Sudesh Group
35 Years of excellence

APLAPOLLO PIPING SYSTEMS
Made for life

APLAPOLLO Ultima
PVC-O PIPES

The world's ***Strongest*** *PVC pipe*

ISO

www.apollopipes.com

35
Years of excellence

10,000+
RETAIL PARTNER

1000+
EMPLOYEES

1000+
DISTRIBUTION PARTNER

29%
5-YEAR REVENUES CAGR

2500+
SKU'S

1,30,000
MTPA CAPACITY AS ON 31ST DECEMBER 2022

6
MANUFACTURING PLANTS

AMONG THE LEADING PVC PIPE MANUFACTURES IN INDIA

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MISSION

Our mission is to become a market leader by being one of the best quality product suppliers by expanding continuously, using new technologies, improving business methods, satisfying market expectations, and ensuring employee happiness.

We have always believed in returning back to the society, and so we're working to harness the potential of non-renewable energy sources. Furthermore, we are devoted to deliver on every promise to our valued clients, and work with them to fully understand their evolving needs and long-term requirements.

VISION

We aspire to become a global leader in the field of Plastic Piping Systems through our relentless process of transforming innovative ideas into incredible realities. We aim to be a genuinely global, high-performing organisation that provides excellent goods and services to its customers.

With our ideals, we seek to create an innovative, high-performance company that is dedicated to offering great products to its clients. We strive to achieve total customer satisfaction by continually improving on product quality, ease of use, availabilty and cost performance. These values have guided our interactions with customers, partners, employees, and shareholders at large.

OUR JOURNEY

2022-23
- PPR-C Pipes and Fittings Launch.
- Purchased of new land for upcoming plant at Dadri 2

2020-21
- Concluded the strategic acquisition of 'Kisan Mouldings' unit in Bengaluru.
- Successful listing of company's share on NSE.
- Started manufacturing water tank, solvent cement and Bath Fittings Robust.

2019
- Concluded promoter infusion of 142 crore through issuance of equity shares and fully convertible warents on preferential basis.

2018
- Purchased a land with building in Noida to develop Apollo Pipes corporate office.
- Introduced a brand new products range of faucets, taps, showers and accessories.

2017
- Largest plastic piping solution company.
- Installed capacity of moulding division enhanced to 27,000 MTPA

2016
- First in north India to install 900kg/hr PVC extension line.
- Expanded capacity by 10,000 MTPA
- Took total available capacity to 50,000 MTPA

2013-15
- Started manufacturing uPVC plumbing pipes fittings with 180 MTPA Capacity.
- Commenced CPVC pipes & fittings using kemone, France resin.
- Started manufacturing uPVC agri and SWR fittings.

2005-10
- Started manufacturing HDPE pipes
- Setup new plant at Dadri-UP of capacity 21,000 MTPA

2000
- Commercial PVC pipe manufacturing operations.
- Establised 3000 MTPA in Sikanderabad, U.P.

APLAPOLLO Ultima PVC-O PIPES

MANUFACTURING UNITS

Manufacturing Plant - Dadri (U.P.)

Corporate Office - Noida (U.P.)

Manufacturing Plant - Raipur (Chhattisgarh)

Manufacturing Plant - Bawla (Gujarat)

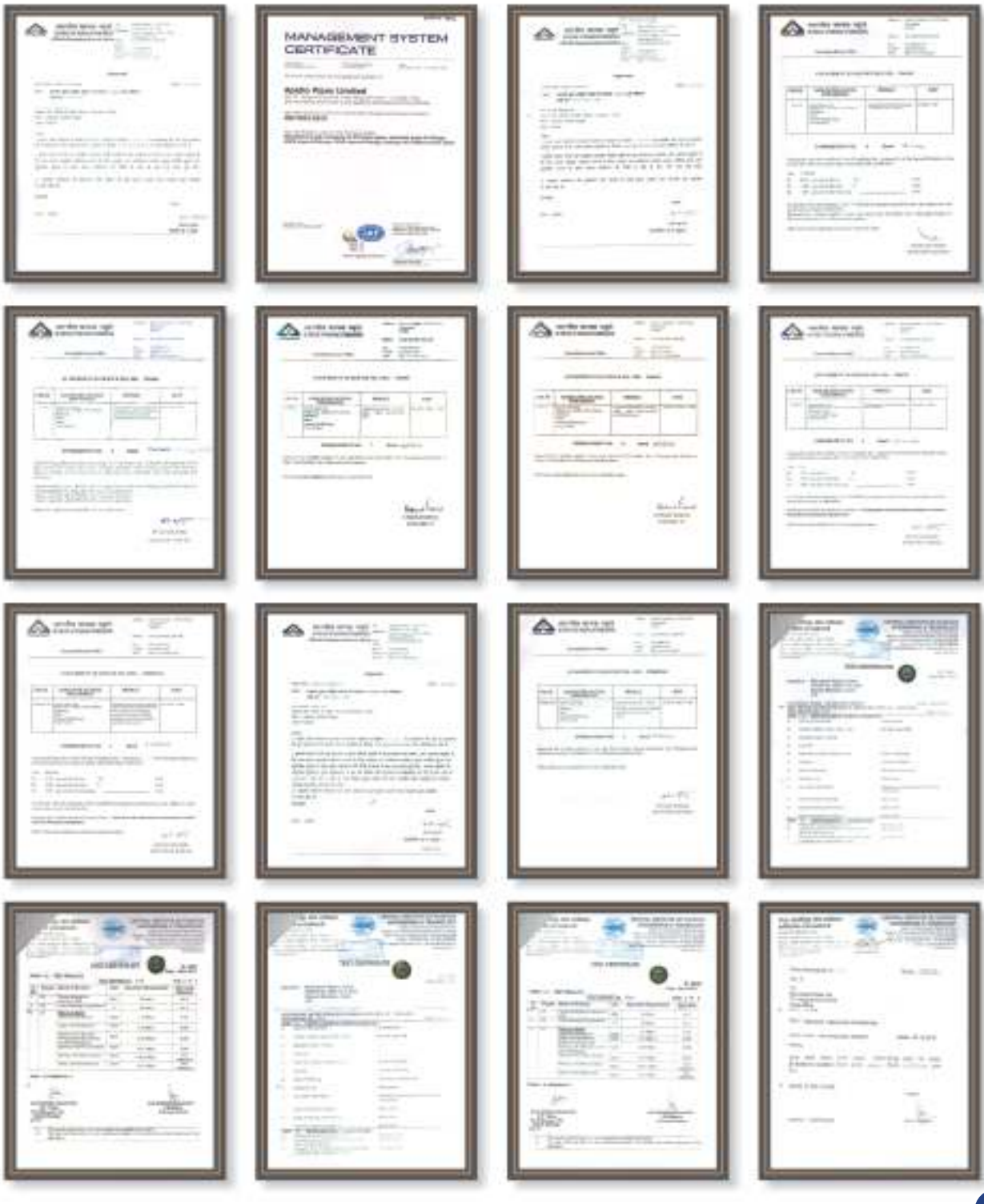
Manufacturing Plant - Sikandrabad (U.P.)

Manufacturing Plant - Tumkur (Karnataka)

AWARDS & CERTIFICATIONS

Iconic Brands Award of India-2022
by
The Economic Times

Best Brand Award-2021
by The
Economic Times

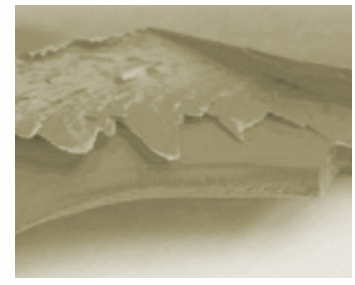


Molecular Orientation, a revolution in PVC

APL Apollo Ultima PVC-O pipes stand out as the most advanced option available for efficiently transporting high-pressure water. They boast exceptional features designed for this specific purpose, thanks to a technique called Molecular Orientation.

PVC, the material used, is typically a disordered polymer with molecules arranged randomly. However, under specific conditions of pressure, temperature, and speed, stretching the material allows the polymer molecules to align with the direction of the stretch.

The degree of alignment varies based on process parameters and the stretch ratio. The outcome is a plastic with a noticeable layered structure.



When PVC with its amorphous structure (lower section) is subjected to the orientation process, a laminate structure is obtained (upper section).

