# PLASTMIDDLEAST

## Double wall CORRUGATED PIPES

## Double Wall Corrugated Pipes
## For
## Sewerage and Drainage Applications

It is well-known the corrugated pipes can offer exceptional material savings, good hydraulic (flow) properties and high compression strength. For these reasons corrugated pipes have shown high growth rates in recent years resulting in the continued development of its production technology.

In the early days corrugated pipes benefitted from the growth in demand for telecommunication cable ducting. But in terms of material conversation tonnage, cable ducting has now been overtaken by drainage and sewage pipes for construction and infrastructure. Corrugated pipes can be made of a wide range of different materials such as polyamide (PA), thermoplastic elastomers (TPE), thermoplastic rubber (TPR), polytetrafluoroethylene (PTFE), but the primary raw material in the manufacture of corrugated pipes for water transportation is high-density polyethylene (HDPE), followed by polypropylene (PP) and polyvinyl chloride (PVC).

Corrugated pipes can be as small as 1 mm. In the smaller diameter range up to 50 mm they are usually used for cable protection systems in house installations and the medical automotive and food Industries. Mid-sized corrugated pipes (50 mm ID to 500 mm OD) are commonly used as protective pipes, drainage, sewage, storm water, sewage, control shafts, conveyor pipes. And in the larger sizes up to 3,000 mm, the pipes are employed for storm water, sewage, control shafts, conveyor pipes and manholes.

### Production

Standard pipe corrugators use a continuous chain of mould blocks mounted on one or two oval tracks to vacuum form a continuously extruded tube or pipe. The corrugators can be either of horizontal or vertical design, each of them has its own advantages and disadvantages. In addition, corrugators are available in either blow moulding or vacuum forming design.

The use of vacuum instead of positive air pressure is now standard for the production of corrugated pipes, although sometimes air pressure is used to assist on larger parts. The vacuum technology uses vacuum to pull the outer surface of the hot plastic pipe against the mould blocks to provide the desired geometry. Vacuum forming of parts requires some air inside the part, which is typically provided via a needle in the die, so that atmospheric pressure can push the part against the mould. The wall distribution is more even on a vacuum-formedcorrugators type as the wall is not inflated, according to the advocates of this process. Blowing a profile against a mould may thin the walls in the ridges, a disadvantage since this is precisely where more material is needed.

Another basic technical difference is the cooling system. European corrugators typically use water cooled moulds, while North American models are commonly air cooled. Air cooled blocks are more cost-effective while water cooled blocks offer higher cooling efficiency and therefore higher output.

In the larger diameterrange of 800 mm and above what are known as shuttle corrugators are increasingly employed where a small number of moulds are moved back and forth on rails. For instance, in shuttle-type corrrugators the corrugator is fed by one or two single screw extruders, usually equipped with barrier screw and grooved feed bush in order to achieve high output of the ployolefin material. If PVC from dry blend is processed, counter-rotationg twin screw extruders are employed.

## Why Polypropylene (PP)?

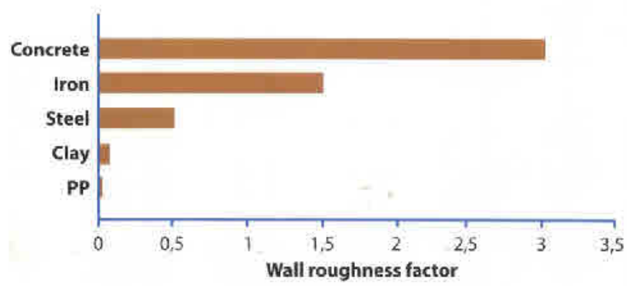
POLYPROPYLENE is a member of Polyolefin family and easily processed into pipe. PP is stiffer than other Polyolefin material such as PE and therefore desired stiffness is obtained with less material content. Substantial economic advantage. Ring seal sockets can be formed on PP pipes ensuring homogeneity to the jointing. Lesser weight ensures easy handling. Lesser weight means cost savings. Polyolefin pipes are more eco-friendly. If required, PP pipes can be welded to avoid root penetration into pipe line.

## Important Features of DWC PP Sewer Pipes System

- Manufactured and tested according to EN 13476
- Raw Material: Polypropylene (PP)
- Nominal Density of material: 0.900-0.910
- Tensile stress at yield – 30 MPa (Pipes) and 27 MPa (fittings)
- E Modulus: 1700 MPa (Pipes) and 1200 MPa (Fittings)
- Melting Point: 160 deg C
- Specific heat: 2.00kJ/Kg.K
- Coefficient of heat conduction: 0.17/0.22 W/mk
- Coefficient of linear expansion: 15 x 10  mm/m°C
- Colour: Black/ Terracotta – outer wall
- Grey/ off white – inner wall (for employing CCTV inspection facility)

## Advantages of PP DWC Pipe Systems over Concrete/Clay System.

- Easy pushfit connection with excellent joint integrity.
- No site welding.
- Robust construction with handle and install.
- Flexible: adapted to earth movements.
- High chemical resistance as per ISO/TR 10358.
- High abrasion resistance: withstands solids movement in the flow.
- High temp. resistance (up to 95deg. C)
- Easy inspection conditions (CCTV compliant)
- Full range of fittings available.
- Easily connectable to plastic manholes
- Easily connectable to other existing sewers such as concrete and clay.
- Smooth bore, better flow.




