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CTP BORU / GRP PIPES

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ALFEBOR

Fiber Glass Reinforced Polyester (GRP) Pipe

ALFEBOR is one of the leading Fiber Glass Reinforced Polyester (GRP) pipe manufacturers in Turkey with its capacity of production up to 4 meter diameter.

Alfebor Boru San. ve Tic. A.Ş. (ALFEBOR) was incorporated in 2015 in the Antakya Organized Industrial Zone of Hatay province in order to produce Glass Fiber Reinforced Polyester (GRP) with the aim of becoming one of the leading organizations in both Turkish and international pipe market with its location, technical staff and quality standards.

As ALFEBOR, we carry out our productions operating with fully automatic mechanism covering the entire process from supply of raw materials to the last stage of pipe production within the framework of a quality control system complying with the international standards. All our productions are realized with a reliable and innovative approach that takes into account the impermeability, external load bearing capacity and environmental protection factors at every stage; and each final product is subjected to all performance tests as stipulated by international standards.

Established over a total area of 40,000 m^2, 7,800 m^2 of which is indoor area, ALFEBOR is one of the leading Fiber Glass Reinforced Polyester (GRP) pipe manufacturers in Turkey with its capacity of production up to 4 meter diameter. The current average production capacity of facility with two production lines is 800 m/day at several diameters, and this capacity will increase with the addition of new production line.

ALFEBOR GRP PIPES REPRESENT THE HIGHEST STANDARDS IN PRODUCTION BAND QUALITY.


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GENERAL FEATURES
ALFEBOR GRP Pipes are manufactured making use of the vast accumulation of knowledge and the latest technological systems. For this reason, the products are durable for 50 years, economical and advantageous due to its low maintenance costs.

PROCESS
Continuous Filament Winding Process

NOMINAL DIAMETER
DN 300 mm – DN 4000 mm

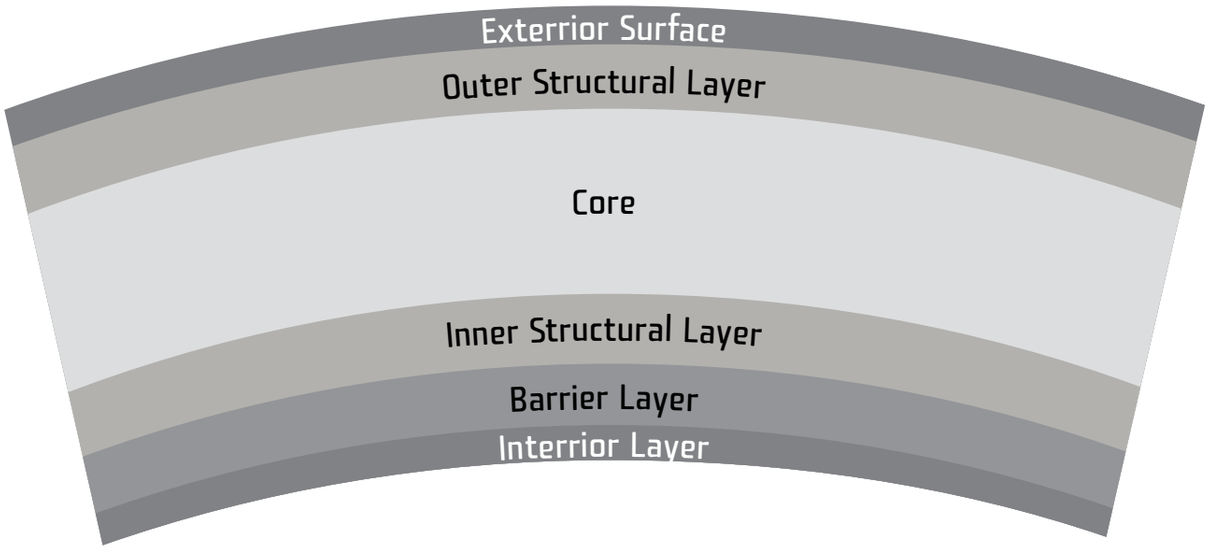
PIPE LENGTHS
ALFEBOR GRP Pipes are manufactured with lengths ranging from 6 m to 12 m with probability to customize lengths from 0.5 m to 16 m. the pipe lengths can be customized based on the project requirements.

PRESSURE CATEGORIES
PN1 bar – PN 32 bars

STIFFNESS CATEGORIES
ALFEBOR GRP Pipes are manufactured in SN 2500 N/m², SN 5000 N/m² SN 10000 N/m² with the probability of manufacturing in any stiffness as per the project requirements.

ALFEBOR GRP Pipes are used in infrastructure and superstructure systems for the following purposes;

- Drinking water networks and water distribution pipelines
- Irrigation networks and drainage applications
- Sewage project networks and collection lines
- Sewage project waste water discharge lines
- Pressure pipes for hydroelectric power stations
- Storm water drainage
- Cooling water supply and discharge in power stations
- Pipelines for carrying chemical wastes
- Priming applications
- Pipelines for discharging industrial wastes
- Cylinder liner renewal applications
- Geothermal water transmission pipelines
- Reservoir for chemical facilities and drinking water
- Discharge lines to the sea.
- Oil and chemical material conveying



PRODUCTION PROCESS

ALFEBOR GRP Pipes are produced by filament winding on fully automatic machinery. The pipe wall is made on base of glass fiber reinforced polyester and filling materials. The iner and outer layer of the pipe wall contain a high concentration of polyester reinforced with fiber, which gives outstanding resistance to chemicals.

The mid layer of the pipe is sprecially strong providing longidutinal and peripheral strength to with stand working pressure and providing the required stiffnes.

Process parameters and pipe thickness are continuously monitored and recorded and reports are issued.

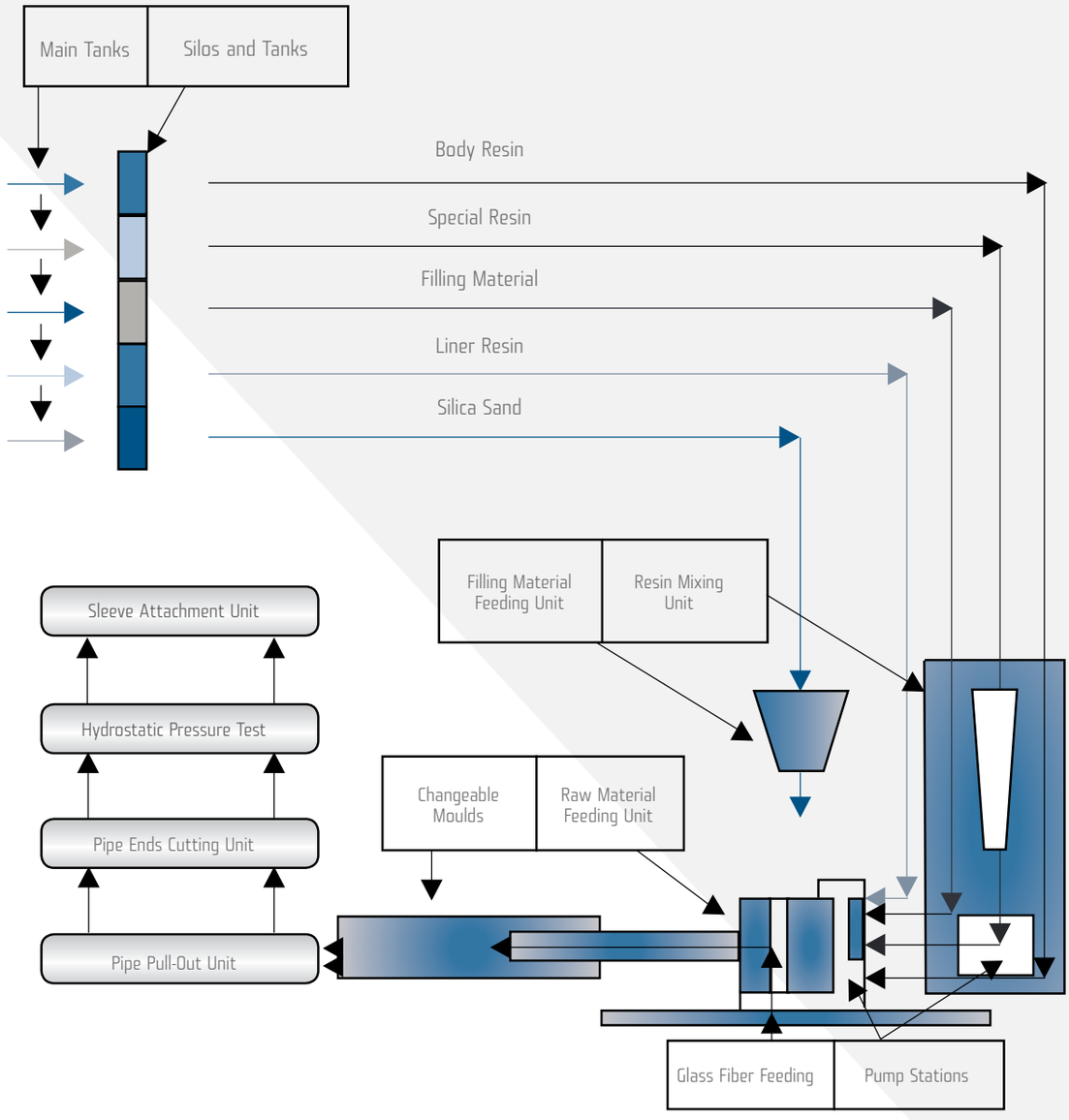
The cutting unit that is in harmony with the pipe which has axial and radial movement, ensures the clean cut of the glass reinforced pipe.

Upon entering the pipe length into the control system, cutting operation is realized automatically. Pipes can be cut at any length from 0.3 m up to 15 m. The pipes cut are received by the lifting tables that are specially designed, and afterwards, they pass to the calibration unit, then to the hydotesting unit.

The main machine used in the production is composed of a continuous steel band carried by beams that form a cylindrical mandreal.

