

WATSAN **ENGINEERING** **SERVICES**

PIPING SOLUTIONS FOR A BETTER FUTURE

HDPE PIPE

Applications

- Water Supply
- Waste Water
- Natural Gas
- Industrial RO, HVAC
- Fire Fighting
- Fish Farming
- Agriculture
- Mining
- Marine
- Compressed Air



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High Density Polyethylene Pipes PE-100



Introduction

Watsan Engineering Services was established in 2010 as a trading company of HDPE Pipes and fittings for Water, Wastewater, Gas, Compressed Air, Chilled/RO Water, Liquid Chemical i.e Acidic water and effluent water treatment plants, as well as Agricultural drip irrigation pipes and fittings.

Watsan Engineering Establishment manufacturing facilities in 2016 for HDPE, MDPE, **PPR-C**, **uPVC Pipes** & Fittings with state-of-the-art Pipes Production Machines with Injection Moulding Machines with ITALIAN PLAST Brand.

Our company is ISO 9001-2000 certified and also certified from PSQCA as approved with different government, Public Sector Organizations, Water Management Department as well leading Industries all over Pakistan as well serving with best quality products.

HDPE Pipes Applications

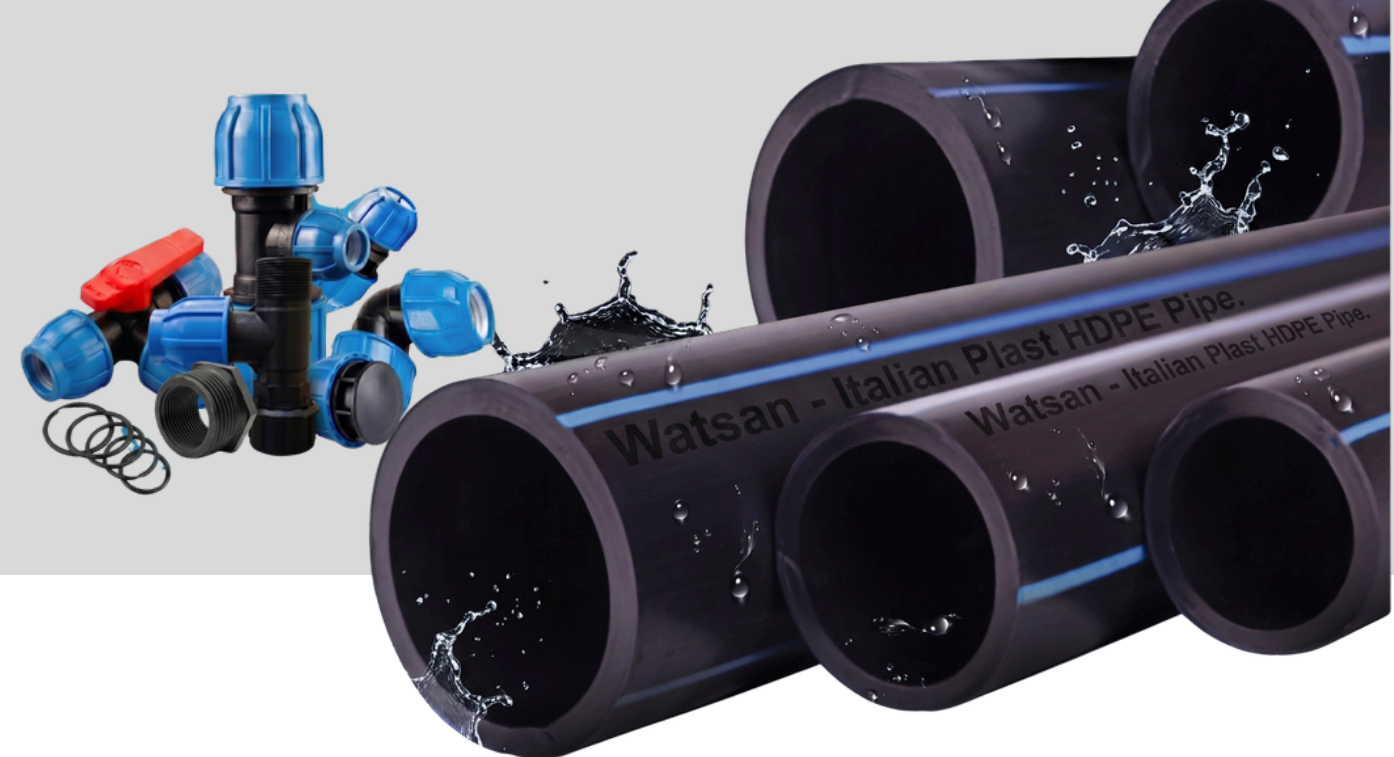
Compression fittings can be used for several domestic, municipal, industrial and utility services. The following are the most used applications. Potable water supply networks

- Sprinkler Irrigation Systems & Drip Irrigation Systems variety
- Handling Saline Water, Sea water intake
- Suction & delivery of Water with Pump sets
- Bore well application for submersible pumps
- Submarine & Underwater pipelines
- Horizontal and Directional Drilling
- Septic Tank/ Leach Bed Lines, Condensates, Aeration & Caustic Lines
- Conveying corrosive effluents of chemical & other process industries like Petrochemicals, Dyestuff, Paints, Rayon & Fertilizers

- Water & Wastewater Treatment plants/Corrosive & Reclaimed Water
- Handles edible oils, fruit juices & pulps, Milk and other Food Materials.
- Ducting for Air Conditioning, Ventilation, Fiber Optic and Electric cables
- Sewer, Storm and Sanitary Pipelines
- Diffuser, Outfalls & Dredging Applications
- Treats Radio-active waste
- Conveys acids, alkalis & other highly corrosive chemicals
- Fish Farming
- Hydro transport systems - Cement/ Clinker, Coal, Sand slurry & other abrasive slurries like ironer, fly ash conveyance, etc.

