PVC-O PIPES

ashirvad
by aliaxis

WATER DISTRIBUTION

dynaflo

SMART REPLACEMENT
FOR DI PIPES

Elevate Your Projects with **ashirvad** dynaflo!

As India's influence grows on the global stage, so does the need for infrastructure that stands strong amidst challenging conditions. A steadfast foundation is essential for our nation's progress, and at Ashirvad, we are committed to shaping the future with innovative solutions. Introducing **ashirvad** dynaflo from house of Ashirvad – a revolution water transimission piping systems designed to overcome the challenges with conventional system.

Engineered to Embrace Excellence

At Ashirvad, innovation and purpose drive our endeavors. With unwavering dedication to Provide quality products, we proudly present Ashirvad dynaflo, an PVC-O pipe that redefines performance standards. This cutting edge solution overcomes challenges with conventional systems and provides better solution in terms of flow rate, ease of installtion, easy product handling (to name a few) aiming towards sustainable solution for water transmission

IS 16647

CM/L-6200192915

The Science behind **ashirvad** dynaflo's Triumph

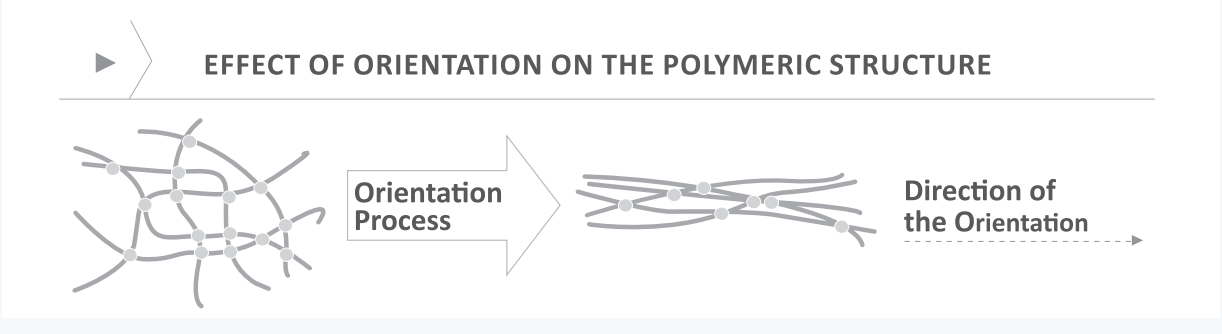
Molecular orientation

Physical process that modifies molecular structure

Dynaflo PVC-O pipes are the most advanced pipes for the conveyance of high-pressure water currently available on the market, with a number of exceptional features for similar application, thanks to the process of Molecular Orientation.

PVC is essentially an amorphous polymer in which the molecules are located randomly. However, under certain conditions of pressure, temperature and speed, by stretching the material, it is possible to orient the polymer molecules in the same direction as which the material has been stretched.

Depending on the process parameters used and mostly stretch ratio, a higher or lower orientation degree will be obtained. The result is a plastic with a layered structure in which layers can be seen at a glance.

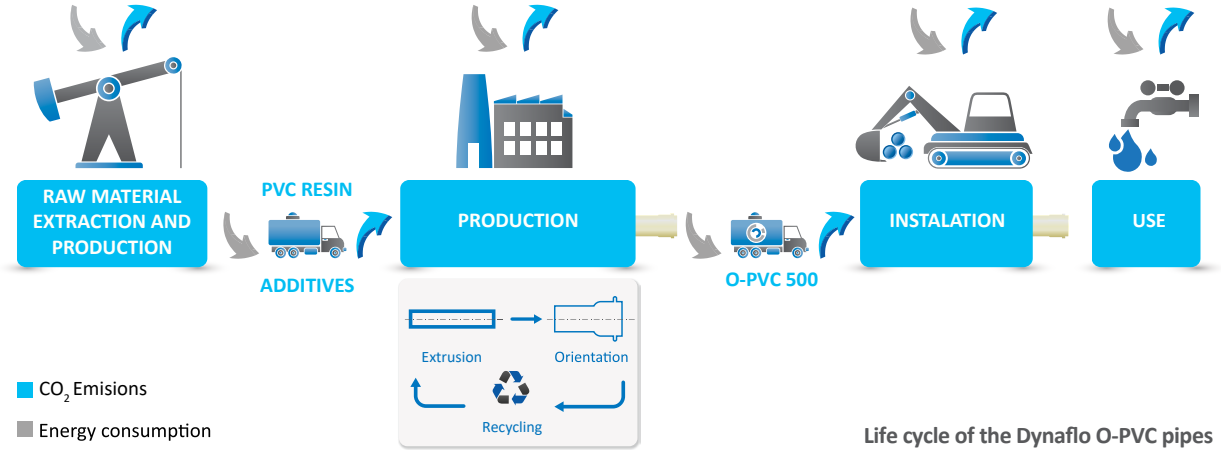


The Molecular Orientation process modifies the PVC's structure by giving the polymer's molecules a linear orientation.

The most eco-friendly pipes with the environment

The environmental impact of a piping system depends on its composition and application thereof, being the type of raw material used, the production process, the finished product and the pipe's life expectancy, the main factors that determine the efficiency and sustainability throughout their life cycle.

