



# FLOWTITE Pipe Systems for Irrigation



**AMIAANTIT PIPE SYSTEMS**

# Introduction

Pipes constitute a major cost item in irrigation projects. The service life of pipes installed below or above ground is essential for the efficient use of invested resources. The performance of pipes and their operational costs, which form an important aspect of the project costs in irrigation projects world-wide, has become increasingly evident. Particularly in irrigation, pipe systems are preferred which prevent the loss of water.

As a composite material, the use of GRP is becoming more widespread in irrigation applications and FLOWTITE GRP pipes increasingly replacing traditional metal and concrete based pipes, as well as conventional open canals.

They are widely used in main transmission lines, network lines and pumping lines in irrigation projects. Siphon lines in irrigation systems usually cross steep valleys, or creeks and ponds. Thanks to its light weight, FLOWTITE GRP pipes allow easy transportation, even on steep slopes, and safe installation. Their high mechanical strength, flexibility against overload peaks and their corrosion resistance make FLOWTITE GRP pipe systems the preferred solution for irrigation siphon lines.



Excellent corrosion resistance makes additional corrosion protection or cathodic protection unnecessary and the well proven different GRP joining systems guarantee a safe, quick and easy installation of the irrigation pipeline.

The excellent product properties, combined with individual, project-dependant installation methods, avoid leakage in transmission and network lines, vaporisation in open canals and operational losses.



# Product Advantages

FLOWTITE products and accessories offer many advantages for use in irrigation projects and applications.

Features	Benefits
Corrosion-resistant material	<p>Long, effective service life.</p> <p>No need for linings, coatings, cathodic protection, wraps or other forms of protection.</p> <p>No corrosion surveys required.</p> <p>Low maintenance costs.</p> <p>Hydraulic characteristics essentially constant over time.</p>
Light weight (1/4 weight of ductile iron or steel 1/10 weight of concrete)	<p>Easy nested transported, providing great savings in transportation costs.</p> <p>Easy and economic to install. No need for heavy and expensive handling equipment.</p>
Excellent hydraulic characteristics	<p>Extremely smooth bore.</p> <p>Low friction loss means less pumping energy needed and lower operating costs.</p> <p>Compared to metal and concrete pipes, the same flow rate can be conveyed using smaller diameter GRP pipe.</p> <p>Minimum slime build-up can help lower cleaning costs.</p> <p>Lower wave celerity than other piping materials can mean less costs when designing for surge and water hammer pressures.</p>
Multiple joints system	Tight, efficient joints designed to eliminate infiltration and exfiltration.
Coupling, flange, butt & wrap, lock joints	<p>Ease of joining, reducing installation time.</p> <p>Accommodates small changes in line direction without fittings.</p> <p>Suit site and use conditions.</p>
Long standard lengths (6, 12 and 18 meters)	<p>Fewer joints reduce installation time and coupling cost.</p> <p>Lower delivery cost through nesting GRP pipes into one another.</p>
High technology pipe	<p>Consistently high product quality worldwide, which ensures reliable product performance.</p> <p>Manufacturing systems producing pipe that complies to stringent performance standards (AWWA, ASTM, BS, DIN, EN, SASO, TSE, etc...).</p>
Flexible conditions	<p>Can be used in high cover depths with different soil.</p> <p>Additional surge pressure up to 40% of the design pressure without the need to increase the pipe pressure rating.</p> <p>Can resist seismic loads.</p> <p>Field adjustment: the pipe can easily be cut at site at any point along its length.</p> <p>Can absorb structural settlements.</p>

# Advantages of Closed GRP Pipe Systems for Irrigation

## No Vaporisation!

The amount of water wasted is up to 50% in conventional open irrigating systems due to leakage in transmission and network lines, vaporisation and operational losses. This leads to waste of limited water resources and larger distribution and drainage networks, resulting in increased costs and additional energy consumption in pumping systems. This can be prevented by a closed GRP piping system. The prevention of evaporation allows huge cost savings at installation, in operation and at maintenance.

## Tailor-Made Capacity and Construction!

Individual design studies and hydraulic calculations provide customers with tailor-made GRP pipe solutions. This prevents water losses and the resulting larger networks and higher pumping costs.

