Maintenance

Westerleigh Group
Herne Bay
Crematorium

SUDS MANAGEMENT & MAINTENANCE PLAN

R G Carter Projects Ltd

AUGUST 2023

1 Introduction

1.1 This document sets out the principles for the long term management and maintenance of the surface water Sustainable Drainage Systems (SuDS) to be constructed at new Crematorium Herne Bay Kent.

1.2 The purpose of this document is to set out the basis of the development SuDS Maintenance Plan and to ensure that the adopting management company is entrusted with a robust inspection and maintenance programme, ensuring the optimum operation of the surface water drainage network is continually maintained for the lifetime of the development and to prevent the increased risk of flooding both on and off site in accordance with the National Planning Policy Framework (NPPF).

1.3 The activities listed in this document are generic to the relative SuDS types and represent the minimum maintenance and inspection requirements, however additional tasks or varied maintenance frequency may be instructed by the maintenance company as required. Specific maintenance needs of the SuDS elements should be monitored and maintenance schedules adjusted to suit requirements.

1.4 All those responsible for maintenance should follow relevant Health and Safety legislation (Health and Safety at Work Regulations, 1999) for all activities listed within this report including lone working, if relevant) and risk assessments should always be undertaken.

1.5 Any contractor employed by the Westerleigh Group shall carry out periodic maintenance of all such SuDS in accordance with the schedules listed in this report. Inspection checks shall be carried out by a qualified and competent person, at the minimum intervals listed within the schedules and the appropriate work carried out.

2 SuDS Layout & Design

2.1 The storm water drainage strategy for the proposed development is utilises SuDS features to intercept and convey all pluvial surface water runoff. The design of the system aims to attenuate runoff and encourage infiltration.

2.2 The proposed storm water system consists of the following SuDS components:

- Swale;
- Infiltration; and
- Storage Basins.

2.3 There are three categories of maintenance activities referred to in this report:

- **Regular maintenance** (including inspections and monitoring).
  Consists of basic tasks done on a frequent and predictable schedule, including vegetation management, litter and debris removal, and inspections.
- **Occasional maintenance**
  Comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example).

- **Remedial maintenance**
  Comprises intermittent tasks that may be required to rectify faults associated with the system, although the likelihood of faults can be minimised by good design.
  Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict.

3 SUDS Management & Maintenance

3.1 Attenuation Basin, Swales and Headwalls

3.2 Note: The operations contained within this section specific to the maintenance of landscaping, shall be read in conjunction with any development landscape maintenance plan(s).

3.3 The land drainage system including the attenuation basin, swales and associated inlet / outlet headwalls and pipework will be subject to a routine monitoring and maintenance schedule as part of the general site management. This will be carried out at monthly intervals between 1 April and 31 October and once between 1 November and 31 March unless otherwise detailed. A record of maintenance visits and remedial operations shall be maintained. The following guidelines are offered as an initial regime, but maybe either increased or decreased by the management company depending on the local environment and any external contributing factors.

3.4 The key maintenance requirement for the attenuation basin, swales and associated inlet / outlet headwalls and pipework will be the maintenance of vegetation and mowing of grass within and on the banks/verges and the removal of accumulated sediments and collection of litter and debris.

3.5 During the inspections the general operation, and structural condition of the inlet / outlet headwalls and any erosion of banks or scour control features should be identified and rehabilitated as required.

3.6 Vegetation within on the banks of the pond should be trimmed twice a year, preferably in April and October to a height of 100mm to establish a dense sward and provide long grass margins which will discourage public access down to the water's edge. Vegetation in and on the banks of the swale should be trimmed at least twice a year or as required to maintain a height of 75–150mm. Cuttings from any clearance work should be removed from the pond and swale to avoid it causing blockages downstream.

3.7 Accumulated sediments should be removed from the bed of the swale as required (once deposits exceed 25 mm in depth). The frequency of this operation can vary depending on local conditions, however it is recommend that the level of silts should be monitored at least once a year and a maintenance regime implemented to suit.

3.8 De-silting of the attenuation ponds will usually be on a 10-15 year cycle depending on the on-going silt level checking. The desilting work will be carried out under the supervision of consulting engineers and to a pre-agreed method statement. Such a method statement should be submitted in writing to the consulting engineers agreed in advance of the commencement of the works.

3.9 Prior to desilting works commencing, a suitably qualified ecologist shall be appointed to undertake an assessment of the ecological interest within the pond and its margins. In the event that the attenuation ponds develop particular ecological interest, then careful consideration will be given to the timing of this operation.

3.10 Sediments excavated from the pond and swale that receive runoff from greenfield areas are not toxic or hazardous material and can be safely disposed of by either land application or landfilling. However, consultation should take place with the environmental regulator to confirm appropriate protocols. As long as the silt is non–hazardous it can be put it on the bank of the pond / swale and depositing silt on top of the banks allows for any organisms to re-establish.

Table 1: Maintenance Plan for the Attenuation Basin

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Table 2: Maintenance Plan for the Conveyance Swale

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

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Marshalls Civils & Drainage
Mells Road
Nr Frome, Somerset
BA11 3PD
01538 380500

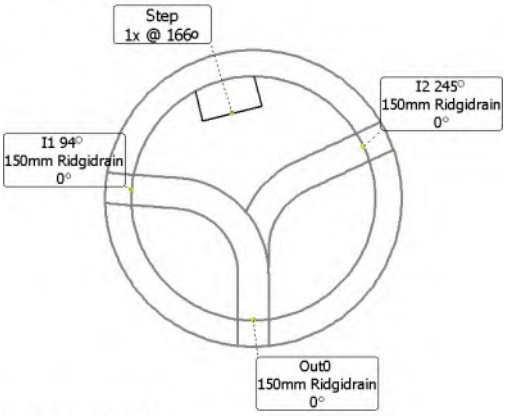
Customer: **Fulker Contractors Ltd - 779**

Site / MH Ref **Herne Bay Crematorium**

Orderdate: **20/12/2022**

Productref: MPB/775/S10
Diameter / Wall: 1200mm / 130mm
Core / Fillheight: 225mm / 150mm
Weight 1356 kg
Special Details:
1 x 225mm SEALED MANHOLE BASE
1 x 250mm CHAMBER RING
1 x HD COVER SLAB WITH 600mm SQ ACCESS
3 x SEATING RINGS

STEP@166°



MPB/775/S10

Productref: MPB/775/S11
Diameter / Wall: 1200mm / 130mm
Core / Fillheight: 425mm / 150mm
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1 x HD COVER SLAB WITH 600mm SQ ACCESS
3 x SEATING RINGS

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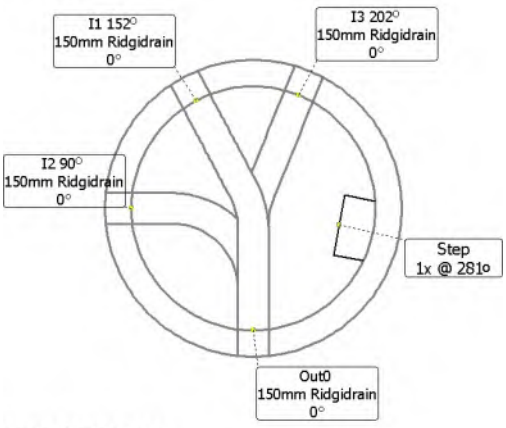

MPB/775/S11

Productref: MPB/775/S12
Diameter / Wall: 1200mm / 130mm
Core / Fillheight: 325mm / 150mm
Weight 1474 kg
Special Details:
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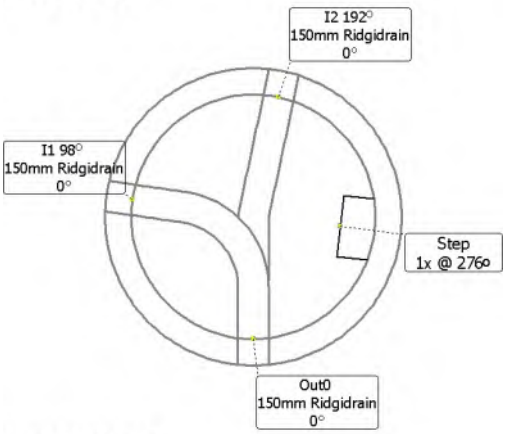
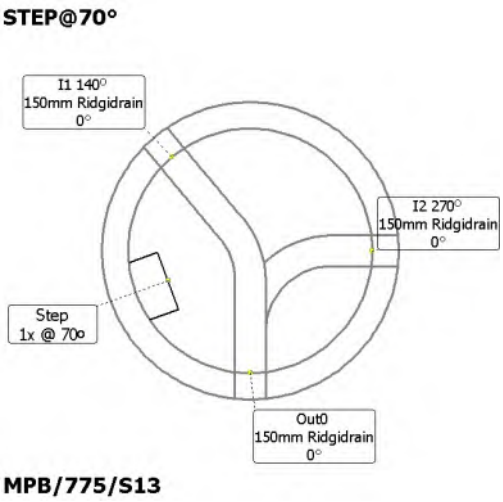
1 x 250mm CHAMBER RING
1 x HD COVER SLAB WITH 600mm SQ ACCESS
3 x SEATING RINGS

STEP@276°



MPB/775/S12

Productref:	MPB/775/S13
Diameter / Wall:	1200mm / 130mm
Core / Fillheight:	225mm / 150mm
Weight	1349 kg
Special Details:	1 x 225mm SEALED MANHOLE BASE 1 x 250mm CHAMBER RING 1 x HD COVER SLAB WITH 600mm SQ ACCESS 3 x SEATING RINGS



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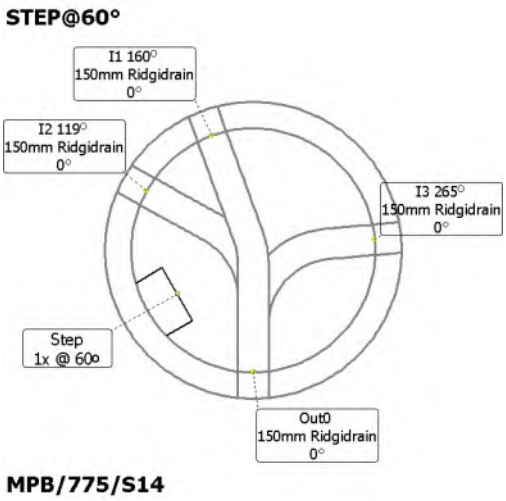
Core / Fillheight:	425mm / 150mm
Weight	1571 kg
Special Details:	1 x 425mm SEALED MANHOLE BASE 1 x HD COVER SLAB WITH 600mm SQ ACCESS 3 x SEATING RINGS



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Diameter / Wall:	1200mm / 130mm
Core / Fillheight:	375mm / 150mm
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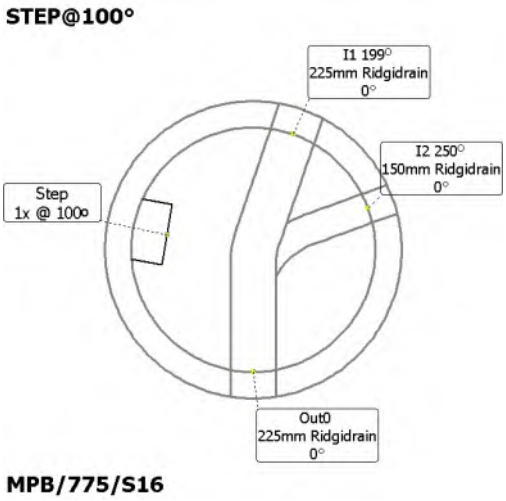
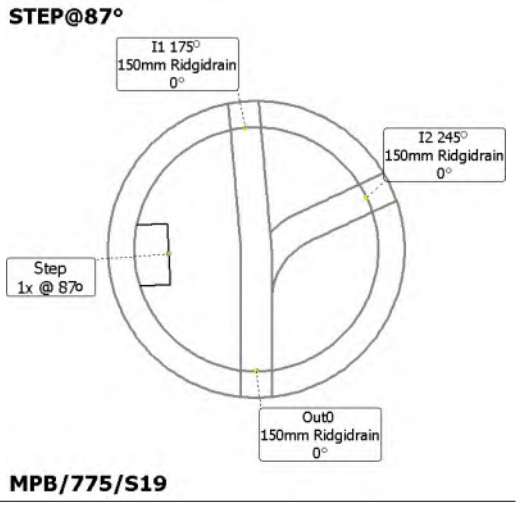
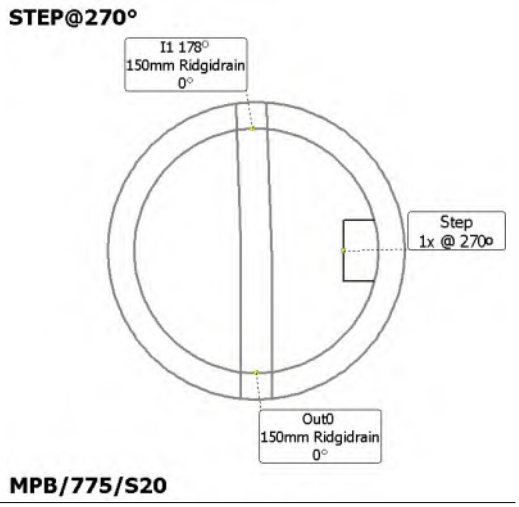


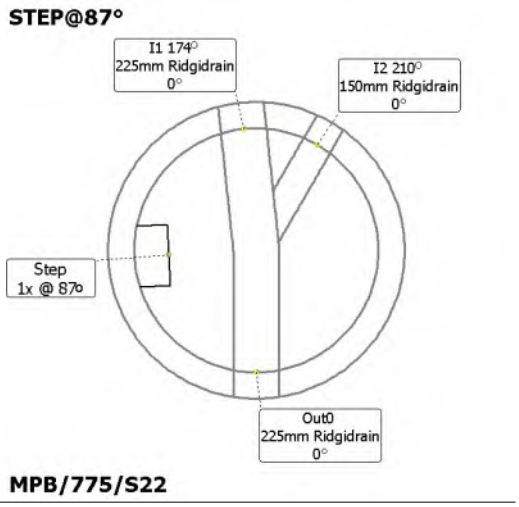
Productref:	MPB/775/S19
Diameter / Wall:	1200mm / 130mm
Core / Fillheight:	425mm / 150mm
Weight	1600 kg
Special Details:	1 x 425mm SEALED MANHOLE BASE 1 x HD COVER SLAB WITH 600mm SQ ACCESS 3 x SEATING RINGS



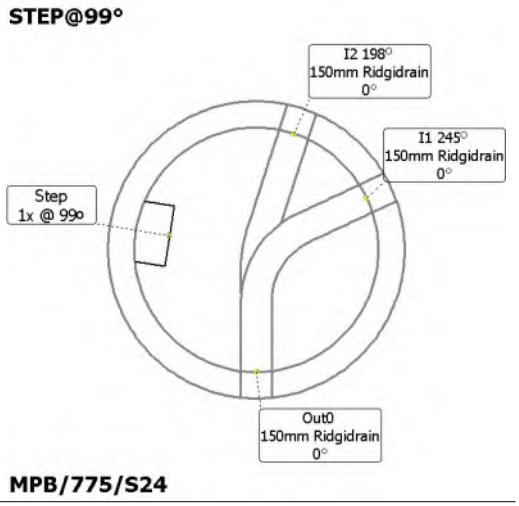
Productref:	MPB/775/S20
Diameter / Wall:	1200mm / 130mm
Core / Fillheight:	425mm / 150mm
Weight	1633 kg
Special Details:	1 x 425mm SEALED MANHOLE BASE 1 x HD COVER SLAB WITH 600mm SQ ACCESS 3 x SEATING RINGS



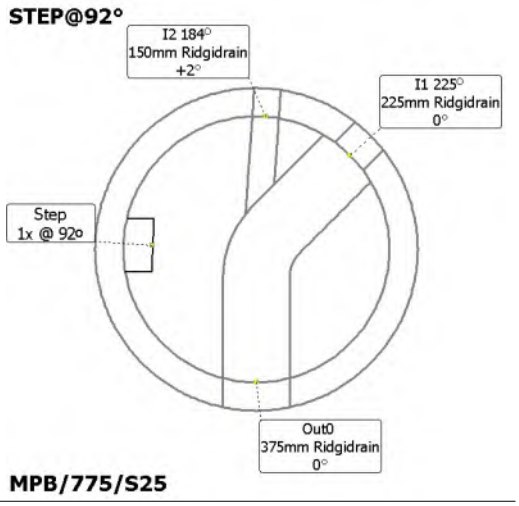
Productref:	MPB/775/S22
Diameter / Wall:	1200mm / 130mm
Core / Fillheight:	425mm / 150mm
Weight	1816 kg
Special Details:	1 x 425mm SEALED MANHOLE BASE 1 x 250mm CHAMBER RING 1 x HD COVER SLAB WITH 600mm SQ ACCESS 3 x SEATING RINGS



