTRIC VEHICLES & INFRASTRUCTURE

HEATING & COOLING

HEAVY TRUCK & BUS

INDUSTRIAL MACHINERY

LIGHTING

MATERIAL HANDLING

MEDICAL

POWER

RENEWABLE ENERGY

TECHNOLOGY & ELECTRONICS

TRANSPORTATION & RAIL

TRUCK & TRAILER

TUNNELS

OPTIMAS

We successfully partner with over **5,000 customers** because we understand and cater to their individual needs. With our commitment to **industry best practices**, we enhance our customers' operations with an **extensive network** of distribution centers, quality labs, manufacturing facilities, as well as a broad product range and **trusted quality partners**.

SUSTAINABILITY

WHERE WE ARE

CERTIFICATIONS

ISO Certified ISO 14001 Environmental Management

ISO 14001 Wood Dale, IL, USA, Droitwich Spa, UK, Gloucester, UK, Bredbury, UK, Suzhou, China, Sarreguemines, France.

100% of our UK employees work within ISO 14001-certified facilities.

ENERGY

UK & France using nuclear, solar and wind electricity, with both regions representing 20% green energy use of Optimas' global energy consumption

Early 2023 Wood Dale, USA, moved onto green energy tariff, meaning Optimas have achieved global green energy usage of over 50% before even starting an official roadmap.

RECYCLING

89% waste recycling (1,087 tons generated).

Up to 92% by volume recycled scrap metal is used in our raw materials.

Optimas started working with an outside energy and **sustainability advisor** in January 2022, providing us with tangible milestones and **science-based targets** to work towards.

From January-April 2023 we have been holding business-wide consultation meetings to establish our current position and detailed baseline data.

Next steps: Outline our timeline and establish a full sustainability roadmap.

Plan.it ZERO By Inspirec

Our commitment in 15 years: Net Zero carbon footprint by 2037

50% reduction in carbon footprint at US and UK manufacturing facilities in five years

We are implementing plans to reduce our Scope 1 and 2 carbon footprint by 50% by 2027 and reach net zero by 2037

The Optimas and **Inspired partnership** to support **carbon neutrality**

19 DEC

AGREED PARTNERSHIP

Optimas signed contracts with Inspired Energy solutions Limited.

2 APR

SET UP MEETINGS

Understanding the different groups which can support the data gathering to complete the Scope 3 categories.

20 JUL

REVIEW STATS

Inspired to review the data captured with the Optimas Exec team to establish ongoing targets and objectives.

1 AUG

SHARE GOALS

Optimas to share our targets dates to achieve carbon neutrality goal.

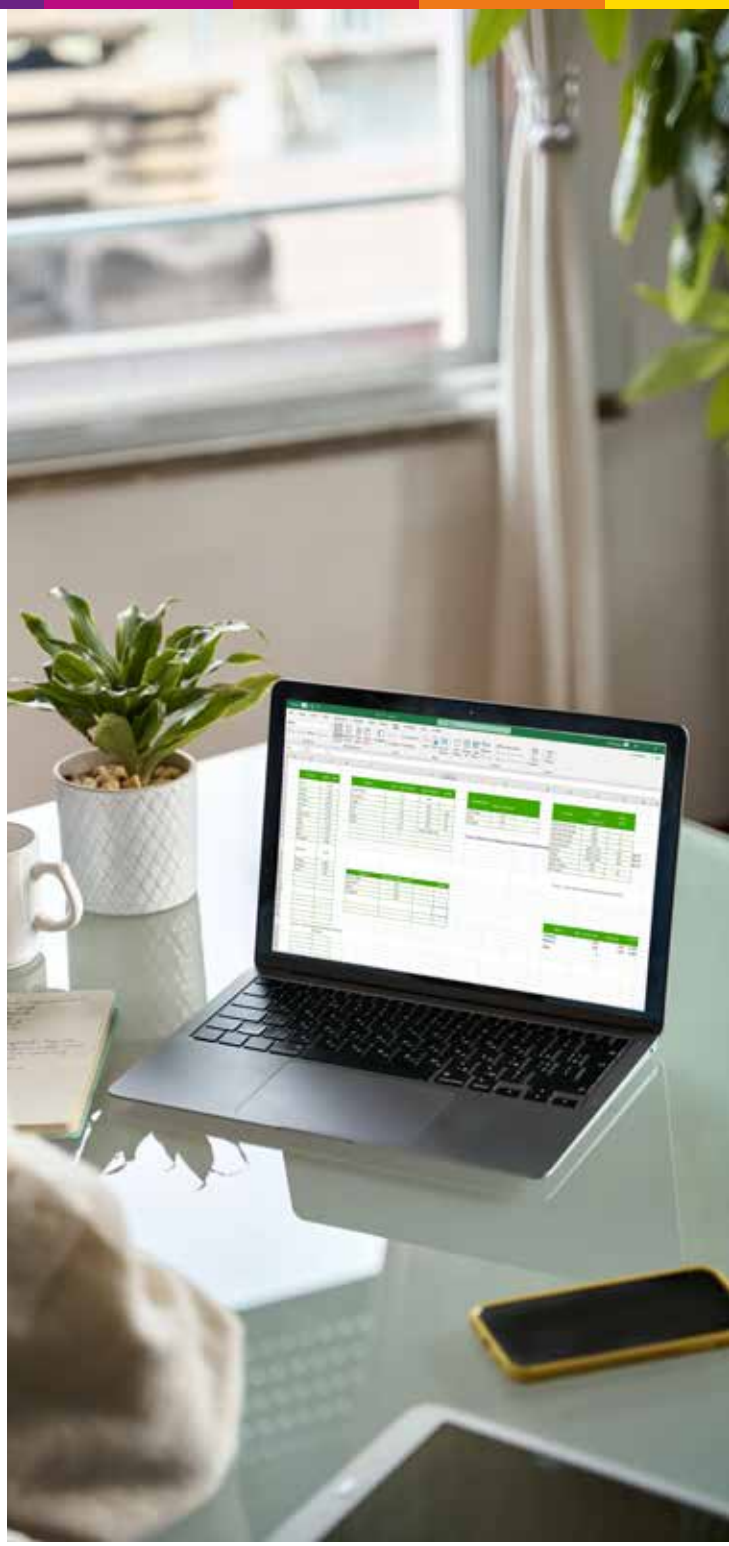
1 NOV

BUDGETING

Optimas to share our targets dates to achieve carbon neutrality goal.

Optimas have the **tools and ability** to identify the **carbon footprint** of individual parts, their manufacturing process and **where they're sourced** from.

This will enable you to make informed decisions on **sustainable sourcing**.



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DOWEL SYSTEM

APPLICATIONS

For use in circumferential joints.

Helping ring builds, providing excellent compression of gaskets and reducing offsets between rings.

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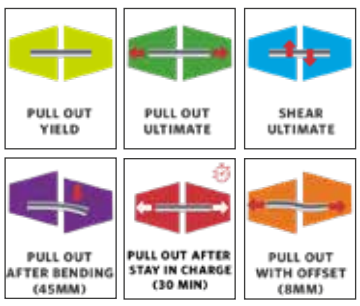
CONTENTS

SOF FIX SYSTEM

SOF FIX system is composed of two sockets and one symmetrical dowel

FEATURES



SOF FIX Sockets are fixed on segments moulds with either a removable steel holder or with the new breakaway OPTIFIX system. When de-moulding segments, the sockets stay perfectly anchored in the concrete.

The dowel is assembled manually in the segment, in the erector area of the TBM. The operator inserts the dowel in the socket on the trailing edge of the ring N by hammering. A special tool is available for this.

The segment is pushed against the ring N-1 and final assembly is achieved using the thrust rams of the TBM.

