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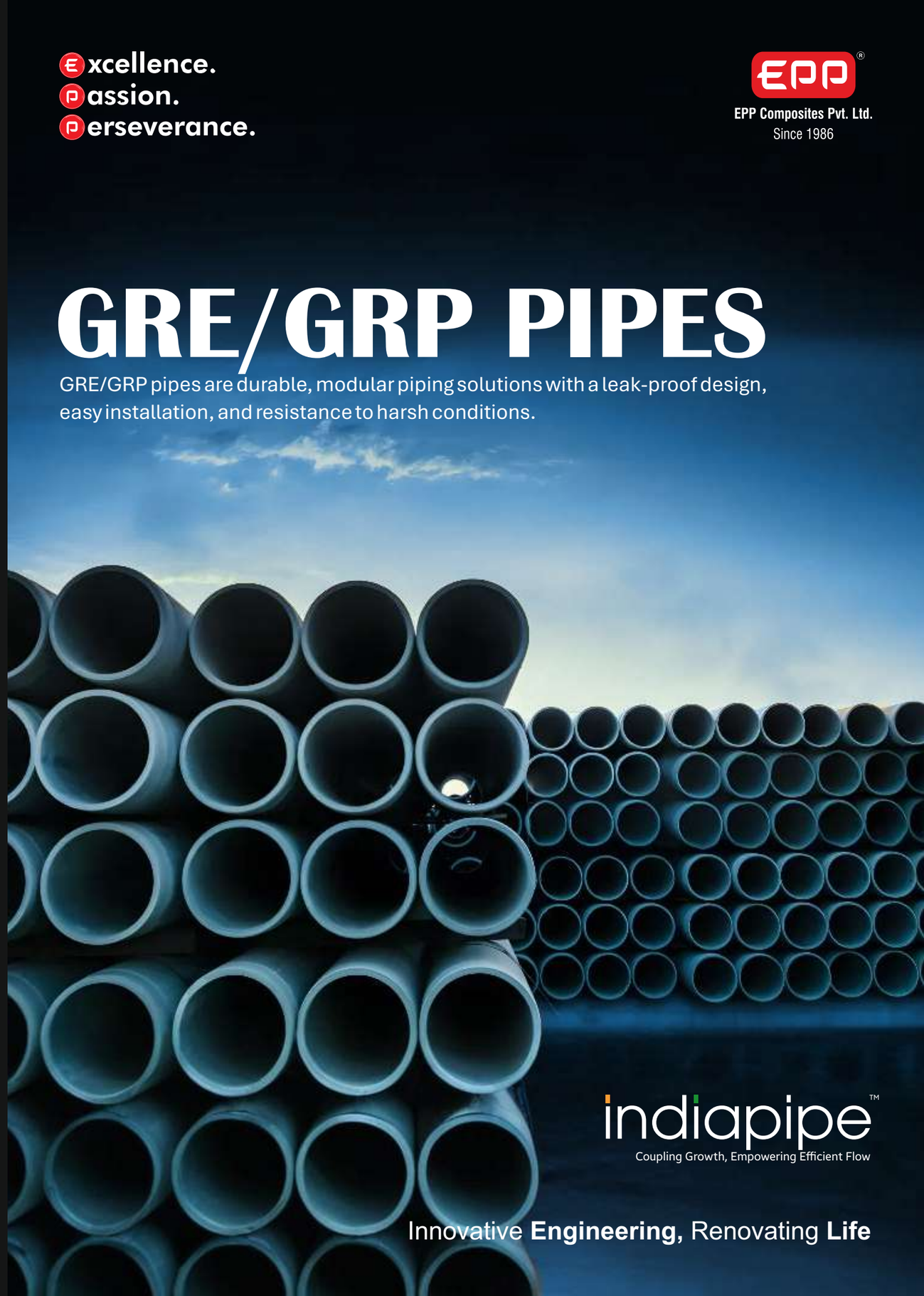
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Excellence.
Passion.
Perseverance.

EPP®
EPP Composites Pvt. Ltd.
Since 1986

GRE/GRP PIPES

GRE/GRP pipes are durable, modular piping solutions with a leak-proof design, easy installation, and resistance to harsh conditions.



indiapipe™
Coupling Growth, Empowering Efficient Flow

Innovative **Engineering,** Renovating **Life**

INTRODUCTION

Welcome

Welcome to EPP Composites

Since 1986, EPP Composites has been a global leader in Fiber-Reinforced Plastic (FRP/GRP) products, offering innovative turnkey solutions across diverse industries. Headquartered in Rajkot, Gujarat, with six strategically located manufacturing campuses spanning 1.25 million square feet, EPP serves over 5,500 customers in India, the Middle East, Asia Pacific, Europe, and the USA.

With a production capacity of 36,000 MT, EPP manufactures a wide range of high-quality FRP products, including GRP piping systems, chemical equipment, electrical enclosures, SMC water tanks, gratings, radomes, wind turbine components, and underground fuel tanks. EPP's robust infrastructure, cutting-edge technology, and adherence to global standards have earned it certifications such as ISO 9001:2015, ISO 14001:2015, ISO 45001:2018, API 15 LR, WRAS, and BIS. Recognized as a "Top Shop" by Composites World (2021, 2023, and 2024), EPP is also acclaimed for its innovation by the Confederation of Indian Industry.

Serving 15+ industries, including water infrastructure, oil & gas, renewable energy, and smart cities, EPP provides comprehensive solutions from design to operation. Exports to over 45 countries contribute 20% of its revenue, reflecting its global footprint. The company's Center of Excellence (CEC) drives R&D, operational excellence, and sustainability initiatives, fostering collaborations with top academic institutions to advance composite technology.

Committed to sustainability and aligned with India's Atmanirbhar Bharat, Viksit Bharat, and Make in India initiatives, EPP is redefining the composite industry. By combining decades of expertise with cutting-edge innovation, EPP aims to empower its customers and communities with superior, sustainable solutions while setting new benchmarks in excellence and leadership.

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Let’s value water as we should

With modern pipe materials and smart solutions

Our GRE/GRP pipes represent the pinnacle of modern engineering, offering unmatched durability, efficiency, and sustainability for water management and beyond. Designed with advanced composite materials, these pipes deliver exceptional resistance to corrosion, chemical exposure, and extreme environmental conditions, ensuring long-term performance in even the most demanding applications.

Thanks to their lightweight yet robust design, GRE/GRP pipes allow for easy handling, quick installation, and minimal maintenance, significantly reducing operational and lifecycle costs. Their seamless construction and superior leak-tightness enhance system reliability, while their ability to withstand high pressures and temperature fluctuations makes them a preferred choice for municipal, industrial, and infrastructure projects.

By choosing our cutting-edge piping solutions, you invest in high-performance, eco-friendly infrastructure that not only meets today's rigorous demands but also helps preserve valuable resources for future generations. EPP's commitment to innovation and sustainability ensures that our GRE/GRP pipes continue to drive progress in water management, energy, and industrial applications worldwide.

Climate change. Urbanization. Energy transition.

There’s many challenges we need to tackle. But to succeed, we must solve the water crisis.

As the world rapidly changes, climate change and urbanization are reshaping our landscapes and societies. While we recognize the impacts, these changes cannot be reversed overnight. Alongside efforts to limit future damage, we must also adapt to the economic, environmental, and social consequences that are already unfolding. The reality is clear: our current systems must evolve to meet the demands of a rapidly changing world.

Cities and municipalities are at the frontline of this adaptation. Facing challenges from extreme rainfall, increased populations, and the demand for more infrastructure and energy, they must develop resilient systems to manage water resources and energy efficiently. Urban areas must rethink how they design, build, and maintain their infrastructures to withstand the pressures of a changing climate and growing populations. Technological innovation will play a pivotal role in this transformation, offering the solutions that will help cities not just survive but thrive in this new era. From smart water management to sustainable energy systems, these advancements can empower cities to stay one step ahead.