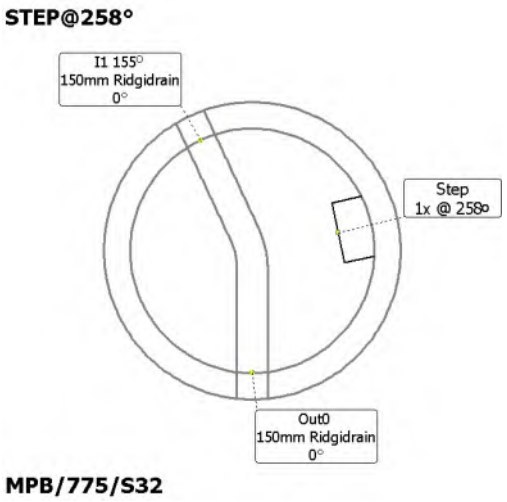
Productref:	MPB/775/S24
Diameter / Wall:	1200mm / 130mm
Core / Fillheight:	325mm / 150mm
Weight	1473 kg
Special Details:	1 x 325mm SEALED MANHOLE BASE 1 x HD COVER SLAB WITH 600mm SQ ACCESS 3 x SEATING RINGS



Productref:	MPB/775/S25
Diameter / Wall:	1500mm / 160mm
Core / Fillheight:	425mm / 150mm
Weight	3512 kg
Special Details:	1 x 425mm SEALED MANHOLE BASE 1 x 1000mm CHAMBER RING 1 x HD COVER SLAB WITH 600mm SQ ACCESS 3 x SEATING RINGS



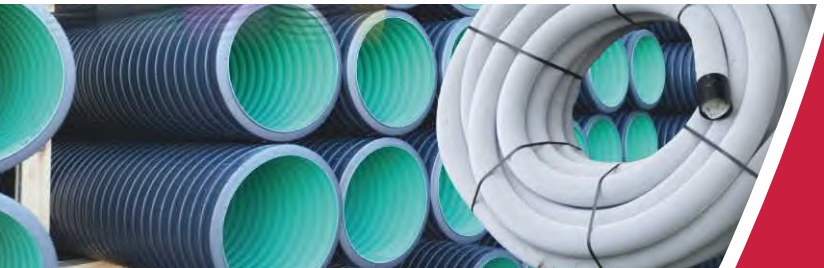
Productref:	MPB/775/S32
Diameter / Wall:	1200mm / 130mm
Core / Fillheight:	425mm / 150mm
Weight	1637 kg
Special Details:	1 x 425mm SEALED MANHOLE BASE 1 x 250mm CHAMBER RING 1 x HD COVER SLAB WITH 600mm SQ ACCESS 3 x SEATING RINGS



NAYLOR
DRAINAGE
Made in the UK

Product Guide

email: info@naylor.co.uk web: www.naylordrainage.co.uk





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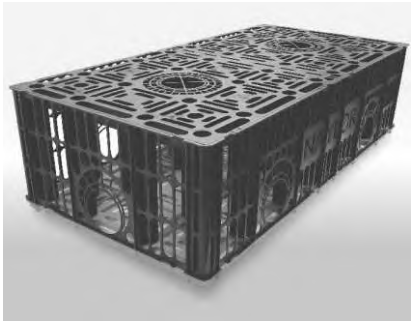
Introduction to Naylor

Now exceeding 130 years in manufacturing, Naylor Plastics have an enduring reputation throughout the UK for producing high quality plastic pipe systems, together with associated products for building, construction, utility and general infrastructure markets.



Developments
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Rail
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INVESTORS IN PEOPLE

HUMAN CAPITAL AWARDS
Winners -
Growing Business

MADE IN BRITAIN

MADE IN SHEFFIELD

Applications

The MetroDrain Premium Drainage system has been specified and installed on many civil engineering and construction projects.

Highway Drainage

Naylor MetroDrain is suitable for the collection and disposal of surface and sub-surface storm water. The product meets the specific requirements of the Highways Agency Manual of Contract Documents for Highway Works and is an approved alternative to the products in Table 5/1 of the Specification for Highway Works.

MetroDrain products can be adopted under the Highways Act (1980).

Building Drainage

The Naylor MetroDrain Premium Drainage System is suitable for non-adopted surface water drains.

BBA Certificate No: 09/H145

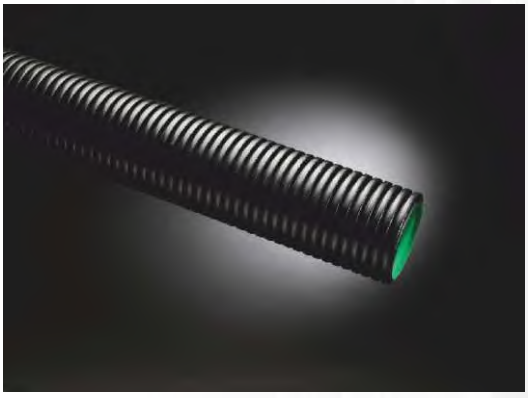
Environmental

MetroDrain is ideally suited for use in environmental systems:

- Pump and sampling chambers
- Catchpits
- Soakaways
- Stormwater attenuation
- Manholes

Applications

- Agricultural (N-Drain)
- Highways
- CIR - Infastructure
- Rail
- Sports Facilities/Stadiums
- Landfill
- Ports (Sea and Air)



MetroDrain

N-Drain

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MetroDrain

Premium Drainage System

Why Naylor MetroDrain?

A range of High Density Polyethelene high performance twin wall pipes designed for use with all non-pressure, surface and sub-surface storm water drainage applications.

- Smooth bore for superior hydraulic flow
- Corrugated outer wall for additional strength
- Available in filter, perforated or half perforated configurations
- SN6
- HAPAS approved by British Board of Agrément approved
- Less brittle, less vulnerable to crack propagation
- Use of recycled materials
- Up to 6% of the weight of traditional concrete product
- Lightweight product - easier transport, handling & installation
- Recognised alternative to concrete and clayware pipes
- High strength and durability
- Excellent resistance to differential ground settlement
- Minimal jointing compared with traditional materials
- Easily cut to required lengths

MetroDrain LC

- The next generation of stormwater and surface drainage pipe
- No reduction in stiffness, jetting resistance, joint performance or durability
- Fully compatible with MetroDrain fittings
- Available in 6 sizes from 150mm to 600mm
- 3 and 6 metre lengths
- All sizes are available in full and half perforated filter drains

Nominal ID (mm)	Pipe	Pipe Stiffness (ISO9969)
100	N-Drain	SN4
150	MetroDrain LC, MetroDrain & N-Drain	SN6, SN6 & SN4
225	MetroDrain LC, MetroDrain & N-Drain	SN6, SN6 & SN4
300	MetroDrain LC, MetroDrain & N-Drain	SN6, SN6 & SN4
375	MetroDrain LC, MetroDrain & N-Drain	SN6, SN6 & SN4
450	MetroDrain LC, MetroDrain & N-Drain	SN6, SN6 & SN4
600	MetroDrain LC, MetroDrain & N-Drain	SN6, SN6 & SN4
750	MetroDrain	SN6
900	MetroDrain	SN6
1050	MetroDrain	SN6*

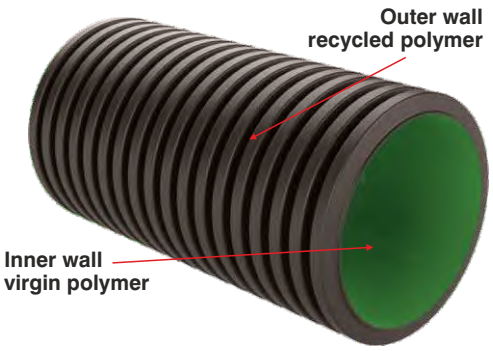
*not covered by BBA

Developments Highways Rail Ports Agriculture

Introducing MetroDrain LC

''All the performance, nearly half the carbon''

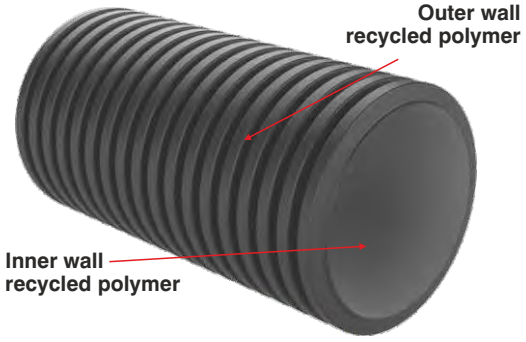
Standard MetroDrain



HDPE	kgCO2e/m of pipe					
	DN150	DN225	DN300	DN375	DN450	DN600
Virgin & Recycled HDPE	1.8	3.9	6.5	9.6	14	24.1

MetroDrain LC

Average 48% reduction in kgCO2e



HDPE	kgCO2e/m of pipe					
	DN150	DN225	DN300	DN375	DN450	DN600
Recycled HDPE	1.0	2.1	3.1	4.7	6.8	13.2

Sustainability

- Use of Recycled Material

Naylor is one of the UK's large user of recycled HDPE: recycled/reprocessed materials are incorporated into our products where possible and technically permissible **without compromising quality**:

- inbound materials are subject to stringent quality to ensure that the quality of finished goods is not compromised
- internal mixing and blending procedures are controlled and maintained

Source materials are primarily:

- Post industrial - produced as an industrial by-product or waste
- Reprocessed waste - any scrap product produced by our operations is granulated and the resultant material reused

Performance testing

	MetroDrain	MetroDrain LC
Material properties & specification	✓	✓
Dimensions	✓	✓
Ring stiffness	✓	✓
Creep ratio	✓	✓
Resistance to longitudinal bending	✓	✓
Impact strength	✓	✓
Rodding resistance	✓	✓
Water jetting	✓	✓
Leaktightness including subject to diameter distortion and angular deflection	✓	✓

Use of recycled Material

	MetroDrain LC	MetroDrain	N-Drain
DN 150	✓	✓	✓
DN 225	✓	✓	✓
DN 300	✓	✓	✓
DN 375	✓	✓	✓
DN 450	✓	✓	✓
DN 600	✓	✓	✓
DN 750		✓	
DN 900		✓	
DN 1050		✓	

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MetroDrain

HDPE Premium Twin Wall Carrier/Filter Drainage System

Developments Highways Rail Agriculture Ports

MetroDrain Pipes

Unperforated/plain ended

ID (mm)	Nom OD (mm)	Length (m)	Pack Qty.	Nom Wt. kg/m	Code	Certification
150	173	6	33	1.4	71302	BBA
225	265	6	14	3	71303	BBA
300	353	6	9	5	71304	BBA
375	432	6	5	7.4	71305	BBA
450	518	6	4	10.8	71306	BBA
600	692	6	28/Load	18.6	71307	BBA
750	860	6	18/load	26.8	71358	BBA
900	1034	6	8/load	36	71359	BBA
1050	1189	6	8/load	51.2	71360	-

Unperforated/socketed

750	918‡	3	36/load	26.8	71363	BBA
900	1093‡	3	16/load	36	71364	BBA
1050	1255‡	3	16/load	51.2	71331	-

Unperforated/socketed

750	918‡	6	18/load	26.8	71311	BBA
900	1093‡	6	8/load	36	71321	BBA
1050	1255‡	6	8/load	51.2	71328	-

‡Nominal OD including socket

Perforated/plain ended

ID (mm)	Nom OD (mm)	Length (m)	Pack Qty.	Nom Wt. kg/m	Code	Certification
150	173	6	33	1.4	71312	BBA
225	265	6	14	3	71313	BBA
300	353	6	9	5	71314	BBA
375	432	6	5	7.4	71315	BBA
450	518	6	4	10.8	71316	BBA
600	692	6	28/Load	18.6	71317	BBA
750	860	6	18/load	26.8	71361	BBA
900	1034	6	8/load	36	71137	BBA
1050	1189	6	8/load	51.2	71166	-

Perforated/socketed

750	918‡	6	18/load	26.8	71319	BBA
900	1093‡	6	8/load	36	71320	BBA
1050	1255‡	6	8/load	51.2	71329	-

‡Nominal OD including socket

Half Perforated/plain ended

ID (mm)	Nom OD (mm)	Length (m)	Pack Qty.	Nom Wt. kg/m	Code	Certification
150	173	6	33	1.4	71322	BBA
225	265	6	14	3	71323	BBA
300	353	6	9	5	71324	BBA
375	432	6	5	7.4	71375	BBA
450	518	6	4	10.8	71376	BBA
600	692	6	28/Load	18.6	71377	BBA
750†	860	6	18/load	26.8	71126	BBA
900†	1034	6	8/load	36	71155	BBA
1050†	1189	6	8/load	51.2	71183	-

Half Perforated/socketed

750	918‡	6	18/load	26.8	71318	BBA
900	1093‡	6	8/load	36	71327	BBA
1050	1255‡	6	8/load	51.2	71330	-

‡Nominal OD including socket

MetroDrain LC

HDPE Low carbon Twin Wall Carrier Drainage System

NEW PRODUCT

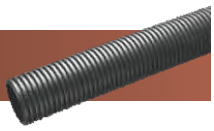
MetroDrain LC Pipes

Unperforated/plain ended

ID (mm)	Nom OD (mm)	Length (m)	Pack Qty.	Nom Wt. kg/m	Code	Certification
150	173	6	33	1.6	74202	-
225	265	6	14	3.3	74203	-
300	353	6	9	5	74204	-
375	432	6	5	7.4	74205	-
450	518	6	4	10.8	74206	-
600	692	6	28/Load	21	74207	-

N-Drain

HDPE Agricultural Twin Wall Carrier/Filter Drainage System



N-Drain Pipes

Unperforated/plain ended

ID (mm)	Nom OD (mm)	Length (m)	Pack Qty.	Nom Wt. kg/m	Code
100	117	6	85	0.63	71107
150	173	6	33	1.18	71260
225	267	6	14	2.52	71076
300	354	6	9	3.9	71075
375	433	6	5	5.59	71117
450	521	6	4	9.1	71118
600	695	6	28/Load	17.05	71093

Perforated/plain ended

ID (mm)	Nom OD (mm)	Length (m)	Pack Qty.	Nom Wt. kg/m	Code
100	117	6	85	0.63	71108
150	173	6	33	1.18	71259
225	267	6	14	2.52	71080
300	354	6	9	3.9	71079
375	433	6	5	5.59	71119
450	521	6	4	9.1	71120
600	695	6	28/Load	17.05	71121

*Half Perforated subject to minimum quantities and lead time.

For N-Drain couplings, sealing rings and fittings see MetroDrain range

*N-Drain

MetroDrain

HDPE Premium Twin Wall Carrier/Filter Drainage System

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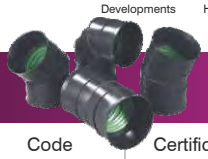
MetroDrainBends



ID (mm)	Bend°	Code	Certification
100*	11¼	71401	-
100*	22½	71402	-
100*	45	71403	-
100*	90	71404	-
150	11¼	71351	BBA
150	22½	71352	BBA
150	45	71353	BBA
150	90	71354	BBA
● 225	11¼	71563	BBA
● 225	22½	71573	BBA
● 225	45	71583	BBA
● 225	90	71593	BBA
300	11¼	71504	BBA
300	22½	71514	BBA
300	45	71524	BBA
300	90	71534	BBA
375	11¼	71505	BBA
375	22½	71515	BBA
375	45	71525	BBA
375	90	71535	BBA
450	11¼	71506	BBA
450	22½	71516	BBA
450	45	71526	BBA
450	90	71536	BBA
600	11¼	71507	BBA
600	22½	71517	BBA
600	45	71527	BBA
600	90	71537	BBA
†750	11¼	71508	
†750	22½	71518	
†750	45	71528	
†750	90	71538	
†900	11¼	71509	
†900	22½	71519	
†900	45	71529	
†900	90	71539	
†1050	11¼	71510	
†1050	22½	71520	
†1050	45	71530	
†1050	90	71540	

† Plain ended. Requires sealing rings on all sealed systems.
100* is N-Drain only.

MetroDrain Junctions

90° Junctions/socketed

ID (mm)	Description	Code	Certification
100 x 100	T	71406	-
150 x 100	T	71604	-
● 150 x 150	T	71585	BBA
● 225 x 150	T	71587	BBA
● 225 x 225	T	71588	BBA
300 x 150	T	71624	BBA
300 x 225	T	71626	BBA
300 x 300	T	71628	BBA
375 x 150	T	71634	BBA
375 x 225	T	71636	BBA
375 x 300	T	71638	BBA
375 x 375	T	71640	BBA
450 x 150	T	71644	BBA
450 x 225	T	71646	BBA
450 x 300	T	71648	BBA
450 x 375	T	71650	BBA
450 x 450	T	71652	BBA
600 x 150	T	71664	BBA
600 x 225	T	71666	BBA
600 x 300	T	71668	BBA
600 x 375	T	71670	BBA
600 x 450	T	71672	BBA
600 x 600	T	71674	BBA

Junctions continued in next column
Requires sealing rings on all sealed systems. 100* is N-Drain only.