As the mandreal moves under the control of programmable logic control system and computer, filling material, sand, glass, fiber, resin and surface materials are measured and applied in exact quantities.

Production Flow Chart



ENGINEERING FORMULA

HEAD LOSS

The Hazen Williams, Manning and Darcy; Weisbach methods are prevalently used to determine the local and continuous pressure loss.

Hazen-Williams Equation;

Hazen Williams equation is applicable to water pipes under conditions of full turbulent flow. Although not as technically correct as other methods for all velocities the Hazen Williams equation has gained wide acceptance in the water and wastewater applications.

Many engineers prefer a simplified version of the Hazen Williams equation.

$h_f = [3.35x10^6Q/(Cd^{2,63})]^{1,852}$
h_f : Friction factor, m of water /100 m
Q : How rate (L / sec)
C : Hazen Williams roughness coefficient,
(dimensionless)
Typical value for fiberglass pipe= 150
d : Pipe inside diameter, mm

Head Loss Converted to Pressure Loss;

p = [(hf/100)L (SG)]
p : Pressure loss, tone/m^2 (1 tone/ m^2= 9,81 kPA)
L : Line length (m)
SG : Specific gravity, dimensionless, (1 for water)

DIMENSIONS AND WEIGHTS OF GRP PIPES

Dimensions and weights of GRP pipes of all stiffness and pressure class are shown on table 1, 2 and 3.

THICKNESS & WEIGHT OF 2500 STIFFNESS PIPES

NOMINAL DIAMETER	OUTSIDE DIAMETER	6 BAR PRESSURE		10 BAR PRESSURE		12 BAR PRESSURE		16 BAR PRESSURE	
		Wall Thickness	Weight	Wall Thickness	Weight	Wall Thickness	Weight	Wall Thickness	Weight
mm	mm	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m
300	310	4,2	7,2	4,1	7,1	4,1	7,1	4,1	7,0
350	361	4,8	9,7	4,7	9,6	4,7	9,5	4,6	9,2
400	412	5,4	13	5	12	5	12	5	12
450	463	6	16	5,6	15	5,5	14	5,4	14
500	514	6,6	20	6	18	6	18	5,9	17
600	616	7,7	28	7	25	7	25	6,9	25
700	718	8,9	37	8,1	34	7,9	33	7,8	33
800	820	9,9	48	9	43	9	43	8,8	42
900	922	11,1	61	9,9	55	9,9	54	9,7	53
1000	1024	12,2	74	11	67	10,8	66	10,7	65
1100	1126	13,3	89	12	80	11,8	79	11,6	78
1200	1228	14,4	106	13	95	12,7	93	12,6	92
1300	1330	15,6	124	14	112	13,8	109	13,5	108
1400	1432	16,7	143	15	129	14,7	126	14,5	124
1500	1534	17,8	164	16	147	15,7	144	15,5	142
1600	1636	18,9	186	17	166	16,6	163	16,4	161
1700	1738	20	209	18	188	17,6	183	17,4	181
1800	1840	21,1	234	19	210	18,6	205	18,3	203
1900	1942	22,2	260	20	233	19,5	228	19,2	225
2000	2044	23,4	288	21	258	20,5	253	20,2	248
2100	2146	25	317	22	284	21,5	278	21,2	274
2200	2248	25,6	348	23	310	22,4	304	22,1	300
2300	2350	26,7	380	24	338	23,4	332	23	327
2400	2452	28	412	25	368	24,3	360	24	355
2500	2554	29	448	26	399	25,3	391	25	385
2600	2656	30	483	27	430	26,3	423	25,9	416
2700	2758	31,2	520	28	463	27,2	454	-	-
2800	2860	32,3	559	29	498	28,2	488	-	-
3000	3064	34,47	640	31	571	30,2	560	-	-
3200	3268	37,6	745,5	-	-	-	-	-	-
3400	3472	39,9	841,0	-	-	-	-	-	-
3500	3574	41,1	890,6	-	-	-	-	-	-
3600	3676	42,2	942,2	-	-	-	-	-	-
3700	3778	43,4	995,0	-	-	-	-	-	-
3800	3880	44,5	1049,1	-	-	-	-	-	-
4000	4084	46,8	1161,9	-	-	-	-	-	-

THICKNESS & WEIGHT OF 5000 STIFFNESS PIPES

NOMINAL DIAMETER	OUTSIDE DIAMETER	6 BAR PRESSURE		10 BAR PRESSURE		12 BAR PRESSURE		16 BAR PRESSURE	
		Wall Thickness	Weight	Wall Thickness	Weight	Wall Thickness	Weight	Wall Thickness	Weight
mm	mm	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m
300	310	5,1	8,9	5,1	8,9	5,0	8,7	4,9	8,6
350	361	5,9	12,1	5,8	11,9	5,7	11,7	5,5	11,4
400	412	6,71	16	6,31	15	6,16	15	6,01	14
450	463	7,52	20	6,96	19	6,79	18	6,6	18
500	514	8,35	25	7,62	23	7,42	22	7,22	22
600	616	9,81	35	9	32	8,7	31	8,44	30
700	718	11,27	48	10,31	44	9,96	42	9,68	41
800	820	12,66	61	11,57	56	11,23	54	10,9	53
900	922	14,15	78	12,91	71	12,52	69	12,13	66
1000	1024	15,61	95	14,22	87	13,79	84	13,32	81
1100	1126	17,06	115	15,51	104	15,03	101	14,54	98
1200	1228	18,51	136	16,81	123	16,29	120	15,75	116
1300	1330	19,98	159	18,17	145	17,56	140	17,05	136
1400	1432	21,51	185	19,52	168	18,83	162	18,23	157
1500	1534	22,9	211	20,8	192	20,1	185	19,48	180
1600	1636	24,29	239	22,08	217	21,37	210	20,67	203
1700	1738	25,81	270	23,43	245	22,64	237	21,86	229
1800	1840	27,2	302	24,71	274	23,92	265	23,11	256
1900	1942	28,73	336	25,99	304	25,17	295	24,29	285
2000	2044	30,12	372	27,34	337	26,38	325	25,48	314
2100	2146	31,64	410	28,62	371	27,71	359	26,73	346
2200	2248	33,03	449	29,97	407	28,97	394	27,92	379
2300	2350	34,41	488	31,24	444	30,17	429	29,16	414
2400	2452	35,93	533	32,35	480	31,44	466	30,35	450
2500	2554	37,34	577	33,88	524	32,72	506	31,6	489
2600	2656	38,86	625	35,16	565	33,99	547	32,79	527
2700	2758	40,22	671	36,42	608	35,17	587	-	-
2800	2860	41,76	723	37,78	654	36,51	632	-	-
3000	3064	44,56	827	40,42	751	38,99	724	-	-
3200	3268	50,3	996,0	-	-	-	-	-	-
3400	3472	53,3	1122,2	-	-	-	-	-	-
3500	3574	55,0	1190,7	-	-	-	-	-	-
3600	3676	56,5	1258,4	-	-	-	-	-	-
3700	3778	58,0	1328,0	-	-	-	-	-	-
3800	3880	59,6	1402,6	-	-	-	-	-	-
4000	4084	62,6	1551,1	-	-	-	-	-	-

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THICKNESS & WEIGHT OF 10000 STIFFNESS PIPES

NOMINAL DIAMETER	OUTSIDE DIAMETER	6 BAR PRESSURE		10 BAR PRESSURE		12 BAR PRESSURE		16 BAR PRESSURE	
		Wall Thickness	Weight	Wall Thickness	Weight	Wall Thickness	Weight	Wall Thickness	Weight
mm	mm	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m
300	310	6,3	11,2	6,3	11,1	6,2	11,0	6,0	10,6
350	361	7,3	15,2	7,3	15,2	7,1	14,8	6,8	14,2
400	412	8,39	20	8,15	19	7,84	19	7,49	18
450	463	9,44	25	9,04	24	8,67	23	8,28	22
500	514	10,5	32	9,95	30	9,53	29	9,08	27
600	616	12,39	45	11,74	43	11,25	41	10,74	39
700	718	14,28	61	13,55	58	12,62	54	12,32	52
800	820	16,1	78	15,31	74	14,6	71	13,87	67
900	922	18,03	99	17,12	94	16,34	90	15,49	85
1000	1024	19,92	122	18,92	116	18,02	110	17,09	104
1100	1126	21,81	147	20,67	139	19,73	133	18,65	126
1200	1228	23,68	174	22,46	165	21,39	157	20,24	149
1300	1330	25,59	204	24,26	194	23,11	184	21,88	175
1400	1432	27,54	237	26,1	224	24,82	213	23,53	202
1500	1534	29,36	271	27,87	257	26,52	245	25,08	231
1600	1636	31,19	307	29,65	292	28,23	278	26,64	262
1700	1738	33,14	347	31,42	329	29,88	313	28,28	296
1800	1840	34,96	387	33,2	368	31,58	350	29,83	331
1900	1942	36,92	432	34,97	409	33,29	390	31,45	368
2000	2044	38,74	477	36,75	453	34,93	431	33,03	407
2100	2146	40,69	526	38,52	499	36,64	474	34,59	448
2200	2248	42,51	576	39,76	539	38,34	520	36,22	492
2300	2350	44,32	628	42,12	597	39,97	567	37,6	534
2400	2452	46,27	684	43,9	650	41,68	617	39,34	583
2500	2554	48,11	742	45,07	695	43,4	670	40,97	633
2600	2656	49,26	790	47,46	762	45,1	724	42,54	683
2700	2758	51,85	863	49,2	820	46,72	779	44,08	735
2800	2860	53,82	930	50,99	881	48,46	838	-	-
3000	3064	57,49	1065	54,61	1012	51,81	961	-	-
3200	3268	68,7	1355,0	-	-	-	-	-	-
3400	3472	73,0	1529,0	-	-	-	-	-	-
3500	3574	75,0	1619,0	-	-	-	-	-	-
3600	3676	77,2	1712,2	-	-	-	-	-	-
3700	3778	79,3	1809,6	-	-	-	-	-	-
3800	3880	81,5	1908,4	-	-	-	-	-	-
4000	4084	85,7	2113,1	-	-	-	-	-	-

