FARATEC

FARATEC PIPE JACKING
PIPE SYSTEMS

TRENCHLESS TECHNOLOGIES

• FARATEC Jacking Pipes

FARATEC

FARATEC PIPE JACKING
PIPE SYSTEMS

Contents

1-Introduction.....1

2-FARATEC Jacking pipes 2

3-Advantages of FARATEC Jacking pipes 6

4- Scope of FARATEC Jacking pipe products 7

5- FARATEC Jacking pipes applications.....10

6- FARATEC Jacking pipes engineering design.....11

7- Production standard 11

8- FARATEC qualification tests..... 12

9-Quality control tests of FARATEC Jacking pipes 14

10-Joining system of FARATEC Jacking pipes..... 15

11-FARATEC Jacking pipes and environment.....16

1- Introduction

FARATEC GRP pipes (Glass Reinforced Polymer Pipes) are known as composite pipes which have been produced with better performance and lower cost than the other pipes due to the latest advances in technology. Superior manufacturing technology of FARATEC GRP pipes is the main reason which encourages customers to use them as the best option in large-scale projects around the world.

New FARATEC composite jacking pipes can be manufactured in either standard or custom diameters as ID series pipes. Additionally, the pipes are available in different pressure classes and high jacking force strengths depending on the intended use. FARATEC jacking pipes are produced based on advanced engineering designs.
New FARATEC jacking pipes compared with other pipe jacking technologies have higher resistance, lower thickness, and better performance which mean the least cost. The unique features of this technology lead to a significant decrease in costs because less jacking force and consequently less heavy pipe jacking machinery is needed.

2- FARATEC Jacking pipes

FARATEC jacking pipes are manufactured using Continuous Filament Winding method (CFW). The structural layers of the pipe gain the maximum mechanical strength in this method. Using CFW method causes the less weight and the maximum resistance for the pipes.

FARATEC jacking pipes are manufactured using CFW method according to ISO 25780 standard. These pipes are produced on the basis of engineering of the compacted layers which are compositions of glass fiber, resin and filler (Silica sand). FARATEC jacking pipes benefit from the production method that makes a uniform distribution of weight and thickness along the pipe. Thus, the maximum jacking force resistance with minimum wall thickness will be created and consequently, axial resistance of the jacking pipes will be increased for pipe jacking operations.
The constant and low inner surface roughness (Hazen-Williams coefficient C=150) of the FARATEC pipes leads to reduction in head loss and decrease in required pipe diameter. In addition, due to the small outer diameter and smooth outer surface of the jacking pipe, a lower jacking force and smaller machines are required for the pipes. In other words, smooth outer surface is also a guarantee for low friction during jacking, thus enabling impressively long drives without the need for intermediate jacking stations.

Nowadays, GRP jacking pipes are being used as the best option in European, Asian and African countries. FARATEC jacking pipe systems ensure the maximum single drive length up to about 200 m depending on soil conditions and jacking parameters. Various manual, mechanical and remote-controlled jacking machines can be used for pipe jacking. Usually the drive length depends on the following parameters:

1- Stability and friction properties of the soil
2- Length, weight and the diameter of the pipes
3- Excavation method (jacking machines)
4- Jacking power

It is noteworthy that an intermediate jacking station is often used when jacking forces for the complete drive are expected to exceed the capacity of the main jacks due to the soil conditions or drive lengths.

