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MAJO Plastics Twinwall Pipe System

**Product and Installation Guide (June 2018,
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Introduction

The MAJO Plastics twinwall pipe system is a gravity or low-pressure structured wall pipe system made from high density polyethylene (HDPE). This is a cost-effective pipe system intended for use as a direct alternative to all non-pressurised gravity drainage systems, other than where local authority adoption is necessary. These pipes have a smooth bore for superior hydraulic flow and a corrugated outer wall for additional strength. They are available in carrier or perforated configurations.

Typical applications include use in gravity surface and storm water drainage applications. More specifically, their many applications include highway filter and carrier drains, rail track drainage, surface water drains in industrial or commercial developments, golf course drainage, surface water culverts, catch pits, general agricultural drainage, landfill/land reclamation, methane gas venting and landfill leachate control.



Twinwall pipes are manufactured on our own premises by a twin extrusion process in which the two pipe walls are extruded simultaneously, one inside the other, and heat welded together in one continuous process.

Pipes are available in nominal internal diameters of 150, 225, 300, 375, 450 and 600mm and are supplied in 6 metre lengths, either plain for use as a carrier drain, or half or fully perforated for use as filter drains. Perforated pipes have 4 or 8 slots, depending on diameter, equally spaced around their circumference. Half perforated pipes have either 3 or 5 slots per dwell, depending on diameter, with the permeable area proportionally reduced. In this case, the slots are equally spaced around half of the pipe circumference.



MAJO Plastics Twinwall pipes, when slotted, exceed the Department for Transport's minimum requirement of 1000mm² per metre length. Pipes are coloured black; the outer wall being corrugated for strength and the inner wall having a smooth finish to assist hydraulic flow.

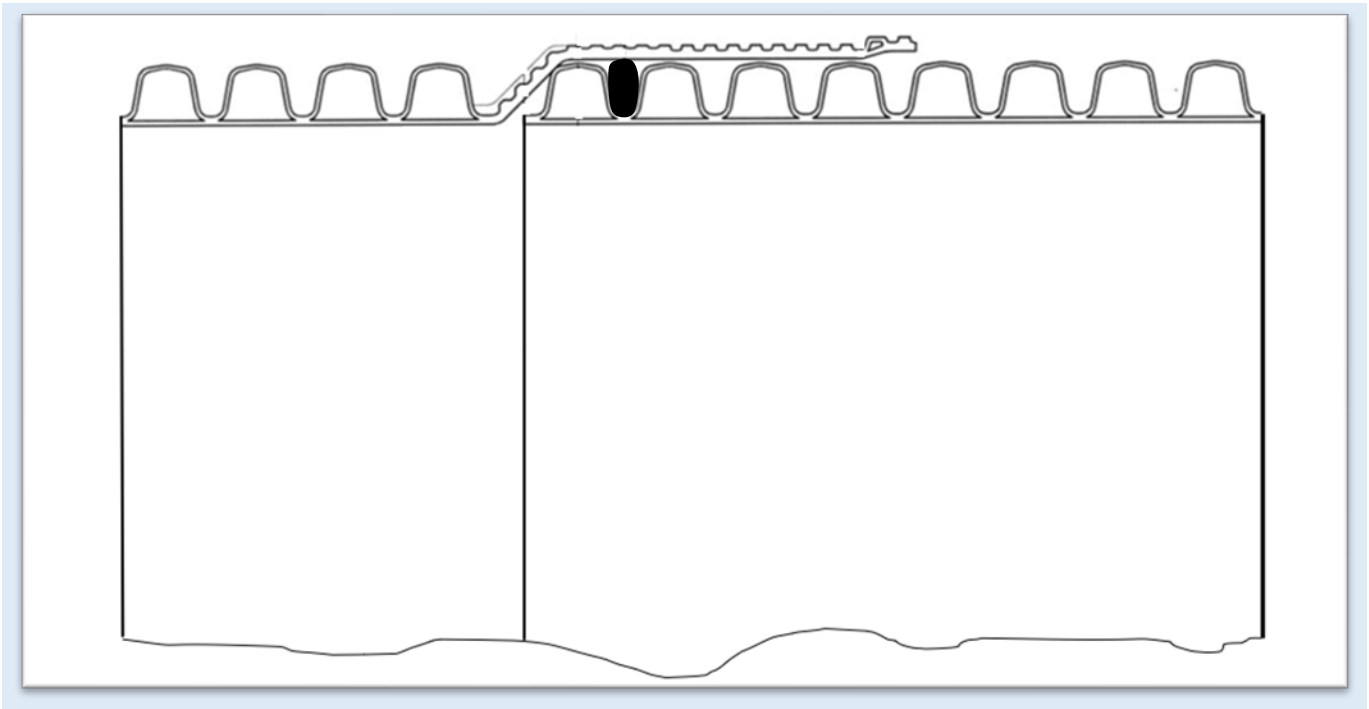
In highway applications, twinwall unslotted carrier pipes and slotted filter pipes and couplings must be installed in accordance with highway authority requirements and clauses 503, 505 and 518 of the Manual of Contract Documents for Highway Works. For typical laying, trench and backfilling specification details reference, should be made to the Manual of Contract Documents for Highway Works, Types T, S, G, H and I.