## Preventing Erosion!

Open, uncontrolled water flow on surfaces with steep slopes leads to corrosion. High pressure GRP pipe irrigation systems help prevent this problem.

## Low Operational Costs!

GRP pipe system networks have advantages that allow high standards of automation, traceability and controlled water distribution. Additionally, cleaning the open trenches from grass and the negative effect of weeds in canals is prevented.



## Bigger Irrigation Areas

Pressurised irrigation systems avoid open canals in the fields. The productive area is bigger resulting in higher yields per square meter

## Economic Investment

Closed systems have become technically practicable and economically wise. Although the initial investment is higher, lower servicing and operating costs reduce the costs dramatically during the lifecycle of a pressurized GRP pipeline and make it cheaper than the current traditional systems.

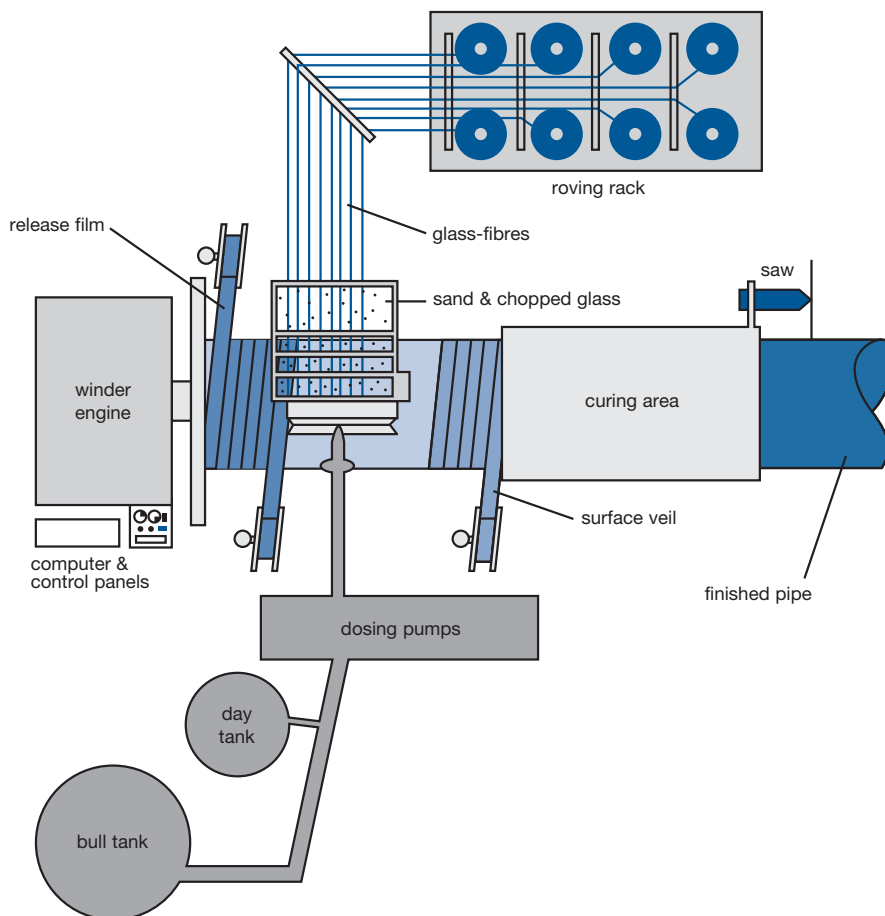
## Safe and Environmental Friendly

Irrigation water usually contains some pesticides, which are necessary for efficient agriculture, and transport in closed GRP pressure piping systems protects the environment, humans and animals from health problems. On the other hand, the irrigation water is also isolated from outside factors such as waste products, wastes and biological dirt. There is no risk, especially for children, of falling into open trenches and drowning. No expropriation of private land is necessary due to the pipes being buried. Closed, buried pipe systems also do not obstruct the traffic flow.

