

# NAYLOR DRAINAGE

*Made in the UK*

Excellent Construction Products

## Clay Drainage



## Denseal Plus

Vitrified Clay  
Drainage  
System

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# Naylor Densel Plus

## Vitrified Clay Drainage



This handbook has been prepared to assist in the specification of Naylor Drainage products. Should any further information be required please contact our sales team by email to [sales@naylor.co.uk](mailto:sales@naylor.co.uk)

For any export enquiries please contact our export sales team by email to [export@naylor.co.uk](mailto:export@naylor.co.uk)

A technical service is available and advice is gladly given for particular requirements and applications. We have both office based and external technical personnel able to answer queries and provide specialist knowledge.





## Denseal Plus

### Description

Naylor Denseal Plus is offered from DN375 to DN600 in accordance with EN295-1 System 'N' with an extensive range of fittings, including beds, junctions, tapers and access item suitable for drainage applications.

Although classed as a ridged system, benefit from advanced flexible jointing technology, which provides the required pipeline flexibility to withstand settlement or other ground movement after installation.

Jointing of the pipes is by the use of a grade 316 stainless steel sleeve with elastomeric seals providing watertight, flexible mechanical joint assemblies, complying with BS EN295-1 system C. All elastomer conform to the performance requirements of BS EN681-1.

### Structural Performance

Denseal Plus can be laid directly on a hand trimmed natural trench bottom with selected, excavated materials (class D bedding) used as a back fill.

Denseal Plus will not distort under loading with a high inherent strength which ensures stability even at extreme depths.

### Crushing Strengths

Denseal Plus meet the requirements of EN295-1 system 'N'.

Nominal Size DN mm	Crushing Strength FN kN/m	Class Number	System	L +/- 20 mm
375	72	240	N	2000
400	48	128	N	2000
450	64	160	N	2000
500	80	160	N	2000
600	96	160	N	2000

### Chemical and Temperature Resistance

Denseal Plus has a high resistance to chemicals and can accommodate controlled discharges of up to 75°C.

### Longevity

For design purpose vitrified clay pipeline can be considered to have unlimited life.

### Water Jetting

Denseal Plus is guaranteed for the lifetime of the system against penetration of the pipewall caused by pressure water jetting when operated in accordance with the following parameters:

- Pressure 510 bar
- Flow Rate 1.5 litres per second
- Time Static for 5 minutes

# Product Specification

## Quality Assurance

Naylor Drainage manufactures its products under the control of an approved Quality Assurance System complying with the requirements of BS EN9002: 2008. Naylor Drainage Ltd is a Registered Firm of Assessed Capability (BSI Certificate No. FM1420).

## Third Party Assurance

Denseal Plus is Third Party Certified by:  
BSI UK Kitemark Licence No 20173.

## CE Conformity

Naylor Drainage Vitrified Clay Pipe conforms to European Standard: EN 295-10.

## Component Specification

All Denseal Plus pipes and assemblies are manufactured in accordance with  
**BS EN295-1 2013**

'Requirements for vitrified clay pipes and joints'.

## Kitemark Certificate

Spigot Controlled Jointing System known as : Denseal Plus  
No. KM 20173

**bsi.** Kitemark™ Certificate

This is to certify that: **Naylor Drainage Limited**  
Clough Green  
Gandhinagar  
Eastmoley  
Surrey  
United Kingdom

Holds Certificate Number: **KM 20173**

In respect of:  
**BS EN 295**  
Vitrified clay pipes & fittings & pipe joints for drains and sewers

This issues the right to use the Kitemark in accordance with the Kitemark Terms and Conditions governing the use of the Kitemark, as may be updated from time to time by BSI Assurance UK Ltd (the "Conditions"). All defined terms in this Certificate shall have the same meaning as in the Conditions.

The use of the Kitemark is authorized in respect of the Product(s) detailed on this Certificate provided at or from the above address.

For and on behalf of BSI: *Gary Penton*  
Gary Penton, Global Product Certification Director

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**BS EN 295-1:2013**

BSI Standards Publication

### Vitrified clay pipe systems for drains and sewers

Part 1: Requirements for pipes, fittings and joints

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**BSI**

raising standards worldwide™

**Kitemark™ Certificate**  
No. KM 20173

**A-2 Pipes (continued)**

**4. Spigot Controlled Jointing System known as: Denseal Plus**

Nominal Size (DN)	Minimum Crushing Strength (FN) kN/m
300	72
375	64
400	64
450	72
500	90

**5. Spigot Controlled Jointing Systems known as: Revit**

Nominal Size (DN)	Minimum Crushing Strength (FN) kN/m	Minimum Declared Sacking Strength (MN) Clause 4.2.4
300	72	1.3
375	48	2.3
400	64	2.7
450	72	3.0
500	90	6.2
600	96	7.3

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## Production Process

**1.** Locally-quarried raw materials are accurately blended before being ground to a fine form to enable subsequent extrusion.