ALFEBOR GRP Pipes provide the following advantages;

- Complete assurance that the material will not pollute the conveyed water(non toxic pipes)
- Negligible roughness of surface even at long term and therefore, assurance that maximum performance will bemaintained after a long period of time
- Inertness to aggressive agents of the ground and complete freedom from attacks by mildew and microorganisms
- Inertness throughout the whole thickness of the pipe, which certainly means that any damage to the pipe causing a local breakdown will not lead to any propagation of the corrosive effects
- Very little aging which has already been taken into account in the safety factors during the design
- No need for secondary coatings which would require periodical inspection and maintenance
- No need for passive protection
- Structural continiuity of the pipeline owing to the homogeneity of the joints
- Easy to transport, handle and lay
- Smooth interior surface reducing friction and minimizingthe operating pumping cost of pressure lines
- Easy flexible joining system reducing installation time and cost, avoiding infiltration/ex-filtration of ground water and allowing small changes in the pipe line without the need of expensive fittings
- Sleeve couplings combined with gaskets provide 100% tightness
- The elastic characteristic of GRP Pipes enables the accommodation to earth movements. For this reason GRP pipes are preferred in seismic zones. Elasticity also reduces the quantities of bends used in the Project

PERFORMANCE STANDARTS

The standarts developed by ASTM, AWWA and ISO; cover a series of glass reinforced pipe applications that also include water, domestic waste water and chemical agent transport. The common point of all those standarts, is that they are all performance-based. In other words the performance tests required for GRP Pipes are determined in those standarts.

ASTM

Today there are different ASTM Product Standarts that are used for various glass reinforced pipe applications. ALFEBOR GRP Pipes are designed in a way to meet all these ASTM Standarts.

ASTM D 3262 Non-Pressure Wastewater Pipe
ASTM D 3517 Pressure Pipe for Fresh Water
ASTM D 3754 Pressure Wastewater Pipe

AWWA

AWWA C950 is one of the valid, most extensive product standarts concerning glass fiber reinforced pipes. In this standart, there are extensive requirement articles focusing on the quality control and prototype competency tests for the pipes and couplings to be used in the pressure water line applications. Alfebor GRP Pipes are designed in a way to meet the performance requirements of this standart.

AWWA C950 Glass Fiber Pressure Pipes, for Fresh Water
AWWA M45 Glass fiber Pipe Design Guide.

ISO

This product Standard is valid for GRP pipes of 50 mm to 4000 mm that are used in water and wastewater applications. It includes the competency tests for pipe and sleeves and all the product tests. ALFEBOR GRP Pipes meet the requiremnts of this standart.

ISO/DIS 0467.3 Wastewater And Drainage
ISO/DIS 0639.3 Clean Water for pressure or non pressure pipes

OTHER STANDARTS

The other standardization organizations such as BS and DIN also had published performance specifications for GRP pipes. ALFEBOR meets the performance requirements of these standarts to the extend that they do not conflict with AWWA C950.

DIN 16869 Glass fiber reinforced polyester resin pipes and fittings.
BS5480 Pipe and coupling elements for the water and wastewater applications.

RAW MATERIALS

Raw materials are supplied together with the certificates of conformity with the quality criteria determined by ALFEBOR. In addition to this, all the raw materials and incoming materials for production are subjected to sample tests.

With these tests, pipe raw materials are assured to comply with the determined specifications.

Glass Fiber
Direct Roving Fibers: are supplied in a cylindrical package, as bobbins so that the thread structures would not be damaged.
Choppable Fibers: are distrubuted in the pipe by cutting in a way similar to the single-direction continuous fiber.
Reinforcing Fiber Filaments: are held together with the help of adhersive resin.

Resin
Polyester resin is dissolved in styrene monomer, this way, the resin is provided to acquire its final thermoset structure with these cross bonds. Organic peroxide catalyst is being used in order to cure polyester resin.

Silica Sand
Sand is used in order to increase the rigidity of the pipe and it is around the neutral axis of the pipe. The sand used generally has high silica content.

PERFORMANCE TESTS

It is a common subject requested by all the standards, from the pipe producer for proving by sampling, the compliance of the pipe with the minimum performance requirements. This minimum performance requirements for GRP pipe are both for short term and long term.

The most important ones are expressed in all the previously described standards as;

1- JUNCTION
2- INITIAL RING DEFLECTION
3- LONG TERM PRESSURE RESISTANCE
4- CORROSION STRAIN CAPACITY

ALFEBOR is carefully performing the all mentioned tests in order to control whether the requirements TS 4355, TS EN 1796, TS EN 14364, ASTM D 3262, ASTM D 3517, AWWA C950, DIN 16869, ISO 10467 and ISO 10639.

1- JUNCTION

Coupling Tests

This important performance test is realized in compliance with ISO 10639 Standard with coupling prototypes made with elastomeric gasket sealed sleeves. This is a standard which is valid for the entire pipe industry and which had determined the coupling performance requirement of the pipes of all types of materials and for each pressure class and diameter.

For the simulated laying conditions, flexible coupling is expected to resist against the hydrostatic pressure. The pressures applied in this test are 100kPA (1 bar) for non-pressure pipes and 1.5 times the operation pressure for the pressure pipes. Additional configurations are linear line, maximum angular turning and differential cutting loads. It also includes some fatigue pressure tests.

2- INITIAL RING DEFLECTION

2.1 Initial Ultimate Deflection in the pipes that are laid underground.
The allowable deflection value is not specified in ISO Standard system, however, this value can be calculated from ISO TR 10465 - 3: 1999 Standard.

ALFEBOR produces GRP pipes in a way to meet;
- ISO/DIS 10639 - GRP Pipe System in Providing Water
- ISO/DIS 10467 - GRP Pipe System in Drainage and Waste Water Applications Standards

And also the mechanical requirements of ANSI/AWWA C950 standard.

The design procedures in AWWA M-45 Glass Fiber Pipe Design Manual for Water Applications should be followed.

2.2 Minimum Axial Strength
ISO initial values are given as N/mm in unit circumference in relation with the pipe pressure class and diameter. Minimum axial strength values in AWWA are given as lbf/inch in unit circumference correlated with the pipe pressure class and diameter.

2.3 Initial Failure (Burst) Pressure
Initial blasting pressure is based on long term safe blasting pressure and the regression factor is obtained from the long term static internal pressure. This test methods applied by using the static pressure are similar in ISO and AWWA, but long term safety factors are different.

3- LONG TERM PRESSURE RESISTANCE

3.1 Hydrostatic design base - HDB
Another important competency test is hydrostatic design base - HDB determination test. This test is realized in compliance with ASTM D2992 Procedure B or ISO and high constant hydrostatic pressure is applied on many pipe samples until they leak. The pressure on which the leaking occurs (or the ring strain resistance) and the time values are extrapolated to 50 years on the logarithmic basis.

Extrapolated damage pressure (strain) value or HDB, should be at least 1.6 times the pressure class of the concerned operation (strain for the related pressure class). In other words, the design criteria, pressure value of the constant pressure pipe for being resistant for 50 years, should be minimum. On the other hand, as the effects of the internal pressure and external burdens on the pipe design is considered as result, the security of the pipe depends on the condition that the internal pressure must be higher than 1.6 as per to the condition stated above. HDB test guarantees long term pipe performance in the application of pressured pipes.

3.2 Leak test

Leak test may be realized by two methods in ISO GRP pipe system: The first one is experimenting each pipe with a pressure which is 1.5 times of its pressure class. Here, the test period is not specified.

The second method is based on subjecting a sample to a test for 6 minutes under very high pressure. Test pressure is determined from the regression curved obtained from the long term static pressure test. This way, if the long term safety factor is equal to the value calculated from ISO DTR 104-65 - 3, then there will be a failure risk of 6.5%.

3.3 Long Term Ultimate Deflection

Although there is no requirement in AWWA C 950 related to long term deflection, it requires the producer company to determine the deflection value that is convenient for it and announce it. This value which is shown by Sb symbol is defined as strain (elongation % in breaking off).

In ISO, long term deflection is defined as % and it is as Level A deflection without the formation of pipe crack.

Level B is the requested structural strength, values in parantheses are the requirement of AWWA C 950 (e.i. table 4)

The requirements are same on both methods.The pipes laid underground should operate under nominal pressure. This means that the deflection of the laid pipe should also be taken into account.

This state is explained in ISO in ISO DTR 10465 - 3 Attachment G. The safety factors for the long term average minimum values are given in the following table. The values given above are determined according to 9% deviation coefficient. For higher deviations, the safety factor should be increased.

In AWWA, long term safety factor for aboveground and underground laying is constant and this value is 1.8. The calculation should be made in compliance with AWWA M-45 Article 5.7.4.

Pressure class where safety factor will be applied	PN 32	PN 25	PN 16	PN 10	PN 6	PN 4	PN 2
97.5% long term LCL value,nt PN (97.5% LCL)	1,3	1,3	1,45	1,55	1,6	1,65	1,7
Long term average value,nt, PN mean	1,6	1,6	1,8	1,9	2,0	2,05	2,1

4- CORROSION STRAIN CAPACITY

This is the only and important pipe performance requirement test that is applied by subjecting the sample for the non-pressure pipes for sewage water, to deflection in chemicals and it is a special test performed for glass fiber pipes that transport chemical materials.

This test is performed by subjecting at least 18 ring samples taken from the pipe, to be deflected at various levels and by keeping them constant at this position according to ASTM D3681 and ISO 10952. The strained samples under the load are subjected to sulfuric acid of 1.0 N (5% by weight) from their internal bottom surfaces. This way, septic waste water medium is simulated. This state represents the Central Asia conditions where the worst septic waste water medium shown and where GRP applications are realized succesfully.

By using the smallest squares analysis method, minimum corrosion strain value extrapolated for 50 years should be equal to the value shown for each stiffnes class.

The value obtained this way shows the safe installing limitations during the design of GRP pipes to be used in these type of applications.