3- Advantages of FARATEC jacking pipes

FARATEC jacking pipes' manufacturing process is adjustable, so it is easy to manufacture a custom product to meet the specific project requirements. In addition, continues manufacturing process increases the quality and speed of pipe production and makes uni¬form high quality products available in a short time. The other main advantages of these pipes are as follows:

No.	Advantages
1	Lighter weight compared to other kinds of jacking pipes
2	Higher mechanical strength
3	Producible at different diameters
4	Smaller jacking machinery requirement
5	Designable axial force at different conditions
6	Maximum cost savings compared to other materials
7	Ability to be joined with other pipes
8	The least roughness compared to other pipes
9	Abrasion resistant
10	Fast installation
11	Resistant to sewage acids
12	No scaling and corrosion • No need for coating and cathodic protection • pH-resistant (1-14) for 50 years of lifespan • Constant hydraulic characteristics during the lifespan
13	Uniformity of production according to CFW method
14	Higher production speed in a shorter time
15	Lower thickness and as a result: less weight and smaller required jacking force
16	Superior resistance specifications • Higher compressive strength • Higher strength against jacking force in long drives
17	Hydraulic characteristics • More smooth outer surface which leads to lower friction and lower jacking force • Lower inner surface roughness which leads to less head loss and more flow discharge
18	Superior joining system • The specific design of the pipes allows them to be designed as pressurized conduits
19	Advanced technology of pipes in accordance with international standards • High quality of manufactured pipe, ensures reliable performance
20	Suitable option for micro tunneling • Using CFW method, the dimensions are precise without any curvature. Due to its smooth outer surface, less jacking force is needed.

4-Scope of FARATEC Jacking pipe products

FARATEC Jacking Pipes can be designed and manufactured based on the customer's request in scope of 300mm to 4000mm diameter, 1 to 16 bar, 30 to 2200 ton jacking force, 1 to 6 m length and 2500 to 100000 (or more) Pascal stiffness.
This product scope is according to national and international standards. If any unusual product is required, the product will be individually designed and manufactured by the company. Then, manufacturing of products in various diameters, nominal pressures and stiffness classes is possible. Please consult the manufacturer before making a decision about such cases.

FARATEC JACKING PIPES, Standard dimensions, standard jacking force, standard stiffness