**2.** Clay raw material is mixed with water to give plasticity for extrusion. High-pressure extrusion ensures that a strong dense pipe body is produced. Close attention to drying to remove moisture is undertaken prior to firing under accurate temperature control.

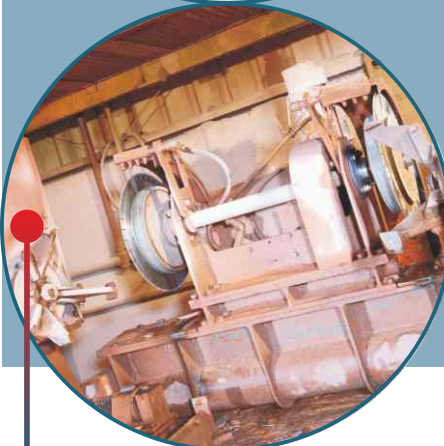


**3.** Use of special highly-insulated kilns is employed for attaining accurate firing.

The special qualities of vitrification of the pipe body are attained at a firing temperature in excess of 1050°C.



**4.** After the firing and subsequent grading processes the pipe ends are accurately machined with computer-controlled diamond profile cutters. Accurate production of parallel ends is also achieved.



**5.** Intermediate inspection takes place as well as pipe ends being pressure tested to ensure integrity of pipe material. The joint components are then applied and materials are packed for shipment.



**6.** Naylor Denseal Plus Pipes ready for despatch.



## Delivery and Site Handling

Delivery of pipes is to the customer's request, consignee to be responsible for offloading all packs, which are designed to be offloaded by forklifts.

If there is no forklift available on site a moffat off-load vehicle can be arranged at the time of order placement.

Close attention to packing for transportation and overseas shipment is part of the Naylor delivery service.

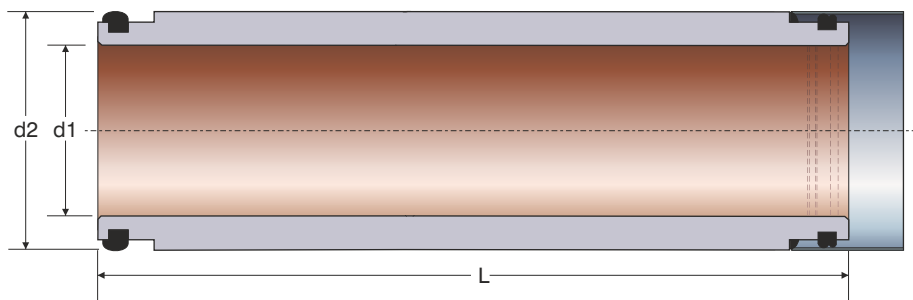
It is a major recommendation that all unit packs must be kept assembled with all protection intact until the pipe is ready for use.

All Denseal Plus pipes and elastomer components are resistant to heat, ozone and ultra violet light.



# Naylor Densel Plus

Consists of a vitrified clay pipe with parallel ends and a rebated accurate joint interface. All pipes consist of a factory fitted grade 316 stainless steel sleeve a 5 bar rated EPDM self-lubricated seal.



Nominal Size	Pipe Dimensions			Strength		Seal Rating	Weight kg/m
	ID	OD	L	Crushing Strength	Class Number		
	DN mm	d2 mm	+/- 20 mm	FN kN/m	Bar		
375	375+/-5	380+/-5	2000	72	240	5	75
400	400+/-5	455+/-5	2000	48	128	5	125
450	450+/-5	585+/-5	2000	64	160	5	150
500	500+/-5	610+/-5	2000	80	160	5	235
600	600+/-7	710+/-7	2000	96	160	5	250

## Seal Design and Function

The seals are designed as a sliding seal that is located in the pipe end rebate. No lubricant is required on either the seal or stainless steel sleeve as lubricant is enclosed within the sliding mantel. As the male spigot is inserted into the female sleeve the seal is compressed creating a positive 5 bar internal and external pressure.

The mantel rolls over the seal during jointing reducing friction to a minimum and acts as a cushion between the spigot and sleeve limiting differential movement under transverse shear loads once the joint is completed. The design optimises joint performance and provides an exceptionally high level of operational reliability.