MAJO Plastics twinwall pipes are predominantly made from recycled materials and are manufactured to stiffness class SN6. Even when their structural integrity requires them to be part manufactured from virgin materials (e.g. 600mm pipes), they are, nevertheless, still 100% recyclable at the end of their useful life.

Principal Features & Benefits

The following is a list of the many features and benefits provided by MAJO Plastics twinwall HDPE pipes:

- Designed for use in gravity surface and storm water drainage applications
- BBA and BBA HAPAS Roads and Bridges Approved, Certificate No. 18/H285
- Structured wall design for high ring stiffness and strength
- Manufactured with a predicted design life of 50 years
- Non-pressure and leak tested up to 100mm water gauge (0.01 bar)
- Smooth bore giving excellent hydraulic properties
- Classed as flexible pipes and are designed to deform under loading
- Less vulnerable to cracking and ideal for cold weather conditions
- Twinwall construction helps to maintain flexibility and reduce the possibility of impact damage on site
- They weigh only a fraction of the weight of precast concrete pipes, which mean less plant is required for installation. This also means reduced transport and installation costs, and it makes installation quicker and with reduced health and safety risks
- Ease of installation and the elimination of wastage reduces labour and plant costs
- Longer lengths and fewer joints assist in both flow capacity and self-cleansing velocity
- Minimal joining compared to concrete or clayware
- Low cover – they withstand vertical pressure by transferring most of the load to the surrounding soil, which results in the pipe supporting loads at only 0.5m of cover
- They can be installed in depths up to 10 metres (see installation notes)
- They are more robust than other pipes, thereby helping to eliminate waste on site
- Reduced CO₂ consumed in production, transportation and on-site handling
- Manufactured from mainly 100% recycled material enabling contractors to increase the percentage of products used on their sites with a recycled content
- Resistant to ground movement and differential settlement
- Integrally socketed in diameters 375 to 600mm for ease of installation
- They can be easily cut on site
- They are resistant to most naturally occurring chemicals and therefore suitable for use in the majority of soil conditions
- They can be stored in direct sunlight for up to 3 months



Integrated Coupler Joint Detail (375, 450 and 600mm diameter pipes)



Health and Safety

All activities associated with the transport, handling, storage and installation of MAJO twinwall pipes and couplings are subject to the requirements of the Health and Safety at Work Act (or equivalent legislation depending on the jurisdiction) and the requirements of BS5995: Part 6: 1980 and, for applicable contracts, the Highways Agency Manual of Contract Documents for Highway Works and Sewers for Adoption (or equivalent depending on the jurisdiction).