MetroDrain Junctions continued

90° Junctions/plain ended*

ID (mm)	Description	Code	Certification
750 x 150	T	71834	n/a
750 x 225	T	71836	n/a
750 x 300	T	71838	n/a
750 x 375	T	71840	n/a
750 x 450	T	71842	n/a
750 x 600	T	71844	n/a
750 x 750	T	71846	n/a
900 x 150	T	71854	n/a
900 x 225	T	71856	n/a
900 x 300	T	71858	n/a
900 x 375	T	71860	n/a
900 x 450	T	71862	n/a
900 x 600	T	71864	n/a
900 x 750	T	71866	n/a
900 x 900	T	71868	n/a
1050 x 150	T	71884	n/a
1050 x 225	T	71886	n/a
1050 x 300	T	71888	n/a
1050 x 375	T	71890	n/a
1050 x 450	T	71892	n/a
1050 x 600	T	71894	n/a
1050 x 750	T	71896	n/a
1050 x 900	T	71898	n/a
1050 x 1050	T	71900	n/a

Requires sealing rings on all sealed systems/couplers.

MetroDrain Junctions

45° Junctions/socketed

ID (mm)	Description	Code	Certification
100 x 100*	Y	-	-
150 x 100	Y	71698	-
● 150 x 150	Y	71581	BBA
● 225 x 150	Y	71586	BBA
● 225 x 225	Y	71584	BBA
300 x 150	Y	71623	BBA
300 x 225	Y	71625	BBA
300 x 300	Y	71627	BBA
375 x 150*	Y	71633	BBA
375 x 225*	Y	71635	BBA
375 x 300*	Y	71637	BBA
375 x 375*	Y	71639	BBA
450 x 150*	Y	71643	BBA
450 x 225*	Y	71645	BBA
450 x 300*	Y	71647	BBA
450 x 375*	Y	71649	BBA
450 x 450*	Y	71651	BBA
600 x 150*	Y	71663	BBA
600 x 225*	Y	71665	BBA
600 x 300*	Y	71667	BBA
600 x 375*	Y	71669	BBA
600 x 450*	Y	71671	BBA
600 x 600*	Y	71673	BBA

45° Junctions/plain ended

750 x 150	Y	71833	n/a
750 x 225	Y	71835	n/a
750 x 300	Y	71837	n/a
750 x 375	Y	71839	n/a
750 x 450	Y	71841	n/a
750 x 600	Y	71843	n/a
750 x 750	Y	71845	n/a
900 x 150	Y	71853	n/a
900 x 225	Y	71855	n/a
900 x 300	Y	71857	n/a
900 x 375	Y	71859	n/a
900 x 450	Y	71861	n/a
900 x 600	Y	71863	n/a

Junctions continued in next column
Requires sealing rings on all sealed systems/couplers. 100* is N-Drain only.

Telephone: 01226 790591 Email: info@naylor.co.uk www.naylordrainage.co.uk

MetroDrain

HDPE Premium Twin Wall Carrier/Filter Drainage System

Developments Highways Rail Ports Agriculture

MetroDrain Junctions continued

45° Junctions/plain ended

ID (mm)	Description	Code	Certification
900 x 750	Y	71865	n/a
900 x 900	Y	71867	n/a
1050 x 150	Y	71883	n/a
1050 x 225	Y	71885	n/a
1050 x 300	Y	71887	n/a
1050 x 375	Y	71889	n/a
1050 x 450	Y	71891	n/a
1050 x 600	Y	71893	n/a
1050 x 750	Y	71895	n/a
1050 x 900	Y	71897	n/a
1050 x 1050	Y	71899	n/a

Requires sealing rings on all sealed systems.

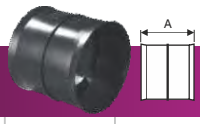
MetroDrain Level Invert Reducers

Socketed

ID (mm)	Code
150 x 100	71701
225 x 150	71703
300 x 150	71705
300 x 225	71706
375 x 150	71708
375 x 225	71709
375 x 300	71710
450 x 150	71712
450 x 225	71713
450 x 300	71714
450 x 375	71715
600 x 150	71717
600 x 225	71718
600 x 300	71719
600 x 375	71720
600 x 450	71721
750 x 150	71742
750 x 225	71743
750 x 300	71744
750 x 375	71745
750 x 450	71746
750 x 600	71747
900 x 150	71752
900 x 225	71753
900 x 300	71754
900 x 375	71755
900 x 450	71756
900 x 600	71757
900 x 750	71758
1050 x 150	71772
1050 x 225	71773
1050 x 300	71774
1050 x 375	71775
1050 x 450	71776
1050 x 600	71777
1050 x 750	71778
1050 x 900	71779

Requires sealing rings on all sealed systems.

MetroDrain Couplings



ID (mm)	Pallet Qty.	Dimension mm A	Code	Certification
100*	400	-	71085	-
150	200	176	71332	BBA
225	96	284	71333	BBA
300	45	353	71334	BBA
375	25	330	71335	BBA
450	20	396	71336	BBA
600	12	485	71337	BBA
750	2	700	71045	BBA
900	2	800	71047	Pending
1050	2	900	71050	-

One coupling and two seals are required per joint if coupling used.
100* is N-Drain Couplings only

End Caps

Size (mm)	Code
150	71802
225	71803
300	71804
375	71805
450	71806
600	71807

MetroDrain Sealing Rings

ID (mm)	Material	Pack Qty.	Code	Certification
100*	EPDM	1	71001	-
150	EPDM	1	71342	BBA
225	EPDM	1	71343	BBA
300	EPDM	1	71344	BBA
375	EPDM	1	71345	BBA
450	EPDM	1	71346	BBA
600	EPDM	1	71347	BBA
750	EPDM	1	71099	BBA
900	EPDM	1	71102	BBA
1050	EPDM	1	71104	-

Two seals are required per joint
100* is N-Drain Sealing Rings only

Lubricant

Size (Kg)	Code
1.0	50001
2.5	50002

DN Pipe Size	100	150	225	300	375	450	600	750	900	1050
Average No. of Joints per Kg.	100	50	30	24	15	10	8	5	3	2

Suitable for all types of push fit gravity pipe systems. We cannot guarantee the performance of the product if Naylor Lubricant is not used.

Gullies/Accessories

Developments Telecoms Highways Rail Power & Energy Ports Agriculture

Ribbed Road Gullies

All Plastic HDPE Gullies are supplied complete with internal trap and rodding eye.
Supplied into stock in pack quantities only. 100% recycled.

Pack Qty.	DN Internal (Nominal)	Internal Depth (Nominal)	DN Outlet (Nominal)	Code
20	450	900	178	67003
20	450	900	160	67004
20	450	750	160	67005
20	450	750	178	67009
20	375	750	178	67002

Yard Gully

Supplied into stock in pack quantities only.
100% recycled.

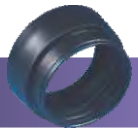
Pack Qty.	Dia. (mm)	H (mm)	DN	Code
30	300	600	110	67006

Gully Connection Pipe

Dia. (mm)	Length (m)	Pallet Qty.	Code
160	25	5	67011
178	25	5	67008

Single wall Supplied in coils.

Outlet Adaptor



OD (mm)	Code	Box Qty.
160/178*	67012	20

*Reversible

160mm Outlet Connects to	150mm ID	178mm OD	Twinwall
	150mm ID	178mm OD	Ultra-Rib
	150mm ID	178mm OD	Clayware
	150mm ID	160mm OD	Quantum
	-	160mm OD	PVC-u
	-	160mm OD	Land Drain
	-	160mm OD	Gully Connection Pipe
	-	178mm OD	Gully Connection Pipe
178mm Outlet Connects to	150mm ID	160mm OD	Quantum
	-	160mm OD	PVC-u
	-	160mm OD	Land Drain
	-	160mm OD	Gully Connection Pipe

Adaptor Coupling

OD (mm)	Code	Box Qty.
178/172	71700	-

Fabrications

A comprehensive fabrication service is available producing complementary items such as bespoke catchpits, manholes, fittings and flow control chambers etc.

Please contact sales office for price and availability.

Naylor MetroDuct

Introduction

Naylor offer a technically advanced and comprehensive range of ducting systems. With production facilities in both England and Scotland we are well placed to meet the needs of civils, utility, telecommunication markets and others.

The Naylor ducting system comprises three main components: ducting pipes, access chambers, covers and frames.

Naylor 50-150mm ducting is manufactured to BBA and BS EN61386 as required by the Highways Agency.

Developments Telecoms Highways Rail Power & Energy Ports

MetroDuct

BBA BRITISH BOARD OF AGREMENT CERTIFICATE No. 00 / H131

KM 57808

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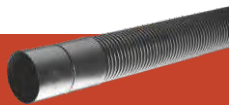
NJUG Colour Coding

All MetroDuct Twin Wall Pipes up to 150mm Manufactured to BS EN 61386

Colour	Application
Black/Red	Electricity/Power
Orange	Street Lighting/Traffic Signal
Purple	Motorway Communication/ Street Lighting (Scotland)
Yellow	Gas
Blue	Water
Green	CCTV
Grey	Telecommunications

Up to 150mm manufactured in accordance to BS EN 61386

Class 1 Twin Wall Duct



Fully compliant with ENATS 12/24 Certificate No. A3002

HDPE Twinwall Ducting

ID/OD (mm)	Length (m)	Colour	Pack Qty.	Code	Certification
100/120	6	Black/Red	85	29526	ENATS 12/24
125/145	6	Black/Red	72	29626	ENATS 12/24
150/178	6	Black/Red	33	29726	ENATS 12/24

NEW PRODUCT

Class 2 Twin Wall Cable Duct

Fully compliant with ENATS 12/24 Certificate No. T5952

ID/OD (mm)	Length (m)	Pack Qty.	Code	Certification
100/120	6	85	29516	ENATS 12/24
100/120	3	85	29513	ENATS 12/24
100/120	2	85	29512	ENATS 12/24
100/120	1	85	29511	ENATS 12/24
125/145	6	72	29616	ENATS 12/24
125/145	3	72	29613	ENATS 12/24
125/145	2	72	29612	ENATS 12/24
125/145	1	72	29611	ENATS 12/24
150/178	6	33	29716	ENATS 12/24
150/178	3	33	29713	ENATS 12/24
150/178	2	33	29712	ENATS 12/24
150/178	1	33	25711	ENATS 12/24

Supplied with one coupling per length.

MetroDuct - Twin Wall - Electric Black

Heavy Duty HDPE Twin Wall Ducting

printed - Electric Cable Duct

ID/OD (mm)	Length (m)	Pack Qty.	Code	Certification
94/110	6	100	29120	BBA
100/120	6	85	29278	BBA
125/145	6	72	29111	BBA
137/160	6	33	29119	BBA
150/178	6	33	29112	BBA
100/120	3	85	29208	BBA
125/145	3	72	29273	BBA
150/178	3	33	29275	BBA
100/120	2	85	29347	BBA
125/145	2	72	29199	BBA
150/178	2	33	29209	BBA

MetroDuct - Twin Wall Split Duct

C/W Dowels or ties as appropriate.

ID/OD (mm)	Length (m)	Pack Qty.	Code
94/110	1	100	29285
100/120	1	85	29080
125/145	1	72	29210
150/178	1	33	29121
94/110	3	100	29070
100/120	3	85	29081
125/145	3	72	29242
150/178	3	33	29223

Made to order, subject to a lead time.

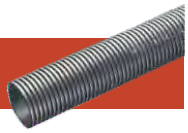
MetroDuct - Twin Wall - Unmarked Black

HDPE Twin Wall Ducting

ID/OD (mm)	Length (m)	Pack Qty.	Code	Certification
94/110*	6	100	29450	BBA
100/120*	6	85	29451	BBA
125/145*	6	72	29452	BBA
137/160*	6	33	29453	BBA
150/178*	6	33	29454	BBA

*Subject to minimum order quantity and lead time.

MetroDuct Sealed System



Motorway Communications/Power

Black Plain Ended

ID/OD (mm)	Length (m)	Pack Qty.	Code
94/110+	6	100	29007
100/120+	6	85	29388
150/178+	6	33	29370

For sealed system 2 sealing rings required per 6m length.

* Subject to minimum order quantity and lead time.

MetroDuct Sealed System

Motorway Communications

Purple Plain Ended

ID/OD (mm)	Length (m)	Pack Qty.	Code	Certification
94/110	6	100	29046	BBA
100/120	6	85	29364	BBA
150/178	6	33	29420	BBA

For sealed system 2 sealing rings required per 6m length.

* Subject to minimum order quantity and lead time.

MetroDuct Twin Wall Coiled Ducting

HDPE/MDPE Twin Wall Ducting

Printed - Electric Cable Duct

ID/OD (mm)	Length (m)	Colour	Pallet Qty.	Code	Certification
50/63	50	Black	8	29113	BS
94/110	50	Black	5	29267	BS
137/160	25	Black	7	29268	BS
137/160	50	Black	4	29092	BS

Coils supplied with pre-installed draw string and coupling.

Telephone: 01226 790591 Email: info@naylor.co.uk www.naylordrainage.co.uk

MetroDuct

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MetroDuct Twin Wall

Motorway Communication - Purple
Printed - Motorway Communications

ID/OD (mm)	Length (m)	Pack Qty.	Code	Certification
94/110	6	100	29043	BBA
100/120	6	85	29200	BBA
137/160	6	33	29249	BBA
150/178	6	33	29059	BBA

Supplied with one coupling per length.

MetroDuct Twin Wall Coiled Ducting

Motorway Communications - Purple
Printed - Motorway Communications

ID/OD (mm)	Length (m)	Pallet Qty.	Code	Certification
50/63	50	8	29279	BS
94/110	50	5	29280	BS
137/160*	50	4	29019	BS

MetroDuct Twin Wall

Street Lighting/Traffic Signal or Plain - Orange

ID/OD (mm)	Length (m)	Marked	Pack Qty.	Code	Certification
50/63*	6	SL	158	29087	BBA
50/63*	6	TS	158	29086	BBA
94/110	6	SL	100	29085	BBA
94/110	6	TS	100	29084	BBA
94/110	6	Plain	100	29042	BBA
100/120*	6	SL	85	29083	BBA
100/120*	6	TS	85	29082	BBA
100/120*	6	Plain	85	29052	BBA
137/160*	6	SL	33	29198	BBA
137/160*	6	TS	33	29189	BBA
137/160*	6	Plain	33	29197	BBA
150/178	6	SL	33	29061	BBA
150/178	6	TS	33	29356	BBA
150/178*	6	Plain	33	29357	BBA

MetroDuct Twin Wall Coiled Ducting

Orange

ID/OD (mm)	Length (m)	Marked	Pallet Qty.	Code	Certification
50/63	50	SL	8	29091	BS
50/63	50	TS	8	29090	BS
50/63	50	Plain	8	29037	-
94/110	50	SL	5	29089	BS
94/110	50	TS	5	29088	BS
94/110	50	Plain	5	29047	-
137/160*	50	SL	4	29135	BS
137/160*	50	TS	4	29348	BS
137/160*	50	Plain	4	29124	-

*Subject to minimum order quantity and lead time.

Metro Twin Wall Utility Ducting

Yellow

ID/OD (mm)	Length (m)	Pack Qty.	Code	Certification
94/110	6	100	29045	BBA
100/120*	6	85	29349	BBA
137/160	6	33	29244	BBA
150/178	6	33	29358	BBA
225/266+	6	14	29411	-
300/353+	6	9	29412	-
450/518	6	4	29437	-

Yellow Perforated

ID/OD (mm)	Length (m)	Pack Qty.	Code	Certification
150/178	6	33	29431	-
225/266	6	14	29424	-
300/353	6	9	29427	-
450/518	6	4	29436	-

Blue

ID/OD (mm)	Length (m)	Pack Qty.	Code	Certification
94/110	6	100	29110	BBA
100/120*	6	85	29350	BBA
137/160	6	33	29241	BBA
150/178	6	33	29355	BBA
225/266+	6	14	29413	-
300/353+	6	9	29414	-
450/518	6	4	29434	-

Blue Perforated

ID/OD (mm)	Length (m)	Pack Qty.	Code	Certification
150/178	6	33	29432	-
225/266	6	14	29428	-
300/353	6	9	29433	-
450/518	6	4	29435	-

Green - CCTV Printed

ID/OD (mm)	Length (m)	Pack Qty.	Code	Certification
94/110	6	100	29281	BBA
100/120*	6	85	29351	BBA
137/160*	6	33	29250	BBA
150/178	6	33	29359	BBA

Grey - Telecommunications

ID/OD (mm)	Length (m)	Pack Qty.	Code	Certification
94/110*	6	100	29238	BBA
150/178*	6	33	29396	BBA

Red - unprinted*

ID/OD (mm)	Length (m)	Pack Qty.	Code	Certification
94/110*	6	100	29170	BBA

Supplied with one coupling per length.
* Subject to minimum order quantity and lead time.
+ Please Note: Pipe supplied plain ended - order couplings separately .

MetroDuct

Developments Telecoms Highways Rail Power & Energy Ports Agriculture

MetroCoil Single Wall Ducting

Yellow
Perforated Gas Duct Pipe Kitemarked to BS4962

OD (mm)	Length (m)	Pallet Qty.	Code	Certification
60	50	8	68075	BS
60	150	5	68074	BS
80	25	9	68073	BS
80	50	7	68072	BS
80	100	4	68071	BS
100	25	7	68070	BS
100	50	6	68069	BS
100	100	4	68068	BS
160	50	4	68066	BS

MetroDuct Twin Wall Utility Ducting

Yellow Coils

KM 57808

ID/OD (mm)	Length (m)	Pallet Qty.	Code	Certification
50/63	50	8	29040	BS
94/110	50	5	29050	BS

Blue

KM 57808

ID/OD (mm)	Length (m)	Pallet Qty.	Code	Certification
50/63	50	8	29039	BS
94/110	50	5	29049	BS

Green

KM 57808

ID/OD (mm)	Length (m)	Pallet Qty.	Code	Certification
50/63	50	8	29094	BS
94/110	50	5	29171	BS

Coils supplied with pre-installed draw string and coupling.
Other colours available subject to a minimum order quantity and lead time.