DN	Pipe OD max		100	150	200	250	300	350	400	450	500	550	600	650	700
300	401	Pipe ID	333	310	286										
		Wall Thickness(mm)	34.1	45.5	57.7										
		Weight (kg/m)	80	103	127										
		Stiffness (Pa)	700000	1800000	3900000										
400	478	Pipe ID	417	400	381	361									
		Wall Thickness(mm)	30.3	39.2	48.6	58.4									
		Weight (kg/m)	87	110	133	157									
		Stiffness (Pa)	250000	600000	1200000	2200000									
500	550	Pipe ID	494	479	464	448	431								
		Wall Thickness(mm)	27.9	35.4	43.1	51.1	59.3								
		Weight (kg/m)	93	116	140	163	186								
		Stiffness (Pa)	140000	280000	500000	900000	1400000								
600	650	Pipe ID	599	587	574	561	548	535							
		Wall Thickness(mm)	25.5	31.6	37.9	44.4	51	57.7							
		Weight (kg/m)	101	125	148	172	195	219							
		Stiffness (Pa)	65000	120000	210000	300000	500000	750000							
700	752	Pipe ID	705	694	683	673	662	651	639	628					
		Wall Thickness(mm)	23.7	29	34.3	39.7	45.2	50.7	56.4	62.2					
		Weight (kg/m)	110	133	157	180	204	227	251	274					
		Stiffness (Pa)	40000	60000	100000	150000	200000	300000	400000	600000					
800	860	Pipe ID	807	798	789	779	770	760	751	741					
		Wall Thickness(mm)	26.5	31	35.7	40.3	45	49.8	54.7	59.6					
		Weight (kg/m)	141	164	187	211	234	258	281	305					
		Stiffness (Pa)	30000	40000	70000	100000	120000	180000	250000	300000					
900	960	Pipe ID		901	893	885	876	868	859	851	842	833			
		Wall Thickness(mm)		29.5	33.6	37.7	41.9	46.1	50.3	54.6	58.9	63.3			
		Weight (kg/m)		175	199	222	246	269	293	316	340	363			
		Stiffness (Pa)		25000	50000	60000	80000	100000	130000	150000	200000	250000			
1000	1099	Pipe ID		1042	1036	1029	1022	1015	1007	1000	993	985	978	970	
		Wall Thickness(mm)		28.4	31.5	35	38.6	42.2	45.8	49.5	53.1	56.8	60.6	64.3	
		Weight (kg/m)		196	214	238	261	285	308	332	355	379	402	426	
		Stiffness (Pa)		20000	20000	30000	40000	50000	60000	80000	100000	120000	150000	180000	
1200	1280	Pipe ID			1217	1214	1208	1202	1196	1190	1184	1177	1171	1165	1159
		Wall Thickness(mm)			31.3	32.9	35.9	39	42	45.1	48.2	51.3	54.4	57.5	60.7
		Weight (kg/m)			254	264	287	311	334	358	381	405	428	452	475
		Stiffness (Pa)			20000	20000	25000	30000	40000	45000	55000	70000	80000	150000	170000
1300	1348	Pipe ID				1283	1278	1272	1267	1261	1255	1249	1243	1237	1231
		Wall Thickness(mm)				32.7	35	37.8	40.7	43.6	46.5	49.5	52.4	55.4	58.3
		Weight (kg/m)				279	295	319	342	366	389	413	436	460	483
		Stiffness (Pa)				20000	20000	25000	30000	35000	45000	50000	60000	70000	80000
1400	1499	Pipe ID							1422	1417	1412	1407	1402	1396	1391
		Wall Thickness(mm)							38.5	40.9	43.5	46.1	48.7	51.3	53.9
		Weight (kg/m)							363	383	407	430	454	477	501
		Stiffness (Pa)							20000	20000	25000	30000	35000	40000	50000
1500	1637	Pipe ID									1554	1550	1545	1540	1536
		Wall Thickness(mm)									41.7	43.6	46	48.3	50.7
		Weight (kg/m)									431	446	470	493	517
		Stiffness (Pa)									20000	20000	20000	25000	30000
1600	1720	Pipe ID										1634	1631	1626	1622
		Wall Thickness(mm)										42.9	44.7	46.8	49
		Weight (kg/m)										466	483	503	527
		Stiffness (Pa)										20000	20000	20000	25000
1700	1841	Pipe ID												1750	1746
		Wall Thickness(mm)												45.6	47.4
		Weight (kg/m)												531	550
		Stiffness (Pa)												20000	20000
1800	1940	Pipe ID													
		Wall Thickness(mm)													
		Weight (kg/m)													
		Stiffness (Pa)													
1900	2045	Pipe ID													
		Wall Thickness(mm)													
		Weight (kg/m)													
		Stiffness (Pa)													
2000	2160	Pipe ID													
		Wall Thickness(mm)													
		Weight (kg/m)													
		Stiffness (Pa)													
2100	2249	Pipe ID													
		Wall Thickness(mm)													
		Weight (kg/m)													
		Stiffness (Pa)													
2200	2400	Pipe ID													
		Wall Thickness(mm)													
		Weight (kg/m)													
		Stiffness (Pa)													
2300	2453	Pipe ID													
		Wall Thickness(mm)													
		Weight (kg/m)													
		Stiffness (Pa)													
2400	2555	Pipe ID													
		Wall Thickness(mm)													
		Weight (kg/m)													
		Stiffness (Pa)													
2700	2870	Pipe ID													
		Wall Thickness(mm)													
		Weight (kg/m)													
		Stiffness (Pa)													
2800	3000	Pipe ID													
		Wall Thickness(mm)													
		Weight (kg/m)													
		Stiffness (Pa)													

FARATEC JACKING PIPES, Standard dimensions, standard jacking force, standard stiffness