As we move into an uncertain future, the need for forward-thinking, scalable, and sustainable infrastructure has never been more urgent. Cities are no longer just hubs of growth—they are the beacons of innovation, driving us toward a world where resilience and sustainability are not just ideals, but realities. The future demands collaboration, smart planning, and bold solutions—ensuring that cities continue to be places where people and nature coexist in harmony, now and for generations to come.

“ What cities need are solutions they can count on, innovations that stand the test of fast-changing times, pipeline technologies that safeguard the environment while serving the needs of future generations. ”

GRE/GRP - the perfect answer to the challenges of this century

One of the key benefits of GRE/GRP pipes is their small carbon footprint during production. Unlike traditional metal pipes, which require energy-intensive processes such as mining, smelting, and welding, GRE/GRP pipes are manufactured using environmentally friendly composite materials that significantly reduce emissions and energy consumption. Their lightweight nature not only simplifies transportation and handling but also facilitates rapid installation, reducing labor costs and construction time.

In operation, GRE/GRP pipes provide efficient fluid transportation with minimal pressure loss, thanks to their smooth internal surfaces that resist scaling and deposits. Their excellent leak-tightness and resistance to root infiltration ensure the longevity and integrity of pipelines, preventing costly water loss and structural failures. Additionally, their buckling resistance and ability to withstand harsh weather conditions make them a reliable choice for a wide range of applications, from municipal water supply and wastewater systems to industrial cooling, chemical processing, and offshore platforms.

The long service life of GRE/GRP pipes—often exceeding 50 years—further enhances their sustainability and cost-effectiveness. With minimal maintenance requirements and resistance to harsh environmental conditions, these pipes serve as a trouble-free, long-term investment that reduces the need for frequent repairs and replacements. Their durability also means lower lifecycle costs, making them a preferred choice for industries looking for economical and future-proof solutions.











EPP's two specialist pipe technologies—CFW (Continuous Filament Wound) and HFW (Helical Filament Wound) pipes—represent the culmination of over six decades of innovation, expertise, and continuous development in composite pipe manufacturing. Designed to meet the evolving demands of modern infrastructure and industrial applications, these advanced piping solutions outperform traditional materials such as concrete, iron, and steel, offering a superior alternative that excels in performance, longevity, and ease of use.

By leveraging decades of engineering excellence and technological advancements, EPP's CFW and HFW pipes stand as a testament to innovation, delivering a modern, high-performance alternative that not only matches traditional materials in strength but surpasses them in every other aspect—from corrosion resistance and ease of handling to sustainability and longevity.

GRE/GRP is our DNA

We are EPP

EPP specializes in designing and supplying world-class GRE/GRP pipes and fittings with a lifespan of several generations. Our mission is to address global water, sewer, and energy challenges through innovative and future-ready solutions.

With expertise in GRE/GRP system solutions, we provide high-performance, corrosion-resistant piping for wastewater, drinking water, hydropower, and industrial applications. Our pipes offer durability and minimal maintenance, making them an ideal choice for modern infrastructure needs.







39+
Years

Experience in GRE/GRP production and research

2000+
People

Employed Worldwide

45+
Countries

Where GRE and GRP products are used

We are where you are



With over 39 years of experience in GRE/GRP production and research, EPP has built a strong reputation as a leader in composite piping solutions, continuously innovating to meet future industry demands. Our commitment to quality and advancement is backed by an accredited GRE/GRP pipe testing laboratory in Rajkot, ensuring rigorous testing and cutting-edge R&D.

Headquartered in Rajkot, Gujarat, India, EPP operates state-of-the-art production facilities in the region, manufacturing high-performance, corrosion-resistant piping systems for diverse applications. With a global workforce of over 2,000 professionals, we are dedicated to delivering sustainable, efficient, and cost-effective solutions for the evolving needs of infrastructure and industry.





EPP's extensive network of sales and engineering offices enhances our global reach, ensuring that customers receive tailored, high-performance solutions wherever they are. Our team of experienced experts works closely with clients to deliver precisely engineered GRE and GRP products that meet the most demanding industry standards.

To date, our cutting-edge piping solutions are used in 45+ countries worldwide, playing a vital role in infrastructure, industrial, and energy projects. If laid end to end, our pipes would span the globe multiple times, highlighting our unparalleled expertise, reliability, and international impact in composite piping solutions.

Pipe Production

EPP plants are modern, efficient, and located strategically across Rajkot, India. Raw materials are delivered with vendor certification demonstrating their compliance with EPP quality requirements. In addition, all raw materials are sample tested prior to their use. These tests ensure that the pipe materials comply with the specifications as stated.

1. Helical Filament Winding (25mm to 4000mm Dia.)

GRE/GRP Pipes are manufactured by helical filament winding process where glass fibers are transported on the mandrel where a layer of resin is already laid from a moving resin bucket. Glass fibre is thus impregnated in resin and creates the matrix. This process is continued till desired thickness is achieved. The pipe is then cured and extracted from the mandrel mechanically by a hydraulic pipe extractor.



Pipe is then resized by cutting to the required length. On the next workstation pipe ends are machined to meet the joint configuration. We have multiple HFW lines.

2. Continuous Filament Winding (300mm to 3500mm Dia.)

EPP pipes with CFW technology are manufactured using a continuous advancing mandrel process. This process allows the use of continuous glassfiber reinforcements in the circumferential direction. For a pressure pipe or buried conduit the principle stress is in the circumferential direction, thus incorporating continuous reinforcements in this direction yields a higher performing product at lower cost. A very compressed laminate is created that maximizes the contribution from the three basic raw materials: Continuous glass fibre roving and choppable roving are incorporated for high hoop strength and axial reinforcement, and a sand fortifier provides increased stiffness by adding extra thickness. With the EPP dual resin delivery system, the equipment can apply a special inner resin liner for severely corrosive applications while using a standard type resin for the structural and outer portion of the laminate. Other materials such as a glass veil or a polyester veil can be used to enhance the abrasion, the chemical resistance, and the finishing of the pipe.

The filament winding manufacturing machine consists of a continuous steel band mandrel supported by beams in a cylindrical shape. As the beams turn, friction pulls the steel band around and a roller bearing allows the band to move longitudinally so that the entire mandrel moves continuously in a spiral path towards the exit assembly. As the mandrel rotates, all composite materials are continuously metered onto it in precise amounts with the help of electronic sensors. Firstly, mould release film, followed by various forms and patterns of glass fibres, embedded in a polyester resin matrix. The structural layers are made of glass and resin only, whereas the core layer includes pure silica. After the pipe has been formed on the mandrel, it is cured and later cut to the required length. The ends of the pipe section are calibrated to fit the coupling.





GRE/GRP Pipes











Advanced Technology

GRE/GRP pipes are manufactured through the state-of-the-art filament winding process. The product ranges for HFW from 25 mm to 4000 mm dia. pipes and for CFW from 300 mm to 3500 mm dia. pipes. Main raw materials used are superior quality glass fibre and polyester resin. Silica sand, surface mats, catalysts, additives and accelerators are other ingredients which are used in different proportions in manufacturing of the pipes. The glass roving is wound in the hoop direction to build strength around the circumferential direction while the chopped mats provide strength across the longitudinal direction. The structural layer consists of glass reinforced skins which sandwich the silica and glass - resin core to provide optimal bending stiffness. Polyester, Bisphenol, vinyl ester and epoxy resins are used as matrices depending on the pipe characteristics and the nature of the transported liquids.













World class quality & testing

Raw Material Quality

All raw materials are carefully selected based on vendor certification and compliance with our quality standards. These raw materials are then tested as samples prior to their use. These tests ensure that pipe materials comply with specifications as mentioned in the design.