As ISO requirement, level A and level B values are used in order to form a regression formula. Calculations for 1.000, 3.000 and 10.000 hours are made from these deflection values. Test samples are kept at this deflection value and they are requested not to encounter any structural damage at the period calculated by the regression formula.

The environmental and axial load bearing capacities of the pipes produced are proved by routine tests. Additionally, pipe structure and composition are controlled by tests and approved.

Controls at the stage of production:

- Visual examination
- Barcol hardness
- Wall thickness measurement
- Pipe length
- Diameter measurement
- Hydrostatic leak-proof test

The controls realized by taking sample:

- Pipe rigidity
- Deflection test performed without damage and structural damage
- Ring tensile strength
- Axial tensile strength

QUALITY CONTROL

ALFEBOR GRP Pipe production technology includes a detailed quality control program. The compliance of the production and testing of the pipes and fittings with the international and Turkish standards is provided by this program.

Quality Control Tests

Raw material is tested before the production. Tests include the compliance of the raw materials and the products produced (pipe, sleeve, fitting) with the standards.These tests guarantee the compliance of the pipe materials used with the specified tests. Certification works within the direction of ISO 9001 standards are provided by the total quality concept that is applied with the joint participation of the employees at ALFEBOR.

Measured Qualities	Limits of change
Pipe wall thickness	Avt single spot (-10% of nominal thickness)
Visual inspection	Standard
Pipe length	± 100 mm
Pipe diameter	± 1 mm
Pipe hardness	± 5 BarcoL
Pipe stiffness	ASTM D-2412 Standard
Tensile strength	ASTM Standart D-638 Standard
Peripheral tensile strength	ASTM Standart D-2290 Standard
Laminate bonding	ASTM Standard D-2584 Standard

Classification of the pipes according to their operation pressures is according to the criterias included in AWWA C 950 Standard and characteristics included in M 45.

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FUNDAMENTAL DESIGN FEATURES

FLOW VELOCITY

The recommended maximum flow velocity for a Standard GRP pipe:

$$u = \frac{48}{(p)^{0,33}}$$; u= fluid speed (ft/sn), p= fluid density (lb/ft^3) (for water; 62.4 lb/ft3)

(AWWA M-45 Manuel)

FLOW COEFFICIENT

The roughness coefficient to be used for ALFEBOR GRP pipes in hydraulic calculations:

For Hazen-William flow coefficient	: C= 150
For Manning coefficient	: n= 0.009
For Colebrook – White coefficient	: k= 0.029 mm

UV RESISTANCE

There is no evidence related to ultraviolet rays decreasing the long term performances of ALFEBOR GRP Pipes. It is observed that is only effects by changing the color of the outer surface of the pipe. If desired, the laying contractor is able to paint the outer surface of ALFEBOR GRP pipe by 2 part urethane paint that is compatible with GRP material. However, this application will be one which will require maintenance in future.

POISSON RATIO

Poisson ratio is influenced by the pipe structure. For ALFEBOR GRP Pipe, its equivalence to the circumferential load in the axial direction is in between 0.22 – 0.29. Poisson ratio to the axial load in the circumferential is a little lower.

TEMPERATURE

The maximum allowable temperature value in transport of the industrial wastes without any need to decrease the pressure class is 35°C - 50°C, it is recommended to decrease the pressure class one level.In such a case, PN 16 pipe can be used as PN 10 pipe.

THERMAL COEFFICIENT

longation and shortening thermal coefficient in the axial direction of ALFEBOR GRP Pipes:

(24) to (30) x $\frac{1}{10^6}$ mm/mm/°C

COUPLING ANGULAR DISPLACEMENT

Couplings will be tested extensively according to ASTM D 4161 and ISO DIS 8369 and their competency will be assured. The maximum angular displacement measured from the difference of the central line of two consecutive pipes at the coupling location of each sleeve should not exceed the values given in the following table.

ALFEBOR GRP coupling enabling angular deflection frob 0.5 to 3 degrees propartional top ipe diameter under pressure and decreases by the number of elbows.Pipes should be connected by linear adjustment then the angular displacement at the desired value should be made.

CLASSIFICATION AND REFERENCE STANDARTS

STIFFNESS CLASSIFICATION

The stiffness classificaiton in ISO standards is made according to N/m^2 unit. As shown in Table 2, minumum initial rigidity is defined for two different series.

Nominal Diameter (mm)	Angular Deviation (Degree)
DN ≤ 500	3,0
600 ≤ DN ≤ 900	2,0
1000 ≤ DN ≤ 1800	1,0
DN >1800	0,50

Table 2: Nominal stifness Values (ISO)

Original GRP Series	Thermoplastic Pipes
SN 630	SN 500
SN 1250	SN 1000
SN 2500	SN 2000
SN 5000	SN 4000
SN 10000	SN 8000

In AWWA C950, rigidity is defined as – psi – unit and it is very close to the values in psi unit.

Table 3: Stiffness comparison between

ISO	AWWA
SN 1250	9 psi
SN 2500	18 psi
SN 5000	36 psi
SN 10000	72 psi

Long Term Stiffness: No requirements concerning long term rigidity are determined neither in ISO nor in AWWA.

PRESSURE CLASSES

The pressure classes in ISO (PN) are determined by accepting the bar unit fort he pressuer to be applied. Nominal pressure classifications: PN 1, (2,5),(4), 6, (9), 10, (12), (15), 16, (18), (20), 25, 32. The values in the parenthesis are the pressure classes that are not preferred, as nominals. PN 1 pressure class is for the non pressure pipes (that liquid flows by gravity)

In AWWA C 950, GRP nominal pressures are classified as follows: Psi: 50, 100, 150, 200, 250

INITIAL ULTIMATE DEFLECTION

The initial deflection requirements are same in ISO and AWWA C 950 and the same classification system given in Table 4 is valid in both standarts.

Table 4: İnitial deflection requirements İn ISO/AWWA C 950

Class	Level A	Level B
SN 500	24,4	40,8
SN 625	22,7	37,8
SN 1000	19,4	32,4
SN 1250	18,0 (18)	30,0 (30)
SN 2000	15,4	25,7
SN 2500	14,3 (15)	23,9 (25)
SN 4000	12,2	20,4
SN 5000	11,3 (12)	18,9 (20)
SN 8000	9,7	16,2
SN 10000	9,0 (9)	15,0 (15)

Level A is the requested reflection where no damage on pipe (bore cracking) is allowed to ocur. Level B is the required structural strength. Values in parantheses are requirements of AWWA C 950.

BAĞLANTI PARÇALARI

ALFEBOR CTP boru bağlantı parçaları uluslararası standartlara uygun olarak CTP borular için geliştirilmektedir. Bunlar sulama suyu, içme suyu, atık su ve kanalizasyon suyunun yer çekimi ya da basınç ile taşınmasında kullanılır.

FITTINGS

ALFEBOR GRP Pipe coupling parts are developed for GRP Pipes in compliance with international standarts. They are being used in transport of the irrigation water, potable water, wastewater and sewerage water by gravity or pressure.

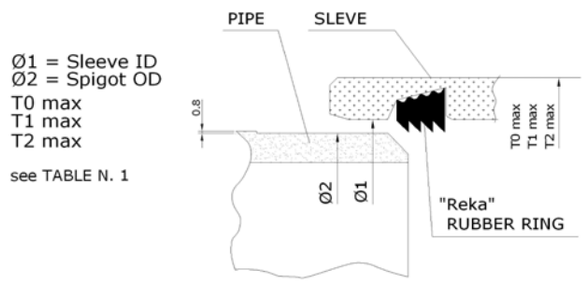
300-4000 mm BORULARIN BAĞLANTI BOYUTLARI

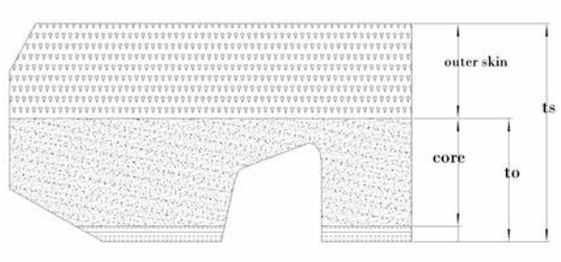
REKA kauçuk halka bulunan bağlantıların boyutları ve kesit detayları aşağıdaki tablolarda sunulmuştur:

COUPLING DIMENSION OF 300 – 4000mm PIPES

Coupling dimensions and section details with "REKA" rubber ring are shown on tables:

MANŞON BOYUTLARI
DIMENSIONS OF JOINT PARTS



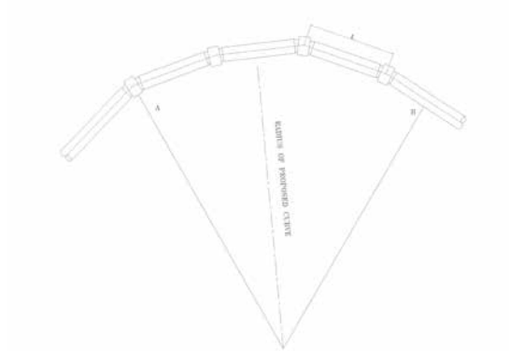


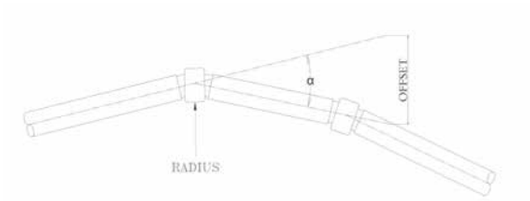
ts = Manşon et kalınlığı - Sleeve Thickness
t0 = İç yüz - Inner Skin
t1 = Dış yüz - Outer Skin
Ǿ1 = Manşon iç çapı - Sleeve ID
½ = Manşon yarı uzunluğu - Half the length of coupling.

