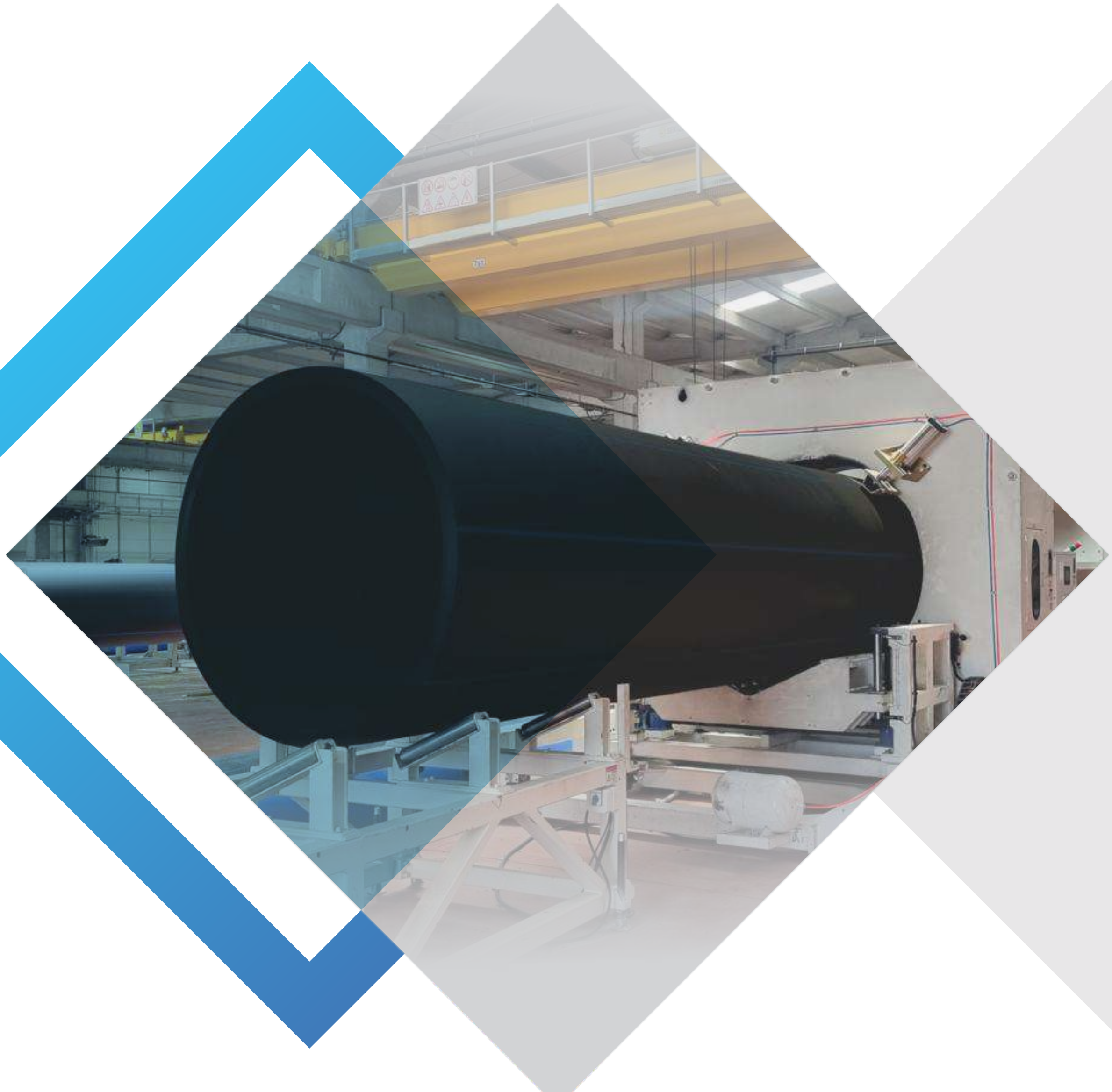
kuzeyboru



POLYETHYLENE PRODUCT CATALOG


kuzeyboru

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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 200.336,23 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.

200.336,23 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

Our Quality Philosophy

We adopt an inclusive management approach that empowers leadership at all levels and strengthens the implementation of decision-making processes and the analysis of data to make continuous improvements. Our goal is to achieve sustainable success through operational excellence and lean production, making the most effective use of workforce, processes, and technology.Kuzeyboru's quality control process is composed of three main sections to ensure quality at every stage of production:

Incoming Quality Control
Process Quality Control
Final Quality Control

1. Incoming Quality Control

The process begins with the procurement of raw materials and auxiliary supplies from external sources. Upon delivery, the ordered materials are subjected to incoming quality control tests according to the quality control plan and relevant product standards. Products that pass the conformity tests are labeled with an acceptance tag and moved to stock areas. Non-conforming products are identified with a non-conformity report, transferred to the rejection area, and returned to the supplier.

2. Process Quality Control

At the start of production, all stages of our machinery are checked for occupational safety and production efficiency. During production, samples from the first output are tested in our laboratory according to the relevant product standards and specifications. Every product produced is inspected in accordance with the quality plan to ensure compliance with customer requirements and international standards.To ensure traceability, each product is permanently marked using laser marking. All records related to raw materials, machine process logs, sample test results, and periodic inspection outcomes are stored digitally and preserved for the duration specified in the quality standards.

3. Final Quality Control

Products that pass both the incoming and process quality control stages and are moved to stock are subjected to a final quality check before shipment. At this stage, quality control engineers re-verify compliance with all quality standards, and shipment approval is granted.

Our Accredited Testing Laboratory

Kuzeyboru Testing Laboratory prioritizes conducting its operations in accordance with national and international standards, delivering results in the shortest time possible, using cost-effective and technically sound practices. Core principles include impartiality, independence, integrity, confidentiality, reliability, and legal compliance.The laboratory aims to exhibit excellent professional practices with its continuously trained expert staff, meet customer expectations at the highest level using up-to-date testing methods and technologically advanced devices, and ensure accurate test results using necessary reference/standard materials. Additionally, it strives to improve test quality through interlaboratory comparison measurements and minimize complaints with a customer satisfaction-oriented approach.All personnel work in accordance with policies and procedures based on the TS EN ISO/IEC 17025 standard. The laboratory management is committed to complying with this standard and pursuing continuous improvement.

LABORATORY TESTS PERFORMED WITHIN THE SCOPE OF ACCREDITATION	STANDART
Determination of Dimensions	TS EN ISO 3126
Determination of Density	TS EN ISO 1183-1 (Metot A)
Determination of Volatile Matter Content	TS EN ISO 12099
Determination of Mass Melt Flow Rate (MFR)	TS EN ISO 1133-1 (Metot A)
Determination of Tensile Properties	TS EN ISO 6259-1, TS EN ISO 6259-3
Determination of Degree of Pigment or Carbon Black Distribution	TS ISO 18553
Determination of Carbon Black by Calcination and Pyrolysis	TS ISO 6964, ASTM D4218
Change in Length	TS EN ISO 2505
Determination of Resistance to Internal Pressure	TS EN ISO 1167-1, TS EN ISO 1167-2
Determination of Resistance to Rapid Crack Propagation (RPC)	TS EN ISO 13477
Determination of Rim Stiffness	TS EN ISO 9969
Determination of Ring Elasticity	TS EN ISO 13968
Determination of Resistance to External Impact Along the Circumference	TS EN ISO 3127
Oven Test	TS ISO 12091
Determination of Oxidation Induction Time (OIT)	TS EN ISO 11357-6, TS EN ISO 11357

4. kuzeyboru pe pipe systems

4.1. KUZEYBORU PE 100 PIPES

Kuzeyboru PE pipe systems are produced from polyethylene (PE) raw material in compliance with TS EN 12201-1 and TS EN 12201-2 standards. Available in various pressure classes and sizes, these pipes are used in pressurized water supply, sewage, and drainage systems due to their strength, durability, ease of application, and superior resistance to abrasion, chemicals, and corrosion.

Polyethylene Pipe Tests

Feature	Standard	Unit	Value
Molten mass flow rate (MFR) 190°C , 5Kg	TS EN ISO 1133-1	g/10 min	0,2 ≤ MFR ≤ 1,4
Density	TS EN ISO 1183-1	Kg/m3	≥ 930
Dimensional stability (110) °C	TS ISO 2505	"heating time:65 min"	Length change shall be ≤ %3.
Resistance to internal pressure	TS EN ISO 1167-1 TS EN ISO 1167-2	1000 hours 5.0 MPa 80 °C	No damage
Elongation at break	EN ISO 6259-1	100 hours 12.0 MPa 20 °C	≥ %350
Determination of oxidation induction time	TS EN ISO 11357-6	200 °C ≥ 20 min	≥ 20 min. No decomposition
Evaluation of the degree of dispersion of pigment or carbon black	ISO 18553	%	Dispersion degree ≤ %3
Amount of carbon black	ISO 6964	%	It shall be between 2-2.5% by mass
Determination of volatile matter content	TS EN ISO 12099	%	≤%300mg-kg shall be
Determination of resistance to crack propagation - Slow crack propagation3 test on notched pipes	TS EN ISO 13479	1000 hour 80°C 9.2bar	No damage
Determination of resistance to rapid crack propagation	TS EN ISO 13479	<4,7x nominal diameter mm	≥250