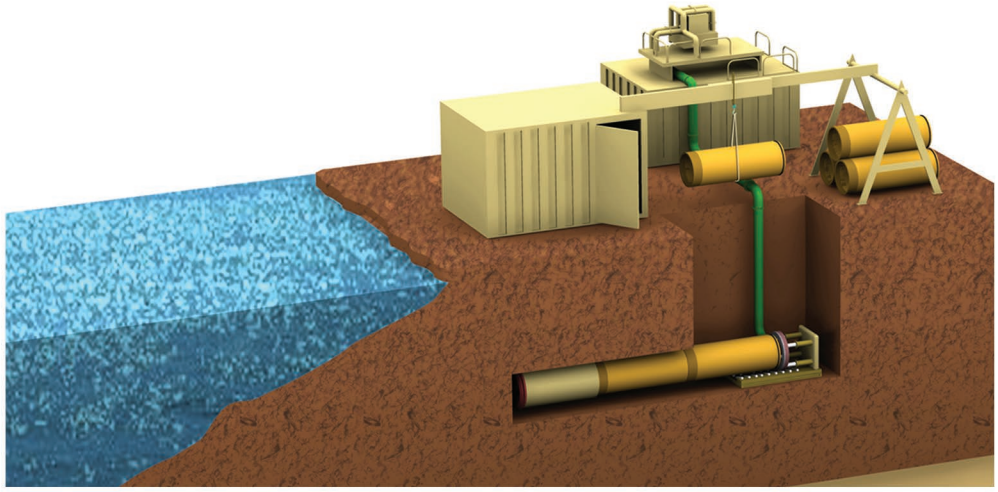
FARATEC PIPE JACKING
PIPE SYSTEMS

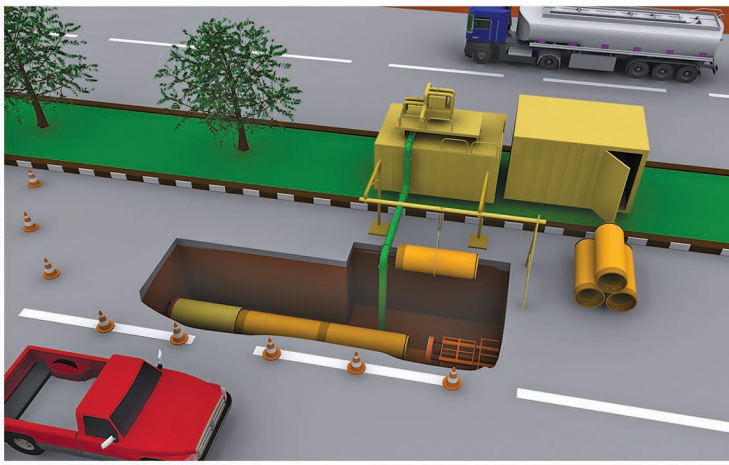
Jacking Force (Ton)