Dynaflo PVC-O is the most environmentally friendly solution existing on the market, due to its best contribution to the correct sustainable development of the planet, as it has been demonstrated by different studies worldwide, since they present **environmental benefits at all stages of their life cycle**; thus resulting in **the most efficient from the energy point of view**.



Life cycle of the Dynaflo O-PVC pipes

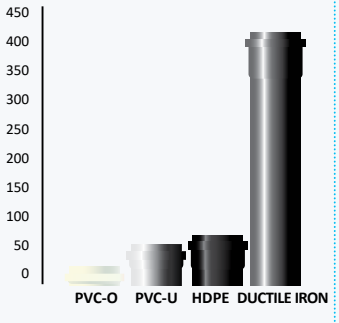
Resources efficiency

- The exceptional mechanical properties of these pipes allow **considerable savings in raw materials**. For the same external nominal diameter, Dynaflo requires less PVC.
- Only 43% of the PVC composition depends on oil. Therefore, the required consumption of this resource is lower than in other plastic solutions.
- **Energy consumption is lower in all phases of the life cycle**: raw material extraction, pipe manufacturing and use.

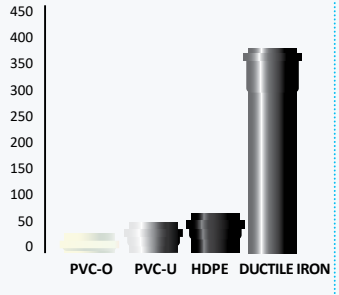
Throughout its lifetime, Dynaflo prevents unnecessary consumption of energy resources and **reduces CO_2 emissions into the atmosphere**.

Optimal use of water resources

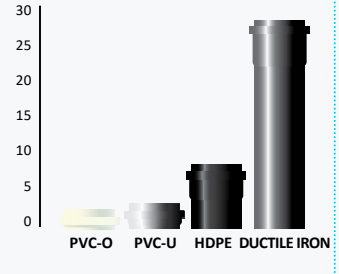
Energy consumed by pipes (raw materials + manufacture) (kWh)



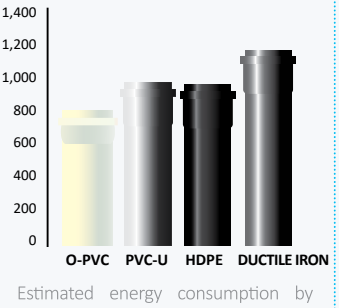
Energy consumed by raw materials (kWh)



Energy consumed in manufacturing (kWh)



Energy consumed by pumping (kWh)



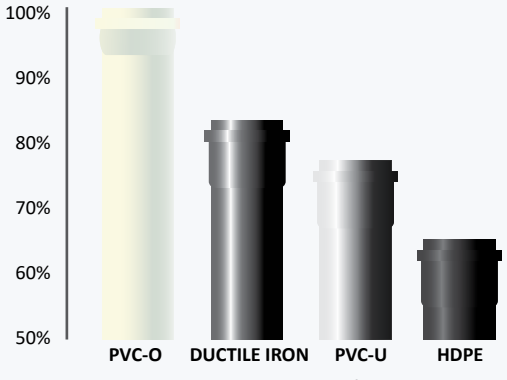
Estimated energy consumption by PVC-O, PVC-U, HDPE and Ductile Iron piping production and use. Polytechnic University of Catalonia, Spain, December 2005.

Thanks to their **long useful life and optimum water-tightness**, Dynaflo pipes are the best ally for the rational use of water resources.

Water supply networks installed with traditional materials are currently registering a **leakage rate of up to 25% of channeled water** and, the latter's chemical deterioration means that some water conduits are currently being replaced despite having been laid only a few years ago.

Water pipes must not only be resistant to pressure, must also carry the maximum amount of water **consuming the least quantity of energy**. The extreme smoothness of the inner wall of the Dynaflo pipe minimizes pressure loss, so the energy required for transport is lower.

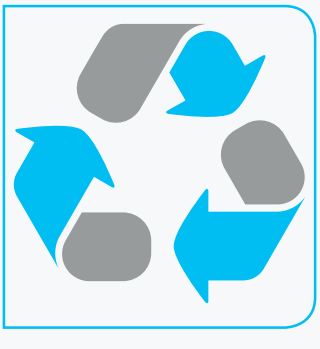
Hydraulic capacity



For a 1m DN250 mm PN16 bar

The infrastructures created with PVC-O pipes are **an excellent tool for managing water resources for generations**.

Waste Management Efficiency



Dynaflo is a **100% recyclable material.** Molecor, as part of the value chain of the plastics industry, shows its commitment to the environment by offering to the market products with a lower environmental impact, and incorporating the principles of the circular economy into their manufacturing.

Why **ashirvad** dynaflo Stands Out:

Molecular Mastery for Superior Strength

Dynaflo's secret lies in Molecular Orientation. By aligning polymer molecules under precise conditions, we've created a pipe that's unmatched in strength and resilience. It's a plastic with a layered structure, forged to withstand the harshest pressures and conditions, while maintaining its original properties.