Finished goods Quality

All finished goods are subjected to the following tests under the supervision of our quality experts:

- Visual Inspection
- Physical measurement of thickness, length, width and diameter
- Barcol Hardness
- Hydrostatic Leak tightness test (2 times the Nominal Pressure)
- Design as per standards

The following tests are conducted on sample basis:

- Composite structural analysis and design verification
- Pipe Stiffness
- Under deflection load following controls are checked structural failure and inner surface
- Hoop tensile strength
- Axial tensile strength

Long Term Performance

GRP pipes apart from their short term quality criteria also need to be checked for long term performance criteria. The most important factors affecting long term performance of our GRP pipes which are considered are as follows

- Hydrostatic Design Basis (HDB)
- Long term Specific Ring Stiffness
- Long term Bending Strain
- Long term Strain Corrosion

Other Qaulity Checks

The following criteria are also checked for all our pipes before doing the final certification

- Fire Resistance
- Ultra-Violet Resistance
- Abrasion Resistance
- Flow Velocity
- Chemical Resistance

Advantages

Why engineers choose EPP GRE/GRP pipes

Expected service life
GRE/GRP pipes have an expected service life of several generations.

Corrosion-free
GRE/GRP pipes need no coating or anti-corrosion treatment. The pipes are manufactured from inherently corrosion-resistant materials, thus outperforming steel, ductile iron, and steel-reinforced pipes that require corrosion protection.

UV resistant
GRE/GRP pipes are resistant to UV light.

Acid resistant
GRE/GRP pipes have an extraordinary resistance against acid and chemicals. The unique resistance of grp pipes is ensured by careful consideration of all raw materials, the pipe design and production process. GRE/GRP pipes resist the sulfuric acids that build up in sewers. They resist the actions of ground salts and salty waters. GRE/GRP pipes may also be used in other chemically demanding applications. Please see the table on chemical resistance in the Appendix for more details.

Lightweight design
GRE/GRP pipes are lighter than ductile iron, steel, concrete and most non-reinforced plastic pipes. This makes transportation less expensive, and less expensive installation equipment can be used. Their light weight enables the pipes to be easily transported and handled in remote and hardly accessible areas. GRE/GRP pipes can be nested, meaning that smaller pipes can be transported inside larger pipes, thus reducing the cost of transportation.



Environmental impact of EPP pipes

GRE/GRP pipes have a low carbon footprint compared to other pipe materials. This has been confirmed by external bodies and universities.

Comparison to other materials
An independent study conducted at the Norwegian University of Life Sciences in 2012 concludes that GRE/GRP pipes have a minimal negative environmental impact compared to other pipe materials. The main reason for this is the material efficiency.

Energy-efficient in operation
The smooth bore and good flow characteristics of GRE/GRP pipes reduce the amount of energy used for pumping. In penstocks, it increases the energy output.

Low energy consumption in production
The amount of energy used in the production of GRE/ GRP pipes is less than what is required for most other pipe materials.

Efficient transportation
Lightweight design combined with the fact that GRE/GRP pipes can be nested during transportation lead to lower carbon emissions from pipe transportation.

Recyclable
GRE/GRP pipes are recyclable. The Federation of Reinforced Plastics in Germany recommends that GRE/GRP pipes are used e.g. in cement production and best source of energy for thermal power plants.

A full, third-party-verified Lifecycle Assessment has been conducted on GRE/GRP pipes according to various standards. The information may be provided upon request by EPP.







Technical Data for EPP GRE/GRP Pipes

Main Materials	Resin, Glassfibers & Other Additives
Operating Temperature	-50 °C to +120 °C
Standard Length	From 3 m to 12 m
Diameter Range	PN 3, 6, 9, 12, 16, 20, 25 and 32
Stiffness Classes	2500, 5000 and 10000 N/m
Estimated Life	50 Years
Corrosion Protection	Not Required
Standards Followed - International Pipe Standards	AWWA M 45, ASTM D3262, ASTM D 3754, ASTM D3517, AWWA C950, IS12709, Is14402, DIN Standards & ISO Standards







Reference Standards

AWWA M-45:

Fiberglass Pipe Design Manual for Underground and Aboveground Installation

AWWA C 950:

Fiberglass Pressure Pipe

ASTM D 3262

Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting-Resin) Sewer Pipe. Applicable for pipes 200 mm through 3600 mm diameter, with or without siliceous sand, and polyester or epoxy resin.

ASTM D 3517

Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting-Resin) Pressure Pipe. Applicable for pipes 200mm through 3,600 mm diameter, with or without siliceous sand, and polyester or epoxy resin.

ASTM D 3754

Standard Specification for "Fiberglass", (Glass-Fiber Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe. Applicable for 200 mm through 3,600 mm diameter, with or without siliceous sand, and polyester or epoxy resin.

IS12709

GRP pipes joints and fittings for use in potable water supply

IS14402

GRP pipes joints and fittings for use in transportation of sewerage, industrial waste and water (other than potable)

Installation

A pipeline is an engineered structure where the interaction between the pipes, joints, supports, embedment, backfill, and cover form the basis for its ultimate stability and reliability. The pipe stiffness and soil consistency together determine system performance, a significant factor in buried installations. It is therefore the quality of the materials used and execution that are the most important criteria for the integrity of the finished pipeline structure.

Underground Installation

Pipe Trench

When selecting the pipe route, ensure that the line is as straight as possible because any changes in direction can have an adverse effects on hydraulic friction loss. Avoid counter slopes. If there are any, ports must be provided for venting at all the highest elevations and draining at the lowest elevations in the pipeline.

When designing and excavating pipe trenches and pits, we recommend complying with EN 1610. In addition, the requirements of ISO/TS 10465-1 can also be taken into consideration. It is generally the designer's responsibility to meet specifications and follow local guidelines. Conditions on site should also be observed. It is important is to select the trench width allowing at least the required compaction to be achieved with suitable machinery and installation to be carried out safely and correctly (Table 1).

Excavated material that cannot be used for embedment in the trench must be separated from suitable backfilling material. If you have any questions about minimum or maximum depth of cover and special installation conditions, EPP will be happy to advise you. EPP can also provide structural calculations acc. to ATV-DVWK-A 127 if required.

Minimum trench width (D_e + x)				Trench depth	
Diameter (mm)	Lined trench (m)	Unlined trench		Trench depth (m)	Minimum trench width (m)
		β > 60 °	β ≤ 60 °		
≤ 200	D_e + 0.40	D_e + 0.40		≤ 1.00	not specified
> 200 to ≤ 350	D_e + 0.50	D_e + 0.50	D_e + 0.40	> 1.00 to ≤ 1,75	0.80
> 350 to ≤ 700	D_e + 0.70	D_e + 0.70	D_e + 0.40	> 1.75 to ≤ 4.00	0.90
> 700 to ≤ 1200	D_e + 0.85	D_e + 0.85	D_e + 0.40	> 4.00	1.00
> 1200	D_e + 1.00	D_e + 1.00	D_e + 0.40		

Table : 1 Minimum trench width

Multiple pipelines

If planning multiple pipelines, also proceed as described in Section underground installation and base calculations for the distance between them on the pipe with the largest diameter. It is important to always have enough space for proper compaction between the pipelines. The minimum spacing (x) between the pipelines should be 15 cm. If you need to walk along the trench during the installation, leave at least 50 cm between the pipes for bedding work (Figure 1). Proceed in a similar way for stepped trenches, as the lower trench area is usually backfilled first.

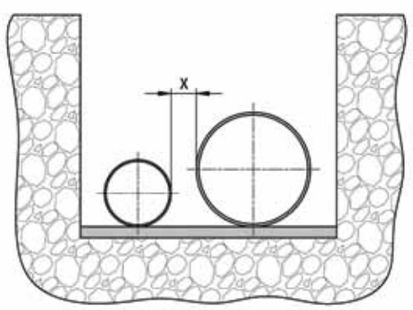


Fig. 1: Minimum spacing (x) between pipelines

Installation with steep gradients

Where pipe routes have steep gradients, e.g. on slopes or mountains, you need to prevent the pipeline from sliding down and the bedding material from being washed out. In most cases this can be achieved with concrete slabs, which stop both the bedding layer from being washed away and the pipeline from being undercut. The planer has to design the concrete slabs accordingly to secure the pipeline in the longitudinal direction.

