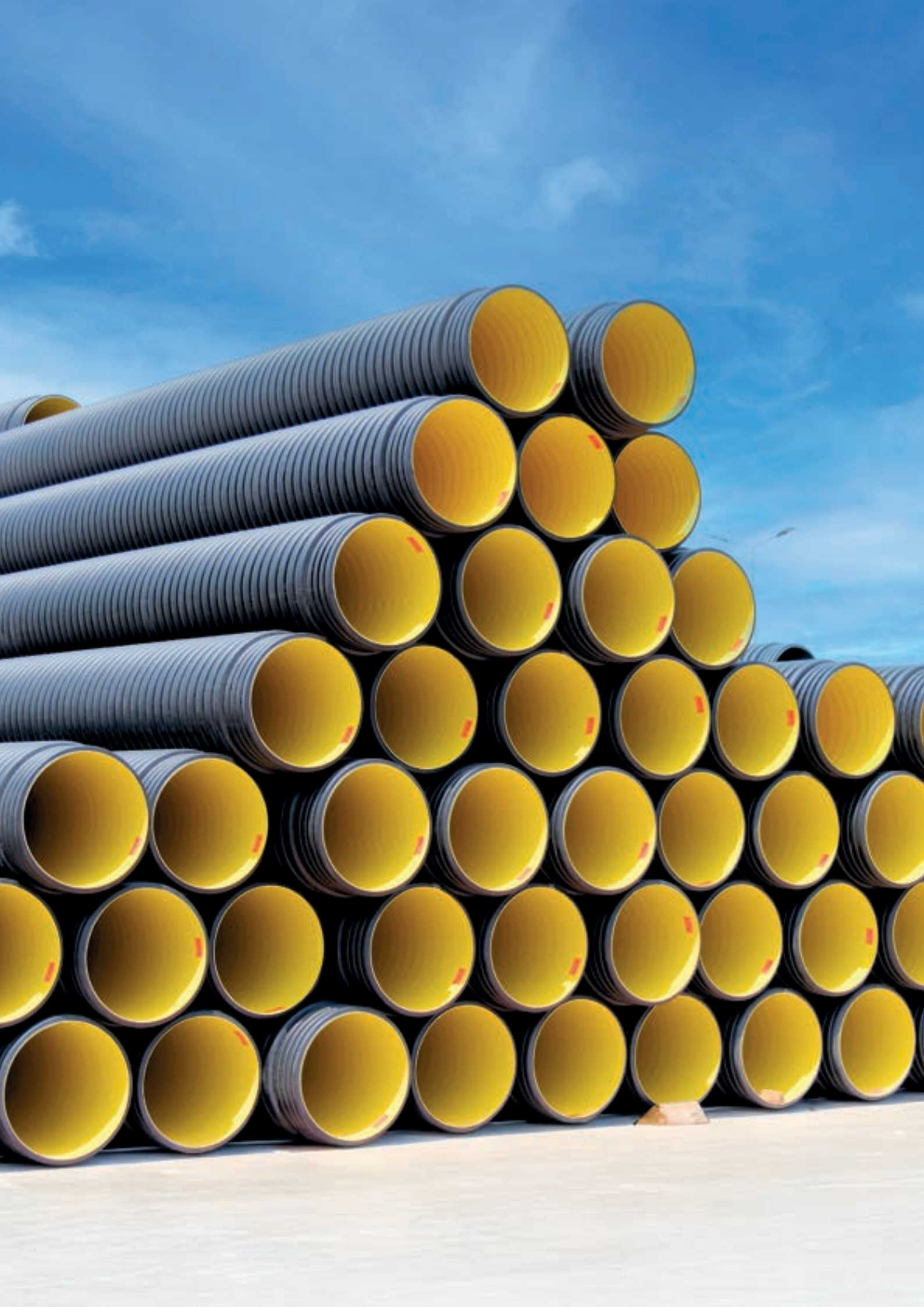
kuzeyboru

CORRUGATED CATALOGUE

MAY 2025



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1. about us

Kuzeyboru was established in 2001 with the vision of a global brand offering innovative solutions for infrastructure and superstructure piping systems. With its world-class production facilities and wide product range, Kuzeyboru specializes in the production of pipes, especially GRP, HDPE, Corrugated, PPR pipes and fittings, and 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 more than 100 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 Kuzeyboru makes a difference with its projects that
aims to create an ecosystem that can respond quickly to the changing needs of the market. The R&D Center is one of the important building blocks that contribute to Kuzeyboru's sustainable production goals.

add value to society beyondbeing a professional solution partner. In line with its social responsibility principles, the company prioritizes women's employment and equal opportunities and takes important steps in this area. 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 competing 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

2. environment and sustainability

Kuzeyboru holds TS EN ISO 14001 Environmental Management System certification for environmental safety and develops its innovative products with health and environmental priorities. Considering the environment as a precious treasure, Kuzeyboru attaches great importance to sustainability, carbon footprint monitoring and the use of renewable energy. It manages natural resources effectively and efficiently by using environmentally friendly technologies and raises awareness among its employees and stakeholders to protect biodiversity.

Sustainability is among Kuzeyboru's strategic priorities and is an integral part of all its activities. Thanks to its land-type and rooftop solar energy systems, it meets the energy it needs in its production activities from sustainable sources.