Exceptional Properties, Endless Possibilities

Unmatched Durability:
Ashirvad dynaflo's Molecular Orientation enhances its physical properties, from flexibility to impact resistance. In high-pressure water pipelines, its robustness shines, offering unparalleled longevity.

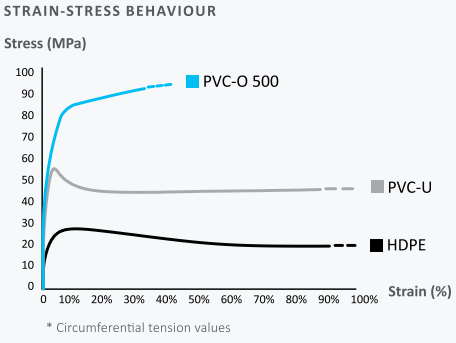
Tailored for Indian Climates:
Crafted to conquer India's diverse weather conditions, Ashirvad dynaflo remains unwavering against heat, ensuring sustained performance in every setting.

Eco-Friendly & Energy Efficient:
Beyond durability, Ashirvad dynaflo's eco-friendly construction and energy efficiency make it a responsible choice for a sustainable tomorrow.

The best mechanical properties

Tensile resistance

Ashirvad dynaflo stress strain curve changes significantly compared to conventional plastics behaviors, coming very close to the metal ones. Mechanical properties complete transformation of PVC-O compared to conventional PVC can only be achieved in the higher-class 500, such as Ashirvad dynaflo pipes.

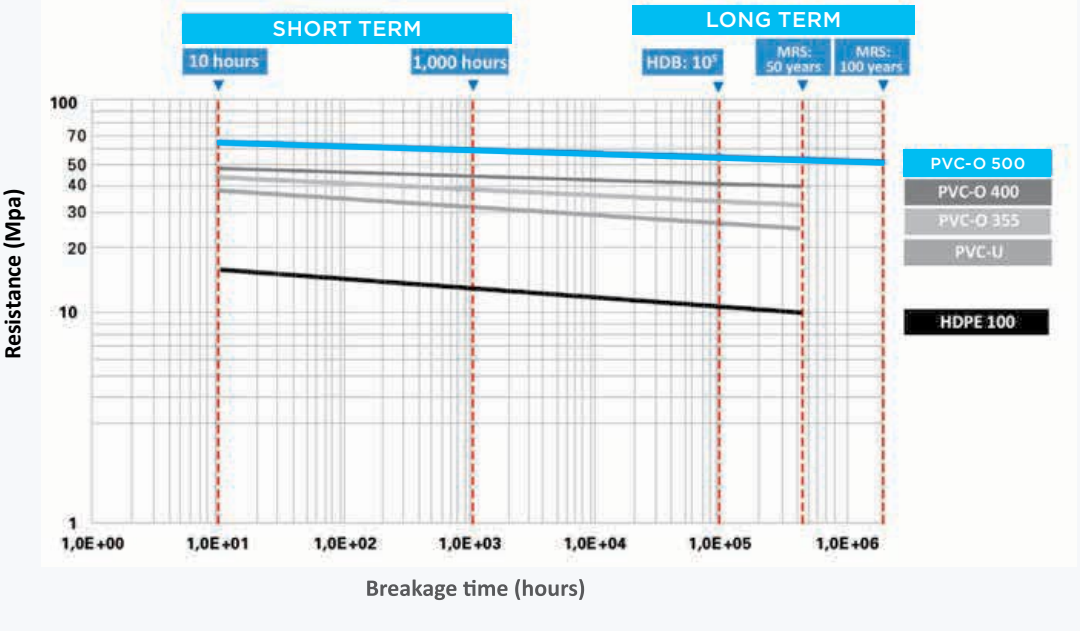


Long-term hydrostatic resistance

Materials lose their mechanical properties when subjected to strain for a long period of time. This characteristic, known as creep, appears to a far lesser extent in PVC-O 500 than in conventional plastics, which means better properties over the long term. Bearing in mind that PVC-O is exceptionally resistant to fatigue and has a very good chemical resistance, in common with conventional PVC.

Ashirvad dynaflo pipe maintains the characteristics of a class 500 pipe over 100 years as indicated by long-term tests (10,000 hours) carried out by an independent accredited laboratory to pipe according to the ISO 9080: 2013 and UNE – EN 1167: 2006 Part 1 and 2 standards. This means that the pipe can withstand its nominal pressure beyond 100 years, as long as there are no alterations in the operation of the installation. Ashirvad Dynaflo pipe has a useful life of more than 100 years.

Stress Regression Line



Piping and material mechanical properties

The following table summarizes the technical characteristics of Dynaflo PVC-O pipes in comparison with other plastic pipes.

		PVC-O 500	PVC	HDPE-100	HDPE-80
Product Standard	**Units**	**IS 16647 UNE-EN 17176**	**UNE-EN 1452**	**UNE-EN 12201**	**UNE-EN 12201**
Minimum required strength (MRS)	MPa	50.0	25.0	10.0	8.0
Overal service coefficient (C)	-	1.4	2.0	1.25	1.25
Design stress (σ)	MPa	36.0	12.5	8.0	6.3
Short term elasticity modulus (E)	MPa	4,000	>3,000	1,100	900
Resistance to uniaxial traction	MPa	≥48	≥45	19	19
Resistance to hoop traction	MPa	>85	≥45	19	19
Shore hardness D at 20 °C	-	81 - 85	70 - 85	60	65

(1) For pipes with a DN ≥110.