Keep the trench dry while laying the pipes. Also ensure that surface water drains away from the trench. For steep gradient pipelines, suitable means of compacting the bedding material must be available to ensure a proper installation.

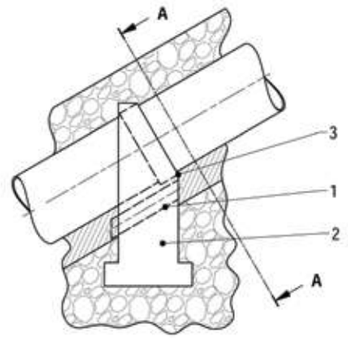


Fig. 2: Sideview of a support in steep terrain

1 Drainage pipe
2 Concrete support
3 Concrete support has to be flush with the coupling

Laying pipes in groundwater

To guarantee a safe structure in the long term, the soil and groundwater conditions must be examined. Installation in groundwater requires special consideration. Where pipelines lie in groundwater, check that flotation is prevented and take appropriate action if necessary.

Take appropriate steps to ensure that the trench stability meets the project specifications and complies with safety requirements, e.g. with sheeting. It is important for shoring system installation and removal to be taken into account in the structural calculations. When removing the sheeting or shoring, the pipeline must not be damaged or its location changed.

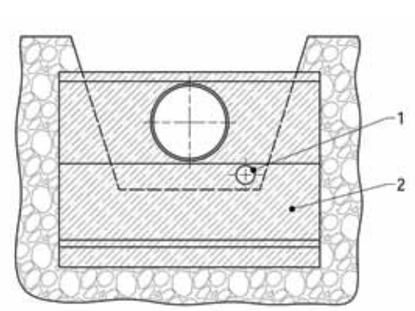


Fig. 3: Front view (section A-A) of a support in steep terrain

Soil Types

Both the native soil and the bedding material have to be of adequate load-bearing capacity. Do not use any frozen soil in the pipeline zone or backfill on top of frozen bedding. EPP Pipes are also ideal for many difficult soil conditions because of their outstanding properties. Given their low weight, they are particularly suitable for soils susceptible to subsidence. It may still prove necessary to take special action with soils prone to settling or of inadequate load-bearing capacity in order to prevent the pipe from sinking. There is a risk of subsidence in particular in peaty or clayey soils, etc. We recommend the exchange of soil or using geotextiles, gravel beds, duckboards, etc. It depends on the designer's foundation recommendations based on the soil investigation report.

Modulus of deformation ES (N/mm²) and degree of compaction D_{pr} (%)						
Soil types (to ATV 127)	D_{Pr} = 85	90	92	95	97	100
Group 1: Non cohesive soils (e.g. gravel)	2	6	9	16	23	40
Group 2: Slightly cohesive soils (e.g. sand)	1.2	3	4	8	11	20
Group 3: Cohesive mixed soils (sand/clay mixtures)	0.8	2	3	5	8	14
Group 4: Cohesive soils (e.g. clay)	0.6	1.5	2	4	6	10

Table 2: Modulus of deformation and degree of compaction

Trench Bottom and Pipe Bedding

Load-bearing pipe bedding is an important requirement for a long-lasting pipeline that functions properly. Prepare the trench bottom for the specified gradient and depth of installation. Avoid any loosening of the soil in the area of the bottom here (Table 3).

If it has however become loosened, place suitable bedding material in the trench bottom to equalize load distribution, and tamp it evenly to the original density or the minimum compaction indicated in the structural calculations. When the native soil consists of clay or silt, it sometimes proves necessary to lay a drain for dewatering and ensure the pipe bedding is dimensioned as described below. First place the pipe bedding on the excavated trench bottom. When compacted, it must be of at least the following thickness:

Bedding: 0.1 x DN or at least 15 cm (Figure 4). If the soil is soft or not load bearing, replace another 15 cm with soils of groups 1 or 2.

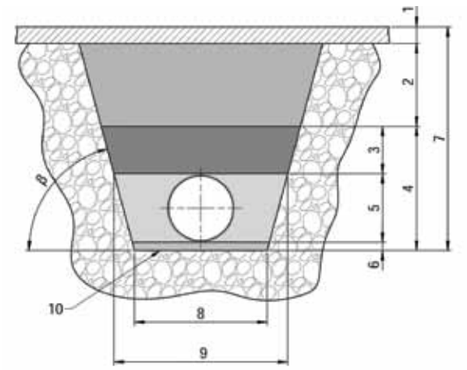


Fig. 4: Pipe trench to ATV-DVWK-A 127

1 Surface	6 Bedding
2 Final backfill	7 Trench depth
3 Cover	8 Trench width at bottom
4 Pipeline zone	9 Trench width at pipe crown
5 Initial backfill	10 Trench bottom α Trench wall angle

To ensure that the pipe barrels lie smoothly and evenly on the bedding, leave suitable bell holes in the area of the coupling (about 2–3 times the coupling width). When making the hollows for the couplings in the pipe bed, ensure there is room for joining the pipes and checking them, and no pressure peaks due to bad bedding can act (Figure 6).

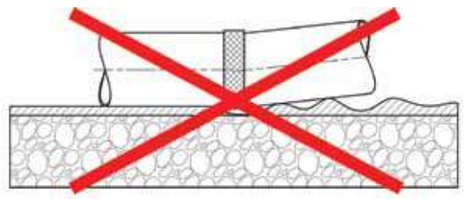


Fig. 5: Improper pipe bedding

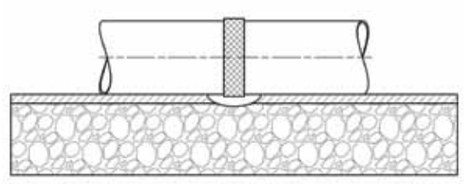


Fig. 6: Pipe laying with bell hole

Placing in the Pipe Trench

Before lowering the pipe into the trench, again inspect all parts to be installed for damage. Depending on the weight and local conditions, the installation parts, especially the pipes, can be placed by hand. If used, lifting or suspension gear should not pose any risks of damaging the material. Hooks, chains, wire rope, and other sharp-edged equipment that could slip and cause impact or shock should be avoided at all costs. It is therefore advisable to use at least two textile slings per 6 meter pipe. Pay particular attention to preventing the pipe from slipping in the slings (ensuring health and safety at work)

Embedding in the Pipeline Zone

Embed the pipeline immediately after lowering the pipes into the trench and joining them. A good quality of embedding in the area of the pipe zone is essential to provide support and primarily determines the pipeline's load-bearing capacity. Incorrect embedment can cause excessive pipe deflection.

The initial backfill therefore has to be compacted properly using suitable machinery (e.g. hand tamper or small pneumatic compactor). When using compacting machines, ensure that the pipes are not damaged during the process. Proceed with due care, especially if pipes of smaller diameters have thin walls. Place the bedding material on both sides of the pipeline from a diameter of DN 400 up to a depth of max. 30 cm above the crown in layers of 30 cm maximum and then compact them. If the diameters are smaller, adjust the layer depth accordingly to 100 to 200 mm.