## Stiffness – An Overview

For a pressure pipe system, we classify the pipes as PN6, PN10, PN16 etc. witch refer to resistance against internal pressure.

In the gravity sewer system, there is no internal pressure. Most of the time, the pipe is only partially filled. The sewer water flows only by gravity created by the slope of the installation. but there will external load factors such as soil load, wheel load etc. this will cause diametrical defection of the pipe system. The standards stipulate the maximum diametrical deflection permitted between 5 to 7%. The Ring Stiffness of the Pipe and the quality of back filling of the soil around the pipe controls the deflection caused by the external loads. Therefore, sewer pipes are classified with their Ring Stiffness as Sn2, SN4, and SN8. SN8 means Ring Stiffness of 8 KPa or 8 KN/sqmtr. The pipes made by us have a Ring Stiffness of 8 KPa.

EN ISO 9969 stipulates that the Ring Stiffness is calculated

**SN=(0.0186+0.025 y/d) F/LY.**

F = Force in Kilo Newton.

L= length of the pipe in mtrs.

Y= deflection in Mtrs. Corresponding to 3% of Original internal dia.

D= Original average internal dia (ID).

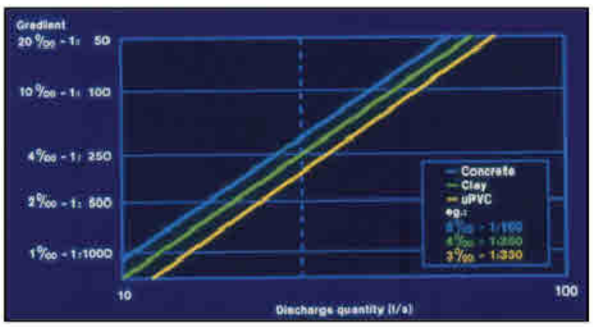
## Flow Characteristics

One of the most important advantages in Plastic sewer pipes is the smooth bore and consequent better flow as compared to traditional materials like concrete. Alternately, for the same flow you require lesser slope for plastic pipes.

The Prudential doefficient used in Gauckler-Stricler formula is 80 m 1/3.s-1.

In the Colebrook White formula the roughness factor Plastic pipe is 0.00025.

In the following chart, relative slopes requirement between Plastic/Concrete/clay pipe is shown.




For the same flow, plastic pipe require about half the slope of concrete pipes, alternately, with the same slope you get about 30% extra flow in plastic pipes as compared to concrete pipes.

The following table shows the velocity and flow for different size pipes laid at different slopes (0.5%, 1% and 2%) and different filling (50%, 70% and 95%). The calculation is made based on the Gauckler-Stricler formula using a constant of 80.

Pipe filled 50%

| Size | Slope i = 0.5% | | Slope i = 1.0% | | Slope i = 2% | |
|---|---|---|---|---|---|---|
| | velocity | flow | velocity | flow | velocity | flow |
| ID | m/sec | m3/sec | m/sec | m3/sec | m/sec | m3/sec |
| 300 | 1.01 | 0.04 | 1.42 | 0.05 | 2.01 | 0.07 |
| 400 | 1.22 | 0.08 | 1.72 | 0.11 | 2.44 | 0.15 |
| 500 | 1.41 | 0.14 | 2.00 | 0.20 | 2.83 | 0.28 |
| 600 | 1.60 | 0.23 | 2.26 | 0.32 | 3.19 | 0.45 |
| 800 | 1.93 | 0.49 | 2.74 | 0.68 | 3.87 | 0.97 |
| 1000 | 2.20 | 0.88 | 3.13 | 1.25 | 4.41 | 1.76 |

