

BBR VIT CONA CMG

Strand ground anchors for geotechnical & underground engineering applications

Certified, strong & durable



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The BBR Network is recognized as the leading group of specialized engineering contractors in the field of post-tensioning, stay cable and related construction engineering. The innovation and technical excellence, brought together in 1944 by its three Swiss founders – Antonio Brandestini, Max Birkenmaier and Mirko Robin Ros – continues, more than 75 years later, in that same ethos and enterprising style. From technical headquarters in Switzerland, the BBR Network reaches out around the globe and has at its disposal some of the most talented engineers and technicians, as well as the very latest internationally approved technology.

THE GLOBAL BBR NETWORK

Within the Global BBR Network, established traditions and strong local roots are combined with the latest thinking and leading edge technology. BBR grants each local BBR Network Member access to the latest technical knowledge and resources – and facilitates the exchange of information on a broad scale and within international partnering alliances. Such global alliances and co-operations create local competitive advantages in dealing with, for example, efficient tendering, availability of specialists and specialized equipment or transfer of technical know-how.

ACTIVITIES OF THE NETWORK

All BBR Network Members are well-respected within their local business communities and have built strong connections in their respective regions. They are all structured differently to suit the local market and offer a variety of construction services, in addition to the traditional core business of post-tensioning.

BBR TECHNOLOGIES

BBR Technologies have been applied to a vast array of different structures – such as bridges, buildings, cryogenic LNG tanks, dams, marine structures, nuclear power stations, retaining walls, tanks, silos, towers, tunnels, wastewater treatment plants, water reservoirs and wind farms. The BBR brands and trademarks – BBR®, COÑA®, BBRV®, HiAm®, DINA®, BBR E-Trace® and CONNAECT® – are recognized worldwide. The BBR Network has a track record of excellence and innovative approaches – with thousands of structures built using BBR Technologies. While BBR's history goes back over 75 years, the BBR Network is focused on constructing the future – with professionalism, innovation and the very latest technology.

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Certified, strong & durable

The BBR VT CONA CMG system is the very latest European assessed and CE-certified construction engineering technology which has been introduced with impeccable Swiss credentials – and proven high levels of corrosion protection.

BBR has built an international reputation for the highest quality construction engineering and service, earned over many decades as a specialist company in the fields of post-tensioning, stay cable technologies, geotechnical and related solutions. It will, therefore, be no surprise to learn that we apply the same strict approach towards quality and performance of our geotechnical systems as we do to our post-tensioning technologies. In this context, we went the extra mile and conducted extensive performance and corrosion protection tests in order to obtain European Assessment * – thus CE marking – for our BBR VT CONA CMG geotechnical strand ground anchor systems. As you will see, the engineers in our R&D department have not only optimized the CONA CMG system – so that only the amount of materials actually needed are used – but they have also created a new benchmark in corrosion protection for ground anchors. Along the way, our engineers have reached out even further and devised a way of testing grout cracking of a confined and stressed anchor – this was previously thought to be very difficult and thus not pursued by others. So, we know for sure that BBR VT CONA CMG strand ground anchors, supplied and installed exclusively by BBR Network Members using BBR grouting products and procedures, will provide the most durable solution on the market. By now, you may have realized that we are very excited about the BBR VT CONA CMG system – and when you read on, we are sure you will be too!

* European Technical Assessment (ETA) in progress.

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System features & components

The BBR VT CONA CMG strand ground anchor system offers state-of-the-art performance, including the widest size range across three different corrosion protection levels to allow customers to select the optimum force range and design life characteristics for specific projects.

The BBR VT CONA CMG anchor is an optimized system which ensures both effective performance and economy. The main components are:

- the anchor head, including corrosion protection elements and a solution to lock-in the load bearing tendon elements
- tendon in the free length, where the strands are de-bonded from the surrounding grout confinement allowing free elongation
- tendon in the bond length, where the strands are bonded to the surrounding ground by means of cementitious grout.

For strand ground anchors to fulfill their purpose and become activated, an external force is applied thus active support for the structure is achieved. Active force applied to the structure prevents it from any movement and ensures the durability of the entire structure.

Economical short-term ground anchor solution

BBR VT CONA CMG PL1 is a temporary strand ground anchor for applications of up to two years and represents an economical solution. The limitation on the duration of application up to two years guarantees effective anchor performance even though some of the corrosion protection layers may become compromised.