R & D Center

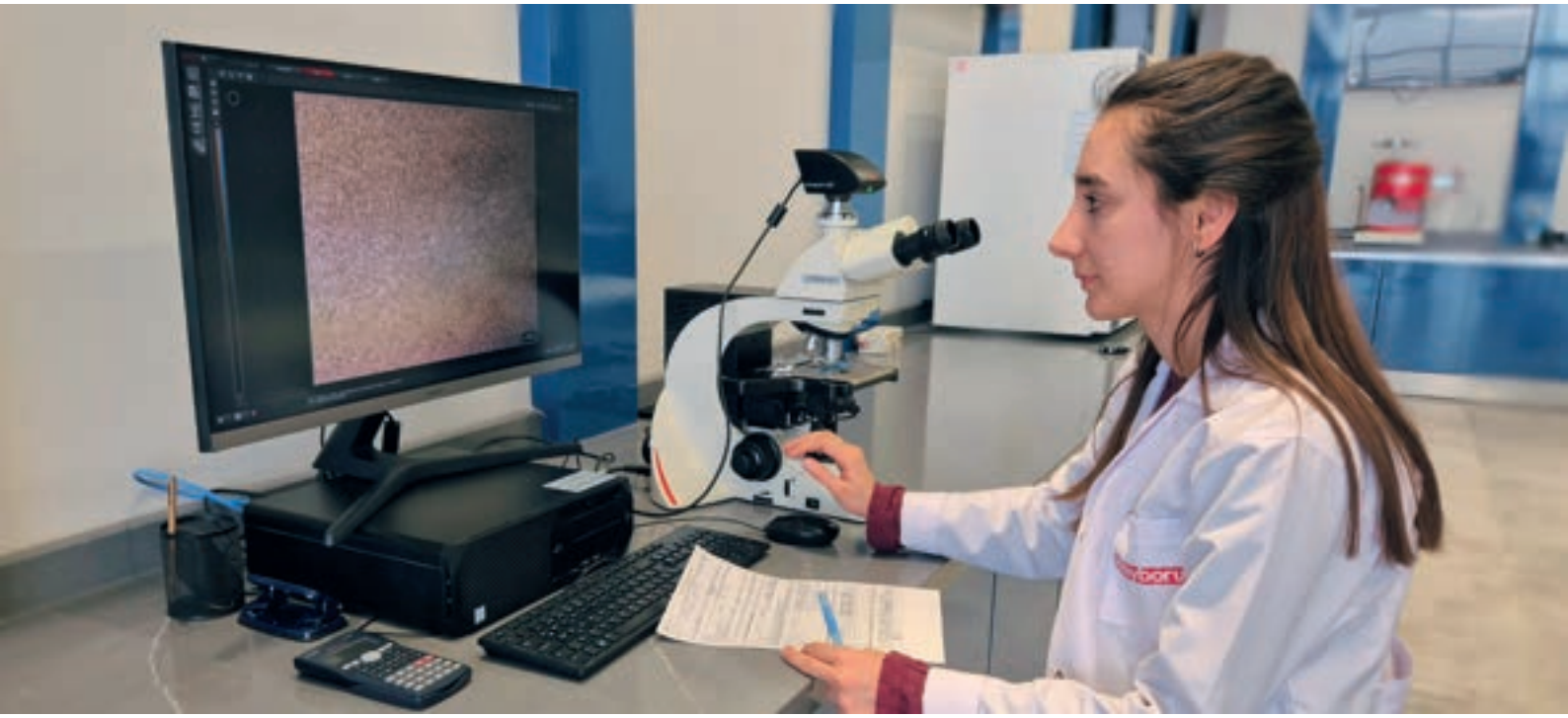
We Shape the Future with R&D, the Meeting Point of Industry and Science

As Kuzeyboru R&D Center, we develop projects focused on technological innovation, process improvement, digitalization and green transformation, and produce solutions that shape the industry. In our 2094 m^2 R&D area, we develop new generation technologies that increase global competitiveness, support sustainable production processes and focus on efficiency.

In line with Industry 4.0 and digital production systems, we develop innovative solutions that reduce carbon footprint and minimize energy consumption while optimizing production processes with full automation and real-time data analytics. In this context, we put sustainable production at the center with our projects that accelerate digital transformation in industry.

Our unit, which was approved as an R&D Center by the Ministry of Industry and Technology on July 8, 2024, has a structure that supports scientific research, advanced technology integration and industrial innovation in engineering and production processes. Launched on July 9, 2024, our R&D Center not only strengthens our company's R&D vision, but also offers solutions that shape the industrial ecosystem.
Our R&D activities are carried out to increase industrial efficiency, develop sustainable production processes and offer advanced engineering solutions.

3. quality



Our Quality Approach

With the goal of continuous improvement, we adopt a comprehensive management approach that ensures leadership at all levels, enables effective use of workforce, processes, and technology to achieve sustainable success based on operational excellence and lean production. This approach strengthens the implementation of decision-making processes and encourages improvements through data analysis.
Kuzeyboru's quality control process consists of three main phases to ensure quality at every stage of production:

Incoming Quality ControlProses

Process Quality Control

Final Quality Control

1 . Incoming Quality Control

The process begins with the procurement of raw materials and auxiliary components from external suppliers. Upon delivery, the products are subjected to incoming quality control tests in accordance with the quality control plan and relevant product standards. Products that meet the criteria are labeled with an acceptance tag and moved to the storage area. Non-conforming products are marked with a nonconformity 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. Throughout the production process, samples taken from the first product are tested in our laboratory according to relevant product standards and specifications. Every product produced is inspected in line with the quality plan, ensuring compliance with customer requirements and international standards.

To ensure traceability, each product is marked using laser technology in a permanent manner. All records of raw materials, machine process data, sample test results, and periodic inspection outcomes are digitally archived and retained for the duration specified in quality standards.

3. Final Quality Control

Products that have successfully completed incoming and process quality controls and are taken to the stock area are subjected to a final quality control process before being shipped.

At this stage, quality control engineers re-verify that the products comply with all quality standards and authorize shipment.

Our Accredited Test Laboratory

Kuzeyboru Test Laboratory conducts its operations in compliance with national and international standards, prioritizing impartiality, independence, integrity, confidentiality, reliability, and legal requirements while ensuring fast, economical, and technically sound testing practices. Our laboratory's goal is to deliver high-level customer satisfaction through expert personnel who receive continuous training, adhere to best professional practices, and utilize up-to-date testing methods and modern technological devices. To ensure accurate results, reference and standard materials are used. Furthermore, the laboratory engages in interlaboratory comparison tests to enhance test quality and minimize complaints by prioritizing customer satisfaction.

The staff operates according to policies and procedures in compliance with TS EN ISO/IEC 17025. The laboratory management is committed to upholding this standard and maintaining continuous improvement.

4. kuzeyboru plastic pipe systems for non-pressurized, underground drainage and sewage applications

4. 1. KUZEYBORU CORRUGATED PIPES

Kuzeyboru corrugated pipe systems are manufactured from polyethylene (PE) in compliance with TS EN 13476-3 standards. They are produced in ring stiffness classes ranging from SN4 to SN16 and in internal diameters of DN100, DN150, DN200, DN300, DN400, DN500, DN600, DN700, DN800, DN900, and DN1000, with 6-meter socketed pipe lengths.

4. 1. 1. Application Areas of Kuzeyboru Corrugated Pipes

Thanks to their ease of installation and durability, corrugated pipe systems are widely used in various areas. These pipes possess excellent resistance to abrasion, chemicals, and corrosion, and are particularly effective in wastewater discharge systems. They are used in the transportation of urban and domestic wastewater, drainage of rain and snowwater, groundwater removal in drainage systems, as well as in industrial and non-pressurized gravity flow systems. Additionally, they are preferred for energy and communication cable protection, chemical and biological waste transport systems. Their wide range of applications makes corrugated pipes both a practical and reliable solution.

4. 1. 2. General Features of Kuzeyboru Corrugated Pipes

Load Resistance
High resistance to soil and traffic loads thanks to the special trapezoidal structure.

Material
Made from HDPE, offering improved flexibility.