kuzeyboru

DN mm	Toleranslar (+) *			SDR 41 PN 4			SDR 33 PN 5			SDR 26 PN 6			SDR 21 PN 8		
	A*	B*	O*	S mm	S*	M kg/m	S mm	S*	M kg/m	S mm	S*	M kg/m	S mm	S*	M kg/m
16	0,3	0,3	1,2	-	-	-	-	-	-	-	-	-	-	-	-
20	0,3	0,3	1,2	-	-	-	-	-	-	-	-	-	-	-	-
25	0,3	0,3	1,2	-	-	-	-	-	-	-	-	-	-	-	-
32	0,3	0,3	1,3	-	-	-				-	-	-	-	-	-
40	0,4	0,4	1,4	-	-	-							2,0	2,3	0,24
50	0,4	0,4	1,4	-	-	-				2,0	0,3	0,30	2,4	0,3	0,36
63	0,4	0,4	1,5	1,8	0,3	0,36	2,0	0,3	0,39	2,5	0,4	0,47	3,0	0,4	0,57
75	0,4	0,5	1,6	1,9	0,3	0,45	2,3	0,4	0,54	2,9	0,4	0,65	3,6	0,4	0,81
90	0,6	0,6	1,8	2,3	0,3	0,64	2,8	0,4	0,78	3,5	0,5	0,94	4,3	0,5	1,16
110	0,7	0,6	2,2	2,7	0,4	0,93	3,4	0,5	1,16	4,2	0,6	1,38	5,3	0,6	1,74
125	0,8	0,6	2,5	3,1	0,5	1,22	3,9	0,5	1,50	4,8	0,6	1,79	6,0	0,7	2,25
140	0,9	0,9	2,8	3,5	0,5	1,52	4,3	0,6	1,86	5,4	0,7	2,26	6,7	0,8	2,81
160	1,0	1,0	3,2	4,0	0,5	1,97	4,9	0,6	2,40	6,2	0,8	2,96	7,7	0,9	3,69
180	1,1	1,1	3,6	4,4	0,6	2,46	5,5	0,7	3,04	6,9	0,8	3,70	8,6	1,0	4,64
200	1,2	1,2	4,0	4,9	0,6	3,02	6,2	0,8	3,81	7,7	0,9	4,59	9,6	1,1	5,75
225	1,4	1,4	4,5	5,5	0,7	3,82	6,9	0,8	4,74	8,6	1,0	5,77	10,8	1,2	7,26
250	1,5	1,5	5,0	6,2	0,8	4,79	7,7	0,9	5,88	9,6	1,1	7,16	11,9	1,3	8,89
280	1,7	1,7	9,8	6,9	0,8	5,94	8,6	1,0	7,35	10,7	1,2	8,94	13,4	1,4	11,18
315	1,9	1,9	11,1	7,7	0,9	7,46	9,7	1,1	9,32	12,1	1,4	11,37	15,0	1,6	14,10
355	2,2	2,2	12,5	8,7	1,0	9,49	10,9	1,2	11,78	13,6	1,5	14,40	16,9	1,7	17,86
400	2,4	2,4	14,0	9,8	1,1	12,03	12,3	1,4	15,01	15,3	1,7	18,26	19,1	1,9	22,72
450	2,7	2,7	15,6	11,0	1,2	15,17	13,8	1,5	18,90	17,2	1,9	23,09	21,5	2,2	28,81
500	3,0	3,0	17,5	12,3	1,4	18,89	15,3	1,7	23,31	19,1	2,1	28,49	23,9	2,4	35,56
560	3,4	3,4	19,6	13,7	1,5	23,52	17,2	1,9	29,34	21,4	2,3	35,75	26,7	2,7	44,51
630	3,8	3,8	22,1	15,4	1,7	29,75	19,3	2,1	37,01	24,1	2,6	45,29	30,0	3,0	56,24
710	6,4	6,4	24,9	17,4	1,9	37,86	21,8	2,3	47,04	27,2	2,9	57,61	33,9	3,3	71,52
800	7,2	7,2	28,0	19,6	2,1	48,01	24,5	2,6	59,58	30,6	3,2	73,02	38,1	3,7	90,58
900	8,1	8,1	31,5	22,0	2,3	60,55	27,6	2,9	75,47	34,4	3,9	92,35	42,9	4,2	114,77
1000	9,0	9,0	35,0	24,5	2,6	74,98	30,6	3,2	92,96	38,4	4,0	114,55	47,7	4,7	141,83
1200	10,8	10,8	42,0	29,4	3,1	107,93	36,7	3,8	133,73	45,9	4,5	164,30	57,2	5,2	203,39
1400	12,6	12,6	49,0	34,3	3,6	146,87	42,9	4,4	182,28	53,5	5,5	223,43	66,7	5,8	276,21
1600	14,4	14,4	56,0	39,2	4,1	191,80	49,0	5,0	237,89	61,2	6,3	292,10	76,2	6,5	360,37

A* : Pipe outside diameter tolerance with normal tolerance, mm. (+ in.)
B* : Precision tolerance pipe outside diameter tolerance, mm. (in +)
O* : Tube ovality tolerance, mm. (in +)
S* : Wall thickness tolerance, mm. (in +)

SDR* : Standard Length Ratio = Outside Diameter / Wall Thickness
DN* : Outer Diameter
S* : Wall Thickness
* : Letters preceded by a * indicate tolerances

SDR 17 PN 10			SDR 13,6 PN 12,5			SDR 11 PN 16			SDR 9 PN 20			SDR 7,4 PN 25			SDR 6 PN 32		
S mm	S*	M kg/m	S mm	S*	M kg/m	S mm	S*	M kg/m	S mm	S*	M kg/m	S mm	S*	M kg/m	S mm	S*	M kg/m
-	-	-	-	-	-	-	-	-	2,0	0,3	0,09	2,3	0,3	0,11	3,0	0,4	0,12
-	-	-	-	-	-	2,0	0,3	0,11	2,3	0,4	0,13	3,0	0,4	0,16	3,4	0,5	0,18
-	-	-	2,0	0,3	0,15	2,3	0,4	0,17	3,0	0,4	0,21	3,5	0,5	0,24	4,2	0,6	0,28
2,0	0,3	0,19	2,4	0,4	0,23	3,0	0,4	0,27	3,6	0,5	0,32	4,4	0,6	0,38	5,4	0,7	0,45
2,4	0,4	0,29	3,0	0,5	0,36	3,7	0,5	0,42	4,5	0,6	0,50	5,5	0,7	0,60	6,7	0,8	0,70
3,0	0,4	0,45	3,7	0,5	0,54	4,6	0,6	0,66	5,6	0,7	0,78	6,9	0,8	0,93	8,3	1,0	1,08
3,8	0,5	0,71	4,7	0,6	0,87	5,8	0,7	1,04	7,1	0,9	1,25	8,6	1,0	1,46	10,5	1,2	1,69
4,5	0,6	1,01	5,6	0,7	1,23	6,8	0,8	1,46	8,4	1,0	1,75	10,3	1,2	2,08	12,5	1,4	2,43
5,4	0,7	1,45	6,7	0,8	1,76	8,2	1,0	2,11	10,1	1,2	2,53	12,3	1,4	2,99	15,0	1,7	3,51
6,6	0,8	2,15	8,1	1,0	2,60	10,0	1,1	3,13	12,3	1,4	3,76	15,1	1,7	4,47	18,3	2,0	5,22
7,4	0,9	2,74	9,2	1,1	3,35	11,4	1,3	4,06	14,0	1,6	4,87	17,1	1,9	5,76	20,8	2,2	6,74
8,3	1,0	3,44	10,3	1,2	4,20	12,7	1,4	5,06	15,7	1,7	6,09	19,2	2,1	7,23	23,3	2,5	8,45
9,5	1,1	4,50	11,8	1,3	5,48	14,6	1,6	6,64	17,9	1,9	7,94	21,9	2,3	9,42	26,6	2,8	11,03
10,7	1,2	5,69	13,3	1,5	6,96	16,4	1,8	8,40	20,1	2,2	10,04	24,6	2,6	11,91	29,9	3,1	13,94
11,9	1,3	7,02	14,7	1,6	8,53	18,2	2,0	10,36	22,4	2,4	12,42	27,4	2,9	14,73	33,2	3,5	17,21
13,4	1,5	8,90	16,6	1,8	10,83	20,5	2,2	13,00	25,2	2,7	15,72	30,8	3,2	18,61	37,4	3,9	21,79
14,8	1,6	10,91	18,4	2,0	13,34	22,7	2,4	16,12	27,9	2,9	19,32	34,2	3,6	22,98	41,5	4,3	26,87
16,6	1,8	13,70	20,6	2,2	16,72	25,4	2,7	20,21	31,3	3,3	24,28	38,3	4,0	28,82	46,5	4,8	33,71
18,7	2,0	17,35	23,2	2,5	21,19	28,6	3,0	25,58	35,2	3,7	30,72	43,1	4,5	36,48	52,3	5,4	42,66
21,1	2,3	22,09	26,1	2,8	26,87	32,2	3,4	32,47	39,7	4,1	39,01	48,5	5,0	46,25	59,0	6,0	54,19
23,7	2,5	27,91	29,4	3,1	34,07	36,3	3,8	41,23	44,7	4,6	49,49	54,7	5,6	58,75			
26,7	2,8	35,36	33,1	3,5	43,16	40,9	4,2	52,21	50,3	5,2	62,66	61,5	6,3	74,32			
29,7	3,1	43,70	36,8	3,8	53,25	45,4	4,7	64,42	55,8	5,7	77,22						
33,2	3,5	54,74	41,2	4,3	66,81	50,8	5,2	80,70	62,5	6,3	96,43						
37,4	3,9	69,33	46,3	4,8	84,45	57,2	5,9	102,25	70,3	7,2	132,5						
42,1	4,4	87,97	52,2	5,4	107,28	64,5	6,7	129,97	79,3	8,1	149,0						
47,4	4,9	111,55	58,8	6,0	136,09	72,6	7,4	162,8	89,3	9,1	200,2						
53,3	5,5	141,11	66,1	6,7	172,29	81,7	8,3	207,5									
59,3	6,1	174,39	73,4	7,5	212,64	90,8	9,2	261,3									
71,1	6,8	248,56	88,2	9,0	324,0												
83,0	7,6	337,82	102,9	10,4	462,8												
94,8	8,5	440,55	117,5	11,9	616,4												

4.2. PE 80 NATURAL GAS PIPES

Kuzeyboru manufactures natural gas pipes from PE 80 and PE 100 raw materials. These polyethylene pipes, suitable for pressurized pipe applications, are available in yellow, orange, and black colors. Due to their flexibility, they exhibit impact resistance at low temperatures. The pipes are available in diameters ranging from Ø32-250 mm, with standard lengths of 6 m, 13.5 m, or 11.8 m. For smaller diameters, coils can be produced up to 100 meters in length. Additionally, the lengths of both coils and straight pipes can be adjusted according to customer requirements.

Tests Conducted on PE80-100 Natural Gas Pipes in Our Accredited Laboratory

Test name	Parameters		Method
Density	≥ 930 kg/m3	23 °C	EN ISO 1183-1
Mfr (Raw Material)	0,2 ≤ mfr ≤ 1,4	5 Kg, 190 °C, 10 min.	EN ISO 1133
Mfr (Pipe)	The difference compared to the raw material should be at most 20%.	5 Kg, 190 °C, g/10 dk. Min	EN ISO 1133
Elongation at Break	≥ %350	23 °C	"EN ISO 6259-1 ISO 6259-3"
Hydrostatic Strength	No damage should be observed on the test piece during the test period. ≥ 20 min	100 hours 20°C 165 hours 80 °C 1000 hours 80 °C	EN ISO 1167-1 EN ISO 1167-2
Oxidation Induction Time	≥ 20 min	15 mg ± 2, 190 °C, With oxygen	ISO 11357-6
Carbon Black Amount	% 2- 2,5	550 °C / 900 °C	ISO 6964
Pigment Distribution	Grade ≤ 3 Distribution DegreeA1, A2, A3 or It should be B.	150 ~ 210 °C	ISO 18553
Resistance to Slow Crack Growth (Cone Test)	10 mm- day	e ≤ 5 mm	ISO 13480
Resistance to Slow Crack Growth (Notch Test)	During the experiment part of any no damage should be observed.	e ≤ 5 mm	EN ISO 13479
Determination of Volatile Matter ContentDensity	pc ≥ 1,5 MOP pc = 3,6 pc,s4 + 2,6	0 °C	EN ISO 13477
Mfr (Raw Material)	≤ 350 mg/kg	"65dk/min105 °C"	EN 12099

Natural Gas Pipe Sizes and Tolerances (HDPE 80, HDPE 100)