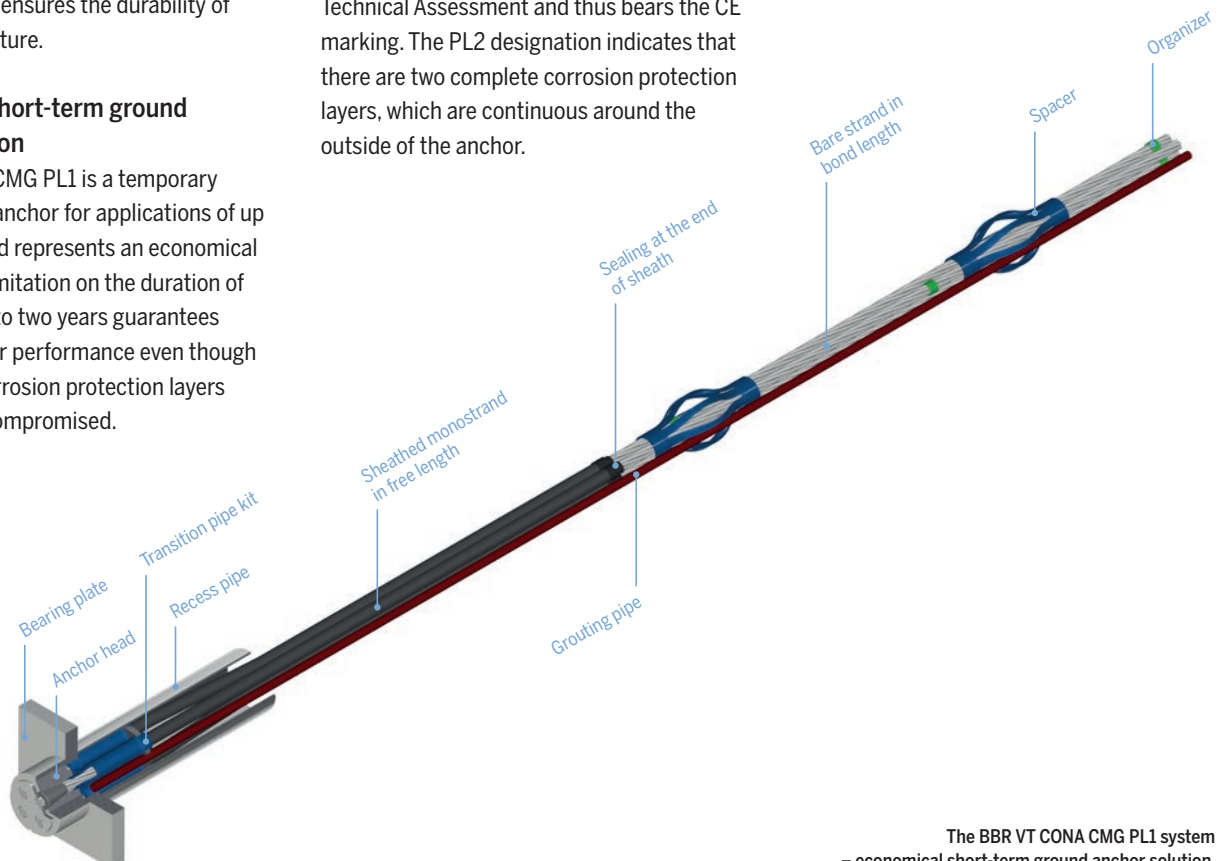
Temporary ground anchor

BBR VT CONA CMG PL1+ is a temporary strand ground anchor for applications up to seven years. It offers at least one continuous corrosion protection layer around the periphery of the anchor. Strand ground anchors with PL1+ protection level are used to temporarily secure excavations as tie-backs on construction projects of longer duration.

Highest durability permanent ground anchor

The BBR VT CONA CMG PL2 system exhibits the highest corrosion protection level for a ground anchor of this type. This has been successfully proven according to the stringent requirements of European Technical Assessment and thus bears the CE marking. The PL2 designation indicates that there are two complete corrosion protection layers, which are continuous around the outside of the anchor.

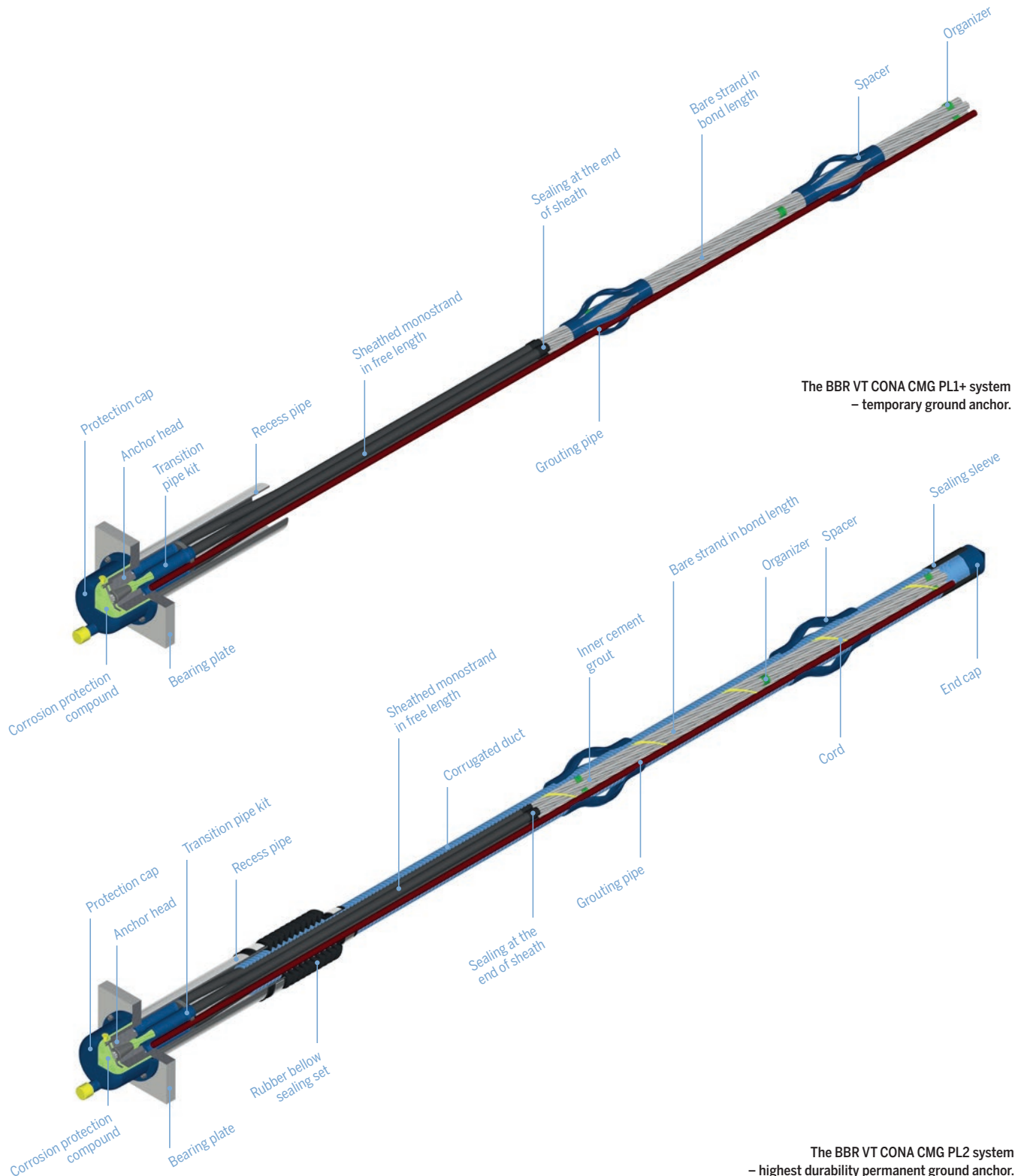
The fully tested and approved set-up of a BBR VT CONA CMG system ensures effective double corrosion protection through the corrugated duct and grout. Any potential cracking under service load is limited to a maximum of 0.1mm and thus the grout is accepted as a corrosion protection layer. BBR VT CONA CMG PL2 strand ground anchors are used for permanent applications and have a design life expectancy of up to 100 years as tie-back anchors, uplift control, slope stabilization or rockfall protection.