Elastic Deformation
Absorbs impact and pressure loads, returning to its original shape.

Temperature Resistance
Withstands temperatures between -50°C and +60°C.

Maintenance
Requires minimal maintenance; easily cut to desired length with a saw.

Damage Repair
Can be repaired by opening only the damaged section and using a sliding sleeve.

No Waste
Produces no waste during installation.

Chemical Resistance
Excellent resistance to chemicals and does not erode.

Inner Surface
Smooth interior prevents sediment buildup and can be used without sealing the ends.

Longevity
Long service life against external loads.

Cost Efficiency
Stacking inside each other saves space, time, and transportation costs.

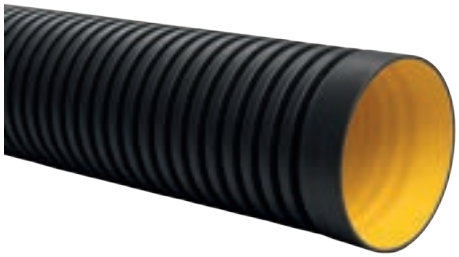
Field Installation
Easy to install due to lightweight structure.

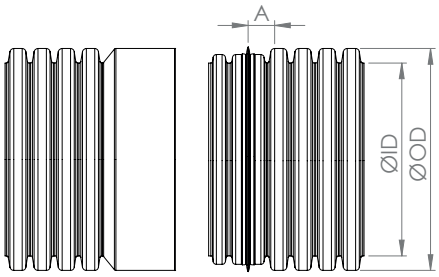
Applıcable Test Standards

STANDARD	REQUIRED PROPERTY	UNIT	TEST TYPE
TS EN ISO 1133-1	min. 0.20-1.6	g/10 min	Melt flow rate (MFR/MVR) of thermoplastics
TS EN ISO 1183-1	±0.930	g/cm3	Density determination of non-cellular plastics
TS ISO 12091	No delamination or bubbles	Visual	Oven test for profiled thermoplastic pipes
TS EN ISO 9969	4-8-10-12-16	≥kN/m2	Determination of ring stiffness
TS EN ISO 3127	≤10	≤10% TIR without damage	Impact resistance under external impact
TS EN ISO 13968	30% without damage ≥	≥kN/m2	Determination of ring flexibility
TS EN 1277	No leakage	Visual	Leak tightness of elastomeric-sealed joints for underground use

Sn And Sr Comparison Table

TS 12132	DIN 16961	DIN 16566	TS EN 13476 - 3	ISO 21138 - 3
	SR24= EI/r (kN/m²)		SN=EI/D3 (kN/m²)	
Type 7	125	125	16	16
Type 6	63	63	8	8
Type 5	31,5	31,5	4	4
Type 4	16	16	2	2
Type 3	8	8	-	-
Type 2	4	4	-	-
Type 1	2	2	-	-





Corrugated Pipe Nominal Diameters

DN	ØID (mm)	ØOD (mm)	Amin (mm)
100	98	115	32
150	148	171,5	43
200	198	231	54
300	297,5	348,5	64
400	397	466	74
500	496,5	582,5	85
600	600	701	96
800	800	936	118
1000	1000	1176	140

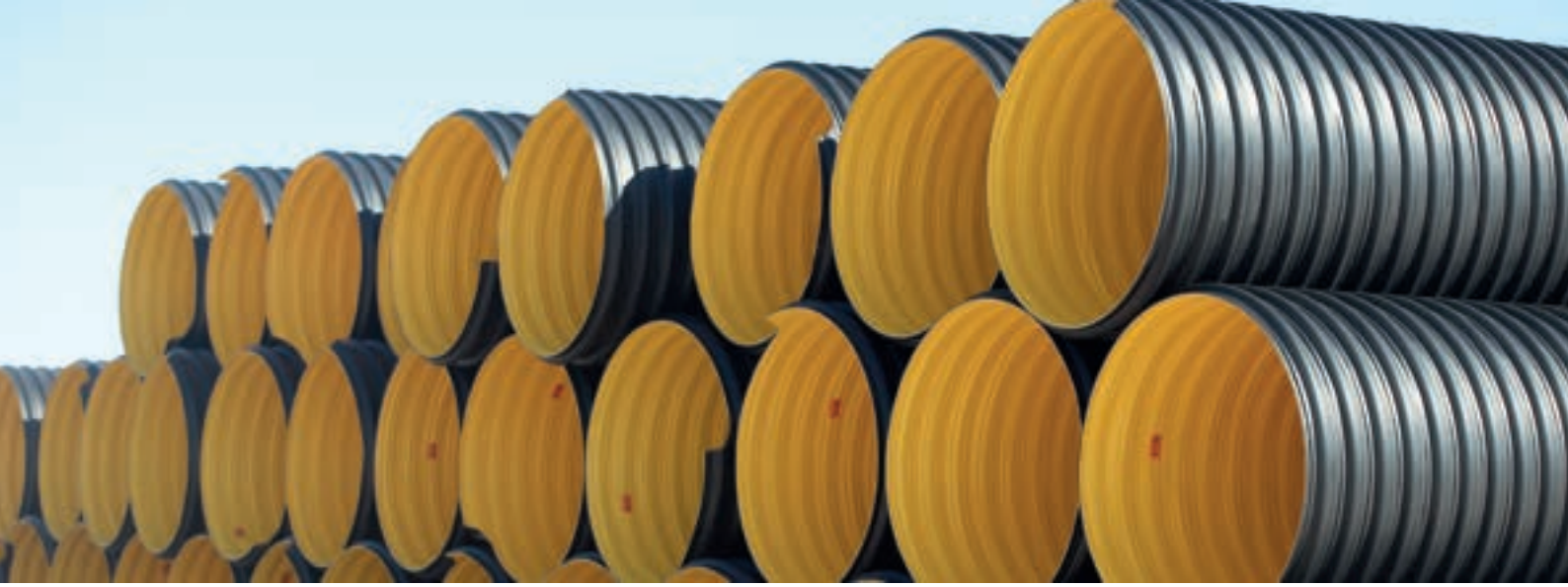
4. 2. KORUGE EK PARÇALAR

Safe and Long-Lasting Solutions for Corrugated Pipe Fittings
Kuzeyboru corrugated fittings offer effective solutions for safe and durable connection needs in infrastructure projects. It stands out with its long-lasting use and high sealing performance, especially in sewage, rainwater and other infrastructure systems.
Complementary parts such as sleeves, elbows, tees, reducers and adapters, which are produced in full compatibility with corrugated pipes with self-buffered structure, reduce labor costs and save time by providing fast and easy installation in the field, thus providing significant advantages to the user in both new installations and maintenance-repair works.
Developed specifically for project needs, these parts can be easily used in different diameter, slope and connection configurations thanks to their flexible structure. Thus, both technical and operational efficiency is achieved in infrastructure systems.

