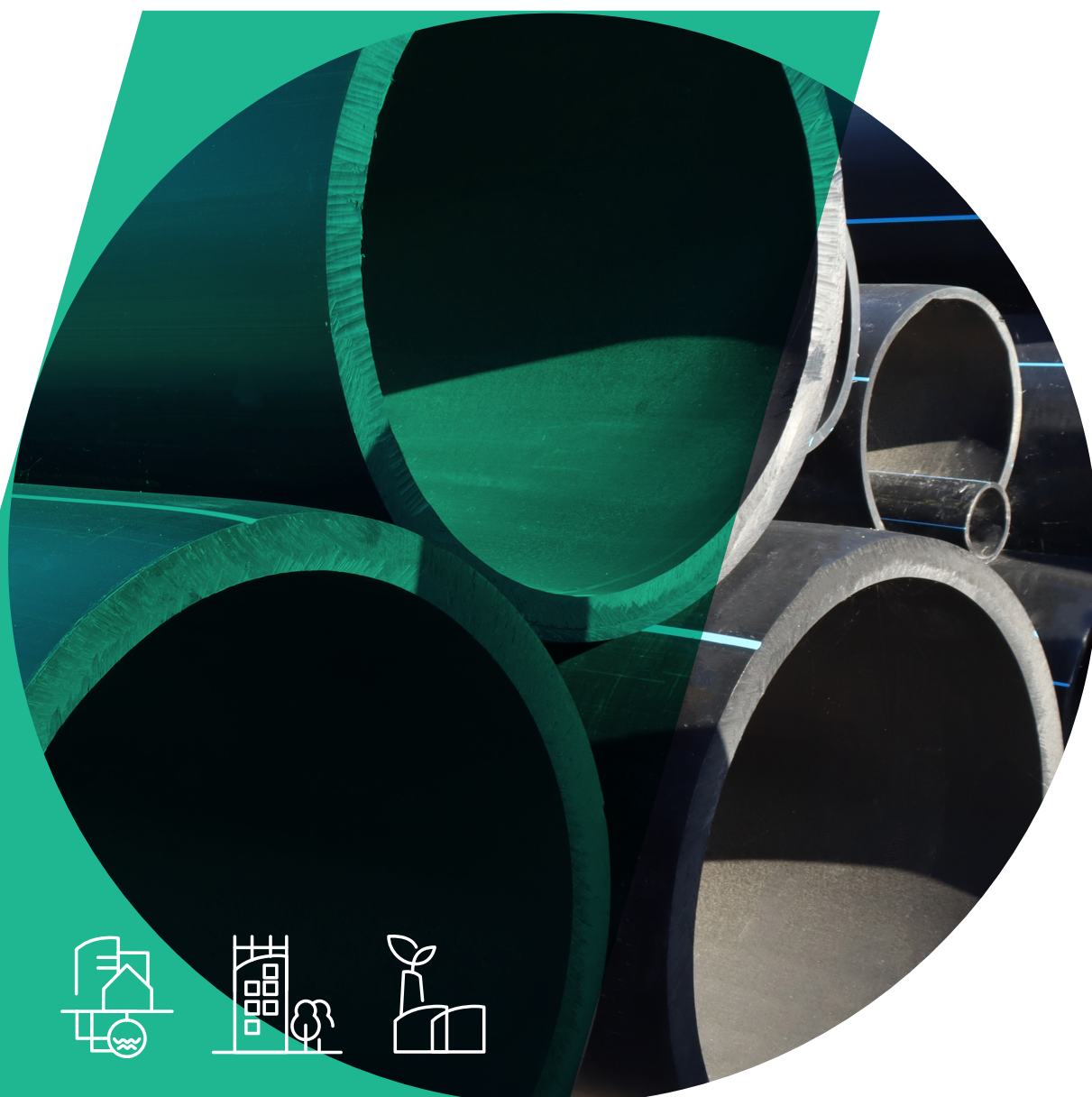


Solutions for a green future

POLIHIDRO
CD11R02



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The best thermoplastic solutions for infrastructure networks