The BBR VT CONA CMG PL1 system – economical short-term ground anchor solution.

Key benefits of the BBR VT CONA CMG system

- Latest technology – engineered in response to recent market feedback mitigates drawbacks of existing solutions
- Unique-in-the-market corrosion protection features – enhanced corrosion protection in transfer zone behind the bearing plate and leak-tightness of the PE-sheathed strand, which meets the criteria of latest European Assessment Documents (EADs)
- Fully ETA-approved and CE-certified system – including all components, system set-up and performance
- Effective corrosion protection solution – due to proven limitation of grout cracking
- Widest range of anchorage sizes – allows use of right size for each project, without needing to use oversized solutions



Applications for BBR VT CONA CMG system

Geotechnical strand ground anchors are a proven construction method for securing retaining structures. They promote productivity and safety on site – often alongside enhanced aesthetics and reduced project costs.

By using ground anchors, internal stiffening in the excavation can be avoided thus increasing space for operations during ground engineering works. Ground anchors can be used as additional supports for retaining walls which improves the aesthetics of the final outcome or limits the dimensions of the structures by providing additional points of support.

Nowadays strand ground anchors are used for multiple applications such as uplift control in areas of high water level, hold-down solutions for foundations and towers and masts, tie-backs for retaining structures such as abutments, highway flyovers, rockfall and ground slide protection walls and in many other situations.

Retaining structures

Ground anchors are frequently used within city center excavations as a tie-back for retaining structures, instead of using compression struts. Thus, work with equipment such as cranes or other construction plant can proceed unhindered – also saving time and costs. Ground anchors actively secure the retaining structures as they are post-tensioned and therefore any possible deformation of the secured structure is avoided.



Ground anchor applications

- Retaining structures
- Slope stabilization
- Hold-down solutions
- Horizontal tie-rods
- Uplift control
- Dam retrofitting

Slope stabilization

A further use of ground anchors is for stabilization of slopes. This is most often required alongside roads or railway cuttings where embankments are under threat of slip or erosion.

Hold-down solutions

Any large structure that may be at risk of overturning can be secured by using ground anchors. Typically, this application might include masts, towers and wind power generators.

Horizontal tie-rods

Within a structure, horizontal tie-rods are used to stabilize two or more points in relation to one another. Tie backs provide stabilization at the head of earth filled dams which have been laterally sheet piled. It is possible to achieve a high tensile force capacity with stabilizing cross-ties. Also, in foundations, the shifting horizontal forces can be transferred using tie rods.



Uplift control

This application relates to foundation slabs and structures which require securing during construction against uplift forces generated by ground water pressure. An added benefit of using strand ground anchors in such a situation is that the slab thickness can be reduced, saving on both project material costs and time.

Dam retrofitting

The relatively recent introduction of stringent regulations in certain regions for massive structures such as dams or hydro-electric power stations means that existing structures must be retrofitted to conform with the latest codes and standards. This may require substantial force to be applied to enhance load bearing capacity and resistance against seismic loads or other phenomena. These forces can be brought into control by using BBR's strand ground anchors, which can be assembled and supplied up to 91 strands. Larger sizes upon request.

System product range & description

The BBR VT CONA CMG* system is designed for geotechnical applications, as soil or rock anchors. The system covers a maximum force range from 177kN to 6,138kN, aiming to satisfy the major market demands.