Other material characteristic

The table below shows other, non-mechanical characteristics of Dynaflo PVC-O 500.

Characteristic	Units	Value
Density	g/cc	1.40 - 1.46
PVC Resin K value	-	>64
Poisson coefficient	-	0.4
Vicat temperature	°C	>80
Lineal expansion coefficient	$°C^{-1}$	$7 \cdot 10^{-5}$
Thermal conductivity	Kcal/mh°C	0.14 - 0.18
Specific heat at 20 °C	cal/g°C	0.20 - 0.28
Dielectric stiffness	kV/mm	20 - 40
Dielectric constant at 60 Hz	-	3.2 - 3.6
Transverse resistivity at 20 °C	Ω/cm	$>10^{16}$
Absolute roughness (ka)	mm	0.007
Absolute roughness (Hazen Williams)	-	150
Manning roughness coefficient (n)	-	0.009

Characteristics of the water-tight joint

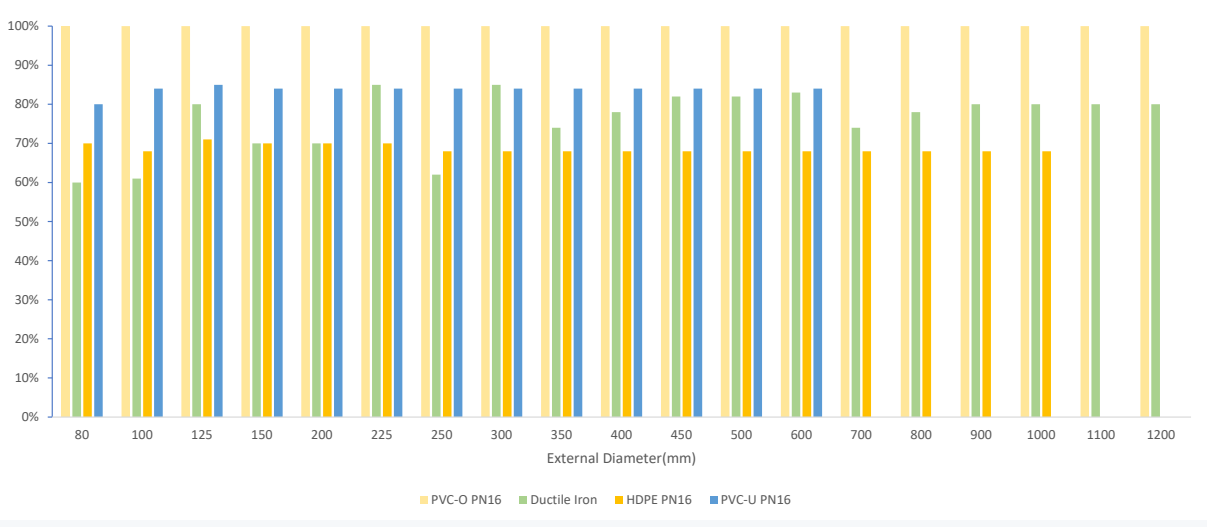
Characteristic	Units	Value
Elastomer hardness	IRHD	60 ±5

Unbeatable Hydraulic Properties

Hydraulic capacity

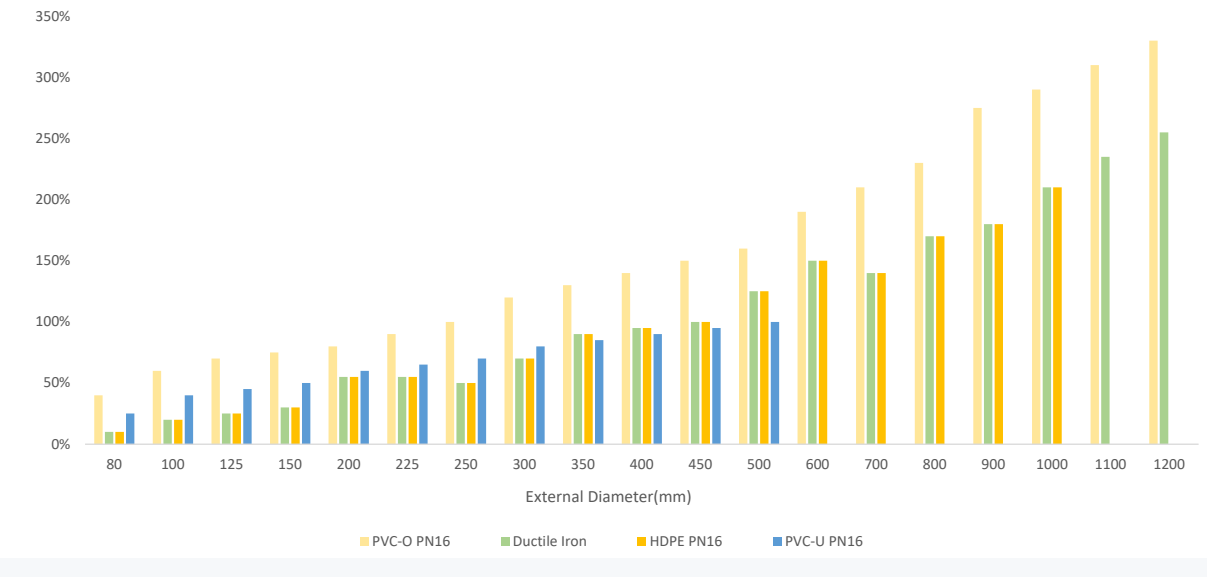
Water pipes requirements are not only related to pressure resistance; they also have to transport the highest amount of water while consuming the least energy. Ashirvad dynaflo pipes walls are thinner than conventional plastic ones and are on their inside smoother than metals, which means that a greater hydraulic capacity is attained.

