



bhartiwaters[®]
advancing resources

PIPE
WAYS TO PROGRESS

**Bharti
PVC-O Pipes
(Class 500)**

**Built
to
Last**



Engineered for
High Pressure



Tested
for Toughness



Designed for
100+ Years



Water Supply Infrastructure
Irrigation & Agriculture
Drainage & Sewerage

More Economical | Leak-Proof
No Lead & No Heavy Metals | Corrosion-Resistant
Lowest Carbon Footprint | Lifetime Warranty

Introduction

We would like to introduce **Bharti Waters Pvt. Ltd.**, as one of India's leading manufacturers of latest generation **Class 500 PVC-O Pipes** (Oriented High-Pressure and Leak-Proof pipes) for piped Water Supply Infrastructure, Drainage, Agriculture, Irrigation and Sewerage applications. Our state-of-the-art **factory, spread over 100,000 sq. ft** located in RIICO Industrial Area in Alwar (RJ), manufactures **Bi-Axial Oriented Class 500 PVC-O Pipes from 110-315 mm** in pressure ratings of PN10 to PN25, which covers more than 90% of the piping requirements for Public Pipe Infrastructure.

PVC-O Pipes are approved by the CPHEEO Manual (GOI) and is extremely popular because of its various merits. PVC-O pipes are also very popular in USA, Europe, Africa, South-East Asia and Australia*.

Our company has a professional team with over 50 years of experience in R&D, manufacturing, sales, and service. We provide high-quality pipes for high-pressure applications. Our company adheres to the motto "Pipe Ways to Progress," with a focus on R&D, Production, and Application of PVC-O Pipes.



By switching to PVC-O pipes, the government can complete the same water piping project for Rs. 60-70 crores instead of Rs. 100 crores, saving 1000s of crores in the long term.

Today most of the India's drinking water, drainage and waste water infrastructure is affected by leakage and corrosion issues, causing massive losses and inconvenience to Indian citizens. These issues can be avoided with the use of PVC-O Pipes.

Currently PVC-O Pipes are approved and used in the Pressure Pipe Water Transmission projects of over 10 States in India.

Bharti PVC-O
Manufacturing Unit
Alwar, Rajasthan



Benefits as per CPHEEO Manual (GOI)

- **Greater lightness and easy handling:** The manufacturing system of the pipes delivers both health & safety, and economic savings during the pipe installation process.
- **Excellent Flexibility:** The high flexibility of the pipes enables withstanding large deformations without suffering structural damages.
- **Greater Hydraulic Capacity:** Between 15%-40% higher than pipes made of other material with the same outer diameter
- **Higher Chemical Resistance:** PVC-O is immune to corrosion so it does not require any coating or special protection, this results in cost savings.
- **Higher hydrostatic resistance:** These pipes can endure internal pressure up to twice the nominal pressure conventional pipes can withstand.
- **Higher Resistance against water hammers:** The lower celerity figure of the pipes virtually eliminates the possibility of breakage that can occur during the process of opening/closing valves or when starting pumping operations.



Other Benefits

- Service Life of 100+ years
- 30-80% more economical than Ductile Iron (DI) and HDPE pipes for the same or higher-pressure rating
- 100% Leak-Proof
- 100% Lead Free & 100% safe for humans