Size		0.62"strand: d = 15.7mm A _p =150mm ² , M=1.17kg/m			
Anchor head type	Number of strands	Y 1860S7-15.7		Y 1770S7-15.7	
	n	F _{pk}	F _{p0.1k}	F _{pk}	F _{p0.1k}
[-]	[-]	[kN]	[kN]	[kN]	[kN]
0106	1	279	246	266	234
0206	2	558	492	532	468
0306	3	837	738	798	702
0406	4	1,116	984	1,064	936
0506	5	1,395	1,230	1,330	1,170
0606	6	1,674	1,476	1,596	1,404
0706	7	1,953	1,722	1,862	1,638
0806	8	2,232	1,968	2,128	1,872
0906	9	2,511	2,214	2,394	2,106
1206	12	3,348	2,952	3,192	2,808
1306	13	3,627	3,198	3,458	3,042
1506	15	4,185	3,690	3,990	3,510
1606	16	4,464	3,936	4,256	3,744
1906	19	5,301	4,674	5,054	4,446
2206	22	6,138	5,412	5,852	5,148

Size		0.60"strand: d = 15.3mm A _p =140mm ² , M=1.09kg/m			
Anchor head type	Number of strands	Y 1860S7-15.3		Y 1770S7-15.3	
	n	F _{pk}	F _{p0.1k}	F _{pk}	F _{p0.1k}
[-]	[-]	[kN]	[kN]	[kN]	[kN]
0106	1	260	229	248	218
0206	2	520	458	496	436
0306	3	780	687	744	654
0406	4	1,040	916	992	872
0506	5	1,300	1,145	1,240	1,090
0606	6	1,560	1,374	1,488	1,308
0706	7	1,820	1,603	1,736	1,526
0806	8	2,080	1,832	1,984	1,744
0906	9	2,340	2,061	2,232	1,962
1206	12	3,120	2,748	2,976	2,616
1306	13	3,380	2,977	3,224	2,834
1506	15	3,900	3,435	3,720	3,270
1606	16	4,160	3,664	3,968	3,488
1906	19	4,940	4,351	4,712	4,142
2206	22	5,720	5,038	5,456	4,796

Size		0.50"strand: d = 12.9mm A _p =100mm ² , M=0.78kg/m			
Anchor head type	Number of strands	Y 1860S7-12.9		Y 1770S7-12.9	
	n	F _{pk}	F _{p0.1k}	F _{pk}	F _{p0.1k}
[-]	[-]	[kN]	[kN]	[kN]	[kN]
0105	1	186	164	177	156
0205	2	372	328	354	312
0305	3	558	492	531	468
0405	4	744	656	708	624
0705	7	1,302	1,148	1,239	1,092
1205	12	2,232	1,968	2,124	1,872
1905	19	3,534	3,116	3,363	2,964

F_{pk} = characteristic value of maximum force F_{p0.1k} = characteristic value of 0.1% proof force A_p = area cross section d = nominal strand diameter
 *Bearing CE marking. Larger sizes also available.



Quality assurance & traceability

The BBR VT CONA CMG system is European assessed * and thus bears the CE marking. Although strand ground anchors are highly customized, with project-specific bond length and free length values, as well as various options for corrosion protection, the highest standard of Quality Assurance is implemented by the BBR Network for the BBR VT CONA CMG system.

European assessed technology

The key parameters of a CE marked BBR VT CONA CMG system are summarized in the particular ETA which becomes the technical reference document defining the conditions of use of the system. The full ETA document is made available to designers, engineers, contractors and clients.

Quality assured installation

European assessed and CE-marked strand ground anchor kits must be installed by certified GT Specialist Companies – BBR Network Members. The BBR GT Specialist Company is responsible, under supervision of the ETA holder (BBR VT International Ltd), for compliance with all regulations set out in the relevant technical approvals for the strand ground anchor kit and with the respective standards and regulations in force at the place of use, and must ensure a professional execution of the installation and post-tensioning works. Key personnel of the BBR GT Specialist Company are continuously trained in the usage of the particular strand anchor kits and are certified for the installation and post-tensioning works by the ETA Holder – BBR VT International Ltd.

Factory Production Control

The European Assessment Document (EAD) for strand ground anchor kits with monostrand specifies the minimum production control plan and frequencies that have to be achieved. Compliance with these and the complete factory production process are fully audited by the Approval/Notified Body and any non-conformity must be rectified prior to any CE marking.

During the validity period of the ETA, the Approval/Notified Body continues to exert full control of the production and, in addition to the audits and testing by the Kit Manufacturer:

- the ETA Holder, the Kit Manufacturer and each Component Manufacturer are audited every year
- kit components are collected from site annually for independent testing and checking of the mechanical performance.

These provisions guarantee proper quality and compliance of the kit components.

Guarantee of quality

BBR's Quality Assurance procedures are applied to the standard components of the BBR VT CONA CMG system. The BBR Factory Production Control (FPC) system includes continuous surveillance and full traceability, followed by Pre-Delivery Inspection (PDI) before goods are dispatched.

The highest attention is given to the assembly of the final product according to project specifications. The standard components are verified once again during assembly. Both standard and customized features of each individual anchor are examined to ensure the conformity to general and project-specific requirements. The high standard of quality control applied in the selection of raw materials, the production process, the mechanical and geometrical features of the end product guarantee that the BBR VT CONA CMG system offers the highest level of quality and desired performance.

BBR E-Trace platform

BBR's unique E-Trace online trading and quality assurance platform, to which BBR Network Members have access, eliminates human errors during project execution, thus limiting the workload and costs. BBR E-Trace ensures easy access to up-to-date prices, quality documents and project references – all in one place. Most importantly, the BBR E-Trace platform facilitates the full traceability of products during their long journey from raw material up to their installation on site.

* European Technical Assessment (ETA) in progress.