Couplings

Black as standard

OD (mm)	Bag Qty.	Code
40	-	29161
50	-	29167
63	2000	29104
90	-	29103
110	400	29225
120	400	29101
145	250	29100
160	200	29099
178	200	29098

Sealing Rings

Black as standard

Diameter (mm)	Code
110	29107
120	29115
160	29106
178	29117

For sealed system 2 sealing rings required per 6m length.

Twin Wall Bends

Supplied plain ended. Black as standard.

ID/OD (mm)	11¼° Code	22½° Code	45° Code	90° Code
94/110	29144	29141	29138	29149
100/120	29215	29174	29164	29159
125/145	29243	29165	29166	29156
137/160	29022	29180	29181	29182
150/178	29262	29183	29163	29162

Order couplings separately.

Telephone: 01226 790591 Email: info@naylor.co.uk www.naylordrainage.co.uk

MetroDuct

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MetroCoil Single Wall Ducting

Street Lighting Scotland - Purple

OD (mm)	Length (m)	Colour	Code
35	25	Purple	M68027
63	100	Purple	M68006
105	40	Purple	M68001

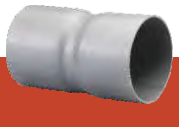
MetroSmooth Duct

Street Lighting/Traffic Signal

ID/OD (mm)	Description	WT (mm)	Pack Qty	Code
53/63*	Street Lighting	5	288	38028
97/107	Street Lighting	5	76	38091
53/63*	Traffic Signal	5	288	38059
97/107	Traffic Signal	5	76	38030

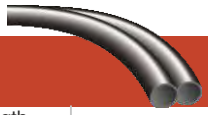
Supplied with a coupler. Extra couplings to be ordered separately.
*Subject to minimum order quantity and lead time.

MetroSmooth Couplings



ID/OD (mm)	Code
53/63	38007
97/107	38042

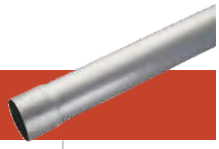
MetroSmooth Electric Cable Duct



ID/OD (mm)	WT (mm)	Length (m)	Code
32/37	2.5	25	38020
32/37	2.5	50	38023
32/37	2.5	100	38024
38/44	3	25	38021
38/44	3	50	38025
38/44	3	100	38026
50/60	5	25	38033
50/60	5	50	38034

HDPE Smooth internal and external. Colour Black.
Coils supplied plain ended and couplers can be made to special order and a minimum order quantity applies.

General Purpose Duct



Dia (in)	Nom Dia (mm)	Pack Qty	Code
2	54	369	30052
3	88.9	125	30053
4	114	76	30054
6	168	39	30055
8	200	25	30056

6 Metre lengths.
Lightweight applications only. Check suitability before installation.
NB. Requires adequate protection during installation.

General Purpose Duct Bends

Dia (in)	Dia (mm)	Bag Qty	11¼° Code	22½° Code	45° Code	90° Code
2	54	50	36054	36058	36071	36073
3	88.9	15	36053	36057	36078	36074
4	114	10	36052	36056	36079	36075
6	168	2	36051	36055	36080	36076
8	200	1	-	-	36081	36077

Supplied into stock in bag quantities only.

General Purpose Duct Connectors

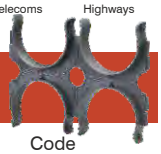
Dia. (in)	Dia. (mm)	Bag Qty	Code
2	54	100	36050
3	88.9	50	36049
4	114	50	36048
6	168	25	36047
8	200	1	36046

Supplied into stock in bag quantities only.

MetroDuct Accessories

Developments Telecoms Highways Rail Power & Energy Ports Agriculture

Duct Spacer



Description	Size (mm)	Code
4 Way	110	29230
4 Way	120	29375
4 Way	150 (178)	29399
6 Way	110	29228
6 Way	150 (178)	29231
8 Way	150 (178)	29235

End Caps

Diameter (mm)	Code
63	29131
90*	29130
110	29129
120	29128
145	29127
160	29126
178	29168

*Subject to minimum order quantity and lead time.

Lubricant

Size (Kg)	Code
1.0	50001
2.5	50002

Suitable for all types of push fit gravity pipe systems. We cannot guarantee the performance of the product if Naylor Lubricant is not used.

Sitework Equipment

Draw Cord

Description	Code
220 Metre Coil	29264
500 Metre Drum	29191

Nominal 5kN Breaking Strength. 6mm cord.

Marker Tape

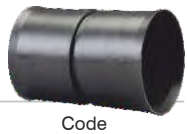
Service	Colour	Code
Electric Cable	Yellow	34036
Water Main	Blue	34037
Gas Main	Yellow	34038
Telephone Cable	Green	34039
Foul Sewer	Red	34040
Street Lighting	Yellow	34041

365m Rolls.

MetroCoil Fittings

Junction Boxes - Scotland

OD (mm)	Colour	Code
105	Black	M68132



Connectors - Scotland

OD (mm)	Colour	Code
63	Black	M29343
105	Black	M29345

Reducers - Scotland

OD (mm)	Colour	Code
105x63	Black	68008

Metro Access Chamber

The Naylor Modular Access Chambers systems are an easy to assemble, eco-friendly system, which can either be supplied flat packed or pre-assembled depending on the customer's preference.

Metro Access Chambers

Clear Opening (W) mm	Clear Opening (L) mm	Depth (D) mm	Pallet Qty.	Code
300	300	330	18	69224
300	450	330	18	69225
450	450	330	24	69226
450	600	330	18	69227
600	600	330	13	69228

Larger sizes are available upon request.
Supplied fully assembled or flat packed.

Features

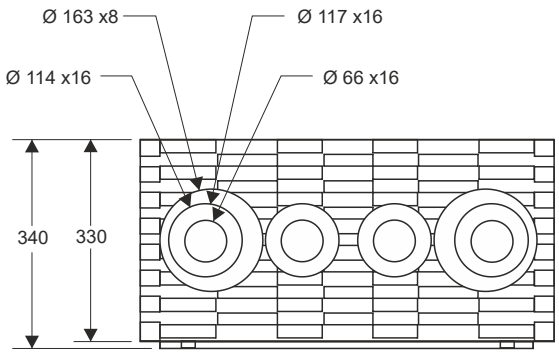
- Panels quick and easy to assemble
- Interlock design at each corner
- Panels available from 300, 450 & 600mm
- Panels are 330mm deep, with locking features
- Panels are trepanned to take pipe from 63mm to 160mm
- Wide flange design, enables covers to fit onto top chamber ring

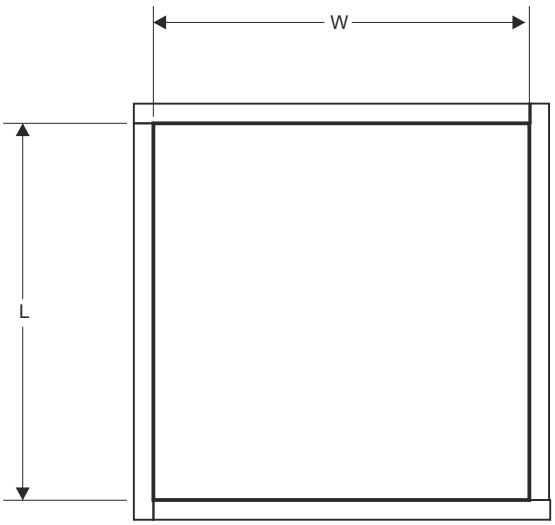
Access Plate Packaging Details

Plate Size mm	Pallet Qty.	Code
300	600	69220
450	400	69221
600	200	69222
900	200	69229
1200	150	69230

Benefits

- Manufactured from recycled Polypropylene
- External wall patterned, such that concrete surround will flow into voids
- Composite covers & frames available
- Adaptors available to suit 178mm pipe
- Chamber system used by many Local Authorities





Please refer to Technical Document for Installation Details

Developments Telecoms Highways Rail Power & Energy Ports Agriculture

Covers and Frames

Composite and Galvanised

Features and Benefits

- Composite covers available with an integral anti-skid pattern on the surface, load rated to BS EN124 Class B125
- Composite Covers are black in colour and marked ‘Naylor Drainage’ with the legend ‘Traffic Signals’ or ‘Street Lighting’ where applicable
- Composite Covers have integral lifting keyholes and locking features available as standard
- A wide external frame flange enables easy fit onto Naylor Access Chambers
- A deep seated galvanised frame ensures flush fit to Naylor Access Chambers
- Covers available in all sizes to fit Naylor Metro Access Chambers
- Used by many Local Authorities
- Stocked as standard

Metro Covers & Frames

Composite - Anti Slip

Dimension (mm)	Code
300x300	69128
300x450	69129
450x450	69127
450x600	69126
600x600	69125

Market sectors

- Building
- Construction
- Highways
- Water
- Rail
- Traffic Signal & Street Lighting
- Ministry of Defence
- Agriculture

Developments Telecoms Highways Rail Power & Energy Ports Agriculture

Telephone: 01226 790591 Email: info@naylor.co.uk www.naylordrainage.co.uk

Land Drainage

KM 58740

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Agri-Drain Land Drainage

Perforated - Black

External Dia. (mm)	Length (m)	Colour	Pallet Qty.	Code
60	25	Black	12	68029
60	50	Black	8	68032
60	150	Black	5	68033
80	25	Black	9	68034
80	50	Black	7	68035
80	100	Black	4	68036
100	25	Black	7	68037
100	50	Black	6	68038
100	100	Black	4	68039
160	50	Black	4	68007
160†	35	Black	-	68094

Manufactured in 100% recycled HDPE.
Manufactured in accordance with BS 4962.
†Scotland only.

Agri-Drain Land Drainage

Unperforated - Black

External Dia. (mm)	Length (m)	Colour	Pallet Qty.	Code
60	50	Black	8	68042
60	150	Black	5	68043
80	25	Black	9	68048
80	50	Black	7	68053
80	100	Black	4	68049
100	25	Black	7	68050
100	50	Black	6	68044
100	100	Black	4	68045
160	50	Black	4	68009
160†	35	Black	-	68046

Manufactured in 100% recycled HDPE.
Manufactured in accordance with BS 49626.
†Scotland only.

Kitemarked Land Drainage

Perforated - Black

External Dia. (mm)	Length (m)	Colour	Pallet Qty.	Code	Certification
60*	50	Black	8	68202	BS
60*	150	Black	5	68204	BS
80*	25	Black	9	68301	BS
80*	50	Black	7	68302	BS
80*	100	Black	4	68303	BS
100*	25	Black	7	68401	BS
100*	50	Black	6	68402	BS
100*	100	Black	4	68403	BS
160*	50	Black	4	68502	BS

Manufactured in 100% recycled HDPE.
Kitemarked to BS 4962

Unperforated - Black

External Dia. (mm)	Length (m)	Colour	Pallet Qty.	Code	Certification
60*	150	Black	5	68214	BS
80*	100	Black	4	68313	BS
100*	100	Black	4	68413	BS
160*	50	Black	4	68512	BS

Manufactured in HDPE. *Marked Naylor BS 4962

Land Drainage Universal Fittings

Junctions

Description	Pack Qty.	Code
60/80/100 Multi Junction	50	68064
60/160 Multi Junction	10	68061

Land Drainage Connectors

External Dia. (mm)	Code
60	68086
80	68087
100	68062
160	68063

Land Drainage End Caps

External Dia. (mm)	Code
60	68090
80	68088
100	68091
160	68109

Wrapped Land Drainage

Geotextile wrapped land drainage coil prevents ingress of very fine particles, such as sand and sediment, in appropriate soil conditions.

Land Drainage

Agri-Wrapped Land Drainage

Available in 80 and 100mm diameters in 50m lengths

External Dia. (mm)	Length (m)	Pallet Qty.	Code
80	50	5	68077
100	50	5	68118
160	50	3	68119

Naylor Environmental

Sustainable Drainage Systems (SuDS)

Hard and soft SuDS solutions for the construction and building industry

MetroPave Grass & Gravel Ground Reinforcement Grids

The Naylor MetroPave grid is Made from 100% recycled plastic and is designed to withstand loading of up to 30 tonne axle loads.
The MetroPave grid is intended for use in domestic and pedestrian settings such as driveways, paths and shed bases. Units can be infilled with grass or gravel to suit the local environment and are fully SuDs compliant. Interlocking grids for a quick and easy installation process.

All quality systems and inspection procedures comply with BS EN ISO 9001: 2015 (Certificate No: FM 01420).

Product Details

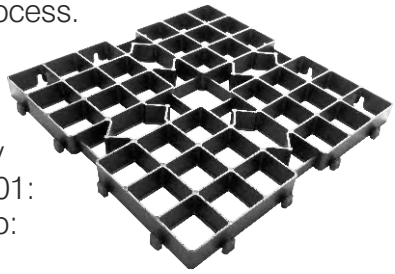
Description	MetroPave
Naylor Product Code	**65110**
Unfilled Load Bearing Capacity (Tonnes/m²)	150
Filled Load Bearing Capacity (Tonnes/m²)	800
Nominal Installed Size (mm)	481x481x40
Nominal Cell Size (mm)	66x66
Grids/m²	4.32
Infill Volume/m²	0.034m³
Weight (kg)	0.7 (2.98 kg/m²)
Infiltration (mm/hr)	>5000
Colour	Black
Material	Recycled HDPE/PP
Chemical Resistance	Excellent
UV Resistance	High
End Life	Recyclable
Connection Type	Side lugs and slots
Demarcation Block Compatibility	✓
Country Of Manufacture	UK
Pallet Details	120/pallet (27.8m²) 1 x 1 x 1.2m (110kg)
Full Load Details	48 pallets/load (1,340m²)

Naylor Aquavoid-Metro - Surface water attenuation and infiltration crates

Naylor's Environmental division addresses the growing need for environmental products and SuDS solutions that have a sustainable element to them, using recycled materials where possible and all offering an improvement to the surrounding built environment. These include products for both soft & hard SuDS:

MetroPave Plus Grass & Gravel Ground Reinforcement Grids

The Naylor MetroPave Plus grid is Made from 100% recycled plastic, is designed to withstand higher and more regular loading of up to 60 tonne axle loads. The MetroPave Plus grid is intended for use in commercial car parks, and car access roads. It can withstand occasional HGVs loadings for emergency access.
Units can be infilled with grass or gravel to suit the local environment and are fully SuDs compliant. Interlocking grids for a quick and easy installation process.



All quality systems and inspection procedures comply with BS EN ISO 9001: 2015 (Certificate No: FM 01420).

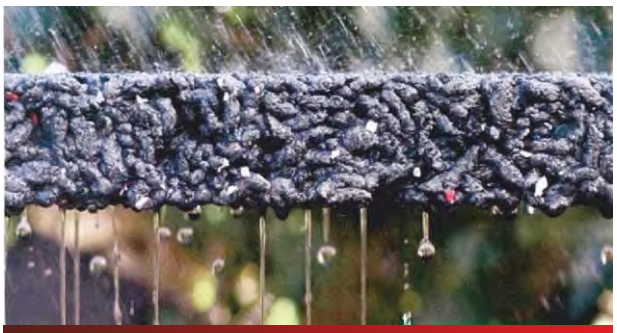
Product Details

Description	MetroPave Plus
Naylor Product Code	**65111PLUS**
Unfilled Load Bearing Capacity (Tonnes/m²)	320
Filled Load Bearing Capacity (Tonnes/m²)	1000
Nominal Installed Size (mm)	500x500x40
Nominal Cell Size (mm)	68x68
Grids/m²	4
Infill Volume/m²	0.035m³
Weight (kg)	1.2 (4.8 kg/m²)
Infiltration (mm/hr)	>5000
Colour	Black
Material	Recycled HDPE/PP
Chemical Resistance	Excellent
UV Resistance	High
End Life	Recyclable
Connection Type	Side lugs and slots
Demarcation Block Compatibility	✓
Country Of Manufacture	UK
Pallet Details	120/pallet (30m²) 1 x 1 x 1.2m (170kg)
Full Load Details	48 pallets/load (1440m²)

Naylor MetroPave HGV

(75mm) Heavy Duty System

Telephone: 01226 790591 Email: info@naylor.co.uk www.naylordrainage.co.uk



Naylor Enviroflow™ Drainage and Filtration units

The Naylor Enviroflow™ provides a unique solution for land drainage, ground stabilisation, green infrastructure and filtration solutions that are proven to be technically superior to traditional systems. Made from 100% recycled thermo-plastics, Enviroflow's products are permanent solutions that do not clog, are easy to install and handle, require little to no maintenance and are high strength and long lasting. Suitable for land drainage, water treatment, ground stabilisation, retention/detention, or permeable paving, Enviroflow™ has a solution for you.

- Enviroflow, a non-clogging fully recycled high strength land drainage and filtration solution that is easy to install and handle and requires little to no maintenance.

