PRESSURE and GRAVITY POLYETHYLENE PIPES

Group Companies

EBS®
ECE PIPE SYSTEMS

HIGHER QUALITY IN INFRASTRUCTURE

Ece Group has 25 years of proven quality and success in the production of concrete and reinforced concrete pipes. Its two established factories are located in Manisa and Adapazarı, Turkey. The company has expanded over the years to produce a variety of Polyethylene Pipes (PE63, PE100, PE80, PE 80 Gas, Steel Wire Reinforced Thermoplastic Pipes , Corrugated HDPE Pipes, Metal Reinforced Corrugated HDPE Pipes) and GRP (Glassfiber Reinforced Polyester Pipes) and Pipe Fittings with the EBS (Ece Boru Sistemleri-Ece Pipe Systems) brand name. All of its products are up-to-date and comply with the needs of infrastructure projects according to the latest technological developments.

EBS is located in Manisa, Turkey with a large and modern plant based on high technology. It has a closed area of 7.500 sqm and an open area of 50.000 sqm. In addition to this, there are plans to expand on this and to build new facilities. The company is continually expanding its production capacity and broadening its range of products.

EBS (Ece Boru Sistemleri-Ece Pipe Systems), which is a subsidiary of Ece Group, is the first and only in Turkey with such a wide diversity within its production range. All of EBS products are produced within the scope of TSE (Certificate of Turkish Standards Institude) and ISO (International Organization for Standardization) and other related international standards.

EBS (Ece Boru Sistemleri- Ece Pipe Systems) which follows and applies all the new technologies, included and started producing **Metal Reinforced Corrugated HDPE 100 Pipes** and **Steel Wire Reinforced Thermoplastic Pipes** to keep up to date in pipe industry.

Group Companies

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PRESSURE and **GRAVITY** **POLYETHYLENE** PIPES

INDEX

PRODUCT DESCRIPTION

PRODUCTS

Pressure Pipes:
- PE 32 (LPDE- Low density polyethylene), PE 63 (MPDE-Middle density polyethylene), PE100 (HDPE-High density polyethylene)
- PE 80 Natural Gas pipes
- SRTP Composite Pipes (Steel Reinforced Thermoplastic Pipes)

Gravity Pipes:
- Corrugated HDPE Pipes and Fittings
- MRP Pipes and Fittings (Metal Reinforced Polyethylene Pipe)
- Cable Protection Pipes

NOMINAL DIAMETERS:
- DN 20-DN 630 mm.pressure pipes
- DN 110-DN 1600 mm gravity pipes

PIPE LENGHTS:
Pipes are manufactured between 6m-12m, may also be manufactured between 1m-16m length depending on the desired length according to the project needs.

PRESSURE CATEGORIES
- PN 1 bar-PN 32 bar in pressure pipes
- Manufacturing is up to 4 bar in gravity pipes

TEST PRESSURE:
The test pressure of pressure pipes is min. 1,5 times of operating pressure. The test pressure is 1 bar for water tests and 0,5 bar for air tests valid for gravity lines.

STIFFNESS:
Gravity pipes are manufactured between SN4 - SN20 kN/m^2 stiffness values.

RAW MATERIALS
For Pressure Pipes:
- Pressure Pipes: PE32, PE63, PE80, PE100 raw materials and steel wires for reinforcement.

For Gravity Pipes:
- PE80, PE100 raw materials and galvanised metal plates for reinforcement.

STANDARDS
Pipes are manufactured in accordance with all the national and international standards like TSE, ISO, BS, DIN, ASTM ve AWWA.

AREAS OF USE
Pressure Pipes
- Natural gas networks
- Drinking water networks and water transport pipelines Irrigation networks
- Sea outfall
- Fish Farms
- Pipelines to carry the chemical contented liquids
- Relining applications
- Pipelines to remove the industrial wastes
- Fire protection water-cooling water lines
- Discharging lines for water and methan gas in solid waste projects
- Geothermal projects

Gravity Pipes
- Sewerage and stormwater networks
- Sewerage and stormwater collector lines
- Cable protection pipes
- Highway culvert applications
- Manhole and shaft applications
- Pipelines to remove the industrial wastes
- Modular office building applications
- Plastic raw material silo apllications