New benchmark for corrosion protection

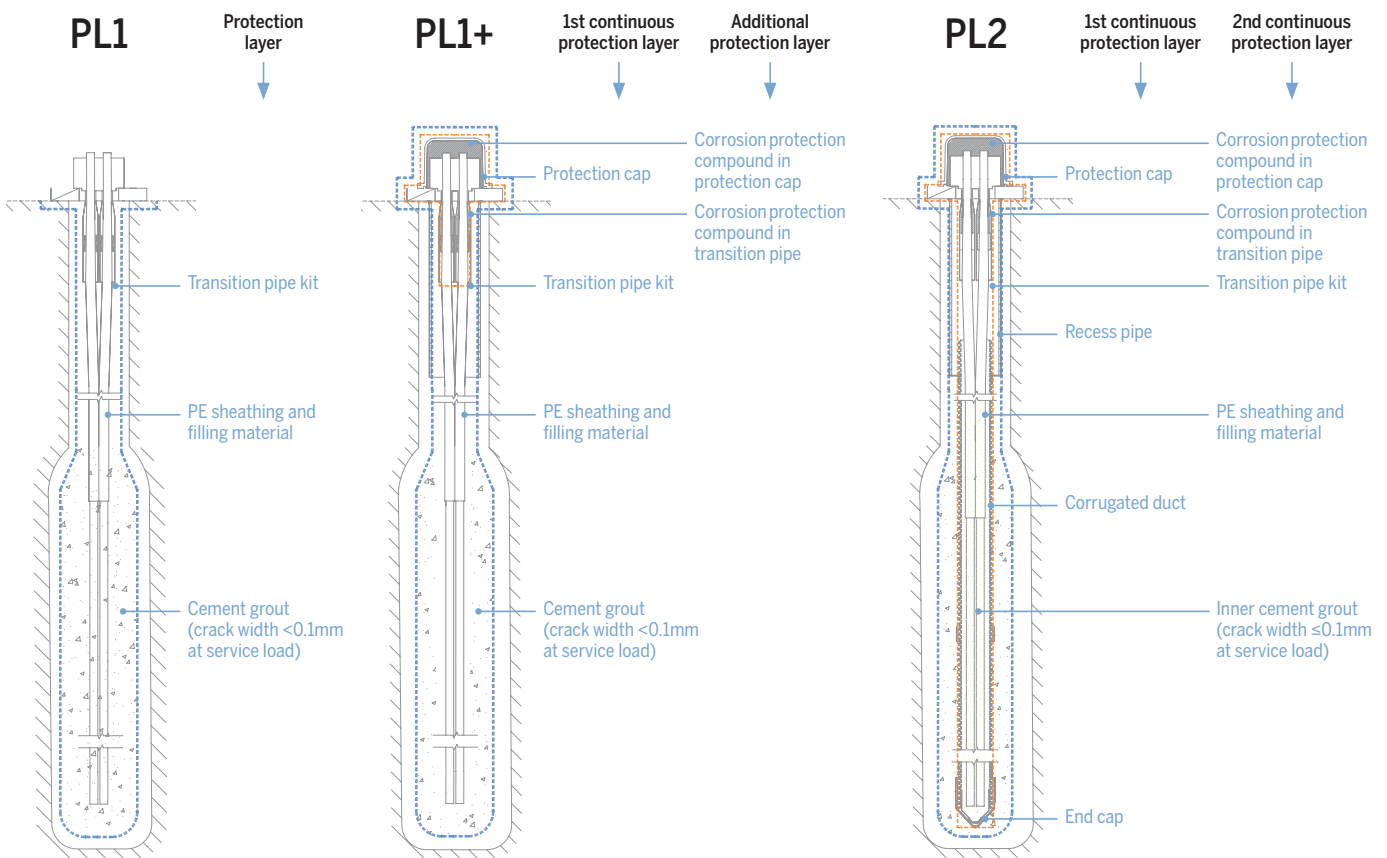
The BBR VT CONA CMG system takes corrosion protection to a whole new level and – alongside common, robust corrosion protection methods – it introduces a set of performance-enhancing measures which are totally new to the market. With these new corrosion protection features, the CONA CMG system has set a new global benchmark in the development of construction technology.

For many years, strict provisions have been in place on the corrosion protection performance of post-tensioning systems, though post-tensioning tendons are mainly installed in concrete, which itself provides a level of corrosion protection. Corrosion protection of a ground anchor is therefore even more crucial to achieving the desired performance since the strand ground anchors are typically installed in ground conditions which vary in terms of

density, porosity, water level and environmental aggressivity and can thus represent a significant threat to the ground anchors and indeed the structures they are designed to support. This is true, not only because of the long service life and aggressive geological conditions, but also because of the great difficulty and cost of direct monitoring of the ground anchor after it has been installed into the ground and become invisible.