750	800	850	900	950	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200
1152	1146																
63.8	67																
499	522																
200000	250000																
1225	1219	1213															
61.3	64.3	67.3															
507	530	554															
100000	110000	120000															
1386	1381	1375	1370														
56.6	59.2	61.9	64.6														
524	548	571	595														
55000	60000	70000	80000														
1531	1526	1521	1516	1512	1507												
53.1	55.5	57.9	60.3	62.7	65.2												
540	564	587	611	634	658												
35000	40000	45000	50000	55000	60000												
1617	1613	1608	1604	1599	1595	1590	1585										
51.3	53.6	55.9	58.1	60.4	62.7	65	67.3										
550	574	597	621	644	668	691	715										
25000	30000	35000	40000	45000	50000	55000	60000										
1743	1739	1735	1730	1726	1722	1713	1705										
49	51.1	53.2	55.3	57.5	59.6	63.8	68.1										
564	588	611	635	658	682	729	776										
20000	20000	25000	25000	30000	35000	40000	50000										
1844	1840	1837	1833	1829	1825	1817	1809	1801									
48.2	49.8	51.5	53.3	55.3	57.3	61.4	65.4	69.5									
593	609	626	646	670	693	740	787	834									
20000	20000	20000	20000	20000	25000	30000	35000	45000									
	1938	1936	1932	1928	1924	1917	1909	1901	1893								
	53.3	54.7	56.6	58.5	60.4	64.2	68	71.9	75.8								
	686	699	723	746	770	817	864	911	958								
	20000	20000	20000	20000	25000	30000	35000	40000	50000								
		2052	2049	2046	2043	2036	2029	2022	2015								
		53.9	55.4	56.8	58.3	61.9	65.5	69.1	72.7								
		737	754	770	787	834	881	928	975								
		20000	20000	20000	20000	20000	25000	30000	35000								
				2137	2134	2128	2122	2115	2108	2100							
				56.1	57.6	60.4	63.7	67.2	70.6	74.6							
				798	817	849	894	941	988	1045							
				20000	20000	20000	20000	25000	30000	35000							
					2287	2281	2276	2271	2265	2259	2252						
					56.6	59.3	61.8	64.4	67.5	70.7	74						
					869	904	935	968	1011	1058	1105						
					20000	20000	20000	20000	20000	25000	25000						
						2335	2330	2325	2320	2314	2307	2301					
						59	61.4	63.9	66.6	69.6	72.8	76					
						925	953	986	1021	1066	1113	1160					
						20000	20000	20000	20000	20000	25000	25000					
						2438	2433	2429	2424	2419	2413	2407	2400				
						58.6	60.8	63.1	65.6	68.2	71.2	74.2	77.3				
						967	994	1024	1058	1093	1140	1187	1234				
						20000	20000	20000	20000	20000	20000	25000	30000				
									2742	2738	2734	2730	2726	2721	2716		
									63.9	66	67.9	70	72.1	74.3	77		
									1192	1225	1250	1280	1310	1343	1390		
									20000	20000	20000	20000	20000	20000	20000		
											2865	2861	2857	2854	2850	2846	2841
											67.3	69.4	71.4	73.2	75.2	77.2	79.7
											1311	1343	1375	1399	1429	1461	1505
											20000	20000	20000	20000	20000	20000	20000

5- FARATEC Jacking pipes applications

- Tunnel of urban facilities
- Urban sewerage networks
- Reconstructing old sewerage systems
- Surface water networks
- Pressurized fluid transmission pipelines
- Road-crossings and culverts
- Pipelines below rivers and seas (offshore)
- High pressure water transmission pipelines





6- FARATEC Jacking pipes engineering design

Companies under the license of Faratec such as Farassan Fars, Saba Loole, Farapox, Avisa Parseh Zabol, Farassan in Iran, Grand pipe in Turkey, Romania and Africa provide engineering services to customers currently. These services are detailed studies, providing executable drawings for piping, stress analysis of the piping, hydraulic studies, project control process, installation, etc. In addition, the above mentioned companies are able to carry out EPCC (Engineering, Procurement, Construction and Commissioning) projects under the FARATEC license.

7- Production standard

FARATEC technology center is an accredited standard center providing different qualification tests on the products. ISO 25780 standard is usually applied to GRP jacking pipes although the following standards could be used if needed:

GRP pipes for pressurized or gravity systems	ISO 10639
GRP pipes for sewerage and drainage purposes	ISO 10467
Guide to the raw material, pipes and joining system	ISO 25780

8- FARATEC qualification tests

Qualification tests such as long-term tests are performed necessarily according to international and national standards in order to ensure the quality of raw materials for a 50-year lifespan.
These tests show that the final properties of the product match the standards.

8-1- Raw materials tests

According to international standards, qualification tests are required to be performed on raw materials of the composite pipes. Long term qualification testing consists of testing at least 18 samples at a variety of strain levels over a period of at least 10,000 hours (approximately 14 months). The results of the tests are analyzed using the methods prescribed in the standards and extrapolated to 50 years. The pipes will be designed for 50 years lifespan using the safety factors determined by the qualification tests.