PRODUCT DESCRIPTION

AUTOMATION IN PRODUCTION

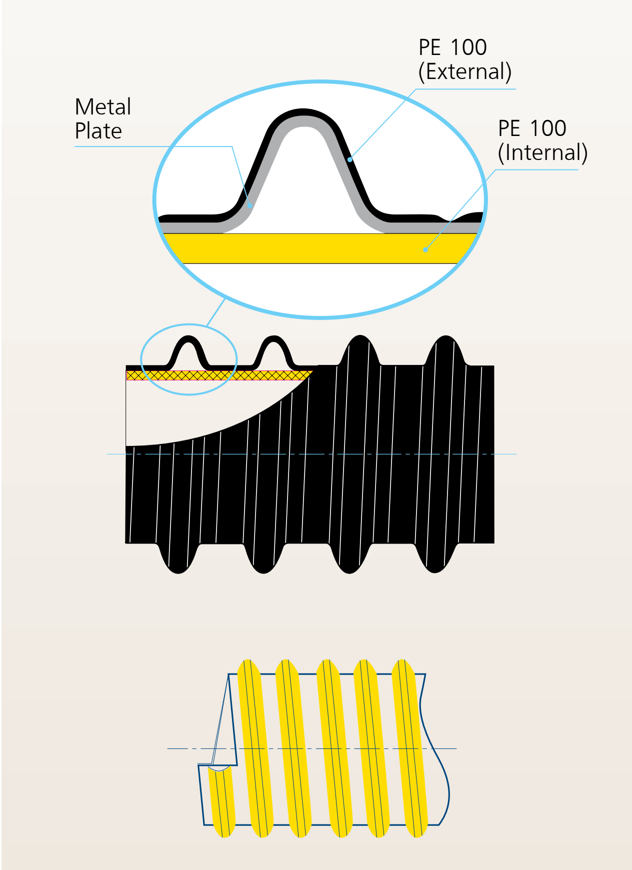
The production process is fully operated based on computer control system to ensure the continuous and repeatable quality

NEW

MRP (Metal Reinforced Polyethylene) Pipes

DN 600 - DN 1600

MRP pipes (Metal Reinforced PE Pipes) that EBS has introduced to the local market are designed for the conditions (storm water, sewerage lines, etc.) where standard corrugated HDPE pipes do not assure ring stiffness. (deep excavations, heavy live loads, high groundwater level) There are metal profiles beneath outer PE layer of MRP pipes which are corrosion resistant during the 50 years of design and 100 years of service lifetime of the pipes.



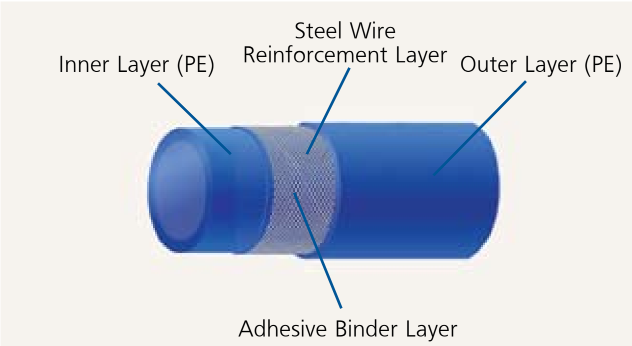
MRP Pipe

NEW

SRTP (Steel Wire Reinforced Thermoplastic PE100) Pipes

DN 110-DN 250 mm

SRTP pipes (Steel Reinforced, Thermoplastic PE100 pipe) are manufactured with an integrated system based on computer control, by attaching an extra steel fiber winding unit to the extruder machine. This system is designed to use in the transport of water in high temperature or high pressure and to use in natural gas network.



SRTP Pipe

PRODUCT DESCRIPTION

DIAMETER CATEGORIES FOR THE PIPE TYPE

PRESSURE PIPES						GRAVITY PIPES	
HDPE 100 PIPE DIAMETERS (mm)	HDPE 80 PIPE DIAMETERS (mm)	MDPE 63 PIPE DIAMETERS (mm)	LDPE 32 PIPE DIAMETERS (mm)	PE 80 NATURAL GAS PIPE DIAMETERS (mm)	SRTP PIPE DIAMETERS (mm)	CORRUGATED PIPE DIAMETERS (mm)	MRP PIPE DIAMETERS (mm)
20	20	20	20	16	110	150	600
25	25	25	25	20	160	200	800
32	32	32	32	25	200	300	1000
40	40	40	40	32	250	400	1200
50	50	50	50	40		500	1400
63	63	63	63	50		600	1500
75	75	75	75	63			1600
90	90	90	90	75			
110	110	110	110	90			
125	125	125	125	110			
140	140	140	140	125			
160	160	160	160	140			
180	180	180		160			
200	200	200		180			
225	225	225		200			
250	250	250		225			
280	280	280		250			
315	315	315					
355	355	355					
400	400	400					
450	450	450					
500	500	500					
560	560	560					
630	630	630					

HDPE 100 Pipes are manufactured between PN4-PN32 pressure categories in accordance with SDR6-SDR41 (standard dimension ratio).
HDPE 80 Pipes are manufactured between PN4-PN25 pressure categories in accordance with SDR6-SDR33 (standard dimension ratio).
MDPE 63 Pipes are manufactured between PN4-PN16 pressure categories in accordance with SDR7,4-SDR26 (standard dimension ratio)

LDPE 32 Pipes are manufactured between PN2,5-PN10 pressure categories in accordance with SDR6-SDR21 (standard dimension ratio).
PE 80 Natural Gas Pipes are manufactured between PN4-PN10 pressure categories in accordance with SDR11-SDR26 (standard dimension ratio).
SRTP Pipes are manufactured between PN10-PN32 pressure categories
Gravity Pipes are manufactured between SN4-SN16kN/m² stiffness categories

SUPERIORITIES & ADVANTAGES

EXTREME PRESSURES
Elastic pipe walls of pressure pipes substantially absorb the peak pressures which is known as water hammer.