Comparison of hydraulic capacity: Dynaflo PVC-O PN16 pipes vs other materials (constant load loss)



Using pipes with a lower hydraulic capacity involves necessarily using a larger nominal diameter, which has a negative effect on both profitability and infrastructure investment costs. **Using Dynaflo means you get more hydraulic capacity fom your investment costs.**

Hydraulic capacity/Piping costs compared to Dynaflo PVC-O PN16



Water Hammer

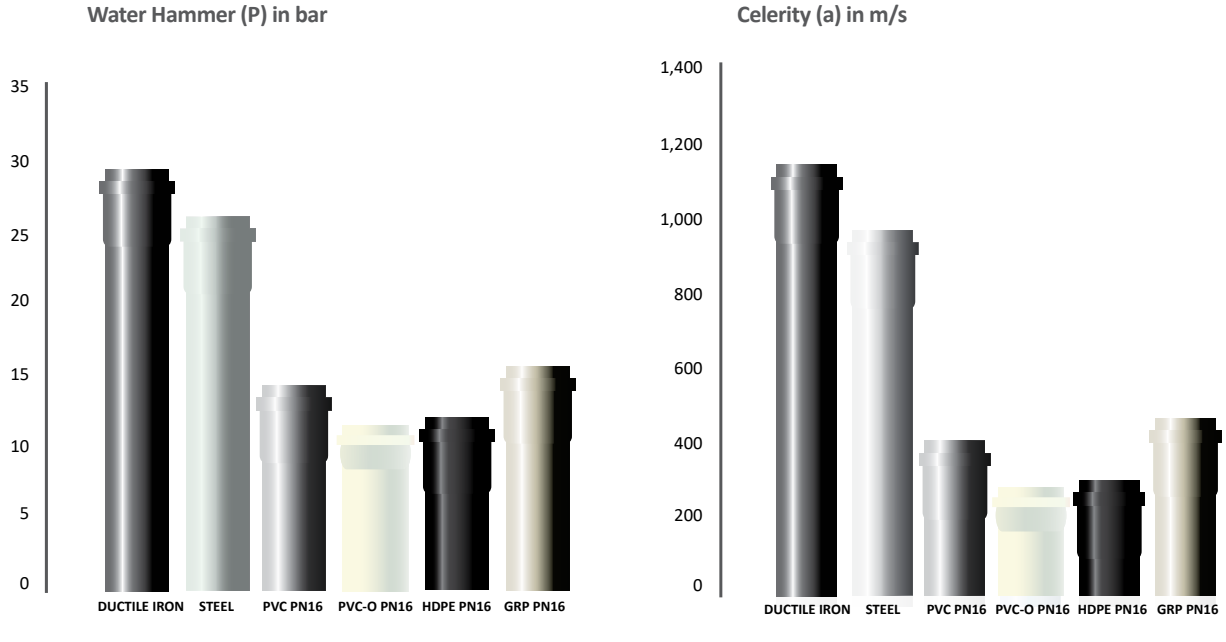
Water hammers occur when liquid flowing through piping stops suddenly when a valve is opened or closed, if a pump is stopped or started or by airlocks shifting within the pipe. Water hammers can result in an higher overpressure than the pipe´s working pressure and lead it to breakage, specially when the pipe has already been damaged by impacts or corrosion.

Water hammers (P) depend on the celerity (a), which is the wave speed, and the fluid's change of speed (V). The celerity depends basically on the pipe's dimensions (the relationship between the external diameter and the minimum thickness) and the specifications of the material with which the tube is made (Young's modulus, E).

$$\mathbf{P} = \frac{a \cdot V}{g} \quad ; \quad \mathbf{a} = \frac{9900}{\sqrt{48.3 + K_c \cdot \frac{D_m}{e}}} \quad ; \quad \mathbf{K_c} = \frac{10^{10}}{E}$$

a: acceleration (wave propagation speed), in m/s Dm: average pipe diameter, in mm e: pipe thickness, in mm Kc : function coefficient of the modulus of elasticity (E) of the material of the pipe expressed in KN/m² E: modulus of elasticity, in KN/m² for the Dynaflo PVC-O pipe: 4 x 10^6 KN/m²

Dynaflo pipes have a significantly lower celerity than pipes made from other materials, particularly so with metal piping. It is particularly significant the difference with pipes made of metal materials, in which the water hammers effects can be very high.