Naylor Smart Sponge®

The Naylor Smart Sponge® is a unique hydrocarbon (oils) removal system designed to remove the oil and permanently bond it into the molecular structure of the material so it cannot be removed under any circumstances. The subsequent waste material can be recycled via a waste to energy facility.

- The Smart Sponge® is NOT a spill kit, Smart Sponge® applications are able to remove up to 95% of all oil contaminants present in stormwater run-off. The Smart Sponge® technology remains buoyant in calm or agitated water, allowing it to remain in place until fully saturated and resulting in no wasted product.
- Smart Sponge®, an innovative way of addressing hydrocarbon pollution. Also available as Plus to treat pathogens or as HM for Heavy Metals.

Geotextiles & Membranes

Our range of Geotextiles & membranes compliment our Aquavoid & Grid solutions.

GeoGrids of various grades for ground reinforcement and stabilisation.

Grass Protection, for overlaying grassed areas to allow vehicular loads.

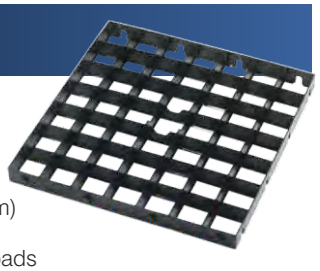
Naylorweb, for embankment stabilisation and tree root protection.

Environmental

Naylor Environmental for Hard and Soft SuDs Solutions

Naylor Grass & Gravel Reinforcement Grids

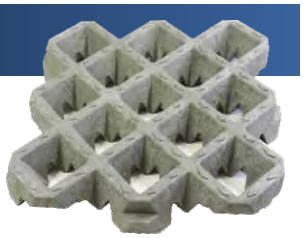
MetroPave



Size: 40mm (481 x 481 x 40mm)
Use: Heavy Duty
Strength up to 30 tonne axle loads
Applications: Driveways, paths and shed bases, SuDs schemes & gravel areas.
4.32 Grids/m^2

Product No.	Description	Pallet
65110	Metropave 40mm deep grid	120

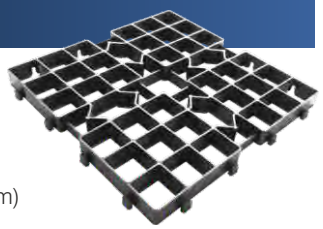
MetroPave HGV



Size: 75mm (600 x 600 x 75mm)
Use: HGV Duty
Strength: 10,000 kN/m^2
Applications: Emergency access routes, turning areas, laybys and Truck Stops.
2.77 Grids/m^2

Product No.	Description	Pallet
65132	HGVGrid 75mm deep grid	180

MetroPave Plus



Size: 40mm (500 x 500 x 40mm)
Use: Heavier Duty
Strength up to 60 tonne axle loads
Applications: Commercial car parks, and car access roads, can withstand occasional HGVs loadings for emergency access. SuDs schemes & gravel areas.
4 Grids/m^2

Product No.	Description	Pallet
65111PLUS	Metropave Plus 40mm deep grid	120

Accessories

White Demarcation Blocks
4 No to form a ''Tee'', 12 per parking bay
130 to form a disabled logo

Product No.	Description	Pallet
65120	AdPave White Markers - 40mm	100

Naylor Enviroflow™ Drainage and Filtration units

Enviroflow™

Size: 4mm (1000 x 220 x 48mm)
Use: Land & bunker drainage
Suitable for: Golf courses, sports arenas

Product No.	Description	Pallet
65300	Enviroflow Plank 4mm	152
65302	Enviroflow Filter box	1

Enviroflow™ Filter box

Naylor Aquavoid-Metro™ - Surface water attenuation and infiltration crates

Nominal crate size	1.2m (L) x 0.6m (W) x 0.3m (H)
Nominal base size	1.2m (L) x 0.6m (W) x 0.02m (H)
Coverage Rate	4.63 crates / m^3
Volume of crates	0.216 m^3
Capacity of crates	0.2063 m^3 (void ratio 95.5%)
Weight	10.5 kg
Short Term Compressive Strength	400 kN/m^2 Vertical 83 kN/m^2 Lateral
Maximum Cover	2.5m
Minimum Cover	0.5m landscape, 0.6m Cars, 0.8m HGV

Product No.	Description	Qty
65230	Crates	1
65231	Bases	1
65233	Clips	100

Accessories

Geotextiles, Geomembranes, Flange Adapters and Top Hats

Product No.	Description
65510	GT1900 non-woven 180g
65514	GT1200 non-woven 100g
65520	1.0mm HDPE geomembrane
65522	0.75mm HDPE geomembrane
65527	150mm Flange Adapter
65528	225mm Flange Adapter
65529	300mm Flange Adapter

Naylor Vortex Flow Controls Surface water applications

To control the flow by diverting excess water into the Naylor Aquavoid attenuation system.
Required:
Outfow in l/s and head height.

Product No.	Description	Pallet
65220	Vortex Flow Control	1

Naylor Smart Sponge®

For more specialist applications we also offer:
Smart Sponge® Plus - Pathogen removal
Smart Sponge® HM - Heavy Metal polishing

We have created a range of products to take advantage of Smart Sponge

Product No.	Description	Box
66500	Smart Gully Adapters	12
66100	Ultra Urban Filters	1
66300	Passive Skimmers	40
66200	Line Skimmers	4
66402	Smart Filters	1
66400	Smart Brakes	1
66404	Smart Stops	1
66600	Smart Paks	4

Denlok trenchless jacking pipes

Introduction

Naylor Denlok is a vitrified clay jacking pipe system to be used in conjunction with trenchless installation techniques. Such installation is undertaken wherever it is not cost effective or convenient to dig a trench to lay pipes in and will typically be used to install sewer pipelines under rivers, railways, in poor ground conditions or where pipelines are to be installed under existing infrastructure including roads and buildings. A range of installation techniques are available from specialist contractors that will involve pushing pipes underground from one vertical shaft to another.

Installation techniques include guided auger boring where augers in steel casings excavate a hole for the product pipe to be pushed in to and microtunnelling where tunnelling machines with grinding heads will dig out a hole for the product pipe to be pushed in to.

Naylor Denlok pipes come with an integrated coupling that is in-line with the external pipe diameter to allow for it to be pushed through the ground. Pipes are available in 1 or 2 metre lengths depending on the diameter allowing for pipes to be installed from a relatively small footprint and therefore minimising disruption to the surrounding area.

Naylor Denlok®
Ranges from 150 to 600mm diameter

1m Range

Naylor Code	Pipe Diameter (mm)	Length (m)	ID	OD	Weight KG	Max Jacking Force kN
40401	DLK 150mm	1m	149+/–3	208+/–3	45	900
40403/316	DLK 225mm	1m	225+/–4	293+/–4	80	1700
40404/316	DLK 250mm	1m	253+/–4	357+/–4	100	3400
40405/316	DLK 300mm	1m	305+/–5	412+/–5	120	4245
40409/316	DLK 400mm	1m	406+/–5	552+/–5	240	8135
40411/316	DLK 450mm	1m	450+/–5	585+/–5	250	8370
40413/316	DLK 500mm	1m	494.5+/–5	639+/–5	260	8735
40417/316	DLK 600mm	1m	609+/–7	758+/–7	340	10580

2m Range

Naylor Code	Pipe Diameter (mm)	Length (m)	ID	OD	Weight KG	Max Jacking Force kN
40404/2/316	DLK 250mm	2m	253+/–4	357+/–4	200	3400
40406/316	DLK 300mm	2m	305+/–5	412+/–5	240	4245
40410/316	DLK 400mm	2m	406+/–5	552+/–5	480	8135
40412/316	DLK 450mm	2m	450+/–5	585+/–5	500	8370
40414/316	DLK 500mm	2m	494.5+/–5	639+/–5	520	8735
40418/316	DLK 600mm	2m	609+/–7	758+/–7	680	10580

Deliveries

Delivery Times
All standard deliveries are made between the hours of 8am and 4pm unless advised at the time of order.

Timed and out of hours deliveries are available for an extra charge.

Delivery Discrepancies
Claims for transit damage or shortage cannot be accepted unless advised within 72 hours of unloading by email to **queries@naylor.co.uk**

Claims reported after 72 hours will not be accepted.

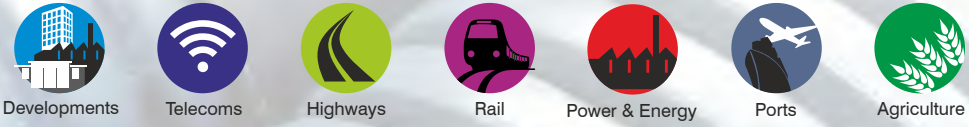
Vehicle Waiting Time
It is a condition of every delivery that when the vehicle reaches its destination, the customer shall unload promptly.

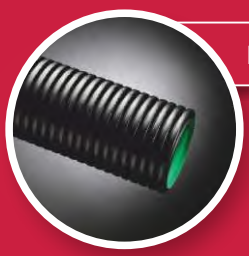
In the event of delays, a waiting time charge will apply as per our standard terms and conditions:-

If a vehicle is waiting in excess of 1 hour for the customer to commence unloading, the following charges will be added to the invoice:-

Part Loads:	£50.00 / hour and part thereof
Full Loads:	£100.00 / hour and part thereof

Please see our website for a copy of our Terms & Conditions





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HDPE premium twin wall carrier/filter drainage system.

N-Drain™

HDPE agricultural twin wall carrier/filter drainage system.

Fabrications

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MetroDuct™

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Range of access chambers.

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Hard and soft SuDs solutions.

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- Vitrified clay pipe systems for trenchless installation
- Band-Seal couplings for the repair of and connections into existing pipelines
- Plastic Land Drainage, Twinwall Ducting Systems and Access Boxes
- Yorkshire Flowerpots, a range of frostproof plant pots
- Concrete - Pre-stressed lintels and pre-cast panels, retaing walls and tanks
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Ref: Plastic Products ?????? 2023

Service & Support Solutions

Klargester

Benefits of commissoning services

Here at Kingspan Klargester, we're proud to be one of the only UK manufacturers to offer comprehensive commissioning packages as part of our whole life care solutions for our wastewater products.

Our commissioning and smart commissioning solutions for domestic and commercial customers not only ensure your system is running optimally at all times (saving you money) but is integral to our Planet Passionate programme, ensuring proactive pollution prevention when it comes to groundwater and waterway pollution caused by poorly maintained systems.

Standard Commissioning

This basic package offers the following benefits:

- Peace of mind – rest assured that all mechanical and electrical components have been installed correctly and tested working
- Trouble-free operation of your system from the start
- You will be issued with a full commissioning certificate for your system
- Available on our full range of wastewater and surface water products

Smart Commissioning

Our smart commissioning package offers all the benefits of commissioning plus the following:

- Under EN 858-2, (specific to separators only) it is recommended that you install a local or remote alarm to your separator in order to prevent pollution incidents – our package includes SmartServ Pro remote monitoring with early fault detection
- Comprehensive asset tracking, removing local reliance to monitor operation status
- Less risk of business downtime – with our SmartServ Pro solution, you can proactively tackle operational problems before they impact your business
- Instant text alerts to site contacts (up to 14) and Kingspan Service Centre simultaneously

To speak to one of our expert team members about your best fit commissioning solution
Email: **klargester@kingspan.com**
Tel: **01296 633033**

Kingspan

Water Management Solutions

BioDisc® BA, BAX, BB, NB Installation Manual

IMPORTANT
Please read before you begin:

Once installed, the motor shouldbe left on and running. If there is delayed electrical connection, or if there is no power available to operate the unit, then the motor with gearbox must be removed, and stored in a dry environment. The motor must not be left non-operational
for a period of 7 days or more.

Part Code	Issue	Description	Date
017900	04	ECN 1611	May 2022

Kingspan®

Contents

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SYSTEM OVERVIEW	4
BIODISC® CHECKLIST	5
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CONTROL PANEL	9
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NOTICE	17

HEALTH & SAFETY

Please read and follow for your own and others safety

You must read these warnings carefully before installing or using the equipment. Please ensure that you have performed a risk assessment before commencing any installation. Note that the risk assessment should be performed by a person who understands the hazards of the work, and the work environment. Note that it must be *suitable and sufficient,* i.e. adequately considers risks and ensures controls in place to mitigate risks.

You must observe all-hazard labels and take appropriate action to avoid exposure to the risks indicated. Always ensure that all relevant documents are supplied with the equipment when being transferred to a new owner.

General guidelines

- Only experienced and competent person(s) should carry out the installation.
- The unit must have a *Pre-Service Agreement Inspection* by an approved engineer.
- Take care to maintain correct posture, particularly when lifting.
- Use appropriate lifting equipment when necessary.
- A qualified electrician should carry out electrical work deemed necessary.
- The covers must be kept locked.

Personal Protective Equipment (PPE)

- We recommend the use of a dust mask and gloves when cutting GRP components.
- Person(s) carrying out maintenance on the equipment should wear suitable PPE.

Maintenance and Inspection Procedures

If you wish to inspect the equipment's operation, please observe all necessary precautions as stated in your risk assessment; including those listed below.

- The power supply must be isolated at the control panel(s) before lifting the covers.
- If the equipment should run with the covers off, care must be taken to avoid contact with moving parts and electrical components or conductors.
- Once the power has been isolated, the control panel must be kept locked shut to avoid accidental reconnection while work or inspection is being carried out.

Working Area

- Ensure that the working area is adequately lit.
- Ensure that you are familiar with the safe working areas and its access and egress.
- Use only the designated access walkways.
- Do not walk on the cover or deep well safety mesh(es).
- Always keep proper footing and your balance, avoid any sharp edges, or restricted points.

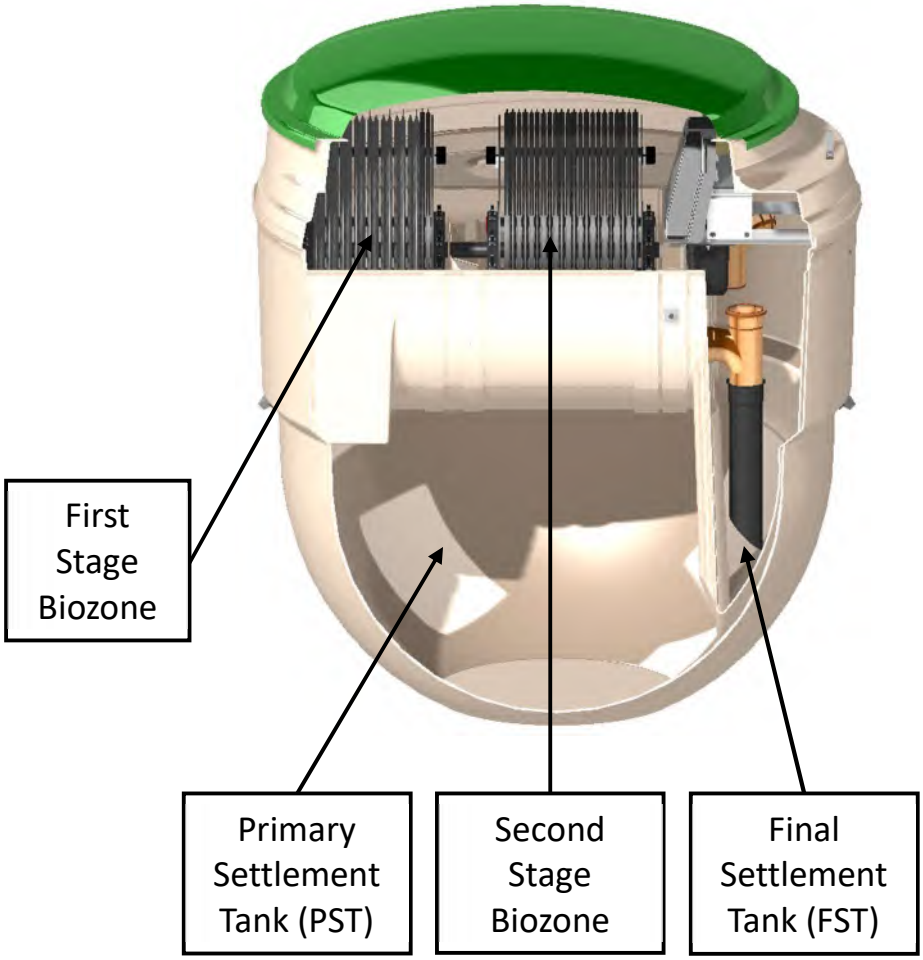
Desludging

- Desludging should be carried out by a licensed waste disposal contractor holding the relevant permits to transport and dispose of sewage sludge in your region/area.

SYSTEM OVERVIEW

Pictorial representation below indicates basic requirements for a standard system.