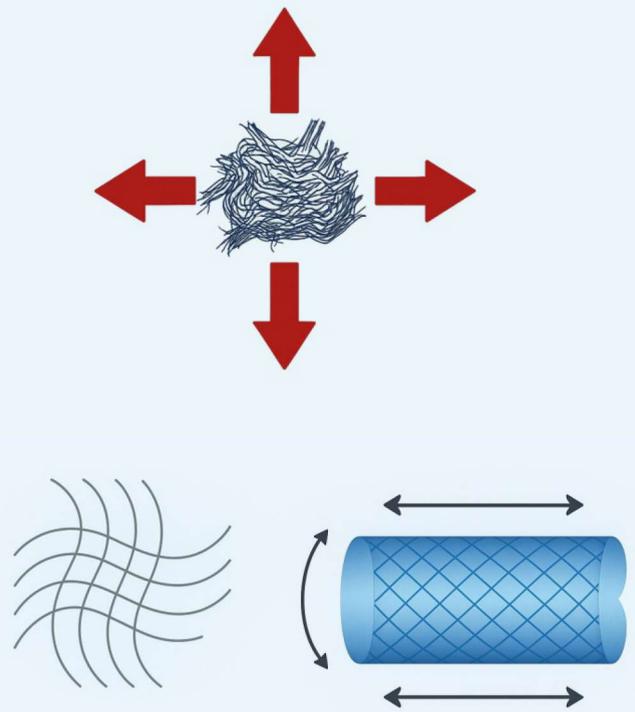
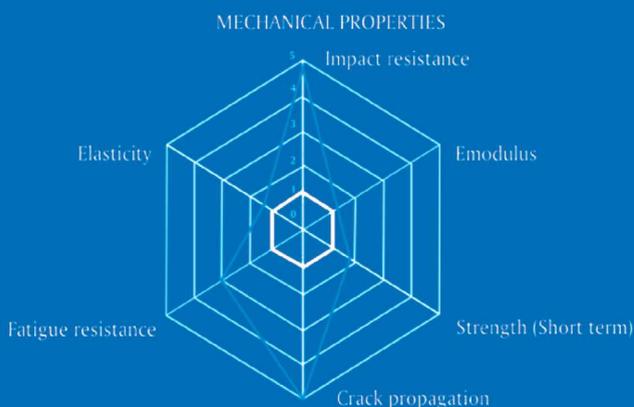


- Very High-Pressure rating upto 25 kg/cm²
- Quick installation (2 times faster than HDPE and 4 times faster than DI)
- Rust and Chemical Resistant
- As per Indian Standard IS 16647:2017
- Approved in over 10 states in India and CPHEEO (GOI)

- Crack-proof and highly ductile and non-brittle (can even withstand the weight of a JCB, Hydra or Truck)
- 15-40% higher hydraulic capacity compared to conventional pipes, which means up to 15-40 % higher water supply capacity in the same pipe diameter
- Water Hammer Effect is 1/4th compared to DI pipes, which are most prevalent
- No Effect of Chlorine on the life of the pipe (Chlorine heavily affects the life of DI and HDPE pipes, causing leakages)
- 30-40% saving in water pumping costs, thus saving more than Rs. 100 crores/ year in state government electricity bills
- Very smooth surface compared with DI and HDPE pipes, thus, much higher velocity and pumping load is significantly less
- 90% less carbon footprint compared with DI pipes and 100% recyclable, thus making it very environmentally friendly

What are PVC-O Pipes

PVC-O Pipes also called biaxially oriented PVC pipes, are a new type of high-pressure pipes obtained by orienting the PVC-U pipes in the circumferential and axial direction. The biaxial orientation greatly enhances PVC's physical and mechanical properties. PVC-O pipes are the most advanced pipes for the conveyance of high-pressure water currently available on the market.

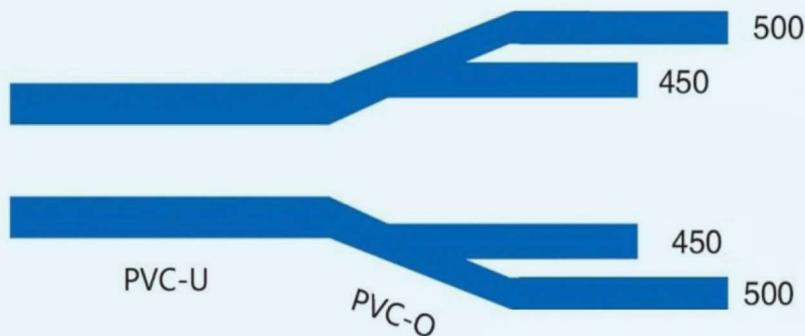


PVC-O Pipes Material Classification

The Standard IS16647:2017 regulates the material classification, overall design coefficient and nominal pressure of PVC-O Pipes. The difference with other material pipes is that PVC-O pipes are classified as 450 and 500 based on the MRS (Material Resistance Strength) value.