MANŞON BOYUTLARI - COUPLING DIMENSIONS

Nominal Size ND(mm)	Pipe Spigot Diameter OD(mm)	Pipe Spigot Diameter	
		Upper Limit	Lower Limit
300	310	+1.0	-1.0
350	361	+1.0	-1.2
400	412	+1.0	-1.4
450	463	+1.0	-1.6
500	514	+1.0	-1.8
600	616	+1.0	-2.0
700	718	+1.0	-2.2
800	820	+1.0	-2.4
900	924	+1.0	-2.6
1000	1026	+2.0	-2.6
1100	1128	+2.0	-2.6
1200	1229	+2.0	-2.6
1300	1332	+2.0	-2.6
1400	1434	+2.0	-2.8
1500	1536	+2.0	-2.8
1600	1638	+2.0	-2.8
1700	1740	+2.0	-2.8
1800	1842	+2.0	-3.0
1900	1944	+2.0	-3.0
2000	2046	+2.0	-3.0
2100	2148	+2.0	-3.0
2200	2250	+2.0	-3.2
2300	2351	+2.0	-3.2
2400	2453	+2.0	-3.4
2500	2556	+2.0	-3.4
2600	2658	+2.0	-3.6
2800	2861	+2.0	-3.8
3000	3066	+2.0	-4.0
3200	3270	+2.0	-4.2
3400	3474	+2.0	-4.4
3600	3678	+2.0	-4.6
3800	3882	+2.0	-4.8
4000	4082	+2.0	-5.0

İZİN VERİLEN EKLEM AÇISI SAPMA ORANI
ALLOWABLE JOINT ANGULAR DEFLECTION





Boru eksenleri arasındaki maksimum açısal değişiklik (bağlantının iki yanında eşit olarak dağıtılan), aşağıdaki tabloda verilen miktarları aşmamalıdır:

The maximum angular change of direction between pipe axis (equally distributed at both sides of the coupling) must not exceed the amount given in the following table:

Nominal Boru Çapı Nominal Pipe Diameter (mm)	Nominal Sapma Oranı (α derece) Nominal Deflection (α degree)	Nominal offset (mm)			Nominal Kurvatür Yarıçapı Nominal radius of curvature (m)		
		Kesit Uzunluğu Section lengths			Kesit Uzunluğu Section lengths		
		3 m	6 m	12 m	3 m	6 m	12 m
350 to 500	3.0	157	314	629	57	115	229
600 to 900	2.0	105	210	419	86	172	344
1000 to 1200	1.5	79	157	314	114	229	458
1300 to 1800	1.0	52	105	210	172	344	687
1900 to 2600	0.5	26	52	105	344	687	1375

EK PARÇALAR

Yukarıda belirtilen çap ve basınç aralıklarında CTP ek parçaları mevcuttur ve şev kesimli süreç kullanarak aynı borudan yapılır ve flanşlar da dahil olmak üzere diğer boru ürünleri, düktil demir, çelik, beton, plastik ve vana gibi diğer parçalara bağlantı sağlamak için kullanılır.

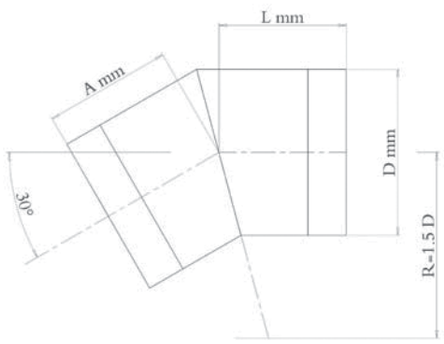
En yaygın ek parçalar dirsek, T boru, Y boru ve CTP boruları diğer boru materyallerine bağlayan flanşlardır. Ek parçalar standart çift taraflı manşon bağlantısı, laminasyon süreci ya da flanşlar kullanılarak CTP borulara eklenebilir.

FITTINGS

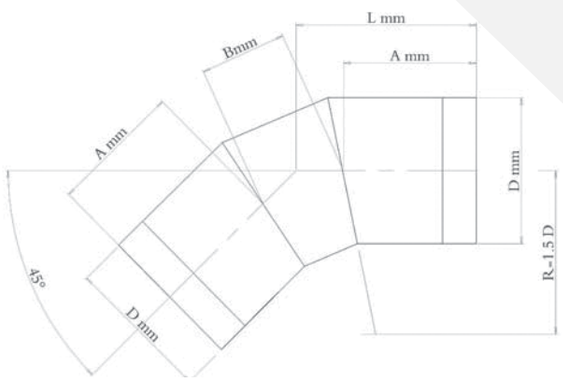
GRP fittings for all above diameter and pressure ranges are available and are made from the same pipe using the mitered process and are available for various connections, including flanges, to allow connection with other pipe products, ductile iron, steel, concrete, plastic and valves.

These most common fittings are Elbows, Tees, Wyes and Flanges to connect GRP pipes to other pipe materials. Fittings can be joined to GRP pipes using the Standard Double bell coupling, lamination process or flanges.

DİRSEK - ELBOW



30 ELBOW



45 ELBOW

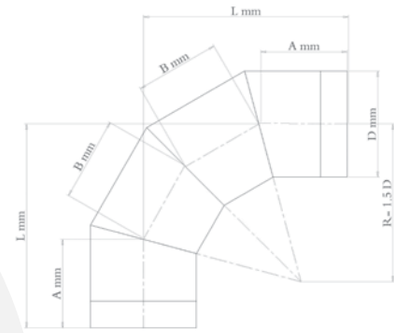
30° ELBOW – 1 METER

D (MM)	A (MM)	L (MM)
400	400	400
450	400	400
500	450	450
600	500	500
700	550	550
800	600	600
900	650	650
1000	650	650
1100	650	650
1200	700	700
1300	750	750
1400	800	800
1500	900	900
1600	950	950
1700	1000	1000
1800	1050	1050
1900	1150	1150
2000	1200	1200
2100	1250	1250
2200	1300	1300
2300	1350	1350
2400	1450	1450
2500	1500	1500

45° ELBOW – 2 METER

D (MM)	A (MM)	B (MM)	L (MM)
400	400	239	529
450	400	269	545
500	450	299	612
600	500	358	694
700	550	418	775
800	600	478	859
900	650	537	941
1000	700	597	1023
1100	750	657	1106
1200	800	716	1188
1300	850	776	1270
1400	900	836	1352
1500	950	895	1434
1600	1000	955	1517
1700	1050	1015	1599
1800	1100	1074	1681
1900	1200	1134	1814
2000	1250	1194	1896
2100	1300	1253	1978
2200	1350	1313	2061
2300	1400	1373	2143
2400	1450	1432	2225
2500	1500	1492	2308

60 ELBOW



90 ELBOW

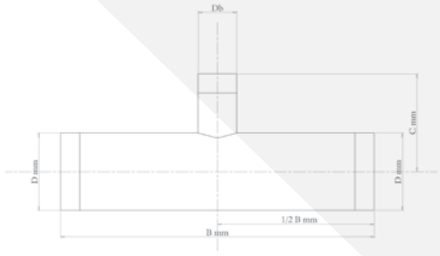
60° ELBOW – 2 METER

D (MM)	A (MM)	B (MM)	L (MM)
400	400	322	586
450	400	362	609
500	450	402	682
600	500	482	778
700	550	563	875
800	600	643	971
900	650	724	1068
1000	700	804	1164
1100	750	884	1260
1200	800	965	1357
1300	900	1045	1503
1400	1000	1126	1650
1500	1100	1206	1796
1600	1200	1286	1943
1700	1300	1367	2089
1800	1400	1447	2235
1900	1500	1527	2382
2000	1600	1608	2528
2100	1650	1688	2625
2200	1750	1769	2771
2300	1850	1849	2918
2400	1900	1929	3014
2500	2000	2010	3160

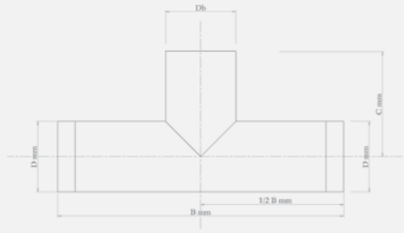
90° ELBOW – 3 METER

D (MM)	A (MM)	B (MM)	L (MM)
400	400	322	840
450	400	352	895
500	450	402	999
600	500	480	1158
700	550	563	1319
800	600	643	1478
900	650	724	1639
1000	700	804	1798
1100	750	884	1958
1200	800	965	2118
1300	900	1045	2328
1400	1000	1126	2538
1500	1100	1206	2747
1600	1200	1286	2957
1700	1300	1367	3167
1800	1400	1447	3377
1900	1500	1527	3586
2000	1600	1608	3797
2100	1650	1688	3956
2200	1750	1769	4167
2300	1850	1849	4376
2400	1900	1929	4535
2500	2000	2010	4746

T PIPE



T90° Db< 1/2 D



T90° Db> 1/2 D

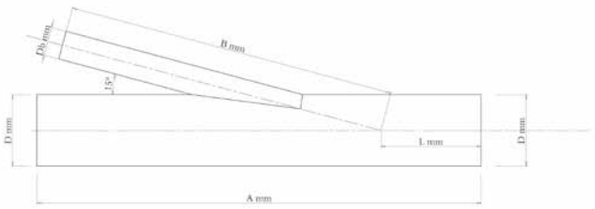
90° T (Db < ½ D)

D (MM)	B (MM)	C (MM)
400	1000	570
450	1050	650
500	1080	670
600	1220	760
700	1350	850
800	1480	940
900	1650	1030
1000	1750	1130
1100	1880	1220
1200	2020	1310
1300	2150	1402
1400	2300	1490
1500	2420	1590
1600	2550	1680
1700	2700	1770
1800	2850	1860
1900	3000	1950
2000	3100	2050
2100	3210	2140
2200	3400	2230
2300	3500	2320
2400	3750	2420
2500	3800	2510

