kuzeyboru

grp

GLASSFIBER REINFORCED
POLYESTER PIPE AND FITTINGS
PRODUCT GUIDE


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about us

Kuzeyboru was established in 2001 with the vision of a global brand offering innovative solutions for infrastructure and superstructure piping systems. Kuzeyboru, which specializes in the production of pipes, especially GRP, Polyethylene (HDPE), Corrugated and PPR pipes and fittings, with its world-class production facilities and wide product range, offers comprehensive solutions for infrastructure and superstructure projects.

Acting with a sustainable production approach, Kuzeyboru has been a professional solution partner in many infrastructure and superstructure projects in 105 countries in 5 continents since its establishment. It has become one of Turkey's largest manufacturers in GRP, Corrugated Pipe, HDPE and PPR product groups with its modern facilities built on a total area of 162,336.23 m². Having the title of "The First Ministry Certified R&D Center" in the plastic pipe sector, Kuzeyboru aims to develop innovative production techniques, process optimization and create an ecosystem that can respond quickly to the changing needs of the market with this center. The R&D Center is one of the important building blocks that contribute to Kuzeyboru's sustainable production targets.

Beyond being a professional solution partner, Kuzeyboru also makes a difference with its projects that add value to society. In line with its social responsibility principles, it prioritizes women's employment and equal opportunities and takes important steps in this field. With the "Etkiniz" project, the Company aims to create social benefit by reducing the environmental impact of production, increasing energy efficiency and developing projects for future engineer candidates. In addition, the Company strengthens the place of women in society and contributes to national sports by supporting the women's volleyball team in the Sultans League.

162.336,23 m²
production area

5 continents Export to
105 countries

Among the 100 fastest
growing companies
according to TOBB data

%100 domestic
capital

environment and sustainability

Kuzeyboru holds the TS EN ISO 14001 Environmental Management System certification, emphasizing its commitment to environmental safety. The company prioritizes health and environmental considerations in the development of its innovative products. Recognizing the environment as a precious treasure, Kuzeyboru places significant importance on sustainability, carbon footprint monitoring, and the use of renewable energy. Kuzeyboru effectively and efficiently manages natural resources by employing environmentally friendly technologies. It also raises awareness among its employees and stakeholders to protect biodiversity.

Sustainability is a strategic priority for Kuzeyboru and an integral part of all its activities. The company meets its energy needs for production from sustainable sources, thanks to its land-based and rooftop solar energy systems.

quality approach and international standards

Quality Approach

To achieve continuous improvement, operational excellence, and sustainable success based on lean production, we adopt an inclusive management approach that ensures leadership at all levels, enhances the implementation of decision-making processes, and strengthens improvements through data analysis. This approach leverages the workforce, processes, and technology in the most effective way.

Accredited Laboratories

Kuzeyboru Testing Laboratory prioritizes impartiality, independence, integrity, confidentiality, reliability, and legal requirements, conducting laboratory work in accordance with national and international standards, with the best economic and technical practices in the shortest time possible.

The laboratory's objective is to exhibit good professional practices with continuously trained expert personnel, using up-to-date testing methods and technologically advanced devices that comply with current standards to meet customer demands at the highest level and ensure precise test results by using the necessary reference/standard materials. Additionally, it aims to enhance test quality through comparative measurements with national and international laboratories and to minimize complaints by focusing on customer satisfaction.

Personnel work in accordance with policies and procedures conforming to the TS EN ISO/IEC 17025 standard. The laboratory management commits to comply with this standard and to continuous improvement.

International Standards

Kuzeyboru GRP pipes are designed and manufactured to meet the requirements of the most comprehensive international standards listed below.

AWWA C950	Standard for Glass Fiber Pressure Pipes - Clean Water
AWWA M 45	Design Guide for Glass Fiber Pipes
ASTM D 3262	Non-Pressure Glass Fiber Pipes for Wastewater Applications
ASTM D 3754	Standard for Sewer and Industrial Pressure Pipes
ASTM D 3517	Standard for Pressure Pipe for Clean Water
ASTM D 3839	Standard for Installation of Glass Fiber Pipes
AWWA C 207-D	Flanges 4" - 144"
ISO 25780	Jacking Pipes for Water Supply, Wastewater, Drainage, and Irrigation Projects
ISO 23856	Water Supply and Wastewater Applications

introduction

The efficient use and effective transportation of water, a vital resource for all life, has become increasingly important due to the diminishing availability of water sources worldwide. Ensuring that transmission lines operate in a manner that minimizes water loss and leakage can only be achieved by using durable and long-lasting pipes.

Kuzeyboru GRP pipes are manufactured with the latest technology to ensure the healthiest and safest conveyance of our most valuable natural resource, water, from one point to another.

The Role of Glass Reinforced Plastic Materials in Our Lives

Composites are among the most widely used materials in the industry due to their high chemical and mechanical resistance. As a composite material, fiberglass reinforced plastic (GRP) is used in the aviation, marine, infrastructure, superstructure, and land transportation industries, as well as in wind turbines, storage tanks, and tank production. One of the most important industrial applications of GRP composite materials is GRP pipes.

GRP pipes are preferred in applications that require the high corrosion resistance of plastics and the high mechanical strength of metals.

GRP pipes are used in potable water and wastewater systems, irrigation projects, industrial projects, and submarine intake and discharge lines.

1. glass reinforced polyester pipes

Glass Reinforced Polyester (GRP) pipes are durable and flexible composite pipes obtained by adding fiberglass to a thermoset resin matrix. Known for their high fracture resistance and lightweight structure, GRP pipes are preferred in many industries due to their chemical resistance, non-magnetic properties, and permeability to radio signals. GRP pipes can be easily shaped for various applications, making them widely used in the chemical, construction, and energy sectors.

1.1. Why Kuzeyboru GRP Pipes?

In the production of Kuzeyboru GRP pipes, sustainable development principles are prioritized. From the selection of raw materials to the final product, all processes aim for a low carbon footprint, and environmentally friendly production processes have been developed. The GRP pipes produced with technologies developed at the Kuzeyboru R&D center can be customized to meet project needs and meet high-quality standards.

Kuzeyboru GRP pipes are certified with local and international quality certifications and are designed for long-term durability, offering longevity across generations. To minimize environmental impact, green energy sources are utilized in production, advanced technology machines are preferred, and occupational safety is prioritized. This ensures an environmentally friendly and safe production process.

Kuzeyboru GRP pipes, an economically sustainable solution, offer ease of transportation and installation due to their lightweight structure. Their abrasion resistance and smooth inner surface, which retains its properties throughout its lifespan, reduce operational and maintenance costs, making the operational process more efficient.

Kuzeyboru's environmentally friendly, durable, and high-quality GRP pipes provide an economically sustainable and long-lasting solution for your projects.

1.2. Areas Of Use

- Drinking water transmission lines and distribution networks
- Irrigation projects main transmission and distribution lines
- Wastewater pumping lines, sewer networks
- Wastewater treatment plants
- Drinking water treatment plants
- Hydroelectric power plant transmission lines

- Seawater intake and discharge lines, and cooling water lines for power plants
- Stormwater lines
- Seawater desalination plants
- Tank and silo production
- Micro-tunneling applications
- Jacking applications

1.3. Kuzeyboru GRP Fittings

- Tee pieces
- Elbows
- Reducers
- Flanges
- Manholes
- Saddles
- Special design spools
- WYE pieces

1.4. . Kuzeyboru GRP Pipe Production Ranges

Kuzeyboru manufactures GRP pipes in the required diameters, pressures, and stiffness according to project requirements. The production ranges for Kuzeyboru GRP pipes are given below.

Length (m)	: *6m ve 12m. Upon request and considering transportation conditions, Kuzeyboru GRP pipes can be manufactured in the desired lengths.*
Diameter (DN)	: *300mm - 4.000 mm*
Pressure (PN)	: *1-32 bar.*
Rigidity (SN)	: *Standard 2.500 - 5.000 - 10.000 N/m². Upon request, production can be carried out up to SN1,000,000 N/m²*

1.5. Advantages of Kuzeyboru GRP Pipes

Lightweight	: *Kuzeyboru GRP pipes weigh 1/10th of concrete pipes and 1/4th of steel pipes.*
Low Transportation Cost	: *Their lightweight nature and suitability for nested shipment provide economical solution.*
Easy Installation	: *Offers easier and faster installation compared to other types of pipes.*
Couplings	: *Kuzeyboru possesses both coupling technologies used for joining GRP pipes. Depending on project requirements and demand, REKA or integrated gasketed couplings can be preferred.*
High Corrosion Resistance	: *GRP pipes do not corrode, eliminating the need for additional coating or protection.*
Superior Hydraulic Properties	: *Kuzeyboru GRP pipes maintain their hydraulic properties throughout their operational life due to their smooth inner surface.*
Water Hammer Resistance	: *Higher than other types of pipes, tolerating additional pressure increases up to 40% from water hammer effects*
Long Service Life	: *50 years of service life.*
Low Operating Costs	: *Due to superior hydraulic properties and a smooth inner surface, hydraulic losses are less than other types of pipes. Consequently, a lower capacity pump can be selected, and energy savings can be achieved throughout the operational period.*

2. grp pipe production technologies

GRP pipes, which use fiberglass, thermoset resin, and silica sand as main raw materials, are manufactured using three different methods.