DN (mm)	Tolerans (+)*			SDR17,6			SDR17			SDR11		
	A*	B*	C*	S mm	S*	m kg/m	S mm	S*	m kg/m	S mm	S*	m kg/m
32	0,3	0,3	1,3	2,3	0,4	0,22	2,3	0,4	0,22	3	0,4	0,29
40	0,4	0,4	1,4	2,3	0,4	0,27	2,4	0,4	0,29	3,7	0,5	0,44
50	0,4	0,4	1,4	2,9	0,4	0,43	3,0	0,4	0,45	4,6	0,6	0,69
63	0,4	0,4	1,5	3,6	0,5	0,68	3,8	0,5	0,71	5,8	0,7	1,09
75	0,5	0,5	1,6	4,3	0,6	0,96	4,5	0,6	1,01	6,8	0,8	1,52
90	0,6	0,6	1,8	5,2	0,7	1,40	5,4	0,7	1,45	8,2	1,0	2,20
110	0,7	0,6	2,2	6,3	0,8	2,07	6,6	0,8	2,17	10,0	1,2	3,28
125	0,8	0,6	2,5	7,1	0,9	2,65	7,4	0,9	2,76	11,4	1,3	4,25
140	0,9	0,9	2,8	8,0	0,9	3,34	8,3	1,0	3,47	12,7	1,4	5,30
160	1,0	1,0	3,2	9,1	1,1	4,34	9,5	1,1	4,53	14,6	1,6	6,97
180	1,1	1,1	3,6	10,3	1,2	5,53	10,7	1,2	5,75	16,4	1,8	8,81
200	1,2	1,2	4,0	11,4	1,3	6,80	11,9	1,3	7,10	18,2	2,0	10,86
225	1,4	1,4	4,5	12,8	1,4	8,59	13,4	1,4	8,99	20,5	2,2	13,76
250	1,5	1,5	5,0	14,2	1,6	10,59	14,8	1,6	11,04	22,7	2,4	16,93

4.3 MARINE DRAINAGE PIPES (DREDGING PIPES)

Our marine drainage pipes are produced from HDPE material, and when used with Kuzeyboru's connection equipment and flange adapters, no chemical or physical issues arise. These pipes are designed to withstand harsh conditions at sea and on ships, offering high abrasion resistance. Due to their UV additives, the pipes are produced in black and are protected from harmful sunlight, ensuring long durability. Our certified welding teams expertly join pipes with the same chemical properties. The steel flanges we use are custom-made and offer a lighter, more practical use with standard hole numbers.

Pipe Floatation Buoy Features

Floatation buoys are used for floating plastic pipes when operating a discharge machine. These buoys are specially manufactured according to the required buoyancy force or desired diameters. In case of cracks during operation, the pipes are filled with foam-EPS to prevent sinking. They can be safely used with corrosion-resistant bolts and nuts. The conical design reduces friction during floating. The buoys can be used with or without foam filling. The tight-fitting corner bolts secure the buoys firmly to the pipe. The internal configuration provides a versatile gripping surface that directs fluids passing between the pipe and the float, increasing the contact area with the pipe. This system does not require rubber or additional seals. The buoys can be stacked for storage or transport. Profiles interlock to lock and provide easy assembly.

Pipe Floatation Buoys Dimensional Table

Nominal Diameter mm	Inc	OD mm	ID mm	Lenght mm	Weight kg s
250	10"	750	260	750	34
315	12"	850	325	1100	54
355	14"	850	365	1100	54
400	16"	850	410	1100	54
450	18"	850	460	1100	54
500	20"	1175	515	1100	100
560	22"	1175	575	1100	100

630	24”	1300	650	1300	150
560	26”	1300	785	1300	150
700	28”	1550	715	1300	200
750	30”	1550	765	1300	200
800	32”	1700	820	1300	225

4.4 PERFORATED (HOLED) PE 100 PIPES

PE100 pipes, which are pressure-resistant, are perforated (drilled or slot-opened) and can carry groundwater or leachate from waste facilities under the ground for many years without crushing or breaking. When joined using butt fusion or electrofusion methods, the joints are highly durable. Kuzeyboru specializes in the perforation (drilling or slot opening) of PE100 pipes and their joining on-site using butt fusion or electrofusion methods. Based on customer requirements, we perform drainage calculations regarding hole diameter, number, pipe diameter, and wall thickness to provide the most suitable products.

4.4.1 Applications of Perforated Drainage Pipes

·Collection of leachate in solid waste (landfill) facilities

·Collection of excess groundwater in agricultural areas

·Land reclamation of swampy or marshy lands

·Collection and drainage of water from deep foundations of buildings

·Infrastructure in sports fields, such as soccer complexes

·Drainage of embankments on highways

4.5. HDPE PRE-INSULATED PIPES

Standard pre-insulated pipes consist of three main materials. The carrier pipes are made of steel, copper, or plastic-based materials, depending on the fluid being transported. The casing pipes are produced from high-density polyethylene (HDPE) raw material with UV resistance and 100% water impermeability. Between the carrier and casing pipes, a polyurethane-based insulation material is placed, which acts to prevent heat loss.

4.5.1 HDPE Pre-Insulated Pipe Features

Areas of Use:

·Geothermal district heating and cooling projects

·Fire lines

·Central heating systems, satellite towns, housing complexes

·Gallery or underground applications

·Industrial facilities, greenhouse applications, gas and oil pipelines

·Hotel and tourism facilities

·Universities, military installations, water lines

·Ship installations and many other areas

HDPE Pre-Insulated Thermal Pipes Features

Pre-Insulated System

In Concrete Channels and Galleries	Since the casing pipe is seamless and drawn from an extruder machine, no water can penetrate the polyurethane material. The insulation material's l ifespan is a minimum of 30 years.
Solution for Thermal Expansion	No corrosion occurs on the carrier pipe due to external factors.
Heat Loss:	30 years (at 120°C continuous service temperature).
Service Life	Only joint labor is required.
Corrosion	No corrosion occurs on the carrier pipe due to external factors.
Insulation Lifespan	30 years (at 120°C continuous service temperature).
Field Labor	Only joint labor is required.
Installation Time	Installation time is halved compared to conventional systems.
Insulation Type	Special polyurethane, the best insulation material, is used.
Casing Pipe	The casing pipe is seamless polyethylene, making leakage impossible. Polyethylene is resistant to corrosion and impacts.
Leak Detection Systems	If required, leak detection wires can be installed inside the pipes to pinpoint leak locations with a precision of ±1 to ±2 meters in a 10 km network.
Homogeneous Heat Distribution	Homogeneity is maintained in the insulation thickness.
Variety of Accessories	Homogeneity is maintained in the insulation thickness.
Production Standard:	Manufactured according to the EN253 standard, established by European manufacturers with 30 years of experience.

5. polyethylene fittings

Product	EF Sleeve
Diameter	DN 20 - 1600 mm
Material	High-Density Polyethylene
Application	Water and Gas Systems

Product	Flange Adapter
Diameter	DN 140 - 1600 mm
Material	High-Density Polyethylene
Application	Water and Irrigation Pipe Systems

Product	EF Elbow 90°
Diameter	DN110 - 90 / 1600 - 500 mm
Material	High-Density Polyethylene
Application	Water and Gas Systems

Product	Elbow 90°
Diameter	DN 63 - 315 mm
Material	High-Density Polyethylene
Application	Water and Irrigation Pipe Systems

Product	EF Equal TEE
Diameter	Dn25 - 315 mm
Material	High-Density Polyethylene
Application	Water and Gas Systems

Product	Equal TEE
Diameter	DN 63 - 315 mm
Material	High-Density Polyethylene
Application	Water and Irrigation Pipe Systems

Product	Elbow 45°
Diameter	DN63 - 315 mm
Material	High-Density Polyethylene
Application	Water and Irrigation Pipe Systems

Product	Reduction
Diameter	DN 20 - 900 mm
Material	High-Density Polyethylene
Application	Water and Irrigation Pipe Systems

Product	EF Service TEE
Diameter	DN 40 - 20 / 450 - 63 mm
Material	High-Density Polyethylene
Application	Water and Gas Systems

Product	Cross TEE
Diameter	DN 90 - 315 mm
Material	High-Density Polyethylene
Application	Water and Irrigation Pipe Systems

Product	EF Flanged Service TEE
Diameter	DN63 - 20 / 280 - 63 mm
Material	High-Density Polyethylene
Application	Water and Gas Systems

Product	EF Saddle
Diameter	DN110 - 90 / 1600 - 500 mm
Material	High-Density Polyethylene
Application	Water and Gas Systems

Product	End Cap
Diameter	DN 20 - 450 mm
Material	High-Density Polyethylene
Application	Water and Gas Systems

Product	EF Elbow 45°
Diameter	DN110 - 90 / 1600 - 500 mm
Material	High-Density Polyethylene
Application	Water and Gas Systems

Product	Unequal Tee
Diameter	DN 63 - 315 mm
Material	High-Density Polyethylene
Application	Water and Irrigation Pipe Systems

Product	EF Cap
Diameter	DN25 - 315 mm
Material	High-Density Polyethylene
Application	Water and Gas Systems

Product	EF Reduction
Diameter	DN31 - 20 / 125 - 110 mm
Material	High-Density Polyethylene
Application	Water and Gas Systems

5.1 STEEL TRANSITION FITTINGS

Product	Steel Transition Fitting
Diameter	DN 20 - 500 mm
Material	Pe100 - Steel
Application	Water and Gas Systems

Product	Solid Brass Transition (Internal Thread)
Diameter	DN 26 - 63 mm
Material	Pe100 - Steel - Brass
Application	Water and Gas Systems

Product	Steel Flange
Diameter	DN 20 - 1200 mm
Material	PE100 - Steel - Brass
Application	Water and Gas Systems

Product	Solid Brass Transition (External Thread)
Diameter	DN 26 - 63 mm
Material	Pe100 - Steel - Brass
Application	Water and Gas Systems

5.2 GARMENT FITTINGS

Product	Elbow 45°
Diameter	DN 20 - 1600 mm
Material	High-Density Polyethylene
Application	Water and Gas Systems

Product	Elbow 90°
Diameter	DN 20 - 1600 mm
Material	High-Density Polyethylene
Application	Irrigation Systems

Product	Y Fitting
Diameter	DN 20 - 1600 mm
Material	High-Density Polyethylene
Application	Irrigation Systems

Product	Cross TEE
Diameter	DN 20 - 1600 mm
Material	High-Density Polyethylene
Application	Irrigation Systems

Product	Equal TEE
Diameter	DN 20 - 1600 mm
Material	High-Density Polyethylene
Application	Irrigation Systems

Product	Reduction
Diameter	DN 20 - 1600 mm
Material	High-Density Polyethylene
Application	Irrigation Systems