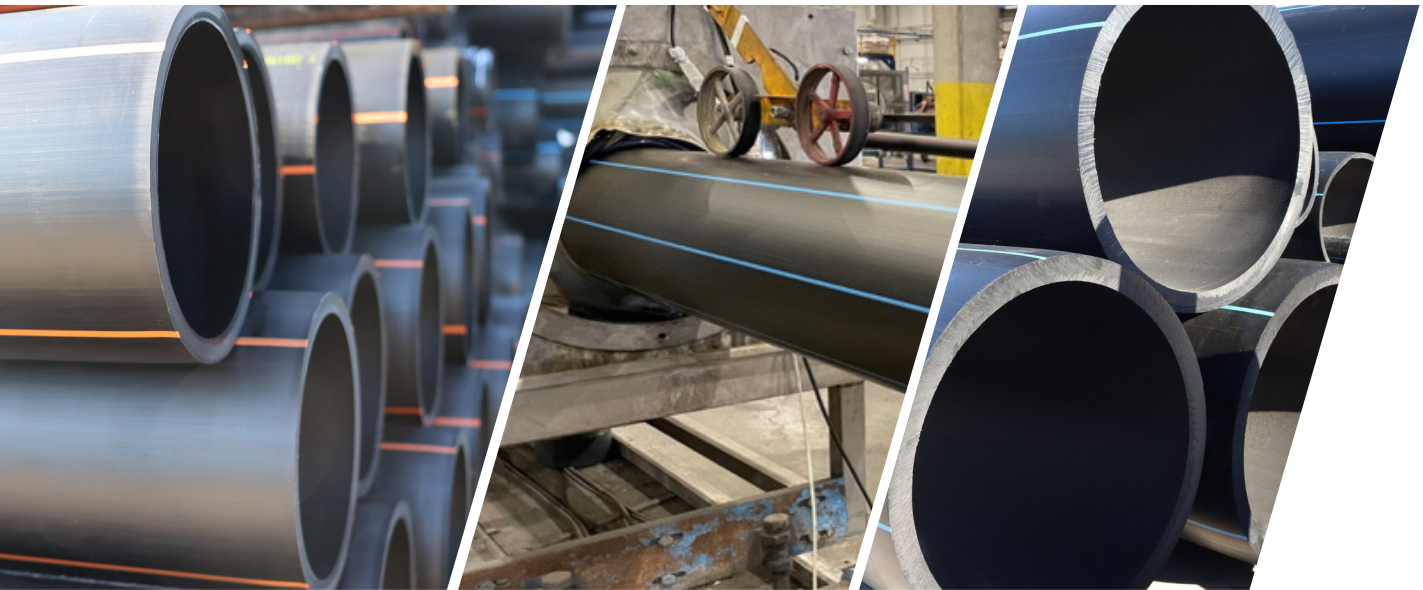
Politejo Group was founded in 1978, as an industry specialized in the manufacture of thermoplastic solutions and its main activity is the production of pipes and plastic accessories for the water supply, waste water, irrigation, electricity and telecommunications.

Our strategy is based on the constant innovation of products and services, with a skilled team, able to understand the needs associated with the various sectors and present highly reliable solutions, longevity that allow the conservation of water resources and the environment.

The success of Politejo Group is based on the profile of its employees, with a family-oriented management, due to the strategic location of its manufacturing units and their complete solutions.

This profile enabled a notable growth throughout the last 40 years, and currently Politejo Group is present in Angola, Brazil, Spain, Mozambique and Portugal, with a view to expanding to new locations.

POLIHIDRO



1. Manufacturing process

POLIHIDRO PE100 polyethylene pipes are manufactured using an extrusion process.

After raw material inspection, it is fed into the extruder through an automatic vacuum feeding system. The material is conveyed by a screw, while temperature and pressure increase, allowing the polymer to plastify.

Next, the material passes through a die that gives it the required diameter and wall thickness. It is then cooled in vacuum tanks, where the final dimensions of the pipe are calibrated.

2. Product typology

POLIHIDRO HDPE pipes are supplied in straight lengths and coils, and feature meter-by-meter marking, enabling thorough traceability control.

Type	Standard
Pipe	EN 12201-2 Plastic piping systems for water supply and for drainage and sewerage under pressure. Polyethylene (PE). Part 2: Pipes.

3. Quality and Environment

The different companies within the group hold management and product certifications.

To consult the respective valid certificates, please contact our sales department or visit our website: www.politejo.com



4. Product Marking and Certificates

POLIHIDRO PE100 polyethylene pipes are certified by AENOR and SGS and are manufactured in accordance with the following standards: EN 12201-2 Plastic pipes systems for water supply and for drainage and sewerage under pressure. Polyethylene (PE). Part 2: Pipes ISO 4427 Piping systems for water supply, and for drainage and sewerage under pressure. Polyethylene (PE). Part 1: General

Commercial Range	Brand	Certification	Marking
POLIHIDRO	AENOR	AENOR 001/XXX	AENOR 001/XXX POLITEJO POLIHIDRO HDPE PE100 DN ___ x ___ PN ___ bar SDR ___ UNE-EN 12201 (DATE CODE) (USE W or USE P) BATCH (BATCH CODE)
	SGS	SGS PT07/XXX	POLITEJO POLIHIDRO HDPE PE100 DN ___ x ___ PN ___ bar SDR ___ EN 12201 (USE W or USE P) (DATE CODE) SGS ICS PT 07/XXX BATCH (BATCH CODE)

Certified pipes can be produced with different types of ribs depending on the application for which they will be used:

Example of SGS pipe marking:

- Blue – Drinking water supply;



- Brown or without stripe – Other uses, sewage, sanitation, etc.;



- Purple – Reclaimed water;



There are also PE-100 pipes for other applications, with different stripe colors, always outside the above certifications. For example, it is common to manufacture PE-100 pipes with a red stripe for fire protection systems and high-voltage cable conduits.