# Production Process

The basic raw materials used in FLOWTITE pipe manufacturing are resin, fibreglass and silica sand. FLOWTITE pipes are manufactured using the continuous advancing mandrel process which represents the state of the art in GRP pipe production. This process allows the use of continuous glass fibre reinforcements in the circumferential direction. For a pressure pipe, the principle stress is in the circumferential direction. Incorporating continuous reinforcements in this

direction therefore yields a higher performing product at a lower cost. A very compressed laminate is created that maximises the contribution from the three basic raw materials. Both continuous glass fibre rovings and choppable roving are incorporated for high hoop strength and axial reinforcement. A sand fortifier placed near the neutral axis in the core is used to provide increased stiffness by adding extra thickness.



# Product Range

## Pipe Programme

The FLOWTITE GRP product programme offers an extensive range of pipe diameters and is completed by an outstanding range of fittings and accessories.

Our range of standard diameters in mm:

100 · 150 · 200 · 250 · 300 · 350 · 400 · 450 · 500
600 · 700 · 800 · 900 · 1000 · 1200 · 1400
1600 · 1800 · 2000 · 2400 · 2600 · 2800 · 3000

Other diameters up to 4000mm are available on request. Please contact your local supplier.

All pipes are available in standard stiffness classes SN 2500, SN 5000 and SN 10000. Additional, custom designed stiffness classes are available on request.

Depending on diameters, FLOWTITE GRP pipes are available in nominal pressure classes between 1 bar and 32 bar. We feel committed to high quality standards and therefore ensure that all pipes with a pressure greater than PN1 are 100% pressure tested to twice their nominal pressure, dependent on capacity of the hydrotester equipment.



Standard Pressure Class PN in bar	
	1
	6
	10
	16
	20
	25
	32

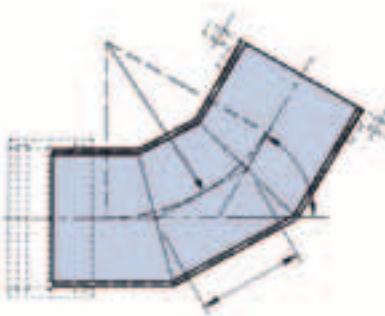
Other pressure classes are available on request. Please contact your local supplier.

Our pipes are supplied in standard lengths up to 12 metres. Other, customised lengths are also available on request.

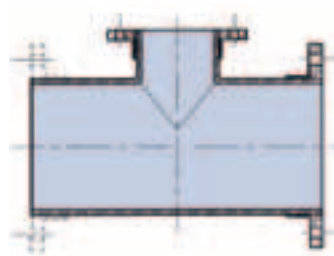


## Fittings and Accessories

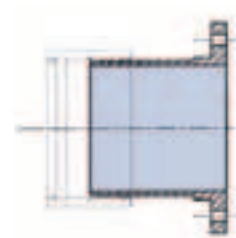
In addition to the pipe programme, a wide range of GRP fittings and accessories are offered. This includes bends, tees, branches, flanges or pre-assembled, custom designed spools. The high flexibility of the materials used allows the individual and tailor-made manufacturing of fittings based on customers' requirements. The fabrication of fittings is an integral part of our business – one that we take very seriously.



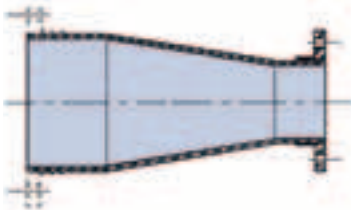
Bends 5-90°



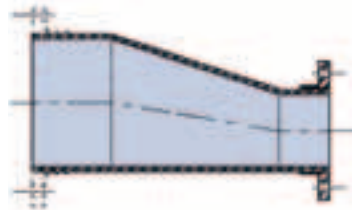
Tee 90°



Loose / Fixed Flanges



Concentric Reducer



Eccentric Reducer



# Product Specification

FLOWTITE GRP pipe systems provide solutions for applications with high requirements in terms of corrosion and high pressure resistance. Our GRP pipes are characterised by the immense strength of the glass fibre and the high level of resistance against corrosion of the resin. This combination of mechanical and chemical properties makes them an ideal choice for irrigation projects.

Consistently high quality standards are an important factor of our FLOWTITE pipe systems. All manufacturing sites are periodically certified by third parties and have official certification such as ISO 9001. Depending on the country, the pipe systems are approved according to AWWA, CEN, ASTM, DIN, BSI, ISO, TSE and many other international or local standards and certifications.