6. methods for merging

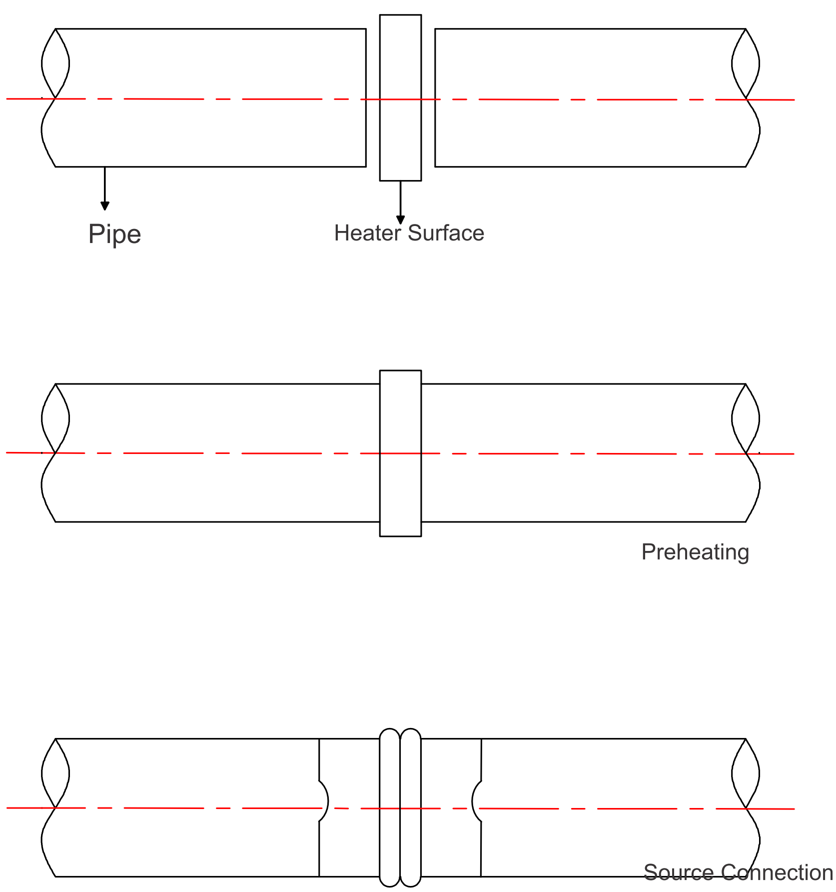
6.1. WELDİNG JOİNİNG METHODS

6.1.1. Butt Welding Method

The butt welding method is a process in which the pipe ends are trimmed and then pressed together under a specific temperature and pressure using a butt welding machine. This method is applied in accordance with the DVS 2207 standard and is especially recommended for diameters larger than Ø63. The pipe ends are heated with a resistance plate under specified pressure and time intervals, and the surfaces are fused and cooled.

Advantages:
·No need for additional fittings.
·Elbows and "T" fittings can be produced.
The process is simple and cost-effective.
The internal and external lips enhance safety.

Process Steps:
Pipes are placed and compressed in the machine.
Surfaces are trimmed and inspected.
The heating plate is applied.
After removing the plate, the pipes are joined and cooled.



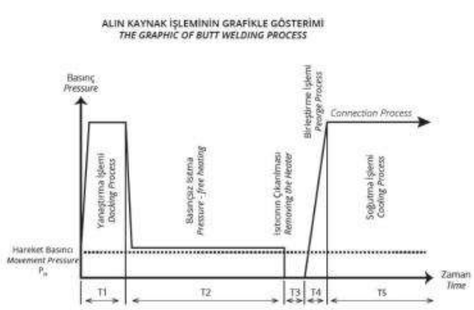
Parameters for Butt Welding

Thickness (mm)	Lip Height (mm)	Pre-heating Time (T2)	Adjustment Time (s)	Welding Time (s)	Cooling Time (s)
4,5	0,5	55	5	5	7
4,5-7	1	55-84	5-6	5-6	7-11
7-12	1,5	84-135	6-8	6-8	11-18
12-19	2	135-207	8-10	8-11	18-28
19-26	2,5	207-312	10-12	11-14	28-40
26-37	3	312-435	12-16	14-19	40-55
37-50	3,5	435-600	16-20	19-25	55-75
50-70	4	600-792	20-25	25-35	75-100

Half of the hole and slot number values given for Half Tunnel can be considered

Butt Welding Machines

Pipe Length	Technical Specifications	
40 - 160	Material Type	PE - PP - PVDF
63 - 160	Pipe Pressure Class:	PN 32
75 - 250	Heating Power	220 V - 1,5 kW 380 V - 16 kW 380 V - 24 kW
90 - 315	Trimming Power	220 V - 0,81 kW 380 V - 3 kW 380 V - 2,2 kW
180 - 500	Electrical System	Single Phase Three Phase
200 - 450	Total Power Consumption	3,00 kW 21,20 kW 30,20 kW
315- 630	Hydraulic Power	380 V - 2,2 kW
500 - 800	Working Pressure	150 Bar 200 Bar
710 - 1000	Required Generator Power	4 kW 30 kW 50 kw
710 - 1200	Working Temperature:	(-40 C ° ~ + 40 C °)
710 - 1200	Hydraulic Oil	Hydraulic 46/1 lt



6.1.2 Electrofusion Welding Method

The electrofusion welding method involves heating the internal heating resistors in the fusion fitting using an electrical current. In this method, pipes are placed inside the electrofusion fittings, and an electric current is applied to the resistance wires with a welding machine. The inner surface of the fitting is raised to its melting temperature, and thus, the HDPE pipes are joined with the fittings. The electrofusion welding method is performed in accordance with the DVS 2207 standard.

Advantages:

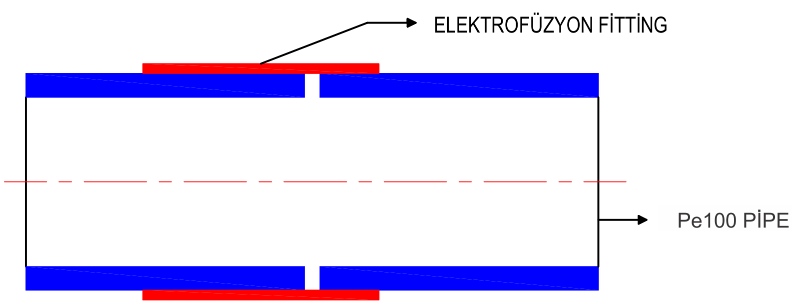
·Direct exit from the main pipe can be obtained.

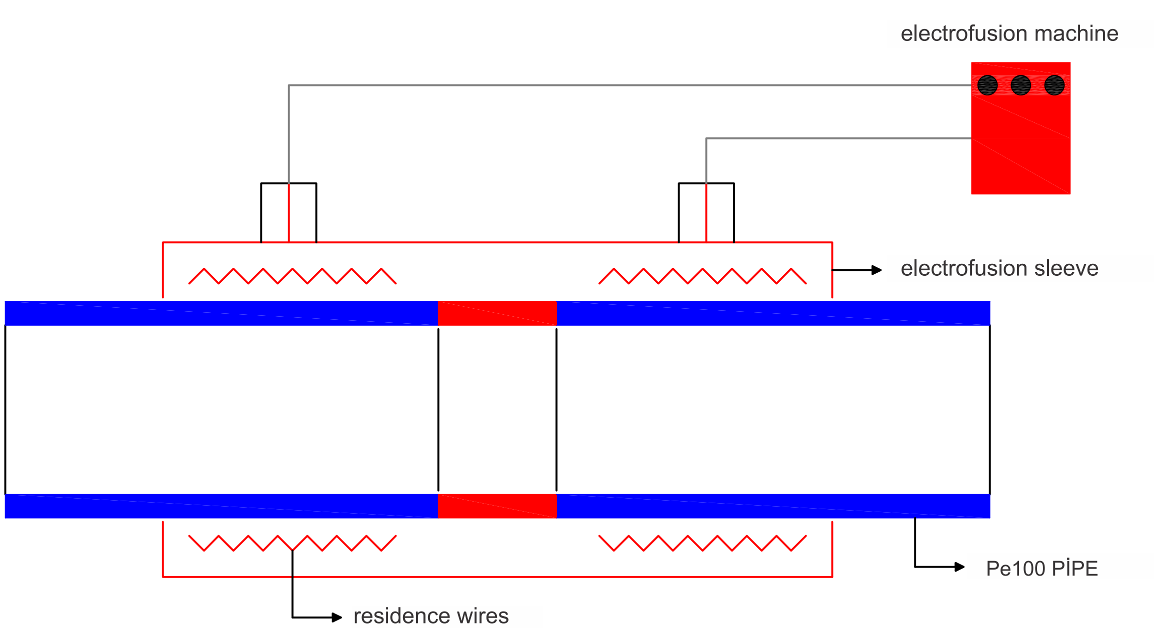
·Applicable in tight spaces and does not require excavation or backfilling

Considerations for Electrofusion Welding:

·The materials being welded should have the same parametric values.

·The working environment must be clean, and surfaces should be protected from rain, snow, mud, and oils. The surface should not be touched by hand. The permissible ambient temperature for electrofusion is between 5°C and 45°C.



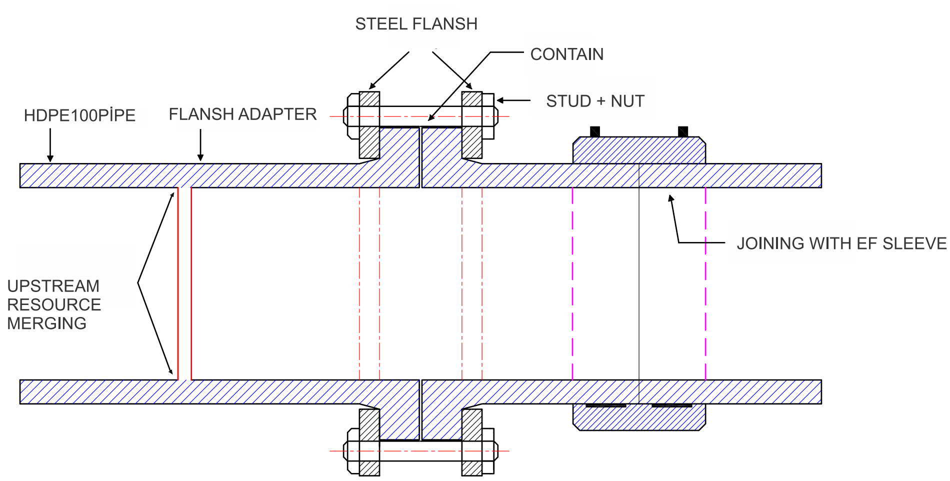


EF Welding Machines
Technical spesification

Output Voltage	8-48 V
Nominal Voltage	230 V
Frequency	50/60 Hz
Power	2800 VA (80% dutry cy.)
Max. Current	120 A
Operating Temperature	-20+60°C
Memory	1800 Kayıt
Protection Class	IP54
Dimensions	545x435x230
Source Cable Length	4 mt
Operating Mode	Barkod

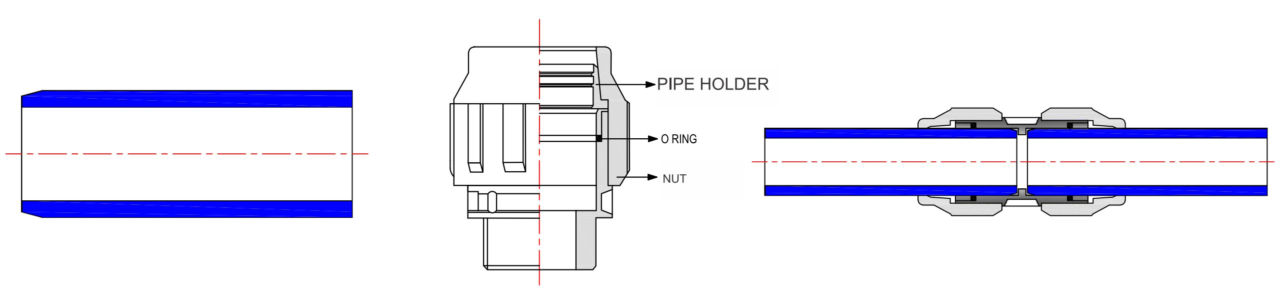
6.2. FLANGED JOINT METHOD

The steel ring, known as the flange, is placed at the end of the PE pipeline, and then a PE fitting, which has a flange adapter, is welded to the pipe using the butt welding method. The two pipe ends are brought together, and a gasket is placed between them. Then, the flanges are connected using bolts and nuts. A key point to note is that the bolts should be tightened in a crosswise pattern, not in a circular sequence. Tightening the bolts correctly ensures that the pipeline does not pull apart and prevents excessive loading.