COUPLING
There are 3 different methods used for assembling the pipes. Electrofusion fittings (sleeves), buttwelding fittings and push fit (plug-in)fittings. The method preferred depends on the economic analysis performed considering the diameter and pressure categories. For the underwater applications the pipe line may be combined with flanges.

EBS, Corrugated HDPE pipes are manufactured either with couplings or without couplings. The EPDM rubber gasket fittings ensures the fast and easy mounting and provides %100 tightness. Welded electrofusion bands are used in connection of the MRP pipes.

ELASTICITY
Polyethylene pressure and gravity pipes are flexible which considerably reduces the requirement for bends in infrastructure projects. Elasticity of the pipes is an important factor in consistency to earth motions, thus this type of pipes are preferred in eartquake regions. Generally, bends smaller than 11° are not required in the projects where the polyethylene pressure pipes are used.

AXIAL TENSILE STRENGTH
Polyethylene pressure pipes have high axial tensile strength and incomparebly preferred in relining projects and trenchless piping systems.

CORROSION RESISTANCE
Corrugated HDPE pipes, MRP pipes and PE, SRTP pipes have extra resistance against external corrosive affects of the chemical materials existing in the soil and internal corrosive affects of the liquid it carries. The pipes are not affected by corrosion during their 50 years lifetime of design and 100 years lifetime of service. Specially coated steel reinforcement of SRTP pipes and galvanised metal reinforcement of MRP pipes remain between poyethylene layers keeping the pipes corrosion free during their 100 years of service lifetime.

SMOOTH INTERNAL WALLS
Pressure and gravity polyethylene pipes have perfectly smooth internal walls which provides savings in the pipe diameter. It allows a higher flow rate for the same diameter. Thus, pressure pipes provide saving in energy consumptions in pumping lines.

HANDLING, STORAGE AND QUICK ASSEMBLY
- Polyethylene pipes provide considerable savings in transportation and storage area with their telescobic loading specification.
- Polyethylene pipes have high resistance since they are flexible materials, and they are not affected by damages which might occur during transportation and loading.
- Pipes are fairly light,and allow easy transportation, storage and quick assembly.
- PE Pipes are longer than concrete pipes which provide economy in transportation and mounting.
- Dimunition of handling and mounting is %0
- The pipes can be cut easily by handsaw or decoupage.
- They do not require heavy construction machines because they are light.
- The coil packaging is possible in pressure polyethylene pipes between DN 20 - DN 125 diameters. For diameters larger than DN 140 mm, they are packed in 12 meters length. The coil lengths can be 100 meters or longer according to the requests.
- Pressure pipes are combined outside the trench in certain lengths and than moved inside the trench for the mounting. Thus mounting is fast where the underground water level is high and the soil is unstable.

QUALITY TESTS

TEST	PURPOSE	STANDARDS	REFERENCE	STANDARDS
Melt flow rate (MFR)	To determine the behaviour of the raw material against the variation in temperature.	The change in MFR should be ±20%	TS EN 1155-2 table 6 TS 418-2 table 5	EN ISO 1133
Thermal Stability (OIT)	The thermal stability of the raw materials.	≥20 minutes	TS EN 1155-2 table 6 TS 418-2 table 5	EN 728
Elongation at break	The tensile strength of the raw material in the liquid limit.	≥350%	TS EN 1155-2 table 6 TS 418-2 table 5	EN ISO 6259-3
Density	To determine the raw materials' weight of unit volume.	≥930 kg/m	TS EN 1155-2 table 1 TS 418-1 table 1	ISO 1183
Dimensional Stability (drying oven)	To determine the physical properties of the raw materials.	≤3%	TS EN 1155-2 table 6	EN 743
20°C, 100 h pressure test	The behaviour of the pipes under pressure in time.	should be no failure	TS EN 1155-2 table 4 TS 418-2 table 3	TS EN ISO 1167-1
80°C, 165 h pressure test	The behaviour of the pipes under pressure in time.	should be no failure	TS EN 1155-2 table 4 TS 418-2 table 3	TS EN ISO 1167-1
80°C, 1000 h pressure test	The behaviour of the pipes under pressure in time.	should be no failure	TS EN 1155-2 table 4 TS 418-2 table 3	TS EN ISO 1167-1
Carbon Black Content	To determine the amount of carbon black ratio of the raw material.	2 - 2,5%	TS 418-1 EN 12201- 1 table 1	ISO 6964
Carbon Black Dispersion (black paste)	To determine the dispersion of the carbon black of the raw material.	≤degree 3	TS 418-1 EN 12201- 1 table 1	ISO 18553
Carbon Black Dispersion (blue paste)	To determine the dispersion of the carbon black dispersion of the raw material.	≤degree 3	TS 418-1 EN 12201- 1 table 1	ISO 18553


PRESSURE AND GRAVITY POLYETHYLENE PIPE FITTINGS








ENGINEERING FORMULAS

Hazen-Williams equation;

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

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

$h_f = [3{,}35 \times 10^6\, Q/(Cd^{2,63})]^{1,852}$

h_f : Friction factor, m of water /100 m
Q : Flow rate (L / sec)
C : Hazen Williams roughness coefficient, (dimensionless)
Typical value for polyethylene pipe= 149
d : Pipe inside diameter, mm

Head Loss converted to Pressure Loss;

$p = [(h_f/100)\ L\ (SG)]$

p : Pressure loss, tone/m² (1 tone/ m²= 9,81 kPA)
L : Line length (m)
SG : Specific gravity, dimensionless, (1 for water)

Manning equation;

The manning equation typically solves gravity flow problems where the pipe is only partially full and is under the influence of an elevation head only.