1. Continuous Filament Winding

2. Centrifugal Casting

3. Filament Winding

Kuzeyboru GRP pipes are manufactured using the latest advanced technology, the **Continuous Filament Winding Method.** The advantages of this technology include.

•While the length of pipes in other production methods is limited to 6m, the Continuous Filament Winding Method allows the production of pipes in desired lengths, such as 12m or 15m, depending on transportation conditions.

•The production speed in the Continuous Filament Winding Method is much higher than other methods. As a result, the production of pipes required for the project can be completed in much shorter timeframes.

•Larger diameter GRP pipes can be produced using the Continuous Filament Winding Method.

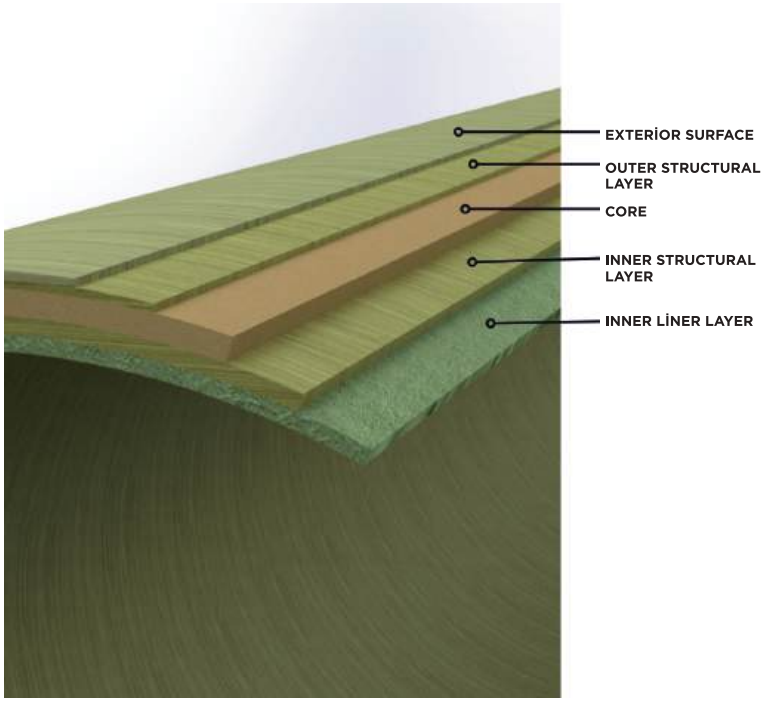
•Optimum solutions can be produced to meet project requirements by using different types of resins and fibers.

2.1.Kuzeyboru GRP Pipes Wall Structure

The GRP pipe wall consists of five layers that adhere perfectly to each other, each with different properties and characteristics according to their function.

Exterior Surface, Outer Structural Layer, Core, Inner Structural Layer, Inner Liner Layer

The combination of fiberglass, resin, and silica sand used in the production of GRP pipes creates a structure that is resistant to axial, circumferential, and peak loads. Continuous fibers provide circumferential strength to the pipe, mainly ensuring pressure resistance. Chopped fibers contribute to the axial strength of the pipe, while the sand ensures that the pipe's rigidity reaches the desired level at a minimal cost. The resin acts as a binder for all these materials.



3. kuzeyboru grp pipes

Kuzeyboru GRP pipes are manufactured with advanced Continuous Filament Winding (CFW) machines at the Malatya-Turkey facilities. In the Continuous Filament Winding method, the pipe is produced by winding fiberglass yarns onto an endless mandrel while resin, sand, and chopped fiberglass are poured from above. The materials poured and wound onto the mandrel are compressed using a pressure arm. Kuzeyboru produces GRP pipes in various diameters ranging from 300 mm to 4000 mm.

In a composite material like GRP pipe, the casting location, the amount of raw materials in the composition, and the characteristics of the materials used play a significant role in determining the performance of the pipe.

Resin and continuous fiber are used as the main components in the production of Kuzeyboru GRP pipes. Additionally, chopped fiber and sand are also used in production, depending on the required pipe characteristics.

Kuzeyboru designs superior quality GRP pipes that meet your project requirements, offering the optimum solution for your project.

Beyond producing and delivering GRP pipes and fittings according to your project needs, Kuzeyboru also offers engineering and design support along with on-site supervision services as your professional solution partner.

3.1.Raw Materials

The following raw materials are used in the production of GRP pipes, depending on project conditions and requirements:

3.1.1.Glassfiber

Glass reinforcements are made from two different glass compositions: "C" glass, which exhibits excellent chemical inertness against chemical corrosion, and "E" glass, which has very high mechanical strength.

In the production of fiberglass pipes, fiberglass is used both as continuous fiber and as chopped fiber. Additionally, fiberglass surface veil is also used on the outer surface of the pipe.

3.1.2.Resin

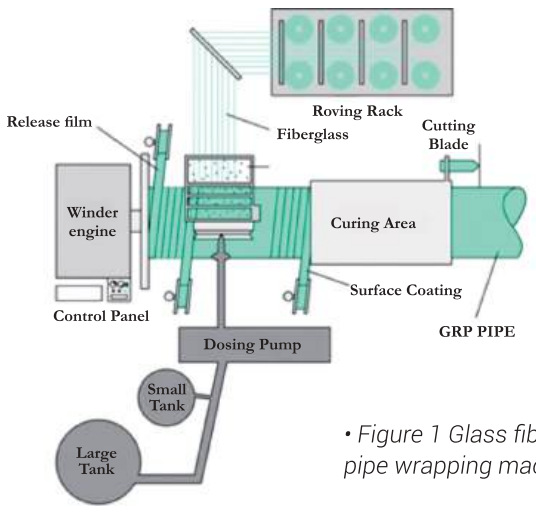
Depending on the type and temperature of the fluid, and to meet project requirements and ensure the desired performance, Kuzeyboru GRP pipes can be manufactured with four different types of resin.

1.Terephthalic Resin

2.Orthophthalic Resin

3.Isophthalic Resin

4.Vinylester Resin



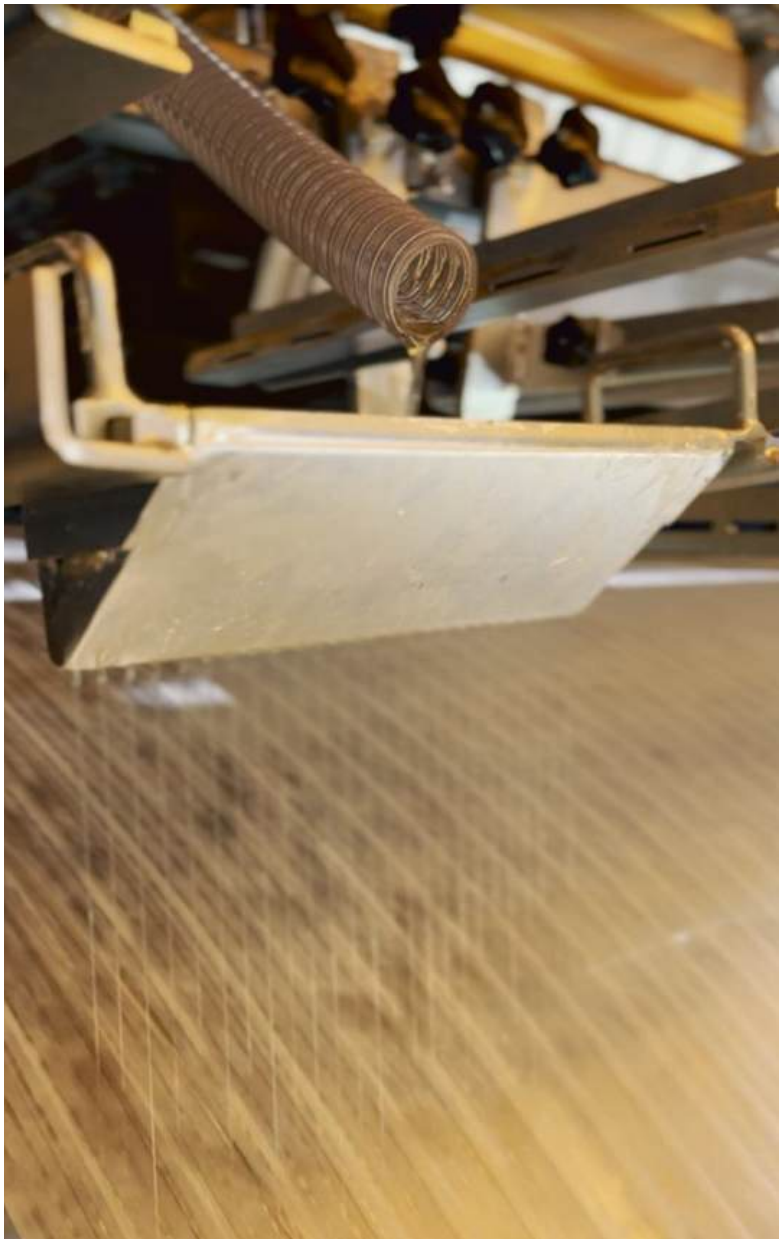
• *Figure 1 Glass fiber pipe wrapping machine*

3.1.3. Chemical Additives and Accelerators

Various chemicals such as catalysts, hardeners, and pigments are used in the production of GRP pipes.