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Typical Physical Properties Of HDPE Material

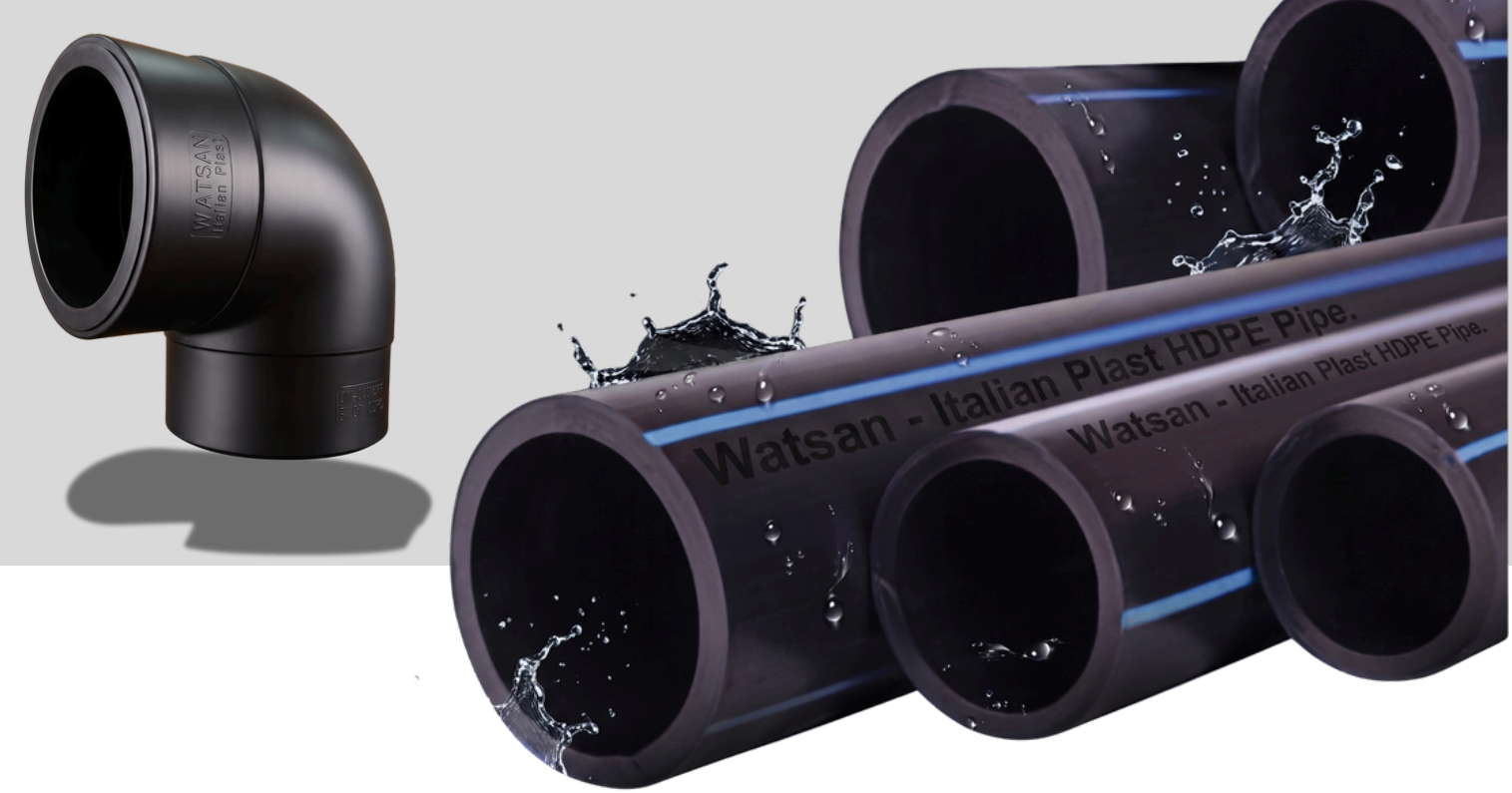
Property		PE80		PE100	
		Typical Value	Unit	Typical Value	Unit
Density	(Base resin)	946	Kg/m ³	949	Kg/m ³
Density	(Compound)	956	Kg/m ³	959	Kg/m ³
Melt Flow Rate	(190°C/2.16Kg)	<0.1	g/10min	<0.1	g/10min
Melt Flow Rate	(190°C/5.0 Kg)	0.3	g/10min	0.3	g/10min
Tensile Stress at Yield	(50mm/min)	22	Mpa	25	Mpa
Tensile Modulus	(50mm/min)	1000	Mpa	-	
Elongation at Yield		9	%	-	
Elongation at Break		>600	%	>800	%
Charpy Impact, notched	(0 °C)	14	Kj/m ²	16	Kj/m ²
Hardness, Shore D		-		60	-
Carbon Black Content		>2	%	>2	%
Brittleness Temperature		< -70	°C	< -70	°C
ESCR	(10% Igepal)	>10000	h	>10000	h
Thermal Stability	(210°C)	>15	min	>15	min

General Properties Of HDPE Pipes

- **Abrasion Resistance** HDPE pipes have excellent resistance to abrasion/ wear. Due to this unique property, these pipes are used for dewatering, dredging in ports, and transportation of abrasive slurries and sand stowing of mines.
- **Flexibility** The flexibility of HDPE pipe allows it to adapt to the contour of the land as well as to directional changes. In some cases, the flexibility of HDPE pipes reduces the need for fittings & saves installation costs. It can bend to a minimum radius of 20 to 40 times the pipe diameter.
- **Flow Factors** HDPE pipes have a very smooth internal surface. Smooth internal surface offers excellent flow characteristics and minimum pressure losses. Lower friction leads to energy savings in pumping of liquids.
- **Life Expectancy** HDPE pipes have a projected life expectancy of 50 years transporting water at 20 deg. C.
- **Lightweight** It is lighter than Mild steel, Stainless steel, Concrete & Cast Iron. It is easier to handle & install as compared to the above materials. Density = 0.95kg/cm³
- **Toughness** HDPE has low notch sensitivity, high tear strength & excellent scratch & abrasion resistance. Its resistance to environmental stress cracking is outstanding.
- **UV Protection** As Black colored HDPE pipe contains 2 to 2.5% carbon black, it can be safely stored for some time outside in the sun without being damaged from U.V exposure
- **Welding** HDPE pipe can be joined by mechanical & butt-fusion methods. In butt-fusion, the strength of the joint is stronger than the pipe itself & the welding is homogenous. It can be flanged, tapped and reduced, like other piping materials.
- **Coiled Pipe** HDPE Pipe is available in coil form up to 200mtrs (for sizes 20 mm up to 63 mm dia.) and up to 100 mtrs (for sizes 75 mm to 110 mm dia). It leads to significant savings in installation/welding costs.
- **Corrosion Resistance** HDPE pipes are corrosion resistant, rust-proof, rot, or corrode.
- **Leak Proof** Leak-tight, Heat-fused joints create a homogeneous, monolithic system.
- **Joining** Polyethylene pipe is normally joined by heat fusion. Butt-Fusion Welding creates a joint that is as strong as or even stronger than the pipe itself, and is virtually leak-free.