BBR VT CONA CMG solution kits for different corrosion protection levels

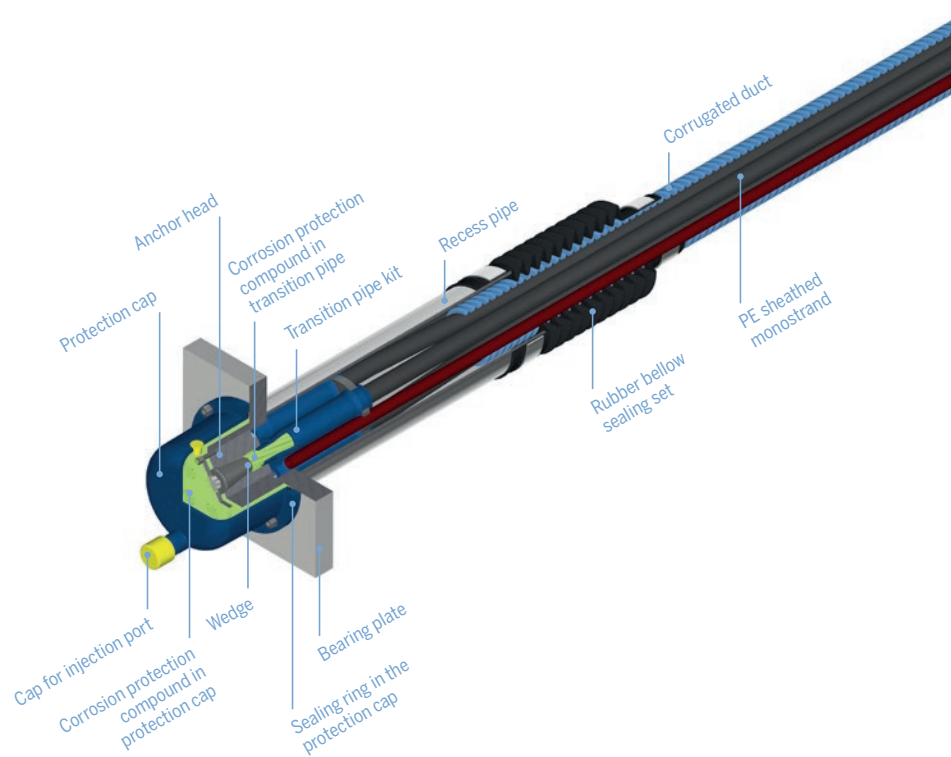
The BBR VT CONA CMG system provides three solution kits with different corrosion Protection Levels (PL), designed for applications with different service lives – up to 2 years, 2 to 7 years and over 7 years – as described in the adjacent table.



BBR VT CONA CMG – corrosion protection layers for the three different solution kits.

Transition zone sealing

The most recent research results revealed that the transition zone beneath the anchorage zone bears the highest risk of corrosion. The PE sheath of the free length of monostrand ends in this zone and thus the bare surface of the strands can be exposed. Unlike many unsecured filling solutions available on the market, the BBR VT CONA CMG system provides a fully sealed transition pipe kit for each individual monostrand. The transition pipe is sealed against water ingress up to 3.5 bars at the two ends, i.e. the upper joint connecting to the anchor head and the lower joint between the transition pipe and the PE sheath of the monostrand. The space within the transition pipe is filled with corrosion-inhibiting compound (optional for PL1). This solution minimizes the risk of full tendon failure as the bare strand protruding beyond the PE sheath is fully encapsulated by the transition pipe and flexible anti-corrosion compound. Should one strand somehow become exposed to corrosion, all the other strands are still fully protected and isolated from the corrosion source. While maximizing corrosion protection, this unique solution can also minimize workload as the transition pipe kit is pre-assembled in the factory. The seal between the recess pipe and corrugated duct (for the BBR VT CONA CMG PL2 system) is a unique feature of BBR's solutions set. As well as the proven water-resistance performance, the solution is specifically designed using a highly flexible sealing device to compensate for angular and/or axial displacement which could eventually occur on site. Currently, this is the only solution on the international market offering such an advantage.



Bare strand in the transition zone is fully encapsulated by a transition pipe and flexible anti-corrosion compound.

Monostrand in free length

For a ground anchor, the free length of the tensile element transfers tensile force from bond length to the anchorage. Lack of proper protection of the tensile element in the free length from alkaline cementitious grout exposes it to possible corrosion, such is very often the case in existing solutions. BBR considers monostrand for geotechnical applications (GT monostrand) to be an essential part of durable ground anchor solutions and thus undertook special care during testing of this element. The GT monostrand is a bare strand of which the free length area is covered by a flexible and durable PE sheath and the cavity between the strands and PE sheath is filled with anti-corrosion compound. The joint position between the free length and bond length is sealed to avoid water or cementitious grout ingress. The sealing solution at the joint is tested and approved up to 3.5 bars. All the desired performances of the monostrand have been comprehensively proven by

testing according to internationally recognized recommendations.

Proven bond length protection

The BBR VT CONA CMG system is the very first strand ground anchor system in which cementitious grout in the corrugated duct has been proven as a valid protection barrier against corrosion according to EN1537. This proof presents an outstanding advantage to the BBR VT CONA CMG PL2 system where the bare strand in the bond length is totally encapsulated by a double-layer barrier comprising the surrounding cementitious grout and a single layer of corrugated duct. This certified double-layer solution delivers a significant economic advantage when compared with other solutions on the market which typically feature two layers of corrugated ducting – requiring larger boreholes, bigger drilling equipment, more materials and other resources – to achieve the same international standard requirements for corrosion protection.

Application		Temporary	Temporary with extended use		Permanent	
Solution kit		PL1	PL1+		PL2	
Protection		1st layer	1st continuous layer	Additional layer	1st continuous layer	2nd continuous layer
Zone	Anchor head		Protection cap	Corrosion protection compound filling in protection cap	Protection cap	Corrosion protection compound filling in protection cap
	Transition zone	Sealed transition pipe	Sealed transition pipe	Corrosion protection compound filling in transition pipe	Recess pipe	Sealed transition pipe with corrosion protection compound
	Free length	Monostrand	Monostrand		Corrugated duct	Monostrand
	Bond length	Cement grout crack width <0.1mm at service load	Cement grout crack width <0.1mm at service load		Corrugated duct	Cement grout crack width <0.1mm at service load