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SOF FIX SYSTEM

SOF FIX system is composed of two sockets and one symmetrical dowel

SOCKETS

SOF FIX 60

Length	:	96 mm
Diameter	:	57 mm
Material	:	Polyamide

SOF FIX 80

Length	:	112 mm
Diameter	:	57 mm
Material	:	Polyamide

SOF FIX 110

Length	:	127 mm
Diameter	:	57 mm
Material	:	Polyamide

DOWELS

SOF FIX 60

Length	:	216 mm
Standard diameter	:	68 mm
Diameter on teeth	:	36 mm
Insert	:	Steel core M16 grade 8.8

SOF FIX 80

Length	:	247 mm
Standard diameter	:	68 mm
Diameter on teeth	:	36 mm
Insert	:	Steel core M16 grade 8.8

SOF FIX 110

Length	:	278 mm
Standard diameter	:	68 mm
Diameter on teeth	:	36 mm
Insert	:	Steel core M16 grade 8.8

SOF FIX SYSTEM

SOF FIX system is composed of two sockets and one symmetrical dowel

DOWEL SYSTEM

SOF FIX 60

Pull out yield	:	60 kN
Pull out ultimate	:	90 kN
Displacement at yield pull-out resistance	:	5 mm
Shear ultimate	:	160 kN

SOF FIX 80

Pull out yield	:	80 kN
Pull out ultimate	:	120 kN
Displacement at yield pull-out resistance	:	5 mm
Shear ultimate	:	160 kN

SOF FIX 110

Pull out yield	:	110 kN
Pull out ultimate	:	140 kN
Displacement at yield pull-out resistance	:	5 mm
Shear ultimate	:	160 kN

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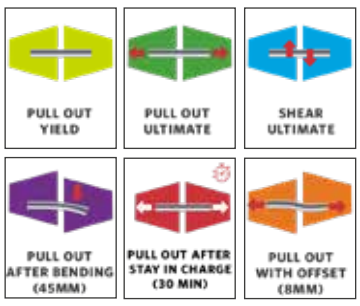
SOF FAST SYSTEM

SOF FAST system is composed of a bolting socket,
a clipping socket and an asymmetric dowel

FEATURES



MADE IN FRANCE

SOF FAST system is composed of 1 bolting socket on the trailing edge of ring N, 1 clipping socket on leading edge of the ring N-1 and 1 asymmetric dowel.

The dowel can be assembled manually or automatically on the TBM. It is screwed in the socket installed on the trailing edge of the ring N.

The segment is pushed against the ring N-1 thanks to the erector and the final assembly is made by the thrust rams of the TBM.

SOF FAST SYSTEM

SOF FAST system is composed of a bolting socket, a clipping socket and an asymmetric dowel

BOLTING SOCKETS

SOF FAST 60

Length	:	100 mm
Diameter	:	43 mm
Material	:	Polyamide + GF

SOF FAST 80

Length	:	100 mm
Diameter	:	43 mm
Material	:	Polyamide + GF

SOF FAST 110

Length	:	100 mm
Diameter	:	43 mm
Material	:	Polyamide + GF

CLIPPING SOCKETS

SOF FAST 60

Length	:	96 mm
Diameter	:	57 mm
Material	:	Polyamide

SOF FAST 80

Length	:	112 mm
Diameter	:	57 mm
Material	:	Polyamide

SOF FAST 110

Length	:	127 mm
Diameter	:	57 mm
Material	:	Polyamide

OPTIMAS

SOF FAST SYSTEM

SOF FAST system is composed of a bolting socket a clipping socket and a asymmetric dowel

DOWELS

SOF FAST 60

Length	:	214 mm
Standard diameter	:	68 mm
Diameter on teeth	:	36 mm
Insert	:	Steel core M16 grade 8.8

SOF FAST 80

Length	:	251 mm
Standard diameter	:	68 mm
Diameter on teeth	:	36 mm
Insert	:	Steel core M16 grade 8.8

SOF FAST 110

Length	:	267 mm
Standard diameter	:	68 mm
Diameter on teeth	:	36 mm
Insert	:	Steel core M16 grade 8.8

DOWEL SYSTEM

SOF FAST 60

Pull out yield	:	60 kN
Pull out ultimate	:	90 kN
Displacement at yield pull-out resistance	:	4 mm
Shear ultimate	:	160 kN

SOF FAST 80

Pull out yield	:	80 kN
Pull out ultimate	:	120 kN
Displacement at yield pull-out resistance	:	4 mm
Shear ultimate	:	160 kN

SOF FAST 110

Pull out yield	:	110 kN
Pull out ultimate	:	140 kN
Displacement at yield pull-out resistance	:	4 mm
Shear ultimate	:	160 kN

OPTIFIX SOLUTIONS

An innovative & efficient fixing method for sockets in the segment form-works.

The OPTIFIX system provides a new fixing method of the sockets in the segment form-works, bringing efficiency, quality and safety.

The OPTIFIX solutions provides a benefit of time saving by preparation of the moulds and by de-moulding.

The OPTIFIX system is now available for the global range of bolting socket.

- **Marking Plates**
- **Dowels**
- **Temporary Fasteners**
- **Grouting System**
- **Bolting**
- **Guiding Rods**

OPTIMAS

DOWEL SYSTEM VERSIONS

ALTERNATIVE CENTRAL DIAMETERS

ø 59

Diameter	:	ø 59 mm
Shear resistance	:	130 kN
Application	:	For segments with lower concrete thickness & lower shear requirements

ø 68

Diameter	:	ø 68 mm
Shear resistance	:	160 kN
Application	:	For segments with lower concrete thickness & lower shear requirements

ø 76

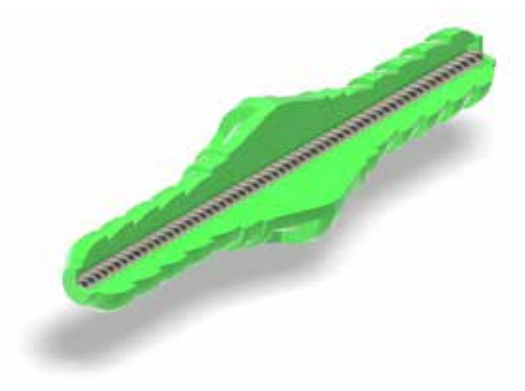
Diameter	:	ø 76 mm
Shear resistance	:	180 kN
Application	:	For higher shear resistance. These geometries improve the segment guidance ring build

ø 88

Diameter	:	ø 88 mm
Shear resistance	:	200 kN
Application	:	For higher shear resistance. These geometries improve the segment guidance ring build

DOWEL SYSTEM VERSIONS

DOWEL TP

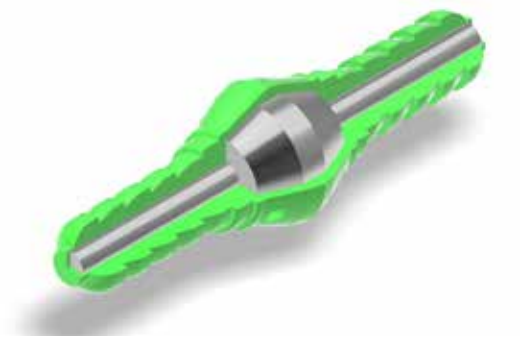


Recommended for temporary segments that will be removed later. For example, by mining through a future station. The steel insert is replaced by a composite material insert that it's easier to cut.

REMOVABLE DOWEL

For a temporary use, without any pull-out resistance, this dowel ensures good segment alignment. Can be used for master rings assembly.

DOWEL HSR & HSR+



Can be used when high shear resistance is required. This dowel has an additional steel ring in the centre cone.

DOWEL SYSTEM VERSIONS

ROLLING CORRECTION DOWEL

It allows a correction of the ring roll. On the leading edge of the Ring N-1, a bi-component resin needs to be injected in a 20mm diameter hole, first drilled at the corrected position.

HALF DOWEL

The M16 steel core insert on the half dowel allows screwing these half dowels on the metallic thrust support, for example.

PACKER OPTIONS

When packers are added between rings and not foreseen in the initial ring design.

UNIVERSAL DOWEL

FOR SOF FIX RANGE

The progressive pitch of the teeth dowel of the ring N-1 helps to compensate the packer thickness and ensures a good clipping of the system.

This dowel is compatible with packers with a thickness up to 3mm. It is available for all the SOF FIX range dowels.

COMPENSATION WASHER

FOR SOF FAST RANGE

This PP plastic washer is added on the threaded part of the dowel. Its thickness corresponds to the compressed packer thickness.

It is available in thickness 2mm and 3mm.

ACCESSORIES

SOCKET PROTECTION CAP

They are installed on the sockets after the segments production and ensure protection against sand, water and dust penetration. Caps are removed before dowels implementation.

These caps are compatible with sockets SOF FIX, SOF FAST, SOF FIX FD and SOF FIX ZUB.

DOWEL IMPLEMENTATION TOOL

It helps dowels SOF FIX and SOF FAST implementation on segments. For SOF FIX the tool is used as hammer support.

For SOF FAST it is used as a screw tool, adaptable with a shock screwer.

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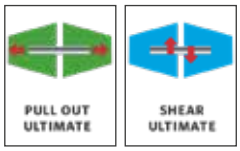
SOF FIX ZUB SYSTEM

SOF FIX ZUB system is composed of a set of sockets and one symmetrical dowel.

FEATURES



SOF FIX ZUB system is composed of a set of sockets and one symmetrical dowel.

The dowel is force fitted by hammering into the socket, on one side and the other side it is pushed by the thrust rams.