3.1.4. Filler Material (Silica Sand)

Silica sand is used along with fiberglass and resin to produce GRP pipes at optimal cost within the desired rigidity class.



3.2 Kuzeyboru GRP Pipe Types

3.2.1.Pressure Pipes

Kuzeyboru offers optimum solutions to clients by producing pressure pipes up to 32 bar using the most advanced technology, the Continuous Filament Winding Method. Kuzeyboru GRP pipes are used in potable water transmission lines, pressurized drainage and wastewater pumping lines, pressurized irrigation lines, and both underground and aboveground applications.

3.2.2.Sewer Pipes

Kuzeyboru also produces specially designed GRP pipes for sewer applications. Kuzeyboru GRP pipes offer the best solutions for sewer projects with their high abrasion resistance against corrosive conditions caused by acids, bases, and aggressive chemicals, and their special inner design that can withstand water jet pressure.

3.2.3.Biaxial Pipes

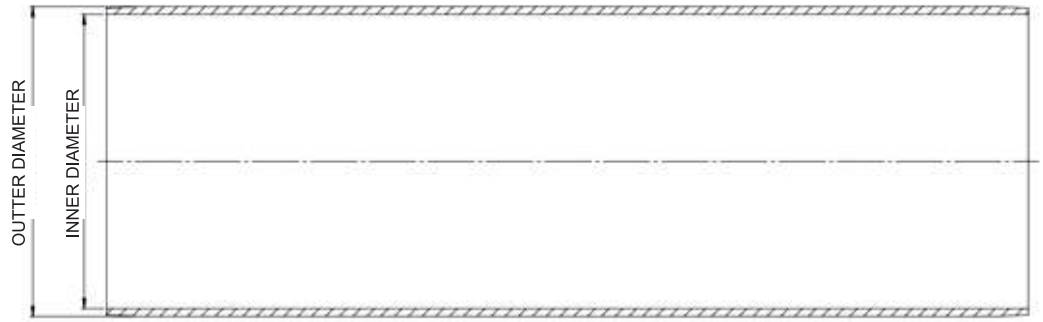
Kuzeyboru biaxial GRP pipes are designed to withstand forces in both directions (circumferential and axial). The use of biaxial pipes eliminates the need for thrust blocks, providing significant advantages, especially in aboveground applications for industrial projects. In pipelines where biaxial pipes are used, joints are made with flanges, hand lay-up, or locking couplings. Axial forces occurring in the pipeline are transferred from one pipe to another through the joints. Kuzeyboru also provides engineering services for projects where biaxial pipes are used.

3.2.4.Jacking Pipes

Kuzeyboru jacking pipes are used for the renewal and construction of underground pipelines through trenchless methods. The high axial pressure resistance of jacking pipes offers significant advantages for Micro-tunneling and pipe jacking applications compared to other pipe materials. The technical specifications and wall thicknesses of the pipes used for these applications vary. Accordingly, they are manufactured in special lengths up to a nominal rigidity of 1,000,000 N/m².

3.2.5.GRP Pipe Dimensions

PRESSURE CLASS			PN1						PN6						PN10					
STIFFNESS CLASS			SN2500 N/m²		SN5000 N/m²		SN10000 N/m²		SN2500 N/m²		SN5000 N/m²		SN10000 N/m²		SN2500 N/m²		SN5000 N/m²		SN10000 N/m²	
DN		OD	ID	W	ID	W	ID	W	ID	W	ID	W	ID	W	ID	W	ID	W	ID	W
(mm)	(inç)	(mm)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)
300	12''	323,8	305,8	7,28	303,97	9,01	301,49	11,34	305,8	7,28	304	9,01	301,5	11,34	305,8	7,28	304	9,01	301,5	11,34
350	14''	375,7	356,64	9,78	354,38	12,28	351,47	15,47	356,6	9,78	354,4	12,28	351,5	15,47	356,7	9,77	354,4	12,28	351,5	15,47
400	16''	426,6	402,04	12,42	399,4	15,71	396,38	19,43	402	12,42	399,4	15,71	396,4	19,44	402,2	12,22	399,4	15,71	396,4	19,43
450	18''	477,6	451,79	15,74	448,88	19,8	445,63	24,3	451,8	15,74	448,9	19,8	445,6	24,3	452,1	15,22	448,9	19,72	445,6	24,3
500	20''	529,5	501,49	19,51	498,49	24,16	494,88	29,71	501,5	19,51	498,5	24,16	494,9	29,71	502,1	18,55	498,5	24,14	494,9	29,71
600	24''	616,5	601,15	27,79	597,71	34,18	593,37	42,19	601,2	27,79	597,7	34,18	593,4	42,19	602	26,22	597,7	34,18	593,4	42,19
700	28''	718,9	700,95	37,24	696,92	45,96	691,85	56,87	700,9	37,25	696,9	45,95	691,8	56,87	701,9	35,22	696,9	45,96	691,8	56,87
800	32''	820,9	800,73	48,09	796,12	59,49	790,3	73,79	800,7	48,09	796,1	59,49	790,3	73,79	801,7	45,57	796,1	59,49	790,3	73,79
900	36''	922,9	900,51	60,35	895,31	74,8	888,74	92,94	900,5	60,36	895,3	74,81	888,7	92,98	901,6	57,28	895,3	74,81	887,7	92,95
1000	40''	1024,9	1000,28	74	994,48	91,91	987,18	114,32	1000,3	74,01	994,5	91,92	987,2	114,34	1001,4	70,34	994,5	91,92	987,2	114,33
1100	44''	1126,9	1100,05	89,06	1093,67	110,73	1085,58	138,01	1100,1	89,07	1093,7	110,76	1085,6	137,97	1101,3	84,77	1093,7	110,74	1085,6	137,98
1200	48''	1228,9	1199,81	105,55	1192,83	131,39	1184	163,9	1199,8	105,56	1192,8	131,39	1184	163,91	1201,1	100,58	1192,8	131,42	1184	163,91
1300	52''	1330,9	1299,57	123,45	1291,99	153,85	1282,41	192,01	1299,6	123,46	1292	153,86	1282,4	192,02	1301	117,76	1292	153,84	1282,4	192,02
1400	56''	1432,9	1399,3	142,84	1391,14	178,1	1380,8	222,45	1399,3	142,85	1391,1	178,08	1380,8	222,46	1400,8	136,33	1391,1	178,08	1380,8	222,46
1500	60''	1534,9	1499,06	163,53	1490,29	204,12	1479,19	255,14	1499,1	163,52	1490,3	204,14	1479,2	255,16	1500,6	156,29	1490,3	204,14	1479,2	255,16
1600	64''	1636,9	1598,81	185,68	1589,42	232	1577,56	290,15	1598,8	185,72	1589,4	232,02	1577,6	290,17	1600,4	177,64	1589,4	232,01	1577,6	290,17
1700	68''	1738,9	1698,55	209,3	1688,56	261,66	1675,93	327,04	1698,5	209,36	1688,6	261,68	1675,9	327,45	1700,2	200,39	1688,6	261,68	1675,9	327,37
1800	72''	1840,9	1798,27	234,37	1787,68	293,17	1774,29	366,96	1798,3	234,36	1787,7	293,19	1774,3	367	1800	224,54	1787,7	293,19	1774,3	366,98
1900	76''	1942,9	1898	260,9	1886,78	326,6	1872,64	408,86	1898	260,92	1886,8	326,62	1872,6	408,89	1899,8	250,1	1886,8	326,62	1872,6	408,9
2000	80''	2044,9	1997,73	288,79	1985,92	361,6	1970,99	453	1997,7	288,81	1985,9	361,62	1971	453,11	1999,6	277,06	1985,9	361,62	1971	453,11
2100	84''	2146,9	2097,45	318,12	2085,03	398,55	2069,34	499,44	2097,5	318,15	2085	398,57	2069,3	499,6	2099,4	305,44	2085	398,57	2069,3	499,6
2200	88''	2248,9	2197,21	348,94	2184,12	437,42	2167,63	548,5	2197,2	348,96	2184,1	437,44	2167,7	548,26	2199,1	335,24	2184,1	437,44	2167,7	548,34
2300	92''	2350,9	2296,88	381,26	2283,24	477,91	2265,98	599,46	2296,9	381,28	2283,2	477,96	2266	599,48	2298,9	366,45	2283,2	447,96	2266	599,48
2400	96''	2452,9	2396,57	415,15	2382,34	520,4	2364,27	653,14	2396,6	415,17	2382,3	520,42	2364,3	653,16	2398,7	399,09	2382,3	520,42	2364,3	653,16
2500	100''	2554,9	2496,3	450,16	2481,43	564,66	2462,62	708,6	2496,3	450,19	2481,4	564,69	2462,6	708,62	2498,5	433,16	2481,4	564,64	2462,6	708,62
2600	104''	2656,9	2596	486,82	2580,52	610,82	2560,94	766,61	2596	486,84	2580,5	610,86	2560,9	766,64	2598,2	468,65	2580,5	610,88	2560,9	766,64
2700	108''	2758,9	2695,71	524,82	2679,6	658,79	2659,24	827,04	2695,7	524,83	2679,6	658,9	2659,2	827,07	2698	505,57	2679,6	658,85	2659,2	827,07
2800	112''	2860,9	2795,38	564,64	2778,66	708,87	2757,53	889,88	2795,4	564,67	2778,7	708,67	2757,5	889,91	2797,7	543,93	2778,7	708,63	2757,5	889,91
2900	116''	2962,9	2895,1	605,43	2877,75	760,39	2855,84	954,85	2895,1	605,5	2877,8	760,42	2855,9	954,73	2897,5	583,73	2877,8	760,42	2855,9	954,72
3000	120"	3064,9	2994,79	647,87	2976,84	813,78	2954,14	1022,16	2994,8	648,01	2976,8	813,81	2954,1	1022,19	2997,2	624,96	2976,8	813,81	2954,1	1022,19
3100	124"	3166,9	3094,48	691,91	3075,9	869,3	3052,4	1092,17	3094,5	691,92	3075,9	869,3	3052,4	1092,17	3097	667,64	3075,9	869,29	3052,4	1092,17
3200	128"	3268,9	3194,16	737,39	3174,96	926,54	3150,68	1164,23	3194,2	737,29	3175	926,54	3150,7	1164,23	3196,7	711,76	3175	926,54	3150,7	1164,23
3300	132"	3370,9	3293,84	784,27	3274,04	985,52	3248,96	1238,67	3293,8	784,21	3274	985,52	3249	1238,66	3296,4	757,33	3274	985,52	3249	1238,65
3400	136"	3472,9	3393,53	832,58	3373,11	1046,4	3347,18	1316,06	3393,5	833,02	3373,1	1046,4	3347,2	1316,08	3396,2	804,34	3373,1	1046,4	3347,2	1316,07
3500	140"	3574,9	3493,2	882,44	3472,14	1109,49	3445,5	1394,68	3493,2	882,5	3472,1	1109,49	3445,5	1394,68	3495,9	852,81	3472,1	1109,49	3445,5	1394,77
3600	144"	3676,9	3592,87	933,91	3571,2	1174,05	3543,74	1476,4	3592,9	933,91	3571,2	1174,05	3543,7	1476,59	3595,6	902,73	3571,2	1174,05	3543,7	1476,72
3700	148"	3778,9	3692,56	986,46	3670,2	1241,24	3642,91	1549,88	3692,6	986,46	3670,2	1241,24	3642,9	1549,88	3695,3	954,11	3670,2	1241,24	3642,9	1549,84
3800	152"	3880,9	3792,19	1041,19	3769,3	1309,01			3792,2	1041,19	3769,3	1309,01			3795	1006,95	3769,3	1309,01		
3900	156"	3982,9	3891,98	1096,63	3868,34	1379,37			3891,9	1096,62	3868,3	1379,37			3894,8	1061,24	3868,3	1379,37		
4000	160"	4084,9	3991,56	1153,86	3967,38	1451,65			3991,6	1153,86	3967,4	1451,66			3994,5	1117	3967,4	1451,66		