Safe off-loading:

- Delivery drivers must:
 - Comply with all relevant health and safety rules at the destination location/site. This includes wearing personal protective equipment and clothing in accordance with the site's health and safety policy/rules
 - Comply with MAJO Plastics' health and safety procedures while delivering and off-loading pipes
 - Report to the relevant delivery location and await instructions from the designated responsible individual before any unloading activities are undertaken
- A designated individual representing the location/site should be in attendance during off-loading activities
- It is the customer's/recipient's / contractor's responsibility to ensure health and safety measures are in place and any necessary risk assessments are carried out prior to self off-loading and storage
- Prior to offloading, a check should be undertaken to ensure that the load has not shifted during transit and all wedges and banding are securely in place
- Any load strapping used to secure the load must remain in place until lifting gear is in place.
- Recipients/contractors must comply with the Work at Height Regulations when accessing a trailer to place lifting gear/slings
- Mechanical lifting equipment that lifts to a height of 5m must be used to unload pipes
- Loads should only be lifted with the use of appropriate fabric slings by trained and experienced personnel



Safe Storage:

Pipe packages should be stored as per the following table:

Pipe Diameter	No of Pipes Per Package	Max No of Packages that may be Stacked Vertically
150mm	36	3
225mm	14	3
300mm	8	3
375mm	5	3
450mm	4	3
600mm	2	4

- Pipe stacking height should be limited to not more than 2.5m
- Pipes should not be stored where they may be subject to high winds
- Pipes and fittings should be stored on flat ground, free from rocks and other sharp objects to avoid damage due to point loading
- Wood bearing supports should be used between each pipe to ensure even load distribution and chocks should be used to prevent pipes from rolling



Safe Installation:

Installation activities must be carried out by observing the requirements of relevant health and safety at work legislation.

All trenches must be excavated in accordance with the relevant health and safety regulations and local building regulations.

- Site health and safety rules must be strictly complied with
- Extreme care must be taken while working in deep pipe trenches
- Unstable soil must be adequately supported if individuals are entering deep pipe trenches/excavations
- Care must be taken when manually handling pipes into position



Plain Ended Pipe

High Density Polyethylene Twinwall pipes in sizes 150, 225 and 300mm, both slotted and unslotted



Pipe with Integrated Coupler

Integral coupler used on the 375, 450 and 600mm nominal diameter pipes.



Separate Coupler

Separate polypropylene coupler used on plain ended pipes in sizes 150, 225 and 300mm nominal diameter

General Installation Procedures

Pipe should be installed in accordance with the following national guidelines:

United Kingdom: The Manual of Contract Documents for Highway Works, Volume1 series 500, clauses 503, 505, 518.7 and 518.8 as published by the Highways Agency.

Ireland: The Manual of Contract Documents for Road Works, Volume1 series 500, clauses 503 and 505 as published by the NRA.

Installation activities should be carried out by observing the requirements of relevant health and safety at work legislation, having regard to the specific jurisdiction.

Trench Preparation:

- Trench width should generally lie between outside diameter + 300mm and outside diameter + 600mm, but larger trenches are permissible.
- The trench bed should be firm and free from large stones.
- The trench width should be sufficient to allow placement and compaction of the granular fill around the pipe.
- The trench should provide for a minimum of 150mm pipe bed and local soft spots should be removed and replaced with hardcore.
- The pipe should sit evenly on the bed and be free of voids under the pipe. The trench should not be excavated too far in advance of pipe installation.
- Pipes should preferably be laid to a gradient of 1:400 or as close to this as possible.
- Care should be taken during backfill to maintain the line and level of the pipeline. If necessary, pipes should be restrained to prevent uplift.
- Pipes will perform within the required design limits under traffic loading conditions.
- The recommended minimum cover depth is as follows:
 - 0.6m for non-trafficked green areas
 - 0.9m to finished surface for trafficked areas not subject to Highways Agency or National Roads Authority requirements
 - 1.2m to finished surface for trafficked areas subject to Highways Agency or National Roads Authority requirements
- In certain circumstances, lower minimum cover levels may be allowable e.g. when pipes are installed with a rigid pavement or concrete surround.

Pipe Installation:

- Pipes are easily cut using conventional hand tools but should be cut square between the corrugations.
- Always use the seals supplied by MAJO Plastics.
- For a watertight joint, the pipe ends and coupler should be clean and the rubber seal fitted externally between the first and second corrugation in the pipe.
- Location of the ring between the first and second corrugation is the preferred location as this ensures the seal reaches the greatest depth in the socket.