PVC Çıkışlı Koruge C Tipi | Redüksiyon | PVC Çıkışlı Koruge TE | Muayene Bacası | İstavroz TE | Kör Tapa | Eşit TE

Dirsek 45° | İnegal TE | Manşon | Adaptör | Dirsek 90° | Koruge Çıkışlı C Tipi | Beton Geçiş Koruge Ek Parçası

All our fittings are designed in accordance with international quality standards and manufactured with a high engineering approach. Thanks to the tightness tests, mechanical strength analysis and long life simulations applied during the production process, our products provide maximum reliability under field conditions.
Kuzeyboru corrugated fittings offer a sustainable and long-lasting solution while maintaining the integrity of infrastructure systems. With our engineering-oriented approach, environmentally friendly production policies and comprehensive quality control processes, we provide high added value to your projects.



4. 3. STEEL-REINFORCED SPIRAL CORRUGATED PIPES

Combining the superior properties of steel and polyethylene through state-of-the-art production technology, Kuzeyboru manufactures Steel-Reinforced Spiral Corrugated Pipes with nominal diameters from 800 mm to 2400 mm and ring stiffness values ranging from SN 4 to SN 16.
These pipes are designed with a three-layer structure: the inner and outer layers are made of HDPE (High-Density Polyethylene), and the middlereinforcement is a "U"-shaped steel strip. The inner layer is formed through HDPE extrusion in a winding process. Before being shaped into a profile, the steel strip is coated with a special adhesive material. This coating ensures that all three layers—inner, middle, and outer—are integrated into a spirally ribbed pipe during production.
Steel enhances the pipe's exceptional mechanical strength, while the coating protects it against all forms of corrosion.

4. 3. 1. Steel Raw Material

DKP DC01 Cold-Rolled Coil Sheet
DKP DC01 is one kind of cold rolled low carbon steel sheet. DKP stands for “Low Carbon Stainless” and is a type of material commonly used in the manufacturing industry.
DC01 is a material with a high level of surface quality and is often suitable for painting or coating processes. It also has a high level of machinability due to its low carbon content and can be easily formed, cut and drilled.

Adhesive Resin
Maleic anhydride grafted polyethylene containing TPE for super adhesion properties that provide superior resistance to delamination of layers in the steel pipe coating method.
HDPE is a modified polyethylene based adhesive resin designed for steel reinforced corrugated pipe application. This grade is mainly recommended for adhesion between polyethylene layer and steel strip in corrugated pipe application. It shows high bond strength, high thermal stability, flexibility and aging resistance.

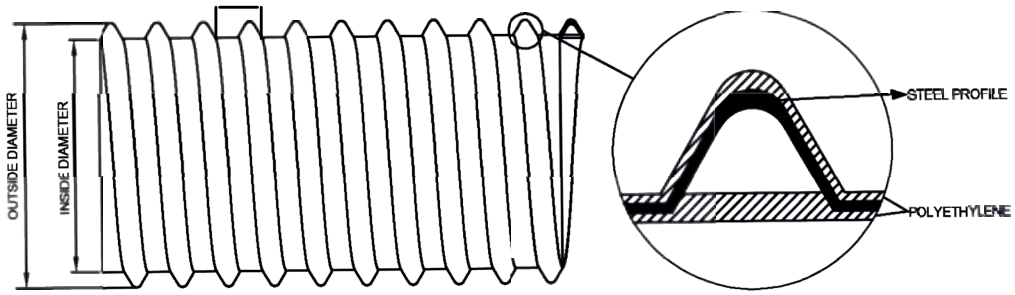
LOW CARBON COLD ROLLED COLD FORMABLE STEELS (CR) (TS EN 10130)

Order No	Steel Quality	Steel Number	Chemical Composition (%) Max				Mechanical Properties						
							Yield Stress (N/mm2) Max			Tensile Stress at Rupture (N/mm2)	Elongation Quantity (%) Min		
			C	S	P	Mn	e < 0, 5	0, 5 < e < 0, 7	0, 7< e		e < 0, 4	0, 5 < e 0 ,7	0, 7 < e
1	DC 01	1. 0330	0, 12	0, 045	0, 045	0, 60	320	300	280	270 - 410	24	26	28

Kuzeyboru's steel-reinforced spiral corrugated pipes are widely used in infrastructure projects. They provide a durable solution for water transmission in hydroelectric power plants, and offer long-lasting and secure performance in irrigation systems and sewer lines. These pipes are also ideal for stormwater drainage, industrial applications requiring high strength, and treatment systems that demand safe and efficient water transport.

4. 3. 2. Technical Specifications

Full resistance to corrosion and chemicals thanks to inner and outer HDPE layers
100% HDPE use enables desired ring stiffness (SN values)
High strength through steel rib reinforcement
Easy to install; compatible with electrofusion band welding for all diameters



Nominal Sizes – Steel-Reinforced Spiral Corrugated Pipes

Nominal size (mm)	Inside Diameter (mm)	Outside Diameter (mm)	Pitch (mm)	Minimum Pipe Stiffness (MPa)
800	813	891,8	108	0,4
900	914	1000,8	124	0,4
1000	1016	1198,9	169,9	0,4
1200	1219	1432,1	205	0,4
1400	1372	1603,2	224,8	0,4
1600	1676	1940,6	235	0,4
1800	1829	2107,7	235	0,4
2000	2032	2317,8	235	0,4
2200	2235	2529,2	235	0,4
2400	2438	2732,6	235	0,4
Note: Custom diameters are available based on project requirements.				

Ring Stiffness Of Steel-Reinforced Spiral Corrugated Pipes

Nominal Size (mm)	Ring Stiffness (kN/m²)				
DN	SN4	SN8	SN10	SN12,5	SN16
800	+	+	+	+	+
900	+	+	+	+	+
1000	+	+	+	+	+
1200	+	+	+	+	+
1400	+	+	+	+	+
1600	+	+	+	+	+
1800	+	+	+	+	-
2000	+	+	+	+	-
2200	+	+	+	+	-
2400	+	+	+	+	-

4. 3. GEOTEXTILE-WRAPPED DRAINAGE PIPES

Geotextile-Wrapped Drainage Pipes by Kuzeyboru are produced by wrapping drainage pipes with high-performance geotextile fabric. This protective layer helps guard against physical damage, . environmental factors, and clogging during operation The geotextile fabric used is 100% synthetic, non-woven, needle-punched, and thermally processed to form an ideal filter medium.