PN12						PN16						PN20						PN25					
SN2500 N/m²		SN5000 N/m²		SN10000 N/m²		SN2500 N/m²		SN5000 N/m²		SN10000 N/m²		SN2500 N/m²		SN5000 N/m²		SN10000 N/m²		SN2500 N/m²		SN5000 N/m²		SN10000 N/m²	
ID	W	ID	W	ID	W	ID	W	ID	W	ID	W	ID	W	ID	W	ID	W	ID	W	ID	W	ID	W
(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)	(mm)	(kg/m)
305,6	7,5	304	8,99	301,5	11,34	306,1	6,98	304,4	8,63	302	10,85	306,1	6,98	303,6	9,33	302,4	10,48	305	7,95	304,5	8,4	302,4	10,46
356,9	9,52	354,6	12,01	351,5	15,47	355,9	10,55	355,1	11,48	352,3	14,53	357,1	9,22	354,8	11,8	352,8	14	356	10,4	355,3	11,14	353	13,7
402,4	11,89	399,9	15,07	396,4	19,43	401,8	12,64	400,4	14,37	397,3	18,28	402,7	11,49	400,5	14,22	397,8	17,59	401,6	12,87	400,7	13,92	398,1	17,18
452,4	14,78	449,6	18,84	445,6	24,3	452,2	15,11	450,2	17,92	446,6	22,9	452,8	14,25	450,4	17,53	447,3	21,99	451,6	15,88	450,5	17,32	447,6	21,46
502,4	17,99	499,2	23,03	494,9	29,71	502,5	13,79	499,9	21,86	495,9	28,4	502,8	17,3	500,2	21,36	496,7	26,9	501,6	19,19	500,3	21,1	497,1	26,22
595,5	32,7	598,5	32,7	593,4	42,19	602,8	24,58	599,4	30,93	594,6	39,92	602,9	24,3	599,8	30,17	595,5	38,2	601,6	26,76	598,9	31,72	596	37,19
697,8	44,09	697,8	44,09	691,8	56,87	702,9	32,9	698,9	41,59	693,2	53,93	701,7	35,35	699,3	40,52	694,3	51,52	701,6	35,56	698,9	41,36	694,9	50,09
797	57,2	797	57,2	790,3	73,79	802,9	42,43	798,3	53,85	791,8	70,08	802,1	44,39	798,9	52,41	793	66,87	801,5	45,61	798,9	52,23	793,8	64,95
896,3	72,07	896,3	72,07	888,7	92,93	903	53,2	897,8	67,73	890,4	88,41	902,5	54,43	898,4	65,87	891,8	84,27	901,5	56,92	898,6	65,05	892,6	81,78
995,5	88,68	995,5	88,68	997,2	114,34	1003	65,19	997,2	83,22	988,9	108,91	1002,9	65,47	997,9	80,87	990,6	103,7	1001,5	69,45	998,2	79,83	991,5	100,58
1094,7	107,4	1094,7	107,04	1085,6	137,96	1103,1	78,42	1096,6	100,34	1087,5	131,58	1103,3	77,5	1097,4	97,44	1089,3	125,2	1101,5	83,23	1097,8	96,15	1090,3	121,35
1194	127,18	1194	127,18	1184	163,91	1203,1	92,89	1196,1	119,9	1186	156,46	1203,3	91,75	1196,9	115,59	1188	148,76	1201,5	98,26	1197,3	114,01	1189,2	144,11
1293,2	149,09	1293,2	149,09	1282,4	192,02	1303,1	108,61	1295,5	139,48	1284,5	183,53	1303,4	107,24	1296,4	135,31	1286,3	174,39	1301,5	114,52	1296,8	133,41	1288	168,87
1392,4	172,78	1392,4	172,78	1380,8	222,46	1403,1	125,58	1394,9	161,51	1383	212,81	1403,4	123,95	1395,9	156,61	1385,4	202,11	1401,5	132,03	1396,4	154,37	1386,8	195,62
1491,5	198,26	1491,5	198,26	1479,2	255,16	1503,1	143,8	1494,3	185,19	1481,5	244,32												
1590,7	225,53	1590,7	225,53	1577,6	290,17	1603,2	163,27	1593,7	210,52	1580	278,05												
1689,9	254,61	1689,9	254,61	1675,9	327,41	1703,2	184,01	1693	237,52	1678,5	314,01												
1789	285,49	1789	285,49	1774,3	366,98	1803,2	206,01	1792,4	266,17	1776,9	352,22												
1888,1	318,17	1888,2	318,17	1872,6	408,87	1903,2	229,27	1891,8	296,5	1875,4	392,67												
1987,3	352,68	1987,3	352,68	1971	453,05	2003,2	253,8	1991,1	328,49	1973,8	435,38												
2086,5	389	2086,5	389	2069,3	499,6	2103,2	279,61	2090,5	362,16	2072,3	480,34												
2185,6	427,15	2185,6	427,15	2167,7	548,28	2203,1	306,68	1189,9	397,51	1170,7	527,57												
2284,7	467,13	2284,7	467,13	2266	599,48	2303,1	335,04	2289,2	434,55	2269,1	577,07												
2383,9	508,94	2383,9	508,94	2364,3	653,16	2403,1	364,67	2388,5	473,27	2367,5	628,84												
2483	552,59	2483	552,59	2462,6	708,62																		
2582,1	598,08	2582,1	598,08	2560,9	766,64																		
2681,2	645,41	2681,2	645,41	2659,2	827,07																		
2780,3	694,59	2780,3	694,59	2757,5	889,91																		

4. grp couplings

• *Reka Type*

• *Integrated Gasket Type*

Kuzeyboru is among the few manufacturers offering both options by producing two types of couplings that provide excellent sealing for the joining of GRP pipes. Kuzeyboru GRP pipes and fittings can be shipped with either REKA Type or Integrated Gasket Type couplings attached to one end.