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High Density Polyethylene Pipes PE-100



DESIGN CONSIDERATIONS

Internal Pressure

The burst pressure of polyethylene pipe is time dependant and therefore it is necessary to define the strength of the material at a reference lifetime.

The lifetime chosen for this reference value is 50 years. It should be noted that it does not mean that the pipeline will fail after 50 years, as the various safety factors that are incorporated into the design mean that the actual lifetime will be many times greater.

In order to generate the burst strength of the material at 50 years, a number of pipe samples are pressure tested to failure at lifetimes between 10 and 10,000 hours. The results of these tests are graphically or numerically analysed to obtain the minimum required strength (MRS) at 50 years. Thus, material classification PE 80 has a minimum required strength of 8 Mpa while PE 100 has a minimum required strength of 100 Mpa. Depending upon the operating conditions (eg: surge, elevated temperature, conveyance of gas, poor ground condition, etc). the pipeline engineer has the option to include additional design factors (safety factor) in order to account for the “unknown” loading or environmental conditions.

For polyethylene pipeline systems, the recommended design factor is 1.25, which enables the allowable operating pressure to be calculated for each system using Lamé's formula for thick-walled pipes;

$$\text{Hoop stress: } s = \frac{p}{2t}(D - t)$$

Where:

S = Hoop stress (Mpa)

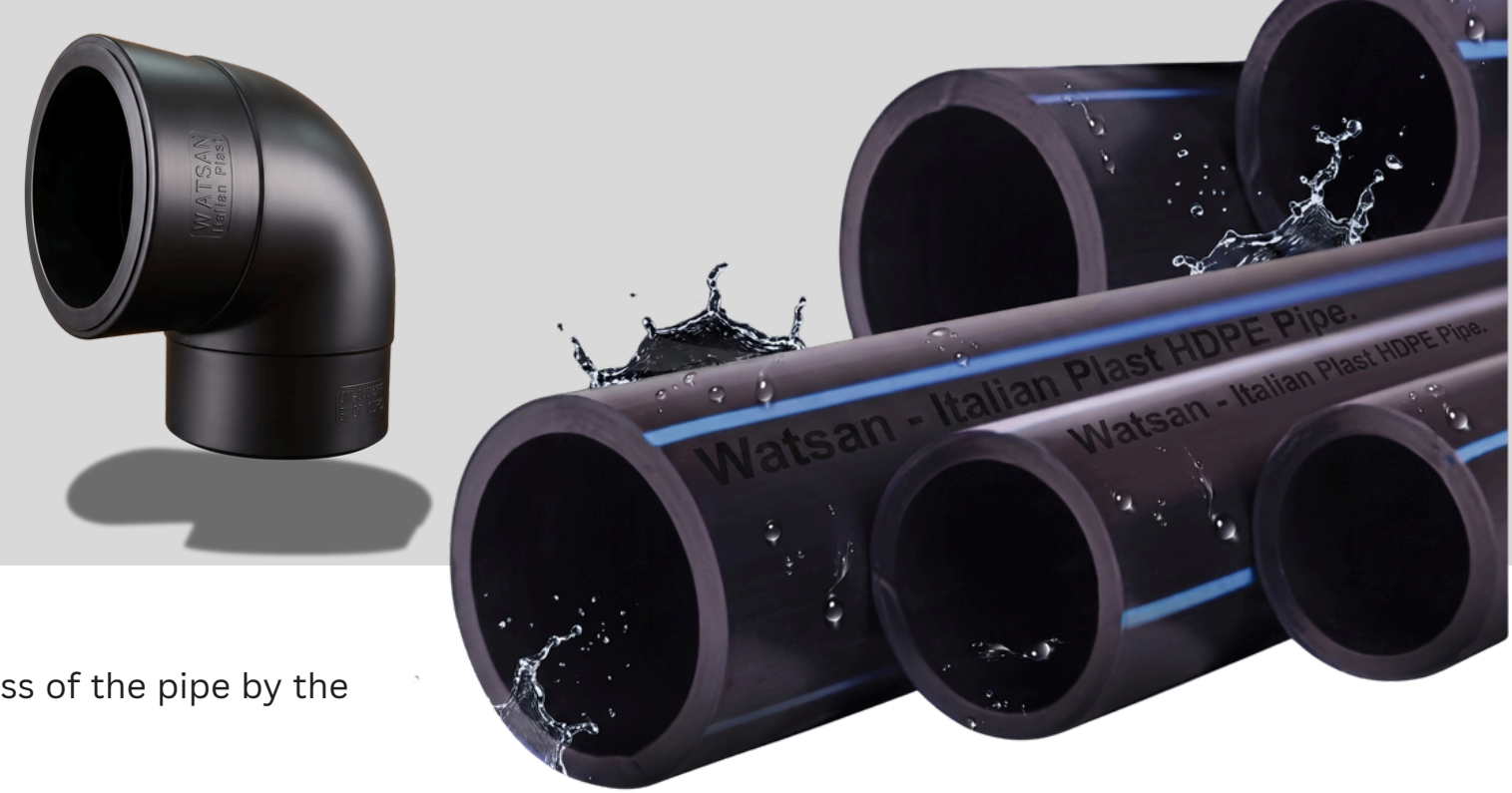
P=Max. operating pressure (Bar) D = Outside diameter(mm)

T = wall thickness (mm)

$$\text{Therefore: } s = \frac{p}{2} \left(\frac{D}{t} - 1 \right)$$

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Now the standard dimensional ratio (SDR) is related to the diameter and wall thickness of the pipe by the formula:

$$SDR = \frac{D}{t}$$

Therefore: $S = \frac{p}{2}(SDR - 1)$ or $P = \frac{2s}{(SDR - 1)}$

If this equation is applied to a polyethylene pipe system, it is possible to calculate the maximum allowable operating pressure (MOP) as given below.

$$MOP = \frac{2 \times MRS}{(SDR - 1) \delta} \quad , \quad \delta = \text{minimum design factor}$$

This equation gives the stress in MPa. For environmental use, and to express the pressure in bar rating, the value in MPa is multiplied by 10, for example:

For PE80: $MOP = \frac{2 \times 8 \times 10}{(SDR - 1) \times 1.25}$, $MOP = \frac{128}{(SDR - 1)}$