## Flow Coefficient and Flow Velocities

GRP pipe systems have a resin-rich interior layer, providing a very smooth inner surface. This smooth interior surface results in very low fluid resistance. Based on tests carried out on FLOWTITE pipe in existing installations, the Colebrook-White coefficient may be taken as 0.029 mm on site. This corresponds to a Hazen-Williams flow coefficient of approximately  $C=150$ . The Manning coefficient is  $n = 0.009$ . In contrast to other corroding materials, the inner surface roughness of FLOWTITE pipes does not change with time as GRP pipes display no corrosion. Maximum recommended flow velocity is 3.0m/sec. Flow Velocities of up to 4 m/s can be used if the water is clean and contains no abrasive material. Our local service teams offer support in calculating the headloss, thus ensuring that the correct pipe materials and dimensions are chosen. The ideal choice results in huge savings and/or additional money for other investments.



**Thermal Coefficient**

The thermal coefficient of axial expansion and contraction for GRP pipe is 24 to 30 x 10<sup>-6</sup> cm/cm/°C.

**Water Hammer**

Water hammer or pressure surge is the sudden rise or fall in pressure caused by an abrupt change in the fluid velocity within the pipe system. The usual cause of these flow changes is the rapid closing or opening of valves or the sudden starting or stopping of pumps, e.g. during a power failure. The most important factors which influence the water hammer pressure in a pipe system are the change in velocity of the fluid, the rate of change in velocity ( valve closing time ), the compressibility of the fluid, the stiffness of the pipe in the circumferential “hoop” direction and the physical layout of the pipe system.



The water hammer pressure expected for FLOWTITE pipe systems is approximately 50% of that for steel and ductile iron pipe under similar conditions. Our GRP pipes have a surge pressure allowance of 40% of the nominal pressure. An approximate ratio for the maximum pressure variation at a given point in a straight pipeline with negligible friction loss can be calculated with the formula:

$$\Delta H = (w\Delta v)/g$$

Where:

- $\Delta H$  = change in pressure (m)
- w = surge wave celerity (m/s)
- $\Delta v$  = change in liquid velocity (m/s)
- g = acceleration due to gravity (m/s<sup>2</sup>)

SN	PN	DN 300-400	DN 450-800	DN 900-2500	DN 2800-3000
2500	6	365	350	340	330
	10	435	420	405	390
	16	500	490	480	470
5000	6	405	380	370	360
	10	435	420	410	
	16	505	495	480	
	25	575	570	560	
10000	6	420	415	410	400
	10	435	425	415	
	16	500	495	485	
	25	580	570	560	
	32	620	615	615	

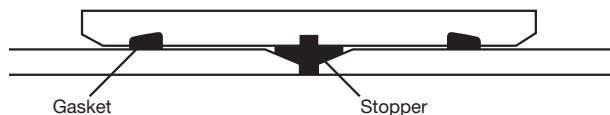
\*Some figures are rounded. Exact values require a transient analysis. Please contact your local FLOWTITE supplier.

**Surge Wave Celerity\* for FLOWTITE Pipes in meters/sec.**

# Pipe Jointing

All FLOWTITE GRP pipe solutions have a proven jointing system that ensures the system works through its whole estimated service life. The system also offers solutions for transitions to other materials, such as connection to valves or other accessories. The pipes are typically jointed using FLOWTITE GRP couplings based on the REKA system. Pipes and couplings can be supplied separately or pre-assembled at one of the female pipe ends. The couplings have an elastomeric sealing gasket (REKA system) based in a precision-machined groove. They also include a stopper in the middle of the coupling.

**! Note:** Detailed installation instructions can be found in our separate publications for pipe installation below ground and above ground.



## Joint Angular Deflection

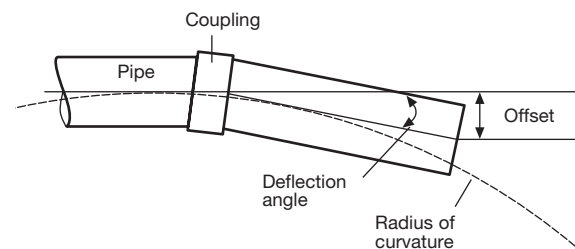
The joint is extensively tested and qualified in accordance with ASTM D4161, ISO DIS8639 and EN 1119. Maximum angular deflection (turn) at each coupling joint, measured as the change in adjacent pipe centre lines, must not exceed the amounts given in table below.