Effect of orientation on the polymeric structure

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

A plastic with unbeatable properties

The APL Apollo Orientation process significantly improves the physical and mechanical properties of PVC, resulting in several outstanding features. Importantly, these enhancements don't compromise the inherent advantages and properties of the original polymer.

When employed in high-pressure water pipelines, this type of piping exhibits high resistance and an exceptionally long lifespan, promoting energy efficiency and eco-friendliness not only in its manufacturing process but also in its subsequent usage. Additional benefits encompass cost reductions and shortened installation times.

For these reasons, APL Apollo Ultima PVC-O pipes emerge as the optimal solution for medium and high-pressure water networks, serving various applications such as irrigation systems, potable water supply, fire extinguishing networks, and pumping systems.

APL Apollo Ultima PVC-O Pipes

Cutting-edge technology for water

- The achievement of Molecular Orientation is made possible by meticulously applying uniform temperature distribution and high pressures (up to 35 bars). This is ensured through rigorous quality control checks on each pipe individually and across the entire manufacturing process.

- In contrast to the traditional intermittent method, the APL Apollo pipes are manufactured using a continuous and fully-automated process. This approach offers enhanced control over the final product, ensuring consistent quality for each pipe.

Maximum Reliability and Security

Benefiting from the exceptional technological advancements in the APL Apollo manufacturing system, we provide unparalleled reliability, security, and several compelling advantages compared to other products:

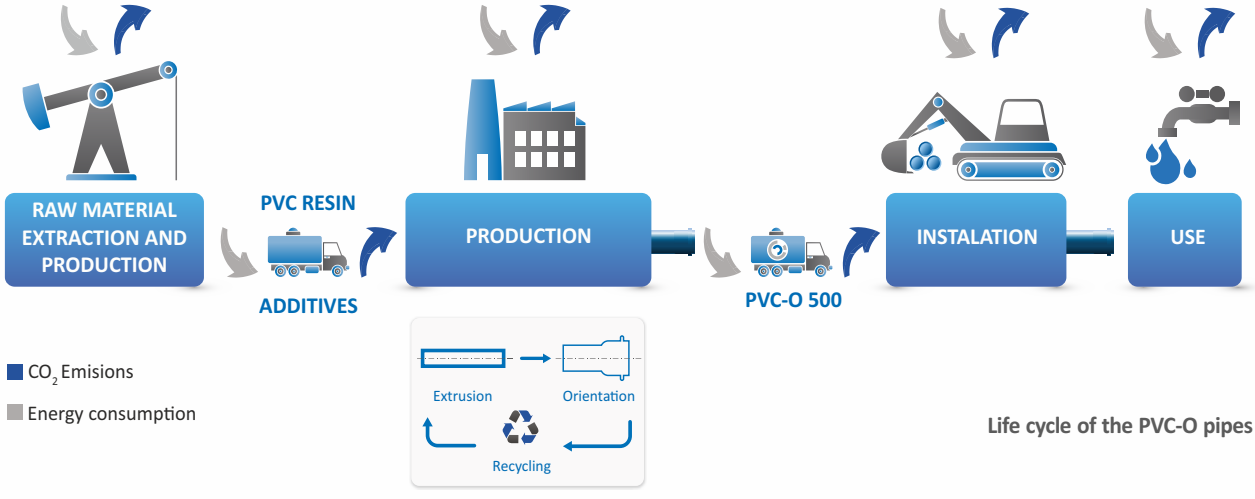
- Maximum Molecular Orientation: Achieving Class 500 as per the **IS 16647:2017,** ISO 16422: 2014, and EN 17176-2 Standards. This represents the highest degree of orientation, ensuring superior mechanical properties.
- Enhanced reliability in the final product.
- Adherence to strict dimensional tolerances.
- Consistent behaviour of the materials employed.
- Strengthened socket, meticulously shaped during the orientation process.

Manufacturing process developed by APL Apollo uses most advanced technologies and it is completely automatized. This gives APL Apollo pipes maximum guarantee of quality and consistency.

The most eco-friendly pipes with the environment

The environmental influence of a piping system is contingent on its composition and application. The primary factors determining efficiency and sustainability throughout its lifespan include the raw material type, production process, finished product, and the pipe's life expectancy.

APL Apollo Ultima PVC-O stands out as the most eco-friendly solution available in the market. This is attributed to its significant contribution to the proper sustainable development of the planet, as affirmed by various global studies. These pipes exhibit environmental benefits at every stage of their life cycle, making them the most energy-efficient option.



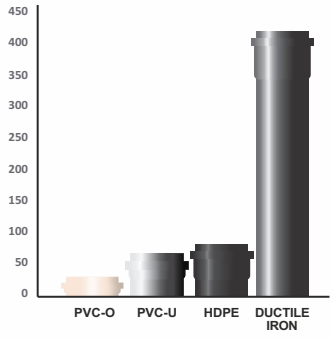
Life cycle of the PVC-O pipes

Resources efficiency

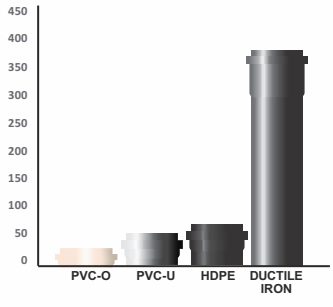
- The remarkable mechanical attributes of these pipes result in significant raw material savings. In comparison to other plastic alternatives with the same external nominal diameter, APL Apollo necessitates less PVC.
- With only 43% of the PVC composition dependent on oil, the demand for this resource is notably reduced compared to other plastic solutions.
- Additionally, energy consumption is lower across all stages of the life cycle, including raw material extraction, pipe manufacturing, and usage. Throughout its lifespan, APL Apollo mitigates unnecessary energy resource consumption and diminishes CO2 emissions into the atmosphere.

Optimal use of water resources

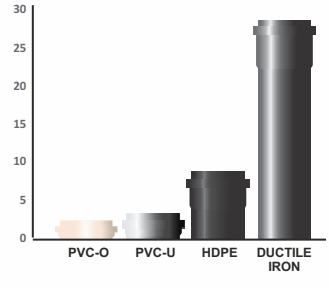
Energy consumed by pipes (raw materials + manufacture) (kWh)



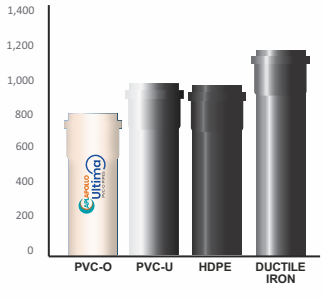
Energy consumed by raw materials (kWh)



Energy consumed in manufacturing (kWh)



Energy consumed by pumping (kWh)



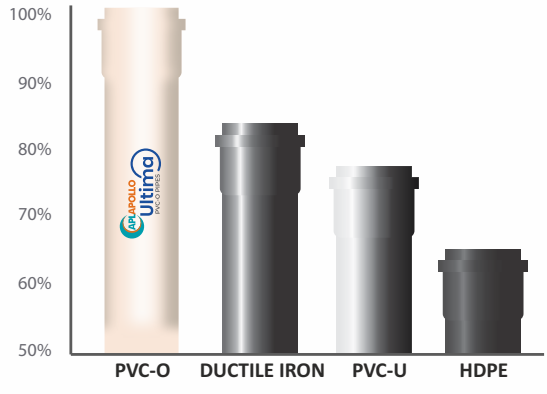
Estimated energy consumption by PVC-O, PVC-U, HDPE and Ductile Iron piping production and use. Polytechnic University of Catalonia, Spain, December 2005.

Due to their extended lifespan and excellent water-tightness, APL Apollo pipes become essential partners in the judicious utilization of water resources. Current water supply networks constructed with conventional materials experience leakage rates of up to 25%, leading to chemical degradation and premature replacement of relatively new conduits.

Water pipes should not only withstand pressure but also efficiently convey the maximum amount of water with minimal energy consumption. The exceptionally smooth inner surface of APL Apollo pipes minimizes pressure loss, reducing the energy needed for transportation.

Infrastructures built using APL Apollo pipes prove to be outstanding assets for water resource management across generations.

Hydraulic capacity



For a 1m DN250 mm PN16 bar

The infrastructures created with APL Apollo pipes are an excellent tool for managing water resources for generations

Waste Management Efficiency

PVC is a completely recyclable material. APL Apollo, as an integral player in the plastics industry value chain, demonstrates its dedication to the environment by presenting products to the market with reduced environmental impact. The incorporation of circular economy principles into their manufacturing processes further emphasizes this commitment.