$Q = (K/n)\ (S)^{0,5}\ (R_H)^{2/3}\ A$

n : Roughness coeefficient
(0,009 for typical polyethylene pipe)
K : Coefficient (K=1,0m)
S : Hydraulic slope, S=(H1-H2)/L
H_1 : Upstream elevation (m)
H_2 : Downstream elevation (m)
L : Length of pipe section (m)
A : Cross sectional area (m²)
R_H : hydraulic radius (m), (A/Wp)
Wp : wetted perimeter of pipe (m)

Darcy-Weisbach equation;

The primary advantage of this equation is that it is valid for all fluids in both laminar and turbulent flow. "f" coefficient in this equation is characterized with Reynolds number.
If Re≤2000 flow type is "Laminar"
If 2000<Re<4000 flow type is "Transition flow zone"
If Re≥4000 flow type is "Turbulent"

$h_f = (f/D)\ (V^2/2g)\ L$

f : Darcy-weisbach friction factor, (dimensionless)
D : Pipe inside diameter (m)
h_f : Friction factor (m)
g : Gravitational constant (9,81 m/s²)
L : Length of pipe section (m)
V : Fluid velocity (m/sec)

If Re≤2000; f_l=64/Re
If Re≥4000; f coefficient is,
$f_t = [1{,}8 \times \text{Log}\ (Re/7)]^{-2}$ (%1 imperfection)

Colebrook-White equation;

$$\frac{1}{\sqrt{f}} = -2 \log\left(\frac{k}{3{,}71\,D} + \frac{2{,}51}{Re}\,\frac{1}{\sqrt{f}}\right)$$

D: Pipe inside diameter (m)
k: Roughness constant (m) (0,02)
f: Darcy-Weisbach coefficient
Re: Reynolds number

Kutter equation

$$V = \frac{100\sqrt{R}}{b+\sqrt{R}} \times \sqrt{(J \times R)}$$

V: Fluid velocity (m/s)
R: Hydraulic radius (m)
R= D/4 (gross flow)
J: Gradiant (m/m)
b: Kutter coefficient (0,12)

ENGINEERING FORMULAS

Determination of pipe diameter

For water;

$d = 186\, [Q/SG]^{0,5} / \rho^{0,33}$

d: Inner diameter (mm)
Q: Flow (L/sn)
SG: Specific gravity (dimesionless, 1 for water)
ρ= Liquid density (kg/m^3)

For erosive and corrosive liquids

$d = 262\, [Q/SG]^{0,5} / \rho^{0,33}$

Pressure surge

Pressure surge, also known commonly as water hammer, results from an abrupt change of fluid velocity within the system. The magnitude of pressue surge is a function of the fluid properties and velocity, the modulus of elasticity and wall thickness of the pipe material, the length of the line, and the speed at which the momentum of the fluid changes.

$Ps = a\,(SG)\,\Delta V$

Ps : Pressure surge deviation from normal (kPa)
SG : Fluid specific gravity, (dimensionless), (1 for water)
ΔV : Change in flow velocity (m/sec)
a : Wave velocity, (m/sec)
$a = 1/[(\rho/g)(1/10^9\, k + d/10^9\, E(t)]^{0,5}$
ρ : Fluid density (kg/m^3)
g : Gravitational constant (9,81 m/sec^2)
k : Bulk modulus of compressibility of liquid (Gpa) (2 Gpa for water)
d : Pipe inside diameter (mm)
E : Modulus of elasticity (GPa)
t : Pipe wall thickness (mm)

The pressure class Pc must be greater than or equal to the sum of the working pressure Pw and surge pressure Ps divided by 1,4.

$Pc \geq (Pw+Ps)/1,4$ (AWWA M45)
Pw : Working pressure
Ps : Surge pressure

CALCULATION OF STIFFNESS AND STANDARD DIMENSION RATIO (SDR)

Stiffness

Corrugated HDPE sewerage and storm water pipes are classified according to the ring stiffness categories. Gravity sewerage and storm water pipes are designed to support the external loads where there is no internal pressure to balance the system when the pipes are under load.

$SN = E \times I / D^3$

SN: Ring stiffness (kN/m^2)
D: Avarage diameter (m)
I: Moment of inertia (m^4/m)
E: Modulus of elasticity (kN/m^2)

Generally ring stiffness is not calculated for pressure PE pipes because they own sufficient value of ring stiffness depending on their wall thickness upto the pressure categories they are designed (ring stiffness is proportional with wall thickness). Pressure PE pipes are identified according to SDR value. (standard dimension ratio)

$SDR = D/t$

SDR: Standard dimension ratio
D: Outside diameter (mm)
t: Wall thickness (mm)

DEFLECTION

Deflection is calculated as follows in gravity polyethylene pipes .