The higher the pipe class, the greater the material strength and nominal pressure. For the same DN and PN, a higher pipe material class results in greater hydraulic capacity, lower head loss, and reduced cost.

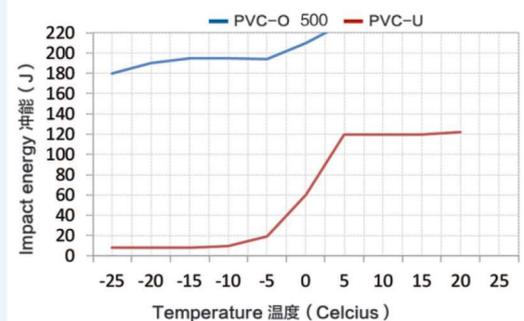
According to the standard requirements and using a comprehensive evaluation method, Bharti PVC-O pipes achieve Class 500. Our company is able to this by deploying our state-of-the-art PVC-O Pipe manufacturing technology and machinery with strict quality control measures.



The Advantages of Bharti PVC-O Pipes

Unbeatable Impact Resistance

Bharti PVC-O Pipes have unbeatable impact resistance, especially in cold environment. Its impact resistance doesn't reduce much even in -25°C .



Above PVC-O Below: PVC-U



PVC-O

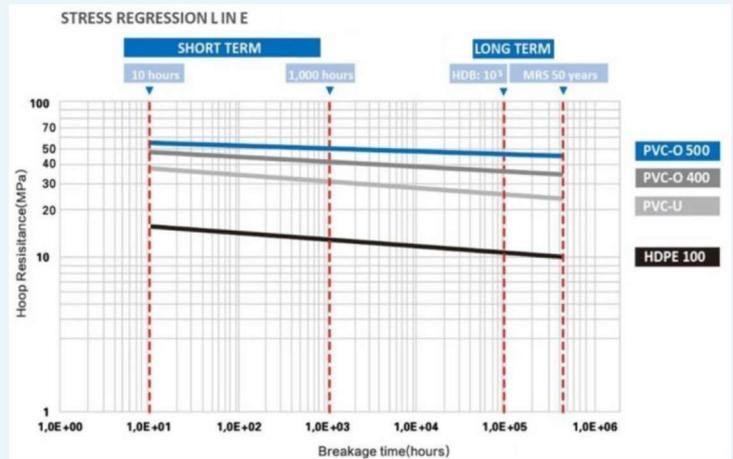
Crack Propagation

Because of their net and layered structure, Bharti PVC-O Pipes prevent the propagation of cracks and scratches and eliminate the risk of rapid crack behaviour.

Fatigue Resistance

Materials tend to lose their mechanical properties when subjected to prolonged strain, a phenomenon known as creep.

Bharti PVC-O exhibits very low creep behaviour. Compared to conventional plastics, Bharti PVC-O pipes are exceptionally resistant to fatigue, ensuring durability and reliable performance at nominal pressure for over a hundred years.



Maximum Flexibility

Thanks to their excellent elasticity, Bharti PVC-O pipes can withstand significant deformations of their internal diameter. When crushed or subjected to mechanical impact, they immediately return to their original shape. This greatly reduces the risk of breakage caused by soil subsidence, sharp rock edges, or heavy machinery



Excellent Response to Water Hammers

Bharti PVC-O Pipes have thinner wall thickness, bigger internal diameter, so they have lower celerity than other piping systems (four times less than ductile iron pipes), which means less water hammers caused by sudden variations in water volume and pressure. This reduces the possibility of breakage during opening and closing in the water network, and when pumping gets underway, protecting every component of the network.