Sustainability

APL Apollo represents a sustainable pipe, incorporating design considerations for environmental preservation, encompassing aspects such as energy conservation, sustainable utilization of natural resources, durability of structures, and the eco-friendliness of materials.

Remaining at the forefront of industry standards, APL Apollo adheres to the latest common methodology for calculating recommendations outlined in 179/2013/EC proposed by the European Commission for the Study of Product Environmental Footprint (PEF). This involves a comprehensive evaluation of the environmental impact of the APL Apollo Ultima PVC-O pipe throughout its entire life cycle — from raw material extraction to product disposal. This assessment covers manufacturing, distribution, and pipe usage.

Within this framework, the impact of the APL Apollo Ultima PVC-O pipe on 14 environmental factors is studied, categorized based on their effects on different environmental aspects:

Air and atmosphere

Climate change, acidification, depletion of the ozone layer and photochemical ozone formation.

Water

Resource depletion (water), freshwater toxicity and water eutrophication.

Soil

Depletion of resources (minerals), land eutrophication and ground use.

Human health

Inorganic respiratory elements, ionizing radiation, effects on human health (cancer-causing) and effects on human health (non-cancerous).

Environmental impacts	Absolute	
Climate change	8.3E+01	kg CO2e
Ozone depletion	5.3E-06	kg CFC-11e
Ecotoxicity – aquatic, fresh water	1.8E+02	CTUe
Human toxicity – cancer effects	4.8E-06	CTUe
Human toxicity - non-cancer effects	8.6E-06	CTUh
Particulate matter / Respiratory inorganics	1.3E-02	kg PM2.5e
Ionising radiation – human health effects	5.3E+00	kg U235e
Photochemical ozone formation	4.1E-01	kg NMVOC
Acidification	4.1E-01	mol H+e
Eutrophication - terrestrial	1.0E+00	mol Ne
Eutrophication – aquatic, fresh water	1.6E-03	kg Pe
Eutrophication – aquatic, sea water	9.5E-02	kg Ne
Resource depletion – water	1.9E-01	m^3 SWU
Resource depletion – mineral, fossil	3.8E-03	kg Sbe
Land transformation	1.6E+02	kg Cdef

Class 500 APL Apollo Ultima PVC-O pipes environmental footprint according to Recommendation 179/2013/EC

APL Apollo Ultima PVC-O Pipes: The best choice

for high-pressure fluid transport

Unbeatable impact resistance

APL Apollo Ultima PVC-O pipes exhibit strong resistance to impact, reducing the likelihood of breakages during installation or on-site trials caused by drops or contact with stones. Moreover, Molecular Orientation hinders the spread of cracks and scratches, eliminating the risk of rapid crack development. The outcome is a remarkable extension of the product's lifespan.

High short- and long-term hydrostatic resistance

APL Apollo Ultima PVC-O pipes provide internal pressure resistance of up to twice the nominal pressure (32 bar in PN16 bar pipes or 400 psi in PN200 psi). This capability enables them to withstand occasional excessive pressure events, such as water hammers or network malfunctions. Additionally, the material's low creep behaviour ensures the pipe's longevity when operating at nominal pressure for well over a century.

Excellent response to water hammers

APL Apollo Ultima PVC-O pipes exhibit reduced celerity compared to alternative piping systems, amounting to one-fourth that of ductile iron pipes. This results in fewer water hammers induced by sudden changes in water volume and pressure. This diminished celerity significantly lowers the likelihood of breakage during the opening and closing of the water network and when pumping initiates, safeguarding each component within the network.

The impact of a 500 kg rock dropped from a height of 3 metres leaves a APL Apollo Ultima PVC-O pipe completely unscathed.

Increased hydraulic capacity

Molecular Orientation expands the inner dimensions of the pipe, providing APL Apollo Ultima PVC-O pipes with a larger internal diameter and an increased flow section. Additionally, the internal surface is exceptionally smooth, minimizing load loss and hindering the formation of deposits on the inner walls. Consequently, APL Apollo Ultima PVC-O pipes deliver 15% to 40% more hydraulic capacity compared to pipes made from other materials with the same external dimensions.

ADVANTAGES

Maximum flexibility

Due to their exceptional elasticity, APL Apollo Ultima PVC-O pipes can withstand significant deformations of their internal diameter. In situations such as crushing or mechanical accidents, these pipes promptly revert to their original shape, thereby reducing the risk of potential breakage caused by soil subsidence or contact with sharp edges on rocks or machinery. Additionally, owing to their substantial load-bearing capacity, APL Apollo PVC-O pipes ensure optimal performance when installed underground.

Completely corrosion-resistant

Oriented PVC is immune to corrosion and to natural chemical substances, as well as to aggression from micro- and macro-organisms. APL Apollo Ultima PVC-O pipes, therefore, are not degradable. Moreover, they do not require any type of special protection or coating, which means cost-savings.

APL Apollo Ultima PVC-O pipes will take any kind of deformation without suffering structural damage.

Total water quality

The quality of the fluid flowing through APL Apollo Ultima PVC-O pipes remains constant as the material is resistant to corrosion and migrations within the pipes or their coating. Compulsory tests, including those specified by Spanish Law RD 140/2003, affirm that these pipes meet the necessary health standards for human consumption of water.

Moreover, APL Apollo Ultima PVC-O pipes adhere to various other sanitary standards, such as ACS, WRAS, or DWI, further confirming their suitability for use with water intended for human consumption.

Completely water-tight

The joints are entirely waterproof and are assured not to shift once the pipes are in place. APL Apollo Ultima PVC-O pipes are straightforward to connect and can be installed by workers with lower qualifications.

Locked-in ring seals ensure a perfect water-tight fit.

Lower cost and easier installation

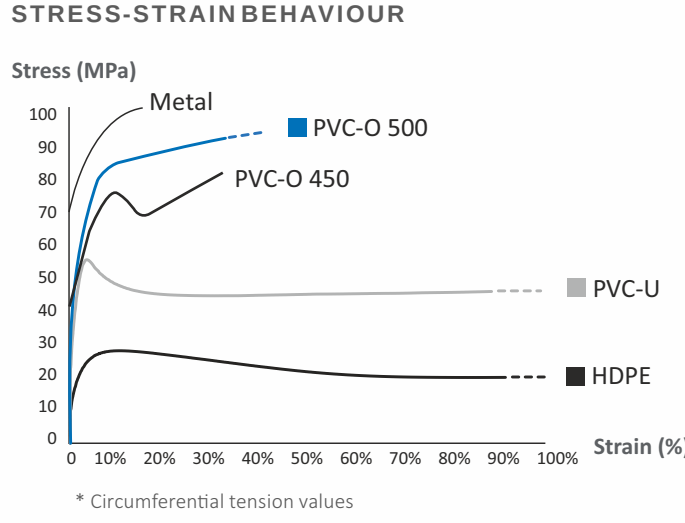
APL Apollo Ultima PVC-O pipes are lighter and more manageable than pipes made from alternative materials, often not requiring machinery for handling. Additionally, their ease of connection, flexibility, and impact resistance contribute to greater cost-effectiveness, performance, and installation speed when compared to pipes made from other materials.

APL Apollo Ultima PVC-O pipes are extremely lightweight.