4. 4. 1. Advantages

- Long service life underground
- High chemical resistance
- Lightweight structure for easy transport, installation, and storage
- Simple and quick application
- Can function effectively in sandy soils without additional filter material
- Strong construction from high-density polyethylene
- No material waste or clogging issues

4. 4. 2. Applications

- Removal of excess water from agricultural fields
- Protection of building foundations exposed to groundwater
- Base drainage in construction sites
- Drainage of turf fields
- Reclamation of muddy and clay-rich areas
- Roadside drainage
- Mine dewatering

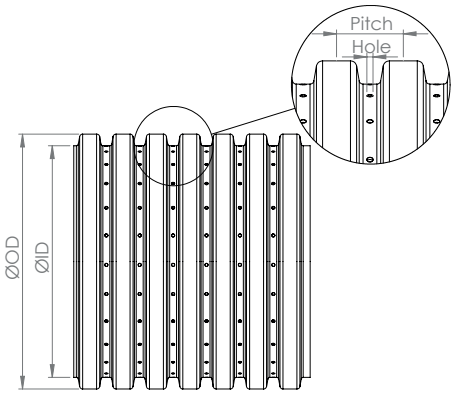
4. 5. PERFORATED CORRUGATED PIPES

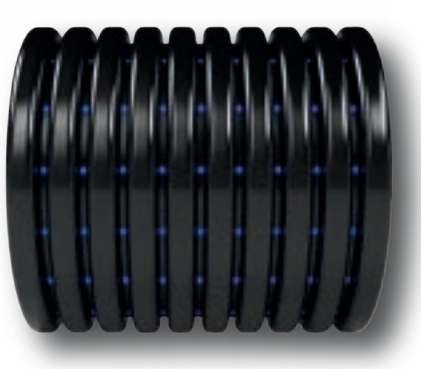
Corrugated perforated and slotted pipes made from high-density polyethylene are used to drain excess or polluted water from underground or surface areas. They are produced to R2 standards as per DIN 4262-1, with optional perforation/slitting patterns on the outer ribbed surface based on customer demand.

These pipes comply with TS EN 13476-3 standards and are available in ring stiffness classes from SN4 to SN16.

Perforation Dimensio

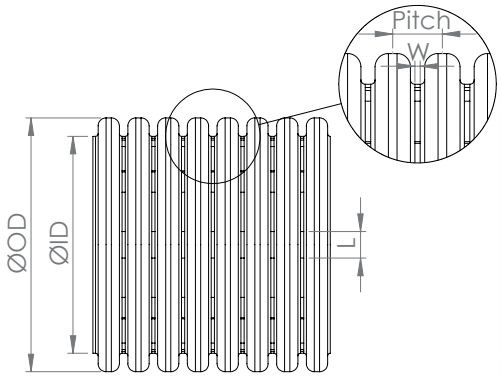
DN	ØID (mm)	ØOD (mm)	Pitch (mm)	Hole Ø (mm)	Hole Count	Hole Count (max)
100	98	115	15,63	3	4	8
150	148	171,5	20,32	4	4	8
200	198	231	29,03	5	4	8
300	297,5	348,5	40,64	8	4	10
400	397	466	50,8	10	4	12
500	496,5	582,5	67,73	10	6	16
600	600	701	81,28	12	6	16
800	800	936	101,6	12	6	20
1000	1000	1176	135,47	12	8	24

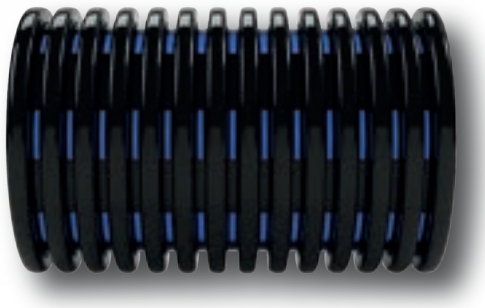




Slotted Dimensions

DN	ØID (mm)	ØOD (mm)	Pitch (mm)	L (mm)	W (mm)	Slit Count	Slit Count (max)
100	98	115	15,63	20	1,5	4	6
150	148	171,5	20,32	20	2	4	6
200	198	231	29,03	25	2	4	6
300	297,5	348,5	40,64	30	2,5	4	8
400	397	466	50,8	35	2,5	4	8
500	496,5	582,5	67,73	40	3	6	10
600	600	701	81,28	50	3	6	10
800	800	936	101,6	60	3,5	6	12
1000	1000	1176	135,47	65	4	6	12





4. 6. KUZEYBORU DOUBLE-WALL CABLE PROTECTION PIPES

Kuzeyboru cable protection pipes are essential components of infrastructure systems for telecommunications and data transmission. With their special design and high-quality structure, they offer exceptional durability against environmental conditions. These pipes are manufactured in accordance with TS EN 61386-1 standards.

4. 6. 1. Applications

- Telecommunications lines
- Indoor installations
- Underground power lines
- Traffic light and signal systems
- Railway signal lines
- Industrial energy and data transmission lines

4. 6. 2. Key Features

- Flexible structure absorbs underground movements
- High strength against traffic and soil loads
- Elastic deformation under sudden loads
- Excellent chemical resistance
- Easy transport, installation, and storage

Cable Protection Pipe Dimensions

Outer Diameter (mm)	Inner Diameter (mm)	Packaging (m)
50	42	6/12 veya 100 m Kangal
63	54	6/12 veya 100 m Kangal
75	66	6/12 veya 100 m Kangal
90	78	6/12 veya 100 m Kangal
115	100	6, 7, 12, 13
160	150	6, 7, 12, 13
225	200	6, 7, 12, 13
275	250	6, 7, 12, 13
300	295	6, 7, 12, 13
400	395	6, 12

Raw Material Tests

Test	Valeu	Unit	Method
Melt Flow Rate (190 ° C / 5 kg)	0,15≤mfr≤0,40	g/10 min	TS EN ISO 1133-1
Density 23 ° C	≥ 0.960	g/cm3	TS EN ISO 1183-1
Elongation at Break	>500	%	TS EN ISO 1183-1
Tensile Strength	Min 24	MN/m2	TS EN ISO 527-1
ESCR(% 10 Igepal C-630)2/10	>48	hour	ASTM 1693

Cable Casing Tube Tests (Flat Type 450-750 Nm)

Test Name	Value	Unit	Method
Melt Flow Rate (190 ° C / 5 kg)	0,15≤mfr≤0,40	g/10 min	TS EN ISO 1133-1
Density 23 ° C	≥ 0.960	g/cm3	TS EN ISO 1183-1
Elongation at Break	>500	%	TS EN ISO 527-1
Tensile Strength	Min 24	MN/m2	TS EN ISO 527-1
ESCR(% 10 Igepal C-630)2/10	>48	hour	ASTM 1693
Impact Test	Max3/12 cracking	mm	TS EN 61386-24
Ring Flexibility	-	No Damage	TS EN ISO 9969
Deformation	di*0,03	g/cm3	DIN 16961

5. corrugated pipe jointing methods

Kuzeyboru corrugated pipes are joined using three methods:

1. Socketed (Integral Bell) Gasket Joint
2. Coupler Gasket Joint
3. Electrofusion Welding with EF Tape (Steel Reinforced Spiral)

Socketed (Integral Bell) Gasket Joint

5. 1. Coupler Gasket Joint Method

In this method, a gasket is placed between two plain-ended corrugated pipes, and the pipes are inserted into a coupler. Once both pipe ends are pushed into the coupler, the connection is completed and sealed. This method provides excellent leak-tightness and durability, making it a preferred solution in drainage, sewer, and stormwater discharge systems.