Cross Section



Top View

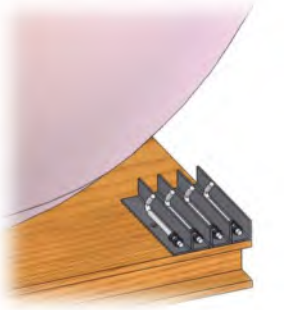
BioDisc® CHECKLIST

BA, BAx, BB & NB BioDisc

1. The unit will be fitted complete with internal pipework and equipment.
2. Inlet pipework will be fitted.
3. Unit supplied strapped to a standard pallet.
4. Unit overall heights are as follows:

INLET INVERT (MM)	HEIGHT (MM)
450	2160
750	2460
1250	2960

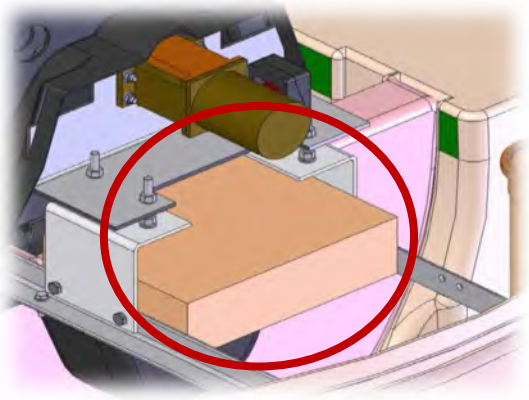
Holding Down Bolts



1. The holding down bolts pack will be secured to the pallet as shown in the figure to the right.
2. The holding down bolts need to be fitted to the holding down lugs that are fitted to the tank. This process is shown later in the installation section.

Control Panel and Beacon

1. The control panel and beacon must be removed before the tank is installed.
2. The unit control panel and beacon will be secured inside the tank:
   - The control panel is located under the motor
   - The beacon is located within the owner's pack



If any items are missing, Kingspan must be alerted within three days of delivery.

INSTALLATION

General

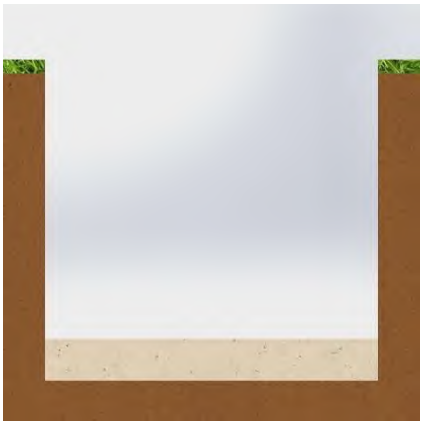
- Our domestic treatment plant are structurally tested in accordance with EN 12566-3, which specifies structural stability testing for both wet and dry sites using granular backfill 3-8mm. However, in GB it would be typical for tanks to be installed in concrete due to rising water table, and it can generally be assumed that buoyancy prevention of concrete backfill is more advantageous than the granular backfill materials used in testing.
- During installation, care must be taken to ensure the body of the unit is uniformly supported to avoid point loads on the unit.
- A water supply must be available on site to enable the unit to be ballasted during backfilling.
- When units are installed in unstable ground conditions where movement of the surrounding material and/or unit may occur, the connecting pipework must be designed to minimise the risk of damage from differential movement of the unit(s) and/or surrounding material.
- In situations where the excavation will not maintain a vertical wall, it will be necessary to support side walls of the excavation (E.g. with suitable trench sheets and bracing systems) from the bottom to the top. DO NOT completely remove the shoring system until after the backfilling is complete, but before the concrete fully hardens.
- If there is a risk of a high water table or of the site flooding, a structural design by a suitable specialist will be required to hold the tank in place.
- In areas where the water table is above the bottom of the excavation and/or the excavation is liable to flood, the excavation must be de-watered, using suitable pumping equipment, until the installation is complete. Ensure that the pump discharge does not saturate the ground in the immediate vicinity. In such conditions it may be advisable to line the excavation with polythene sheeting, to prevent cement being washed out of the concrete surround/base.
- Concrete Specification below is a *general* specification. It is not a site-specific installation design.

GENERAL CONCRETE SPECIFICATION IN ACCORDANCE WITH BS EN 206-1 (BS 8500-1)		
TYPE OF MIX		(DC) DESIGN
PERMITTED TYPE OF CEMENT		BS 12 (OPC): BS 12 (RHPC): BS 4027 (SRPC)
PERMITTED TYPE OF AGGREGATE (coarse & fine)		BS 882
NOMINAL MAXIMUM SIZE OF AGGREGATE		20 mm
GRADES:	C25 /30	REINFORCED & ABOVE GROUND WITH HOLDING DOWN BOLTS
	C25 /30	REINFORCED (EG. FOR HIGH WATER TABLE)
	C16 /20	UNREINFORCED (NORMAL CONDITIONS)
MINIMUM CEMENT CONTENT:	C30 C20	270 - 280 Kg/M3 220 - 230 Kg/M3
SLUMP CLASS		S1 (25mm)
RATE OF SAMPLING		READY MIX CONCRETE SHOULD BE SUPPLIED COMPLETE WITH APPROPRIATE DELIVERY TICKET IN ACCORDANCE WITH BS EN 12350-1
NOTE: STANDARD MIXES SHOULD NOT BE USED WHERE SULPHATES OR OTHER AGGRESSIVE CHEMICALS EXIST IN GROUND WATER		

1. Excavate Hole & Lay Concrete Bed

- Approximate dimensions of units:

Inlet Invert Depth (mm)	Diameter (mm)	Base to Ground Level (mm)	Internal Volumes of Unit (m^3)	
			Base to Outlet	Outlet to Ground Level
450	1995	1945	3.00	3.00
750	1995	2245	3.00	4.75
1250	1995	2745	3.00	7.50



- Excavate a hole with clearance on all sides and base of the unit of 150 – 200 mm, depending on site conditions.
- If shuttering is required to maintain a vertical wall, increase the width of the excavation to accommodate.
- If the excavation has an **unstable base**, excavate an additional 250 – 300 mm and fill with compacted hard-core.
- If water is present in the excavation, de-water using suitable pumping equipment. Place a sheet of polythene over the base and up the sides of the excavation before creating the concrete slab.
- The four anchor bars must be assembled and attached to the tank as shown.

- A minimum base of 150 – 200 mm of lean mix concrete is required for all ground conditions. The installer must ensure that the base is adequate to support the weight of the tank and its contents.
- It is recommended to backfill with C25 SEMI-DRY MIX.

2. Lower Unit onto Concrete & Ensure Level

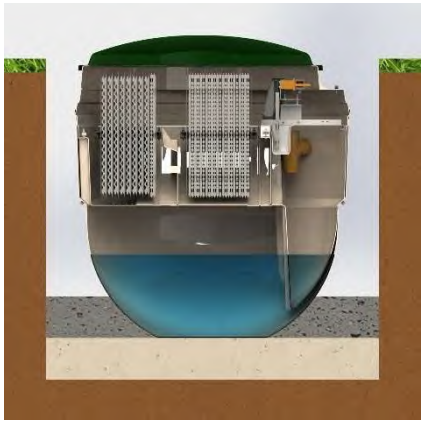
- Approximate weights of units in kilograms, depending on inlet invert:

Inlet Invert (mm)	BA (kg)	BAx (kg)	BB (kg)	NB (kg)
450	310	335	335	360
750	325	350	350	375
1250	380	405	405	430

- Lower the tank into the hole. A suitable spreader bar must be used with lifting slings located through the lifting points provided on the tank.
- The slings must not be attached to the inlet or the outlet pipe.
- Tank must not be lifted with any water inside.
- Check the **Inlet** and **Outlet** pipe orientation is correct.
- Check the unit is levelled. The rotor shaft must be level end to end, to within ±3mm, measured at the bearing caps or directly on the shaft. The unit must also be level to within ±5mm from side to side, measured at the GRP platform on either side of the rotor.
- Check the BioDisc rotates freely with no clashes before turning on to ensure no damage occurred during transit.

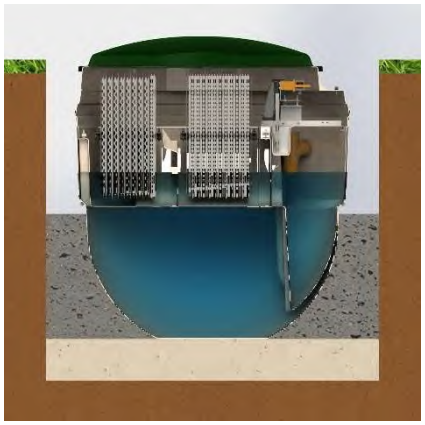
3. Backfill the Tank Unit

- The backfilling must start before the base has hardened and must be a single continuous operation, so the tank has a full concrete jacket without joins.
- The backfill must be free from organic material, large stones, brick or sharp objects.
- Backfilling must be carried out in layers, making sure that voids are not left under or around the sides of the tank and there are no localised stress concentrations.
- The installer must progressively fill the tank via a hose while keeping the water level 300 mm above the backfill to stabilise pressures on the tank. **If the pressures are not stable the tank can become distorted and damaged.**



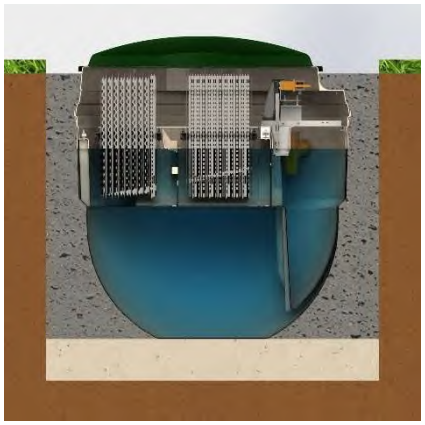
4. Second Backfill Stage

- Continue to fill the tank with water and backfill evenly around the tank, consolidating in 300 mm layers.
- DO NOT use vibrating pokers to consolidate concrete.
- DO NOT discharge concrete directly on to the tank.
- Ensure that the concrete is not too wet and that is tamped in around the tank.
- Continue until just below inlet and outlet pipework.
- Remove covers and connect inlet and outlet pipework.



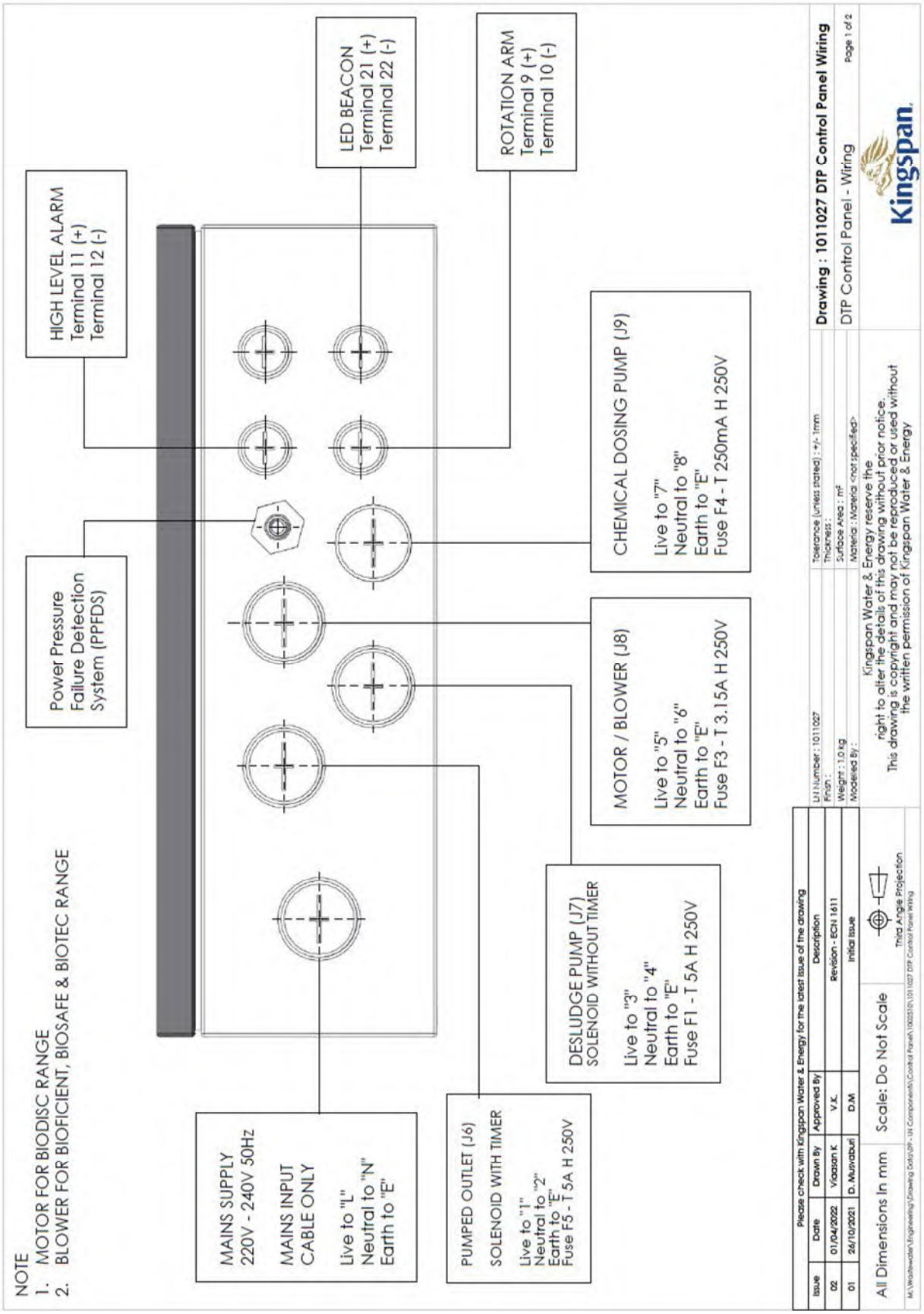
5. Final Stage

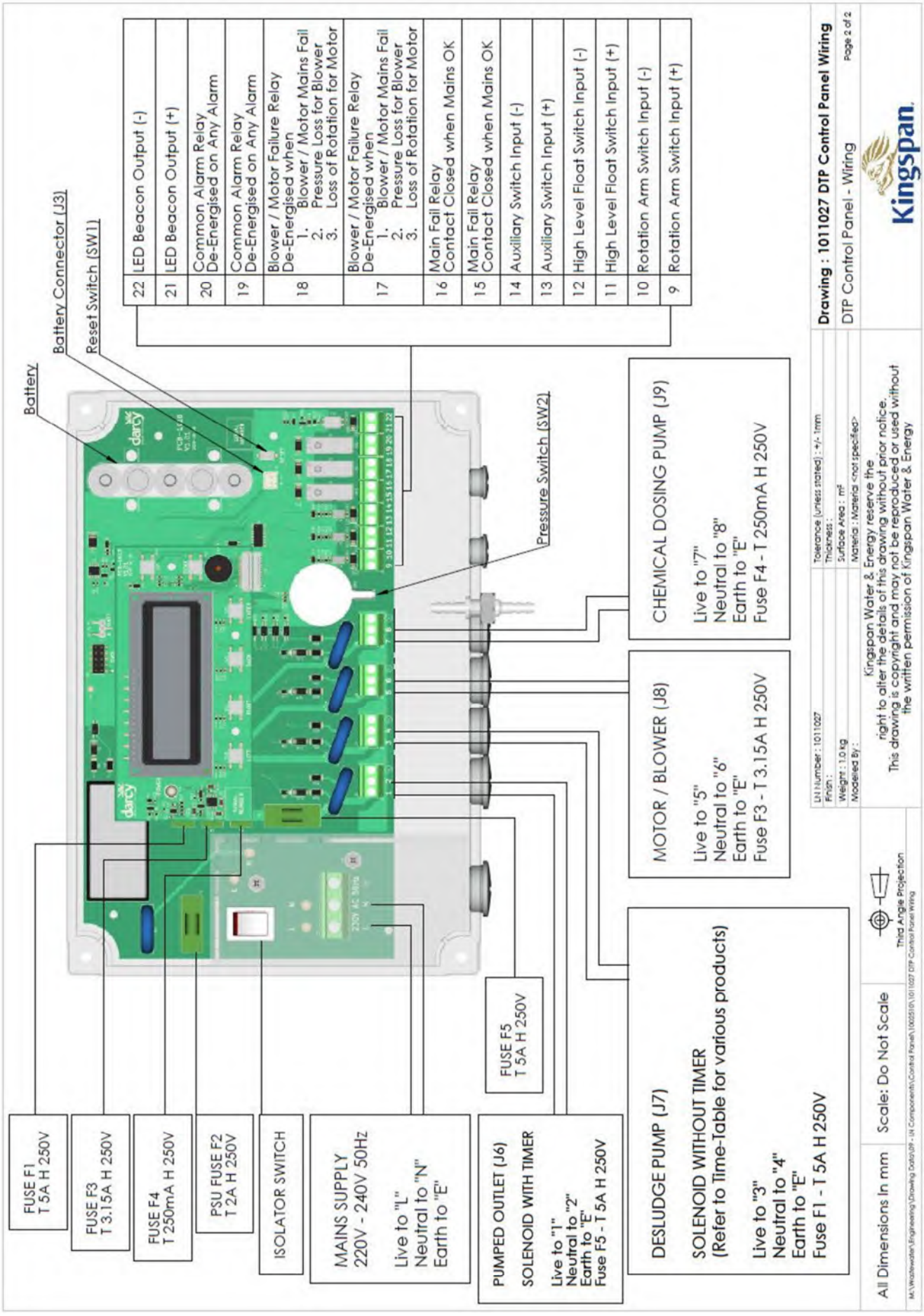
- Determine the number of cables to be connected to the control panel from within the BioDisc. A cable will be required for every occupied gland hole on the control panel, use the 'Control Panel Entry Points' table on Page 9 to determine how many gland holes will be in use.
- Drill a 15 mm hole in the BioDisc case for every cable. The holes must be located 100 mm below ground level and adjacent to one end of the baffle supporting the Motor/gearbox.
- Erect the Control Panel as described on Page 9.
- Continue to concrete backfill up to the lip of the cover.
- Once the unit has been installed, it must be left filled with water.