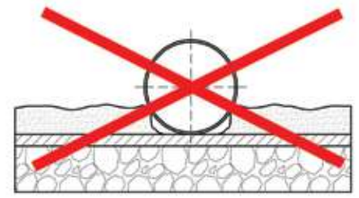


Fig. 7: Inadequate backfilling at the haunches

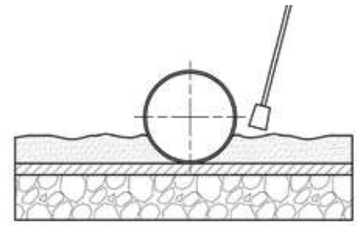


Fig. 8: Proper backfilling at the haunches

Pay particular attention to compacting the backfill under the pipe haunches (Figure 8). Compact the material less above the crown area if necessary to prevent pipe deflection (horizontal ellipse). The degree of compaction at the side of the pipes inside the pipeline zone should be at least Dpr = 90 % or as determined by structural calculations. The initial deflection must be checked.

When the backfill has reached the pipe crown, vertical ovalization should not exceed 1.5 % of the pipe diameter (vertical ellipse). Horizontal deflection (horizontal ellipse) should be avoided where possible.

If necessary, backfilling and compacting should therefore be carried out on both sides at the same time or the pipeline weighed down in sections with bedding material. In the area of the embedment zone, compact manually or use light vibrating tampers (max. impact force 0.3 kN) or light plate compactors (max. impact force 1 kN) with appropriate compaction depth.

To achieve the necessary compaction, keep the pipe trench free of water. Compaction work during installation must not cause the direction or height of the pipeline to be altered. Pay particular attention to this where the pipes are light. Dewatering serves to create the required conditions for ensuring installation complies with regulations. When it rains, steps also have to be taken to prevent fines from being washed out. Work involved in installing and removing dewatering systems must be carried out in such a way that the stability of the environment and pipeline is not adversely affected. Structural analysis is required accordingly for any special work. Only use G1 or G2 soils to ATV-DVWK-A 127 capable of being compacted for embedment, apart from where exceptions apply. If the soil is saturated with groundwater or water bearing, material without fines must be used for embedding and backfilling. Use material of the following grain sizes that is capable of being properly compacted (Table 3).

Requirements for bedding material	
Soil group:	G1, G2
Grain size:	≤ 16 mm for pipes ≤ DN 400
	≤ 32 mm for pipes > DN 400

Table 3: Requirements for bedding material

Take appropriate action to prevent bedding material from migrating into or mixing with the native soil, e.g. use geotextile separation fabrics. Ensure that the density of the soil in the pipeline zone required in the structural calculations is achieved with appropriate compaction. Make absolutely sure that the compaction in the embedment zone is at least of the same level as that of the pipe cover. If you work with sheeting or shoring, remove it in layers and compact the bedding material against the trench wall layer by layer. This prevents higher loads on the pipe or it from being displaced. In every case the type of trench lining and removal selected must conform to the structural calculations.

Final Backfilling of the Pipe Trench

After the embedment zone comes the cover. In addition to EN 1610, we also recommend following the DWA A 139 code and taking the national rules and regulations into consideration for backfilling. Fill the trench and cover the pipe in layers of such depths that on one hand the pipeline's stability is not at risk and on the other the soil can be adequately compacted. From 0.3 to 1.0 m crown cover (Zone B in Figure 9) you can compact the soil with medium vibrating tampers (max. impact force 0.6 kN) or plate compactors (max. impact force 5 kN). Medium and heavy vibrating rammers and compactors may only be used from a cover of 1 m (Zone A in Figure 18). Compacting the soil above the pipeline by dropping heavy weights or pressing it with excavator buckets is not permissible. Comply with the specifications in DWA A 139 (Table 4) or national regulations.

The maximum deflection after final backfilling of the pipe trench must also meet the designer's specifications. We recommended using the ATV-DVWK-A 127 standard for structural analysis. According to ATV-DVWK-A 127, the permissible long-term vertical deflection must not exceed 6 %. Special loads occurring during installation from heavy machinery or construction vehicles, which do not reflect the structural conditions when pipeline installation is complete, must be verified with separate structural calculations. Additional effects such as vacuum must also be taken into account.

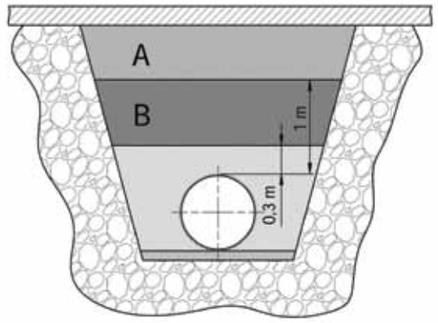


Fig. 9: Zones for using compaction equipment

A Use of medium and heavy vibrating rammers and compactors (max. 80 kN)

B Use of vibrating tampers
(max. impact force 0.6 kN) or plate compactors (max. impact force 5 kN)



Type of machine		Service weight (kg)	Compactibility classes								
			V1*			V2*			V3*		
			Suitability	Fill depth (cm)	Number of transitions	Suitability	Fill depth (cm)	Number of transitions	Suitability	Fill depth (cm)	Number of transitions
1. Compacting machines (primarily for pipeline zone)											
Vibrating tamper	light	to 30	+	to 20	2-4	+	to 20	2-4	-	-	-
	medium	30-60	o	20-40	2-4	o	20-30	3-4	-	-	-
	heavy	60-100	o	30-50	2-4	o	20-40	3-4	-	-	-
Rammer	medium	to 100	o	20-40	3-4	o	20-40	3-4	-	-	-
Plate compactor	light	to 100	+	bis 20	3-5	+	bis 15	4-6	-	-	-
	medium	100-300	o	20-30	3-5	o	15-25	4-6	-	-	-
2. Compacting machines (above the pipeline zone from 1 m cover depth)											
Vibrating tamper	medium	30-60	+	20-40	2-4	+	20-30	2-4	o	10-30	2-4
	heavy	60-100	+	30-50	2-4	+	20-40	2-4	o	20-30	2-4
Rammer	medium	to 100	o	20-40	3-4	o	20-40	3-4	o	20-30	3-5
Plate compactor	medium	100-300	+	20-40	3-5	o	20-40	3-5	-	-	-
	heavy	300-750	+	30-60	3-5	o	30-50	3-5	-	-	-
Vibrating roller	heavy	600-8000	+	30-80	4-6	+	30-60	4-6	o	30-60	4-6

Table 4: Soil compaction, fill depths, and number of transitions to DWA A 139

+ Recommended
o Generally suitable, check in each individual case
- Unsuitable
* V1 Non cohesive to slightly cohesive, coarse and mixed grain soils (GW, GI, GE, SW, SI, SE, GU, GT, SU, ST)
V2 Cohesive, mixed grain soils (GU, GT, SU, ST)
V3 Cohesive, fine grain soils (UL, UM, TL, TM)

Laying in Liquid Soil

Pipe laying in liquid soil requires thorough preparation. Note inparticular:

- Planning requirements
- Structural analysis
- Selection of the liquid soil or the recipe to achieve the required properties
- Selection of the shoring technology
- Any existing lines, cables, etc. crossing the route
- Groundwater table
- Securing the pipeline's location, in particular to prevent flotation
- Quality assurance plan for the entire installation process

In particular, determine the correct stiffness class at the design stage. Depending on the installation technology to be used, pipes deviating from the standard length may prove necessary. When preventing pipeline flotation, ensure that it does not lead to any deflection, displacement, or damage. Sheeting or shoring must be installed in such a way that the liquid soil fills all the cavities and the structural analysis conditions are met. Given the wide range of conditions and factors involved, we recommend consulting an experienced designer at the preliminary planning stage. EPP works together with experienced experts and is happy to help.

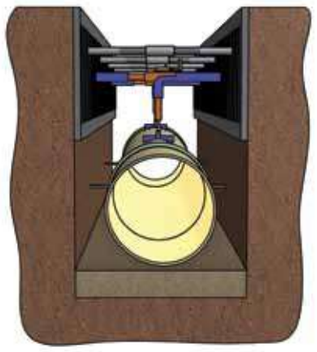


Fig. 10: Possible flotation restraints for installation in liquid soils, front view



Fig. 11: Possible flotation restraints for installation in liquid soils, top view

Above-Ground Installation

This section describes the above-ground installation of pipelines with EPP Standard Couplings.