- On the pipe, lubricate the groove between the ribs into which the seal will be inserted. Industry recommended lubricants should be used, such water-based gel or fluid, or a silicone spray.
- Line up the axis of the pipe with the axis of the socket i.e. get the pipe and socket in a straight line
- The inside of the coupler should be lubricated and the pipe pushed fully home to the central register either by hand or using a lever if necessary. If using levers, steps should be taken to prevent damage to the ends of the pipe.
- Twinwall pipes and couplings must be protected against damage from site construction traffic.

Trench and backfilling specification details

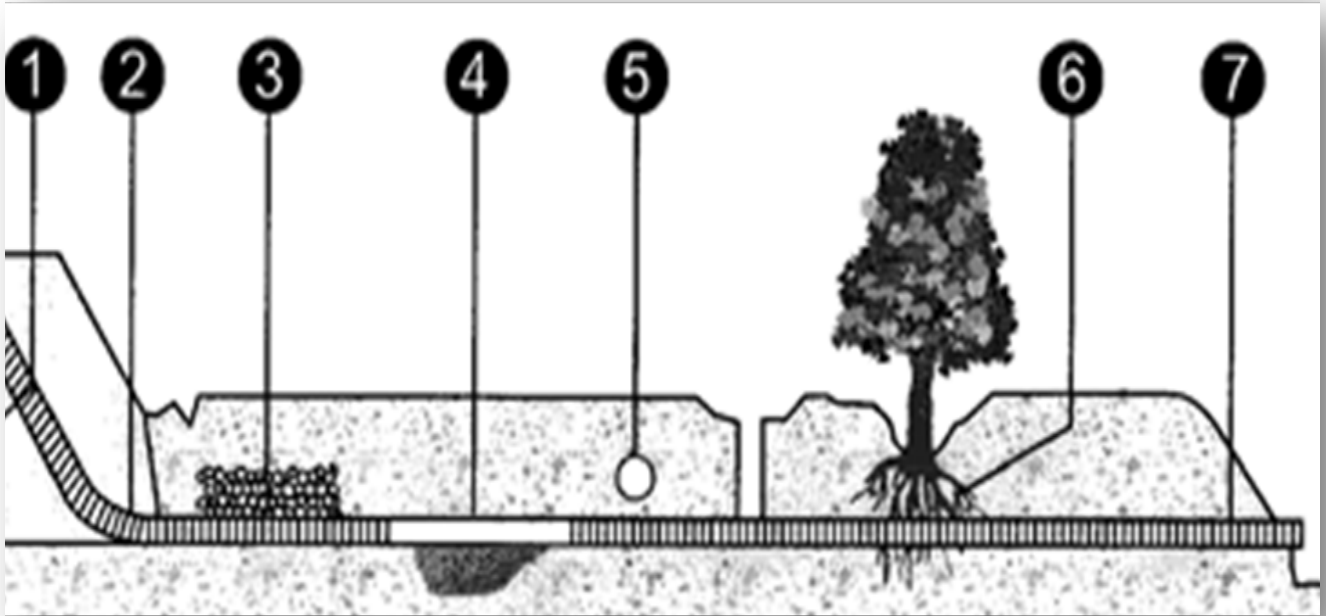
For typical piping situations, trench and backfilling specification details, reference should be made to the trench details contained in Figure 6 of the MAJO Plastics BBA Certificate (18/H285) and to the Manual of Contract Documents for Highway Works, Volume 3, Drawings No F1 (Type T and S) and No F2 (Type G, H and I).





Maximum cover:

- The maximum cover depth can normally vary between 6 and 10 meters when installed in accordance with series 500 of the MCDHW, Volume 1
- The maximum allowable cover depth is dependent on the following installation parameters, and may possibly exceed 10 meters:
 - Soil stiffness
 - Factor of safety
 - Pipe bed and surround stiffness
 - Size of trench
 - Density of the overburden
 - Hydrostatic loading
 - Maximum allowable deflection limit



Other Pipelaying Considerations:

See the sketch and key below for considerations that may apply to specific pipelaying scenarios.