To consult the respective valid certificates, please contact our commercial department or visit our website: www.politejo.com

5. Product characteristics and testing

POLIHIDRO HDPE pipes are manufactured in accordance with EN 12201-2.

The following characteristics stand out:

- **Durability:** service life up to 100 years;
- **Resistance:** resistant to most chemical agents, corrosion, and aggressive environments;
- **Flexibility:** their elasticity allows greater resistance to water hammer compared to other rigid materials;
- **Freeze-resistant:** the material has high insulating capacity, resisting the freezing of the fluid;
- **Standardized:** manufactured in accordance with UNE and ISO standards and certified for quality;
- **Non-toxicity:** odorless, non-toxic, and tasteless, making them ideal for conveying drinking water without altering its organoleptic properties;
- **Ease of installation:** adaptable to uneven terrain, easy to transport and handle, with a reduced number of joints over long distances;
- **Minimal head loss:** the inner surface of the pipe is smooth, reducing friction and the formation of deposits or scaling;
- **Recyclable.**

5.1. Raw material characteristics

Characteristic	Unit	Value
Density	g/cm ³	>0,95
Carbon black content	%	2,0 – 2,5
Carbon black dispersion		≤ Grau 3
OIT	min	>20 a 200 °C
Volatile matter content	mg/Kg	< 350
Water content	mg/Kg	< 300
Short-term modulus of elasticity	MPa	1000-1200
Long-term modulus of elasticity	MPa	200
Poisson's ratio		0,4
Thermal expansion coefficient	mm/m°C	0,22
Dielectric constant	Kcal/hm°C	0,37

5.2. Product tests

Test	Standard	Parameters
Appearance, colour, dimensional control and marking	EN 12201	In accordance with the standard
Elongation at break	ISO 6259	>350%. Speed depending on thickness
Melt Flow Index	EN ISO 1133	190°C, 5 kg. Raw material/pipe variation < 20%
Hydrostatic pressure at 20°C and 100 hours	EN 1167	No failure. Stress: 12.4 MPa
Hydrostatic pressure at 80°C and 165 hours	EN 1167	No failure. Stress: 5.4 MPa
Hydrostatic pressure at 80°C and 1000 hours	EN 1167	No failure. Stress: 5.0 MPa
Oxidation induction time	ISO 11357-6	≥ 20 min at 200°C

6. Product range

6.1. Polihidro pipe

DN	Diameter		Thickness								Ovality
	min.	max.	PN5 min.	PN6 min.	PN8 min.	PN10 min.	PN12,5 min.	PN16 min.	PN20 min.	PN25 min.	max.
32	32,0	32,3	-	-	-	2,0	2,4	3,0	3,6	4,4	1,3
40	40,0	40,4	-	-	2,0	2,4	3,0	3,7	4,5	5,5	1,4
50	50,0	50,4	-	2,0	2,4	3,0	3,7	4,6	5,6	6,9	1,4
63	63,0	63,4	-	2,5	3,0	3,8	4,7	5,8	7,1	8,6	1,5
75	75,0	75,5	-	2,9	3,6	4,5	5,6	6,8	8,4	10,3	1,6
90	90,0	90,6	-	3,5	4,3	5,4	6,7	8,2	10,1	12,3	1,8
110	110,0	110,7	-	4,2	5,3	6,6	8,1	10,0	12,3	15,1	2,2
125	125,0	125,8	-	4,8	6,0	7,4	9,2	11,4	14,0	17,1	2,5
140	140,0	140,9	-	5,4	6,7	8,3	10,3	12,7	15,7	19,2	2,8
160	160,0	161,0	-	6,2	7,7	9,5	11,8	14,6	17,9	21,9	3,2
180	180,0	181,1	-	6,9	8,6	10,7	13,3	16,4	20,1	24,6	3,6
200	200,0	201,2	-	7,7	9,6	11,9	14,7	18,2	22,4	27,4	4,0
225	225,0	226,4	-	8,6	10,8	13,4	16,6	20,5	25,2	30,8	4,5
250	250,0	251,5	-	9,6	11,9	14,8	18,4	22,7	27,9	34,2	5,0
280	280,0	281,7	-	10,7	13,4	16,6	20,6	25,4	31,3	38,3	9,8
315	315,0	316,9	9,7	12,1	15,0	18,7	23,2	28,6	35,2	43,1	11,1
355	355,0	357,2	10,9	13,6	16,9	21,1	26,1	32,2	39,7	48,5	12,5
400	400,0	402,4	12,3	15,3	19,1	23,7	29,4	36,3	44,7	54,7	14,0
450	450,0	452,7	13,8	17,2	21,5	26,7	33,1	40,9	50,3	61,5	15,6
500	500,0	503,0	15,3	19,1	23,9	29,7	36,8	45,4	55,8	-	17,5
560	560,0	563,4	17,2	21,4	26,7	33,2	41,2	50,8	62,5	-	19,6
630	630,0	633,8	19,3	24,1	30,0	37,4	46,3	57,2	70,3	-	22,1
710	710,0	716,4	21,8	27,2	33,9	42,1	52,2	64,5	79,3	-	-
800	800,0	807,2	24,5	30,6	38,1	47,4	58,8	72,6	89,3	-	-
900	900,0	908,1	27,6	34,4	42,9	53,3	66,1	81,7	-	-	-
1000	1000,0	1009,0	30,6	38,2	47,7	59,3	73,4	90,8	-	-	-
1200	1200,0	1210,8	36,7	45,9	57,2	71,1	88,2	-	-	-	-
1400	1400,0	1412,6	42,9	53,5	66,7	83,0	102,9	-	-	-	-
1600	1600,0	1614,4	49,0	61,2	76,2	94,9	117,5	-	-	-	-
1800	1800,0	1816,2	55,1	68,8	85,8	106,6	-	-	-	-	-
2000	2000,0	2018,0	61,2	76,4	95,3	118,4	-	-	-	-	-