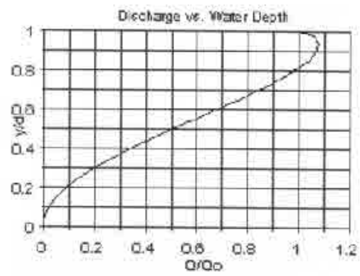
Pipe filled 70%

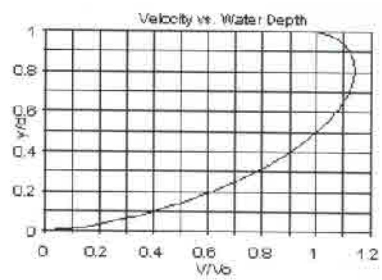
| Size | Slope i = 0.5% | | Slope i = 1.0% | | Slope i = 2% | |
|---|---|---|---|---|---|---|
| | velocity | flow | velocity | flow | velocity | flow |
| ID | m/sec | m3/sec | m/sec | m3/sec | m/sec | m3/sec |
| 300 | 1.13 | 0.06 | 1.59 | 0.08 | 2.25 | 0.12 |
| 400 | 1.36 | 0.13 | 1.93 | 0.18 | 2.73 | 0.26 |
| 500 | 1.58 | 0.23 | 2.24 | 0.33 | 3.17 | 0.47 |
| 600 | 1.79 | 0.38 | 2.53 | 0.53 | 3.58 | 0.76 |
| 800 | 2.17 | 0.81 | 3.06 | 1.15 | 4.33 | 1.63 |
| 1000 | 2.46 | 1.48 | 3.50 | 2.09 | 4.94 | 2.95 |

Pipe filled 95%

| Size | Slope i = 0.5% | | Slope i = 1.0% | | Slope i = 2% | |
|---|---|---|---|---|---|---|
| | velocity | flow | velocity | flow | velocity | flow |
| ID | m/sec | m3/sec | m/sec | m3/sec | m/sec | m3/sec |
| 300 | 1.10 | 0.08 | 1.56 | 0.11 | 2.20 | 0.15 |
| 400 | 1.33 | 0.16 | 1.89 | 0.23 | 2.67 | 0.33 |
| 500 | 1.55 | 0.30 | 2.19 | 0.42 | 3.10 | 0.60 |
| 600 | 1.75 | 0.49 | 2.47 | 0.69 | 3.50 | 0.97 |
| 800 | 2.12 | 1.04 | 3.00 | 1.48 | 4.24 | 2.09 |
| 1000 | 2.35 | 1.89 | 3.35 | 2.68 | 4.72 | 3.79 |

Most of the times, the flow of sewer will be only partial in the pipe 50% or 70% etc. when you know the Discharge and the velocity for full flow it is possible to calculate the discharge and velocity for partial flow from the following table. This factor does not change with size, slope or frictional coefficient. For example, if the depth of flow is 60% (0.6) the discharge will be 0.7 x discharge with full flow. Corresponding velocity will be 1.08 x velocities with full flow. This is an important chart to calculate flow and velocity for partial filled pipes.

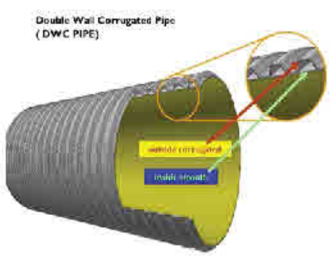



## Single Wall Pipe

A single wall corrugated HDPE pipe can be employed for drainage projects where flexibility, lightweight and low cost are important. Multiple drainage applications such as farms, golf courses, parks and playing fields, downspouts run offs, driveway culverts and wet spots on the lawn are possible. The use of single wall plastic pipe is only recommended where drainage water is free of debris and floating material. Perforated corrugated HDPE pipes are often used to control water levels in agricultural land, to collect and transport subsurface drainage, subsurface water collection and leaching action in the mining industry.

## Dual/Double Wall Pipe

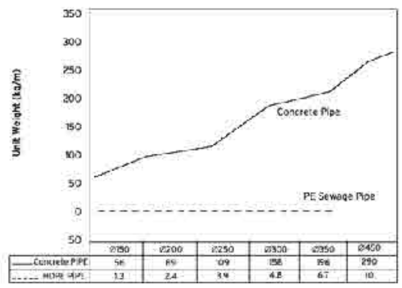



A dual/double wall pipe is the most common corrugated pipe design for drainage and sewage. Various different designs of pipes are available, such as single channel or double flow channels, and they all have in common a smooth inner surface for good flow rates and a corrugated layer. Double wall corrugated pipes can be produced with either one or two extruders. The latter allows walls with two different materials in a single pipe. In addition there are other corrugated pipe designs that can be found on the market such as triple wall pipe (smooth inner and outer walls and a corrugated structural core) and Ultra Rip (smooth inner wall with concentric reinforcing ribs that encircle the pipe to provide higher ring stiffness).

## PE Corrugated Sewage Pipes are easy to install.

Advantage of weldability out of the trench.

Because of the elastic nature of the PE pipes, these pipes can be welded at a suitable place near the trench. Once the tip of the pipe is bounded there will be no cracks or slipping of the pipe from the joint places. Welding of PE pipes out of the trench can be applied to all diameters.