SOF FIX ZUB SYSTEM

Composed of a set of sockets & one symmetrical dowel

SOF FIX ZUB

SOF FIX ZUB

Pull out yield	:	-- kN
Pull out ultimate	:	65 kN
Displacement at yield pull-out resistance	:	7 mm
Shear ultimate	:	90 kN

SET OF 2 SOCKETS

Length	:	90 mm
Diameter	:	130 mm
Material	:	Polyamide + GF

DOWEL

Diameter on teeth	:	48 mm
Central diameter	:	60 mm
Material	:	Polyamide + GF
Steel insert	:	M14 grade 8.8

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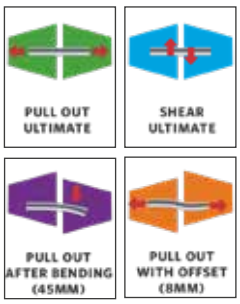
SOF FIX FD SYSTEM

Composed of two sockets & one symmetric dowel

FEATURES



SOF FIX FD system is composed of two sockets and one symmetric dowel.

The dowel is screwed into the socket on the trailing edge, and force-fitted by the thrust rams on the leading edge.

SOF FIX FD SYSTEM

Composed of two sockets & one symmetric dowel

SOF FIX FD

SOF FIX FD

Pull out yield	:	-- kN
Pull out ultimate	:	40 kN
Displacement at yield pull-out resistance	:	4 mm
Shear ultimate	:	60 kN

SET OF 2 SOCKETS

Length	:	92 mm
Diameter	:	55 mm
Material	:	Polyamide + GF

DOWEL

Length	:	178 mm
Diameter on teeth	:	29 mm
Central diameter	:	49 mm
Material	:	Polyamide + GF
Steel insert	:	M12 grade 8.8

FEATURES
SUMMARY

	SOF FIX	SOF FAST	SOF FIX ZUB	SOF FIX FD
PULL OUT YIELD	✓	✓	✗	✗
PULL OUT ULTIMATE	✓	✓	✓	✓
SHEAR ULTIMATE	✓	✓	✓	✓
PULL OUT AFTER BENDING (45MM)	✓	✓	✗	✓
PULL OUT AFTER STAY IN CHARGE (30 MIN)	✓	✓	✗	✗
PULL OUT WITH OFFSET (8MM)	✓	✓	✗	✓

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RESISTANCE
TABLE

PRODUCT REFERENCE	DIAMETER	PULL OUT YIELD	PULL OUT ULTIMATE	SHEAR RESISTANCE
SOF FIX FD		-	40 KN	90 KN
SOF FIX ZUB		-	65 KN	90 KN
SOF FIX 60 **SOF FAST 60**	59 ⌀ 68 ⌀ 76 ⌀ 88 ⌀	60 KN	90 KN	130 KN 160 KN 180 KN 200 KN
SOF FIX 80 **SOF FAST 80**	59 ⌀ 68 ⌀ 76 ⌀ 88 ⌀	80 KN	120 KN	130 KN 160 KN 180 KN 200 KN
SOF FIX 110 **SOF FAST 110**	59 ⌀ 68 ⌀ 76 ⌀ 88 ⌀	110 KN	140 KN	130 KN 160 KN 180 KN 200 KN

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BOLTING SYSTEM

APPLICATIONS

First used in radial linking and in circumferential joints, as temporary or permanent fixations of tunnel lining segments.

Can be used in temporary fixations supports (ventilation, conveyor, bridge etc.).

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CONTENTS

SOF BOLT T19

Pull-out resistance	:	110 kN

First used in radial linking and in circumferential joints, as temporary or permanent fixations of tunnel lining segments.

Can be used in temporary fixations supports (ventilation, conveyor, bridge etc.).

SOF BOLT T19

SOF BOLT T19

SOCKET T19/100

Length	:	100 mm
External diameter	:	28.5 mm
Material	:	Polyamid + G.F

BOLT

Length	:	On request
Thread length	:	100 mm
Rod diameter	:	16 mm
Inner thread diameter	:	14.3/14.8 mm
On thread diameter	:	18.5/19 mm
Material	:	Steel C45 or equivalent
Finition	:	Black or HDG

WASHER 45 X 19 X 3

External diameter	:	45 mm
Internal diameter	:	19 mm
Thickness	:	3 mm
Material	:	Steel C45
Finition	:	Black or HDG

SOF BOLT T20

PULL OUT RESISTANCE

Pull-out resistance	:	80 kN

First used in radial linking and in circumferential joints, as temporary or permanent fixations of tunnel lining segments

Can be used in temporary fixations supports (ventilation, conveyor, bridge, etc.).

SOF BOLT T20

SOF BOLT T20

SOCKET T20/135

Length	:	135 mm
External diameter	:	35 mm
Material	:	Poly propylene

BOLT

Length	:	on request
Thread length	:	135 mm
Rod diameter	:	20 mm
Inner thread diameter	:	16.6 mm
On thread diameter	:	23.8 mm
Finition	:	Black or HDG
Material	:	Steel C45 or equivalent

WASHER 50 X 20 X 4

External diameter	:	50 mm
Internal diameter	:	20 mm
Thickness	:	4 mm
Material	:	Steel C45
Finition	:	Black or HDG

SOF BOLT T25

PULL OUT RESISTANCE

T25 x 80	:	110 kN
T25 x 100	:	140 kN
T25 x 105	:	140 kN
T25 x 120	:	180 kN
T25 x 140	:	220 kN
T25 x 160	:	260 kN
T25 x 115	:	Stainless steel

First used in radial linking and in circumferential joints, as temporary or permanent fixations of tunnel lining segments

Can be used in temporary fixations supports (ventilation, conveyor, bridge etc.).

SOF BOLT T25

SOF BOLT T25

SOCKET T25

Length	:	80 to 160 mm
External diameter	:	35 mm
Material	:	Polyamid 6 + F.G. or T25/115 in stainless steel

BOLT

Length	:	On request
Thread length	:	80 to 160 mm
Rod diameter	:	22 mm
Inner thread diameter	:	20 mm
On thread diameter	:	25 mm
Material	:	Steel C45 or equivalent
Finition	:	Black or HDG

WASHER 70 X 27 X 5

External diameter	:	75 mm
Internal diameter	:	27 mm
Thickness	:	5 mm
Material	:	Steel C45 Stainless steel
Finition	:	Black or HDG

SOF BOLT T28

PULL OUT RESISTANCE

T28 x 100	:	140 kN
T28 x 120	:	180 kN
T28 x 140	:	220 kN
T28 x 160	:	260 kN
T28 x 175	:	400 kN
T28 x 115	:	Stainless steel

First used in radial linking and in circumferential joints, as temporary or permanent fixations of tunnel lining segments

Can be used in temporary fixations supports (ventilation, conveyor, bridge etc.).

SOF BOLT T28

SOF BOLT T28

SOCKET T28

Length	:	100 to 175 mm
External diameter	:	38 mm
Material	:	Polyamid 6 + F.G.
		or T25/115 in stainless steel

BOLT

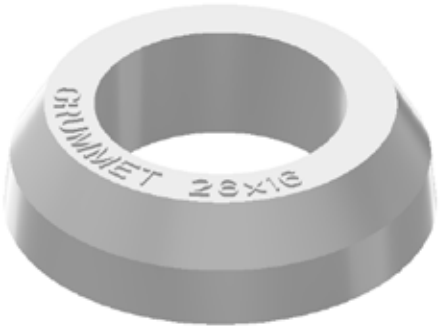
Length	:	On request
Thread length	:	100 to 175 mm
Rod diameter	:	25 mm
Inner thread diameter	:	22.5 mm
On thread diameter	:	28.5 mm
Material	:	Steel C45*
Finition	:	Black or HDG

WASHER 80 X 30 X 8

External diameter	:	80 mm
Internal diameter	:	30 mm
Thickness	:	8 mm
Material	:	Steel C45
Finition	:	Black or HDG

*or equivalent

BOLTING SYSTEM ACCESSORIES



GROMMET

The Grommet ensures the centering of the bolt in the concrete bolt channel. The Grommet's are a available for the T25 and T28 systems and made from Polyethylene

CENTERING CONE

The Centering Cone helps to reduce the gap between the bolt and concrete reservation. The bolt can better work in shear, and it helps to reduce steps and lips between segments

Centering Cone's are a available for the T25 and T28 systems and made from PA 6.6.

BOLTING SYSTEM ACCESSORIES

GRUMMET WASHER

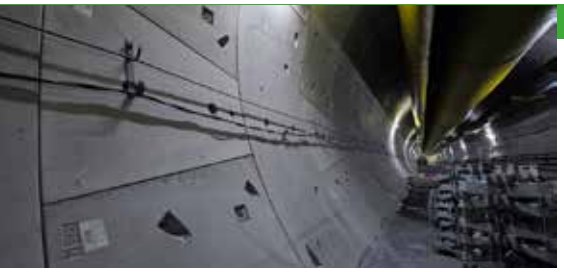
The Grummet Washer ensures the water-tightness of the bolt head. Grummet Washers are available for any size washer and is made out of steel and rubber.