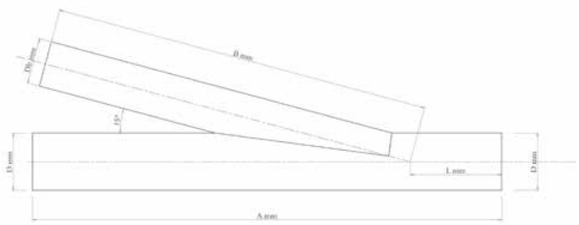
(Db > ½ D)90° T

D (MM)	B (MM)	C (MM)
400	1400	700
450	1500	750
500	1600	800
600	1800	900
700	2050	1025
800	2300	1150
900	2550	1275
1000	2800	1400
1100	3050	1525
1200	3300	1650
1300	3550	1775
1400	3800	1900
1500	4050	2025
1600	4300	2150
1700	4550	2275
1800	4800	2400
1900	5050	2525
2000	5300	2650
2100	5550	2775
2200	5800	2900
2300	6050	3025
2400	6300	3150
2500	6550	3275

Y PIPE



Y 15° Db< 1/2 D



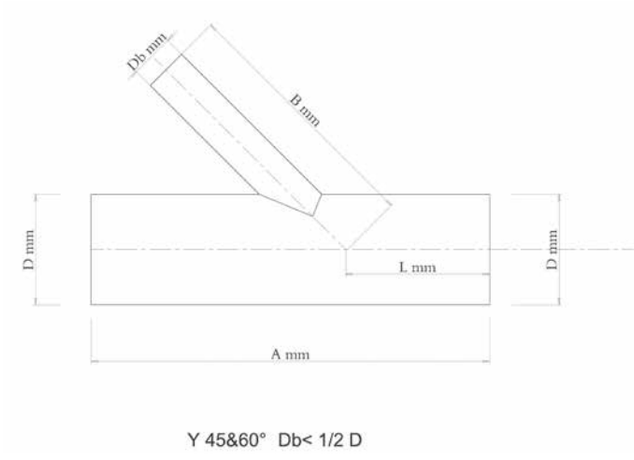
Y 15° Db> 1/2 D

15° Y (Db < ½ D)

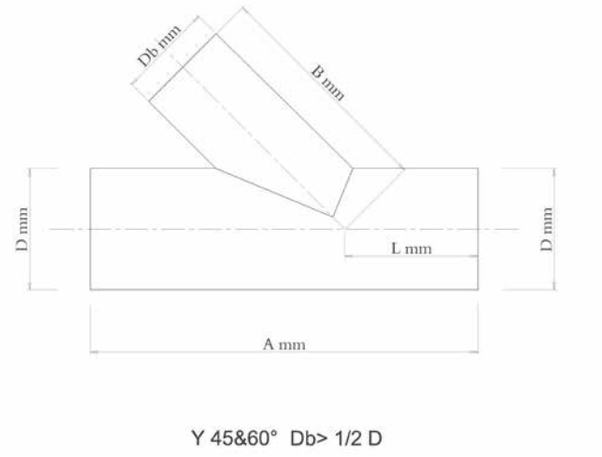
D (MM)	A (MM)	B (MM)	L (MM)
400	2500	1900	600
450	2800	2100	700
500	3100	2300	800
600	3550	3650	900
700	4000	3000	1000
800	4500	3400	1100
900	4900	3800	1200
1000	5100	4200	1300
1100	5700	4550	1400
1200	6200	4950	1500
1300	6700	5300	1600
1400	7200	5500	1700
1500	7700	5800	1800
1600	8350	6000	1900
1700	8850	6300	2000
1800	9300	6700	2100
1900	9800	7100	2200
2000	10300	7300	2300
2100	10750	8000	2400
2200	11250	8300	2500
2300	11700	8500	2600
2400	12200	8700	2700
2500	12650	8900	2800

15° Y (Db > ½ D)

D (MM)	A (MM)	B (MM)	L (MM)
400	3500	2900	600
450	3800	3100	700
500	4100	3300	800
600	4550	3650	900
700	5000	4000	1000
800	5500	4400	1100
900	6000	4800	1200
1000	6500	5200	1300
1100	6950	5550	1400
1200	7450	5950	1500
1300	7900	6300	1600
1400	8400	6700	1700
1500	8900	7100	1800
1600	9350	7450	1900
1700	9850	8580	2000
1800	10300	9200	2100
1900	10800	9600	2200
2000	11300	10000	2300
2100	11750	10350	2400
2200	12250	10750	2500
2300	12700	11100	2600
2400	13200	11500	2700
2500	13650	11850	2800



Y 45&60° Db< 1/2 D



Y 45&60° Db> 1/2 D

45°& 60° Y (Db < ½ D)

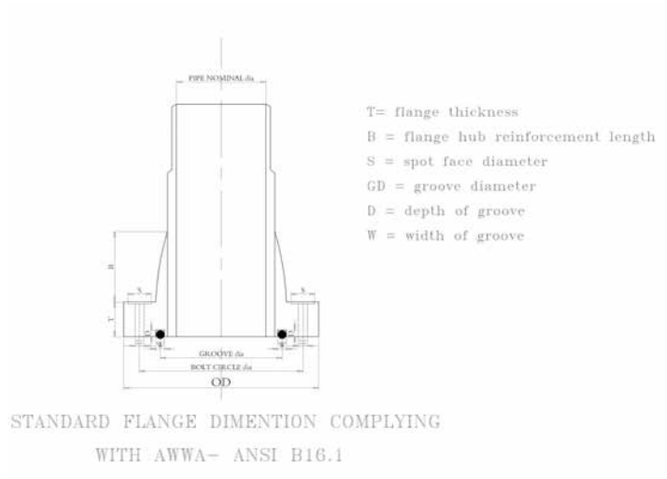
D (MM)	A (MM)	B (MM)	L (MM)
400	1550	1000	550
450	1700	1100	600
500	1800	1150	650
600	2050	1300	750
700	2350	1500	850
800	3650	1700	950
900	3950	1900	1050
1000	3250	2100	1150
1100	3550	2300	1250
1200	3850	2500	1350
1300	4150	2700	1450
1400	4450	2900	1550
1500	4750	3100	1650
1600	5050	3300	1750
1700	5350	3500	1850
1800	5650	3700	1950
1900	5950	3900	2050
2000	6250	4100	2150
2100	6550	4300	2250
2200	6850	4500	2350
2300	7150	4700	2450
2400	7450	4900	2350

45°& 60° Y (Db > ½ D)

D (MM)	A (MM)	B (MM)	L (MM)
400	1250	850	400
450	1500	900	500
500	1600	950	550
600	1750	1100	600
700	2050	1300	700
800	2350	1400	800
900	2550	1600	850
1000	2660	1700	900
1100	2950	1800	950
1200	3250	2000	1050
1300	3550	2200	1150
1400	3760	2400	1200
1500	3950	2600	1250
1600	4100	2700	1300
1700	4300	2800	1350
1800	4600	2900	1450
1900	4800	3000	1500
2000	5000	3100	1550
2100	530	3200	1650
2200	5500	3300	1700
2300	5700	3400	1750
2400	5850	3600	1800

FLANGES

STANDART FLANGE DIMENSION COMPLYING WITH AWWA - ANSI B16.1

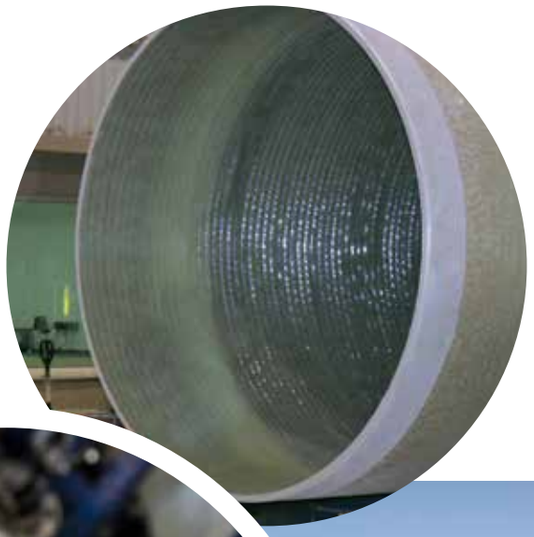


Nominal Dia.		Flange Thick.	Flange OD	Groove Diameter	DRILLING STANDARDS					
					AWWA Class D			ANSI B 16.1 Class 125		
mm	inç	T(mm) +10	+10-0	GD (mm)	No of Bolts	Bolt hole Dia+1.5	Bolt Circle Dia	No of Bolts	Bolt hole Dia+1.5	Bolt Circle Dia
350	14	45	537	399.3	12	31.6	476.3	12	31.6	476.3
400	16	47	601	434.3	16	34.8	539.8	16	31.6	539.8
450	18	52	645	485.3	16	34.8	577.9	16	34.8	577.9
500	20	53	703	536.3	20	34.8	635	20	37.8	635
600	24	57	823	638.3	20	37.8	749.3	20	37.8	749.3
700	28	66	937	743.9	28	37.8	863.6	-	-	-
800	32	72	1064	845.9	28	44.1	977.9	-	-	-
900	36	78	1172	947.9	32	44.1	1085.9	32	44.1	1085.9
1000	40	83	1287	1049.9	36	44.1	1200.2	-	-	-
1100	44	93	1401	1155.8	40	44.1	1314.5	-	-	-
1200	48	98	1509	1257.8	44	44.1	1422.4	44	44.1	1422.4
1300	52	104	1636	1359.8	44	50.5	1536.7	-	-	-
1500	60	115	1858	1563.8	52	50.5	1759	52	50.5	1758.9
1700	66	130	2030	1771.7	52	50.5	1930.4	-	-	-
1800	72	136	2194	1873.7	60	50.5	2095.5	60	50.5	2095.5
2000	78	147	2373	2077.7	64	56.8	2260.6	-	-	-
2100	84	155	2537	2182.3	64	56.8	2425.7	64	56.8	2425.7
2300	90	167	2715	2386.3	68	63.3	2590.8	-	-	-
2400	96	174	2880	2488.3	68	63.3	2755.9	68	63.3	2755.9

TRANSPORTATION AND STORAGE

GRP pipes are transported on wood cradles and secured in place using polyester or nylon straps. Pipes should not touch each other to avoid rubbing during transportation. Insert 5mm PE sheet between pipes and do not over deflect the pipes by the straps since this can damage the pipes.