8-2- Strain corrosion test

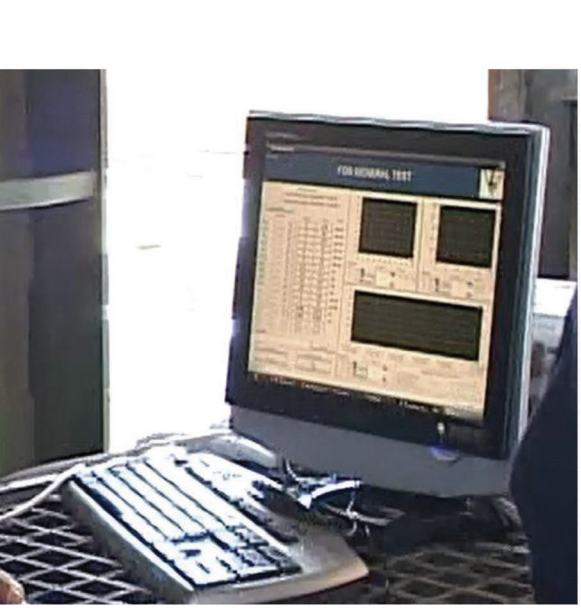
All of the FARATEC jacking pipes which will be subjected to sewage must be qualified according to strain corrosion test.

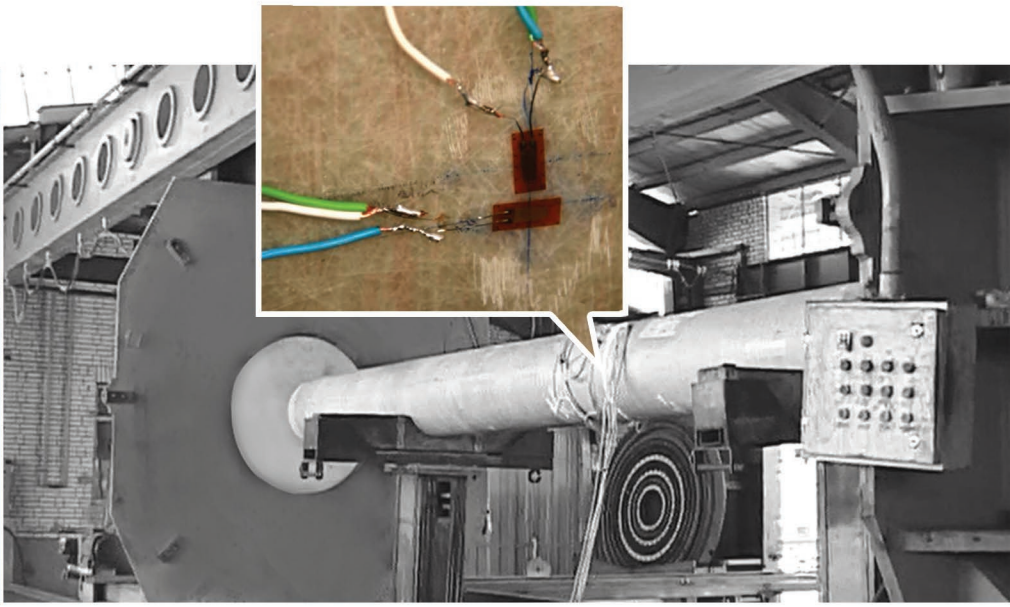
8-3- Long term stiffness (Creep) test

Results of long-term creep tests conducted by FARATEC Company show the negligible changes in jacking pipes' stiffness during their 50 years of service because of their low creep values.

8-4- Compressive stress test

Compressive properties of jacking pipes are presented in ISO 25780- annex B standard. It is noteworthy that all of the FARATEC jacking pipes are qualified according to this standard.