Support spacing

If a standard pipe with a length of 6 m is used, the supports may be located at 3 m or 6 m intervals depending on the diameter (Figure 12, Figure 13, Figure 14). When determining the support spacing and design, you also have to take external effects, such as wind, snow or other loads into consideration.

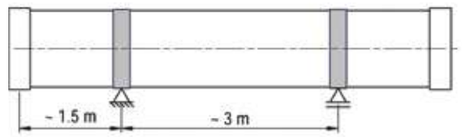


Fig. 12: Support spacing for gravity pipelines, DN 150–3600

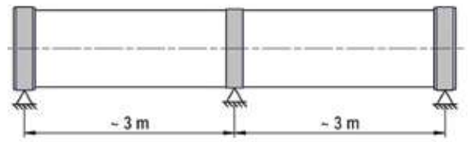


Fig. 13: Support spacing for pressure and gravity pipelines, DN 150–500

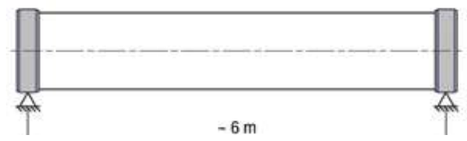


Fig. 14: Support spacing for pressure and gravity pipelines, DN 600–3600

To ensure that temperature-related expansions in every pipe can be compensated in the next coupling, secure every second support in place with a tightly done up clamp. This only applies if all the supports are attached to the pipe. If the supports rest on the coupling itself, tighten all the clamps securely.

Support design

When designing the supports and other means of restraining the pipes, take the longitudinal and lateral forces acting on the pipeline into account. This applies in particular to pressure pipes and pipelines subject to more extreme differences in temperatures. It is the designer's and customer's responsibility to ensure that the supports comply with the project specifications. Local load points should be prevented and the supports therefore designed accordingly. The supports must be designed to withstand loads that are caused by:

- The weight of the pipe and medium
- External loads (wind, snow, etc.)
- Shear forces caused by internal pressure (in pressure pipes)
- Forces caused by friction on the supports due to temperature and/or pressure fluctuations

Friction forces in the supports are the result of contraction and expansion of the pipe during operation (internal pressure, temperature) and friction resistance in the joint with a rubber support. Different support systems are possible, e.g. for suspended pipelines (bridge drainage, etc.).

The width of the support should be 200 mm and the support angle at least 120°. Elastic bedding approximately 5 mm thick (shore hardness: 45–50, made of EPDM, no PVC plasticizer) is required between the pipe and support material to prevent point loading.

The pipe clamp should be rounded on the inside edges and its inside diameter plus rubber support about 0.5 % larger than the outside diameter of the pipe or coupling.

Support types

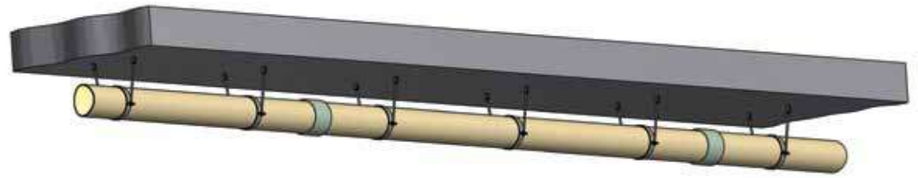


Fig. 15: Suspended support, e.g. bridge drainage

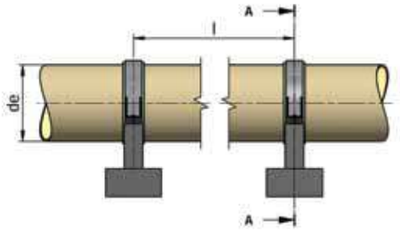


Fig. 16: Above-ground support at the coupling

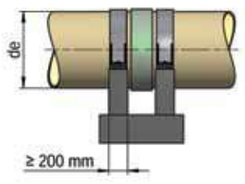


Fig. 17: Above-ground support at the pipe

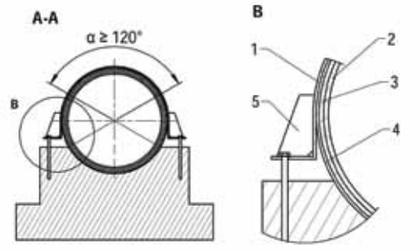


Fig. 18: Above-ground support at the coupling, cross-section

1 Support
2 Pipe
3 Coupling
4 Rubber belts
5 Clamp α Supporting angle de Outside diameter

Temperature effects

The prevailing temperature conditions can vary considerably between above-ground and buried pipelines. If a pipeline is empty, e.g. during installation, there is a greater tendency for it to heat up, above all when exposed to sunlight. A medium flowing in it however normally compensates for changes in temperature. When calculating the change in length due to temperature fluctuations, use a thermal expansion coefficient α of approx. 30 x 10^{-6} 1/°K in the longitudinal direction.

$$s = (T_{max} - T_{inst}) * l * 30 * 10^{-6}$$

Temperature difference in medium or environment (K)	Temperature expansion in 6 m pipes (mm)
20	3.6
30	5.4
40	1.2
50	9.0
60	10.8

Table 5: Changes in length of 6 m pipes as a function of temperature difference



EPP Standard Couplings generally absorb any changes in length due to temperature differences, with the result that in such cases there is no need for special expansion joints. For applications with higher medium temperatures, contact EPP. EPP Pipes can be used with medium temperatures of up to 80°C.

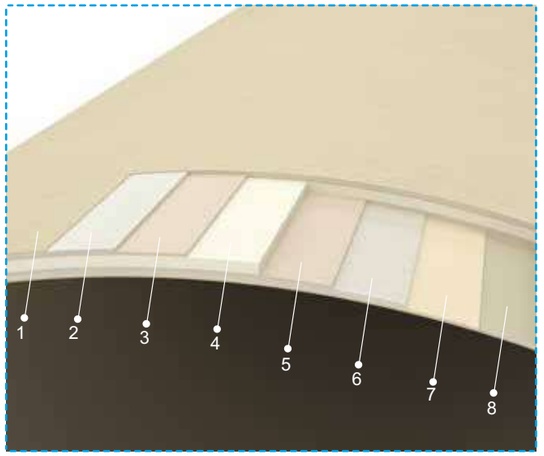
Environmental effects on the outside of the pipe (UV light, weather)

The outer layer of the pipes protects the structural layers below from environmental impacts, such as ultraviolet radiation and the weather. This is achieved with a particularly compact layer of sand matrix composite. In regions subject to higher ultraviolet light exposure, the outer layer can also be adapted to be even more resistant to ultraviolet radiation.

EPP Circular Pipes

GRE/GRP pipes with EPP technology

GRE/GRP pipes with EPP technology are produced by centrifugal casting in a 100 % computer-controlled process. The manufacturing machine's arm feeds all raw materials – chopped glass fibers, thermosetting plastics (unsaturated polyester or vinylester resins), and reinforcing agents – into a fast-rotating mold. Layer by layer, the pipe wall is built up from the outside inwards in a predefined process. The centrifugal casting process ensures that the pipes are circular, the wall thickness is uniform over the entire length at exact outer diameter, and the material displays a high longitudinal compressive strength.