Nom Pipe Diameter (mm)	Pressure (PN) in bars			
	Up to 16	20	25	32
		Max. Angle of Deflection (deg)		
DN ≤ 500	3.0	2.5	2.0	1.5
15 < DN ≤ 800	2.0	1.5	1.3	1.0
900 < DN ≤ 1800	1.0	0.8	0.5	0.5
DN > 1800	0.5	NA	NA	NA

## Angular Deflection at Double Coupling Joint



The pipes must be joined in a straight alignment, but not all the way to the home line, and can thereafter be deflected angularly as required.



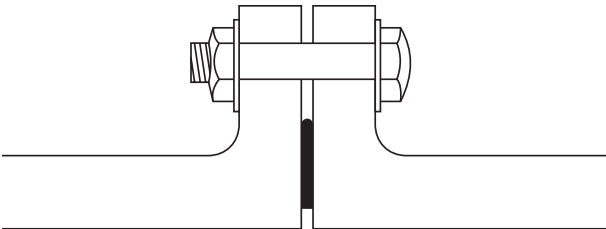
## Offset and Radius of Curvature

Angle of Deflection (deg)	Maximum Offset (mm) Pipe length			Radius of Curvature (m) Pipe length		
	3 m	6 m	12 m	3 m	6 m	12 m
3.0	157	314	628	57	115	229
2.5	136	261	523	69	137	275
2.0	105	209	419	86	172	344
1.5	78	157	313	114	228	456
1.3	65	120	240	132	265	529
1.0	52	105	209	172	344	688
0.8	39	78	156	215	430	860
0.5	26	52	104	344	688	1376

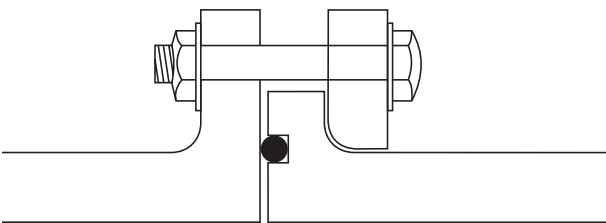
**Offset and Radius of Curvature**

**Flange Connections**

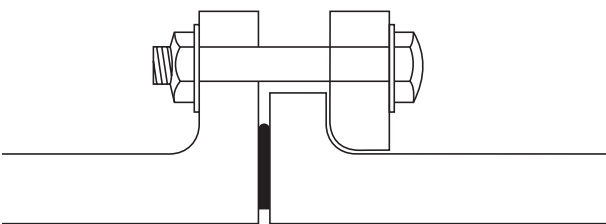
Flanged joints offer the same safety as laminated joints and allow the dismantling of the installation at a later stage. Flanges are also a good solution for connections with other pipe materials, valves and accessories. They are available as fixed and loose flanges.



**Flanged Joint**



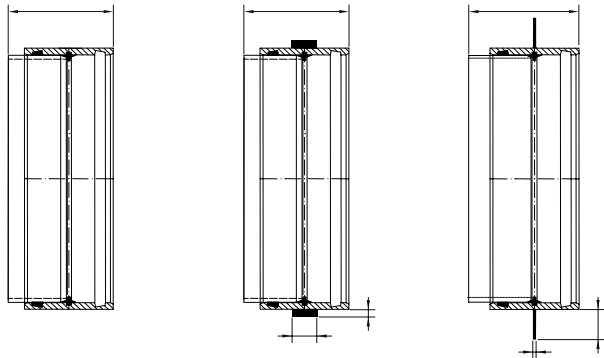
**Loose Ring Flange with O-Ring Gasket**



**Loose Ring Flange with Steel Ring Gasket**

**Wall Couplings**

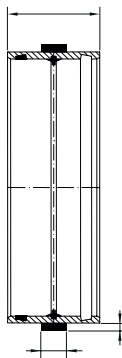
Wall couplings are used especially when it is necessary to join pipes with concrete material or when the pipeline encounters concrete, such as wall connections. They can be manufactured at any desired length up to 3 meters.