CONTROL PANEL

Refer to <u>Manual 1011026</u> for details on Wiring and Setting up the panel.




Battery
Battery Connector (J3)
Reset Switch (SW1)
Pressure Switch (SW2)
22 LED Beacon Output (-)
21 LED Beacon Output (+)
20 Common Alarm Relay De-Energised on Any Alarm
19 Common Alarm Relay De-Energised on Any Alarm
18 Blower / Motor Failure Relay De-Energised when 1. Blower / Motor Mains Fail 2. Pressure Loss for Blower 3. Loss of Rotation for Motor
17 Blower / Motor Failure Relay De-Energised when 1. Blower / Motor Mains Fail 2. Pressure Loss for Blower 3. Loss of Rotation for Motor
16 Main Fail Relay Contact Closed when Mains OK
15 Main Fail Relay Contact Closed when Mains OK
14 Auxiliary Switch Input (-)
13 Auxiliary Switch Input (+)
12 High Level Float Switch Input (-)
11 High Level Float Switch Input (+)
10 Rotation Arm Switch Input (-)
9 Rotation Arm Switch Input (+)
CHEMICAL DOSING PUMP (J9)
Live to "7"
Neutral to "8"
Earth to "E"
Fuse F4 - T 250mA H 250V
MOTOR / BLOWER (J8)
Live to "5"
Neutral to "6"
Earth to "E"
Fuse F3 - T 3.15A H 250V
DESLUDGE PUMP (J7)
SOLENOID WITHOUT TIMER
(Refer to Time-Table for various products)
Live to "3"
Neutral to "4"
Earth to "E"
Fuse F1 - T 5A H 250V
FUSE F5
T 5A H 250V
PUMPED OUTLET (J6)
SOLENOID WITH TIMER
Live to "1"
Neutral to "2"
Earth to "E"
Fuse F5 - T 5A H 250V
MAINS SUPPLY
220V - 240V 50Hz
Live to "L"
Neutral to "N"
Earth to "E"
ISOLATOR SWITCH
PSU FUSE F2
T 2A H 250V
FUSE F4
T 250mA H 250V
FUSE F3
T 3.15A H 250V
FUSE F1
T 5A H 250V
Drawing : 1011027 DTP Control Panel Wiring
DTP Control Panel - Wiring
Page 2 of 2
Kingspan
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All Dimensions In mm
Scale: Do Not Scale
Third Angle Projection

Mounting the Control Panel

- The control panel must be fitted by a qualified electrician working to the latest IEE Regulations.
- The control panel must be positioned so it cannot be reached by someone standing in or on the BioDisc unit.
- It can be wall mounted or fixed to the mounting frame (available separately).
- Allow 350mm minimum clearance from finished ground level to the bottom of the panel.
- When using a mounting frame, set the frame legs in a concrete base, minimum 250mm thick and prop the frame to prevent movement until the concrete has set.

Control Panel Entry Points

Use the diagram below to select the correct gland hole and terminations to connect all the electrical equipment to the control panel. The diagrams and instructions on the following pages give more in-depth guidance on setting up the various equipment configurations.

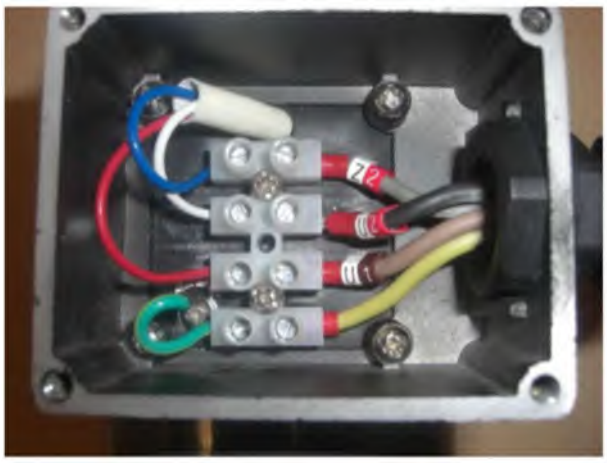
Mains Supply

1. Remove the four screws on the front of the panel and remove the main cover.
2. Remove the four screws holding the safety cover and remove the safety cover.
3. Remove the two screws holding the isolating cover and remove the isolating cover.
4. Using a suitable M20 gland, feed the mains power supply through Gland Hole 1. Wire the mains supply to the terminal blocks following the labels on the connections.
5. Replace the isolation cover and screws.

Motor

Supply voltage | Control Panel | Motor Capacitor Box | Motor Terminal box

1. Before connecting the motor check the BioDisc rotates freely with no clashes to ensure no damage occurred during transit.
2. A capacitor is required for the correct function of the motor on all BA, BAx, BB and NB BioDiscs.
3. The Motor Capacitor Box will be found inside the neck of the BioDisc.
4. The Motor Terminal Box will be found on the motor.
5. Remove the four screws and the cover from the Motor Terminal Box on top of the motor.



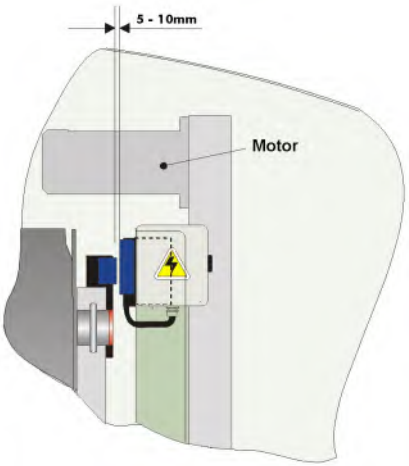
Motor Terminal Box

6. Feed the Pre-fitted Cable from the Motor Capacitor Box through a suitable M20 gland to the Motor Terminal Box and wire as shown. Grey (Z2) to blue, black (U2) to white, brown (U1) to red and Green/yellow to E.
7. Replace the cover on the Motor Terminal Box on the motor.
8. Tighten the cable gland to ensure no moisture can enter the Motor Terminal Box.
9. Remove the four screws and the cover from the Motor Capacitor Box.
10. Feed the Motor Power Supply Cable from the Control Panel to the Motor Capacitor Box. In the Motor Capacitor Box connect the mains power cable, capacitor and Pre-fitted Cable as shown. Green/yellow to green/yellow, blue to grey and blue to the capacitor, which is in turn connected to black, black to brown.
11. Feed the Motor Power Supply Cable through Gland Hole and connect to points 5 and 6 as shown on Page 9.

Motor Capacitor Box

Loss of Rotation Alarm

The alarm sensor (reed switch) is mounted adjacent to the motor/gearbox assembly. The sensor may be supplied out of position to allow for possible minor rotor movement during transport. Check the sensor position and ensure there is a gap of 5 - 10 mm between the sensor and the actuator magnet.



Using a suitable M12 gland, feed the loss of rotation alarm cable through Gland Hole and terminate to connections 9 and 10 as shown on Page 9. Connect the other end of the loss of rotation alarm cable to the junction box in the plant.

Check operation of the Loss of Rotation Alarm as follows:

1. Remove the main cover and switch off the Control Panel.
2. The display will read “Mains Failure”
3. Disconnect the cable to the motor.
4. Switch the Control Panel on. After no more than a couple of minutes the display will read “Loss of Rotation”.
5. Switch the Control Panel off.
6. Reconnect the cable to the motor and replace the safety cover.
7. Switch the control panel on. The display will request to set Date & Time.
8. After resetting the Date & Time, display will return to normal running mode.
9. Replace the main cover on the control panel.

Beacon

The beacon is intended to be mounted on a wall or other solid surface. A 1.5 m cable is supplied but it can be extended up to 30 m. Using a suitable M12 gland, feed the cable from the beacon through Gland Hole and terminate to connections 21 & 22 as shown on Page 9.

Completing the Installation

1. Plug the battery lead into the small white socket of the Control Panel.
2. The display will read “Mains Failure” as there is no mains power.
3. The panel is running on battery power.
4. Replace the safety cover and turn on the mains supply.
5. Turn on the panel using the isolation switch. It should now be illuminated red. The display should now read “J7”
6. Replace the main cover on the control panel.

Fault Codes and Fuses

Please refer to Manual 1011026 for all fault codes and setting up the panel.

Pumped Outlet

Using a suitable M20 gland, feed the integral discharge pump power cable through Gland Hole and terminate to connections 1 and 2 as shown on Page **Error! Bookmark not defined.**.

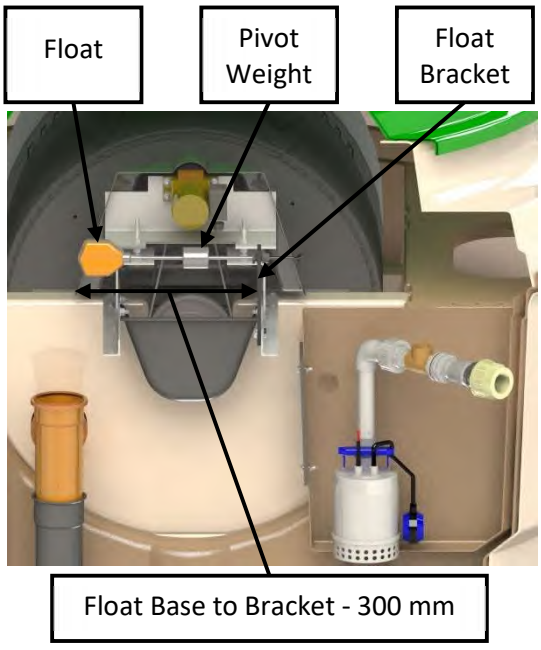
Check the pump, float and associated pipework are positioned as shown. With the pump chamber empty of water, the float must hang clear of the chamber floor. The correct float position and distance is essential. The float must not be able to get trapped or tangle, as this will prevent its correct operation.

High Level Alarm

Remove the link in the terminal blocks between connections 11 and 12 before inserting cables. Using a suitable M12 gland, feed the high level alarm float cable through Gland Hole and terminate to connection 11 and 12 as shown on Page 10.

Fix the bracket attached to the float to the steelwork supporting the motor using the two free holes. The base of the float must be approximately 300 mm from the bracket when held horizontally. This should align the pivot weight with the top of the final settlement tank.

Ensure the float cable will not be able to get trapped or tangled, as this will prevent its correct operation.

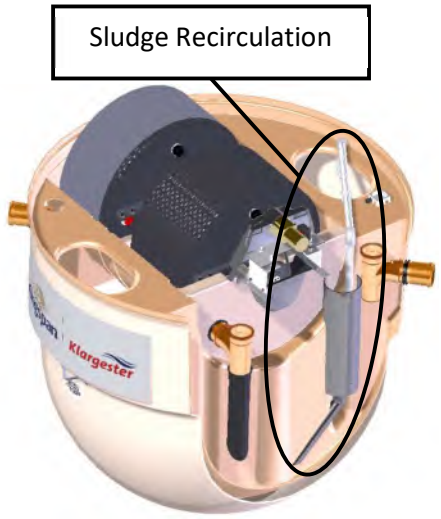


Sludge Recirculation

Please read the instructions in the standard gravity unit section for guidance on connecting the mains power supply, motor, loss of rotation alarm and the beacon.

Sludge Recirculation Pump

Using a suitable M20 gland, feed the integral discharge pump power cable through Gland Hole 3 and terminate to connection 3 and 4 (TB2) as shown on Page 14.



Run and Pause Time Setting

To set the desired run and pause time settings of the Chemical Dosing Pump and the Sludge Return Pump refer to Manual 1011026

Fault Codes and Fuses

To determine the meaning of the fault codes on the control unit use the table below. The related fuse location and fuse ampere rating are also shown if applicable.

All fuses are Time Lag HBC 20mm type

Low battery	Pumped outlet fuse
Loss of rotation	De-sludge pump fuse
High level float probe	Motor/blower fuse
Auxiliary input	Chemical dosing pump fuse
Blower pressure	Service due

Chemical Dosing

Please read the instructions in the standard gravity unit section for guidance on connecting the mains power supply, motor, loss of rotation alarm and the beacon.

Chemical must be supplied by others. The recommended chemical is PAX XL 60, other chemicals may be used but they must be checked for suitability. Please contact Kingspan to do so.

Chemical Dosing Pump

Using a suitable M20 gland, feed the chemical dosing pump power cable through Gland Hole 5 and terminate to connections 7 and 8 (J9) as shown on Page 14.

Connect the other end of the chemical dosing pump power supply cable to the junction box in the plant (marked CHEMICAL DOSING).

Run and Pause Time Setting

To set the desired run and pause time settings of the Chemical Dosing Pump and the Sludge Return Pump refer to Manual 1011026

Electrical Information

	Power (W)	Voltage (V)	Phase	Full Load Current (Amps)
Motor	50	230	Single	0.52
Integral Discharge Pump	250	230	Single	2.2
Sludge Return Pump	250	230	Single	2.2

WARRANTY

The company will replace or, at its option, properly repair without charge any goods which are found to be defective and which cause failure in normal circumstances of use **within a period of twelve months from the date of delivery.**

This warranty is conditional upon:

(a) The Buyer notifying the Company of any claim within Seven days of the failure becoming discernible.

(b) The Company being allowed a reasonable opportunity to inspect the goods so as to confirm that they are defective.

(c) The goods not having been modified, mishandled or misused and being used strictly in accordance with any relevant instructions issued by the Company.

The Company's liability under this Clause is limited to the repair or replacement of the defective goods, and does not cover costs of transport, installation or associated site costs, if applicable.

The Company's liability to replace or repair the goods is in lieu of and excludes all other warranties and conditions, and in particular (but without limitation) the Company shall have no liability of any kind for consequential loss or damage.

A warranty form is included in this package, to register your unit for warranty. Please complete ALL sections of the form and return it at your earliest convenience.

Also within this manual is a **Notice**, describing the necessary maintenance for the plant. This should be fixed within the building.

For any further advice, please contact our Service & Warranty department on +44 (0) 844 225 2785. It would be helpful if you provide your equipment serial number.

Extended warranty for your Klargester BioDisc domestic treatment plant explained

Enjoy a seven year extended warranty period for your BA, BB or BAX Klargester BioDisc sewage treatment plant. In this document, we have outlined the benefits and terms associated with your extended warranty period.

For further enquiries, please contact our Kingspan Service team on:

helpingyou@kingspan.com

0333 240 6868
(NI 028 3836 4600 | ROI 0818 543 500)

kingspanservice.com

How to activate your extended warranty

Register your domestic BioDisc treatment plant online at:
www.kingspan.co.uk/biodisc-guarantee

Benefits of your extended warranty

7 YEARS

Upon activating your extended warranty for your BioDisc treatment plant, you will benefit from:

- Replacement parts if required for your BioDisc system (fair wear and tear only).
- Free expert technical support from our Kingspan Service team.
- Remain fully compliant with local DEFRA/ Environment Agency regulations.
- Peace of mind with no disruption or downtime needed for maintenance or repairs.

Terms of your extended warranty

To ensure your extended warranty is valid, please adhere to the following terms:

- To activate your extended warranty, you must register online at kingspan.co.uk/biodisc-guarantee
- Your domestic BioDisc plant must be commissioned by a suitably qualified professional, either a Kingspan Service engineer or Kingspan Klargester accredited installer.
- You must arrange to have a full service of your domestic BioDisc plant within one year of registering your warranty. Contact our Kingspan Service team on helpingyou@kingspan.com to arrange a suitable date.
- Your domestic BioDisc treatment plant must be serviced once a year by a suitably qualified professional, either a Kingspan Service engineer or Kingspan Klargester accredited installer.
- When claiming Warranty, you must keep a record of all service and maintenance records carried out to your BioDisc treatment plant (either by Kingspan Service and/or the Installer.
- Any repair work carried out under the terms of the extended warranty contract will be guaranteed for a period of 28 days unless the original repair works were necessitated by reason of abuse or misuse of the system (in which case any all repair works will be chargeable).
- The extended warranty will be invalidated if you do not give us a reasonable opportunity to inspect the goods and the system to confirm the cause of the problem which you have encountered with it.
- The warranty will be invalidated if you abuse and/or Misuse the goods and/or the system.
- The warranty set out above will be invalidated if you use
- the goods and/or the system in any way which is inconsistent with any of the following:
  - (a) any specific instruction given to you by us;
  - (b) the manufacturer's guidelines; or
  - (c) any operating instructions.
- The warranty set out above will be invalidated if you fail to notify us in writing of the defect or failure in the goods or system within 14 days of your discovery of the defect or failure.
- We cannot take responsibility for any loss of profit, which you may suffer as a result of any failure or defect in the goods or system.

NOTICE

BioDisc

The foul drainage from this property discharges into a package treatment works.

Maintenance is required, the frequency of which depends upon the model installed, its use and application. Please consult your Operation & Maintenance Manual.