Wall structure of centrifugally cast GRE/GRP pipe (EPP technology)

1 External protective layer
2 Outer structural layer
3 Transition layer
4 Core layer
5 Transition layer
6 Inner structural layer
7 Barrier layer
8 Inner liner layer

Technical data GRE/GRP pipes with EPP technology

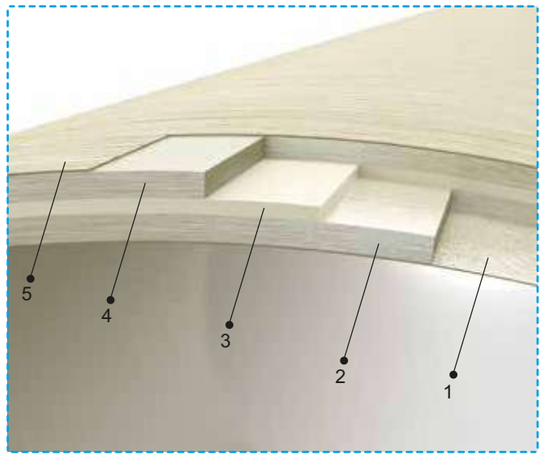
Main Materials	Resin, Glassfibers, Sand
Operating Temperature	-50 °C to +120 °C *
Standard Lengths	6 and 3 m. Other Lengths on Request
Pressure Range	PN 1 – PN 24
Expected Service Life	Many Generations
Corrosion Protection	None Needed
Hydraulic Roughness	k = 0.01-0.016 mm (Colebrook-White)
Water Jetting Resistance	Tested According to DIN 19523

* Higher temperatures may be considered for individual projects.

GRP pipes with EPP technology

Filament wound pipes are built as a structural sandwich, using the continuous filament winding technology. The high-strength continuous glass fibers resist the hoop stresses from internal pressure, while the chopped fibers provide excellent resistance to axial stresses, impact, and handling loads.

The structural laminate consists of heavily reinforced skins, separated by a compact, reinforced silica-filled core to provide optimal bending stiffness. Together with the protective layers, this construction provides capacity to resist high internal pressures and maintains excellent long-term stiffness.



1 Inner liner layer
2 Inner structural layer
3 Core layer
4 Outer structural layer
5 Exterior surface

Wall structure of filament wound GRP pipe (EPP technology)

Technical data GRP pipes with EPP technology

Main Materials	Resin, Glassfibers, Sand
Operating Temperature	-50 °C to +120 °C *
Standard Lengths	12, 6 and 3 m. Other Lengths on Request
Pressure Range	PN 1 – PN 32
Expected Service Life	Many Generations
Corrosion Protection	None Needed
Hydraulic Roughness	k = 0.029 mm (Colebrook-White)
Water Jetting Resistance	Tested According to DIN 19523

* Higher temperatures may be considered for individual projects.

Pressure pipes

GRP pressure pipe

GRP pipe with main reinforcement in the hoop direction. Used in applications without pressure end thrust, for example penstocks, pressure mains, water supply, and cooling water.

Diameter range (DN)	300-4000 mm
Pressure (PN)	up to 32 bar
Nominal lengths	12, 6, 3 m
Stiffness (SN)	5000 & 10 000 N/m²



GRP Grey

Extra impact resistant, uniaxial pressure pipe with main reinforcement in the hoop direction. Used for example in hydro-power, irrigation, water supply, and cooling water applications. Allows for backfill particle size up to 64 mm (sieve size).

Diameter range (DN)	300-4000 mm
Pressure (PN)	up to 32 bar
Nominal lengths	12, 6, 3 m
Stiffness (SN)	5000 & 10 000 N/m²



GRP biaxial pipe

GRP pipe reinforced in the hoop and axial directions to resist pressure end thrust and bending loads. Common uses: cooling water, desalination, and other industrial above ground applications.

Diameter range (DN)	200-4000 mm
Pressure (PN)	up to 20 bar
Nominal lengths	12, 6, 3 m
Stiffness (SN)	5000 & 10 000 N/m²



GRP Orange

Extremely wear-resistant uniaxial pressure pipe that is designed e.g. for mining slurry pipelines. Can also be used in other applications with extreme wear exposure and high flow velocities.

Diameter range (DN)	300-3000 mm
Pressure (PN)	up to 32 bar
Nominal lengths	12, 6, 3 m
Stiffness (SN)	5000 & 10 000 N/m²



GRP pressure pipe

Centrifugally cast Hobas pipe, typically used for penstocks, irrigation, water mains and other pressure applications.

Diameter range (DN)	200-2555 mm
Pressure (PN)	up to 24 bar
Nominal lengths	6 & 3 m
Stiffness (SN)	5000 & 10 000 N/m²



Custom lengths, diameters, pressure and stiffness classes are available on request.

Non-pressure pipes

EPP sewer pipe

Centrifugally cast EPP pipe designed for exceptional acid resistance. Typically used for sewer, drainage, and storm water applications. Water jetting resistant according to DIN 19523.

Diameter range (DN)	300-3500 mm
Pressure (PN)	1 bar
Nominal lengths	12, 6, 3 m
Stiffness (SN)	10,000 N/m^2



EPP PU Line

EPP pipe designed for exceptional wear resistance and low head loss. Typically used for sewer, drainage, and storm water applications. Water jetting resistant according to DIN 19523.

Diameter range (DN)	1200-3600 mm
Pressure (PN)	1 bar
Nominal lengths	6 & 3 m
Stiffness (SN)	10,000 N/m^2



Custom lengths, diameters, pressure and stiffness classes are available on request.

Jacking pipes

EPP jacking pipes

EPP pipe designed to withstand high jacking forces. Typically used for jacking under structures like roads and railways. Water jetting resistant according to DIN 19523.

Diameter range (OD)	272-3600 mm
Pressure (PN)	up to 16 bar
Nominal lengths	1, 1.5, 2, 3, 6 m
Stiffness (SN)	32,000 up to 10,00,000 N/m^2





Joints and Couplings

Pressure and non-pressure couplings

Filament wound coupling (FWC)

Used in pressure and non-pressure pipelines.

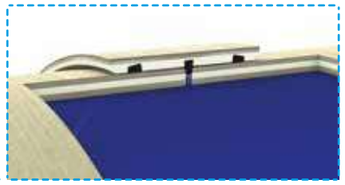
Diameter range (DN)	200-2555 mm
Pressure (PN)	up to 24 bar
Angular deflection*	up to 3°



Pressure coupling (PC)

Commonly used for penstocks, water supply, irrigation and pressure sewer applications.

Diameter range (DN)	200-4000 mm
Pressure (PN)	up to 32 bar
Angular deflection*	up to 3°



Pressure coupling angled (PCA)

Coupling for increased angular deflections up to 3°.

Diameter range (DN)	600-2500 mm
Pressure (PN)	up to 16 bar
Angular deflection*	3°



Lock joint (LJ)

Biaxial joint used for applications where transfer of load between pipes is required.

Diameter range (DN)	200-2000 mm
Pressure (PN)	6-16 bar
Angular deflection*	Not applicable



Non-pressure coupling (SC)

Commonly used for sewer and storm-water applications with EPP pipes.

Diameter range (DN)	300-3000 mm
Pressure (PN)	1 bar
Angular deflection*	up to 3°



EPP non-pressure coupling (ESC)

Alternative coupling for sewer and stormwater applications with EPP pipes.

Diameter range (DN)	300-3600 mm
Pressure (PN)	1 bar
Angular deflection*	up to 3°



Pressure systems (pipe and joints) can be either uniaxial or biaxial. A uniaxial joint will not transfer thrust load from one pipe section to the next, and consequently the pipe is not reinforced to carry such load. Biaxial joints are designed to carry full pressure thrust from one pipe section to the next and the pipe is reinforced to carry that load.

Other terms used:

- Uniaxial: non end-load bearing system, unrestraint system
- Biaxial: end-load bearing system, restraint system

*The degree of angular deflection is dependent on the pipe diameter. Contact your local supplier for more information.

Flush joints

GRP sleeve

Commonly used for jacking and relining. Fits centrifugally cast and filament wound GRP pipes.

Diameter range (OD) 272-3600 mm
Pressure (PN) up to 6 bar



Stainless steel sleeve

Commonly used for jacking and relining. Fits centrifugally cast and filament wound GRP pipes.