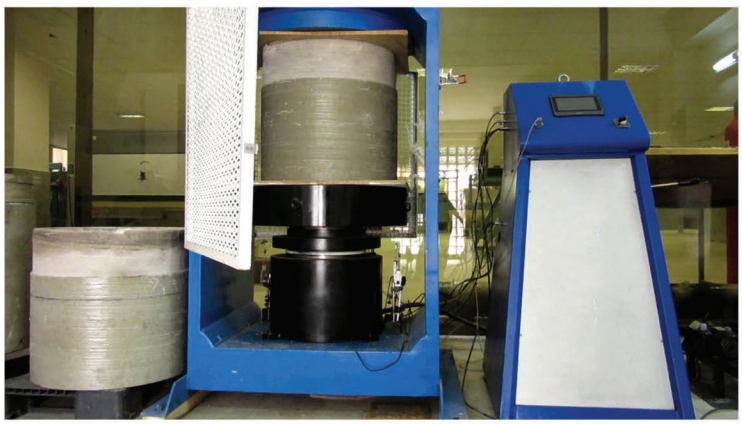


9- Quality control tests of FARATEC Jacking pipes

These tests are held on a routine basis by sampling methods according to the standards. These tests are as follows:

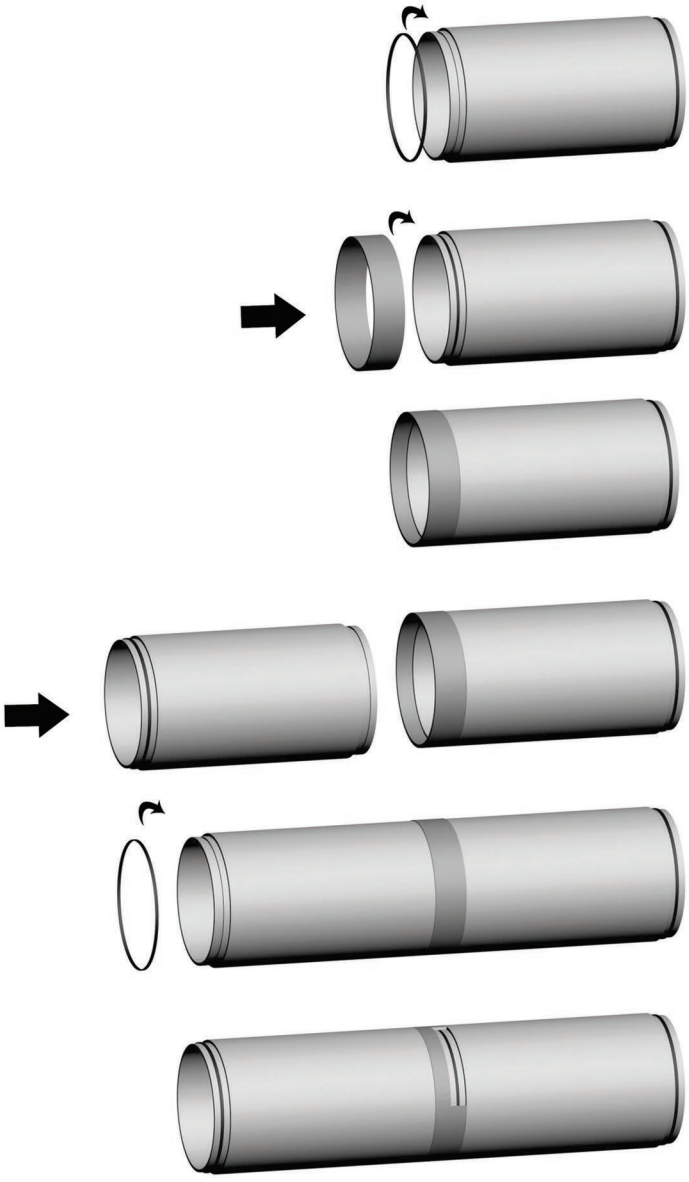
- Raw materials quality
- Axial tensile strength
- Axial and hoop strain
- Stiffness
- Dimensions of the pipe