6.3. COUPLING ADAPTER JOINING METHOD

Coupling adapters are recommended for connecting pipes with a diameter smaller than 125mm. To connect pipes with a coupling adapter, the ends of the pipes are cut perpendicular to their axes and then tapered at a certain angle. The pipes are then pushed into the coupling until they reach the protrusion inside. Afterward, the nuts are hand-tightened to complete the connection.



Storage Guidelines

7.1. THINGS TO CONSIDER DURING STOCKING

During Storage:

1.Prevent Ovalization: Due to the flexible nature of polyethylene pipes, if pipes are stacked for an extended period, the lower pipes may be crushed. Therefore, it is important to stack the pipes properly and avoid overloading to prevent flattening.

2.Protection from Sunlight: Polyethylene pipes can be damaged when exposed to UV rays for prolonged periods. Therefore, it is recommended to store the pipes in shaded areas or covered with UV-protective covers to prevent direct sunlight exposure.

3.Storage on Flat Surface: The ground on which the pipes are placed must be flat and clean. Sharp objects like stones or nails on the ground can damage the pipes. Additionally, wooden pallets or similar materials should be placed underneath the pipes to prevent direct contact with the ground.

4.Stacking Height: During stacking, the pipe diameters should be considered. Larger diameter pipes should be placed at the bottom, and the stacking height should not exceed 1.5 meters

7.2. THINGS TO BE CONSIDERED DURING TRANSPORTATION

During Transportation:

1.Proper Loading: Pipes must be placed properly on trucks or trailers to prevent them from colliding or getting crushed during transportation. Protective materials should be used between pipes when necessary.

2.Protection of Fittings: Flanges, couplings, and other fittings should be properly protected during transportation, and separate handling setups should be used for these components.

3.Protection from Shaking: To prevent movement and excessive shaking of the pipes during transportation, loads must be securely fastened, and straps or other securing materials should be used.

4.Forklift Usage: When using a forklift, the pipes should be lifted from the center to maintain balance.

5.Telescope Loading: During telescopic loading, smaller diameter pipes should be placed inside larger diameter pipes. Care should be taken to ensure that the pipe ends are not damaged..

7.3. PE 100 PIPE AND PE 100 COIL PIPE LOADING CHART

Considerations for Vehicle Sizes:

Since vehicle sizes are not standardized, certain challenges arise during loading and transportation. Therefore, when using the following tables, attention should be paid to the vehicle-specific measurements. It has been observed that the length of the vehicle beds varies depending on the type of vehicle.

Truck Vehicle Types:

Vechİle type	Lenght	Widths	Internal Height
Small-truck	6,80 - 7,40 meter	2,38 - 2,55 meter	2,60 - 3,00 meter
truck	12,00 - 13,60 meter	2,38 - 2,55 meter	2,60 - 3,00 meter

Taking these changes into account, the dimensions of each vehicle's chassis should be carefully checked and loaded accordingly. should be done. Thus, possible problems can be minimized.

PE100 PIPE

DN	Trucks pcs (Pipe Lenght 12-13,5M)	Small-trucks pcs (pipe lenght 5-7,8M)
1600	1	1
1400	3	3
1200	4	4
1000	5	5
900	6	6
800	10	10
710	12	12
630	15	15
560	20	20
500	24	24
450	30	30
400	42	42
355	48	48
315	63	63
280	80	80
250	108	108
225	130	130
200	180	180
180	208	208
160	270	270
140	357	357
125	456	456
110	720	720

P100 COIL

DN	TRUCK NUMBER (PIPE LENGTH 12-13.5M)
20	400
25	350
32	220
40	140
50	60
63	60
75	30
90	25
110	21
125	18

Each coil caltulated as 100 meter
Trucks lenght 13,6 meter.
Note: The coil pipes are calculated based on a length of 100 meters, and the trailer length is considered to be 13.6 meters.

8. auxiliary products

8.1. VALVES AND CAST IRON COMPONENTS

8.1.1. Gate Valves

Gate valves are designed to stop the flow of fluid within a pipeline by means of a gate-like closure element. The gate is operated via a threaded stem mounted inside the valve body, enabling vertical motion to open or close the valve. Sealing is ensured by bushings installed on the body and gate. These valves are suitable for non-abrasive fluids and liquid fuel installations. They are not intended for flow control or throttling purposes.

F5 Metal Seated Gate Valve

Product	F5 Metal Seated Gate ValveDiameter
Diameter	50 – 400 mm
Pressure Class	PN 10 – 16 – 25

F4 ELASTOMER GATE VALVE

Product	F4 Metal Seated Valve
Diameter	50 - 350 mm
Pressure Class	PN 10 - 16 - 25

F5 METAL SEATED GATE VALVE

Product	F4 Metal Seated Valve
Diameter	50 - 400 mm
Pressure Class	PN 10 - 16 - 25

F4 ELASTOMER GATE VALVE

Product	F4 Valve
Diameter	50 - 500 mm
Pressure Class	PN 10 - 16 - 25

8.1.2. Agricultural Irrigation Valve {Almaç}

Used in agricultural pressurized irrigation systems, these valves have a simple structure and allow water intake directly from the irrigation pipeline. The outlet connections are designed to be compatible with standard sprinkler pipes, and flanged outlet options can be provided upon request.

Product	Almaç Valve
Diameter	100 - 150 mm
Pressure Class	PN 10 - 16

8.1.3. Aboveground Fire Hydrant

Installed on pressurized water networks, aboveground hydrants provide one or more hose connections for fire-fighting. The assembly consists of a spindle, spring-loaded check valve, hose couplings, and a cast main body. Operated using a hydrant key, the valve opens counterclockwise and closes clockwise. The valve closes in the direction of the water flow for better sealing and less turbulence, minimizing pressure loss and extending product life. When closed, the spring valve automatically drains any remaining water—especially useful in freezing conditions

Standard Aboveground Fire Hydrant

Product	Above Ground Hydrate
Diameter	80 - 100 mm
Application	Short – Medium – Long

Spring Type Aboveground Fire Hydrant

Product	Spring-Loaded Aboveground Fire Hydrant
Diameter	80 - 100 mm
Application	Kısa - Orta - Uzun

8.1.4. Underground Fire Hydrant (New Model)

These hydrants are installed below ground with an access cover above ground. They consist of a cast iron body, operating spindle, and hose couplings. Operated using a hydrant key, they are commonly used for water supply in industrial plants, warehouses, building perimeters, high-risk forested areas, and residential zones.

New Model Underground Fire Hydrant

Product:	Underground Hydrant (New Model)
Diameter	80 - 100 mm

Standard Underground Fire Hydrant

Product:	Standard Underground Fire Hydrant
Diameter	80 - 100 mm

N-Piece (Hydrant Bend)

Protects the hydrant's connection pipe from bending or breaking by incorporating a flanged elbow.

Product	Spring Type Floor Overhead Fire Hydrant
Diameter:	80 - 100 mm

UNDERGROUND HYDRANT BOILER

Ürün	Spring Type Floor Overhead Fire Hydrant
Çap	80 - 100 mm

8.1.5. Hand-Operated Butterfly Valve

Designed for minimal flow resistance, butterfly valves feature a sealing ring clamped to the edge of the disc. When closed, the ring presses against a conically machined body to ensure bidirectional sealing. The ring can be replaced without removing the disc. The sealing surface, made of hard chrome or stainless steel, resists wear and corrosion. The valves are double-eccentric, reducing pressure on the ring to prevent wear. The shaft increases flow area and provides maintenance-free longevity. Gearboxes enable 90° operation and prevent movement due to flow force. Compatible with electric actuators.
Standards: TS EN 558-1 (face-to-face), EN 1092-2 / ISO 7005-2 (flanges).

Hand-Operated Butterfly Valve

Product	Butterfly Valve
Diameter	100 - 2500 mm
Standards:	EN 1092 - 2 ISO 7005 -2

Actuated Butterfly Valve

Product	Actuated Butterfly Valve
Diameter	100 - 2500 mm
Standards:	EN 1092 - 2 ISO 7005 - 2

8.2. AİR VALVES (AİR RELEASE VALVES)

Dynamic Anti-Shock Air Valve

Releases air in pipelines safely without causing system damage. Internal stainless-steel components ensure high discharge capacity and corrosion resistance for long service life.

Product	Dynamic Air Valve
Diameter	50 - 200 mm
Pressure Class	PN 10 - 16 - 25

8.2.1. Double Ball Air Valve

Prevents air accumulation in pump outlets and pipelines that could reduce flow capacity. Air escapes through perforated inner caps until the chamber fills with water, raising the balls and sealing the outlets.

Product	Double Ball Air Valve
Diameter	50 - 200 mm
Pressure Class	PN 10 - 16 - 25

8.2.2. Single Ball Air Valve

Operates similarly to the double-ball type but contains only one float ball.

Product	Single Ball Air Valve
Diameter	50 - 250 mm
Pressure Class	PN 10 - 16 - 25

8.2.3 Tilting Check Valve

Compact and lightweight, tilting check valves are designed for horizontal or vertical installations. The valve disc opens based on flow velocity, and adjustable counterweights adapt to system conditions. Available with metal-to-metal or rubber-sealed disc options. Maintenance-free design.

Product	Dismantling Joint
Diameter	200 - 2400 mm
Pressure Class	PN 10 - 16 - 25

8.3. DISMANTLING JOINT

Used to facilitate the installation and removal of flanged valves in all pipeline systems by absorbing axial forces and creating space for dismantling.

Product	Dismantling Joint
Diameter	50 - 2400 mm
Pressure Class	PN 10 - 16

Product	Foot Valve (Strainer Type)
Diameter	50 - 500 mm

Product	Vent Pipe (Air Chimney)
Diameter	80 - 200 mm

Product	Valve Tapping Saddle Set
Diameter	50-500mm

Product	Blind Flange Cross Piece (X Fitting)
Diameter	50-400mm

Product	Service Tapping Chamber
Diameter	20-25 mm

9. useful information

9.1. HISTORY OF POLYETHYLENE

Polyethylene, first discovered by accident in 1933, has become an essential part of modern life. The first commercialized product was low-density polyethylene (PE-32 LDPE), obtained through free radical polymerization. Shortly after, new polymerization techniques based on chromium and Ziegler-Natta catalysts enabled the development of PE 63, which could be used in systems that did not require high pressure. Thanks to advanced catalysts and application technologies, LDPE began to demonstrate enhanced polymer performance, leading to widespread use and earning the title of "first-generation" polyethylene. With further technological advances, polyethylene's functionality improved, and PE 80 (MDPE), the "second-generation" polyethylene, emerged as a material that enabled the most efficient use of natural resources such as oil and natural gas.
In early 1999, "third-generation" polyethylene—PE 100 (HDPE)—was developed, offering both high performance and cost-effective solutions for drinking water, utility water, and natural gas networks. The development of PE 100 enabled higher pressure operations with thinner pipe wall thicknesses. For instance, the equivalence of PE 80 SDR 11 PN 16 and PE 100 SDR 17 PN values illustrates the progression of polyethylene pipe technology.