Seals are available in either EPDM or Nitrile certified to EN681- 1



### Root Infestation

Due to the high contact pressure a 5 bar seal reduces the risk of root infestation through the joint allowing for pipe installation under mature trees



# Jointing

Prepare the trench to the pipeline alignment and gradient in accordance with EN 1610 with socket holes provided in the bedding as appropriate.

## Prior to installation

Check the pipes and fittings to ensure that they have suffered no damage, ensuring that the spigot and socket are clean and free of any grit.



## Jointing instructions

Insert the spigot end into the stainless steel sleeve and lower the pipe on to the pipe bedding by the means of a cloth strap around the centre of the pipe. There is no requirement for any lubricant as Naylor Densel Plus EPDM Seals are self lubricating.

Insert a suitable wooden packer into the stainless steel sleeve and apply an equal mechanical force onto the pipe end. The pipe is fully home in the sleeve when there is a 5mm gap between the sleeve and the pipe rebait.

Test the pipe and joint after the installation of every three pipes in accordance with BSEN 295:2013 Clause 5.18 Airtightness.





# Sitework Instructions



## Unloading

Access to site must be over a hard road capable of supporting a fully laden vehicle. The delivery vehicle must be parked on firm, flat ground. Naylor pipes are delivered to site in packs weighing between 1 and 1.9 tonnes. Fittings are usually supplied in crates. Any loose fittings should be removed by hand from the delivery vehicle before other goods are unloaded.

There is usually a choice between:

### 1 Use of Naylor Moffatt self-loading vehicle

If you require this service, please request when making delivery arrangements.

The Moffatt is detached from the trailer-load and is operated as a fork-lift to unload the packs and crates. For this purpose, approx. 10 metres of firm level ground space is required along each side of the trailer.

If conditions allow, packs may be placed around the site in order to reduce subsequently handling.

### 2 Using site equipment to unload - (This is the responsibility of the Contractor.)

The packs and crates can be offloaded by fork-lift, or by suitable crane, or other machine using a proven or test-certified sling.

### 3 Hand offloading by site personnel

Check that the pack is stable and that the pipes and packing woods are undamaged before cutting the straps and manually unloading.

## Stacking

### 1 Pipes delivered in packs

Set the packs down on a firm and level surface.

### 2 Storage of loose pipes

Rest the bottom row of pipes on battens to keep them clear of the ground and stake the end pipes in order to prevent movement of the stack.

## Trench Excavation

There should be at least 150mm width of trench on each side of the pipe barrel, in order to provide sufficient space for jointing and proper compaction of the bedding and fill materials.

It is not good practice to excavate a trench too far in advance of pipe-laying.

Do not exceed the specified maximum trench width without prior approval of the supervising authority, because the trench width affects the loading on the pipeline.

When trenches are battered, the maximum allowable trench width must not be exceeded below a point 300mm above the crown of the pipes.

Always provide adequate support to the trenches, for the protection of workmen and to prevent damage to adjacent property. The attention of all site personnel should be drawn to the requirements of the Health & Safety Executive.

Ref. BS8000: Workmanship on Building Sites Pt.14: Below Ground Drainage. CIRIA\* R97 Trenching Practice.

## Pipe Laying

### Line & Level

The correct pipeline alignment and gradient are indicated by laser equipment or by using a taut string line and sight rails.

Pipe manufacturing tolerances need to be taken into account when assessing line and level. For guidance in setting out see CIRIA\* publication 'A Manual of Setting Out Procedures'.

### Procedure

#### Class D, N, F, B & S Beddings

Compact the bed to the correct level. Commence pipelaying from the lower end of the line. Lay pipes with their couplings facing upstream. Take care to achieve continuous bedding support. If it is necessary to raise a pipe to the correct level, the pipe should be removed and additional bedding material compacted along the full barrel length - prior to relaying.

### Concrete Beddings

Blind the trench bottom with a 50mm thick layer of concrete. Place concrete support blocks on the trench blinding, immediately downstream of each pipe coupling position. Place a compressible board on top of each block and lay the pipes on these. Fine adjustments of the pipe levels can be achieved by using wedges fixed between the pipe barrels and the blocks. To maintain flexibility at joints, fix compressible boards immediately upstream of couplings at the specified intervals along the length of the pipeline. Brace the pipes to prevent any tendency to float when the concrete surround is placed and vibrated.

### Inspect & Clean Pipes & Jointing Components

Before laying, check the pipes and fittings to ensure that they have not suffered damage. Make sure that the pipe ends, jointing components and lubricant are clean and free from grit, before attempting to make joints.