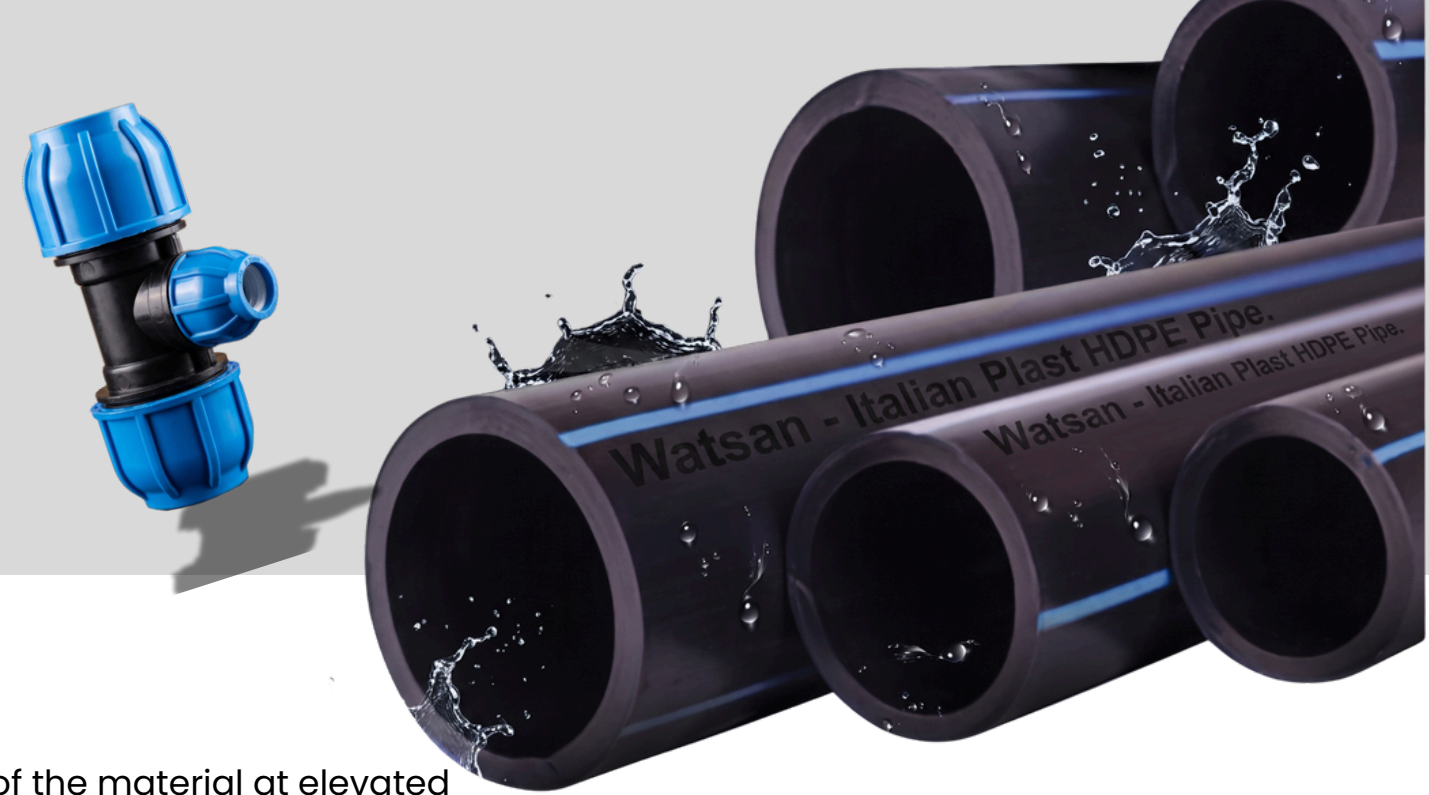
For PE100: $MOP = \frac{2 \times 10 \times 10}{(SDR - 1) \times 1.25}$, $MOP = \frac{160}{(SDR - 1)}$

In calculating the operating pressure, it is customary to round up or down the values to the nearest pressure class.

It should be noted that this pressure class will represent the maximum operating pressures for the pipeline, and additional considerations may cause engineers to reduce the operating pressure to a lower level. For example, on large-diameter PE80 pipelines where rapid crack propagation may be of concern.

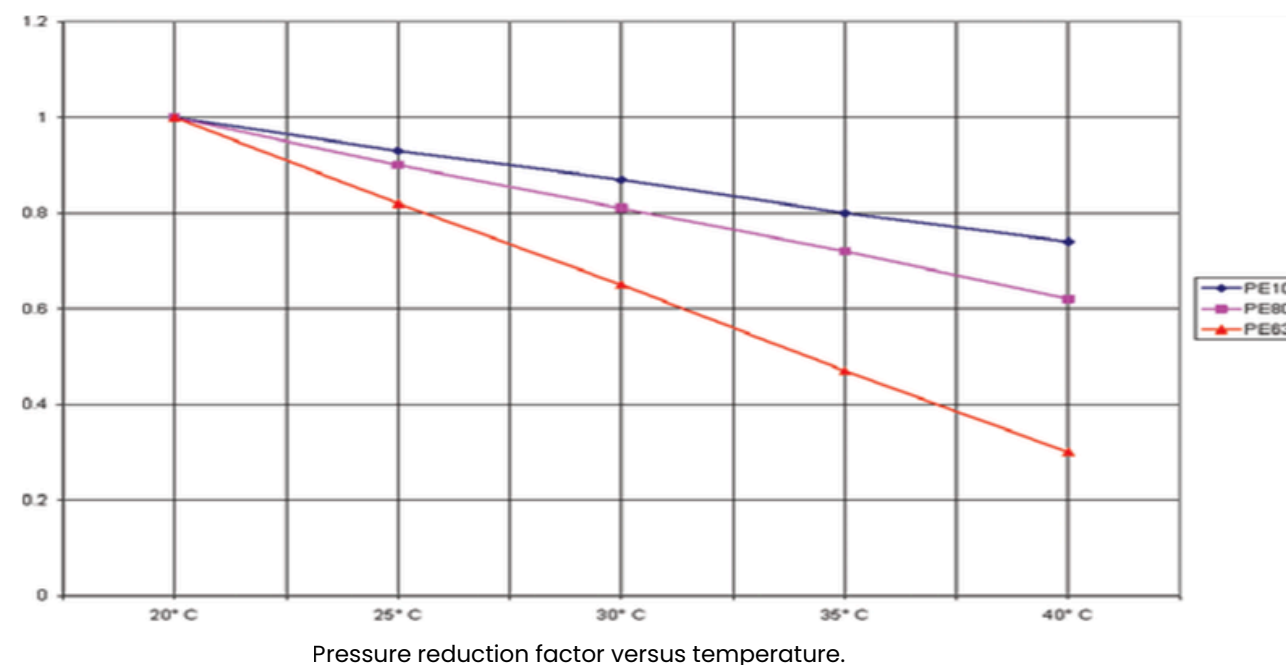
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ELEVATED TEMPERATURES

When operating a pipeline above 20°C it is important to allow reduction in the strength of the material at elevated temperatures. Pressure reduction factors at elevated temperatures up to 40°C applicable to a 50 year lifetime are given in the graph below.