Table 1 Max. allowable angular deflections for coupling joints

Diameter - DN (mm)	Pressure Class PN (Bar)			
	PN ≤ 16	16 < PN ≤ 20	20 < PN ≤ 25	PN ≤ 32
DN≤500	3,0	2,5	2,0	1,5
500<DN≤900	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

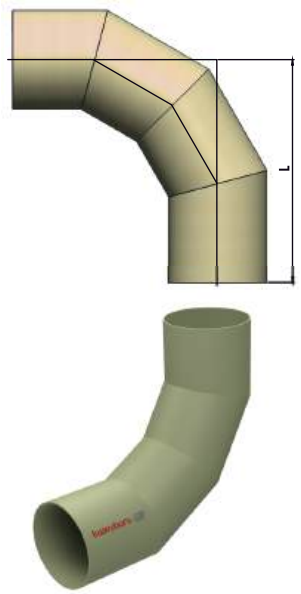
Wall Coupling

Wall couplings are used at the connection points of GRP pipe lines with concrete structures. To ensure tight adhesion between the GRP concrete coupling and the concrete structure, the GRP concrete couplings are coated with sand or gravel. Upon request, concrete couplings can be produced up to 3 meters in length.

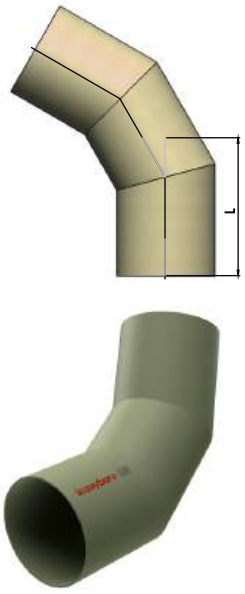
5. kuzeyboru grp fittings

Fittings such as tees, elbows, reducers, and flanges used in GRP pipelines are also produced by Kuzeyboru. Details and dimensions of these fittings are provided in the accompanying tables.

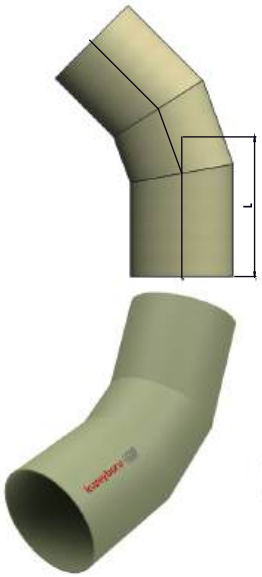
5.1. Elbows



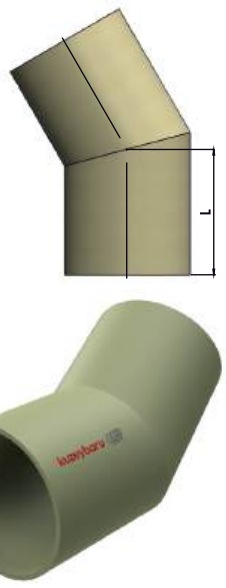
• Elbow 90°



• Elbow 60°



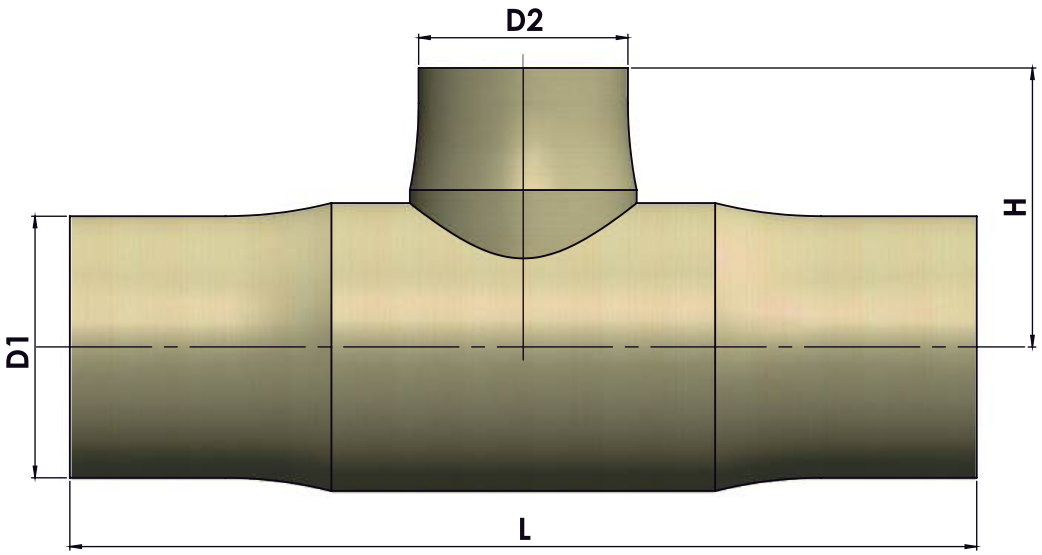
• Elbow 45°



• Elbow 30°

Kuzeyboru Standard Elbow Dimensions PN6/PN10							
Miter No	1				2		3
Angle Degrees	11,25°	15°	22,5°	30°	45°	60°	90°
DN (mm)	L				L		L
300	350	350	400	400	500	550	750
350	400	400	400	450	550	600	800
400	450	450	450	450	600	650	900
450	450	450	500	500	600	700	1000
500	450	450	500	500	650	750	1050
600	400	400	450	450	600	700	1100
700	400	400	450	450	650	800	1200
800	450	450	450	500	700	850	1350
900	450	450	500	550	800	950	1500
1000	450	500	500	550	850	1000	1650
1100	450	500	550	600	900	1100	1800
1200	500	550	600	600	950	1200	1950
1300	500	600	650	700	1050	1300	2100
1400	600	600	650	700	1100	1350	2250
1500	600	650	700	750	1200	1450	2400
1600	650	700	750	800	1250	1550	2550
1700	650	700	800	800	1300	1600	2700
1800	650	750	800	850	1350	1700	2850
1900	700	750	800	850	1400	1750	2950
2000	700	750	800	900	1450	1800	3100
2100	700	750	800	900	1500	1850	3200
2200	700	750	800	900	1550	1950	3350
2300	700	750	800	950	1550	2000	3450
2400	700	750	800	1000	1550	2100	3600
2500	700	750	800	1000	1600	2200	3750
2600	700	800	900	1000	1700	2200	3800
2700	800	800	900	1000	1800	2200	4000
2800	800	800	900	1000	1800	2300	4100
2900	800	800	900	1000	1900	2400	4200
3000	800	800	900	1100	1900	2400	4300
3100	800	800	1000	1100	2000	2500	4500
3200	800	900	1000	1100	2000	2600	4600
3300	800	900	1000	1100	2100	2600	4700
3400	800	900	1000	1100	2100	2700	4900
3500	800	900	1000	1100	2200	2800	5000
3600	900	900	1000	1200	2200	2800	5100
3700	900	900	1100	1200	2300	2900	5200
3800	900	900	1100	1200	2300	3000	5400
3900	900	1000	1100	1200	2400	3000	5500
4000	900	1000	1100	1300	2400	3100	5600

5.2. Tee Pieces (Equal & Unequal)



• *Equal Tee*

• *Unequal Tee*

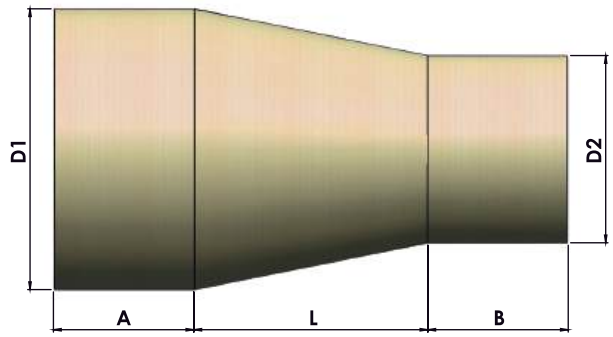
Kuzeyboru T Piece Dımensions PN6/PN10			
D1 (mm)	D2 (mm)	L (mm)	H (mm)
300	100	700	380
	150	800	400
	200	860	420
	250	940	440
	300	1040	520
350	150	800	400
	200	860	440
	250	940	460
	300	1040	560
	350	1120	580
400	200	860	460
	250	940	500
	300	1040	580
	350	1140	600
	400	1220	620
450	200	860	500
	300	1060	600
	350	1140	620
	400	1240	640
	450	1320	660
500	200	860	520
	300	1060	640
	400	1240	680
	450	1320	700
	500	1400	720
600	200	940	560
	300	1120	680
	400	1320	720
	450	1400	740
	600	1640	820
700	200	940	620
	350	1220	760
	450	1400	800
	500	1500	820
	700	1840	920
800	200	960	660
	350	1220	800
	450	1420	860
	600	1660	940
	800	2020	1020