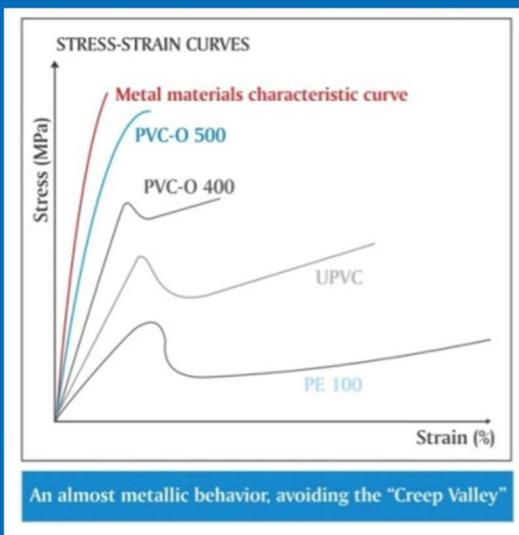
Bharti PVC-O Pipes Increase the Hydraulic Capacity

The higher the material strength, the higher the nominal pressure at the same DN and PN. Bharti PVC-O Pipe have the largest inner diameter, thus giving them the highest hydraulic capacity.

Bharti PVC-O Pipes can offer 15%–40% more hydraulic capacity than the conventional pipes with the same nominal outside diameter. This means **Bharti PVC-O Pipes can transport the highest amount of water while consuming the least energy.**



Excellent for working in extreme water temperature



Hot: up to 45°C
Cold: down to -25°C

Completely Corrosion-Resistant

Bharti PVC-O pipes are immune to corrosion. They can safely convey most corrosive fluids and are suitable for long-term use in corrosive environments. Unlike other materials, they require no special protection or coating, resulting in significant cost savings.

Completely Water-Tight



The rubber ring is elastomeric and integrated with the pipe, preventing displacement during installation.

Bharti PVC-O pipes use elastomeric seals that are 100% watertight and guaranteed to stay securely in place once installed.

Installation Cost (Rs/mtr)



Low Cost & Easy Installation

The weight of Bharti PVC-O Pipes is half of the conventional plastic pipes; 6-12 times lighter than ductile iron pipes. It is easy to handle. In most cases, handling does not require machinery or cranes.

The installation speed is increased greatly; the installation cost is reduced significantly in comparison with pipes of other materials. PVC-O pipes are at least 30-80% more economical than DI & HDPE pipes.

The most secure, hygienic, and eco-friendly pipes

The technology of Bharti PVC-O Pipes requires high-quality raw material and formulation, thus preventing unqualified raw materials. Moreover, because of their complete corrosion resistance, the quality of water that circulates in Bharti PVC-O Pipes will always remain unaltered.

Bharti PVC-O Pipes are manufactured and tested according to Indian Standard IS: 16647:2017.

The advantages of the Bharti PVC-O Pipes are savings in raw materials, lower energy consumption, therefore reduced CO₂ emissions into the atmosphere. PVC is a 100% recyclable material. **Bharti PVC-O Pipes are the most eco-friendly and energy-efficient pipes.**

Figure 1: Energy Consumed by Raw Materials (Kwh)

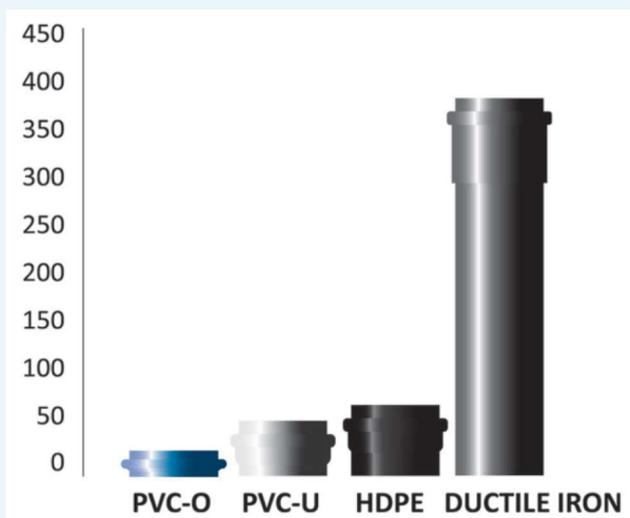


Figure 2: Energy Consumed in Manufacturing (Kwh)