Overpressure produced by sudden pipe shut down with water flowing at 2.5 m/s.

A range for all kinds of applications

Ashirvad dynaflo offers a broad range of piping covering all medium- and high-pressure needs

Applicable Laws and Standards

Ashirvad dynaflo PVC-O pipes are manufactured in accordance with IS 16647:2017 standard, applied to "Plastic piping systems for water supply and for buried and above ground drainage, sewerage and irrigation under pressure- Oriented unplasticized poly(vinyl chloride) (PVC-O). Part 1: General, Part 2: Pipes and Part 5: Fitness for purpose of the system" (based on European Standard EN 17176) and also according to the International Standard ISO 16422:2014, applied to "Pipes and joints made of oriented unplasticized poly(vinyl chloride) (PVC-O) for the conveyance of water under pressure".

Other international standards applicable to PVC-O are as follows. Molecor© could manufacture pipes according to these standards under request.

- India:
  IS 16647:2017 "Oriented Unplasticized Polyvinyl Chloride (PVC-O) Pipes for Water Supply – Specification" (states which have already approved use of PVC-O like Chattisgarh, Maharastra, MP, Assam, Karnataka, Kerala, Tamil Nadu, Rajasthan)

- USA:
  ASTM F1483-17 "Standard Specification for Oriented Poly(Vinyl Chloride), PVC-O, Pressure Pipe"; and ANSI/AWWA C909-16 "Molecularly Oriented Polyvinyl Chloride (PVC-O) Pressure Pipe".

- Australia:
  AS/NZS 4441:2017 "Oriented PVC (PVC-O) pipes for pressure applications".

- Canada:
  CAN/CSA-B137.3.1-13 "Molecularly oriented polyvinylchloride (PVC-O) pipe for pressure applications".

- Russia:
  GOST R 56927-2016 "Pipes made of oriented unplasticized polyvinyl chloride for water supply".

Material classifications

IS 16647:2017 and UNE-EN 17176-2:2019 standards cover several types of PVC-O material, classified according to their MRS (Minimum Required Strength), because Molecular Orientation can be achieved to a greater or lesser extent through different manufacturing processes. Dynaflo PVC-O pipe is manufactured only in the highest class (PVC-O 500), which offers the highest degree of orientation and thus ensures the best mechanical performance. Subsequently, Dynaflo pipes present higher advantages compared to other materials.

	PVC-O 500 Pipe			
	PN12.5	PN16	PN20	PN25
Material class	500	500	500	500
MRS (Mpa)	50.0	50.0	50.0	50.0
Nominal pressure (bar)	12.5	16.0	20.0	25.0
Test pressure over 50 years (bar) (1)	17.5	22.4	28.0	35.0
Test pressure over 10 hours (bar) (1)	23.1	28.9	36.7	48.1
Maximum trial pressure onsite (bar) (2)	17.5	21.0	25.0	30.0
Circumferential stiffness (kN/m²) (3)	5.7	7.0	11	20
Colour (4)	Shade of Cream/Blue	Shade of Cream/Blue	Shade of Cream/Blue	Shade of Cream/Blue

(1) With a temperature of 27° C.
(2) According to EN 805:2000 standard with estimated water hammer.
(3) Average stiffness per pipe according to established tolerances.
(4) Available in Shade of Cream. For other colours, please contact us.

Dimensions

Dynaflo PVC-O 500 Pipe										
Nominal Pressure (bar)	PN12.5		PN16		PN20		PN25			
Nominal Diameter (DN)	Outside Diameter (OD)		Inside Diameter (ID)	Wall Thickness C1.4 (e)	Inside Diameter (ID)	Wall Thickness C1.4 (e)	Inside Diameter (ID)	Wall Thickness C1.4 (e)	Inside Diameter (ID)	Wall Thickness C1.4 (e)
	min.	max.	average	min.	average	min.	average	min.	average	min.
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
110	110.0	110.4	105.8	2.0	104.5	2.6	103.2	3.2	101.6	4.0
160	160.0	160.5	154.0	2.9	152.3	3.7	150.4	4.6	147.9	5.8
200	200.0	200.6	192.5	3.6	190.4	4.6	188.1	5.7	184.9	7.2
250	250.0	250.8	240.7	4.5	238.0	5.8	235.0	7.2	231.3	9.0
315	315.0	316.0	303.3	5.7	300.1	7.2	296.4	9.0	291.3	11.4
400	400.0	401.2	385.2	7.2	381.0	9.2	376.4	11.4	370.1	14.4

Dynaflo PVC-O pipes are supplied in total length of 6.0 metres (including the length limit mark for the socket).
The inside diameters may be subjected to variation according to manufacturing tolerances as per IS 16647:2017

Joints and Watertight Seals

The connection is done by introducing the male part of the pipe in the socket of the other where the elastic joint is placed. The watetight seal includes a Polypropylene ring and a synthetic rubber lip which allows the seal to be integrated with the pipe, avoiding joint displacement or movement while the installation is taking place.