Do not drop the pipes and do not store them on stones or other sharp objects.



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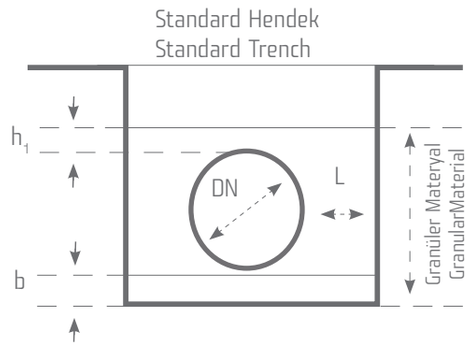
BORU SANAYİ ve TİCARET A.S.

PIPE INSTALLATION

Standard type of trench prepared for mounting the GRP pipes is illustrated shematically below. GRP pipes are manufactured in SN2500, 5000 and 10000 N/m² stiffness categories and offer alternative types for mounting depending on the loads, (live loads, backfill loads, etc) In general the bedding material is preferred to be the same material being used for the initial backfill.h = D/2 (max.300 mm), b= D/4 (min. 150 mm)



PARTICLE SIZE	
DN (mm)	a (mm)
<300	10
300-600	15
700-1000	20
>1000	30

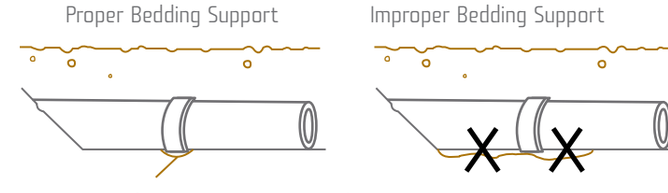
CUSHION LAYER	
DN	b (mm)
300	75
350-500	100
600-2500	150

If the soil removed from the trench will be used as backfill material in pipezone, the particle size allowed should not exceed two times the standard values.

WORK AREA	
DN (mm)	L (mm)
200-350	150
400-500	200
600-900	300
1000-1600	450
1800-2600	600

PIPE ZONE BACKFILL MATERIAL (ASTM D2487)	
ÇAKIL, GRAVEL	GW, GP, GW-GC, GW, GM, GP-GC, GP-GM
İNCE KUM FINE SAND	SW, SP, SW-SC, SW-SM, SP-SC, SP-SM
SAND	SW, SP, SW-SC, SW-SM, SP-SC, SP-SM, SM*, SC* GM*, GC*

The initial deflection limit of GRP pipes installed underground is, %3 for pressure pipes DN≥300 mm and %6 for gravity pipes DN≥300 mm



Support Bell Hole (fill after completing pipe joint)

Water Control

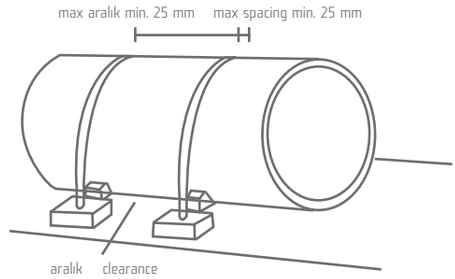
Water Control:It is always good practice to remove water from a trench before laying and backfilling pipe. Well points, deep wells, geotextiles, perforated underdrains or stone blankets of sufficient thickness should be used to remove and control water in trench. Groundwater should be below the bottom of the cut at all times to prevent the washout from behind sheeting or sloughing of exposed trench walls. To preclude loss of soil support, dewatering methods should be employed for minimizing the removal of fines and the creation of voids within in situ materials. Suitable graded materials should be used for foundation layers to transport running water to sump pits or other drains.

Concrete encasement and Flotation

The concrete must be poured in stages allowing sufficient time between layers for the cement to set and no longer exert buoyant forces. The maximum lift heights are shown in the table below.

SN	MAXIMUM LIFT
2500	Larger of 0.3 m or DN/4
5000	Larger of 0.453 m or DN/3
10000	Larger of 0.6 m or DN/24

During pouring the concrete, or in order to prevent floatation, the pipe must be restrained against movement. This is usually done by strapping over the pipe to a base slab or other anchors. The straps are flat with a minimum of 25 mm width and strong enough to withstand the flotation forces.



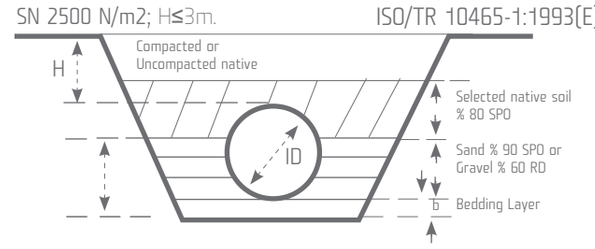
The buoyancy must be checked in cases of low coverage and high groundwater levels or in flood plains.

DN	MAXIMUM SPACING(m)
<200	1.5
200-400	2.5
500-600	4.0
700-900	5.0
≥1000	6.0

DN	h MIN (m) for SECURITY S=1.1
100	0,07
300	0.20
600	0.37
1000	0.62
2000	1.25
2400	1.5

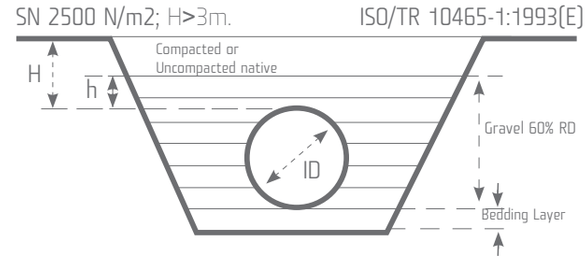
TRENCH SECTIONS

SN 2500 N/m2; H≤3m. ISO/TR 10465-1:1993(E)



SPD: Standard Proctor Density
RD: Relative Density
Granular Materials are filled to the 70% of pipe outside diameter.

SN 2500 N/m2; H>3m. ISO/TR 10465-1:1993(E)



Granular materials are filled from the crown upto the h distance, (h) is min. 100 mm, max.300 mm.

Döşenen CTP Borularda Sapma Limitleri / Limits of Deflection in Installed GRP Pipes					
Deformasyon, Deflection (%)	Toprak Sınıflandırma, Soil Classification				
	1	2	3	4	5
DN≥300 mm (initial)	4	3,5	3	2,5	2
DN<300 mm (başlangıç)	2,5	2,5	2	1,5	1,5
Uzun Vadeli , Long Term	6	6	6	6	6

Toprak Grupları , Soil Groups	1	2	3	4	5
İnce Taneli Toprak, Fine-Grained Soils	çok sert very hard	sert hard	orta medium	yumuşak soft	çok yumuşak very soft
Kaba Taneli Toprak, Coarse-Grained Soils	çok yoğun very dense	yoğun dense	orta medium	gevşek loose	çok gevşek vey loose

Chemical Resistance Guide
ALFEBOR GRP Pipes have a very high corrosion resistance.

The corrosion resistance of the pipe depends, in addition, on the resin selection, the temperature of the media and the concentration of the chemical(s) contained in the media. In some cases, special rubber qualities need to be selected to ensure that the seal has the same service file as the pipes. The barrier layer inside the liner further ensures that in case of a liner crack, the media cannot penetrate the structural layers of the pipe wall.

In the centrifugal process which ensures that no voids exist from air or styrene vapour which would facilitate media or gas penetration into the pipe wall. The glass fiber is completely wetted out in the process, thus preventing corrosion.

The following pages focusing on chemical resistance have been prepared as a general guide only, and the information given should not be used as a design guide in isolated conditions. ALFEBOR will be pleased to provide assistance regarding design issues in cases where chemical resistance is a concern.

ALFEBOR, together with resin manufactures, can engineer a pipe ready for installation when consulted. However no responsibility can be accepted without prior consultation.

When both standard and special pipes are marked in the following tables, this generally means that standard pipes are suitable for the respective chemical in lower concentrations and lower temperatures. When higher concentrations or elevated, temperatures are involved, the pipes should be custom designed.

Chemical	Standart Pipe	Special Pipe
Acedic Acid		X
Acrylic Acid		X
Alcohol Ethyl	X	X
Alcohol Isoprophyl	X	X
Alcohol Methyl Isobuthyl		X
Alcohol Secondary Isobuthyl		X
Alum	X	X
Aluminium Chloride	X	X
Aluminium Flouride	X	X
Aluminium Hydroxide		X
Aluminium Nitrate	X	X
Aluminium Potasium Sulfate	X	X
Ammonia Aqueous		X
Ammonia Gas		X
Ammonium Bicarbonate		X
Ammonium Bisulfate		X
Ammonium Carbonate		X
Ammonium Chloride	X	X
Ammonium Citrate		X
Ammonium Fluoride		X
Ammonium Hydroxide		X
Ammonium Nitrate	X	X
Ammonium Persulphate		X
Ammonium Phosphate	X	X
Ammonium Sulphate	X	X
Analine Sulfate		X
Barium Carbonate		X
Barium Chloride	X	X
Barium Hydroxide		X

Chemical	Standart Pipe	Special Pipe
Barium Sulphate	X	X
Beer	X	X
Gasoline Sulfonic Acid		X
Benzoic Acid		X
Cadmium Chloride		X
Calcium Bisulfite		X
Calcium Carbonate		X
Calcium Chlorate		X
Calcium Chloride	X	X
Calcium Hydroxide		X
Calcium Nitrate	X	X
Calcium Sulphate	X	X
Calcium Sulfite		X
Sugar Cane Liquid		X
Caprylic Acid		X
Carbon Dioxide	X	X
Gaseous Carbon Monoxide	X	X
Chloride Dry Gas		X
Chloride Liquid Gas		X
Citric acid	X	X
Copper Chloride	X	X
Copper Cyanide		X
Copper Fluoride		X
Copper Nitrate	X	X
Copper Sulphate	X	X
Crude Oil, Sour	X	X
Crude Oil, Sweet	X	X
Diesel Fuel	X	X
Ethylene Glycol	X	X