Note: Not all products included in the previous tables are covered by current certificates. For more information, please contact the commercial department or visit our website: www.politejo.com

New PE100 resins

PE100 RC: its main property is preventing crack propagation, also offering greater resistance to point loads.

PE100 RD: developed to meet new technical requirements for water supply. The material has higher resistance to disinfectants used in the maintenance of supply networks, swimming pools, tanks, etc.

PE100 RT: developed for installations operating at temperatures above 40°C and below 90°C.

Please consult the commercial department for diameters and nominal pressures.

6.2. Accessories

Some of the most commonly used accessories are presented. In the following chapter, the joining systems between polyethylene pipes will be discussed, with reference to some of these accessories.



7. Jointing system

The choice of the jointing system depends on the characteristics of the project, pipe diameter, density, and the type of fluid to be conveyed. The most commonly used jointing systems are electrofusion welding, butt fusion welding, mechanical fittings, and flanged joints.

7.1. Electrofusion welding

Electrofusion welding with electrofusion fittings is carried out for PE80 and PE100 pipes and always with the same wall thickness. This system should not be used to join PE40 pipes or pipes with different wall thicknesses.

Electrofusion fittings contain a resistance element inside through which a low-voltage electric current passes via terminals located on the outer part, causing the material to heat up and resulting in the fusion of the pipe with the fitting.



To carry out this operation, appropriate equipment is required. Currently, the most modern machines incorporate data reading systems via barcodes or by contact with the terminals.

Electrofusion fittings must be installed with strict care and clean surfaces to prevent contamination. Likewise, pipe ovality must be within the limits established by the applicable standards.

This operation involves the following steps:

- 01. Cut the pipes perpendicularly and clean their surface;
- 02. Scrape the part of the pipe that will be inserted into the fitting;
- 03. Insert the ends of the pipes to be welded into the coupling, ensuring correct alignment and that both ends reach the bottom of the fitting;

- 04. Connect the cables to the coupling terminals and enter the fitting parameter code.
- Wait for the fusion time. These fittings include holes called welding indicators that show when fusion has been completed;
- 05. Allow the weld to cool according to the specified time.



01.

02.

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04.

05.

7.2. Butt fusion welding

This process is used for PE80 and PE100 pipes from DN90 and wall thicknesses greater than 3 mm.

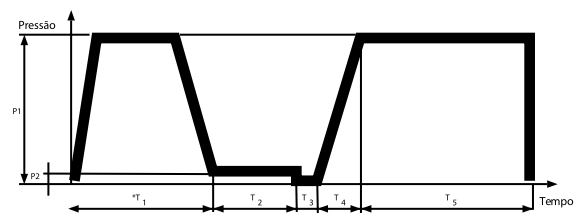
Butt fusion welding consists of heating the pipe ends with a heating plate and applying standardized pressure.

The butt fusion welding equipment must include the following elements: clamps, facing tool, and heating plate.

There are two types of butt fusion welding on site: fixed machine where the pipe moves, or fixed pipe where the machine moves along the pipeline. Naturally, each type of equipment differs depending on whether it is mobile or fixed.



Butt fusion welding parameters



Note: times and pressures are determined by the welding equipment manufacturer.

P1 is the hydraulic system pressure (pressure gauge in bar). (See welding machine table).

Pk is the predefined welding pressure: 1.5 bar.

P2 is the pressure during heating: $P2 = 0.2 \text{ bar} = 10\% \text{ of } P1$.

T1 is the time for the formation of the initial bead with height h.