5. 2. Socketed Gasket Joint Method

Socketed gasket joining is a reliable and practical solution for infrastructure projects. After selecting the gasket appropriate to the pipe diameter, it is placed on the socket end of the pipe. The socket and spigot ends are then joined to ensure leak-tightness. This method offers ease of installation and tight sealing and is commonly used in sewer, drainage, and stormwater discharge systems.

5. 3. Electrofusion Welding with EF Tape

For joining steel-reinforced corrugated pipes, the pipe ends are brought together and wrapped circumferentially with an EF (electrofusion) tape. Electrical current is applied to the tape ends, melting the material and completing the weld. Pipes must be aligned on a flat and clean surface under dry conditions. The fusion process takes 6–15 minutes at a temperature of 190–200°C. During the cooling stage, the pipes must remain stationary for 15–20 minutes. After cooling, the joint area is backfilled, and the pipes should not be moved until the fusion has fully solidified.

6. stock and shipment

6. 1. CONSIDERATIONS DUE TO NON-STANDARD VEHICLE BED SIZES

The fact that the vehicle bodies are not in standard sizes creates some difficulties in loading and transportation processes. Therefore, the following points should be considered when using the relevant tables.
During the checks, it was determined that the length of the crates varies according to the vehicle type.

Vehicle Type	Case Lengths	Case Widths	Inside Height
Trucks	6,80 - 7,40 meter	2,38 - 2,55 meter	2,60 - 3,00 meter
Trucks	12,00 - 13,60 meter	2,38 - 2,55 meter	2,60 - 3,00 meter

Considering these changes, the dimensions of each vehicle's chassis should be carefully checked and loadings should be made accordingly. Thus, possible problems can be minimized.

Corrugated Pipe

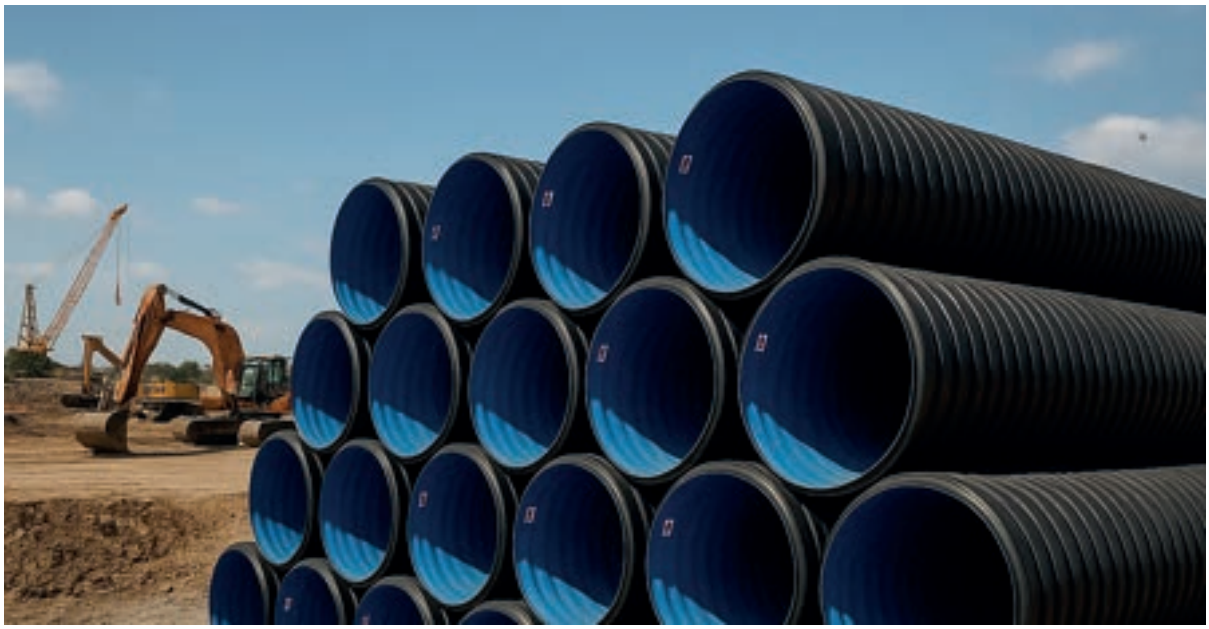
	OPEN TRUCK	TRUCK	CLOSED TRUCK
CROSS	NUMBER	NUMBER	NUMBER
100	1334	667	1196

150	570	285	510
200	320	160	286
300	140	70	112
400	70	35	50
500	48	24	40
600	30	15	24
800	18	9	12
1000	10	5	8
1200	8	4	6
1400	6	3	4
1600	4	2	4
2000	2	1	2
2200	2	1	2
2400	2	1	2

6. 2. STORAGE AND TRANSPORTATION GUIDELINES

- The storage area must be free of sharp objects (rocks, stones, metal, etc.) that can damage the pipes.
- Pipes must not be stacked more than 3 meters high.
- Prolonged exposure to direct sunlight should be avoided. If possible, pipes should be stored in shaded or covered areas.
- Elastomeric gaskets must be protected from direct sunlight.
- Pipes should be stacked with sockets alternately placed to prevent deformation.
- When tying down pipes during transport, use ropes that do not damage the pipe surface.
- Pipes must be protected from impact during handling and installation. Lift them using slings at both ends.
- When using a forklift, lift the pipes from the center in a balanced manner.
- For open-bed transportation, take precautions to prevent vehicle side rails from damaging the pipes.
- Pipes must never be dragged on the ground; instead, roll them gently on clean, smooth surfaces.
- In telescopic loading, when smaller pipes are nested inside larger ones, take care not to damage the socket or weld areas.

7. pipe laying principles



Pipes used in sewer infrastructure must be properly designed and installed to ensure long-lasting and reliable performance. Kuzeyboru pipes are manufactured to withstand earth and traffic loads when buried. Proper field application is essential to ensure decades of problem-free operation.