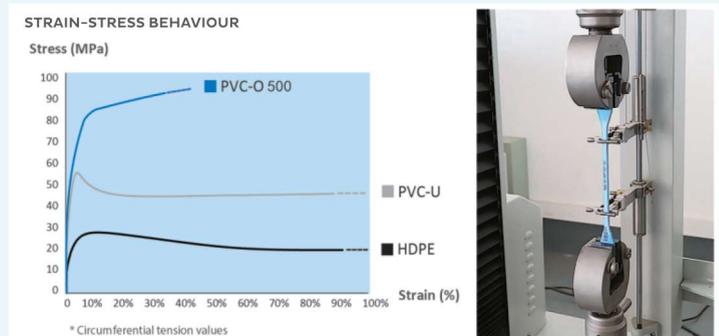
ENERGY CONSUMPTION COMPARISON

The Best Mechanical Properties

Tensile Resistance

The Bharti PVC-O stress-strain curve changes significantly compared to conventional plastics.

The circumferential tension can achieve even more than 90MPa, it is much higher than that of PVC-U and HDPE Pipe.



High Short-term and long-term hydrostatic resistance

Bharti PVC-O Pipes offer a resistance to internal pressure of more than 2.5 times the nominal pressure, which means that they can bear sporadic excessive pressure, such as water hammers and other malfunctions in the network.

Because the creep behaviour of PVC-O material is very slow, this ensures the service life of Bharti PVC-O pipes is more than 100 Years.



Material Mechanical Properties

The table below summarises the technical characteristics of Bharti PVC-O pipes in comparison with other Plastic Pipes.

Product Standard	Units	Bharti PVC-O	PVC-U	HDPE 100
		IS-16647:2017	IS-4985:2021	IS-4984:2016
Minimum required strength	MPa	50	25	10
Overall Service Coefficient		1.4/1.6	2.0	1.25
Design Stress	MPa	36/31	12.5	8

Range of all kinds of Applications

Application Standard

Bharti PVC-O Pipes are manufactured as per the following Indian and International standards: IS 16647:2017, ISO 16422:2014 and UNE EN 17176-1:2019(MAIN)

Fittings

The **Bharti PVC-O 500 pipes** are compatible with all kinds of Ductile Iron & Carbon Steel(CS) fittings (T, Elbows, etc), saddles and flanges.

Tapping saddles allow connecting the pipe in the perpendicular direction to all kinds of fittings, being available with screw ends and flange ends.

Flanges with anti-traction systems allow connecting the spigot ends to all kinds of fittings with connection to a flange.

Fittings with plugs Euro type are connected directly to the pipe, allowing for deviations, reductions and connections on the net.



Applications

The main application of Bharti PVC-O pipes is in conveyance of high-pressure water in Potable Water Transportation, Irrigation, Water Conservancy Projects, Landscaping, Drinking water in the countryside, fire protection nets, Factories and Mines, Corrosion Causing Chemicals, Sewage, Reclaimed water, etc.

Bharti PVC-O pipes are used in:

- **Municipal Engineering:** used for drinking water supply, sewage discharge, drainage, reclaimed water, and flood discharge pipes.
- **Construction Engineering:** used for drinking water supply, building sewage pipes, rain water pipes, underground drainage pipes and ventilation pipes.
- **Chemical, Pharmaceutical and Environmental Protection:** used in industries such as chemical, pharmaceutical and environmental protection.



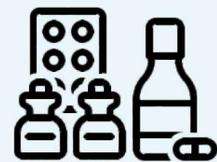
- **Agriculture and Landscaping:** used for farmland, gardens, tea gardens, and forest drainage and irrigation.
- **Road Engineering:** used for Water Supply and Drainage in railways and highways.
- **Mine:** Used for ventilation and drainage pipes in mines.



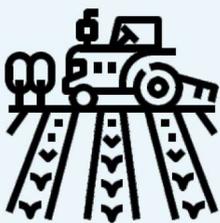
Municipal
Engineering



Construction
Engineering



Chemical, Pharmaceutical
and Environmental Protection



Agriculture
and Landscaping



Road
Engineering



Mine

Hydraulic Design

Technical Feature	Unit	Value
Temperature of conveyance of water	°C	≤45
Density	kg/dm ³	1.35-1.46
Lineal expansion coefficient	°C ⁻¹	7×10 ⁻⁵
Poisson coefficient		0.45
EYoung's modulus	Mpa	4000
Axial tensile strength	Mpa	48
Circumferential tensile strength	MPa	85
Hazen Williams coefficient		150
Manning roughness coefficient		0.009