The specification; design and construction of drainage and sewerage systems using vitrified clay pipes booklet published by CPDA give additional guidelines when laying pipes in a wide range of difficult ground conditions.



\* Construction Industry Research and Information Association

# Testing

## Testing the pipeline for water tightness

When laying Naylor Denseal Plus pipes, it may be convenient to check that all is in order by applying interim air tests to progressive lengths of pipeline as work proceeds.

Once a pipeline has been laid an air or water test may be carried out in accordance with BS EN1610, as detailed below.

### Air Test

- 1 Fix air-tight stoppers at the ends of the pipeline, after checking that they are clean and well-fitting. Connect a manometer to one of the stoppers.
- 2 Blow or pump air into the pipeline until a pressure slightly more than the required air test pressure is indicated on the manometer. After allowing 5 minutes for the temperature to stabilise, adjust to the required pressure and commence the test.
- 3 (a) If the measured drop is less than the allowable drop then the test is passed (see table).

Note: The test pressure LA is the same as that previously used in the UK except that the test period is increased for sizes above DN225, as shown.

Test Method	Test Pressure mbar (kPa)	Allowable Drop mbar (kPa)		
LA	10 (1)	2.5 (0.25)		
Test period in minutes				
DN100	DN200	DN300	DN400	DN600
5	5	7	10	14

- (b) If the measured drop exceeds the allowable loss, carefully check the testing apparatus and stoppers and examine the pipes and joints for leakage. If a defect is discovered, remedy it and re-test.

If this test does not reveal a defect, apply a water test.

The above standards do not regard an air test alone as sufficient grounds for rejection and it is recommended that a water test should be applied in the event of apparent failure to meet the air test. An apparent failure of air test can be due to causes other than defects in the pipeline; for example, changes in ambient temperature.

### Water Test

- 1 At the upstream end of the pipeline to be tested, add a 90° bend and sufficient vertical pipes to provide the required head of water. BS EN1610 requires a minimum 1.0m (10kPa) head of water at the high end with a maximum of 5m (50kPa) at the lower end. Both heads above the pipe crown. In cases of very steep gradients, it may be necessary to test the pipe in stages, in order to comply with these limitations.

2. Tighten stoppers at the lower end of the pipeline and at open branches, after checking that they are clean and well-fitting.
3. Strut the ends of the pipeline and the 90° bend to prevent movement and then fill the line with water.
4. Inspect the pipeline for any obvious leaks and remedy any defects. There will be an initial fall of the water level due to absorption and the displacement of trapped air.
5. After at least one hour, top up to the maximum test head, a longer period may be allowed in extremely dry conditions. The loss of water over a period of 30 minutes should then be measured by adding water from a measuring vessel at regular intervals of 10 minutes and noting the quantity required to maintain the original water level. The test is accepted if the water added does not exceed 0.15l/m<sup>2</sup> of internal wetted area over a 30 minute period, for pipelines. Higher limits are set for pipelines including manholes and inspection chambers.

### Further information

See BS EN1610 and the Clay Pipe Development Association Ltd booklets Specification, Design and Construction and Testing of Drains & Sewers (Water & Air Tests).

## Backfilling

Any selected or granular fill must be carefully hand-compacted in layers not exceeding 150mm to complete the pipeline surround. Place and compact this fill equally on both sides of the pipeline to prevent displacement.

Slice with a spade around the barrels to form a cradle for the pipes. This work is important, as the pipeline derives some of its strength from a properly constructed bedding.

The trench must be backfilled to at least 300mm above the crown of the pipes before any power-ramming takes place. Backfill should then be well-compacted in layers not exceeding 300mm.

As backfilling proceeds withdraw timber and trench sheeting in stages to avoid disturbing the pipeline or the creation of voids within the bedding and surround.

## Site Traffic

Site traffic should not pass over buried pipelines before backfilling has been completed and the final surface constructed.

Overloading by unavoidable site traffic can be prevented by bridging the trench with steel plates, timber sleepers or other temporary protection.



**Naylor Industries plc - more than 100 years of production and supply to the Construction Industry**

- Vitrified clay pipe systems for trench and trenchless installation
- Thermachem - Chemical Drainage and Industrial Ceramics
- Band-Seal couplings for the repair of and connections into existing pipelines
- Plastic Land Drainage, Twinwall Ducting Systems and Access Boxes
- Lintels - Prestressed Concrete Lintels
- Yorkshire Flowerpots, a range of frostproof plant pots



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