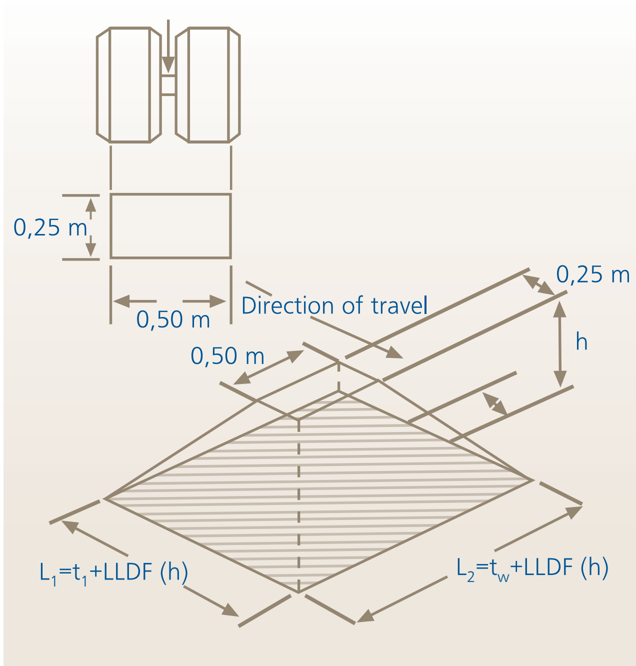
$$\frac{\Delta y}{D} = \frac{(D_L\, W_C + W_L) K_x}{149\, SN + 61000\, M_s}$$

D_L: Deflection lag factor to compansate for the time-consolidation rate of the soil, dimensionless. D_L>1,00 for the calculation of longterm deflection.
W_c : Vertical soil load on pipe (N/m^2)
$W_c = \gamma_s\, H$
γ_s : Unit weight of overburden (N/m^3)
H : Burial depth to top of pipe (m)
W_L : Live load on pipe (N/m^2)

ENGINEERING FORMULAS

$$W_L = \frac{M_p\, P\, I_f}{(L_1)(L_2)}$$

M_p : Multiple presence factor (1,2)
P : Wheel load magnitude (71300 N for HS-20
89000 N for HS-25)
I_f : Impact factor
$I_f = 1 + 0{,}33\,[(2{,}44-h)/2{,}44] \geq 1{,}0$
h : Depth of cover (m)
L_1 : Load width parallel to direction of travel (m)
$L_1 = t_1 + LLDF(h)$
t_1 : Length of tire footprint (0,25 m)
LLDF : Factor to account for live load distribution with depth of fill (1,15 for SC1and SC2, 1,0 for other backfills)
L_2 : Load with perpendicular to direction of travel
$h \leq h_{int}$
$L_2 = t_w + LLDF(h)$
t_w : Width of tire footprint (0,5 m)
h_{int} : Depth at which load from wheels interacts
$h_{int} = (1{,}83m - t_w) / LLDF$
h > hint
$L_2 = [t_w + 1{,}83m + LLDF(h)] / 2$
K_x : Bedding coefficient (dimensionless)
0,1 for non-uniform pipe bedding, 0,083 for uniform shaped buttom support
SN : Stiffness (kPa)
M_s : Composite soil constrained soil (MPa)
$M_s = S_c\, M_{sb}$
S_c : Soil support combining factor (dimensionless)
M_{sb} : Constrained soil modulus of the pipe zone embedment (MPa)
The following S_c values are required to us the table
M_{sn} : Constrained soil modulus of the native soil at pipe elevation (MPa)
B_d : Trench width at pipe spring line (mm)



M_{sb} BASED ON SOIL TYPE AND COMPACTION CONDITION

Vertical Stress Level (kPa)	Depth for Soil Density = 18.8 kN/m³, (m)	Stiffness Categories 1 and 2 (SC1, SC2)			
		SPD100 MPa	SPD95 MPa	SPD90 MPa	SPD85 MPa
6,9	0,4	16,2	13,8	8,8	3,2
34,5	1,8	23,8	17,9	10,3	3,6
69	3,7	29	20,7	11,2	3,9
138	7,3	37,9	23,8	12,4	4,5
276	14,6	51,7	29,3	14,5	5,7
414	22	64,1	34,5	17,2	6,9

Stiffness Category 3 (SC 3)

6,9	0,4		9,8	4,6	2,5
34,5	1,8		11,5	5,1	2,7
69	3,7		12,2	5,2	2,8
138	7,3		13	5,4	3
276	14,6		14,4	6,2	3,5
414	22		15,9	7,1	4,1

Stiffness Category 4 (SC 4)

6,9	0,4		3,7	1,8	0,9
34,5	1,8		4,3	2,2	1,2
69	3,7		4,8	2,5	1,4
138	7,3		5,1	2,7	1,6
276	14,6		5,6	3,2	2
414	22		6,2	3,6	2,4

SPD: Standard proctor density (%)