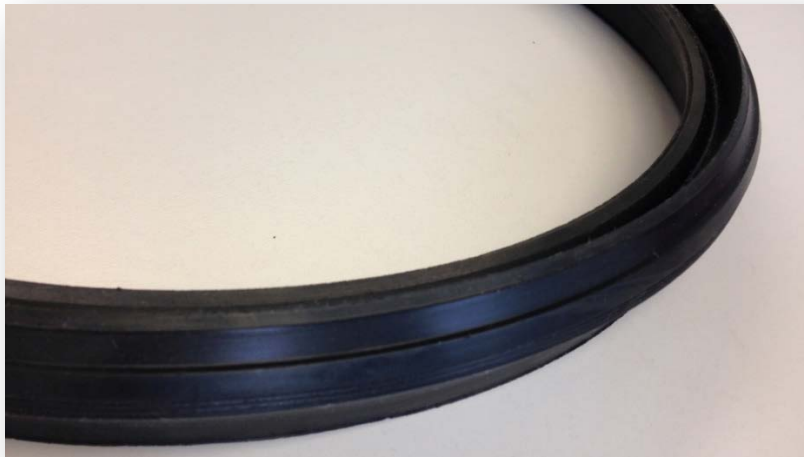
Key:

- 1 Heavy clay soils should have permeable fill to the trench base and brought up to 300 – 400mm from ground level.
- 2 Where possible, pipes should be laid on an even gradient, circa 1:400.
- 3 Permeable fill material should be screened and placed to the correct level.
- 4 Crossings over existing drains, soft soil or old ditches should be bridged with solid pipe.
- 5 Active existing drains should be connected to the new pipework.
- 6 Pipes with sealed joints should be used where pipes are laid close to hedges or trees.
- 7 Pipe outfalls should be constructed from solid pipe, at least 1.5m long.

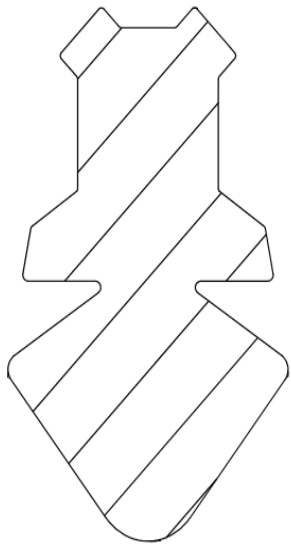
Ring Seals & Lubricants

Ring Seals: Ring seals are available for unperforated pipes where a sealed carrier system is required. Ring seals are manufactured from EPDM (Ethylene Propylene Diene Monomer).

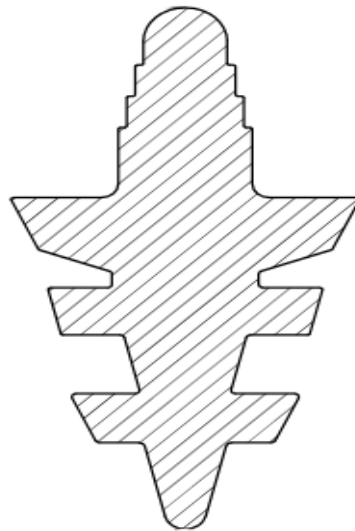
Seal Lubricant: When using ring seals for a sealed system, a seal lubricant should be used to ease the installation of the couplers over the seals.



Seal Profiles:



Seal profile for 150,
225 and 300mm
diameter plain pipes
and separate couplers



Seal profile for 375,
450 and 600mm
diameter integral
coupler pipes

Product Selection Guide

Table 1: Fully Perforated Pipe

Product Code	Nominal internal pipe diameter (mm)	No of slots per dwell	No of rows of slots	No of dwells per metre	Slot width (mm)	Slot length (mm)	Minimum permeable area (mm ² .m-1)	Nominal weight (kg.m-1)
TW150F	150	8	8	44	2	20	14,080	1.3
TW225F	225	8	8	30	2.1	30	15,120	3.0
TW300F	300	4	4	26	2.2	33	7,550	4.7
TW375F	375	4	4	25	3	68	20,400	6.7
TW450F	450	4	4	20	3	85	20,400	9.4