PLASTIC SHEATH

The Plastic Sheath makes the bolt reservation and ensures a protection of the reinforcement by reduced concrete cover and is available in either Polyethlene or Polypropylene.

BOLT BOX COVER

Bolt Box Covers ensures the closing of the intrados bolt box. They offer a better protection of the bolt head, increases the durability and helps to prevent from water turbulences in the tunnel. Bolt Box Covers are made from Polyamid.



BOLTING SYSTEM
OPTIFIX

The OPTIFIX system provides a new fixing method of the sockets in the segment form-works, bringing efficiency, quality and safety.

The OPTIFIX solutions provides a benefit of time saving by preparation of the moulds and by de-moulding.

The OPTIFIX system is now available for the global range of bolting socket.

- **Marking Plates**
- **Dowels**
- **Temporary Fasteners**
- **Injection Grip**
- **Bolting**
- **Guiding Rods**

BOLTING SYSTEM
OPTIFIX

ON THE PYRAMIDS

The breakaway system is integrated in the socket and is easy to fix on the pyramid by a quarter of turn.

By opening the formwork the plastic ring breaks and the socket remains anchored in the segment.

IN THE INTRADOS

The breakaway system is composed of the socket and a breakaway screw cap. The screw cap protects the socket during the storage of the segments.

RESISTANCE TABLE

PRODUCT REFERENCE		SOCKET PULL OUT RESISTANCE	BOLT TENSILE STRENGTH YIELD	ULTIMATE
T19	T19 X 100	>110 KN	65 KN	110 KN
Bolting System T19 : Shrank diameter 16 mm - Thread diameter 18.5 mm - Pitch 6 mm. Steel S355 corresponding to ASTM A307 - 350 MPa = 50'000 Psi - 5000 MPa = 72'000 Psi				
T20	T20 X 135	>80 KN	120 KN	200 KN
Bolting System T20 : Shrank diameter 20mm - Thread diameter 23.8 mm - Pitch 12.5 mm. Steel AF65C45 corresponding to ASTM A307 - 400 MPa = 58'000 Psi - 700 MPa = 101'000 Psi				
T25	T25 X 80	>110 KN	151 KN	265 KN
	T25 X 105	>140 KN		
	T25 X 120	>180 KN		
	T25 X 140	>220 KN		
	T25 X 160	>260 KN		
Bolting System T25 : Shrank diameter 22 mm - Thread diameter 25 mm - Pitch 5 mm. Steel AF65C45 corresponding to ASTM A307 - 400 MPa = 58'000 Psi - 700 MPa = 101'000 Psi				
T28	T28 X 120	>250 KN	196 KN	343 KN
	T28 X 140	>310 KN		
	T28 X 175(Steel grade 8.8)	>360 KN	314 KN	392 KN
	T28 X 175(Steel grade 9.8)	>400 KN	352 KN	441 KN
Bolting System T28 : Shrank diameter 25 mm - Thread diameter 28.5 mm - Pitch 6 mm. Steel AF65C45 corresponding to ASTM A307 - 400 MPa = 58'000 Psi - 700 MPa = 101'000 Psi				

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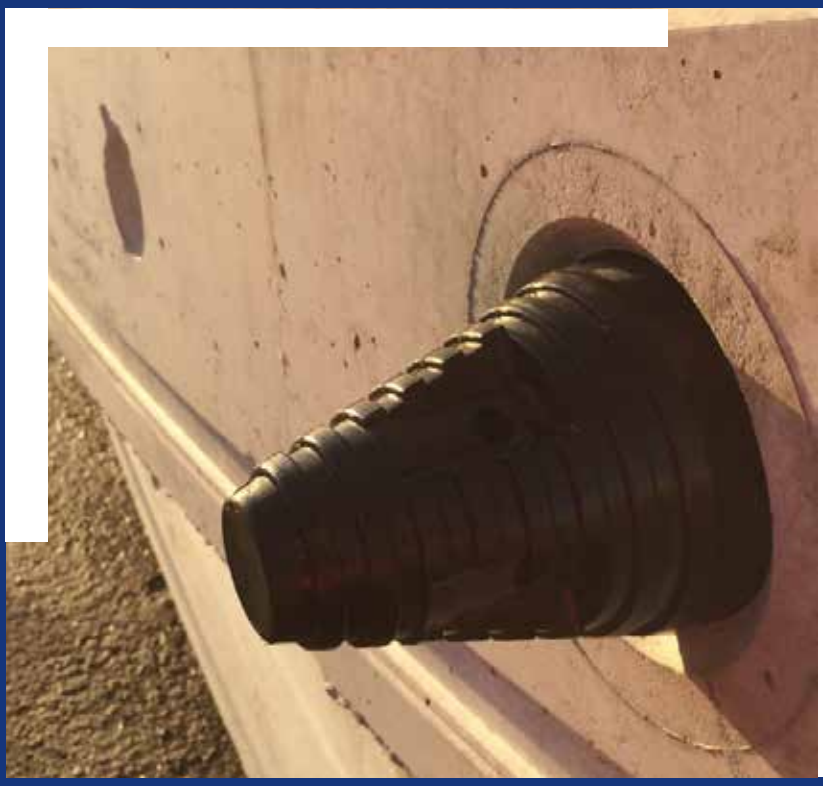
APPLICATION
EXAMPLES

Bolting system used for
levelling of pre-cast elements.

Bolting system used for
levelling of pre-cast elements.

OPTIMAS



SHEAR CONES

APPLICATIONS

The shear cones are located in the circumferential joints. Inserted in concrete recesses, they allow a perfect alignment of the rings by reducing offsets. Due to their conical shape, the bicones help in the installation of the segments.

The shear cones are combined with dowel and bolting systems between rings. In general, they are used in high solicitated areas like cross-passages, sections with low earth cover, at the entrance or exit of the tunnels

OPTIMAS

CONTENTS

OPTIMAS

SHEAR CONES
SC & SOF CLIP

These bicones are used in general in small diameter tunnels (up to 4m). Their primary function is to provide a segment installation assistance. They work well in accordance with bolting systems in circumferential joints.

MADE IN FRANCE

SHEAR CONES

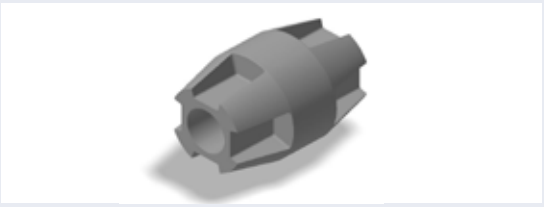
These bicones are used in smaller diameter tunnels of up to 4m.

SOF SHEAR

SOF SHEAR SC

Length	:	144 mm
Central diameter	:	70 mm
Design shear resistance	:	60 kN

BICONE SOF CLIP



Length	:	60 mm
Central diameter	:	65 mm
Design shear resistance	:	50 kN

SHEAR CONES
150 & 180

Used in tunnels with a diameter ø4 - 6m these shear cones with a symmetrical shape will perfectly meet the requirements in terms of flexibility.

OPTIMAS

SHEAR CONES
150 & 180

SOF.SHEAR

SOF SHEAR 150

Length	:	220 mm
Central diameter	:	80 mm
Design shear resistance	:	150 kN

SOF SHEAR 180

Length	:	300 mm
Central diameter	:	100 mm
Design shear resistance	:	180 kN

OPTIMAS

SHEAR CONES
250 & 400

These bicones suit ideally with segments with a high thickness from 400mm. Composed of a combination of several types of plastic material, the result provides a high ductility.

MADE IN FRANCE

SHEAR CONES
250 & 400

SOF.SHEAR

SOF SHEAR 250

Length	:	300 mm
Central diameter	:	120 mm
Design shear resistance	:	250 kN

SOF SHEAR 400

Length	:	300 mm
Central diameter	:	120 mm
Design shear resistance	:	400 kN

OPTIMAS

SHEAR CONE 420

Shear Cones with a steel insert.

With a compact design, this bicone offers high mechanical performance, due to its large steel insert, perfectly over-moulded with elastomerised plastic.

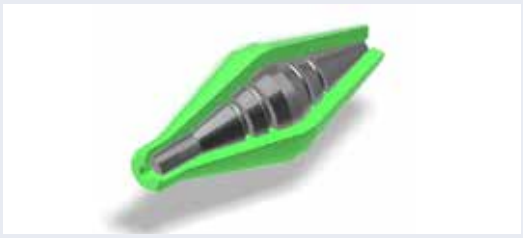
MADE IN FRANCE

SHEAR CONE 420

Shear Cones with a steel insert.