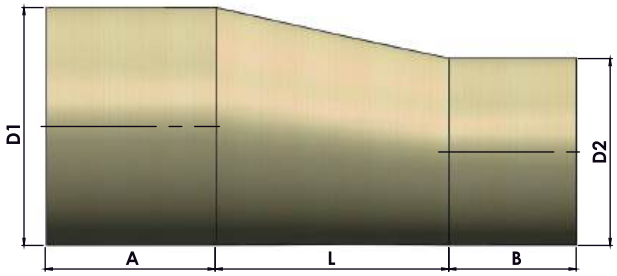
Kuzeyboru T Piece Dimensions PN6/PN10			
D1 (mm)	D2 (mm)	L (mm)	H (mm)
900	200	960	720
	350	1240	860
	500	1500	920
	700	1860	1040
	900	2220	1120
1000	200	1000	800
	350	1250	950
	500	1550	1000
	700	1900	1100
	1000	2450	1250
1100	200	1000	850
	400	1350	1000
	600	1700	1100
	800	2100	1200
	1100	2600	1300
1200	200	1000	900
	400	1350	1050
	600	1700	1150
	900	2300	1300
	1200	2800	1400
1300	200	1000	950
	400	1350	1100
	700	1900	1250
	1000	2450	1400
	1300	3000	1500
1400	200	1050	1000
	400	1400	1150
	700	1950	1300
	1000	2500	1450
	1400	3200	1600
1500	200	1050	1050
	450	1500	1250
	800	2100	1400
	1100	2700	1550
	1500	3400	1700
1600	200	1050	1100
	450	1500	1300
	800	2100	1450
	1200	2900	1650
	1600	3600	1800

Kuzeyboru T Piece Dimensions PN6/PN10			
D1 (mm)	D2 (mm)	L (mm)	H (mm)
1700	200	1100	1150
	450	1500	1350
	900	2300	1550
	1300	3050	1750
	1700	3800	1900
1800	200	1100	1200
	450	1500	1400
	900	2300	1600
	1300	3100	1800
	1800	3950	2000
1900	200	1150	1250
	500	1600	1450
	1000	2500	1700
	1400	3300	1900
	1900	4150	2100
2000	200	1200	1400
	500	1600	1500
	1000	2500	1800
	1500	3500	2000
	2000	4400	2200
2100	200	1200	1400
	500	1600	1600
	1100	2700	1900
	1600	3700	2100
	2100	4600	2300
2200	200	1200	1500
	500	1600	1600
	1100	2800	1900
	1600	3700	2200
	2200	4800	2400
2300	200	1300	1500
	600	1800	1800
	1200	2900	2000
	1700	3900	2300
	2300	5000	2500
2400	200	1300	1600
	600	1800	1800
	1200	2900	2100
	1800	4100	2400
	2400	5100	2600
2500	200	1300	1600
	600	1800	1900
	1300	3100	2200
	1900	4300	2500
	2500	5300	2700

Kuzeyboru T Piece Dimensions PN6/PN10			
D1 (mm)	D2 (mm)	L (mm)	H (mm)
2600	200	1300	1700
	600	1900	1900
	1300	3200	2200
	1900	4300	2500
	2600	5600	2800
2700	200	1400	1700
	700	2100	2000
	1400	3400	2300
	2000	4500	2600
	2700	5800	2900
2800	200	1400	1800
	700	2100	2100
	1400	3400	2400
	2100	4700	2700
	2800	5900	3000
2900	200	1400	1800
	700	2100	2100
	1500	3600	2500
	2200	4900	2800
	2900	6100	3100
3000	200	1400	1900
	700	2100	2200
	1500	3600	2500
	2200	4900	2900
	3000	6300	3200
3100	200	1500	2000
	800	2300	2300
	1600	3800	2600
	2300	5100	3000
	3100	6600	3300
3200	200	1500	2000
	800	2300	2300
	1600	3800	2700
	2400	5300	3100
	3200	6800	3400
3300	200	1500	2100
	800	2300	2400
	1700	4000	2800
	2500	5500	3200
	3300	6900	3500
3400	200	1500	2100
	800	2300	2400
	1700	4000	2800
	2500	5500	3200
	3400	7100	3600

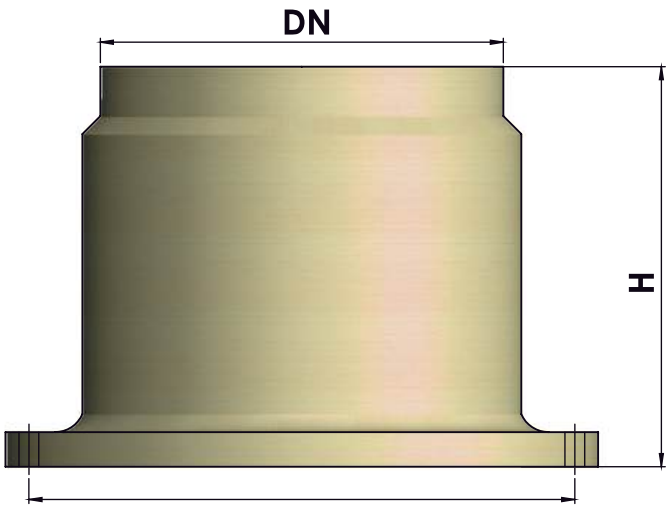
5.3. Reducers





Kuzeyboru GRP Reducer Dimensions PN6/PN10				
DL (mm)	D2 (mm)	A=B (mm)	L (mm)	Total Height (mm)
300	200	400	250	1050
300	250	400	125	925
350	250	400	250	1050
350	300	400	125	925
400	300	400	250	1050
400	350	400	125	925
500	350	400	375	1175
500	400	400	250	1050
600	400	400	500	1300
600	500	400	250	1050
700	500	400	500	1300
700	600	400	250	1050
800	600	400	500	1300
800	700	400	250	1050
900	700	400	500	1300
900	800	400	250	1050
1000	800	400	500	1300
1000	900	400	250	1050
1200	900	500	750	1750
1200	1000	500	500	1500
1400	1000	500	1000	2000
1400	1200	500	500	1500
1600	1200	600	1000	2200
1600	1400	600	500	1700
1800	1400	600	1000	2200
1800	1600	600	500	1700
2000	1600	600	1000	2200
2000	1800	600	500	1700
2200	2000	600	500	1700
2200	2100	600	250	1450
2400	2200	600	500	1700
2400	2300	600	250	1450
2600	2400	750	500	2000
2600	2500	750	250	1750
2800	2600	750	500	2000
2800	2700	750	250	1750
3000	2800	750	500	2000
3000	2900	750	250	1750
3200	3000	900	500	2300
3200	3100	900	250	2050
3400	3200	900	500	2300
3400	3300	900	250	2050
3600	3400	1050	500	2600
3600	3500	1050	250	2350
3800	3600	1050	500	2600
3800	3700	1050	250	2350
4000	3800	1100	500	2700
4000	3900	1100	250	2450

5.4. Flanges



Kuzeyboru GRP Flange Dimensions PN1/PN16			
DN (mm)	H (mm)	DN (mm)	H (mm)
300	700	2100	1100
350	700	2200	1100
400	700	2300	1200
450	700	2400	1200
500	700	2500	1300
600	800	2600	1300
700	800	2700	1400
800	800	2800	1400
900	800	2900	1500
1000	800	3000	1500
1100	900	3100	1600
1200	900	3200	1600
1300	900	3300	1800
1400	900	3400	1800
1500	900	3500	2000
1600	1000	3600	2000
1700	1000	3700	2200
1800	1000	3800	2200
1900	1000	3900	2400
2000	1000	4000	2400

6. grp manhole

GRP manholes are made from durable composite materials consisting of fiberglass-reinforced thermoset resin and silica sand. This composite structure provides the manholes with high durability, corrosion resistance, and a long service life. GRP manholes, which can be used in both underground and aboveground applications, are designed to meet various industrial needs.

6.1.GRP Manhole Applications

Kuzeyboru GRP manholes are widely used in water and wastewater infrastructure projects, industrial facilities, piping systems of chemical production plants, circulation lines of power plants, and transmission lines of hydroelectric power plants. These manholes, preferred in many areas such as stormwater and drainage systems, sewer lines, and underwater pipe applications, provide reliable solutions across a broad range of applications.