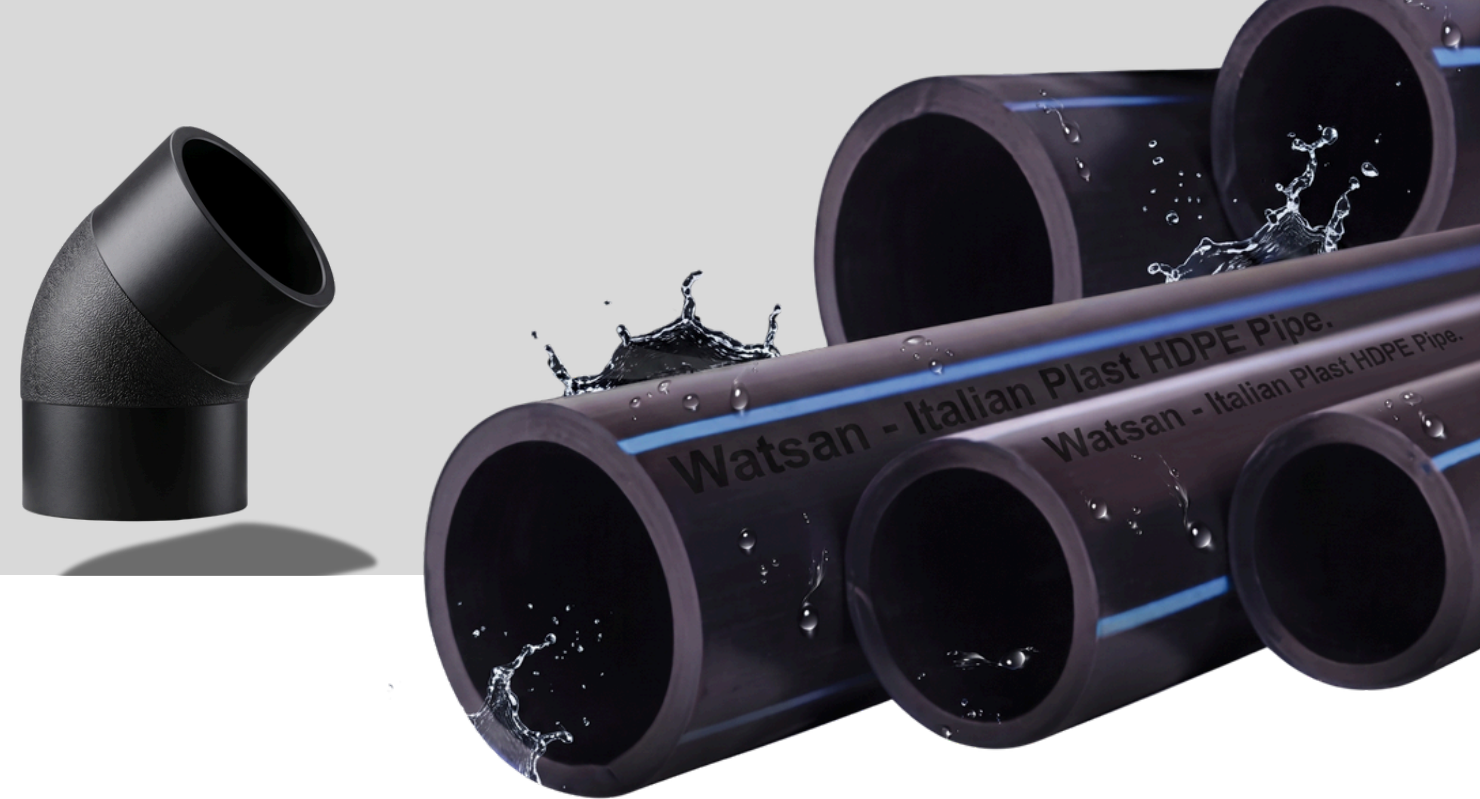
Pressure reduction factor versus temperature. When operating a pipeline above 20°C, it is important to allow for a reduction in the strength of the material at elevated temperatures.

Notch Sensitivity

Many materials may be extremely strong in laboratory tests but when they are notched or scored in handling, they become very brittle. The classic material in this category is glass, which is brittle enough to snap along a defined line when it is lightly scored. When laying a pipeline, it is common for the pipe surface to become lightly scored.

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High Density Polyethylene Pipes PE-100



This is particularly true when the pipe is being inserted into an existing main, or where trenchless laying methods are being used. In order to ensure that brittle failure will not develop in the short or long term from these surface notches, it is usual to carry out elevated temperature pressure tests on notched pipe samples. It is recommended that pipe with notches greater than 10 % of the wall thickness should not be used.

Fast Fracture

For virtually all materials, it is possible for a dynamic crack to grow along the pipe length provided that sufficient energy is available to overcome the material's resistance to crack growth. Fractures of this type have travelled many kilometres in welded steel pipelines and are only arrested by a valve or other pipeline fittings.

Over the past 10 years considerable test work has been carried to investigate the relevance of this mode of fracture to polyethylene pressure pipelines. The conclusions of this work may be summarized as follows.

Crack propagation cannot occur if the pipeline is full of water. However, if the pipeline contains 10% or more air, then propagation can occur.

Cracks will not propagate through fittings including flanges or electrofusion couplers. Therefore, the crack will be limited to one pipe length in these cases.