- For installation, it is enough to open a trench which is 5 cm larger than pipe diameter. This means less excavation and less sand filling –a huge economy-in installation costs.
- For each type of pipes, it is so difficult to make connection in the trench. This can be done for PE pipes very easily out of the trench with less workers and machinery.
- Connection of the pipes can be done without opening the trench. But in case of opening trench. But in case of opening trench, installation of the pipes should be done immediately just after the excavation of the trench. Because when the trench is excavated before a long time, the trench will deform and need to be cleaned.

## installation

### Trench Preparation:

- The width of the trench should be as narrow as possible. Recommended levels are 2 – 3 DN.
- The bottom of the trench should be smooth and clean from sharp objects.
- Pipe cover should be at least 1 mtr. If the cover has less than 1 mtr, proper load calculations should be made by

### Recommended Trench Widths:

| Pipe size mm | Trench widh mm |
|---|---|
| < DN 300 | DN + 500mm |
| 300<DN<900mm | DN + 800mm |
| 900<DN<1200mm | DN + 1000mm |

Trench width/ depth relations

| Top cover P mtrs | Min. total trench width |
|---|---|
| 1.0<P<1.75 mtrs | 0.80 mtrs |
| 1.75<P<4.0 mtrs | 0.90 mtrs |
| > 4.0 mtrs | 1.00 mtrs |

### Trench Bed Preparation:

- Make the bed layer with sand or small size grain soil 100mm to 200mm
- Level the ground and create the slope.
- Start installing the pipes.

### Pipe Laying and Jointing:

- Place the sealing ring between 1st and 2nd corrugated of the spigot. Place the sealing lip in the right direction as marked on the ring.
- Gasket is correctly installed and not twisted.

- Remove the dirt from the joint area and the rubber gasket.
- Lubricate the lip of the gasket and the socket area to smooth jointing.
- Mark the insertion depth to ensure perfect jointing.
- Push the spigot into the socket manually or using mechanical or hydraulic devices. Push the pipe straight into the socket in the axial direction without twisting or rotating the pipes.
- Check the joint for any misalignment and correct slope and adjust if necessary.

### Trench Backfilling and Side Compacting:

- This is a very critical stage during the installation. Side compacting properly reduces the deflection.
- Back filling soil has close relationship with stiffness of the pipe class chosen. Among the the 6 types of soil shown in the following table, it is recommended to use only type 1 to 4.
- Place the compacting soil in layers of 300mm on the sides of the pipe after ensuring compaction of haunch zone (either side of the bottom of the pipe in contact with the bedding) and then compact each layer well till you reach 100 – 150mm above the pipe top (crown).
- Check the slope again and correct if necessary.
- Close the ends of the pipes at the close of the day.

| Soil category | Description | Example |
|---|---|---|
| 1 | Single size gravel<br>Well graded gravel, gravel-sand mixture | Crushed rock, river and beach gravel<br>Morainic gravel, scoria, volcanic ask |
| 2 | Single size sand<br>Well graded sand, sand-gravel mixture | Dune & drift sand, valley sand, basin sand<br>Morainic sand, terrace sand, beach sand |
| 3 | Salty gravels, graded gravel-sand-silt mixture,<br>Clayey gravel silty sands, poorly graded sand silt mixture<br>Clayey sands, poorly graded sand-clay mixture | Weathered gravel, slope debris<br>Liquid sand, loam, loess<br>Loamy sand, alluvial clay/marl |
| 4 | Inorganic silts, very fine sands, rock flour<br>Inorganic clay, distinctly plastic clay | Loess, loam<br>Alluvial marl, clay |
| 5 | Mixed organic soils with admixtures of humus or chalk<br>Organic silt, organic silt clay | Chalky sand, tuff sand<br>Sea chalk, top soil |
| 6 | Peat and other organic soils; mud | Peat |

## Ring stiffness choice

Depending on undisturbed native soil, back filling soil and type of compaction the SN class is chosen. Bearing the following facts in mind:

- Beyond 3 mtr depth soil/ whel load does not increase proportionately.
- TEPPFA studies had shown that side compacting has more influence on deflection than any other factor.
- For traffic load we will use soil types 1 to 4 only and well compacted backfilling (type W) only.
- Under these circumstances SN 8 pipe will cover most of the installation conditions. See the following table application for Traffic areas.

| Filling material class | Compact | Undisturbed native soil class | | | |
|---|---|---|---|---|---|
| | type | 1 | 2 | 3 | 4 |
| 1 | W | 4 | 4 | 6.3 | 6.3 |
| 2 | W | | 6.3 | 8 | 8 |
| 3 | W | | | 8 | 8 |
| 4 | W | | | 8 | 8 |