T2 is the heating time in seconds.

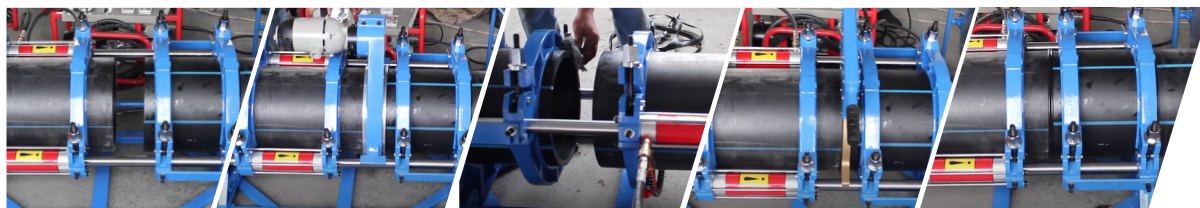
T3 is the time to remove the plate in seconds.

T4 is the time to reach the welding pressure in seconds, $T3 = T4 = 6 \text{ s}$.

T5 is the cooling time in seconds, $T5 = 1.2 \text{ s} \times \text{thickness (PE100)}$, $1.5 \text{ s} \times \text{thickness (PE80)}$.

The butt fusion welding process consists of the following steps:

- 01. Position and align the machine with the pipes (or fittings). Align the surfaces to be welded and remove burrs.
- 02. Align the pipes to confirm parallelism. Misalignment must not exceed 10% of the pipe wall thickness. Clean the faces of the heating plate.
- 03. Place the heating plate between the pipes to be welded and press the pipe ends against the plate until the initial weld bead is formed.
- 04. Remove the plate and join the pipes within time T3, progressively increasing the pressure to the required level during time T4 and maintaining it for time T5.
- 05. Finally, allow cooling without releasing the clamps.



01. 02. 03. 04. 05.

In addition to the above points, the weld must be inspected to verify that it has been correctly executed. Otherwise, the pipes must be cut and a new weld performed.

Appearance		Comment
	Rounded bead	Correct welding
	Bead too narrow and high	Excess pressure
	Small bead	Insufficient pressure
	Deep groove in the center of the bead	Insufficient temperature or long transition time
	Misalignment	Maximum misalignment exceeded
	Uneven bead size	Materials with different melting points

Fittings for butt fusion welding can be of two main types depending on their manufacturing process: injection-moulded fittings or fabricated fittings made from pipe segments.

Injection-moulded fittings can be joined by butt fusion welding or through electrofusion joints.



End cap



30° elbow



45° elbow



90° elbow



Reduction



Tee (three outlets)



Reducing tee



45° tee

Fabricated fittings made from pipe segments are manufactured in the factory by welding several segments of PE pipes.

7.3. Flanged joints

It is possible to join PE pipes using flanges. This system is used for connections with other materials such as steel.

This jointing system can be used for large diameters up to 2000 mm, requiring a stub end to be butt welded or electrofusion welded to the end of the PE pipe.



7.4. Mechanical compression fittings jointing

This system is recommended for joining low-density PE40 pipes in all diameters and for PE80 and PE100 pipes up to a diameter of 90 mm.

Mechanical compression systems or fittings consist of a component with several elements to allow fastening: nut, conical ring, compression rings, O-ring, and the fitting body, usually made of glass fibre reinforced polypropylene.



8. Field of application

The main applications are: drinking water conveyance; sanitation; drainage; reclaimed water; gas conveyance; irrigation; cable protection; solids transport; submarine outfalls; cooling of electrical lines; protection of heating pipelines; rehabilitation of existing pipelines; trenchless installation.

PE pipes for drinking water supply must comply with the requirements specified in EN 12201 Plastic piping systems for water supply and for drainage and sewerage under pressure. Polyethylene (PE).

- 01. Pressurized drinking water conveyance (black with blue stripes);
- 02. Pressurized sewerage networks (black or black with brown stripes);
- 03. Reclaimed water networks (black with purple stripes).



01.

02.

03.

9. Handling, transport and storage

During loading, transport, unloading and storage of the pipe, good practices and appropriate means must be used to ensure its structural integrity and prevent damage.

9.1. Handling

Loading and unloading operations must be carried out in such a way that the elements are not damaged, avoiding impacts between them or with the ground.

Unloading should be carried out close to the installation site and may be done manually or with equipment, avoiding dragging the pipes and impacts.

Defective pipes must be removed. Scratches not exceeding 10% of the wall thickness are acceptable. No special precautions are required at low temperatures.

9.2. Transport

Transport of pipes must be carried out in accordance with traffic regulations, as pipes may be up to 12 metres long.

Pipes are supplied in coils up to diameter 110 and in straight lengths of 6 and 12 metres for all diameters.

Loading, transport and unloading must be carried out in such a way that the pipes do not suffer any damage or deterioration during these operations.