SOF SHEAR

SOF.SHEAR.420



Length	:	200 mm
Central diameter	:	80 mm
Design shear resistance	:	420 kN

APPLICATION EXAMPLES

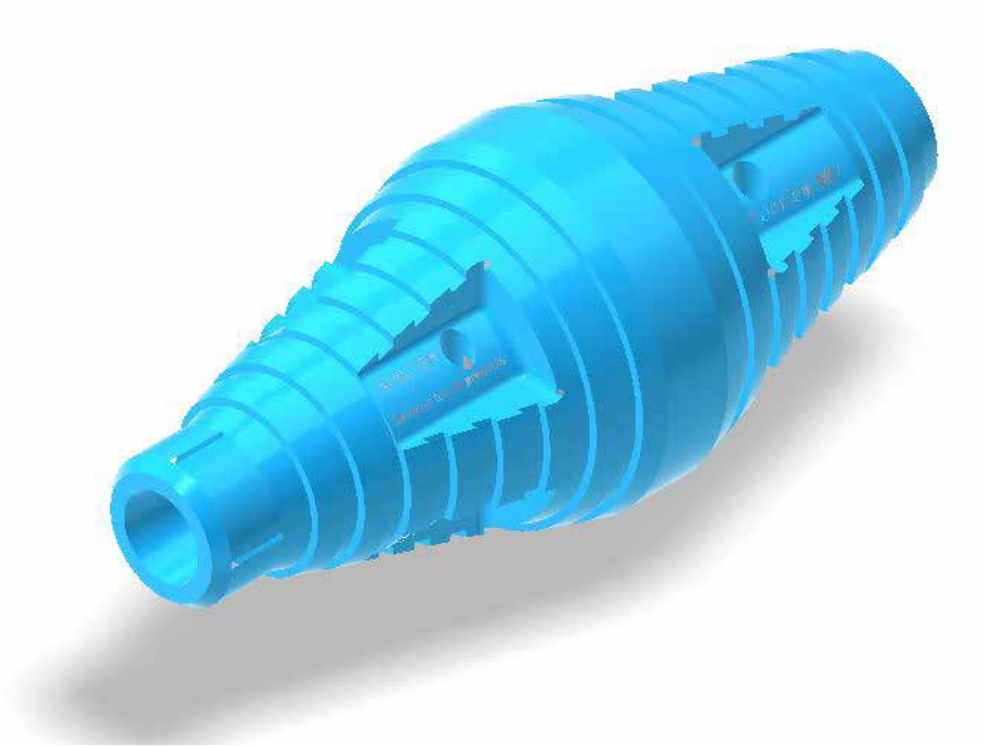
Demolition of the rings in a station without any steel structure.

Excavation of cross-passages during tunnel excavation, without any steel structure

OPTIMAS

SHEAR CONES

150S, 250L, 375 & 500



This range of bicones provides the largest flexibility of use. All products in this range is compatible with the same recess shape.

The range meets the requirements of perfomance for tunnels with a diameter of over ø 6m.

MADE IN FRANCE

SHEAR CONES
150S, 250L, 375 & 500

SOF SHEAR

SOF.SHEAR.150S

Length	:	240 mm
Central diameter	:	100 mm
Design shear resistance	:	150 kN

SOF.SHEAR.250L

Length	:	240 mm
Central diameter	:	100 mm
Design shear resistance	:	250 kN

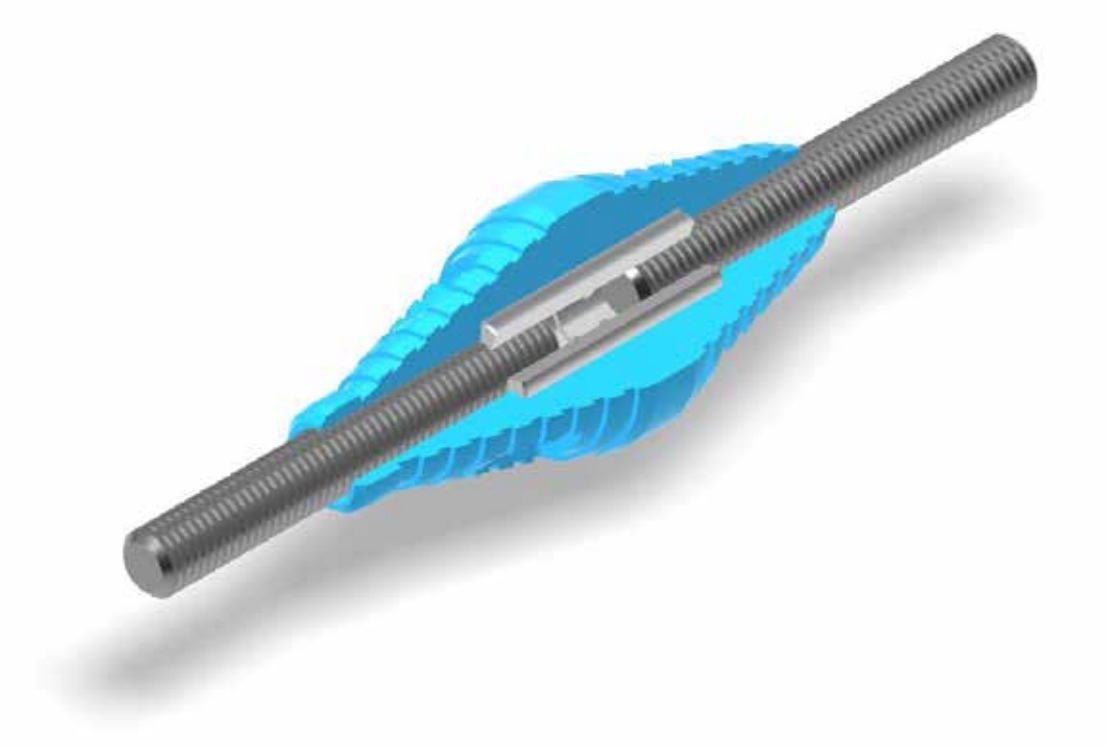
SOF.SHEAR.375

Length	:	240 mm
Central diameter	:	100 mm
Design shear resistance	:	375 kN

SOF.SHEAR.500

Length	:	240 mm
Central diameter	:	100 mm
Design shear resistance	:	500 kN

SHEAR CONES
WITH TIE-RODS



This system is designed to counter the loss of thrust of the TBM cylinders on the last rings before the break-out and thus avoid the gap between the rings.

The system is made up of tie-rods crossing the segments and bicones equipped with a steel coupler, screwed on to the tie-rods.

The bicones are based on the SOF SHEAR 150S and are therefore perfectly compatible with their recesses.

Unlike traditional temporary solutions, this system offers a permanent solution. The tie-rods and the couplers are hot-dip galvanised and the bicones are made of an aging-tested polyamide.

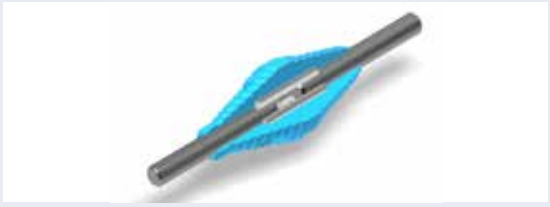
SHEAR CONES
WITH TIE-RODS

SOF SHEAR

SOF.SHEAR.150S-C

Length	:	240 mm
Central diameter	:	100 mm
Design shear resistance	:	150 kN

Tie-Rod M27



Length	:	-- *
Rod diameter	:	25 mm
On thread diameter	:	27 mm
Steel grade	:	8.8 or equivalent
Finition	:	Hot Dip Galvanised

* Defined according to ring design including tapering

The Tie-Rods are inserted in sleeves crossing the segments next to the bicone recesses.

A customised study is proposed to define the range of tie-rods lengths covering all ring rotation configurations (taking tapering into account).

Technical support is also systematically included in the service to study the operating methods for implementing the system on site.

Note: For any questions regarding dimensions, materials and versions, please contact the sales team

OPTIMAS

GUIDING RODS

APPLICATIONS

The guiding rods are used in the radial joints and mainly provide a function of assistance for the installation of the segments.

Made up of a solid plastic section, their shear resistance also reduces the offset of the segments and improves the performance of the gaskets.

The guiding rods are composed of 100% recycled plastic, which gives them a low carbon footprint.

OPTIMAS

CONTENTS

GUIDING RODS

The range of Guiding Rods covers several diameters. Their length is adapted to the ring design.

The Guiding Rods are usually glued in their concrete recess. The new OPTIFIX system now offers an efficient alternative: the guiding rods are fixed with plastic studs by a 100% mechanical connection.