9.2. RAW MATERIAL OF POLYETHYLENE

Polyethylene is a thermoplastic material used in various products and derives its name from the monomer ethylene. Polyethylene is produced from ethylene and is commonly abbreviated as PE in the plastics industry. The ethylene molecule (C_2H_4) consists of two CH_2 groups joined by a double bond (CH_2=CH_2). Polyethylene is produced through the polymerization of ethylene—a chemical reaction in which polymer chains form from repeating monomer units.

Characteristics of Polyethylene Raw Material
High-Density Polyethylene (HDPE) Raw Material Testing

Properties Resin Properties	Typical value (*)	Unit	Test Method
Melt Flow Rate (190°C/2.16 kg)	≥0.05	g/10 min	ASTM D1238
Melt Flow Rate (190°C/5 kg)	≥0.20	g/10 min	ASTM D1238
Density, 23°C (1)	≥0.930	g/cm3	ASTM D1505
Melting Point (DSC, 2nd heat)	131	°C	ASTM D3418
Oxidation Induction Time	≥20	min	TS EN 728

Volatile Matter Content	≤350	mg/kg	TS EN 12099
Water Content	≤300	mg/kg	TS EN 12118
Carbon Black Content	2-2.5	%	ISO 6964

Mechanical Properties (**)	Typical value (*)	Unit	Test Method
Vicat Softening Point, 10 N	124	°C	ASTM D1525
Tensile Strength at Yield	24	mpa	ASTM D638
Tensile Strength at Break	31	mpa	ASTM D638
Elongation at break	875	%	ASTM D638
Flexural Modulus, 23°C	950	mpa	TS EN ISO 178
Izod Impact Strength, 23 ° C (notched)	380	j/m	ASTM D256
Hardness (Shore D)	63	-	ASTM D2240
Environmental Stress Cracking Resistance (10% Igepal, F50)	>1000	hours	ASTM D1693

9.3. TECHNICAL PROPERTIES OF POLYETHYLENE PIPES

The compound type should be determined according to the polyethylene material grade. Raw materials used in the production of polyethylene pipes and fittings are classified according to mechanical strength criteria known as MRS (Minimum Required Strength), which is the minimum required strength a material can withstand under internal pressure for 50 years at 20°C. When tested in pipe form, the required MRS must match the table below:

Table 1 – Material Designation and Maximum Allowable Design Stresses

Designation	Minimum Required Strength (MPa)	Design Stress (Mpa)
Pe100	10,0	8,0
Pe80	8,0	6,3

In polyethylene pipe networks, calculations are made based on a safety coefficient determined by the raw material class and the network's application.

·For natural gas networks: Safety coefficient C = 2.0
·For potable water transmission lines: Safety coefficient C = 1.25

9.4. ADVANTAGES OF POLYETHYLENE PIPES

·Resistant to both slow and rapid crack propagation.
·PE pipes and fittings can be used between -50°C and +60°C. Elasticity is retained down to -40°C.
·High resistance to chemicals.
·Non-carcinogenic.
·Resistant to abrasion even under changing weather conditions due to low friction coefficient.
·Lightweight and insulating, offering advantages over metal pipes.
·UV-resistant.
·Easy installation thanks to fusion joining methods. No material loss, and joints can be made outside the trench. Provides 100% leak-tightness.
·Operates reliably for at least 50 years at nominal working pressure.
·Does not alter the taste or odor of water due to its raw material.
·Resistant to impact and fractures.
·Suitable fire extinguishing agents include water, foam, carbon dioxide, or powder.
·Ignition temperature is 350°C.
·Complies with the Turkish Food Codex regulation on plastics in contact with food.
·Pipes can be coiled without causing local deformations such as bending or kinking.

9.5. AREAS OF USE FOR POLYETHYLENE PIPES

·Potable water transmission mains
·Low-pressure pipelines
·Mining and aquaculture applications
·Marine discharge lines
·Lake and river crossings
·Chemical treatment systems
·Closed-loop irrigation systems
·Hydroelectric power plants
·Drainage systems
·Geothermal pipe systems
·Telecommunications infrastructure
·Gas venting systems

kuzeyboru

Chemical Resistance Table

HDPE PE100 Chemical Resistance Table

Chemicals	20°C'de Weak Resistance At			Chemicals Chemicals	Resistance at 20°C Resistance At		
	Strong A	Medium B	Weak C		Strong A	Medium B	Weak C
Acetaldehyde	x			Acid, stearic	x		
Amyl Acetate	x			Acid, succinic (50 %)	x		
Butyl Acetate	x			Acid, sulpho-chromic			x
Acetone	x			Acid, sulphurous	x		
Acetic Acid (10%)	x			Acid, sulphuric (50 %)	x		
Acetic Acid (100%)	x			Acid, sulphuric (98 %)	x		
Aromatic Acids	x			Acid, tartaric	x		
Benzoic Acid*	x			Acid, trichloroacetic (50 %)	x		
Boric Acid*	x			Acid, trichloroacetic (100 %)	x		
Butyric Acid	x			Acrylonitril	x		
Carbonic Acid	x			Acrylonitri, allyl	x		
Chromic Acid (80%)	x			Acrylonitri, ally	x		
Citric Acid	x			Acrylonitri. benzyl	x		
Dichloroacetic Acid (50%)	x			Acrylonitri, butyl	x		
Dichloroacetic Acid (100%)	x			Acrylonitri, enthy (96%)	x		
High Carbon Fatty Acids (C6 and above)	x			Acrylonitri, furturyl	x		
Formic Acid	x			Acrylonitri, isopropyl	x		
Glycolic Acid (55% & 70%)	x			Acrylonitri, melhoxybutyl	x		
Hydrochloric Acid (all concentrations)	x			Acrylonitri, methyl	x		
Hydrobromic Acid (50%)	x			Aliphatic esters	x		
Hydrocyanic Acid	x			Alum	x		
Hydrofluoric Acid (70%)	x			Ammonia*	x		
Lactic Acid (96%)	x			Anydride, acetic	x		
Maleic Acid	x			Anydride, sulphuros	x		
Monochloroacetic Acid	x			Anydride, sulphuric		x	
Nitric Acid (25%)	x			Aniline	x		
Nitric Acid (50% & 70%)				Antimony trichloride	X		
Oleic Acid (Concentrated)	x			Aqua regia		x	
Oxalic Acid (50%)	x			Benzaldehiyde	X		
Perchloric Acid (20%)	x			Benzene			x
Perchloric Acid (50%)	x			Borax*	X		
Perchloric Acid (70%)	x			Brine	X		
Phosphoric Acid (50%)	x			Bromine	X		
Phosphoric Acid (95%)	x			Calcium hypochlorite"	X		
Phthalic Acid (50%)	x			Camphor	X		
Propionic Acid (50%)	x			Carbon sulphide		x	
Propionic Acid (100%)	x			Carbon tetrachloride	X		
Silicic Acid	x			Cetones	X		
Chlorine (gas/liquid)			x	Glycol	X		
Chlorobenzene			x	Glycol, butyl	X		
Chloroethanol	x			Glycol, methyl	X		
Chloroform			x	Hydrogen chloride gas (dry, wet)	X		
Aluminum Chloride	x			Hydrogen. peroxide(30%)	X		
Ammonium Chloride*	x			Hydrogen, peroxide (100%)	X		
Antimony Chloride*	x			Hydrogen sulphide	X		
Calcium Chloride	x			Iodine tincture	X		
Ferric Chloride*	x			Isoctane	X		
Magnesium Chloride*	x			Mercury	X		

Chemicals	20°C'de Weak Resistance At		
	Strong A	Medium B	Weak C
Mercuric Chloride*	x		
Methylene Chloride			x
Potassium Chloride*	x		
Sodium Chloride	x		
Sulfuryl Chloride			x
Thionyl Chloride			x
Zinc Chloride	x		
Compost	x		
Copper Salts*	x		
Cresol	x		
Cyclohexane	x		
Cyclohexanol	x		
Cyclohexanone	x		
Decalin	x		
Detergents	x		
Dibutyl Phthalate	x		
p-Dichlorobenzene		x	
Dichloroethane		x	
Dichloromethane			x
Diethyl Ether	x		
Dioxane	x		
Ether		x	
Fluorine			x
Formaldehyde (40%)	x		
Fruit Juice	x		
Gasoline	x		
Gelatin	x		
Glycerin	x		
Glycerin Chlorohydrin	x		
Silver Nitrate	x		
Sodium Benzoate	x		
Sodium Borate	X		
Sodium Carbonate (caustic solution)	X		
Sodium Chloride (50%)	X		
Sodium Hydroxide (caustic soda)	X		
Sodium Hypochlorite*	X		
Sodium Nitrate	X		
Sodium Silicate*			x
Sodium Sulfide*	X		
Sodium Thiosulfate	X		
Sugar Syrup	X		

Chemicals	20°C'de Weak Resistance At		
	Strong A	Medium B	Weak C
Metallic sulphates	x		
Methylethyicetone	x		
Molasses	x		
Morpholine	x		
Naphta (heavy petrol)	x		
Naphtalene	x		
Nickel salats*	x		
Nitrogen dioxide gas	x		
Oils, essential		x	
Oils, mineral	x		
Oils, paraffin	x		
Oils, silicone	x		
Oils, vegetable and animal	X		
Olleum		x	
Ozone	X		
Petroleum	X		
Petroleum ether	X		
Phenols	X		
Phosphates*	X		
Phosphorus oxychloride	X		
Phosphorus pentoxide	X		
Phosphorus trichloride	X		
Photographic developers	X		
Polyglycols	X		
Potassium bichromate (40%)	X		
Potassium hydroxide	X		
Potassium permanganate	X		
Pyridine	X		
Sea water	X		
Sulphur	X		
Tallow	X		
Tetrahydrofuran		x	
Tetralin	X		
Thiophone		x	
Toluene		x	
Trichloroethylene			x
Triethanolamine	X		
Turpentine	X		
Vaseline		x	
Yeast	X		
Xylene		x	

CODES	A Durable, with no indication that usability will deteriorate there is no indicator.
	B Variable resistance varies depending on the conditions of use.
	C Flimsy, not recommended for use under any conditions.
	Information not available

10. PE PIPE AND FITTING CALCULATION PRINCIPLES

PE 100 polyethylene pipes stand out with their high mechanical strength, chemical resistance, and flexibility. They are widely used in infrastructure projects such as potable water, natural gas, and wastewater transport systems. This catalogue presents a comprehensive study including the technical specifications, engineering calculations, and performance evaluations of PE 100 pipes. All information has been prepared in accordance with industry standards.