Crack propagation cannot occur in small diameter pipelines, and therefore only large pipelines need to be considered. The critical pressure at which rapid crack propagation will occur depends on the pipe material and the pipe diameter

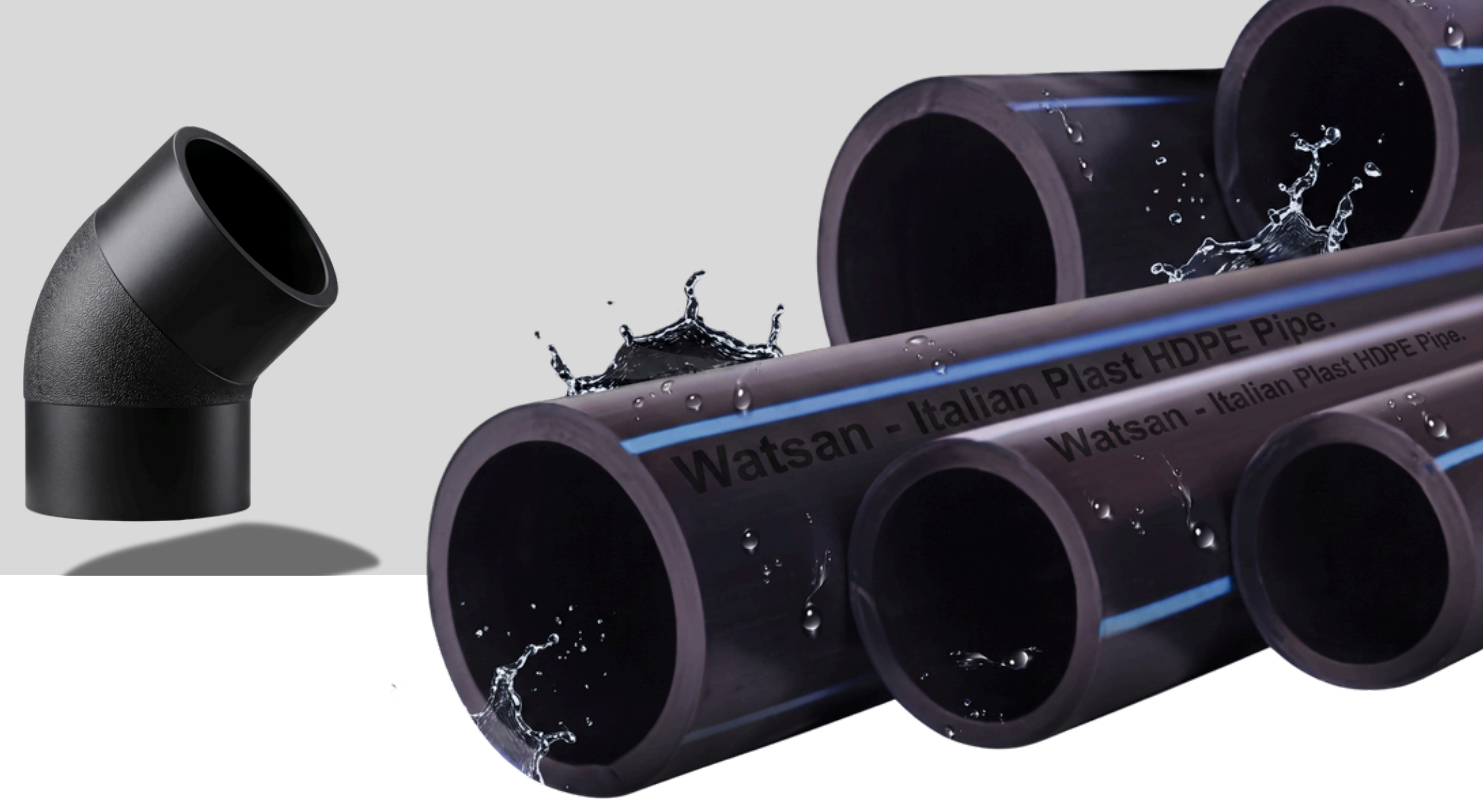
Notch Sensitivity

Polyethylene pipe is classified as hydraulically smooth. The hydraulic frictional coefficients used for design purposes are as follows:

1. Colebrook – white $K_s = 0.003$ mm
2. Hazen-Williams $C = 150$

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High Density Polyethylene Pipes PE-100



Pipe sizing and pressure drop can be determined using the flowchart below.

These are based on the Colebrook – white formula:

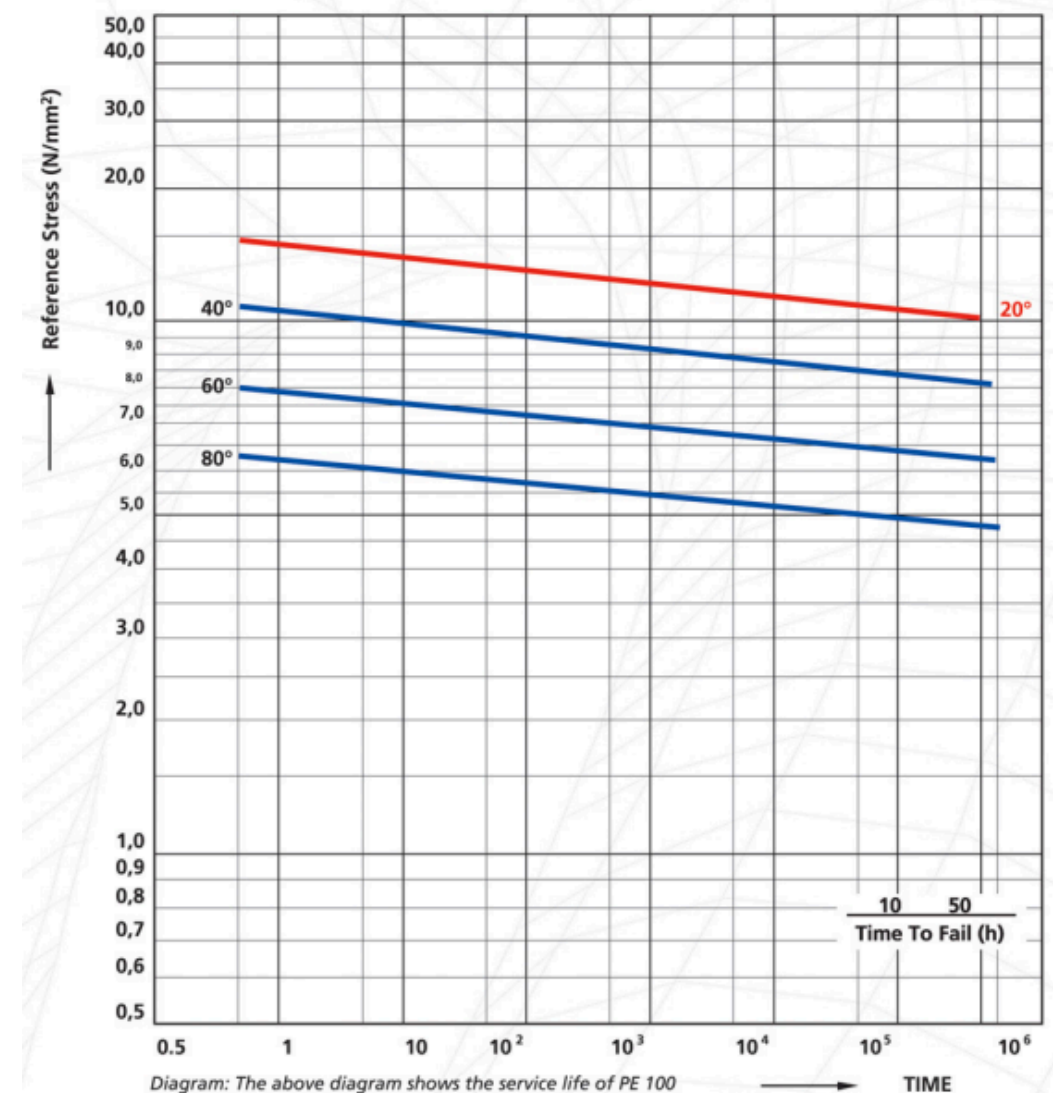
Where:

$$\frac{V}{2} = \sqrt{2gDi} \log \frac{Ks}{\frac{3.7}{D}} \quad 2.51v$$

V = velocity in m/sec; g= acceleration due to gravity 9.807m/sec², i = hydraulic gradient V = kinematic viscosity (a value of 1.141 x m²/s may be assumed for water at 15°C

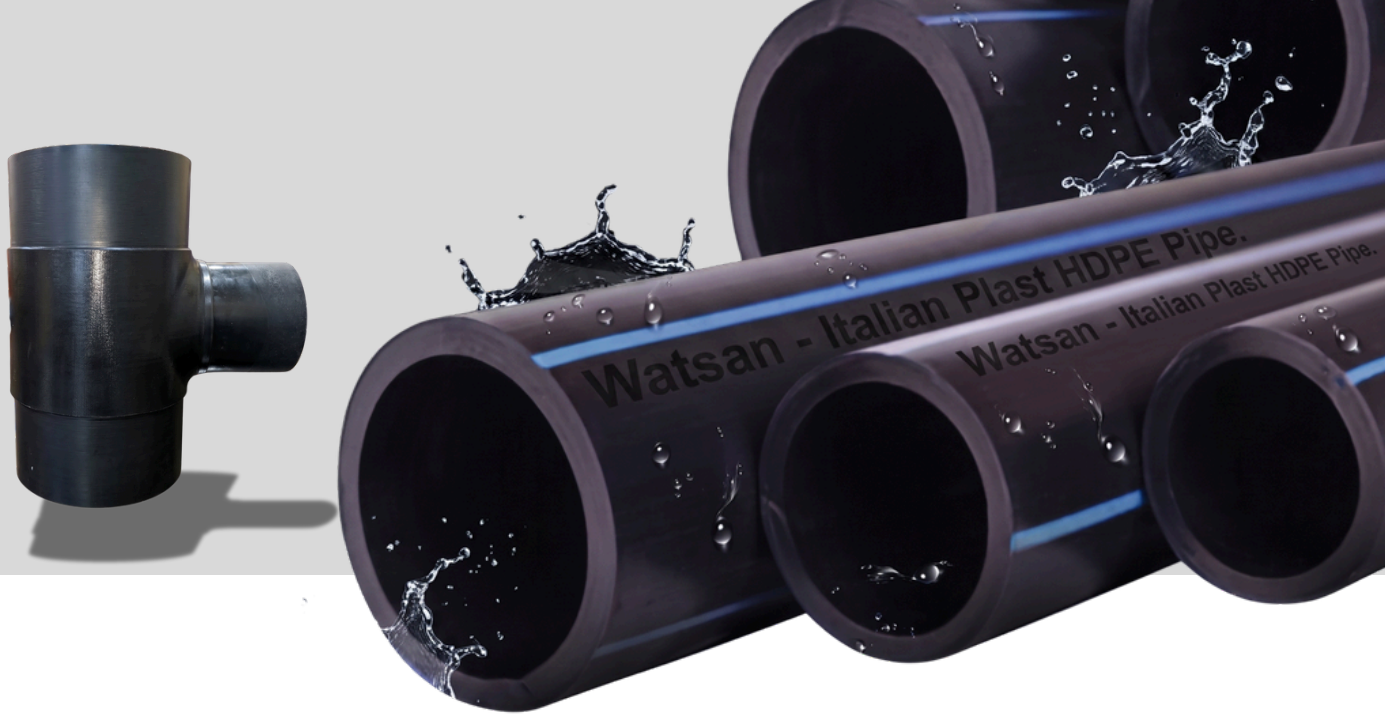
Ks = linear measure of roughness in mm = 0.03 D = mean internal diameter of pipe in meters.

Using the required design flow rate (L/ sec) the frictional head loss (m/ 1000m) and the flow velocity (m /sec) for various pipe sizes can be obtained from the flow chart.



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High Density Polyethylene Pipes PE-100



ISO 4427, DIN 8074/8075 & PS 3580

Pipe dimensions according to iso 4427 pipe wall thickness and classification

Wall Thickness Range											
S.No	Nominal Dia.	SDR-9		SDR-11		SDR-13.6		SDR-17		SDR-21	
	mm	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1	20	2.3	2.7	2	2.3	---	---	---	---	---	---
2	25	3	3.4	2.3	2.7	2	2.3	---	---	---	---
3	32	3.6	4.1	3	3.4	2.4	2.8	2	2.3	---	---
4	40	4.5	5.1	3.7	4.2	3	3.5	2.4	2.8	2	2.3
5	50	5.6	6.3	4.6	5.2	3.7	4.2	3	3.4	2.4	2.8
6	63	7.1	8	5.8	6.5	4.7	5.3	3.8	4.3	3	3.4
7	75	8.4	9.4	6.8	7.6	5.6	6.3	4.5	5.1	3.6	4.1
8	90	10.1	11.3	8.2	9.2	6.7	7.5	5.4	6.1	4.3	4.9
9	110	12.3	13.7	10	11.1	8.1	9.1	6.6	7.4	5.3	6
10	125	14	15.6	11.4	12.7	9.2	10.3	7.4	8.3	6	6.7
11	140	15.7	17.4	12.7	14.1	10.3	11.5	8.3	9.3	6.7	7.5
12	160	17.9	19.8	14.6	16.2	11.8	13.1	9.5	10.6	7.7	8.6
13	180	20.1	22.3	16.4	18.2	13.3	14.8	10.7	11.9	8.6	9.6
14	200	22.4	24.8	18.2	20.2	14.7	16.3	11.9	13.2	9.6	10.7
15	225	25.2	27.9	20.5	22.7	16.6	18.4	13.4	14.9	10.8	12
16	250	27.9	30.8	22.7	25.1	18.4	20.4	14.8	16.4	11.9	13.2
17	280	31.3	34.6	25.4	28.1	20.6	22.8	16.6	18.4	13.4	14.9
18	315	35.2	38.9	28.6	31.6	23.2	25.7	18.7	20.7	15	16.6
19	355	39.7	43.8	32.2	35.6	26.1	28.9	21.1	23.4	16.9	18.7
20	400	44.7	49.3	36.3	40.1	29.4	32.5	23.7	26.2	19.1	21.2
21	450	50.3	55.5	40.9	45.1	33.1	36.6	26.7	29.5	21.5	23.8
22	500	55.8	61.5	45.4	50.1	36.8	40.6	29.7	32.8	23.9	26.4
23	560	62.2	68.9	50.8	56	41.2	45.5	33.2	36.7	26.7	29.5
24	630	70.3	77.5	57.2	63.1	46.3	51.1	37.4	41.3	30	33.1