GUIDING RODS

GUIDING RODS

GUIDING ROD 30

Guiding Rod Diameter	:	30 mm
Shear Resistance	:	15 kN
Length	:	100 mm

GUIDING ROD 35

Guiding Rod Diameter	:	35 mm
Shear Resistance	:	17.5 kN
Length	:	100 mm

GUIDING ROD 40

Guiding Rod Diameter	:	40 mm
Shear Resistance	:	20 kN
Length	:	100 mm

GUIDING ROD 50

Guiding rod diameter	:	50 mm
Shear resistance	:	24 kN
Length	:	100 mm

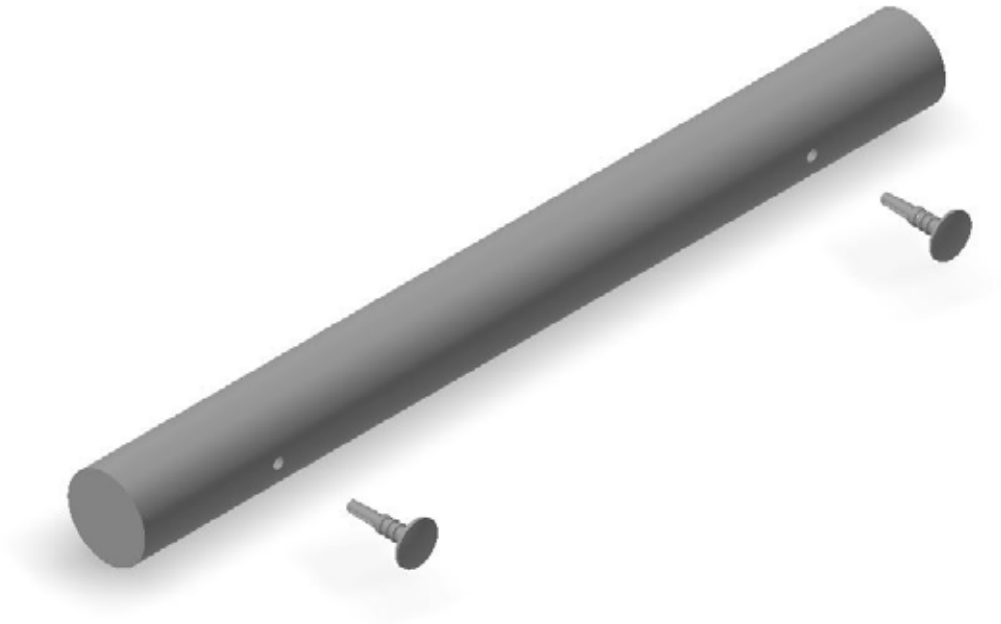
GUIDING ROD 60

Guiding rod diameter	:	60 mm
Shear resistance	:	29 kN
Length	:	100 mm

GUIDING ROD 80

Guiding rod diameter	:	80 mm
Shear resistance	:	39 kN
Length	:	100 mm

OPTIFIX GUIDING
RODS



The OPTIFIX Guiding Rod solution avoids the gluing operation on the segment pre-cast factory. Available in three sizes, they consists of a set of two plastic studs anchored in the concrete and located in the recess. After the segment de-moulding, the Guiding Rods are simply hammered on the studs. This operation can be carried out at any time and does not require any specific workstation.

In addition to the improvement of the working conditions, the OPTIFIX system is also perfectly resistant to climatic conditions such as frost, UV, humidity or temperature and the transport conditions of the segments.

OPTIFIX GUIDING RODS

OPTIFIX GUIDING RODS

SMALL

Range of guiding rods diameter	:	30 mm 35 mm
Stud size	:	S

MEDIUM

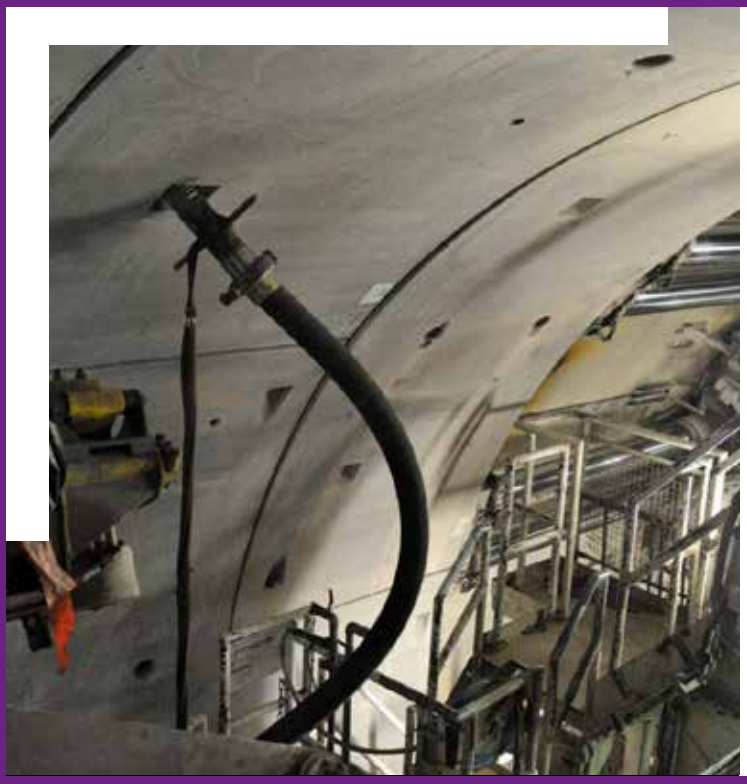
Range of guiding rods diameter	:	40 mm 50 mm
Stud size	:	M

LARGE

Range of guiding rods diameter	:	60 mm 80 mm
Stud size	:	L

Note: The standard distance between studs is 250mm.
Specific distances can be made on request

OPTIMAS



GROUTING & LIFTING SYSTEMS

APPLICATIONS

The injection of mortar or pea-gravel through the thickness of the tunnel lining in order to fill the annular gap. The systems are used either in main injection or in secondary injection.

The lifting of segments, in the case of the use of a mechanized erector.

OPTIMAS

CONTENTS

GROUTING SYSTEMS

Grouting and Lifting systems are composed with plastic sockets anchored in the segments and accessories such as screw caps, non-return valves, hydro-swelling O-rings, lifting- or grouting devices, etc.

The grout sockets can be positioned either directly flush to the intrados surface, or at the bottom of the erector cones.

SOF GROUT TYPE ZU

TYPE ZU

SOF GROUT ZU 100

Length	:	100 mm
Nominal diameter	:	40 mm

SOF GROUT ZU 140

Length	:	140 mm
Nominal diameter	:	40 mm

SCREW CAP

Sealing pressure	:	8 bar*

*tested at 16 bar

NON-RETURN VALVE

Only used in case of injection

HYDRO-SWELLING O-RING

Provides a seal between the socket and the concrete

SOF GROUT TYPE III

TYPE III

SOF GROUT TYPE III

Length	:	130 mm
Nominal diameter	:	70 mm

SCREW CAP

Sealing pressure	:	3 bar*

*tested at6 bar

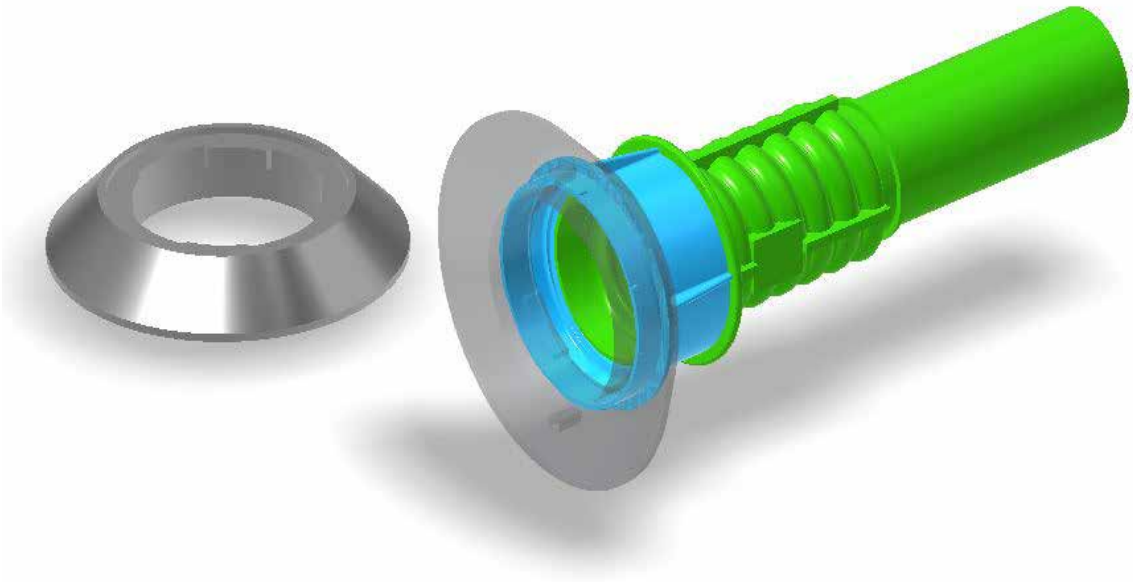
NON-RETURN VALVE

Only used in case of injection

HYDRO-SWELLING O-RING

Provides a seal between the socket and the concrete

SOF GROUT TYPE ZU & III OPTIFIX SOLUTION



Allows quick and easy fixing on the bottom of the mould, with a simple of turn.