Below are some recommendations:

- Pipes must be supported along their entire length. For this purpose, the vehicle must have a flat support surface without protrusions. Otherwise, elements should be placed to compensate for such protrusions.
- For loading, the use of wide straps is recommended, avoiding chains that may deform the pipes.
- Coils should be placed horizontally whenever dimensions allow, supported on a smooth surface and not stacked higher than 1.5 m.

- If transport includes pipes of different diameters, they should be stacked in descending order, placing the largest diameter pipes at the bottom.
- Pipes must not extend beyond the vehicle platform.
- Small diameter pipes should be transported on pallets.

9.3. Storage

Upon arrival on site, a reception inspection must be carried out, discarding any damaged material.

Storage must be in a covered area and on a flat surface, taking into account the following precautions:

- Black PE pipes can be stored both indoors and outdoors.

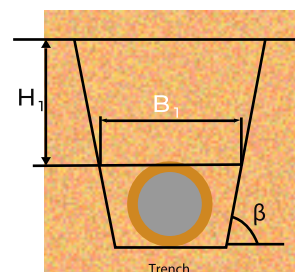
- For other colours (orange, yellow and blue), storage outdoors for more than six months or exposure to UV rays without protection should be avoided.
- Storage of coils must not exceed a height of 1.5 m.
- In all cases, contact with solvents, paints, adhesives, fuels or hot elements such as pipes must be avoided, ensuring that the external temperature does not exceed 50°C.



10. Installation instructions

This chapter presents some recommendations for the installation of POLIHIDRO pipes. Installation must follow good practices recommended by applicable standards.

Where ground conditions and auxiliary means allow, trench walls should be vertical. The recommended trench width is presented in the following table.



10.1. Installation of pipes in trench

The trench geometry is an important factor in determining installation costs and, whenever possible: OD – Outside diameter of the pipe in metres | β – Angle of the trench wall without shoring measured from the horizontal.

DN (mm)	Minimum trench height (OD + X), metres		
	Trench with shoring	Trench without shoring	
		$\beta > 60^\circ$	$\beta \leq 60^\circ$
≤ 225	OD + 0,40	OD + 0,40	
$> 225 \text{ a } \leq 350$	OD + 0,50	OD + 0,50	OD + 0,40
$> 350 \text{ a } \leq 700$	OD + 0,70	OD + 0,70	OD + 0,40
$> 700 \text{ a } \leq 1200$	OD + 0,85	OD + 0,85	OD + 0,40
> 700	OD + 1,0	OD + 1,0	OD + 0,40

The table below shows the recommended minimum values for depth according to installation conditions.

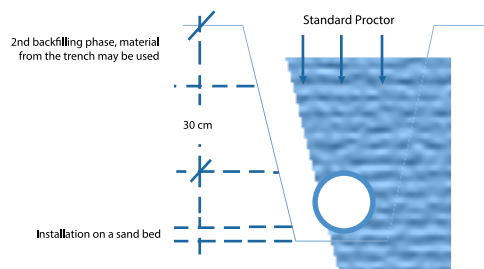
Installation	Depth above crown (mm)
Under road or with traffic	1,00
Under pavement or without traffic	0,80

Before placing the pipe in the trench on a previously prepared sand bed, it is necessary to ensure that there are no objects that could damage the pipe, such as stones or debris.

The trench backfilling should be carried out once the pipe has been placed and tested.



This must be done in successive layers of approximately 10 cm up to a height of 30 cm above the crown of the pipe, achieving 95% Standard Proctor compaction. The compaction process must be carried out evenly on both sides of the pipe to balance the pressure acting on it.



10.2. Above-ground installations

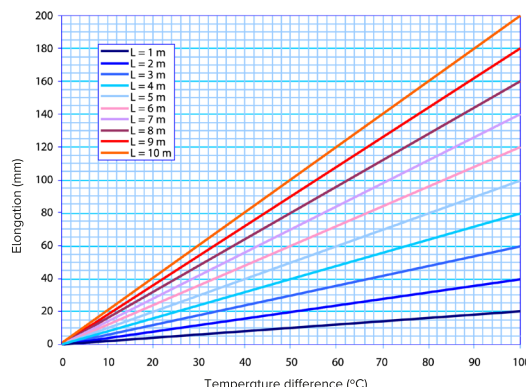
One of the main aspects to consider when carrying out an above-ground installation of PE pipes is the potential deterioration caused by exposure to outdoor conditions. For this reason, the composition of the pipes includes carbon black.

Special attention must also be given to possible thermal expansion that the pipeline may undergo due to temperature effects.

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

- ΔL – length variation, in mm
- α – linear thermal expansion coefficient, in mm/m °C (0.20 average value for PE)
- ΔT – temperature variation, in °C (from 20 °C)
- L – initial pipe length, in m

The following graph shows the values of polyethylene pipe length variation as a function of length and temperature difference.