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High Density Polyethylene Pipes PE-100



TECHNICAL SPECIFICATIONS FOR HDPE

Pressure Rating of Watsan HDPE PE-100 Pipes

Manufactured with a pressure rating of PN 16 and in strict compliance with ISO 4437, Watsan HDPE PE-100 gas pipes are engineered specifically for underground natural gas distribution. They are lightweight, highly flexible, and guarantee a long lifespan while operating optimally in extreme temperatures ranging from -40°F to 140°F.

Identification

Watsan HDPE PE-100 pipes are commonly manufactured in Orange colour.

Size Range

HDPE PE-100 Pipes size range is **20mm, 32mm,40mm, 125mm, 180mm, 250mm.**

Feature / Specification	Details
Pipe Type	HDPE PE-100 Gas Pipe
Measurement Standard	Outer Diameter (OD)
Size Range	20mm - 250mm.
Length Availability	Available in various lengths

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High Density Polyethylene Pipes - PE-80



TECHNICAL SPECIFICATIONS FOR MDPE PE-80

Pressure Rating of Watsan MDPE PE-80 Pipes

Manufactured with a pressure rating of SDR11 and in strict compliance with ISO 4437, Watsan MDPE PE-80 gas pipes are engineered specifically for underground natural gas distribution. They are lightweight, highly flexible, and guarantee a long lifespan while operating optimally in extreme temperatures ranging from -40°F to 140°F.

Identification

Watsan MDPE PE-80 pipes are commonly manufactured in Yellow colour.

Size Range

MDPE PE-80 Pipes size range is ¾", 1-¼", 2", 4", and 6".

Feature / Specification	Details
Pipe Type	MDPE PE-80 Gas Pipe
Measurement Standard	Outer Diameter (OD)
Size Range	¾ " , 1-¼" , 2" , 4" and 6" .
Length Availability	L-100M ,L-12M



TECHNICAL SPECIFICATIONS FOR PPR-C

Pressure Rating of Watsan PPR-C Pipes

Manufactured with a pressure rating of PN16 and PN20 and in strict compliance with DIN 8077/8078, premium PPR-C pipes are engineered specifically for hot and cold potable water distribution. They are lightweight, highly corrosion-resistant, and guarantee a long lifespan while operating optimally in extreme temperatures ranging from 32°F to 203°F.

Identification

Watsan PPR-C Pipes are commonly manufactured in Green colour.

Size Range

PPR-C Pipes size range is **20mm, 25mm, 32mm, 40mm, 50mm, 63mm, 75mm, 90mm, 110mm. upto 250mm.**

Feature / Specification	Details
Pipe Type	PPR-C Pipes
Measurement Standard	Outer Diameter (OD)
Size Range	20mm - upto 250mm.
Length Availability	L-4M - L-6M

TECHNICAL SPECIFICATIONS FOR uPVC

Pressure Rating of Watsan uPVC Pipes

Manufactured in comprehensive pressure ratings—including Class B (6 bar), Class C (9 bar), Class D (12 bar), and Class E (15 bar)—and in strict compliance with BS 3505 and ISO 1452 standards, Watsan uPVC pipes are engineered specifically for both pressurized water distribution and underground sewerage systems. They are lightweight, exceptionally chemical-resistant, and guarantee a long lifespan while operating optimally in extreme temperatures ranging from 32°F to 140°F.

Identification

Watsan uPVC pipes are commonly manufactured in Grey or White colour.

Size Range

- Sewerage Pipes: 50mm, 75mm, 110mm, 160mm, and 200mm
- Pressure Pipes: ½", ¾", 1", 1¼", 1½", 2", 3", 4", 6", 8", 10", and 12"

Feature / Specification	Details
Pipe Type	uPVC pipes
Measurement Standard	Inner Diameter (ID)
Size Range	½" - 12"
Length Availability	L-4M - L-6M

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Low Density Polyethylene Pipes



TECHNICAL SPECIFICATIONS FOR LDPE

Pressure Rating of Watsan LDPE Pipes

Manufactured with an optimal pressure rating varying from 15 psi to 60 psi and in strict compliance with international agricultural irrigation standards, Watsan LDPE pipes are engineered specifically for precision drip irrigation systems and efficient water management. They are lightweight, exceptionally flexible for complex field layouts, UV-stabilized, and guarantee a long lifespan while operating reliably across diverse agricultural climates and extreme weather conditions.

Identification

Watsan LDPE pipes are commonly manufactured in Black colour.

Size Range

LDPE Pipes size range is **12, 16, and 20mm** .

Feature / Specification	Details
Pipe Type	LDPE Irrigation Pipe
Measurement Standard	Outer Diameter (OD)
Size Range	12, 16, and 20mm
Length Availability	L-100 - 400meters.

Why Choose Watsan HDPE Pipes?



Superior Protection
Built-in antimicrobial technology provides 99.99% protection against Bacteria, Fungi and Algae.



Safe & Healthy Water
Prevents biofilm formation and ensures safe, clean and healthy drinking water for all.



Long Lasting Performance
Antimicrobial protection is integrated into the pipe wall and lasts for the entire life of the pipe.



Corrosion & Chemical Resistant
Resistant to corrosion, chemicals and scaling – ideal for a wide range of applications.



Environment Friendly
Non-toxic and recyclable pipes that contribute to a greener and sustainable future.



Premium Quality
Manufactured with state-of-the-art technology and strict quality control for superior performance.

THANK YOU
For Choosing Quality & Reliability

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