ENGINEERING FORMULAS

VALUES FOR THE SOIL SUPPORT COMBINING FACTOR S_c

M_{sn}/M_{sb}	B_d/D 1,25	B_d/D 1,5	B_d/D 1,75	B_d/D 2	B_d/D 2,5	B_d/D 3	B_d/D 4	B_d/D 5
0,005	0,02	0,05	0,08	0,12	0,23	0,43	0,72	1,00
0,01	0,03	0,07	0,11	0,15	0,27	0,47	0,74	1,00
0,02	0,05	0,10	0,15	0,20	0,32	0,52	0,77	1,00
0,05	0,10	0,15	0,20	0,27	0,38	0,58	0,80	1,00
0,1	0,15	0,20	0,27	0,35	0,46	0,65	0,84	1,00
0,2	0,25	0,30	0,38	0,47	0,58	0,75	0,88	1,00
0,4	0,45	0,50	0,56	0,64	0,75	0,85	0,93	1,00
0,6	0,65	0,70	0,75	0,81	0,87	0,94	0,98	1,00
0,8	0,84	0,87	0,90	0,93	0,96	0,98	1,00	1,00
1	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
1,5	1,40	1,30	1,20	1,12	1,06	1,03	1,00	1,00
2	1,70	1,50	1,40	1,30	1,20	1,10	1,05	1,00
3	2,20	1,80	1,65	1,50	1,35	1,20	1,10	1,00
≥5	3,00	2,20	1,90	1,70	1,50	1,30	1,15	1,00

VALUES FOR THE CONSTRAINED MODULUS OF THE NATIVE SOIL AT PIPE ZONE ELEVATION

Native in situ soils				
Granular		Cohesive		
Blow (0,3m)	Description	q_u (kPa)	Description	M_{sn} (MPa)
>0-1	very very loose	0-13	very very soft	0,34
1-2	very loose	13-25	very soft	1,4
2-4		25-50	soft	4,8
4-8	loose	50-100	medium	10,3
8-15	slightly compact	100-200	stiff	20,7
15-30	compact	200-400	very stiff	34,5
30-50	dense	400-600	hard	69,0
>50	very dense	>600	very hard	138,0

The following D_L values are taken according to the compaction of pipezone embedment material		
<%85 Proctor	%(85-95) Proctor	>%95 Proctor
<%40 Relative density	%(40-70) Relative density	>%70 Relative density
D_L=1,5	D_L=1,3	D_L=1,2
Standards: ASTM D 698, ASTM D 4253 and ASTM D 4254		

The following K_x values are taken according to the compaction of pipezone bedding material	K_x
If the bedding layer is <85% proctor density or <40% relative density	0.110
If the bedding layer is (85-95)% proctor density or (40-70)% relative density (For Type A or Type B granular materials or slightly compacted gravels)	0.103
If the bedding layer is >95% proctor density or >70% relative density (For Type A or Type B granular materials or gravels)	0.083
Standards: ASTM D 3839-89	

Calculation of wall thickness

$$t = \frac{PN \times D}{(2 \times \sigma) + PN}$$

t : Wall thickness (mm)
PN : Nominal pressure (N/mm²)
D = Outside diameter (mm)
σ = Design stress (N/mm²)
σ = MRS/c
MRS: Minimum required stress (MPa)
c: Safety factor (c=1,25 for water)

The σ values related to the MRS values of the materials (assuming c=1,25 for water)

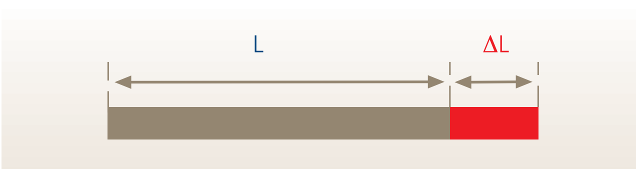
Raw Material	MRS (Mpa)	σ (N/mm²)
PE 32	3,20	2,60
PE63	6,30	5,00
PE80	8,00	6,40
PE100	10,00	8,00

Thermal expansion

The linear expansion coefficient is
δ= 0,18 mm/m.K for HDPE material

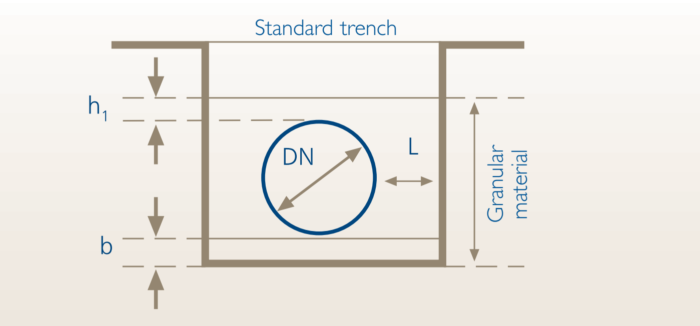
$$\Delta L = L \times \Delta T \times \delta$$

ΔL : Amount of expansion (mm)
L : Pipe length (mm)
ΔT: Change in temperature (K)
δ : Coefficient of linear expansion (mm/m.K)