The best mechanical properties

Tensile resistance

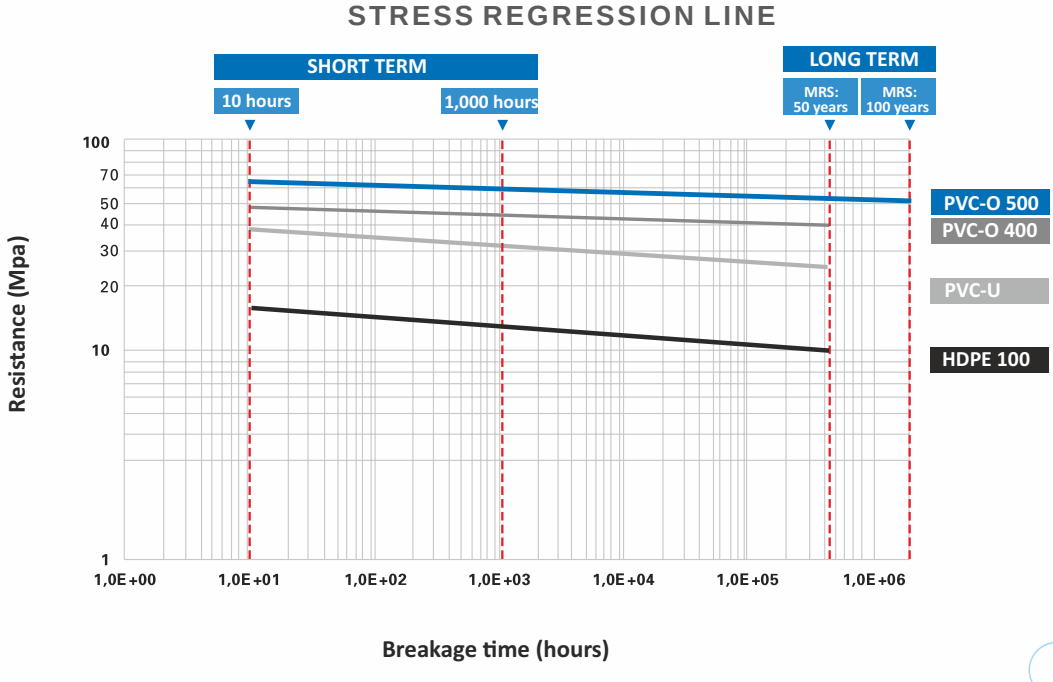
The stress-strain curve of PVC-O undergoes a notable transformation, deviating significantly from the conventional behavior observed in regular plastics and approaching that of metals. This distinctive alteration in mechanical properties is achievable only in the higher-class PVC-O Class 500, exemplified by APL Apollo Ultima PVC-O pipes.



* Circumferential tension values

Long-term hydrostatic resistance

Materials tend to lose their mechanical properties when subjected to prolonged strain, a phenomenon known as creep. In PVC-O 500, this characteristic is significantly minimized compared to conventional plastics, resulting in improved long-term properties. Considering the exceptional resistance to fatigue and robust chemical resistance shared with conventional PVC, APL Apollo Ultima PVC-O pipes maintain the characteristics of a Class 500 pipe for over 100 years. This is substantiated by long-term tests (10,000 hours) conducted by an independent accredited laboratory, adhering to ISO 9080:2013 and UNE – EN ISO 1167:2006 Part 1 and 2 standards. It implies that the pipe can endure its nominal pressure for more than a century, provided there are no alterations in the operation of the installation. Hence, APL Apollo Ultima PVC-O pipes have a useful life exceeding 100 years.



Piping and material mechanical properties

The following table summarizes the technical characteristics of APL Apollo Ultima PVC-O Pipes in comparison with other plastic pipes.

		APL Apollo Ultima PVC-O 500	PVC	HDPE-100	HDPE-80
Product Standard	**Units**	**ISO 16422 UNE-EN 17176**	**UNE-EN ISO 1452**	**UNE-EN 12201**	**UNE-EN 12201**
Minimum required strength (MRS)	MPa	50.0	25.0	10.0	8.0
Overal service cofficient (C)	-	1.4	2.0 (1)	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 PVC-O 500.

Characteristic	Units	Value
Density	kg/dm^3	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)	$m^{0.37}/s$	150
Manning roughness coefficient (n)	$m^{-1/3}s$	0.009

(1) Although the standard allowance includes this range.

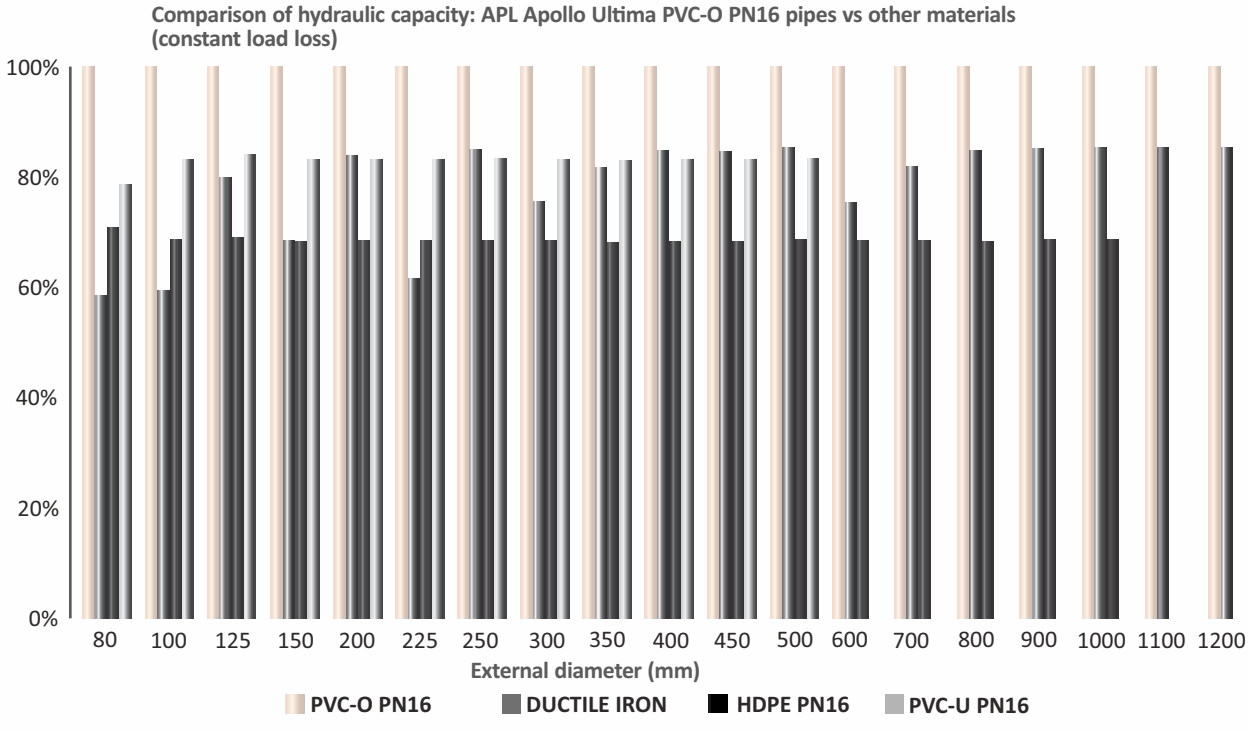
Characteristics of the water-tight joint

Characteristic	Units	Value
Elastomer hardness	IRHD	60 ±5

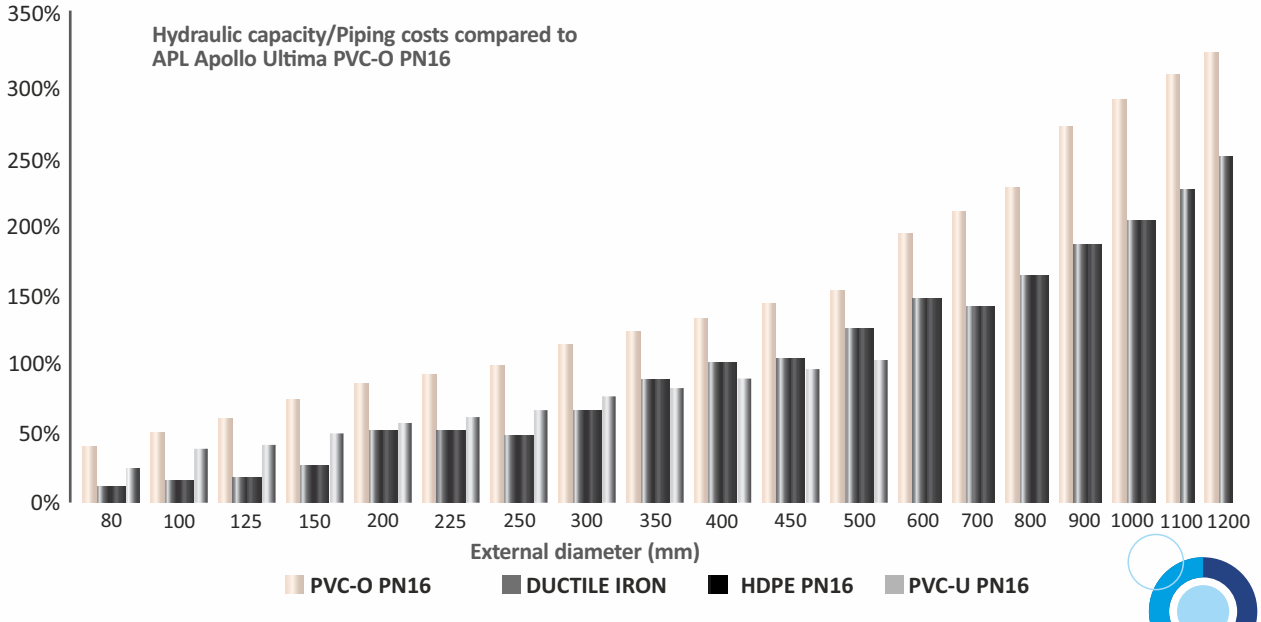
Unbeatable Hydraulic Properties

Hydraulic capacity

The demands placed on water pipes extend beyond pressure resistance; they also involve the efficient conveyance of the maximum water volume with minimal energy consumption. APL Apollo Ultima PVC-O pipes have thinner walls compared to traditional plastic pipes and a smoother interior surface than metals, resulting in an increased hydraulic capacity.