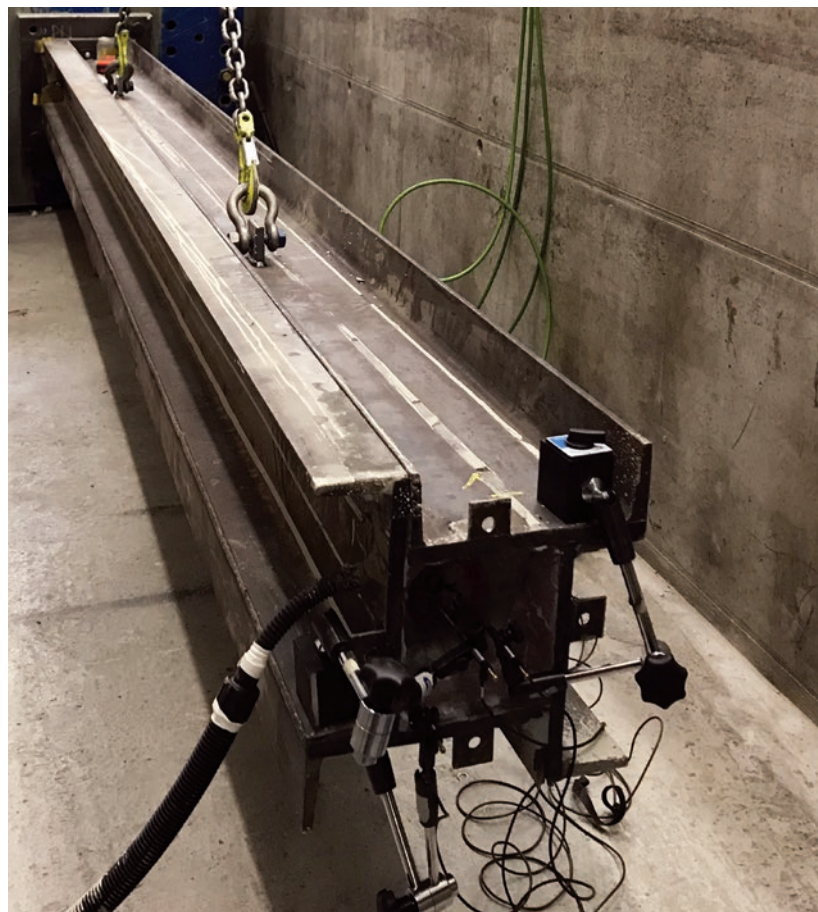
Testing & certification

Throughout BBR's long history, our focus has always been on the provision of the highest standards of construction technology. This is why we conduct independently verified laboratory testing to ensure performance and provide assurance to customers that each product has been engineered to the highest applicable standards. The BBR VT CONA CMG system has been tested for mechanical behavior and also for corrosion protection performance.

Testing provisions for mechanical and corrosion protection performance of the system

The mechanical performance of the BBR VT CONA CMG system has been assessed *, tested and proven as a member of the BBR VT CONA CMX system family range according to the latest European Assessment Document EAD 160004-00-0301 following all the testing provisions: Static, fatigue and load

transfer tests. Furthermore, the corrosion protection performance of the CONA CMG system has also been assessed and verified by carrying out small and large scale tests in independent and accredited European laboratories. The adjacent diagram summarizes the key performance issues and corresponding tests performed to prove the high corrosion protection features of the CONA CMG system.



Advanced corrosion protection test B – with crack width assessment method.

Major requirements according to EN 1537

Following EN1537 specifications, two types of corrosion protection test – “A” for unconfined conditions and “B” for confined conditions – have been carried out on different sizes to examine the corrosion protection performance of the BBR VT CONA CMG system under service load:

- **Corrosion protection Test A** – an assembled anchor is installed on a testing rig and the inner space of the duct is grouted. When the grout achieves the desired strength, the anchor is stressed in equal stages up to 80% of the ultimate characteristic force, then the corrugated duct and inner cement grout is examined at 65% of the ultimate characteristic force. No damage should be observed on the corrugated duct and any cracking of the cementitious grout is assessed.
- **Corrosion protection Test B** – an assembled anchor is installed into a sealed steel frame, cementitious grout is injected in the inner space and outer space. When the grout achieves the desired strength, the anchor is stressed in equal stages up to 80% of the ultimate characteristic force. After unloading, the steel frame is opened to expose the corrugated duct and the inner cementitious grout for assessment. No damage should be observed on the corrugated duct and any cracking of the cementitious grout is assessed.

* European Technical Assessment (ETA) in progress.

BBR innovation

The BBR R&D team went beyond the standard corrosion protection A & B tests by inventing a new 'advanced corrosion protection test B' which is able to identify all the cracks of the cementitious grout and measure their width under working load. As specified in EN1537, in order to consider the inner grout as a corrosion protection layer, the crack width of the cementitious grout under working load in corrosion protection test B must not exceed 0.1mm. However, accurate assessment of the crack width under service load due to tensile force has – until now – been an impossible task because, with this test, cracking could be only checked after unloading and dismantling of the testing setup which means the real crack width at service load cannot be measured directly. To address this challenge, the BBR R&D team developed an advanced corrosion protection test B to identify all the cracks and measure their width under a service load of 65% of the ultimate characteristic force. BBR's new test method was carried out on different sizes of CONA CMG strand ground anchors.

The test results proved that the BBR VT CONA CMG system fully complies with the requirements of a maximum of 0.1mm crack width of the inner cementitious grout and no damage being observed on the corrugated duct. Thanks to this advanced crack assessment method, together with the final testing results, the BBR VT CONA CMG system is supplied to the market as the first strand anchor system for which the cementitious grout has been proven and certified to be a corrosion protection barrier.