INSTALLATION

- The backfill materials must be coated in layers, in filling both sides of the pipe in the trench.
- Compacting the native soil for the backfill is not required except the road crossings. (30 cm from the crown)



b = (DN/10)+10
b : Height of bedding (cm)
DN: Nominal diameter (cm)
h_1= DN/2
h_1 : Height of embedment (cm) (Max. 30 cm)

WORK AREA

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

- Damaged (crushed, punctured, scratched,etc) pipes should not be used.
- The water in the soil should be drained during the installation.
- The backfill height should be min h=100 cm considering the regional frost affects.
- The granular materials with high ability of compaction should be preferred in the bedding zones and for the material surrounding the pipe.
- If the excavated material is suitable for use as backfill material, the pipe can be directly laid on the cleared trench bed.
- If the soil contains muds and clays, the soil should be compacted with fine, coarse grained materials. In extremely loose grounds,the trench wall should be either sloped or sheeting should be applied to the trench walls for workmanship safety.

- Corrugated HDPE pipes are produced in SN4 (4kN/m^2) and SN8 (8kN/m^2) ring stiffness values. SN4 type corrugated HDPE pipes are generally preferred in areas for the backfill heights smaller than 4m. SN8 type pipes are preferred in areas for the backfill heights larger than 4 meters, in areas where underground water level is high and the pipes are subject to heavy live load conditions. Corrugated HDPE pipes may be manufactured with higher stiffness values depending on the project needs.

- MRP pipes (Metal reinforced polyethylene pipes) are manufactured in SN 4 kN/m^2-SN 20 kN/m^2 stiffness classes. The metal reinforcement elements in polyethylene parts of MRP pipes provides extra ring stiffness to the pipe. MRP pipes are economic solutions compared to other large diameter or HDPE, PP (polypropylene) corrugated pipes and RC (reinforced concrete) pipes since no backfill material properties and compacting capabilities are required.

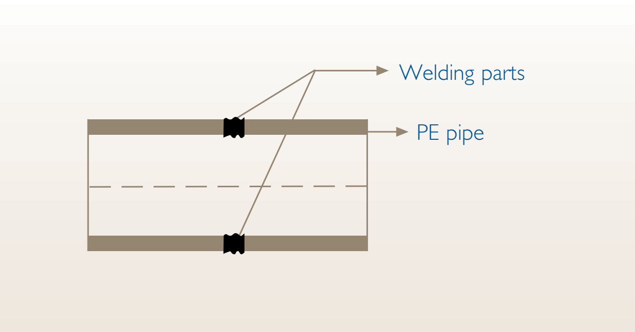
COUPLING

For Pressure Pipes

There are 3 methods used for coupling the pipes. "Butt welding method, electrofusion welding method, push fit method. For underwater applications, the pipes assembled in certain lengths are connected by flanges. Flanged connection might also be used for connection of different type of pipes.

Butt welding method

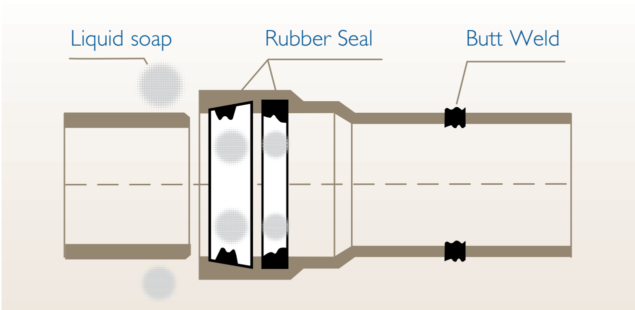
- Butt welding method is generally preferred for the pipe diameters larger than 125 mm.
- Heating plate temperature should be between 200-220 °C. Temperatures should continuously be measured and controlled.
- Heating time should be as; pipe wall thickness X 10 sec.
- Supply of the machinary is easy(local manufacturers are available)
- No need for specially trained personnel.
- Low cost of maintenance.
- 100% leakage proof is provided in butt welding method.
- Low cost of fittings produced with butt welding method.
- The method is simple and easy to use.



Pipe wall thickness (mm)	Bead height (mm)	Heating time (Sec)	Changing time (Sec)	Merning time (Sec)	Cooling time (Sec)
...... 4,5	0,5	45	5	5	6
4,5 7	1,0	45 70	5 6	5 6	6 10
7 12	1,5	70 120	6 8	6 8	10 16
12 19	2,0	120 190	8 10	8 11	16 24
19 26	2,5	190 260	10 12	11 14	24 32
26 37	3,0	260 370	12 16	14 19	32 45
37 50	3,5	370 500	16 20	19 25	45 60
50 70	4,0	500 700	20 25	25 35	60 80

Push fit method;

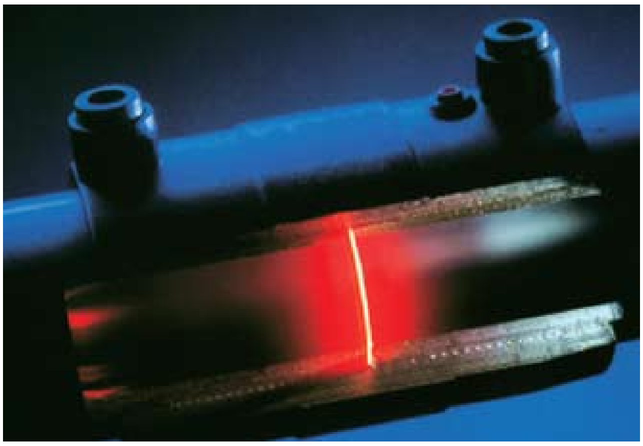
- Is the connection method for pipes with gaskets and provides easy and quick pipe assembly.
- As distinct from other methods, can be applied in all weather conditions.
- No need for electricity.
- Double gasket system.
- Does not require extra qualified personnel.