6.2.Advantage of Kuzeyboru GRP Manholes

GRP manholes stand out for their long lifespan and durable structure. With a minimum service life of 50 years, these manholes operate smoothly across a wide pH range and provide excellent resistance to corrosion. Their lightweight design offers significant advantages in transport and installation; they do not require special equipment during assembly and can be quickly installed. Compared to steel, cast iron, and concrete manholes, GRP manholes are much lighter, making them easy to transport and practical to install.

Kuzeyboru GRP manholes provide low hydraulic losses with their smooth inner surface structure, ensuring efficient transmission of water and wastewater with minimal friction. Their fully integrated elastomeric gasket connection system ensures leak-tightness, creating safe and robust connections.

7. design characteristics

7.1.Hydraulic Roughness

Pipe roughness is a key parameter for hydraulic calculations and analyses. The values to be used for Kuzeyboru GRP pipes are as follows:

Table 2 Hydraulic roughness

Manning (n)	*0,009*
Hazen-Williams (c)	*150*
Colebrook-White (k)	*0,029*

Due to the smooth inner surface of the pipe, hydraulic losses are lower compared to other types of pipes such as steel pipes. This superior feature of GRP pipes reduces the investment costs for equipment like pumps and the amount of energy consumed during operation. The excellent hydraulic properties of GRP pipes also have a positive environmental impact by reducing energy consumption during operation.

7.2.Flow Velocity

The recommended maximum flow rate for GRP pipes is 3.0 m/s. If the water is clean and does not contain abrasive substances, flow rates can go up to 5.0 m/s. For higher flow rates, Kuzeyboru can design special products depending on the fluid.

7.3.UV Resistance

The primary source of ultraviolet rays is sunlight. Long-term performance tests and research have shown that sunlight does not cause any weakening in GRP pipes, only potential color changes on the outer surface. Kuzeyboru GRP pipes are manufactured to withstand UV rays. However, if requested, the outer surfaces of the pipes can be coated with gelcoat or special designs by Kuzeyboru can be applied.

7.4.Poisson Coefficient

The Poisson's ratio is directly related to the structure of the pipe. Kuzeyboru GRP pipes have a Poisson's ratio of 0.22 – 0.29 for circumferential loads in the axial direction. The effect of axial load in the circumferential direction, or the Poisson's ratio, is slightly lower than this and can be considered negligible.

7.5.Thermal Coefficient

The thermal coefficient for axial elongation and contraction for Kuzeyboru GRP pipes is 24 - 30x10^{-6}mm/mm/°C.

7.6.Abrasion Resistance

Abrasion resistance is related to the effects of sand and similar materials within the fluid on the inner surface of the pipe. Although there is not yet a standardized procedure or classification method for this issue, the average abrasion loss for GRP pipes has been determined to be 0.34 mm over 100,000 cycles according to the Darmstadt Test Method. If necessary, Kuzeyboru designs special GRP pipes with high resistance to abrasion.

7.7.Operating Temperature

The abrasion resistance is related to the effects of materials such as sand present in the fluid on the inner surface of the pipe. Although there is no standardized procedure or classification method established for this issue, the average abrasion loss of GRP pipes has been determined to be 0.34 mm over 100,000 cycles according to the Darmstadt Test Method. If required, Kuzeyboru designs special GRP pipes with high resistance to abrasion.

Table 3 Resin types according to operation temperature

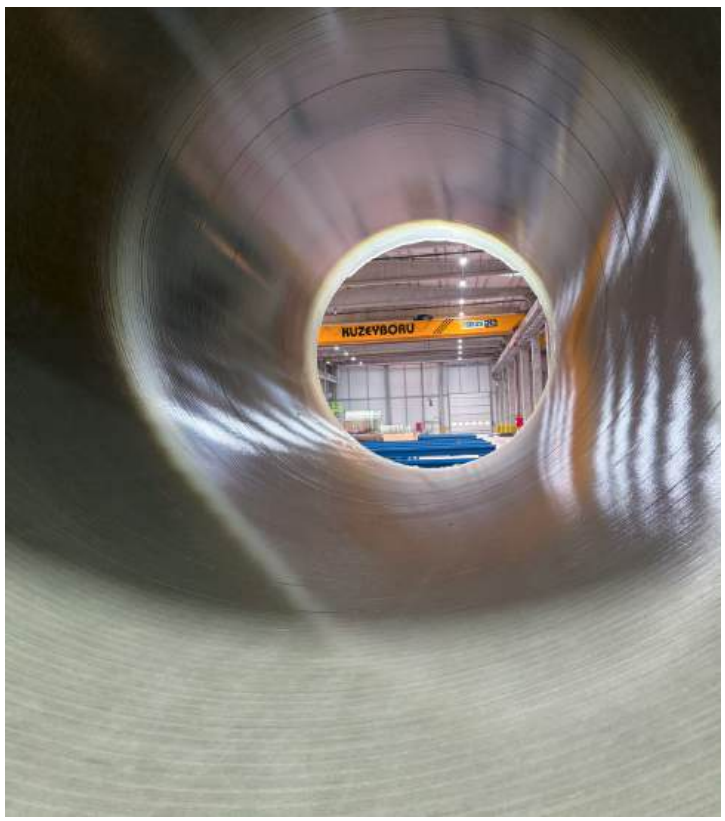
OPERATION TEMPERATURE	PRESSURE DERATING RATIO PN (1-%)	RESIN TYPE
Temp ≤ 35 °C	PN Class	Terephthalic, Orthophthalic, Isophthalic
36 C < Temp ≤ 50 °C	The nominal pipe pressure should be reanalyzed and evaluated according to operating conditions.	Terephthalic, Orthophthalic, Isophthalic
36 °C < Temp ≤ 40 °C 41 °C < Temp ≤ 45 °C 46 °C < Temp ≤ 50 °C	Pressure Derating Ratio : 30 % Pressure Derating Ratio: 40 % Pressure Derating Ratio : 50 %	he type of resin to be used should be determined according to project conditions.
50 °C < Temp	Pressure Derating Ratio : 50 %	Vinyl ester resin should be used either only in the liner layer or in all layers of the pipe, depending on the project conditions.

7.8.Negative Pressure (Vacuum)

If there is negative pressure in the pipeline, pipes with high stiffness values should be preferred. For buried pipelines with a negative pressure of -0.5 bar, it is recommended to use SN5000 pipes and ensure a minimum burial depth of 1 meter.

7.9.Water Hammer Pressure

In pipelines, sudden opening or closing of valves, or sudden stopping or starting of pumps, can cause sudden pressure surges known as water hammer. GRP pipes are less affected by water hammer compared to steel or similar pipes. Kuzeyboru GRP pipes can withstand water hammer up to 40% of their nominal pressure.



8. quality control and performance tests

8.1.Quality

During the production of high-quality Kuzeyboru GRP pipes, tests and measurements are meticulously conducted according to relevant standards at every stage, from the arrival of raw materials at the factory to the shipment of the produced GRP pipes.

Table 4 GRP pipe inspection tests

GRP PIPE LABORATORY TESTS	STANDARD
Barcol Hardness Test	TS EN 59
Long Term Ring Bending Test	TS ISO 10466
Circumferential Tensile Test	TS EN 1394 (Method B, Method D) TS ISO 8521 (Method B, Method D)
Stiffness Test	TS EN 1228 (Method B) ASTM D2412 TS ISO 7685 (Method B)
Axial Tensile Test	TS ISO 8513 (Method A)
Dimensional Controls (Length,OD, Wall thickness)	TS EN ISO 3126 Article 5.2, Article 5.3.3, Article 5.5)
Hydrostatic Pressure Test	ISO 7511 (Method A)

8.1.1.Raw Material Acceptance Tests

For the raw materials provided by approved suppliers with certificates demonstrating their compliance with quality standards, Kuzeyboru performs initial raw material entry control tests on resin, fiber, and sand in accredited Kuzeyboru laboratories within the framework of quality standards. Materials that meet the acceptance criteria are used in production.

- Glassfiber Tests
- Resin Control Tests
- Filler Silica Sand Tests
- Gasket Control Tests

8.1.2. Tests Performed on All Produced Pipes

During the production process of Kuzeyboru GRP pipes, the following tests are conducted to check the conformity of the produced pipes to the criteria.

Visual Controls : *The pipes and fittings shall be free from defects s uch as notches, holes, cracks, pits, foreign materials, air bubbles, and resin-deficient areas that could affect their strength and operational capability.*

Barcol Hardness : *The surface hardness of the produced pipe is measured using a Barcol Hardness Impressor.*

Pipe Wall Thickness Control : *The wall thicknesses of the pipes are measured to check their conformity.*

Pipe Length Control : *The lengths of all produced pipes are measured and checked.*

Diameter Control : *All pipes undergo diameter checks to ensure compliance with standards.*

Hydrostatic Pressure Test : *The produced pipes are tested at 1.5 times their nominal pressure using a hydrostatic pressure testing device.*

8.1.3.Tests Performed on Produced Pipes Using Sampling Method

The produced pipes are subjected to the following tests using a sampling system in accordance with the requirements of standards and specifications.