10.1. POLYETHYLENE PIPE MATERIAL AND CLASSES

10.1.1. Chemical Fundamentals of Polyethylene Structure

Polyethylene is a polymer formed by polymerization of ethylene monomers. The ethylene molecule (C2H4) has a double bond structure. The polymerization process breaks these double bonds and adds them together to form a long chain structure.

$$C_2H_4 \rightarrow (-CH_2-CH_2-)_n$$

This process makes a significant contribution to the crystal structure and mechanical properties of polyethylene. High-density polyethylene (HDPE) is more rigid and durable due to the regularity of its crystal structure. Polyethylene materials are classified according to their minimum required strength (MRS) value.

10.1.2. Types of Polyethylene and Their Properties

Polyethylene pipes are generally classified according to their Minimum Required Strength (MRS), which represents the pipe's resistance to internal pressure over 50 years at 20°C.

·**PE 100:** MRS = 10 MPa (Megapascal)

·**PE 80:** MRS = 8 MPa

Comparison of polyethylene types:

Polyethylene Type	Density (g/cm³)	MRS (Mpa)	Tensile Strength (MPa)	Elongation at Break (%)
Pe100	0,930	10	≥ 25	≥ 350
Pe80	0,930	8	≥ 22	≥ 350

10.2. SDR (STANDARD DIAMETER RATIO) AND PIPE THICKNESS CALCULATIONS

10.2.1. What is the SDR?

SDR (Standard Diameter Ratio) is the ratio of the outer diameter of the pipe to the wall thickness and determines the durability of the pipe. The lower the SDR, the thicker and more durable the pipe.

$$SDR = \frac{D_{\text{outer diameter}}}{t_{\text{wall thickness}}}$$

In this formula:

· Douter diameter: Outer diameter of the pipe (mm)wall thickness

· $t$wall thickness: wall thickness of the pipe mm

10.2.3 SDR and Nominal Pressure (PN) Relationship

Nominal pressure (PN) refers to the maximum internal pressure the pipe can carry. The relationship between SDR and PN is expressed by the following formula:

$$PN = \frac{2 \cdot MRS}{SDR - 1}$$

In this formula:

·MRS: Minimum Required Strength (Mpa)

·SDR: Standard Diameter Ratio

·PN: Nominal Pressure (Bar)

Example: If a PE 100 pipe has an outside diameter of 110 mm and a wall thickness of 10 mm:

$$SDR = \frac{110}{10} = 11$$

Nominal pressure in this case:

$$PN = \frac{21020}{11H0} = \text{—} = 2\text{bar}$$

3.3 PIPE WEIGHT AND INNER DIAMETER CALCULATION

Pipe weight is calculated based on the pipe's outer diameter, wall thickness and density. The weight of PE 100 pipes is calculated using the formula below:Pipe Weight Formula:

$$W = \pi \cdot \left(\frac{D^2_{\text{outside}} - D^2_{\text{inside}}}{4} \right) \cdot L \cdot \rho$$

In this formula:

W: Weight of the pipe (kg)

Doutside: Outer diameter of the pipe (m)

Dinside: Inside diameter of the pipe (m)

L: Length of pipe (m)

P: Polyethylene density (kg/m³)

Inner Diameter Calculation:

Pipe inner diameter is calculated by the following formula depending on the outer diameter and wall thickness:

$$D_{inside} = D_{outside} - 2 \cdot t_{wall\ thicknesso}$$

10.4. PIPE STRENGTH UNDER PRESSURE AND TEMPERATURE

Pipe system strength is affected by internal pressure and ambient temperature. As temperature increases, pipe strength decreases. Therefore, temperature must be considered during pipe selection.

10.4.1 Temperature Factor and Strength Calculation

Piping systems are typically designed for 20°C. At higher temperatures, pipe strength decreases. The following table shows the temperature factor (fT):

Temperature (°C)	Temperature Factor (fT)
20	1.00
30	0.87
40	0.74

10.5. STRESS RESISTANCE AND SERVICE LIFE CALCULATIONS

A pipe's long-term durability depends on its tensile strength and working stress. The following formula can be used to calculate service life:

$$t = \frac{\sigma_{maximum}}{\sigma_{Strain} \cdot f_T}$$

in this formula:

·t: Pipe life (year)

$\sigma_{maxsimum}$: Maximum tensile strength of the pipe (Mpa)

σ_{strain}: Stress to which the pipe is subjected (Mpa)

·fT: temperature factor

Example: If the maximum tensile strength of a PE 100 pipe is 10 MPa and the working stress is 6 MPa, the life of the pipe at 40°C is calculated as follows

$$t = \frac{10}{60.74} = 2.26 l y\imath$$

As the temperature increases, the durability of the pipe decreases, so temperature is a critical factor in pipe selection:

10.6. HYDRAULIC CALCULATIONS AND FLOW RESISTANCE

Flow velocity and frictional losses inside the pipe affect system efficiency. Hydraulic losses can be calculated based on pipe diameter and flow velocity.

10.6.1. Friction Loss According to Darcy-Weisbach Equation

The energy lost by the fluid due to friction in the pipe is calculated by the following equation:

$$h_f = f \cdot \frac{Lv}{D} \cdot \frac{^2}{2g}$$

In this formula:

·hf: Friction loss (m)

·f: Coefficient of friction (dimensionless)

·L: Length of pipe (m)

·D: Inside diameter of the pipe (m)

·v: Flow rate (m/s)

·g: Gravitational acceleration (9.81 m/s²)

10.6.2 Coefficient Of Friction And Flow Efficiency

The coefficient of friction depends on the pipe material and the type of fluid. PE 100 pipes with low surface roughness have a lower coefficient of friction and provide efficient flow. This coefficient varies according to the smoothness of the inner surface of the pipe and the diameter of the pipe.

10.7. RAM IMPACT (WATER HAMMER) CALCULATIONS

Ramming, ramming may occur in the pipeline during sudden flow stops. The safety of the pipeline should be ensured by calculating the effect of this impact.

10.7.1 ram impact pressure

The pressure created by the ram impact is calculated by the following formula:

$$P_{\text{coach coup}} = \rho \cdot v \cdot c$$

in this formula

·Pcoach coup = Sudden increase in pressure (Pa)

·P= Density of the fluid (kg/m³)

·v = Fluid velocity (m/s)

·c= Speed of sound inside the pipe (m/s)

10.7.2. Reducing Water Hammer Effects

High pressure from water hammer can damage the system. It can be mitigated by:

1.Flow-limiting valves

2.Air chambers

3.Elastic pipes like PE 100, which absorb shock

10.8. THERMAL EXPANSION AND CONTRACTION CALCULATIONS

Polyethylene pipes expand or contract with temperature changes. This effect must be considered in system design. Thermal expansion is calculated with:

$$\Delta L = \alpha \cdot L_0 \cdot \Delta T$$

In this formula:

- α : Change in the length of the pipe (m)a
- L_0 : Coefficient of thermal expansion of polyethylene (usually =1.5×10−4K−1)0L
- ΔL: Initial length of the pipe (m)TD
- ΔT: Temperature difference (°C)

$\Delta L = 1.5 \times 10^{-4} \cdot 100.30 = 0.45\text{m}$

Example Calculation: Length of a PE 100 pipe 0L=100 and temperature difference ΔT =30 °C the expansion is calculated as follows:

10.9. CHEMICAL RESISTANCE AND TEST PROCEDURES

10.9.1 Chemical Resistance of PE 100 Pipes

PE 100 pipes exhibit high resistance to many chemicals, especially in acidic and basic environments. Resistance depends on:

·**pH value:** PE 100 is resistant between pH 1 and 14

·**Solution temperature:** Resistance decreases with heat·

Chemical concentration: Higher concentrations reduce lifespan

11. Pressure Loss and Flow Calculations

11.1 FLOW RESISTANCE AND PRESSURE LOSS

The flow in the pipe loses energy due to friction. This loss is calculated by the Darcy-Weisbach equation:

In this formula:

$$h_f = f \cdot \frac{Lv}{D} \cdot \frac{^2}{2g}$$

·hf: Friction loss (m)

·f: Coefficient of friction (dimensionless)

·L: Length of pipe (m)

·D: Inside diameter of the pipe (m)

·v: Flow rate (m/s)

·g: Gravitational acceleration (9.81 m/s²)

Example Calculation: In a PE 100 pipeline, assume that water flows at a velocity of 1.5 m/s through a pipe 100 meters long and 0.2 m in diameter. Coefficient of friction f= 0.02 friction loss is calculated as follows:

This leads to a pressure loss of about 0.382 meters of water column in a 100 meter long pipeline.

$$h_f = 0.02 \cdot \frac{1001.5}{0.229.81} \cdot \frac{^2}{} = 0.382\text{m}$$

11.2. REYNOLDS NUMBER AND FLOW REGIME

Reynolds number (Re), determines whether a flow is turbulent or laminar. The flow regime in PE 100 pipes can be calculated by the Reynolds number:

$$Re = \frac{vD}{\nu}$$

In this formula:
·v: Flow rate (m/s)
·D: Inside diameter of the pipe (m)
·ν: Kinematic viscosity (m²/s)
Reynolds number
·Re<2000 ise flow is laminar,
·Re>4000 ise akış türbülanslıdır.
Example Calculation: Kinematic viscosity in the same pipeline $\nu = 1\times10^{-6}$ m²/s if accepted:

$$Re = \frac{1.5 \cdot 0.2}{1 \times 10^{-6}} = 300{,}000$$

11.3. TENSILE STRENGTH AND PIPE MATERIAL MECHANICAL TESTS

11.3.1 Tensile Strength Test

The tensile strength of polyethylene pipes determines the capacity of the pipe to withstand the maximum load. The tensile test is performed by pulling the pipe at a certain speed and measuring the amount of stress until it breaks. The tensile strength is calculated by the following formula:

$$\sigma = \frac{F}{A}$$

In this formula:
·σ: Tensile strength (Mpa)
·F : Applied force (N)
·A : Cross-sectional area (mm²)
Example Calculation: Cross-sectional area of a PE 100 pipe A= 500 mm², vforce applied to F = 25,000 N ise:

$$\sigma = \frac{25{,}000}{500} = 50\text{MPa}$$

11.4. PIPE LIFE AND EFFECTS OF ENVIRONMENTAL CONDITIONS

Environmental factors like sunlight, chemicals, and stress affect pipe lifespan. UV-resistant additives are used to extend life.
Key considerations include:
1.UV Resistance
2.Chemical Resistance
3.Mechanical Stress Resistance

11.5. PIPE SELECTION BY APPLICATION AND FLOW RATES

Polyethylene pipes are used to transport various fluids and gases. Proper sizing by application (e.g., drinking water, gas, wastewater) ensures system efficiency.

11.6. DRINKING WATER PIPELINES

İIn drinking water systems, the flow velocity is usually kept between 0.5 - 2.0 m/s. This velocity range minimizes pressure losses and reduces frictional effects during water transport.