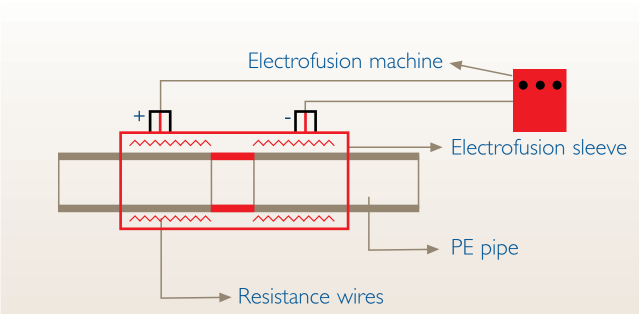


COUPLING

Electrofusion welding method;

- Electrofusion welding method is generally preferred for the pipe diameters smaller than 125mm.
- This method is applied by electrofusion fittings.
- No need for mechanical and hydraulic system as used in butt welding method.
- Is economic in connection of small diameter pipes.





For Gravity Polyethylene Pipes:
EBS, Corrugated HDPE pipes are manufactured either with couplings or without couplings. The EPDM rubber gasket fittings ensures the fast and easy mounting and provides 100% leakage proof. Welded electrofusion bands are used in connection of the MRP pipes.

CHEMICAL RESISTANCE

Chemical Resistance of HDE Pipes (20⁰C)

Chemicals	Resistance	Chemicals	Resistance
Sulphur Dioxide (dry gas)	x	Chloroform	x
Sodium Bicarbonate	x	Adipic Acid	x
Allyl Alcohol	x	Lead Acetate	x
Sodium Hydroxide	x	Aluminium Hydroxide	x
Ammonia, Dry gas	x	Methyl Alcohol	x
Water, Potable, Mineral (Metal)	x	Ammonium Chloride	x
Ammonia (hydrous)	x	Nitric Acid	x
Ammonia (liquid)	x	Oxygen,gas	x
Ferro (II) and (III) Chloride	x	Potassium Hydroxide	x
Ammonium Sulfate	x	Cyclohexanol	x
Formaldehyde	x	Sulphuric Acid	x
Acetic Acid	x	Vinegar	x
Acetic Acid (freezed)	x	Aniline	x
Copper (II) Sulphate	x	Sodium Carbonate	x
Benzene	x	Sodium Chloride	x
Gasoline (Fuel Oil)	x	Sodium Sulfate	x
Beer	x	Distilled Sea Water	x
Vegetable Oil	x	Acetone	x
Butane Gas	x	Hydrochloric Acid	x
Mercury	x	Milk	x
Ethanol	x	Wine	x
Ethinele Glycol	x	Toluen	x
Phenol	x	Trichloroethylene	x
Ure	x	Oil (Vegetable and Animal)	x
Glycerin	x	Calsium Carbonate	x
Air	x	Calcium chloride	x
Hydrogen	x		
Hydrogen Peroxide	x		
Urine	x		
Iodine (In Alcohol)	x		
Carbon Tecrachloride	x		
Carbon Dioxide (damp gas)	x		
Carbon Monoxide, Gas	x		
Chlorinated Water	x		
Chlorine (dry gas)	x		

x: Resistant

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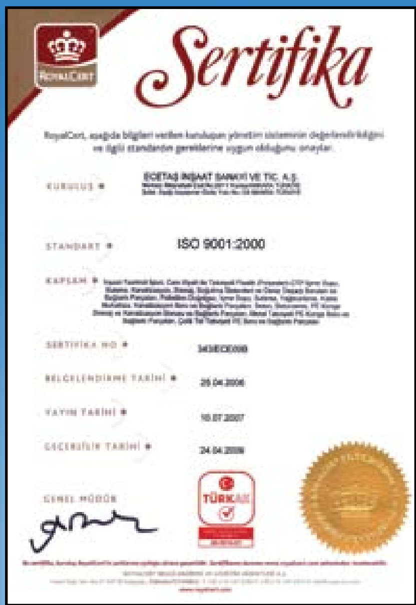

Sertifika

RoyalCert, aşağıda bilgileri verilen kuruluşun yönetim sisteminin değerlendirildiğini ve ilgili standardın gereklerine uygun olduğunu onaylar.

KURULUŞ: ECETAŞ İNŞAAT SANAYİ VE TİC. A.Ş.

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GENEL MÜDÜR

TSEK

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