Nominal Diameter (DN)	Socket Length (SL)	Maximum Diameter (D max)	Length limit mark for the assembly of the pipes (1)			
			PN12.5	PN16	PN20	PN25
mm	mm	mm	mm	mm	mm	mm
110	180	140	163	163	163	163
160	200	197	178	178	178	178
200	225	243	198	198	198	198
250	250	301	222	222	222	222
315	290	374	245	245	245	245
400	325	472	282	282	282	282

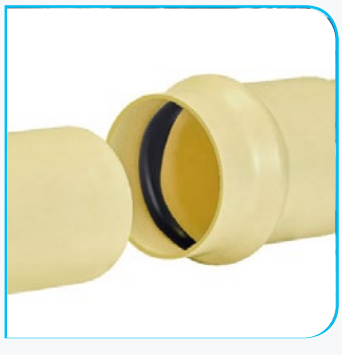
(1) Dynaflo PVC-O pipes have a mark in the spigot, being the limit mark to which the male end of the pipe should be introduced during installation and thus assure water-tightness.

The length limit mark for the assembly of the pipes is the distance from the beveled end of the pipe to the printed cutting mark.

Assembly

In order to do the assembly is necessary to apply lubricant on the chamfer of the spigot end and in the rubber ring joint, and push by hand until the mark of the spigot end is no longer seen.

Apply lubricant on the chamfer of the spigot end and in the rubber ring joint.



Align the pipe and place the spigot end inside the socket or bell.

Firmly push the free end into the other pipe. Introduce until the end marked is no longer seen.

Handling & Storage

Transportation

- While transporting different diameters, the biggest diameters must be placed below.
- Leave the socket ends free by placing alternating sockets and free ends.

Storage

- Do not drop or throw the pipes on hard or sharp surfaces, this will cause defects or deep scratches.
- If deep scratches to a depth of more than 10% of pipe is found, it should be rejected from pressure applications.
- Store the pipes horizontally on a flat surface with proper spacing and with supports at every 1.5m to avoid bowing.
- Pipes should be stacked in layers with alternate socket and free end one over the other so that the socket is not carrying any load.
- The pipes should not be stacked above a height of 1.5m as it will bring more load on the pipe which will cause sagging.
- To prevent overheating and bowing when stored under direct sunlight, the pipes should be covered with light colored opaque material that can radiate solar radiation and proper ventilation should also be provided.

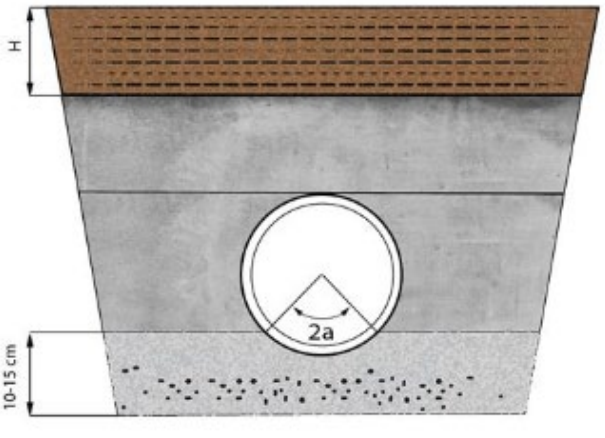
Trenching & Backfilling

- Trenching should be straight and as narrow as practicable, and dimensions of the trench depends on the load to which the pipes will be subjected.
- The crown of the pipe should be at a minimum depth of 0.6 meters where there is no road traffic and at a minimum depth of 1 meter where there is road traffic.
- Ensure that the bottom of the trench has a uniform support or a sand filling along the entire pipe length.
- Clearance holes should be excavated in the bedding for pipe sockets so that the pipeline is supported evenly along the whole length.
- Once the pipe is placed fill the trench with selected material or the same material obtained from excavation and should be compacted properly. It should be ensured that the backfilling material does not have large stones or any soil clods. The pipe should not be buried in contact with soil particles sizes larger than 5% of its diameter.
- The quality of the embedment material along with its density of native soil and the compaction done will ultimately influence the performance of the pipeline.
- Should make sure that temporary supports like bricks or timber under or in contact with the pipe should be removed before doing backfilling.
- If the joints are left uncovered for testing leakage, make sure that the backfilling should be done at least to a height of one and half diameter above the pipe so that the pipe doesn't float in event like rain.
- The minimum width of the trench can be calculated using the following table.

DN (mm)	Minimum with of trench B (m)
110-250	0.60
315	0.85
355	1.00
400	1.10

Depth of trench H (m)	Minimum with of trench B (m)
H < 1.00	0.60
1.00 < H < 1.75	0.80
1.75 < H < 4.00	0.90
H > 4.00	1.00

Trench dimensions



Instruction For Making Joints

- If needed the pipe can be cut to length using a hand saw or powered cutting disc. The end shall be chamfered and 25% of the wall thickness should be removed at an angle of 10 to 15 degree using an approximate field-lathing tool.
- To match the socket depth, a new insert length marking should be made on the spigot end.
- Clean the spigot and socket ends and make sure that the Elastomeric sealing is not damaged or misaligned, if any defects are found it should be replaced.
- Apply lubricant to the spigot end completely covering up to insert length marking.
- Make sure that the pipes are aligned in a straight line before inserting the spigot end into the socket.
- Apply a small longitudinal force and smoothly insert the spigot end into the socket mouth till the insert marking reaches the socket end.
- Ensure that the pipe is not under-inserted because this may result in leakage at joints as the pipes may contract due to thermal effects.
- The insertion of the pipe should not be done with the usage of uncontrolled mechanical forces like using a hammer or a backhoe.