**Type A**

**Type B**

**Type C**



**Type 0**



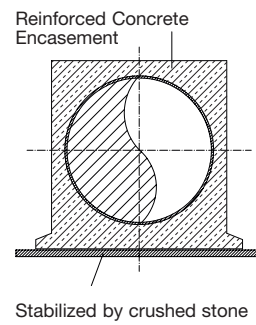
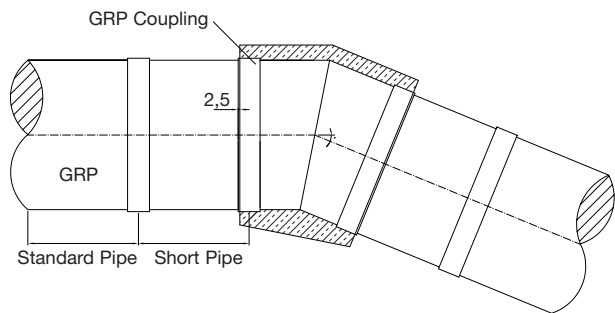
**Type 00**

**Joint and Wall Collar Sanded Circumferentially**



### Thrust Restraints and Concrete Encasement

When the pipeline is pressurized, unbalanced thrust forces occur at bends, reducers, tees, branches, bulkheads and other changes in line direction. These forces must be restrained in some manner to prevent joint separation. Usually this is most economically accomplished by the use of thrust blocks or alternatively by direct bearing and friction between pipe and soil.

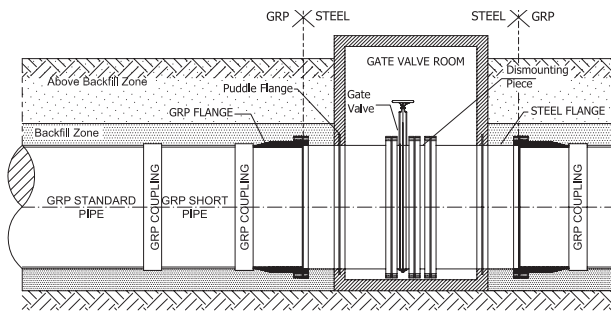


### Typical GRP Elbow Installation

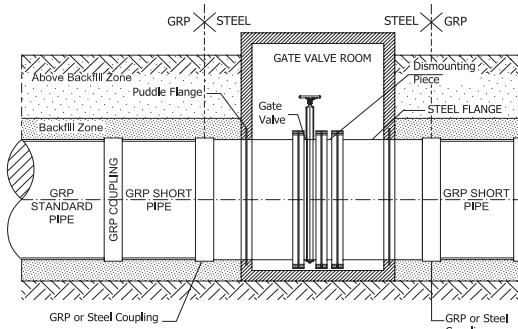


# Valve Chambers

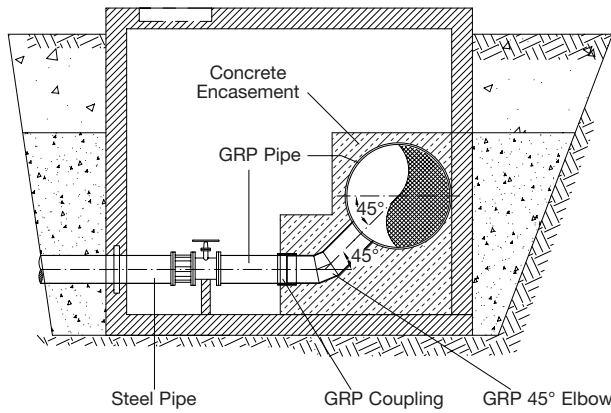
Most pressure irrigation pipelines have periodic in-line valves for isolating a portion of the supply or distribution system, and air and vacuum relief valves at high points in the pipeline to slowly release accumulated air, thereby avoiding blockages, or to allow air to enter in order to avoid negative-pressure, and clean out (wash out) or drainage chambers. All of these different appurtenances can be accommodated with FLOWTITE pipe systems. Additional information can be found in the “FLOWTITE Installation Guide for Buried Pipes”.