By de-moulding of the segment, the fixing ring breaks: the socket remains perfectly anchored in the concrete. A plastic cover protects the inside of the socket from any penetration of cement laitance, dust and water. The sockets are thus preserved from freezing and the risk of mosquito larvae forming in stagnant water.

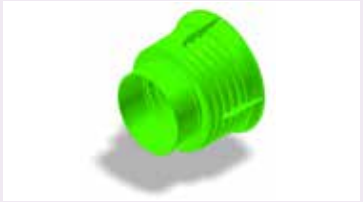
In case of not using the sockets for injection, the plastic cover is left in place and protects the sockets permanently. It replaces the screw cap.

This breakaway system “OPTIFIX” allows the sockets to be placed over the entire intrados surface of the segments, whatever its angle of de-moulding.

SOF GROUT TYPE V

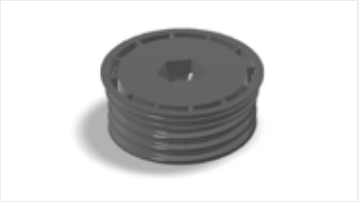
TYPE V

SOF GROUT TYPE V



Length	:	130 mm
Nominal diameter	:	96 mm

SCREW CAP



Sealing pressure	:	7 bar*

*tested at 14 bar

HYDRO-SWELLING O-RING

Provides a seal between the socket and the concrete

LIFTING SYSTEMS

Grouting and Lifting systems are composed with plastic sockets anchored in the segments and accessories such as screw caps, non-return valves, hydro-swelling O-rings, lifting- or grouting devices, etc.

The grout sockets can be positioned either directly flush to the intrados surface, or at the bottom of the erector cones. Lift sockets are generally placed at the centre of the segment.

SOF LIFT TYPE I

TYPE I

SOF LIFT 140

Length	:	140 mm
Nominal diameter	:	40 mm
Pull-out resistance	:	150 kN

SOF LIFT 180

Length	:	180 mm
Nominal diameter	:	40 mm
Pull-out resistance	:	250 kN

SCREW CAP

Sealing pressure : 8 bar*

*tested at 14 bar

NON-RETURN VALVE

Only used in case of injection

HYDRO-SWELLING O-RING

Provides a seal between the socket and the concrete

SOF LIFT TYPE IV

TYPE IV

SOF LIFT 190

Length	:	190 mm
Nominal Diameter	:	70 mm
Pull-out Resistance	:	400 kN

SCREW CAP

Sealing Pressure	:	3 bar*

*tested at 6 bar

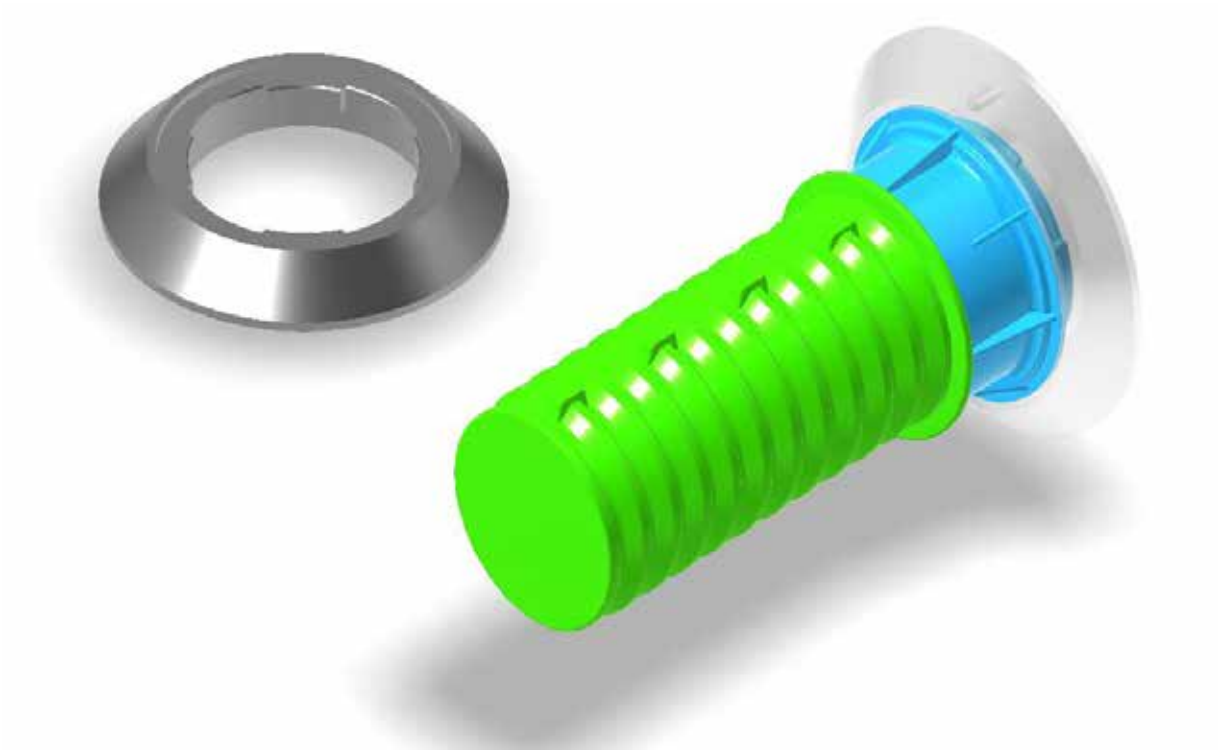
NON-RETURN VALVE

Only used in case of injection

HYDRO-SWELLING O-RING

Provides a seal between the socket and the concrete

SOF LIFT TYPE I & IV
OPTIFIX SOLUTION



Allows quick and easy fixing on the bottom of the mould, with a simple of turn.

By de-moulding of the segment, the fixing ring breaks: the socket remains perfectly anchored in the concrete. A plastic cover protects the inside of the socket from any penetration of cement laitance, dust and water. The sockets are thus preserved from freezing and the risk of mosquito larvae forming in stagnant water.

In case of not using the sockets for injection, the plastic cover is left in place and protects the sockets permanently. It replaces the screw cap.

This breakaway system “OPTIFIX” allows the sockets to be placed over the entire intrados surface of the segments, whatever its angle of de-moulding.

GROUTING SYSTEM
SOF LIFT

GROUTING DEVICES

All types of grouting devices can be supplied, for Male or Female ends, diameter adapted to your requirements. Grouting devices suit perfectly to the threads of injection systems.

LIFTING BOLTS

Like the grouting devices, the lifting bolts are made according to your requirements. The heads of the bolts are compatible with the design of the erector.

TOOL FOR NON RETURN VALVE

This tool makes it easy to screw non-return valves for sockets Type ZU and Type I.

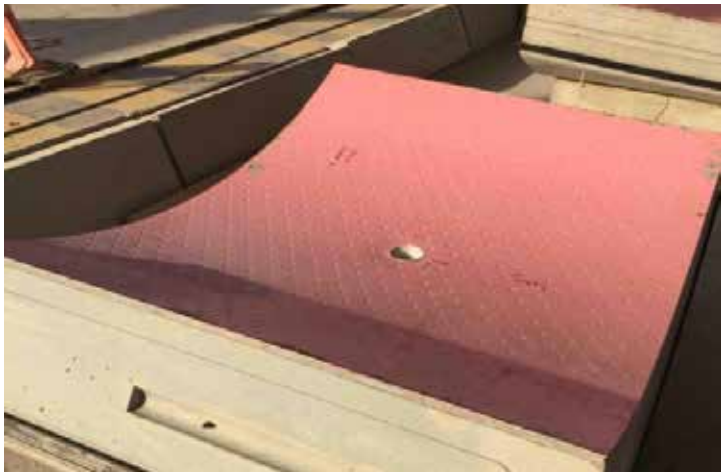
SUMMARY

	TYPE	SOCKET REFERENCE	NOMINAL ∅ [mm]			SCREW CAP	NON-RETURN VALVE	HYDRO-SWELLING O-RING	OPTIFIX	AUTOFIX	OPTILINER
			∅ 40	∅ 70	∅ 96						
GROUTING	TYPE ZU	ZUx100	✓			✓	✓	✓	✓	✓	✓
		ZUx140 + extension	✓								
	TYPE III	Type III + extension		✓							
	TYPE V	Type V + extension			✓		✗		✗	✗	✗
LIFTING + GROUTING	TYPE I	Type Ix140	✓				✓		✓	✓	✓
		Type Ix180	✓								
		Type Ix217 + extension	✓								
	TYPE IV	Type IV + extension		✓							

APPLICATION
EXAMPLES

Lifting sockets Type I adapted for segments with anchored HDPE membrane.