Diameter range (OD) 272-3600 mm
Pressure (PN) up to 6 bar



Stainless steel & rubber sleeve

Commonly used for jacking and relining. Fits centrifugally cast and filament wound GRP pipes.

Diameter range (OD) 272-2500 mm
Pressure (PN) up to 16 bar



Other joints and couplings

Field joints for pressure & gravity applications

Laminated field joints are available in uniaxial and biaxial designs. EPP provides the necessary instructions or skilled personnel for butt-wrap joining in pressure and non-pressure applications. Technologies developed by EPP provide faster and more cost-efficient installations.

Masonry couplings

The masonry coupling is used for connecting pipes to concrete shafts and walls. Masonry couplings are sanded for improved stability in concrete shafts. Masonry couplings can be delivered with pipe ring, and optionally with sealing tape. Lengths can be selected as required in consideration of the pipe joint data.

Mechanical couplings

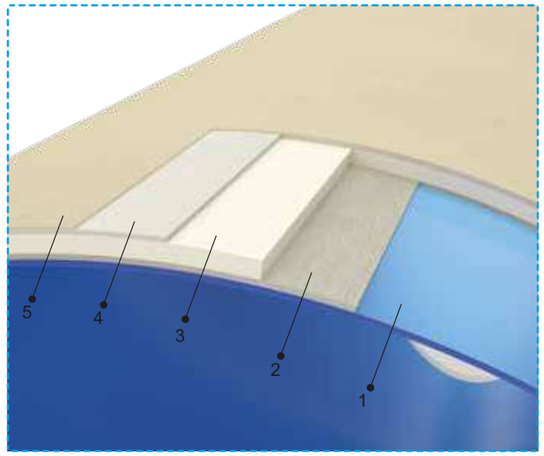
EPP pipes can be joined using mechanical steel couplings such as tangential bolt couplings or axial bolt couplings.

EPP flanges

EPP manufactures and sells flanges in various designs and according to different standards and requirements. When connecting two GRP flanges, the standard bolt pattern to which flanges are manufactured is EN 1092. Other bolting dimension systems such as according to AWWA, ANSI, DIN, and JIS can be supplied.

EPP Non-Circular Pipes (NC Line)

EPP NC Line pipes with their non-circular cross-sections are ideal for relining old city sewers, culverts and channels that often hold non-circular shapes. Non-circular pipes are also used for open-trench applications. The non-circular profiles are produced using a filament winding technology. They can be customized according to customer demands and easily be adapted to different types of shapes and geometries. The remaining annular space between the host and liner pipes is usually filled with grout. This fixes the inserted pipe in its position and can take over the structural load. The product has a proven sealing system that allows excellent tightness and easy joining, also under angular deflection. Non-circular EPP pipes meet the requirements of ISO 16611.



1 Inner liner layer
2 Inner structural layer
3 Core layer
4 Outer structural layer
5 Exterior surface

Wall structure of EPP NC Line pipe

Technical data EPP NC Line pipes

Main Materials	Resin, Glassfibers, Sand
Operating Temperature	-50 °C to +50 °C *
Cross Sections (height/width)	300-4000 mm
Pressure Range	PN 1
Expected Service Life	Many Generations
Corrosion Protection	None Needed
Water Jetting Resistance	Tested According to DIN 19523

* Higher temperatures may be considered for individual projects.

Non-circular profiles

NC Line egg profile

Commonly used for relining old stormwater sewers in cities, sanitary projects, and chemical sewers.

Nominal size*	300-4000 mm
Pressure (PN)	1 bar
Nominal lengths	500-3000 mm
Thickness	Load-carrying or non load-carrying profiles available



NC Line mouth profile

Commonly used for relining old stormwater sewers in cities, sanitary projects, and chemical sewers.

Nominal size*	300-4000 mm
Pressure (PN)	1 bar
Nominal lengths	500-3000 mm
Thickness	Load-carrying or non load-carrying profiles available



NC Line arch profile

Commonly used for relining old stormwater sewers in cities, sanitary projects, and chemical sewers.

Nominal size*	300-4000 mm
Pressure (PN)	1 bar
Nominal lengths	500-3000 mm
Thickness	Load-carrying or non load-carrying profiles available



* Nominal size referring to ISO 16611, i.e., maximum inner height and breadth. The above-mentioned are the most commonly used profiles. Other profiles are available on request. Most profiles can be manufactured with a dry-weather channel.

Jointing of EPP NC Line pipes

Bell & spigot elastomeric seal

Diameter range (DN)	300-4000 mm
Pressure (PN)	1 bar



Bell & spigot glued joint

Diameter range (DN)	300-4000 mm
Pressure (PN)	1 bar



Spectrum of Applications



Industrial Applications

GRP pipes are widely used in industries for their ability to withstand harsh conditions, including chemical and mechanical corrosion, as well as high thermal stresses from transported liquids. They are ideal for cooling water systems in power and desalination plants, sea and raw water intake, and the safe transport of corrosive liquids in chemical and fertilizer plants.

Distribution of Raw Water and Potable Water

GRP pipes are perfectly suited for potable water distribution and transmission. The pipes are supplied with a time tested jointing mechanism which ensures neither leakage of valuable water nor contamination of water through external medial. Due to the light weight of the pipes they can be easily transported and installed in the busy areas of the city. They also come with customised fittings to take care of the laying site conditions.





Irrigation

Irrigation systems are vital for agriculture, requiring durable and reliable pipe networks to prevent water loss. Traditional open canal systems often result in significant losses through evaporation and pilferage. GRP pipes offer a long-term solution, reducing water waste with a lifespan of 50 years, minimizing the need for frequent rehabilitation. They can be installed above or below ground, adapting to site conditions and justifying the higher initial investment.

Effluent and Sewage Water Discharge

Our GRP pipes are customised and structured to handle highly corrosive liquids and are effective for transporting municipal waste and storm water. The pipes are designed to handle extra loads caused by urban conditions. The smooth inner surface of the pipes also helps low gradient flow of sewers effectively without the requirement of frequent maintenance. A large and innovative range of fittings help easy installation of the sewer pipe network in the congested municipal areas.





Oil & Gas Sector

GRP pipes are highly suited for the oil and gas sector due to their non-corrosive properties, making them ideal for offshore and onshore installations exposed to harsh environments. They provide secure and durable pipeline protection in remote areas, ensuring long-term reliability with minimal maintenance. Additionally, GRP pipes are used as protective barriers around drilling rigs and refineries, offering superior resistance to chemicals, extreme temperatures, and mechanical stress.

Marine & Coastal Infrastructure

GRP pipes are ideal for seawater intake and discharge, marine outfalls, and port infrastructure, offering corrosion resistance in harsh coastal environments. They are also used in subsea and offshore platform piping, ensuring long-term performance in saline conditions. Additionally, GRP pipes play a key role in shipbuilding and naval applications, providing a lightweight, strong, and maintenance-free solution for marine operations.





Infrastructure & Construction

GRP pipes are valued for their durability, corrosion resistance, and lightweight design, making them ideal for perimeter protection in chemical plants and refineries. They serve as non-conductive safety barriers in high-voltage substations and are used in cooling tower enclosures for power plants, withstanding moisture and temperature fluctuations. Additionally, they provide pipeline and equipment protection in industrial zones, offering a robust, maintenance-free alternative to traditional materials.

Mining & Slurry Transport

GRP pipes are ideal for mining and slurry transport due to their high resistance to corrosion and harsh environments. They ensure efficient acidic and abrasive slurry transportation without degradation. Their lightweight and strong structure makes them perfect for mine dewatering and tailings disposal, offering reliable water removal and waste management. Additionally, GRP pipes prevent leakage in leachate collection and treatment pipelines, ensuring long-term durability with low maintenance, making them a cost-effective solution for mining operations.