Flow Rate Calculations for Drinking Water Pipes

The sizing of pipes used for the transportation of drinking water in pipelines is made with the following formulas:Volumetric Flow Rate (Q):

$$Q = v \cdot A$$

In this formula:

·Q: Volumetric flow rate (m^3/s)

·v: Flow rate (m/s)

·A: Cross-sectional area of the pipe (m^2)

Example Calculation: For a PE 100 pipeline with a diameter of 0.15 m carrying drinking water with a flow rate of 0.75 m/s:

$$A = \pi \cdot \left(\frac{0.15}{2}\right)^2 = 0.0177 m^2$$

$$Q = 0.75 \ 0.0177 \ \ 0.0133 \ m/s$$

As a result of this calculation, it is calculated that 0.0133 m^3 of water passes through the pipeline per second.

11.7. NATURAL GAS PIPELINES

In natural gas transportation systems, pipe diameter and flow velocity are critical parameters. In natural gas pipelines, the flow velocity is typically kept between 6 - 20 m/s. Factors such as the roughness of the inner surface of the pipe and the density of the gas are also considered in the transportation of the gas.

Flow Velocity Calculations for Natural Gas Pipelines

The volumetric flow rate used in natural gas pipelines is calculated with the following formula:

$$Q = v \cdot A$$

In this formula:

·Q: Volumetric flow rate (m^3/s)

·v: Flow velocity (m/s)

·A: Cross-sectional area of the pipe (m^2)

Example Calculation: For a pipeline carrying natural gas with a flow velocity of 10 m/s and a pipe diameter of 0.25 m:

$$A = \pi \cdot \left(\frac{0.25}{2}\right)^2 = 0.0491 m^2$$

This calculation shows that 0.491 m^3 of natural gas passes through the pipeline per second.

$$Q = 10 \cdot 0.049 = 10.491 m^3/s$$

11.8. WASTEWATER PIPELINES

Flow velocities in wastewater pipelines are generally kept between 0.7 - 3.0 m/s. Since wastewater systems operate under the influence of gravity, the slope of the pipe and gravitational forces are taken into account in their design.

Flow Velocity and Pipe Diameter Calculations for Wastewater Pipes

In wastewater systems, flow velocity and pipe diameter are calculated using Manning's formula. The Manning equation is as follows:

$$v = \frac{1}{n} \cdot R^{2/3/2} \cdot S^{1/2}$$

In this formula:

·v: Flow velocity (m/s)

·n: Roughness coefficient (for PE pipes n = 0.009)

·R: Hydraulic radius (m)

·S: Slope of the pipe (m/m)

The hydraulic radius is calculated by the following formula:

$$R = \frac{A}{P}$$

In this formula:

·A: Cross-sectional area of the pipe (m^2)

·P: Wet circumference of the pipe (m)

Sample Calculation: For a 0.5 meter diameter and 1% slope sewage pipe, roughness coefficient n= 0.009 if accepted:

$$A = \pi \cdot \left(\frac{0.5}{2}\right)^2 = 0.196\text{m}^2$$

$$P = \pi \cdot 0.5 = 1.57\text{m}$$

$$R = \frac{0.196}{1.57} = 0.125\text{m}$$

$$v = \frac{1}{0.009} \cdot 0.125^{2/3} \cdot 0.01^{1/2} = 1.39\text{m/s}$$

12. application scenarios

As a result of this calculation, the flow velocity in the pipeline is

12.1 DRINKING WATER DISTRIBUTION SYSTEM

Scenario:

A drinking water distribution system is being designed for a town. In this system, PE 100 pipes will be used to distribute water from the source (main storage tank) to residential areas. The water tank is located in a tower 30 meters high, and the town's main distribution line is 2 km long. Water must flow at a velocity of 0.75 m/s along this line.

Step 1: Pipe Diameter Selection

In order to calculate the appropriate pipe diameter for potable water distribution, the required volumetric flow rate (Q) is calculated by the formula

$$Qv{=}A\cdot$$

Here v= 0.75 m/s, is the minimum velocity required for the distribution line. Volumetric flow rate is 0.02 m^3/s as the most important factor in the development of the country's economy.

Cross-sectional area (A) is calculated as follows:

$$A = \frac{Q}{v} = \frac{0.02}{0.75} = 0.0267\text{m}^2$$

Pipe diameter is calculated by the following formula:

$$D = 2 \cdot \sqrt{\frac{A}{\pi}} = 2 \cdot \sqrt{\frac{0.0267}{\pi}} = 0.185\text{m}$$

:

According to this calculation, a pipe with a diameter of 185 mm should be used.

Step 2: Pressure Loss Calculations

The pressure loss along this 2 km long line can be calculated with the Darcy-Weisbach equation

$$h_f = f \cdot \frac{L}{D} \cdot \frac{v^2}{2g}$$

It's here:

- f: Coefficient of friction = 0.02
- L: Pipe length = 2000 m
- D: Diameter of the pipe = 0.185 m
- v: Flow rate = 0.75 m/s
- g: Gravitational acceleration = 9.81 m/s²

The pressure loss is calculated as follows:

$$h_f = 0.02 \cdot \frac{2000}{0.185} \cdot \frac{0.75^2}{2 \cdot 9.81} = 6.25\text{m}$$

The total pressure loss will be 6.25 meters of water column.

12.2 WASTEWATER SYSTEM

Scenario:

An industrial facility is designing a pipe system for the gravity-based removal of wastewater. The system will be 1 km long and constructed with a 2% slope. PE 100 pipes will be used, and the wastewater flow velocity is determined to be 1.5 m/s.

Step 1: Pipe Diameter Selection

The pipe diameter for transporting wastewater is calculated using Manning's formula:

$$v = \frac{1}{n} \cdot R^{2/3} \cdot S^{1/2}$$

Here:

- n: Roughness coefficient = 0.009
- R: Hydraulic radius
- S: Pipe slope = 0.02

The hydraulic radius is calculated as follows:

$$R = \frac{D}{4}$$

Diameter is calculated according to flow rate and pipe slope:

$$1.5 = \frac{1}{0.009} \cdot \left(\frac{D}{4}\right)^{2/3} \cdot 0.02^{1/2}$$

By solving this equation, a pipe with a diameter of approximately 0.40 m should be selected.

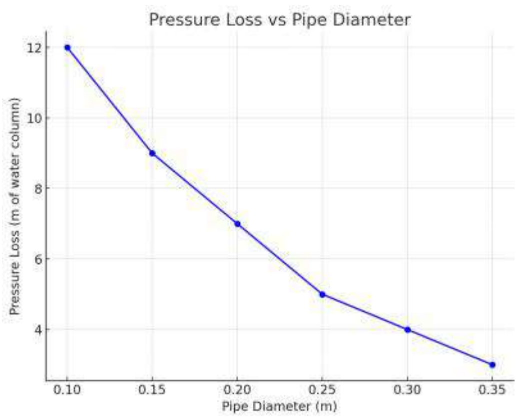
Step 2: Pressure Loss Calculations

Pressure losses in gravity-driven systems can be calculated with the Manning equation.

13. performance graphs

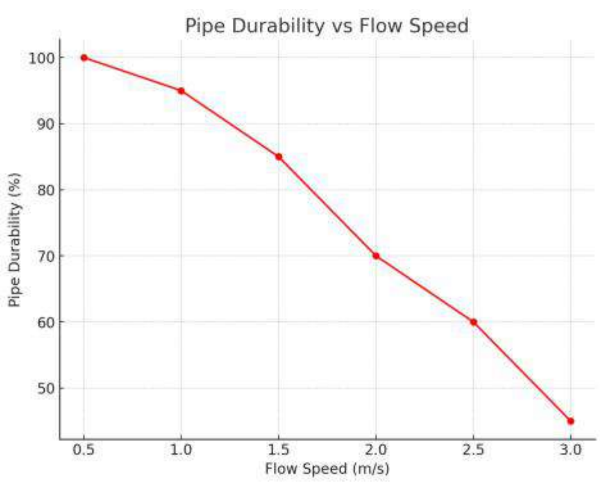
13.1. PRESSURE LOSS GRAPH BASED ON PIPE DIAMETER

The graph demonstrates the effect of pipe diameter on pressure loss. It is observed that larger diameter pipes have lower pressure losses.



13.2. PIPE DURABILITY GRAPH FOR DIFFERENT FLOW VELOCITIES

This graph shows the durability of pipes at different flow velocities. Specifically, at higher velocities, measures to counteract water hammer can be more clearly demonstrated with this graph.



13.3. SYSTEM EFFICIENCY ANALYSIS

System efficiency is an important factor to consider in pipeline design. Efficiency analysis evaluates how to optimize the energy, cost, and hydraulic aspects of the water or gas transported through the pipeline. This section will cover energy efficiency, cost efficiency, and hydraulic efficiency analyses for drinking water distribution systems.

13.4 ENERGY EFFICIENCY

Scenario: Drinking Water Distribution System
The drinking water distribution line designed for a town will be 3 km long using PE 100 pipes, with water being transported from a 30-meter high tank. The flow velocity is set at 1.0 m/s.

$$h_f = f \cdot \frac{Lv}{Dg} \cdot \frac{2}{2}$$

Energy efficiency is calculated based on the pressure loss in the pipeline and the pump power. The pressure loss is calculated as:

$$P = \rho \cdot g \cdot Q \cdot h_f$$

Here:

·P: Power (W)

·ρ: Water density (1000 kg/m³)

·g : Gravitational acceleration (9.81 m/s²)

·Q: : Volumetric flow rate (m³/s)

The volumetric flow rate is calculated as:

$$P = 1000 \cdot 9.81 \cdot 0.0314 \cdot 15.29 = 4710\,\mathrm{W} \approx 4.71\,\mathrm{kW}$$

$$Q = v \cdot A = 1.0 \cdot \pi \cdot \left(\frac{0.2}{2}\right)^2 = 0.0314\,\mathrm{m}^3/\mathrm{s}$$

According to this calculation, the pump system will consume 4.71 kW of energy to transport water over 3 km.

13.5. COST EFFICIENCY

Pipe Cost

The cost per meter of PE 100 pipes varies depending on the pipe diameter. If the cost per meter of a 0.2 m diameter pipe is accepted as 50 USD, the total cost of the 3 km long pipeline is calculated as:

$$\text{Total Pipe Cost} \quad 3000 \cdot 50 = 150{,}000\,\text{USD}$$

Energy Cost

The annual energy consumption of the pump has been calculated as 4.71 kW. If the system operates for 3000 hours per year and the energy cost is 0.1 USD/kWh, the annual energy cost is calculated as:

$$\text{Annual Efficiency cost} = 4.71 \cdot 3000 \cdot 0.1 = 1{,}413\,\text{USD}$$

13.6. HYDRAULIC EFFICIENCY

The hydraulic efficiency of pipeline systems depends on parameters such as pipe diameter and flow velocity. Larger diameter pipes provide lower pressure loss and, therefore, lower energy consumption, but installation costs are higher. Smaller diameter pipes, on the other hand, lead to higher pressure losses and, thus, higher energy costs.

In this system, hydraulic efficiency is optimized by using pipes with a diameter of 0.2 m. If a smaller diameter pipe were used, pressure loss would increase, and energy consumption would rise, reducing system efficiency.

14. documents and certificates

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