Lifting sockets Type I adapted for segments with anchored HDPE membrane.



Lifting sockets Type I adapted for segments with anchored HDPE membrane.

OPTIMAS

MARKING PLATES

APPLICATIONS

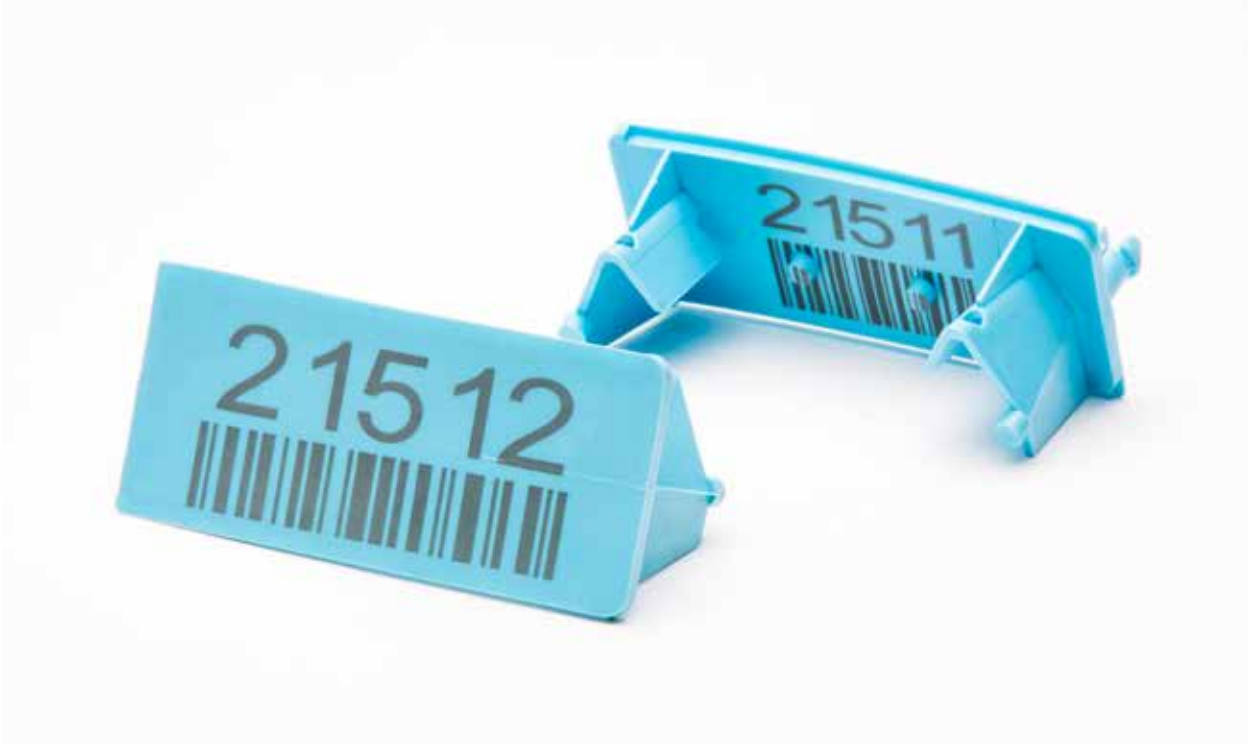
Located on the intrados surface or on an circumferential edge of the segments, the marking plates ensure a permanent traceability of the segments thanks to a unique codification

The marking plates are totally customizable and meet the requirements and constraints of each project.

OPTIMAS

CONTENTS

MARKING PLATES



The coding is compatible with most production, logistic and traceability management systems used in tunnelling market.

A wide range of colours is available and makes it easy to distinguish reinforced rings from standard rings on a same project, for example.

A new version with RFID Tag is now available. This version allows you to add data at the production of the segments and their installation in the tunnel.

MARKING PLATE
PRINCIPLES

IMPLEMENTATION PRINCIPLE

The marking plate is inserted into a metal frame by sliding. By segment de-moulding, it remains anchored in the concrete.

COLOUR OPTIONS

Yellow, Pink, Orange, Blue, Light grey, Green.

MARKING PLATES
CODING & PACKAGING

CODING

The coding is totally customizable: it can be numeric or alpha-numeric, up to 6 digits.

The code is always marked alpha-numerically (to allow a manual reading) and also transcribed into barcode an/or QR code.

The marking is usually made on both sides, to allow a reading on the segment as well as at the bottom of the mould (before concreting).

The plate can also be marked with a logo or a tunnel batch number.

PACKAGING

The marking plates are packaged on cartboard interlayers, thus ensuring a chronological numbering of the plates. These cartboards are ergonomic and fit perfectly into the workstations of the pre-cast factories.

MARKING PLATES
RFID

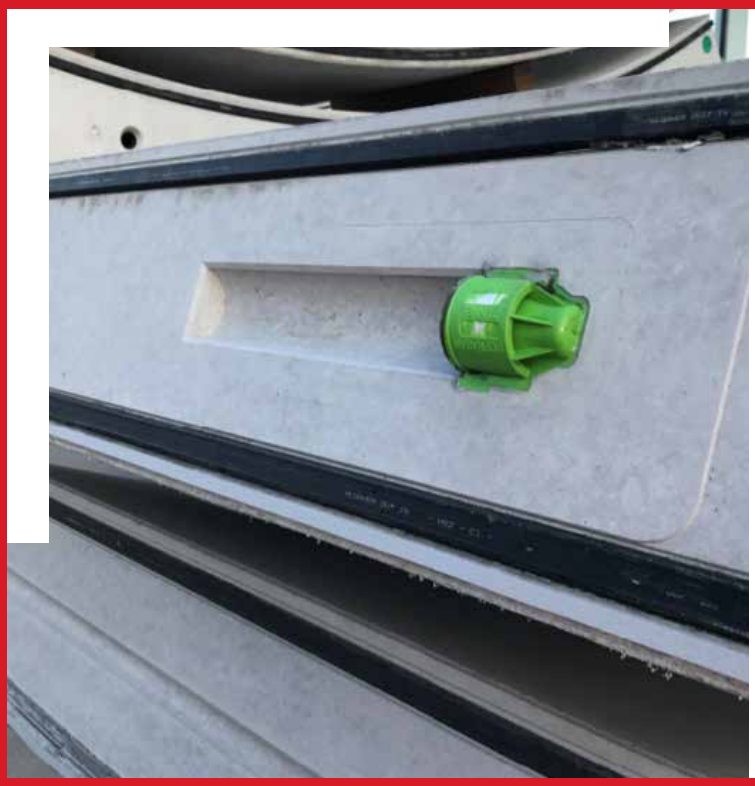
RFID

The addition of a RFID Tag on the back side offers an additional possibility to read the Marking Plates with a tablet or a smart phone. The NFC technology allows to easily add data in the tags during the production process of the segments and/or after the installation of the segments in the tunnel.

Examples of data that can be added furthermore:

- Production date of the segment
- Concrete batch
- Type of rings (reinforcement cage of SFRC)
- Installation date in the tunnel
- Quality control

OPTIMAS



RADIAL COUPLING SOF RADLINK

APPLICATIONS

The new radial coupling is located on the edges between segments of the same ring. It offers unequaled ease of segment assembly and ensures high mechanical properties.

OPTIMAS

CONTENTS

SOF.Radalink 120

Shear Pin

RADIAL COUPLING
SOF.RADLINK

This radial coupling system replaces the combination of a guiding rod and radial bolt. It is made up of 2 female parts, in the shape of an “Omega” (cast-in item) and a male connector. Its design and construction make the system perfectly compatible with the use of circumferential dowel systems. The segments are thus fully assembled without any bolts :

- No screwing operation at height
- No recess on the intrados surface of the tunnel

OPTIMAS

RADIAL COUPLING
SOF RADLINK

SOF.RADLINK.120

SET OF 2

They are composed of an insert in thermoplastic composite material and a plastic over-moulding.

These items are anchored in the segments. Their fixing into the moulds is ensured by a very easy to use handle system.

The geometry of these parts is perfectly anchored in reinforced concrete or steel fibre-reinforced concrete.

SHEAR PIN

The connector works like a shear cone. It is placed manually in the Omega insert and its high shear resistance allows a recovery of mechanical performance of the connectors can be adapted to specific needs by modifying the metal inserts. Its flared shape at the ends facilitates the guidance of the voussoir to the installation.

PERFORMANCE

A perfect alternative to guiding rods combined with radial bolts

Useful in case of high internal water pressure or low earth cover

Applicable for tunnels located in seismic area

Compatible with tunnel segments equipped with HDPE membranes

High Durability = perfect alternative to stainless steel bolts

OPTIMAS

More than **products** we supply **solutions...**

...next generation tunnel connecting **technology**.

OPTIMAS

The Components of Unrivalled Success

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