Table 2: Half Perforated Pipe

Product Code	Nominal internal pipe diameter (mm)	No of slots per dwell	No of rows of slots	No of dwells per metre	Slot width (mm)	Slot length (mm)	Minimum permeable area (mm ² .m-1)	Nominal weight (kg.m-1)
TW150H	150	5	5	44	2	20	8,800	1.3
TW225H	225	5	5	30	2.1	30	9,450	3.0
TW300H	300	3	3	26	2.2	33	5,662	4.7
TW375H	375	3	3	25	3	68	15,300	6.7
TW450H	450	3	3	20	3	85	15,300	9.4

Table 3: Unperforated Pipe

Product Code	Nominal internal pipe diameter (mm)	No of slots per dwell	No of rows of slots	No of dwells per metre	Slot width (mm)	Slot length (mm)	Minimum permeable area (mm ² .m-1)	Nominal weight (kg.m-1)
TW150U	150	Nil	Nil	44	Nil	Nil	Not Applicable	1.3
TW225U	225	Nil	Nil	30	Nil	Nil	Not Applicable	3.0
TW300U	300	Nil	Nil	26	Nil	Nil	Not Applicable	4.7
TW375U	375	Nil	Nil	25	Nil	Nil	Not Applicable	6.7
TW450U	450	Nil	Nil	20	Nil	Nil	Not Applicable	9.4

TW600U	600	Nil	Nil	15	Nil	Nil	Not Applicable	19
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Table 4: Couplers

(Separate Polypropylene Couplers for 150, 225 and 300mm Pipe)

Product Code	Nominal internal pipe diameter (mm)	Internal diameter of coupler (d3) (mm)	Nominal external diameter of coupler (d4) (mm)	Nominal length of coupler (L) (mm)	Height of Seal (h) (mm)	Wall thickness (mm)
TW150C	150	179	184	180	15.5	2.3
TW225C	225	270	277	215	25.6 ± 0.4	3.3
TW300C	300	358	365	240	31.8 ± 0.4	3.1

NOTE 375, 450 and 600 mm Pipes are fitted with Integral Couplers

Table 5: Ring Seals

Product Code	Nominal Internal Diameter (mm)	Height of Seal (mm)	Width of Seal (mm)
TW150RS	150	15.5	7.9
TW225RS	225	25.6 ± 0.4	15.6 ± 0.2
TW300RS	300	31.8 ± 0.4	19.4 ± 0.4
TW375RS	375	34 ± 0.6	18.2 ± 0.4
TW450RS	450	36.9 ± 0.6	20.0 ± 0.5
TW600RS	600	53 ± 0.8	32.0 ± 0.6

Hydraulic Design

Velocities and flow rates for thermoplastic structured wall pipes can be calculated using either the Manning or Colebrook-White equations. The Colebrook-White equation (below) has been shown to provide accurate results for a wide range of flow conditions and is a widely used method in the UK.

A specific approach is required when utilising the **Colebrook-White equation** to determine either the pipe diameter or hydraulic gradient variables.

The Colebrook-White Equation:

$$V = -2\sqrt{(2gS_f D) \log_{10} \left[\frac{k_s}{3.7D} + \frac{2.51\nu}{D\sqrt{(2gS_f D)}} \right]}$$

Where: V = Mean water velocity (m/s)

g = Gravity (m/s^2)

S_f = Hydraulic gradient (m/m)

D = Internal pipe diameter (m)

K_s = Pipe roughness (m)

ν = Kinematic viscosity of water (m^2/s)

$$Q = VA$$

Where: Q = Flow/discharge rate (m^3/s)

V = Water velocity (m/s)

A = Cross-sectional area of pipe (m^2)

Certain Codes of Practice, such as Sewers for Adoption 6th edition (SFA), require a minimum pipe roughness, irrespective of pipe material.

Where: Foul gravity sewer design $k_s = 1.5\text{mm}$ (Clause 2.12 SFA)

Surface water sewer design $k_s = 0.6\text{mm}$ (Clause 2.13 SFA)

Determining the correct pipe size, gradient or discharge capacity using the Colebrook-White equation is an iterative process. Both graphical and tabular methods have been published to assist in the determination of a pipe's hydraulic capacity.

Typically, a chart or table, valid for a specific pipe roughness, details four dependent variables (D , S_f , v & Q). Therefore, if any two variables are known, it is possible to determine the remaining two variables.

Manual calculations using the parameters in the Colebrook – White equation are an alternative method but likely to be less user friendly.