Opting for pipes with reduced hydraulic capacity requires employing a larger nominal diameter, adversely impacting both profitability and infrastructure investment costs. Choosing APL Apollo Ultima PVC-O ensures obtaining greater hydraulic capacity for your investment costs.



Water Hammer

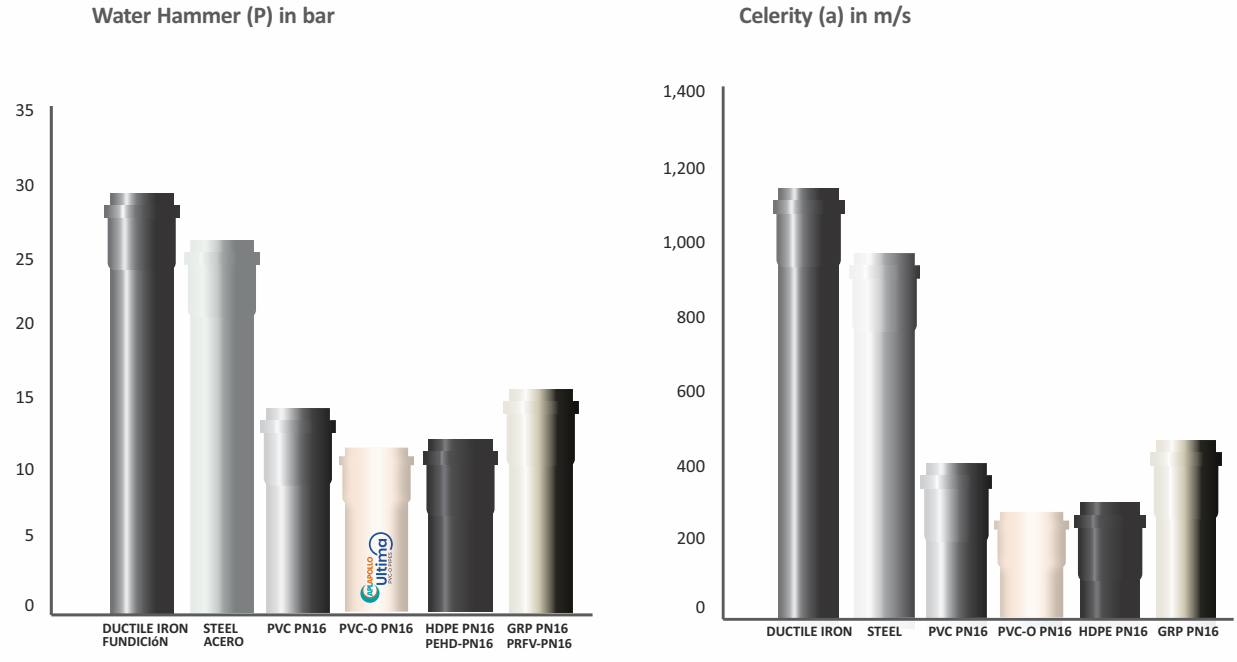
Water hammers occur when the flow of liquid through pipes is abruptly halted, typically when a valve is opened or closed, a pump starts or stops, or due to the movement of air locks within the pipe. These events can lead to higher overpressure than the pipe's working pressure, potentially causing breakage, especially if the pipe is already compromised by impacts or corrosion.

The intensity of water hammers (P) is influenced by the celerity (a), which is the wave speed, and the fluid's change of speed (V). Celerity is primarily determined by the pipe's dimensions (the ratio of external diameter to minimum thickness) and the material specifications (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
D_m: average pipe diameter, in mm
e: pipe thickness, in mm
K_c: function coefficient of the modulus of elasticity (E) of the material of the pipe expressed in kg/m^2
E: modulus of elasticity, in kg/m^2 for the APL Apollo Ultima PVC-O pipe: $4 \times 10^8 kg/m^2$

APL Apollo Ultima PVC-O pipes exhibit a notably lower celerity compared to pipes crafted from alternative materials, especially when compared to metal piping. This difference is particularly significant, especially when considering the potential for substantial water hammer effects in pipes made of metal materials.



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

A range for all kinds of applications

APL Apollo Ultima PVC-O offers a broad range of piping covering all medium- and high-pressure needs.

Applicable Laws and Standards

APL Apollo Ultima PVC-O pipes are produced in compliance with the IS: 16647-2017 standard, which pertains to "Plastic piping systems for water supply and for buried and above ground drainage, sewerage, and irrigation under pressure, but not exposed to direct sunlight. Additionally, they adhere to the International Standard ISO 16422:2014, which applies to "Pipes and joints made of oriented unplasticized poly(vinyl chloride) (PVC-O) for the conveyance of water under pressure but not exposed to direct sunlight." APL Apollo has the capability to manufacture pipes in accordance with these standards upon request.

Material classification

IS: 16647 and its standards encompass various PVC-O materials, categorized based on their MRS (Minimum Required Strength), as Molecular Orientation can vary in degree due to different manufacturing processes. APL Apollo Ultima PVC-O pipes are exclusively produced in the top-tier class (PVC-O 500), ensuring the utmost degree of orientation and, consequently, delivering superior mechanical performance. As a result, APL Apollo Ultima PVC-O Pipes offer greater advantages compared to other materials.

	APL Apollo Ultima 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
Burst pressure over 50 years (bar) (1)	17.5	22.4	28.0	35.0
Burst 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/m^2) (3)	5	7	11	20
Colour (4)	White	White	White	White

(1) With a temperature of 20° C.

(2) According to EN 805:2000 standard with estimated water hammer.

(3) Average stiffness per pipe according to established tolerances.

(4) Available in white color, please contact us for any specific color other than white.

Dimensions

APL Apollo Ultima PVC-O 500 (C 1.4 Pipe)						
Nominal Pressure (bar)			PN12.5	PN16	PN20	PN25
Nominal Diameter (DN)	Outside Diameter (OD)		Wall Thickness	Wall Thickness	Wall Thickness	Wall Thickness
	min.	max.				
mm	mm	mm	mm	mm	mm	mm
63	63	63.3	1.2	1.5	1.8	2.3
75	75	75.3	1.4	1.8	2.2	2.7
90	90	90.3	1.7	2.1	2.6	3.3
110	110	110.4	2.0	2.6	3.2	4.0
125	125	125.4	2.3	2.9	3.6	4.5
140	140	140.5	2.6	3.2	4.0	5.1
160	160	160.5	2.9	3.7	4.6	5.8
180	180	180.6	3.3	4.2	5.2	6.5
200	200	200.6	3.6	4.6	5.7	7.2
225	225	225.7	4.1	5.2	6.4	8.1
250	250	250.8	4.5	5.8	7.2	9.0
280	280	280.9	5.1	6.4	8.0	10.1
315	315	316.0	5.7	7.2	9.0	11.4
355	355	356.1	6.4	8.2	10.1	12.8
400	400	401.2	7.2	9.2	11.4	14.4
450	450	451.4	8.3	10.3	12.8	16.2
500	500	501.5	9.2	11.4	14.2	18.0
560	560	561.7	10.3	12.8	15.9	20.2
630	630	631.9	11.6	14.4	17.9	22.7
710	710	712.0	13.1	16.2	20.2	25.6
800	800	802.0	14.7	18.3	22.7	28.8
900	900	902.0	16.5	20.6	25.5	32.4
1000	1000	1002.0	18.4	22.8	28.4	36.0
1200	1200	1202.0	22.0	27.4	34.0	43.2

APL Apollo Ultima PVC-O pipes are supplied in total length of 6 metres (including the length limit mark for the socket).
The inside diameters may be subjected to variation according to manufacturing tolerances.