- Stiffness Test
- Structural Deterioration Control Under High Deflection
- Circumferential Tensile Test
- Axial Tensile Test
- Composite Test

8.1.4.Qualification Tests

In addition to raw material acceptance, product, and performance tests, the following tests are also conducted to determine if the produced pipes meet the required standards and to monitor their long-term performance.

Tests lasting over 10,000 hours aim to create design data and ensure predictable performance. In other words, according to ISO 10928 standards, the necessary physical parameters for the targeted nominal design life of 50 years are determined during this process. Typically, at least eighteen samples are prepared in the study, allowing for the collection of different data points throughout the testing period. A graph is created using the least squares method in logarithmic regression analysis. The performance values that meet the 50 year service life of the GRP pipe should be presented in accordance with the tables in international standards.

- Strain Corrosion Test
- Hydrostatic Design Basis (HDB)
- Long Term Ring Bending Test
- Long Term Ring Stiffness Test
- Abrasion resistance Test
- Joint Tests

CHEMICAL RESISTANCE TABLE		
MATERIAL NAME	POLYESTER RESIN	VINYLESTER
Acetic Acid < 20%		X
Adipic Acid		X
Alum (Aluminum Potassium Sulfate)	X	
Aluminum Chloride, Aqueous	X	
Ammonia, Aqueous < 20%		X
Ammonium Chloride, Aqueous (40°C)	X	X
Ammonium Nitrate, Aqueous (40°C)	X	
Ammonium Phosphate-Monobasic, Aqueous	X	
Ammonium Sulfate, Aqueous	X	
Aniline Hydrochloride		X
Barium Carbonate		X
Barium Chloride		X
Barium Sulfate		X
Beet Sugar Liquor		X
Benzene Sulfonic Acid (10%) *		X
Benzoic Acid *		X
Black Liquor (Paper)		X
Borax (40°C)	X	
Boric Acid		X
Bromine, Aqueous (5%) *		X
Butyric Acid < 25% (40°C)*		X
Calcium Bisulfide *	X	
Calcium Carbonate	X	
Calcium Chlorate, Aqueous (40°C)	X	
Calcium Chloride (Saturated) (40°C)	X	
Calcium Hydroxide, 100%		X
Calcium Hypochlorite *		X
Calcium Nitrate (40°C)	X	
Calcium Sulfate NL AOC	X	
Cane Sugar Liquor		X
Carbon Dioxide, Aqueous	X	

Casein	X	
Caustic Potash (KOH) (40°C)		X
Chlorine, Dry Gas *		X
chlorine, water *		X
chlorine, wet gas *		X
cıtric acid, aqueous		X
copper acetate, aqueous (40°c)	X	
copper nitrate, aqueous (40°c)	X	
copper sulfate, aqueous (40°c)	X	
crude oil (sour) (30°c) *	X	
crude oil (sweet) (30°c) *	X	
crude oil, salt water (25°c) *		X
cyclohexane (40°c) *		X
cyclohexanol (30°c) *		X
fuel oil (25°c) *	X	
gasoline, ethyl *		X
glycerine		X
green liquor, paper		X
hexane *		X
hydrochloric acid, up to 15%	X	
kerosene *		X
lactıc acid, 10% (30°c)	X	
lead acetate, aqueous (25°c)	X	
lead nitrate, aqueous (25°c)	X	
lınseed oil *	X	
lithium bromide, aqueous (40°c) *	X	
lithium chloride, aqueous (40°c) *	X	
magnesıum bıcarbonate, aqueous (30°c) *	X	
magnesıum carbonate (40°c) *	X	X
magnesıum sulfate	X	
magnesıum chlorıde, aqueous (25°c) *	X	
manganese chlorıde, aqueous (40°c) *	X	
manganese sulfate, aqueous (40°c) *	X	
mıneral oıl *	X	
n-heptane (25°c) *	X	

naphthalene (30°c) *	X	
naptha *		X
oleic acid (40°c)	X	
oxalic acid, aqueous		X
paraffin (30°c) *	X	
perchloric acid (25°c)		X
petroleum, refined & sour *		X
phosphoric acid		X
potassium nitrate, aqueous (40°c)	X	
potassium sulfate (40°c)	X	
propylene glycol (30°c)	X	
sea water (40°c)	X	
sewage (50°c)	X	
silicone oil (40°c)	X	
silver nitrate, aqueous (40°c)	X	
sodium hydroxide 10%		X
sodium mono-phosphate		X
sodium nitrate, aqueous (40°c)	X	
sodium nitrite, aqueous (40°c)*	X	
sodium silicate		X
sodium sulfide		X
sodium tetraborate		X
stannous chloride, aqueous (40°c)	X	
stearic acid, aqueous (40°c)*	X	
sulfuric acid, < 25% (25°c)*	X	
tannic acid, aqueous (35°c)	X	
tartaric acid (30°c)	X	
triethylamine (40°c) *		X
turpentine *		X
urea, aqueous (30°c) *	X	
vinegar (25°c)	X	
water, distilled (40°c)	X	
water, sea (40°c)	X	
water, tap (40°c)	X	
zinc chloride, aqueous (40°c)	X	

For more information on resin type selection, please contact KUZEYBORU.

Certification and Documents


CERTIFICATE OF CONFORMITY
UYGUNLUK SERTİFİKASI
TÜV AUSTRIA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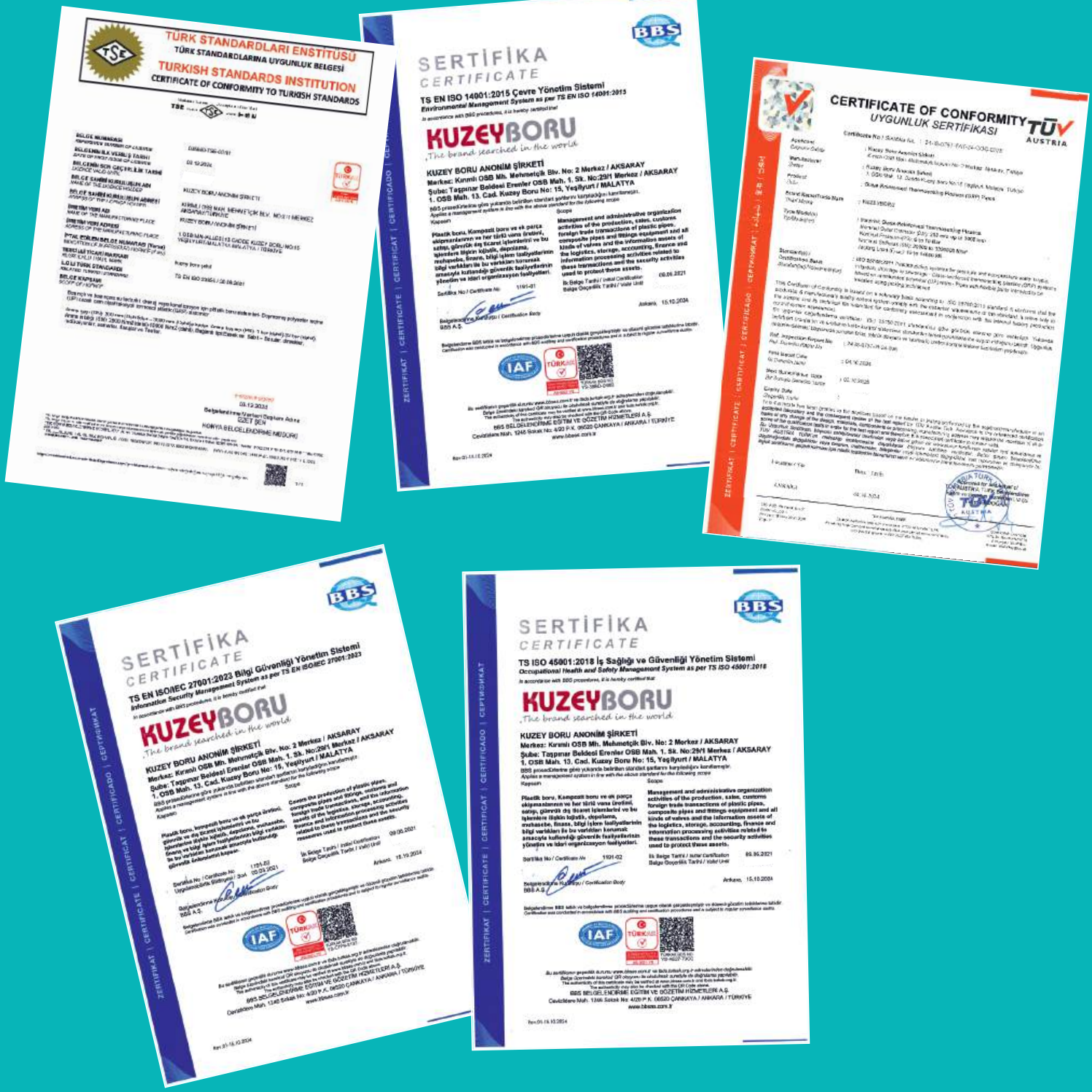

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