Corrosion protection tests

GT monostrand was subjected to a group of delicate tests targeted on evaluating each key property in regard to corrosion protection and mechanical performance of the monostrand, including:

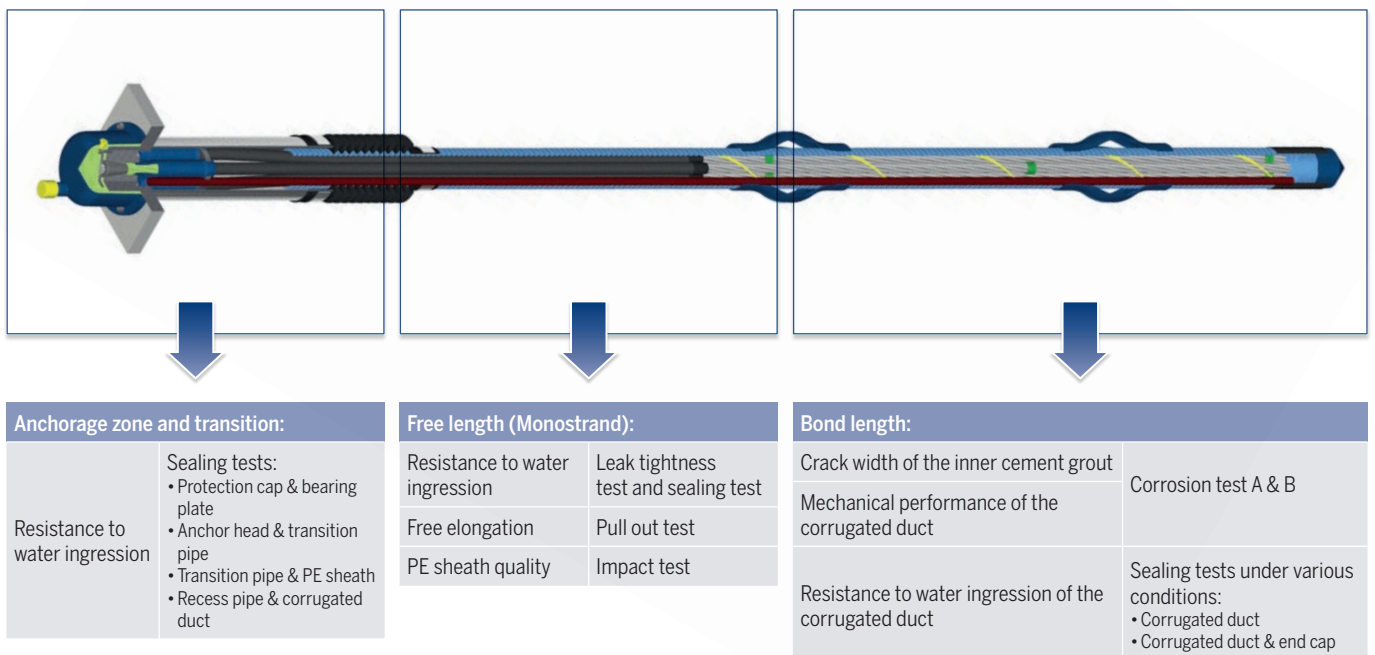
- leak tightness test to verify the effect of the filling of corrosion protection compound against water ingress
- sealing test in confined conditions at the joint between the sheathed section of free length and bare section of the bond length
- pull-out test to ensure that the behavior of the strand during stressing is not replaced by the friction of the flexible filler compound within the PE sheath.

Sealing test for joints & ducts

To ensure the continuity of the protection layers composed of different components, sealing tests were applied to the corrugated duct and the sealing joint component at each connection position:

- protection cap & anchor head
- anchor head & transition pipe
- transition pipe & PE sheath for monostrand
- recess pipe & corrugated duct
- corrugated duct & end cap.

All the sealing components for these joints have been proven to be capable of withstanding an inner and/or an external pressure pressure of at least 1.5 bar, and for some key joints at least 3.5 bar, without leakage or damage. Furthermore, in order to assess the impact of extreme climate or handling which may arise during storage and transportation, some components were subjected to a preconditioning process to simulate severe conditions before the sealing performance testing. Through this extensive and sophisticated testing campaign, the performance of each of the corrosion protection components and joints was carefully verified. The exceptional performance of the BBR VT CONA CMG system proves that it is truly the most durable and robust strand ground anchor system available on the international market.



Key performance issues and corresponding tests proving the BBR VT CONA CMG strand ground anchor system meets the required standards.



Innovative & proven solutions

The BBR VT CONA CMG system represents state-of-the-art geotechnical engineering, backed by European Assessment * and BBR's comprehensive quality control systems. Once again, BBR has pushed the boundaries of technology to introduce innovative and proven construction systems to the international market place.

With over 75 years of experience, BBR continues to apply its own special brand of innovation and quality to producing the finest solutions for its customers worldwide. The focus of our R&D team is always on delivering technology which as well as being technically advanced, also offers additional benefits in terms of on-site productivity, cost savings and promotes environmentally-friendly practices. Around the globe, BBR Network Members advise and deliver construction services to their local markets. Today, the BBR Network has many regular customers who have come to rely on us for:

- Robust and flexible solutions based on experience.
- Independently tested and certified technology.
- Stringent European Factory Production Control.
- Full traceability through BBR's unique E-Trace platform.
- Quality control inspections by BBR engineers.
- Installation by a well-trained, talented network of construction professionals.

We are always happy to discuss your specific project and advise on the most suitable approach. Do get in touch with your local BBR Network Member about your next project – and harness the latest construction engineering innovations for your customer.



* European Technical Assessment (ETA) in progress.

**The BBR Network –
international expertise &
technology delivered locally**





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