Dimensions

APL Apollo Ultima PVC-O 500 (C 1.6 Pipe)							
Nominal Pressure (bar)			**PN10**	**PN12.5**	**PN16**	**PN20**	**PN25**
Nominal Diameter (DN)	Outside Diameter (OD)		Wall Thickness	Wall Thickness	Wall Thickness	Wall Thickness	Wall Thickness
	min.	max.					
mm	mm	mm	mm	mm	mm	mm	mm
63	63	63.3	1.1	1.3	1.7	2.1	2.6
75	75	75.3	1.3	1.6	2.0	2.4	3.1
90	90	90.3	1.5	1.9	2.4	2.9	3.7
110	110	110.4	1.8	2.3	2.9	3.6	4.5
125	125	125.4	2.1	2.6	3.3	4.0	5.1
140	140	140.5	2.3	2.9	3.6	4.5	5.7
160	160	160.5	2.6	3.3	4.2	5.1	6.5
180	180	180.6	3.0	3.7	4.7	5.8	7.3
200	200	200.6	3.3	4.1	5.2	6.4	8.1
225	225	225.7	3.7	4.6	5.8	7.2	9.1
250	250	250.8	4.1	5.1	6.5	8.0	10.2
280	280	280.9	4.6	5.7	7.2	9.0	11.4
315	315	316.0	5.1	6.4	8.1	10.1	12.8
355	355	356.1	5.8	7.2	9.2	11.4	14.4
400	400	401.2	6.5	8.1	10.3	12.8	16.2
450	450	451.4	7.4	9.3	11.6	14.4	18.2
500	500	501.5	8.2	10.4	12.9	16.0	20.3
560	560	561.7	9.2	11.6	14.4	17.9	22.7
630	630	631.9	10.3	13.0	16.2	20.1	25.5
710	710	712.0	11.6	14.7	18.3	22.7	28.7
800	800	802.0	13.1	16.5	20.6	25.5	32.4
900	900	902.0	14.7	18.6	23.1	28.7	36.4
1000	1000	1002.0	16.4	20.7	25.7	31.9	40.5
1200	1200	1202.0	19.6	24.8	30.8	38.3	48.5

APL Apollo Ultima PVC-O pipes are supplied in total length of 6 metres (including the length limit mark for the socket).
The inside diameters may be subjected to variation according to manufacturing tolerances.

Dimensions

APL Apollo Ultima PVC-O 450 (C1.4 Pipe)							
Nominal Pressure (bar)			PN10	PN12.5	PN16	PN20	PN25
Nominal Diameter (DN)	Outside Diameter (OD)		Wall Thickness	Wall Thickness	Wall Thickness	Wall Thickness	Wall Thickness
	min.	max.					
mm	mm	mm	mm	mm	mm	mm	mm
63	63	63.3	1.1	1.3	1.7	2.1	2.6
75	75	75.3	1.3	1.6	2.0	2.4	3.1
90	90	90.3	1.5	1.9	2.4	2.9	3.7
110	110	110.4	1.8	2.3	2.9	3.6	4.5
125	125	125.4	2.1	2.6	3.3	4.0	5.1
140	140	140.5	2.3	2.9	3.6	4.5	5.7
160	160	160.5	2.6	3.3	4.2	5.1	6.5
180	180	180.6	3.0	3.7	4.7	5.8	7.3
200	200	200.6	3.3	4.1	5.2	6.4	8.1
225	225	225.7	3.7	4.6	5.8	7.2	9.1
250	250	250.8	4.1	5.1	6.5	8.0	10.2
280	280	280.9	4.6	5.7	7.2	9.0	11.4
315	315	316.0	5.1	6.4	8.1	10.1	12.8
355	355	356.1	5.8	7.2	9.2	11.4	14.4
400	400	401.2	6.5	8.1	10.3	12.8	16.2
450	450	451.4	7.4	9.3	11.6	14.4	18.2
500	500	501.5	8.2	10.4	12.9	16.0	20.3
560	560	561.7	9.2	11.6	14.4	17.9	22.7
630	630	631.9	10.3	13.0	16.2	20.1	25.5
710	710	712.0	11.6	14.7	18.3	22.7	28.7
800	800	802.0	13.1	16.5	20.6	25.5	32.4
900	900	902.0	14.7	18.6	23.1	28.7	36.4
1000	1000	1002.0	16.4	20.7	25.7	31.9	40.5
1200	1200	1202.0	19.6	24.8	30.8	38.3	48.5

APL Apollo Ultima PVC-O pipes are supplied in total length of 6 metres (including the length limit mark for the socket).
The inside diameters may be subjected to variation according to manufacturing tolerances.

Dimensions

APL Apollo Ultima PVC-O 450 (C 1.6 Pipe)							
Nominal Pressure (bar)			PN10	PN12.5	PN16	PN20	PN25
Nominal Diameter (DN)	Outside Diameter (OD)		Wall Thickness	Wall Thickness	Wall Thickness	Wall Thickness	Wall Thickness
	min.	max.					
mm	mm	mm	mm	mm	mm	mm	mm
63	63	63.3	1.2	1.5	1.8	2.3	2.9
75	75	75.3	1.4	1.8	2.2	2.7	3.4
90	90	90.3	1.7	2.1	2.6	3.3	4.1
110	110	110.4	2.0	2.6	3.2	4.0	5.0
125	125	125.4	2.3	2.9	3.6	4.5	5.6
140	140	140.5	2.6	3.2	4.0	5.1	6.3
160	160	160.5	2.9	3.7	4.6	5.8	7.2
180	180	180.6	3.3	4.2	5.2	6.5	8.1
200	200	200.6	3.6	4.6	5.7	7.2	9.0
225	225	225.7	4.1	5.2	6.4	8.1	10.1
250	250	250.8	4.5	5.8	7.2	9.0	11.2
280	280	280.9	5.1	6.4	8.0	10.1	12.5
315	315	316.0	5.7	7.2	9.0	11.4	14.1
355	355	356.1	6.4	8.2	10.1	12.8	15.9
400	400	401.2	7.2	9.2	11.4	14.4	17.9
450	450	451.4	8.3	10.3	12.8	16.2	20.1
500	500	501.5	9.2	11.4	14.2	18.0	22.3
560	560	561.7	10.3	12.8	15.9	20.2	25.0
630	630	631.9	11.6	14.4	17.9	22.7	28.1
710	710	712.0	13.1	16.2	20.2	25.6	31.7
800	800	802.0	14.7	18.3	22.7	28.8	35.7
900	900	902.0	16.5	20.6	25.5	32.4	40.2
1000	1000	1002.0	18.4	22.8	28.4	36.0	44.6
1200	1200	1202.0	22.0	27.4	34.0	43.2	53.5

APL Apollo Ultima PVC-O pipes are supplied in total length of 6 metres (including the length limit mark for the socket).
The inside diameters may be subjected to variation according to manufacturing tolerances.

Joints and Watertight Seals

The connection process involves inserting the male part of the pipe into the socket of the other, where an elastic joint is positioned. The watertight seal consists of a Polypropylene ring and a synthetic rubber lip, ensuring that the seal seamlessly integrates with the pipe and prevents joint displacement or movement during installation. APL Apollo Ultima PVC-O pipes feature a mark on the spigot, serving as the designated limit for the insertion of the male end during installation, ensuring water tightness. The length limit for assembling the pipes is determined by the distance from the beveled end of the pipe to the printed cutting mark.

Nominal Diameter (DN)	Minimum Depth of Engagement, M_{min}	Minimum Mean Inside Diameter of Socket
mm	mm	mm
63	58	63.4
75	60	75.4
90	61	90.4
110	64	110.5
125	66	125.5
140	68	140.6
160	71	160.6
180	73	180.7
200	75	200.7
225	78	225.8
250	81	250.9
280	85	281.0
315	88	316.1
355	90	356.2
400	92	401.3
450	95	451.5
500	97	501.6
560	101	561.8
630	105	632.0
710	109	712.1
800	114	802.1
900	120	902.1
1000	125	1002.1
1200	136	1202.1

The value of mmin is calculated from the equations given below and as applicable:

$m_{min} = 50mm + 0.22d_n - 2e$ when $d_n \geq 280$, and

$m_{min} = 70mm + 0.15d_n - 2e$ when $d_n \geq 280$

The value obtained shall be rounded to the next greater 1 mm.

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.