The backfill process after trench excavation is critical. Bedding and side-fill materials must be compacted according to the specifications. Proper compaction ensures that external loads are transferred to the bedding material, preserving the pipe's structural integrity. Insufficient compaction can lead to pipe deformation or failure.

7. 1. SOIL LOAD CALCULATION (MARSTON THEORY)

The soil load is the weight of the soil cover on the pipe and is calculated using Marston's Theory.

7. 1. 1. Marston Formula

$W=C_c \cdot \gamma \cdot B \cdot H$
W: Vertical soil load on pipe (kN/m)
C_c: Marston load coefficient (dimensionless)
Y: Unit weight of soil (kN/m^3)
B: Trench width (m) (pipe outer diameter + side clearances)
H: Soil cover height (m)

7. 1. 2. Marston Coefficient (C_c)

C_c, is determined by the friction angle of the trench sidewalls, soil types and compaction condition.

Dar Hendek Koşulları İçin C_c Değeri:
C_c=1-e^(-2Kμ H/B)
K: Lateral earth pressure coefficient (typically 0.5)
μ: Soil-pipe friction coefficient
e: Base of natural logarithm

Note: In practice, C_c values are usually taken from standard tables.

7. 2. Traffic Load Calculation

Traffic load is the portion of loads from surface vehicles transmitted to the pipe. The effect of the load on the pipe decreases as the soil cover height increases.

7. 2. 1. Effective Traffic Load Calculation

The Boussinesq Theory or Equivalent Soil Cover Height Method is used.

7. 2. 2. Equivalent Soil Cover Height Method

$$P = \frac{P_0}{\left(1 + \frac{2H}{L}\right)^2}$$

P: Effective traffic load on the pipe (kN)

H: Soil cover height (m)

P_0: Single wheel load (kN)

L: Half-width of the load area (m)

7. 2. 3. Load Distribution Angle Approach

·Traffic load is distributed within the soil at a certain dispersion angle.
·Dispersion Ratio: 1.5:1 or 2:1 (vertical)

7. 2. 4. Effective Load Width (B_e)

$$B_e = B + 2(H \times n)$$

Be: Effective load width (m)

B: Wheel track width (m)

n: Dispersion ratio (e.g., 1.5)

7. 3. TOTAL LOAD CALCULATION AND SAFETY FACTOR

7. 3. 1. Total Load

W_{total}: $W_{soil} + \frac{P}{L}$

W_{soil}: Soil load (kN/m)

P/L: Value of traffic load distributed along the pipe (kN/m)

7. 3. 2. Safety Factor

·For corrugated pipes, the safety factor is generally taken as 2.0.
·It is selected considering the material strength, ring stiffness, and long-term performance of the pipe.

7. 4. DESIGN CONSIDERATIONS

7. 4. 1. Ring Stiffness (SN) $SN = \frac{E \cdot I}{D^3}$

E: Elastic modulus of the material (MPa)

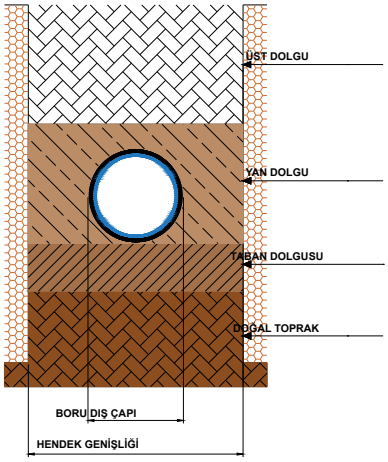
I: Second moment of area of the cross-section (mm^4)

D: Pipe diameter (mm)

7. 4. 2. Backfill Material and Compaction

Side Backfill Material: Granular materials with good drainage properties should be preferred.

Compaction Rate: Should be at 90% Proctor density.



7. 4. 3. Trench Width (B)

Minimum B: Pipe outer diameter (D) + 0.3 m

Maksimum B: Pipe outer diameter (D) + 0.6 m

7. 4. 4. Soil Cover Height (H)

Minumum H: The minimum value specified by the manufacturer and standards (generally 0.5 m)

Maksimum H: Determined based on pipe design and material.

8. useful information

8. 1. POLYETHYLENE RAW MATERIAL

Polyethylene is a thermoplastic material used in a wide range of applications and takes its name from the monomer ethylene. It is produced by polymerizing ethylene and is commonly abbreviated as PE in the plastics industry.

The ethylene molecule (C_2H_4) consists of two CH_2 groups connected by a double bond (CH_2=CH_2). Polyethylene is formed through polymerization, a chemical reaction in which monomer units are bonded to form polymer chains.

High-Density Polyethylene (Hdpe)
Raw Material Tests

Property 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 at , 23°C[1]	>0.930	g/cm^3	ASTM D1505
Melting Point (DSC, 2nd heating)	131	°C	ASTM D3418
Oxidation Induction Time	>20	min	TS EN 728
Volatile Content	<350	mg/kg	TS EN 12099
Moisture Content	<300	mg/kg	TS EN 12118
Carbon Black Content	2-2.5	%	ISO 6964
Mechanical Properties (**)			
Tensile Strength at Yield	24	MPa	ASTM D638
Tensile Strength at Break	31	MPa	ASTM D638
Elongation at Break	875	%	ASTM D638
Flexural Modulus at , 23°C	950	MPa	TS EN ISO 178
Notched Izod Impact Resistance at	380	J/m	ASTM D256
Hardness (Shore D)	63	-	ASTM D2240
Environmental Stress Crack Resistance (%10 Igepal, F50)	>3000	saat	ASTM D1693
Thermal Properties			
Vicat Softening Point , 10 N	122	°C	ASTM D1525

8. 2. Material Characteristics

The material used is polyethylene (PE). Additives are incorporated to facilitate the production of components in compliance with TS EN 13476-3. Type B spiral pipes may include a support profile made from polymers other than PE.

8. 2. 1. Material Properties of Pipes and Fittings

Polyethylene (Pe) Material

Property	Standard	Unit	Value
Melt Flow Index (MFI) at 190°C , 5Kg	**TS EN ISO 1133-1**	g/10 dk	≤ 1,6
Density	**TS EN ISO 1183-1**	Kg/m^3	≥ 930
Hardness	**TS EN ISO 868**	Shore D	63
Heat Resistance at , (150±2) °C	**TS ISO 12091**	heating time e ≤ 3 mm 30 dk	No delamination, cracks, or blisters for: wall thickness

8. 3. 2. Mechanical and Performance Properties of PE Pipes and Fittings

Polyethylene (Pe) Material

Property	Standard	Unit	Value
Ring Stiffness, SN 4	**TS EN ISO 9969**	kN/m^2	≥ 4
Ring Stiffnessi, SN 16	**TS EN ISO 9969**	kN/m^2	≥ 16

Ring Stiffness (SN): Kuzeyboru corrugated pipes meet the SN4 and SN16 ring stiffness classifications as defined in TS EN 13476–3, verified through testing in accordance with ISO 9969.