To counteract the effect of expansion, it is necessary to install mechanisms capable of absorbing it, such as supports, clamps or expansion compensators in the case of straight sections, or to absorb expansion at changes in direction using fixed and sliding anchor points.

Pipes are fixed to supports by means of metal or plastic clamps.

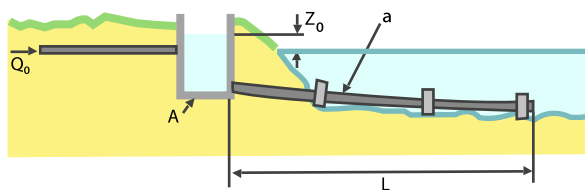
10.3. Submarine outfalls

A submarine outfall is a pipeline through which wastewater, previously treated in treatment plants, is pumped to a certain distance and depth from the coast.

PE pipes are commonly used for this type of construction due to the advantages they offer compared to other materials:

- Resistant to corrosion caused by seawater.
- High flexibility allows achieving certain curvatures, enabling controlled anchoring through progressive flooding of the pipeline.
- Ability to assemble long sections, reducing the number of joints to be executed on site.
- Low adhesion of marine organisms to their surface.

The outfall generally begins in a discharge chamber located in the coastal area, whose purpose is to prevent air from entering the pipeline. At the end of the submarine outfall, a perforated pipe section called a diffuser is installed, which facilitates water dispersion.



Since PE pipes float even when filled with water, it is necessary to sink them using concrete ballast weights that surround the pipe. To avoid direct contact between the weights and the pipe, and prevent damage, EPDM pads are placed between them.

The concrete must withstand the chemical aggressiveness of the water, and the steel used must have a minimum coating of 40 mm.

It is common to place the outfall in a trench on the seabed up to the area where waves no longer break on the bottom, protecting it with a breakwater.

In areas where the outfall is not placed in a trench, it must be protected with rock armour, mats or precast concrete elements, etc.

Special attention must be given to special components such as manholes and tees that form the diffuser section. To withstand anchoring forces, the pipeline in these areas must be reinforced to ensure its structural integrity.

The most common construction method consists of joining pipe sections on land and moving them by floating to the final location, submerging them in a controlled manner by flooding the pipeline. The joining of pipe sections can be carried out on working platforms located at the surface or on the seabed.

Special attention must be given to the phenomenon that occurs when large deformations are generated in the pipe due to compression. This happens when external pressure is greater than internal pressure. For this reason, the pressure inside the pipe must be continuously monitored.



11. Testing

11.1. Pressure test EN 805

Another method for performing the internal pressure test is detailed in Annex A.27 of EN 805 and is specific for PE pipes.

The test consists of the following stages:

- Preliminary or relaxation stage
- Pressure drop stage
- Main stage

Preliminary or relaxation stage:

This consists of slowly filling the pipe, leaving all air release mechanisms open. Precautions must be taken to start filling from the lowest point of the pipeline so that air is expelled from the highest point.

Once filled, it must be maintained for at least one hour. Afterwards, the pressure must be increased gradually over a period not exceeding 10 minutes until reaching the test pressure, maintaining it continuously for one and a half hours, pumping water when necessary.

Subsequently, it will remain for one and a half hours without pumping, and the remaining pressure will be measured at the end of this period.

Preliminary or relaxation stage:

This consists of slowly filling the pipe, leaving all air release mechanisms open. Precautions must be taken to start filling from the lowest point of the pipeline so that air is expelled from the highest point.

Once filled, it must be maintained for at least one hour. Afterwards, the pressure must be increased gradually over a period not exceeding 10 minutes until reaching the test pressure, maintaining it continuously for one and a half hours, pumping water when necessary.

Subsequently, it will remain for one and a half

12. Commissioning of the installation

Once the pipe installation has been completed and all tests have been carried out, and prior to putting the installation into service, cleaning and disinfection must be performed.

Cleaning can be carried out by sections or sectors by closing the isolation valves. The pipeline is generally filled from its lowest point at a low velocity.

After filling, the elements within the sector to be cleaned will be opened, such as drainage valves, air valves, hydrants, connection valves, etc.

As with cleaning, the disinfection of a network or pipeline must be carried out before it is put into service and before it is integrated into the entire water supply infrastructure.

Disinfection requires isolating and emptying the section of pipe to be treated. Therefore, if there are connections or other pipes, they must be closed beforehand.