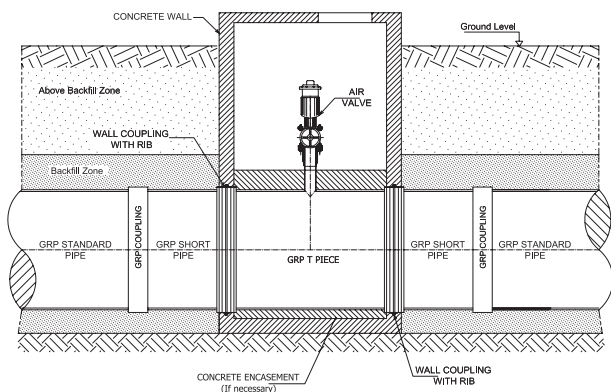
**Typical Valve Chamber Application – Alternative 1**



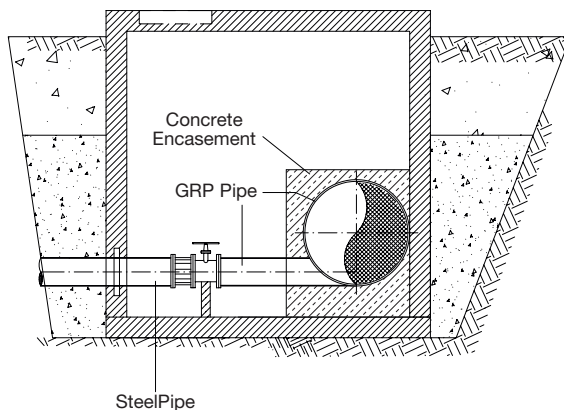
**Typical Valve Chamber Application – Alternative 2**



**Typical Drainage Valve Room Connections – Alternative 1**



**Typical Air Release Room Connection**



**Typical Drainage Valve Room Connections – Alternative 2**

# Services

Throughout the world, specialists in our field and sales offices offer a wide range of products and support. They will assist you in:

- Project study and selection of the most suitable materials according to the conditions
- Configuration of the installation and calculation of supports and anchorages
- Hydraulic calculations
- Stress analysis for underground and aboveground installations
- Workshop pre-mounting of spools
- Jobsite supervision



# References

Thanks to world worldwide product availability, the AMIANTIT group has many references all over the world. The list below only represents a small extract of available references.

For further information please visit our reference page at [www.amiantit.com](http://www.amiantit.com)!

Project	Country	Diameters (mm)	Pressure (bar)	Length (m)
Barreales 1 and 2	Argentina	400 – 1200	6 – 20	52.000
Yaylak Plain Irrigation Project	Turkey	400 – 2100	6 – 10	107.532
Paulo Afonso Project	Brazil	500 – 800	6	10.400
Conduccion Payuelos II	Spain	400 – 2000	6 – 10	100.000
Harran Irrigation Network, Plain Part 6	Turkey	600 – 1700	6	82.400
Metohija Kosovo Irrigation Project	Serbia & Montenegro	800 – 1800	2 – 12	45.000
Aflaj Irrigation Project	Saudi Arabia	350 – 800	12	9.000
Pindal – Maracaibo	Colombia	500 – 700	2	5.000
Jacuipe Project	Brazil	500 – 700	6 – 10	7.400
Şanlıurfa Bozova Pumping Irrigation Project	Turkey	350 – 2000	6 – 16	74.350
Northern Farm Diversion Works Project	China	600	6	2.000
Al-Balikh Irrigation	Syria	350 – 1600	10	18.000
Regadío Zona Monegros II Sectores XVIII – XIX & XXI – XX – XXII	Spain	400 – 1800	6 – 16	74.700
Regadío Ute Regs De La Noguera	Spain	500 – 800	6 – 16	38.900
Upper Harran Plain Irrigation Project	Turkey	600 – 1400	6	42.573
Alto Tunitlan Irrigation Line	Mexico	500 – 600	7 – 14	2.100
Curral Novo Project	Brazil	400-800	6	11.000
Regadío Zona Monegros II Sector VIII	Spain	500 – 1400	10	37.190
Batman Left Bank Main Canal Irrigation Syphon	Turkey	2200	4 – 10	10.235
Regadío de Alcolea del Tajo	Spain	1200 – 1600	10	12.000
Canal del Paramo	Spain	2400	6	3.300