Chemical	Standart Pipe	Special Pipe
Ferric Chloride	X	X
Ferrik Nitrate	X	X
Ferric Sulphate	X	X
Iron Chloride	X	X
Iron Nitrate	X	X
Ferrous Sulphate	X	X
Flobonic Acid	X	X
Fluosilic Acid	X	X
Formic acid	X	X
Oil	X	X
Gas, Natural		X
Gluconic Acid		X
Glucose	X	X
Glycerine	X	X
Heptane		X
Hexane		X
Hexylene Clycol		X
Hydraulic Fluid		X
Hydrochloric Acid		X
Hydroyanid Acid		X
Hydrofluosilic Acid		X
Hydrogen Bronid, Wet Gas		X
Hydrogen Chloride, Dry Gas		X
Hydrogen Chloride, Wet Gas		X
Hydrogen Sulfide, Liquid	X	X
Hydrogen Fluoride, Steam		X
Hydrosulfite Whitener		X
Hydrochloric acid		X
Isopropyl Amine		X

Chemical	Standart Pipe	Special Pipe
Isopropyl Palmitate		X
Kerosene		X
Lactic acid		X
Laurel Chloride		X
Loric Acid		X
Lead Acetate		X
Levulinic Acid		X
Lithium Bromide		X
Lithium Sulphate		X
Magnesium Bisulfite		X
Magnesium Carbonate		X
Magnesium Chloride	X	X
Magnesium Hydroxide		X
Magnesium Sulphate	X	X
Maelite Acid		X
Mercury Chloride	X	X
Mercury Chloride	X	X
Mineral oils	X	X
Engine oil		X
Miristic Acid		X
Naptha		X
Naphthalene		X
Nickel Chloride	X	X
Nickel Nitrate	X	X
Nickel Sulfate	X	X
Octanoic Acid		X
Oleic Acid		X
Oxalic Acid		X
Perchlorethylene		X

If the chemical you will transport is not included in this table, please apply to ALFEBOR for more information.

QUALITY CERTIFICATES

OHSAS 18001:2007

ISO 14001:2015

ISO 9001:2015


QS
QUALITY SERVICE

SERTİFİKA

Sertifika No: 11347

ALFEBOR BORU SANAYİ VE TİCARET A.Ş.
Merkez: Atatürk Cad. İntaş Apt. No:38/1
TR- Antakya HATAY
Fabrika: Şenbük-Antakya Organize Sanayi Bölgesi 3 Nolu Yol
No:25 101 Ada 7 Parsel Belen TR- HATAY

QS Zürich AG, yukarıda adı yazılı olan şirketin yönetim sisteminin incelendiğini ve aşağıdaki talimatlar tarafından belirlenen şartları karşıladığını belgelemektedir

ISO 9001: 2015

Yönetim sisteminin kapsamı

Ctp Boru Üretimi

QS ZÜRICH AG
P.O. Box 6335
CH-8050 Zürich

SWISS
IAF

Yönetim


QS
QUALITY SERVICE

CERTIFICATE

Certificate no. 11347

ALFEBOR BORU SANAYİ VE TİCARET A.Ş.
Headquarters: Atatürk Cad. İntaş Apt. No:38/1
TR- Antakya HATAY
Factory: Şenbük-Antakya Organize Sanayi Bölgesi 3 Nolu Yol
No:25 101 Ada 7 Parsel Belen TR- HATAY

QS Zürich AG certifies that the Management System of the above mentioned company has been evaluated and meets the requirements established by the following rules:

ISO 9001: 2015

The management system includes:

Manufacture of GRP Pipe

First certification date: 11.02.2015
Date of issue: 20.12.2018
Expiration date: 10.02.2020

QS ZÜRICH AG
P.O. Box 6335
CH-8050 Zürich

SWISS
IAF

Management

ISO 10002:2018


CTR

SERTİFİKA

05.10007

ALFEBOR BORU SANAYİ VE TİCARET A.Ş.

ISO 10002:2018

CTP BORU ÜRETİMİ


CTR

CERTIFICATE

05.10007

ALFEBOR BORU SANAYİ VE TİCARET A.Ş.

ISO 10002:2018

MANUFACTURE OF GRP PIPE

GENERAL MANAGER

QUALITY CERTIFICATES

NSF INTERNATIONAL

NSF International

RECOGNIZES

Alfebor Boru Sanayi ve Ticaret A.S.

Facility: Hatay, Turkey

AS COMPLYING WITH NSF/ANSI 61 AND ALL APPLICABLE REQUIREMENTS. PRODUCTS APPEARING IN THE NSF OFFICIAL LISTING ARE AUTHORIZED TO BEAR THE NSF MARK.

NSF International

RECOGNIZES

Alfebor Boru Sanayi ve Ticaret A.S.

Turkey

AS COMPLYING WITH NSF/ANSI 61 AND ALL APPLICABLE REQUIREMENTS. PRODUCTS APPEARING IN THE NSF OFFICIAL LISTING ARE AUTHORIZED TO BEAR THE NSF MARK.

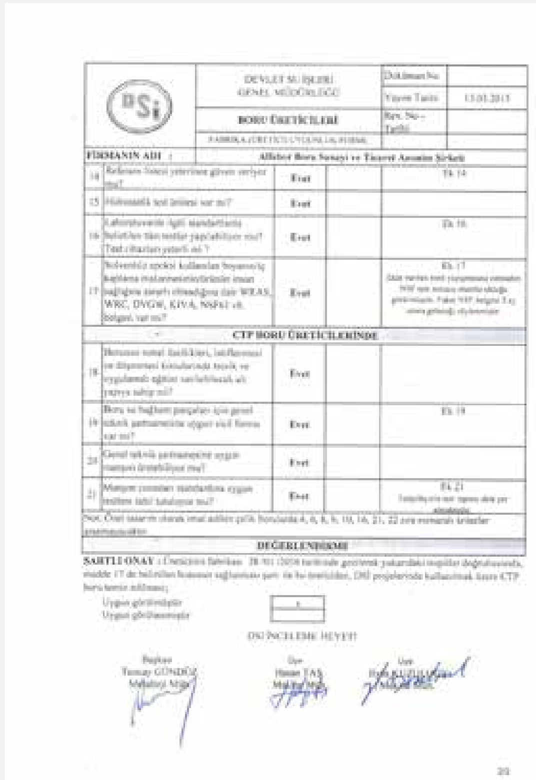
DSİ UYGUNLUK BELGESİ DSI APPROVED MANUFACTURER CERTIFICATION

DEVLET SU İŞLERİ GENEL MÜDÜRLÜĞÜ

BORU ÜRETİCİLERİ

FİRMANIN ADI : Alfebor Boru Sanayi ve Ticaret Anonim Şirketi

İMALATÇI FİRMA GENEL DURUMU



DEVLET SU İŞLERİ GENEL MÜDÜRLÜĞÜ

BORU ÜRETİCİLERİ

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CTP BORU ÜRETİCİLERİNDE

DEĞERLENDİRME

DSİ İNCELEME HEYETİ

TÜRKAK 2017-2019 — TURKAK (TURKISH ACCREDITATION AGENCY) CERTIFICATION

TÜRK AKREDİTASYON KURUMU

AKREDİTASYON SERTİFİKASI

Deney Laboratuvarı olarak faaliyet gösteren,

ALFEBOR BORU SANAYİ VE TİC. A.Ş. Alfebor

Şenbük -Antakya Organize Sanayi Bölgesi 3 Nolu Yol No:25 101 Ada 7 Parsel Belen HATAY 31580 HATAY / TÜRKİYE

TÜRKAK tarafından yapılan denetim sonucunda TS EN ISO/IEC 17025:2012 Standardına göre Ek'te yer alan kapsamlarda akredite edilmiştir.

Akreditasyon No : AB-1000-T

Akreditasyon Tarihi : 18 Aralık 2015

Revizyon Tarihi / No : 8 Haziran 2017 / 01

Bu Sertifika, yukarıda açık adı ve adresi yazılı Kuruluşun TS EN ISO/IEC 17025:2012 Standardına, ilgili Yönetmelik ve Tebliğlere uygunluğunu sürdürmesi halinde , **17 Aralık 2019** tarihine kadar geçerlidir.

Dr. H. İbrahim ÇETİN
Genel Sekreter

Türk Akreditasyon Kurumu (TÜRKAK) ISO/IEC 17025 alanında Avrupa Akreditasyon Birliği (EA) ve Uluslararası Laboratuvar Akreditasyon Birliği (ILAC) ile çok taraflı anlaşma (MLA/MRA) imzalamıştır.

Akreditasyon Sertifikası Eki (Sayfa 1/1)

Akreditasyon Kapsamı

ALFEBOR BORU SANAYİ VE TİC. A.Ş. Alfebor

Akreditasyon No: AB-1000-T
Revizyon No: 01 Tarih: 8 Haziran 2017

Deney Laboratuvarı

Adres: Şenbük -Antakya Organize Sanayi Bölgesi 3 Nolu, Yol No:25 101 Ada 7 Parsel Belen HATAY 31580 HATAY/TÜRKİYE

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E-Posta : info@alfebor.com.tr
Website : www.alfebor.com.tr

Deney Yapılan Malzemeler / Ürünler	Deney Adı	Deney Metodu (Kitabı, Uluslararası standartlar, varsa iç metodlar)
Cam Elyaf Takviyeli Termoset Plastik (GRP) Boru ve Ekleme Parçaları	Başlangıç Sanallık Çember Rijitliğinin Tayini (Max D= 2600 mm)	TS ISO 7685 (Metod B) TS EN 1228 (Metod B)
	Gördür Başlangıç Çevresel Çekme	TS ISO 8521 (Metod A)
	Mukavemetinin Tayini	TS EN 1394 (Metod B)
	Gördür Başlangıç Ansya Çekme	TS EN 1393 (Metod A)
	Mukavemetinin Tayini	TS ISO 8513 (Metod A)
	Diğer (Varsa)	

KAPSAM SONU

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