Calculation of Pipe Head Loss

Pipe head loss is the energy of a hydraulic fluid that is lost along itself due to friction. It can be calculated according to the following formula:

$$h_f = \lambda \cdot \frac{L}{d_i} \cdot \frac{u^2}{2g} \quad \lambda = \frac{0.304}{Re^{0.239}} \quad Re = \frac{u \cdot d_i}{\gamma}$$
$$1000i = 0.000933 \cdot \frac{Q^{1.761}}{d_i^{4.761}}$$

Due to their larger internal diameter, Bharti PVC-O pipes experience over 30% less pressure loss compared to PVC-U pipes and over 50% less than HDPE pipes. This results in significantly lower energy requirements for fluid transport.

Calculation of Water Hammer

$$P = \frac{a \cdot V}{g}; a = \frac{1425}{\sqrt{1 + \frac{\epsilon}{E} \frac{D}{e}}}$$

Because Bharti PVC-O Pipe's D/E is the biggest; the water hammer is the smallest.

Dimensions

Safety Coefficient C-1.4, Material Class 500, Ref. IS: 16647:2017

DN	PN 12.5		PN 16		PN 25	
	Mean Outside Diameter in mm		Mean Outside Diameter in mm		Mean Outside Diameter in mm	
mm	Min	Max	Min	Max	Min	Max
110.0	110.0	110.4	110.0	110.4	110.0	110.4
160.0	160.0	160.5	160.0	160.5	160.0	160.5
200.0	200.0	200.6	200.0	200.6	200.0	200.6
250.0	250.0	250.8	250.0	250.8	250.0	250.8
315.0	315.0	316.0	315.0	316.0	315.0	316.0



PVC-O Pipes are Approved & Used by following Government Departments of India:

Sl. No.	Central Government	Department
1	Government of India	CENTRAL PUBLIC HEALTH & ENVIRONMENTAL ENGINEERING ORGANISATION (CPHEEO) MINISTRY OF JAL SHAKTI

Sl. No.	State	Department
1	MAHARASHTRA	MAHARASHTRA JEEVAN PRADHIKARAN WATER RESOURCE DEPARTMENT MAHARASHTRA
2	ODISHA	ODISHA INDUSTRIAL INFRASTRUCTURE DEVELOPMENT CORPORATION RURAL WATER SUPPLY AND SANITATION DIVISION ODISHA
3	WEST BENGAL	GOVERNMENT OF WEST BENGAL DIRECTORATE OF PUBLIC HEALTH ENGINEERING
4	CHHATTISGARH	GOVERNMENT OF CHHATTISGARH PUBLIC HEALTH ENGINEERING DEPARTMENT CHHATTISGARH URBAN DEVELOPMENT AUTHORITY
5	MADHYA PRADESH	GOVERNMENT OF MADHYA PRADESH PUBLIC HEALTH ENGINEERING DEPARTMENT
6	RAJASTHAN	GOVERNMENT OF RAJASTHAN PUBLIC HEALTH ENGINEERING DEPARTMENT
7	TAMIL NADU	TAMIL NADU WATER SUPPLY AND DRAINAGE BOARD CHENNAI METROPOLITAN WATER SUPPLY AND SEWERAGE BOARD
8	GOA	GOVERNMENT OF GOA PUBLIC WORKS DEPARTMENT
9	KARNATAKA	BANGALORE WATER SUPPLY & SEWERAGE BOARD

जल की आपूर्ति के लिए उन्मुख
असुघट्टित पॉलीविनाइल क्लोराइड
(पीवीसी-ओ) पाइप — विशिष्टि

Oriented Unplasticized Polyvinyl
Chloride (PVC-O) Pipes for Water
Supply — Specification

**ADVISORY ON
PIPE MATERIALS FOR
TRANSMISSION OF WATER**

**Central Public Health and Environmental
Engineering Organisation (CPHEEO)**

Ministry of Housing and Urban Affairs
Government of India

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PIPE
WAYS TO PROGRESS

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