Assembly

To carry out the assembly, it is essential to apply lubricant on the chamfer of the spigot end and on the rubber ring joint. Push the components by hand until the mark on the spigot end is no longer visible.

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

Fittings

TAPPING SADDLES

It permits connecting the pipe perpendicular to various fittings, including house connections, valves, purges, vents, etc. These pipes are accessible with screw ends and flange ends. The saddle ding joint prevents displacement or movement during the installation process.

The saddle must become in solidarity with the pipe. Multidiameter saddles must not be used, but specific PVC saddles for each DN.

Anti-Traction System Flange

Enables the connection of spigot ends to various fittings that are flange-connected, including valves, elbows, tees, DN reductions, caps, and more.

Anti-traction system makes the pipe absolutely fixed to the flange.

Euro Type Plug Fittings

Connecting the fitting directly to the pipe enables the incorporation of bends, reductions, and connections in the network, including elbows, tees, DN reductions, etc.

It is very important to fix the fitting to the ground in order to guaranty the net structural resistance.

APL Apollo pipes are compatible with a diverse array of fittings. Please contact our technical service for guidance on suitable fittings.

Water Hammer

To calculate potential excess pressures (P) generated by water hammers, the celerity (α) must be initially determined. This characteristic, specific to both the pipe and the transported fluid, assesses the variation in water speed (V) that may occur during valve openings and closings or when starting up or shutting down the pump.

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

APL Apollo Pipes PN16 (230 PSI) PIPES

V	a	P (water hammer)	
m/s	m/s	m	bar
0.5	293	15	1.5
1.0	293	30	3.0
1.5	293	45	4.5
2.0	293	60	6.0
2.5	293	75	7.5
3.0	293	90	9.0
3.5	293	105	10.5
4.0	293	119	11.9

K9 DUCTILE IRON PIPES

V	a	P (water hammer)	
m/s	m/s	m	bar
0.5	1100	56	5.6
1.0	1100	112	11.2
1.5	1100	168	16.8
2.0	1100	224	22.4
2.5	1100	280	28.0
3.0	1100	336	33.6
3.5	1100	392	39.2
4.0	1100	449	44.9

Airlocks in pipes during the filling process can be highly detrimental when water hammers occur, leading to excess pressure levels beyond those outlined in the tables above. Hence, it is crucial to adhere to the following recommendations:

Fill the pipe at a low speed (approximately 0.05 m/s) and at the lowest point in the pipe system.

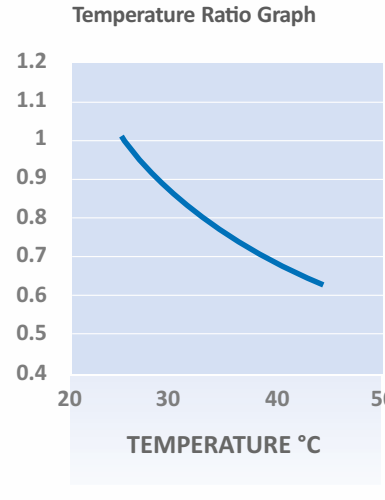
- Install purging mechanisms (double-effect suction mechanisms) at the highest points in each section of the pipe.
- During filling, ensure that elements capable of expelling air (valves) remain open, closing them from the bottom to the top as the pipe fills with water.

Reduction ratios: Temperature and Application

High temperatures (exceeding 25 °C) or challenging and aggressive applications may diminish the Allowable Operating Pressure (PFA) of pipes compared to the Nominal Pressure (NP).

$$PFA = PN \cdot f_T \cdot f_A$$

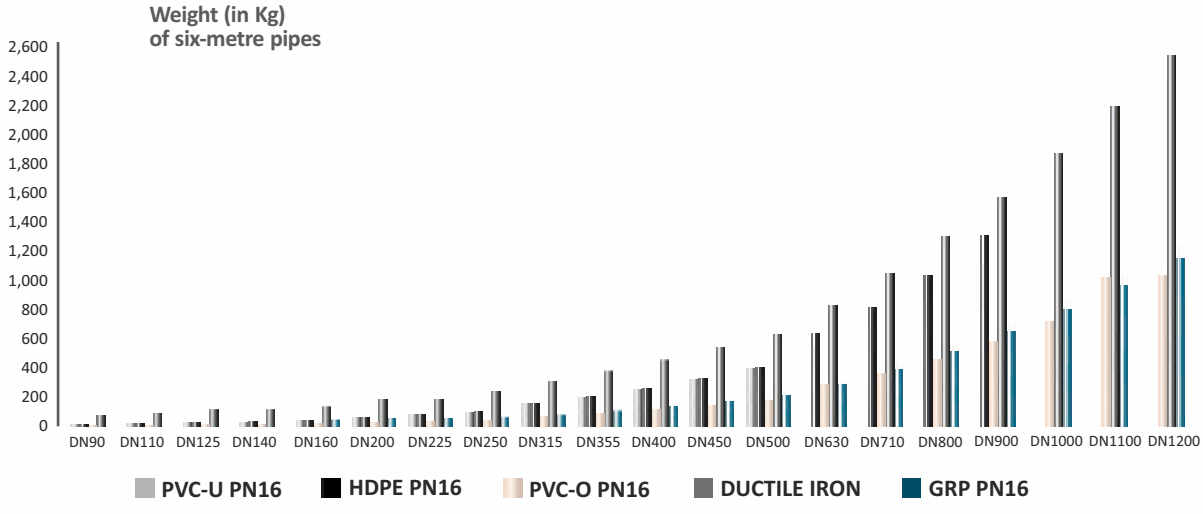
The derating factor (fT) based on the operating temperature can be derived from the graph provided. The derating factor associated with the system's application (fA) must be determined by the Project Manager.

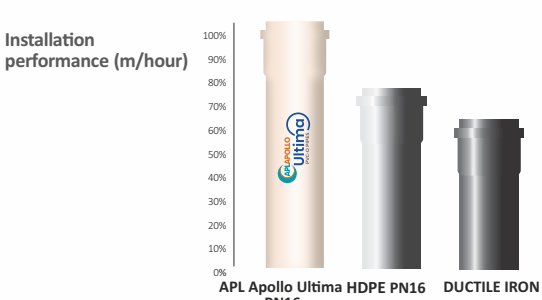


Note: Project design and execution is responsibility of the Project Manager and the Contractor, respectively.

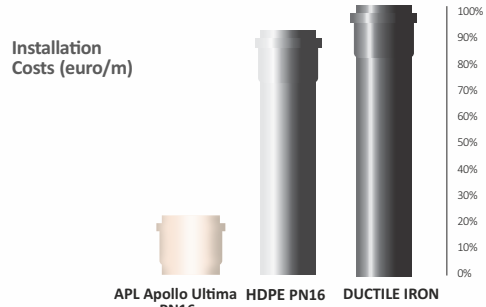
Quick, low-priced installation

APL Apollo Ultima PVC-O pipes weigh less than half of PVC and HDPE pipes, translating to six to twelve times less per linear meter than ductile iron pipes of the same nominal external diameter. Their lightweight nature allows manual lifting without the need for mechanical assistance (cranes, hoists, etc.) up to a diameter of DN315 mm, thereby reducing overall installation costs.





Figures for DN 200-250 mm



Figures for DN 200-250 mm

The high resistance of APL Apollo Ultima PVC-O pipes presents notable benefits in terms of unloading, trench installation, and pipe-to-pipe connections. Additionally, their ease of connection facilitates high performance, making them accessible for handling and installation by less experienced workers without the need for machinery (up to DN 315). Consequently, APL Apollo Ultima PVC-O pipes offer substantial advantages in terms of meters installed per installation hour compared to alternative solutions.

Transport and Storage

The characteristics of APL Apollo Ultima PVC-O pipes make transportation and storage straightforward, resulting in significant cost savings. To enhance transportation efficiency, it is recommended to adhere to the following guidelines:

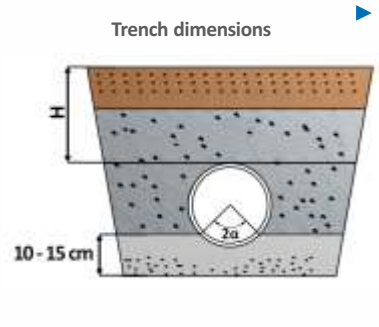
When transporting different diameters in the same batch, place the larger diameters below:

- Keep the sockets free, alternating sockets and free ends.
- For storage without causing damage to the pipes:

INSTALLATION

- Store the pipes horizontally on a flat surface, spaced 1.5 meters apart on supports to prevent bowing.
- Avoid stacking higher than 1.5 meters.
- Leave the sockets free, alternating sockets and free ends.
- If storing pipes in direct sunlight, cover the pallets with opaque material and ensure ventilation to prevent overheating. Light-colored protective material that reflects solar radiation is preferable to prevent pipe overheating.