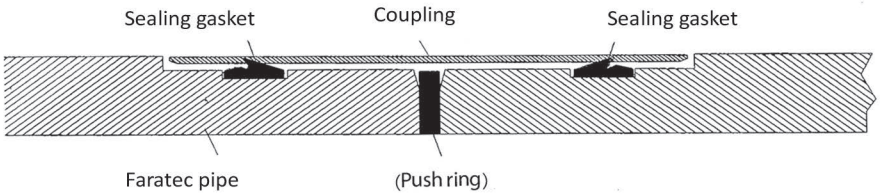
And the other tests which are conducted on GRP pipes.

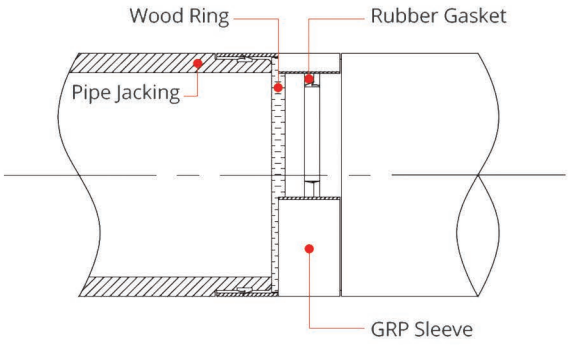


10- Joining system of FARATEC Jacking pipes

Jacking pipes are connected using special joint couplings. FARATEC jacking pipe is equipped with a coupling pushed onto one of the spigots. These couplings have an outer diameter equal to the outer diameter of the jacking pipes, so a uniform outer surface of the pipe will be provided in order to be jacked easily. Jacking pipes with different working pressures can be manufactured due to the specific design capabilities. Coupling with an EPDM elastomeric gasket (sealing rubber) provides a reliable seal in jacking pipes. EPDM elastomeric gaskets are produced according to AS 1646 and EN 681-1 standards. Engineering considerations such as launch shaft and shaft wall design as well as geotechnical condition, geophysics tests, ground water details, soil mechanical parameters, etc. must be taken into account. Jacking Pipes with stainless steel sleeves can be manufactured on request.







11- FARATEC Jacking pipes and environment

The fertile part of the land is its upper layer with about 20 cm thickness which is a very rich soil due to the decomposition of plants and remains of animals, called humus as the organic part of the soil. This layer is usually darker than other parts of the soil and soil fertility depends on this part. If the pipe installation is done by open trench method, a standard trench must be drilled, and humus in the area is damaged along the path. On the other hand, if pipe jacking method is implemented in rangelands and forests, cutting down the trees and disrupting the ecosystem will not occur. The use of pipe jacking method makes it possible to install underground pipes at the desired depth without destroying the soil texture or cutting the tree and interrupting the ecosystem. Due to the fact that the movement of machinery is reduced in pipe jacking method, the related accidents will not happen too. Hence, these types of GRP pipes, which are exclusively supplied by the FARATEC brand, are called eco-friendly pipes.
FARATEC jacking pipes are currently being used as superior quality in various parts of the world including Turkey, Europe, Malaysia and etc.

TÜV SÜD

WRAS APPROVED MATERIAL

ISO 9001
ISO 14001
OHSAS 18001
ISO 50001
ISO 10002
ISO 10015
HSE-MS

Registered CCPL

Global Leadership Award 2011

FARATEC

Head Office Address:

No.249, 22nd Alley,
Eram Ave., **Shiraz-Iran**
PO Box: 71365-1143
Phone:+98(71)-32291918
Fax:+98(71)-32272697
www.Farassan.com
Email :info@Farassan.org

Tehran Office:

No. 28. Nezami Ganjavi St.,
Tavanir Ave., Valiasr Blvd.,
Tehran-Iran
Po Box: 1434-793513
Phone:+98(21)-887862
Fax:+98(21)-88882464