Ring Flexibility: Kuzeyboru corrugated pipes are tested in accordance with TS EN ISO 13968. The pipe is subjected to external compression causing a 30% increase in diameter without permanent deformation, cracking, or breakage.

Impact Resistance: Tested to TS EN ISO 3127, Kuzeyboru corrugated pipes conditioned at 0°C withstand the impact of falling weights appropriate to their diameter without fracturing.

Leak Tightness: Systems comprising elastomer-sealed pipes and fittings are tested to TS EN 1277. The system maintains watertight integrity for 15 minutes under 0.5 bar pressure.

8. 2. 3. Chemical Resistance Chart

Hdpe Pe100 – Chemical Resistance Table

Chemicals	Resistance at 20°C			Chemicals	Resistance at 20°C		
	Strong A	Middle B	Weak C		Strong A	Middle B	Weak C
Acetate, butyl	x			Acid, sulpho-chromic			x
Acetone	x			Acid, sulphurous	x		
Acid, acetic (10%)	x			Acid, sulphuric (50 %)	x		
Acid, acetic (100%)	x			Acid, sulphuric (98 %)	x		
Acids, aromatic	x			Acid, tartaric	x		
Acid, benzoic*	x			Acid, trichloroacetic (50 %)	x		
Acid, boric*	x			Acid, trichloroacetic (100 %)	x		
Acid, butyric	x			Acrylonitril	x		
Acid, carbonic	x			Acrylonitri, allyl	x		
Acid, chromic (80%)	x			Acrylonitri, ally	x		
Acid, citric	x			Acrylonitri. benzyl	x		
Acetaldehyde	x			Acid, stearic	x		

Acetate, butyl	x			Acid, sulpho-chromic			x
Acetone	x			Acid, sulphurous	x		
Acid, acetic (10%)	x			Acid, sulphuric (50 %)	x		
Acid, acetic (100%)	x			Acid, sulphuric (98 %)	x		
Acids, aromatic	x			Acid, tartaric	x		
Acid, benzoic*	x			Acid, trichloroacetic (50 %)	x		
Acid, boric*	x			Acid, trichloroacetic (100 %)	x		
Acid, butyric	x			Acrylonitril	x		
Acid, carbonic	x			Acrylonitri, allyl	x		
Acid, chromic (80%)	x			Acrylonitri, ally	x		
Acid, citric	x			Acrylonitri. benzyl	x		
Acetaldehyde	x			Acid, stearic	x		
Acetate, butyl	x			Acid, sulpho-chromic			x
Acetone	x			Acid, sulphurous	x		
Acid, acetic (10%)	x			Acid, sulphuric (50 %)	x		
Acid, acetic (100%)	x			Acid, sulphuric (98 %)	x		
Acids, aromatic	x			Acid, tartaric	x		
Acid, benzoic*	x			Acid, trichloroacetic (50 %)	x		
Acid, boric*	x			Acid, trichloroacetic (100 %)	x		
Acid, butyric	x			Acrylonitril	x		
Acid, carbonic	x			Acrylonitri, allyl	x		
Acid, chromic (80%)	x			Acrylonitri, ally	x		
Acid, citric	x			Acrylonitri. benzyl	x		

Acetaldehyde	x			Acid, stearic	x		
Chlorine (liquide and gas)			x	Glycol	X		
Chlorobenzene			x	Glycol, butyl	X		
Chloroethanol	x			Glycol, methyl	X		
Chloroform			x	Hydrogen chloride gas (dry, wet)	X		
Chloride, aluminium"	x			Hydrogen. peroxide(30%)	X		
Chloride, ammonium*	x			Hydrogen, peroxide (100%)	X		
Chloride, antimony*	x			Hydrogen sulphide	X		
Chloride, calcium-	x			Iodine tincture	X		
Chloride, ferric*	x			Isoctane	X		
Chloride, magnesium*	x			Mercury	X		
Chloride, mercury*	x			Metallic sulphates	X		
Chloride, methylene			x	Methylethyiceton e	X		
Chloride, potassium*	x			Molasses	X		
Chloride, sodium	x			Morpholine	X		
Chloride, sulfuryl			x	Naphta (heavy petrol)	X		
Chloride, thionyl			x	Naphtalene	X		
Chloride, zinc	x			Nickel salats*	X		
Compote	x			Nitrogen dioxide gas	X		
Copper salts*	X			Oils, essential		X	
Cresol	X			Oils, mineral	X		
Cydohexane	X			Oils, paraffin	X		
Cyclohexanol	X			Oils, silicone	X		

Cyclohexanone	X			Oils, vegetable and animal	X		
Decaline	X			Olleum		X	
Detergents	X			Ozone	X		
Dibutyl phthalate	X			Petroleum	X		
P-dichlorobenzene		X		Petroleum ether	X		
Dichloroethane		X		Phenols	X		
Dichlomethylene			x	Phosphates*	X		
Diethyl ether	X			Phosphorus oxychloride	X		
Dioxane	X			Phosphorus pentoxide	X		
Ether		X		Phosphorus trichloride	X		
Fluorine			X	Photographic developers	X		
Formaldehyde (40%)	X			Polyglycols	X		
Fruit juice	X			Potassium bichromate (40%)	X		
Gasoline	X			Potassium hydroxide	X		
Gelatin	X			Potassium permanganate	X		
Glycerin	X			Pyridine	X		
Glycerin chlorohydirin	X			Sea water	X		
Silver nitrate	X			Sulphur	X		
Sodium benzoate	X			Tallow	x		
Sodium borate	X			Tetrahydrofuran		X	
Sodium carbonate (lyes)	X			Tetralin	X		
Sodium chloride (50%)	X			Thiophone		X	
Sodium hydroxide (lye)	X			Toluene		X	

Sodium hypochlorite*	X			Trichloroethylene			X
Sodium nitrate	X			Triethanolamine	X		
Sodium silicate*			x	Turpentine	X		
Sodium sulphide*	X			Vaseline		X	
Sodium thiosulphate	X			Yeast	X		
Sugar syrup	X			Xylene		X	

CODES

A Resistant no indication that serviceability would be impaired.
B Variable resistance, depending on conditions of use.
C Unresistant, not recommended for service applications under any conditions.

9. documents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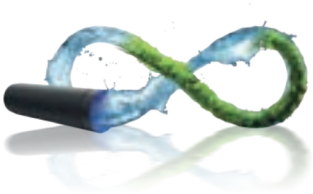

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