Excavation



While APL Apollo Ultima PVC-O pipes can be used for various applications, they are particularly recommended for underground installations. The trench dimensions will depend on the expected loads, such as road traffic and soil types. As a general guideline, in the absence of road traffic, the minimum depth of the pipes should be 0.6 metres (60 cm), while in the presence of road traffic, the minimum depth is 1 metre. The minimum width of the trench can be calculated using provided tables. Ensure the bottom of the trench is uniform, homogeneous, and provides solid support along the entire length of the pipe.

DN (mm)	Minimum with of trench B (m)
90-250	0.60
315	0.85
355	1.10
400	1.10
450	1.15
500	1.20
630	1.35

DN (mm)	Minimum with of trench B (m)
710	1.60
800	1.65
900	1.75
1000	1.85
1100	1.95
1200	2.05

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

Assembly

- Verify that joints are clean both inside the pipe and outside.
- To ease assembly, it is recommended to apply lubricating soap to the sockets and free ends.
- Align the pipe ends and fit the sockets into place.
- For joining pipes, levers (using materials that won't damage the pipes, such as wood) or slings can be employed. With small diameters, the elastic joint system and lightweight nature of the pipe allow coupling with a quick, short movement of the hand.

Angular Deviation

Angular deviations are permissible in the union system, enabling the piping to be routed along a preferred line.

DN	Maximum angular deviation	Displacement between sockets
(mm)	Angle (°)	D (mm) [1]
90-1200	2°	200

(1) Pipes not exceeding 5.95 metres in length.

Anchoring

Pipes experiencing internal hydrostatic pressure also encounter thrust forces at each point of directional change (angular deviations, elbows, curves, etc.) and in components altering the pipe's cross-section, such as valves, branches, overflows, etc. These forces can be formidable, potentially causing ground movement and pipe disconnection. In broad terms, thrust forces can be assessed using the following formula:

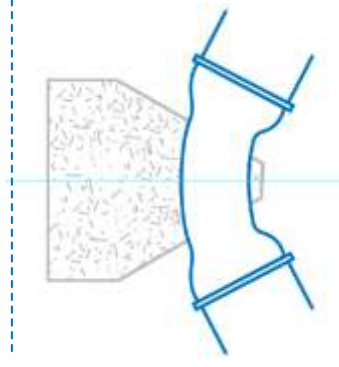
$$\text{Force(kg)} = k \cdot \text{Pressure (bar)} \cdot \text{Pipe Cross Section (cm}^2\text{)}$$

In caps and tees at 90°: K=1

$$\text{In reducers: } k = 1 - = \frac{\text{Smallest cross-section}}{\text{Biggest cross-section}}$$

$$\text{In changes of direction: } k = 2 \cdot \text{sen } \frac{\beta}{2}$$

Anchoring at points of change of direction



It is crucial to pour the concrete directly into the pre-positioned ground, ensuring it possesses the necessary mechanical strength. When planning the anchoring process, consider leaving the joints free to facilitate subsequent inspections during hydraulic trials.

Bedding and Filling the Trench

For a detailed examination of the best and most effective method for preparing the bedding to support the pipe, as well as for the subsequent backfilling and compaction of the surrounding soil, please refer to our installation instructions or reach out to our technical and commercial service.

Fiels trials and Entry into Service

The EN 805:2000 Water Supply Standard is applicable to all aspects of on-site trials and Entry into Service. During installation, it is crucial to conduct trials on completely laid pipeline sections, with the length varying between 500 and 1,000 meters. Seal the ends of each pipeline section using suitable components, and ensure that the joints are partially filled with the entire pipeline visible.

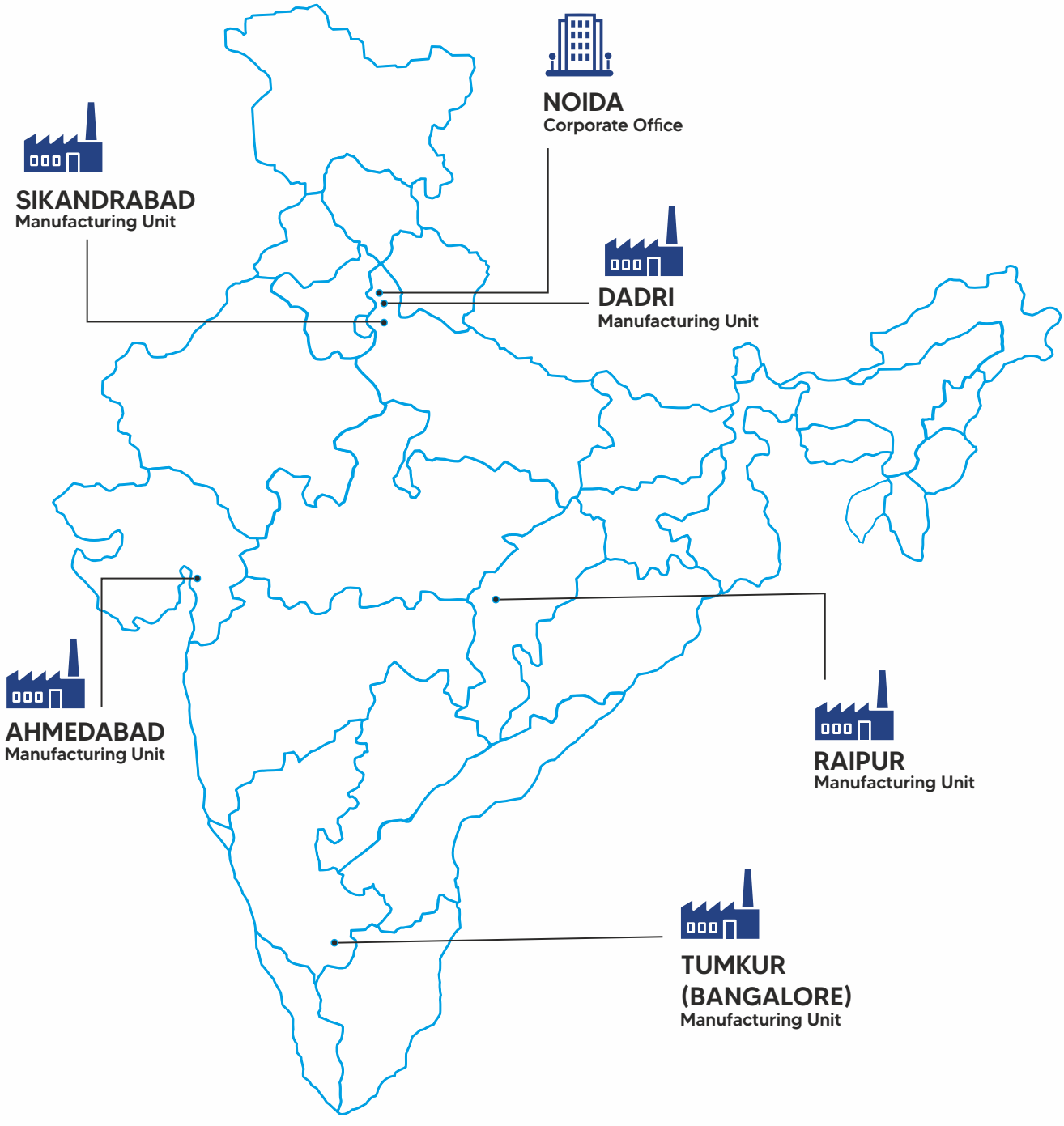
The trial pressure (STP) in N/mm2 (0.1 N/mm2 = 1 atm) is determined as follows:

a) If the water hammer has been precisely calculated: STP = MDP + 0.1

b) If the water hammer is estimated, use the lesser value between the following two options: STP = MDP + 0.5 and STP = 1.5 MDP

MDP represents the Maximum Design Pressure, which is the maximum allowable pressure in a pipe, accounting for the impact of a water hammer. The Entry into Service of drinking water piping must adhere to the necessary health standards for human consumption.

OUR PRESENCE



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