Field Testing

- The test should be carried out on completely laid pipeline length. For this the end of each pipeline is sealed off and filled with water.
- Before testing it is important to ensure that proper backfilling and solid basement is done with the trenches.
- The maximum allowed test pressure will be 1.5 times the maximum design pressure.
- To visually check leakage, the mechanical joints and flanged connections should remain exposed.
- Points where the joints are exposed, some movement of the inserting length marking from the socket may happen. This can be neglected as it happens due to shortening of pipe under circumferential working stress.
- If there is no pressure drop or if no make-up water is required after the inspection time, then the pipe is considered to pass the field test.

Experience the ashirvad dynaflo Difference

Ashirvad dynaflo redefines the possibilities of piping systems, offering:

Impact Resistance:
Fewer breakages during installation, ensuring a longer lifespan.

Hydraulic Capacity:
15% - 40% more flow capacity than pipes of other materials.

Corrosion Resistance:
Immune to corrosion, no need for added coatings or protections.

Ease of Installation:
Lightweight, easy handling, and quicker installation compared to traditional pipes.

Unaltered Water Quality:
Ensures the fluid within remains untainted, adhering to the highest water quality standards.

Technical SPECS

- Material class: 500
- MRS value: 50MPa.
- Safety Coefficient: 1.4
- Design stress Mpa: 36
- Ring stiffness for PN 16>7, PN 25 >20KN/m^2.
- Short term young modulus >4000 MPa.
- Axial tensile > 48MPa
- Circumferential tensile >85MPa.
- Hazen Williums C value: 150
- Manning coefficient (n): 0.009
- Absolute coefficient (ka): 0.007.
- Poisson coefficient: 0.35-0.41.
- Density: 1.40 - 1.46 g/cc.
- PVC Resin: K>64.
- Shore hardness D at 20deg C: 81-85.
- Vicat softening: >80
- Seal hardness Spec: 60 +/- 5 IRHD.

Versatile Product Range

- PN12.5 - Available diameter 110 to 400mm
- PN 16 - Available diameter 110 to 400mm
- PN20 - Available diameter 110 to 400mm
- PN25 - Available diameter 110 to 400mm

Still in Doubt: Comparison with DI vs HDPE vs PVC-O

Parameters	DI	HDPE	PVC-O
Design Friction Manning's Co-efficient (n Value)	0.011	0.017	0.007-0.009
Flexibility of pipe joint in alignment	20 - 50	Flexible Pipe	9 deg Per socket for 110mm pipe and big dia pipe 2deg per socket, FLEXIBLE PIPE
Type of Fittings used	CI / DI	MS / CI / DI / HDPE	DI/ majority PVC-O
Availability of Fittings	Readymade fittings widely available.	Readymade fittings available.	Available with all MOLECOR TECHNOLOGY PVC-O pipe manufacturers
Expected salvage value after 30 years	Rs 25000/MT	Rs 500/MT	100%recyclable,50%PVC value
Direct tapping facility	Directly by ferrule.	Direct tapping not possible, saddle strap to be used.	Direct tapping: saddle strap to be used.
Damping Capacity	High specific damping capacity (15-40%), coupled with low notch sensitivity due to presence of graphite flake is the unique feature.	Medium	medium
Application	All applications.	Not recommended for (1) Pumping main, (2) high probability of third-party damage (3) over ground installation (4) presence of high degree of organic contaminates.	1. To be used as Pumping main/ raising main for water SUPPLY and sewage., 2. Lift irrigation, 3. High pressure drain and storm water, 4. Industrial park, 5. Powerplant water nets. 6. Smart cities WATER SUPPLY LINES.
Not Suitable	• Extremely aggressive soils/ waters (unless high performance protection is specified)	• In case of High-pressure pumping mains • Above ground installation • Ground contaminated with organic chemicals • Major carriageways • Risk of third-party damage	• For transporting solvents, chemical whose pH is <3 and>12.hot waters above 60 deg c continuous supply.
Nature and Frequency of Damage	Impact failure or bursting due to crack or water hammer is extremely rare. Frequency of damage - very low.	Often damaged by third party interference. Failure due to material degradation is also common. Frequency of Damage - medium.	Frequency of damage is very low. Very easy to repair damage with PVC-O service joints
CO2 emmission	High from creddle to crate	High as material is max PE	Lowest as only 47% ethylene and rest salt , light weight so material used less. Lower logistic transport cost,
Life Cycle Cost	High from creddle to crate	Medium lower than DI	Lowest as less material used and life of PVC-O pipes more than 100 years, no scaling or rusting, low maintainance

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