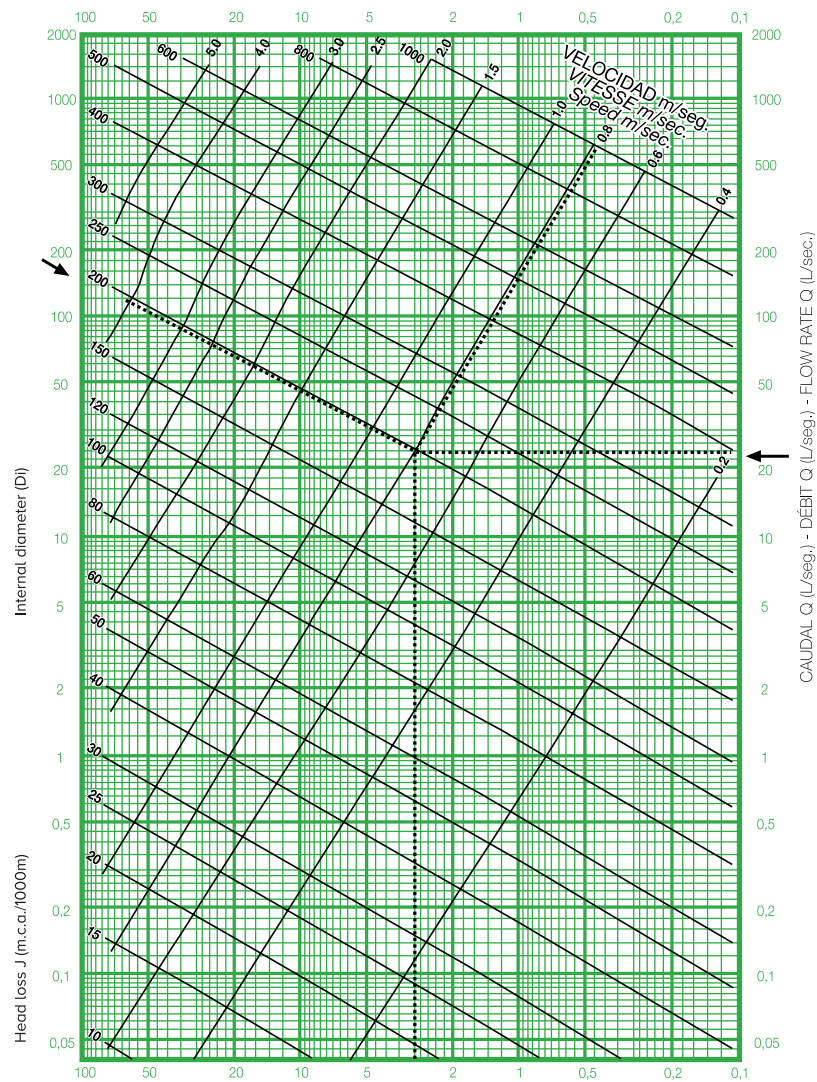
Disinfection will be carried out using a chlorine solution of 25 mg/l, prepared from commercial hypochlorite used for drinking water disinfection.

For this purpose, water will enter the pipeline to fill the section while simultaneously adding the necessary amount of commercial hypochlorite to reach a concentration of 25 mg/l.

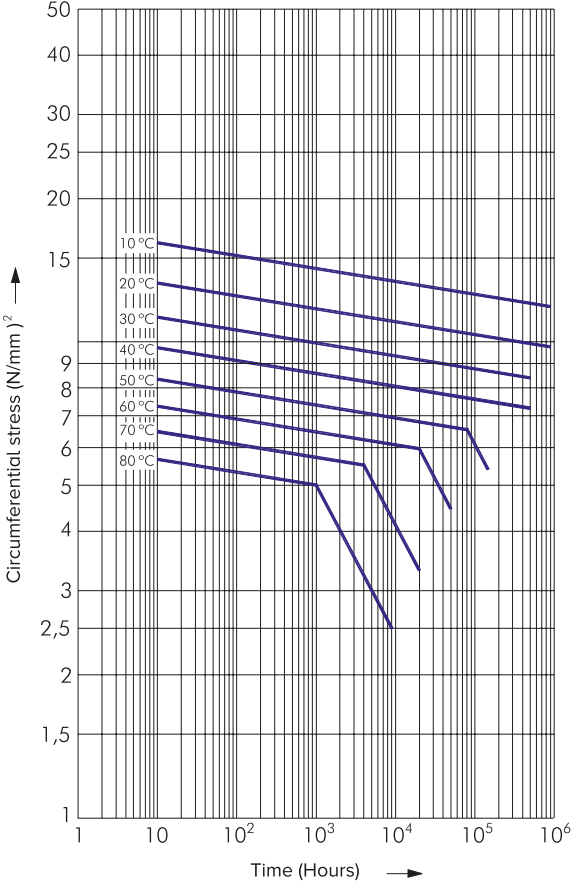
Once disinfection is completed, the pipeline will be put into service by filling it from the lowest point of the network, allowing air to escape through air valves or hydrants in the section, which will remain open until the network is fully filled.

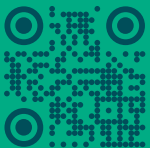
13. Colebrook abacus

The Colebrook abacus is presented, used for calculating head losses.



14. PE100 regression curve





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