***** A BA BioDisc requires annual maintenance and desludging.

***** A BAx BioDisc requires annual maintenance and desludging at 9 month intervals.

***** A BB/NB BioDisc requires annual maintenance and desludging at 6 month intervals.

Refer to owner's manual for information on desludging points.

Maintenance and Desludging should be carried out by the owner in accordance with the Manufactures instructions.

THE OWNER OF THE PROPERTY IS LEGALLY RESPONSIBLE FOR ENSURING THAT THE SYSTEM DOES NOT CAUSE POLLUTION, A HEALTH HAZARD OR A NUISANCE.

We recommend that a separate log is kept of all maintenance and service visits, the log should detail the date and any action taken, e.g. Regular maintenance service, breakdown visit, desludge volume removed, parts replaced.

This notice should be fixed by the owner within the building alerting current and future owners to the maintenance requirement.

(Building regulation H2 (1.57)

Please contact Service NI on 028 383 64600 or Service Department Ireland on 0818 543 500 to arrange a maintenance service or to request replacement operating instructions. It would be helpful if you provide your equipment serial number.

CE

Kingspan

Declaration of Performance

According to the harmonised technical specification EN:12566-3+A2:2013

Identification code	Waste Water Treatment Plant for 6 to 50 Population Equivalents. BA, BB, BC, BD, BE & BF BioDisc.
Type	BioDisc Prefabricated Domestic Waste Water Treatment Plant: BA (6PE) to BF (50PE).
Use	Collection & Treatment of Waste Water from Domestic applications up to 50 Population Equivalent.
Manufacturer	Kingspan Water & Energy Ltd, College Rd North, Aston Clinton, Aylesbury, Buckinghamshire, HP22 5EW.
Attestation of system conformity	PIA Prüfinstitut für Abwassertechnik GmbH, Notified Body No: 1739 Has executed initial type testing according to system 3 and delivered the test reports.
Essential Characteristics	**Performance**
Structural Behaviour	Confirmed by Pit Test under the following Conditions: - Maximum installation Depth 0m over cover level - Wet conditions maximum water level 2.55m
Resistance to fire	Class E
Water Tightness (water test)	Pass
Material Durability	MFR (230/2,16) = (5,0± 3,0g)/10 min (EN ISO 1133)
	Density ≥ 905 kg/m³ (EN ISO 1133)
	Yield Stress ≥ 30 Mpa (EN ISO 527-2)
	Creep Factor αmaterial = 0,48 (average value)
	Ageing Factor (β) = 0,46 (average value)
Emission of Dangerous Substances	NPD
Signed for and on behalf of the manufacturer. Aylesbury, 1st March 2019	
	Paul Copping – Business Unit Director

CE

Kingspan

EN 12566-3+A2:2013			
Name of Product Type		**BioDisc**	
Treatment process		**Rotating Biological Contactor (RBC)**	
Nominal organic daily load		**0.29 kg BOD_5/day**	
Nominal hydraulic daily load		**1.2 m^3/day**	
Testing authority		**PIA GmbH, NB 1739**	
Treatment Efficiency	**COD**	**89.4%**	**59 mg/l**
	BOD_5	**95.7%**	**10 mg/l**
	NH_4-N	**88.6%**	**3.8 mg/l**
	SS	**94.8%**	**15 mg/l**
	P	**NPD**	**NPD**
	KN	**NPD**	**NPD**
Power consumption		**1.3 kWh/d**	

Contact Details

UK

Kingspan Water & Energy Ltd.
College Road
North Aston
Clinton |
Aylesbury
Buckinghamshire | HP22 5EW

T: +44 (0) 1296 633 000
F: +44 (0) 1296 633 001
E: klargester@kingspan.com

www.kingspan.co.uk/klargester

Ireland

Kingspan Water & Energy
Ltd.Unit1a | Derryboy
Road Carnbane Business
Park
Newry | BT35 6QH

T: NI: +44 (0)28 3026 6799
F: ROI: 0818 544 500
E: klargesterinfo@kingspan.com

www.kingspan.ie/klargester

Kingspan Water & Energy Ltd.
Service Office
Details:180
Gilford Road
Portadown |
BT63 5LF

T: NI: +44 (0)28 3836 4600
F: ROI: 0818 543 500
E: helpingyou@kingspan.com

www.kingspanservice.ie

blue range
SURFACE WATER SYSTEMS
600 SERIES

ACCESSO CHAMBER MADE

Inspection chambers

Application

- Above ground access for inspection and maintenance of surface water pipework systems
- Suitable for Adoptable and Non-Adoptable applications
- Maximum installation depth to soffit of pipe - Adoptable 3000mm and Non-Adoptable 3000mm

Compliance

- Design & Construction Guidance (DCG) - Type D & E Chambers
- EN 13598 Part 1 & 2 (2009)
- Building Regulations - Part H1

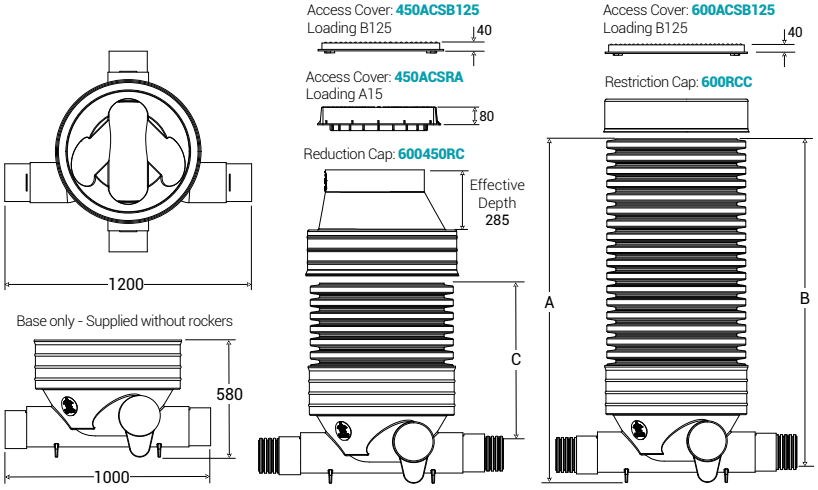
Features & Benefits

- Single Piece - Factory built units
- Robust - Impact resistant rota moulded base
- Quick and simple to install
- Base and five standard depths available
- Compatible with most UK twinwall pipe systems
- Lightweight - No machinery or lifting equipment required
- Stepped base - 60mm step from side to main channel, which meets the DCG requirement for Adoptable Sewers
- Restriction Caps are available for chambers deeper than 1 metre to soffit of inlet pipe to meet DCG
- Option of Reduction Cap 600450RC. This reduces the access diameter from 600mm to 450mm to accommodate a 450mm access cover
- Choice of Access Covers - A15 loading or **NEW:** B125 Loading
- Range of adaptors available to suit other pipework
- Access shafts can be easily cut onsite to required depth
- Granular backfill

MODEL: **AIC600150B**

600mm internal diameter - Factory built inspection chambers, delivered to site as single piece units, ready to install, no assembly required.

All chambers feature a robust, impact resistant, rota moulded base. This model has 150mm twinwall connections to main channel and two further optional 150mm side connections at 90°, these have blind ends, that can be cut off on site, if required. Chambers come with 150mm twinwall rocker pipes to main channel and further 150mm rocker pipes are available for side inlets, as well as adaptors, to offer 110/160mm EN 1401 side connections or 225mm twinwall (outlet only).

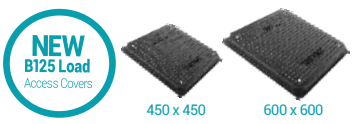


Product Code	Main channel pipework Ø	Optional Side Inlets Ø	Overall Depth A	Inlet Invert B	Soffit Depth C	Approx. Weight
	(mm)	(mm)	(mm)	(mm)	(mm)	(kg)
AIC600150B (Base Only)	150	2 x 150 @ 90°	580	520	370	10
AIC600150B/1	150	2 x 150 @ 90°	990	930	780	29
AIC600150B/1.5	150	2 x 150 @ 90°	1510	1450	1300	37
AIC600150B/2	150	2 x 150 @ 90°	1965	1905	1755	47
AIC600150B/2.4	150	2 x 150 @ 90°	2355	2295	2145	55
AIC600150B/3	150	2 x 150 @ 90°	3000	2940	2790	67

Please Note: Chambers deeper than 1000mm to soffit of pipework, require a Restriction Cap 600RCC to comply with DCG.

Adaptors & Rocker pipes

WSA138110	EPDM seal connection to 110mm EN1401 pipe	1
WSA180160	EPDM seal connection to 160mm EN1401 pipe	1.5
TW150160SPSP	Adaptor - 150mm twinwall to 160mm EN1401	0.5
150TWRP	150mm twinwall rocker pipe and seal. Fits all UK 150mm twinwall systems except Naylor	0.5
TWR225150	225mm twinwall to 150mm twinwall pipe socket - reducer	1



Restriction/Reduction Caps & Access Covers

600RCC	Restriction Cap to 320mm Ø access	3.5
600450RC	Reduction Cap from 600 to 450mm Ø to accommodate 450ACSRA access cover	5
600SR	Sealing Ring for 600RCC Restriction Cap & 600450RC to access shaft	3
450ACSRA	450mm Ø access cover - square section with integral 350mm restricted access - Class BS EN 124 - A15, suitable for loading up 1.5 tonnes	14
450ACSB125	450mm x 450mm composite access cover - Class BS EN 124-B125, suitable for use in situations requiring a loading up to 125kN (12.5 tonnes). **Please Note: The frame of this cover must be supported by a concrete plinth.**	7
600ACSB125	600mm x 600mm composite access cover - Class BS EN 124-B125, suitable for use in situations requiring a loading up to 125kN (12.5 tonnes). **Please Note: The frame of this cover must be supported by a concrete plinth.**	12

Pre - assembled chambers
Lightweight, quick and easy to install
No plant or lifting equipment required
DCG Designed to meet Adoptable Standard
60 YEAR Design Life
Made in the UK
Quick Delivery

email: sales@turtleenviro.co.uk | sales & technical support: tel. 0191 3036315 | **www.turtleenviro.co.uk**

ADSAIC600150B/2/22/V1

Inspection chambers

Application

- Above ground access for inspection and maintenance of surface water pipework systems
- Suitable for Adoptable and Non-Adoptable applications
- Maximum installation depth to soffit of pipe - Adoptable 3000mm and Non-Adoptable 3000mm

Compliance

- Design & Construction Guidance (DCG) - Type D & E Chambers
- EN 13598 Part 1 & 2 (2009)
- Building Regulations - Part H1

Features & Benefits

- Single Piece - Factory built units
- Robust - Impact resistant rota moulded base
- Quick and simple to install
- Base and five standard depths available
- Compatible with most UK twinwall pipe systems
- Lightweight - No machinery or lifting equipment required
- Stepped base - 50mm step from side to main channel, which meets the DCG requirement for Adoptable Sewers
- Restriction Caps are available for chambers deeper than 1 metre to soffit of inlet pipe to meet DCG
- Option of Reduction Cap 600450RC. This reduces the access diameter from 600mm to 450mm to accommodate a 450mm access cover
- Choice of Access Covers - A15 loading or **NEW:** B125 Loading
- Range of adaptors available to suit other pipework
- Access shafts can be easily cut onsite to required depth
- Granular backfill

ADSAIC600225B/2/22/V1

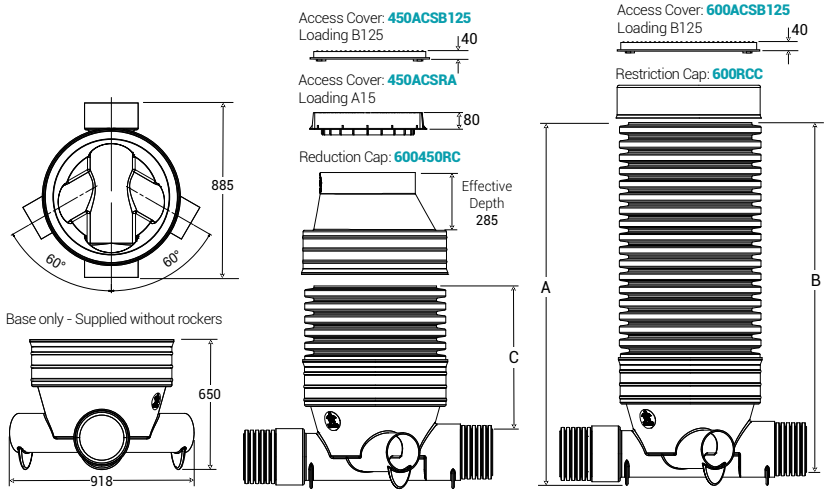
blue range
SURFACE WATER SYSTEMS
600 SERIES

ACCESSO CHAMBER MADE

MODEL: **AIC600225B**

600mm internal diameter - Factory built inspection chambers, delivered to site as single piece units, ready to install, no assembly required.

All chambers feature a robust, impact resistant, rota moulded base. This model has 225mm twinwall connections to main channel and optional 150mm twinwall side connections at 60°, which are provided with blind ends, that can be cut off on site, if required. Chambers come with 225mm twinwall rocker pipes to main channel and 150mm rocker pipes are available for side inlets, as well as a wide range of adaptors to fit both main and side channels.

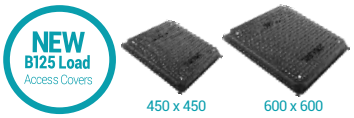


Product Code	Main channel pipework Ø	Optional Side Inlets Ø	Overall Depth A	Inlet Invert B	Soffit Depth C	Approx. Weight
	(mm)	(mm)	(mm)	(mm)	(mm)	(kg)
AIC600225B (Base Only)	225	2 x 150 @ 60°	650	585	360	9
AIC600225B/1	225	2 x 150 @ 60°	1060	995	770	29
AIC600225B/1.5	225	2 x 150 @ 60°	1530	1465	1240	39
AIC600225B/2	225	2 x 150 @ 60°	1930	1865	1640	48.5
AIC600225B/2.4	225	2 x 150 @ 60°	2320	2255	2030	46
AIC600225B/3	225	2 x 150 @ 60°	3000	2935	2710	58

Please Note: Chambers deeper than 1000mm to soffit of pipework, require a Restriction Cap 600RCC to comply with DCG.

Adaptors & Rocker pipes

WSA138110	EPDM seal connection to 110mm EN1401 pipe	1
WSA180160	EPDM seal connection to 160mm EN1401 pipe	1.5
TW150160SPSP	Adaptor - 150mm twinwall to 160mm EN1401	0.5
150TWRP	150mm twinwall rocker pipe and seal. Fits all UK 150mm twinwall systems except Naylor	0.5
TWR225160	225mm twinwall to EN1401 160mm pipe socket - reducer	1
TWR225150	225mm twinwall to 150mm twinwall pipe socket - reducer	1
TW225225UR	Adaptor - 225mm twinwall to 225mm UltraRib	2
TW225225PS	Adaptor - 225mm twinwall to 225mm POLYSEWER (also fits 225mm Marley Quantum)	2
TWR300225	300mm to 225mm twinwall socket reducer	3



Restriction/Reduction Caps & Access Covers

600RCC	Restriction Cap to 320mm Ø access	3.5
600450RC	Reduction Cap from 600 to 450mm Ø to accommodate 450ACSRA access cover	5
600SR	Sealing Ring for 600RCC Restriction Cap & 600450RC to access shaft	3
450ACSRA	450mm Ø access cover - square section with integral 350mm restricted access - Class BS EN 124 - A15, suitable for loading up 1.5 tonnes	14
450ACSB125	450mm x 450mm composite access cover - Class BS EN 124-B125, suitable for use in situations requiring a loading up to 125kN (12.5 tonnes). **Please Note: The frame of this cover must be supported by a concrete plinth.**	7
600ACSB125	600mm x 600mm composite access cover - Class BS EN 124-B125, suitable for use in situations requiring a loading up to 125kN (12.5 tonnes). **Please Note: The frame of this cover must be supported by a concrete plinth.**	12

Pre - assembled chambers

Lightweight, quick and easy to install

No plant or lifting equipment required

DCG Designed to meet Adoptable Standard

60 YEAR Design Life

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Inspection chambers

Application

- Above ground access for inspection and maintenance of surface water pipework systems
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- Maximum installation depth to soffit of pipe - Adoptable 3000mm and Non-Adoptable 3000mm

Compliance

- Design & Construction Guidance (DCG) - Type D & E Chambers
- EN 13598 Part 1 & 2 (2009)
- Building Regulations - Part H1

Features & Benefits

- Single Piece - Factory built units
- Robust - Impact resistant rota moulded base
- Quick and simple to install
- Base and five standard depths available
- Compatible with most UK twinwall pipe systems
- Lightweight - No machinery or lifting equipment required
- Stepped base - 55mm step from side to main channel, which meets the DCG requirement for Adoptable Sewers
- Restriction Caps are available for chambers deeper than 1 metre to soffit of inlet pipe to meet DCG
- Option of Reduction Cap 600450RC. This reduces the access diameter from 600mm to 450mm to accommodate a 450mm access cover
- Choice of Access Covers - A15 loading or **NEW:** B125 Loading
- Range of adaptors available to suit other pipework
- Access shafts can be easily cut onsite to required depth
- Granular backfill

ADSAIC600225225B/2/22/V1

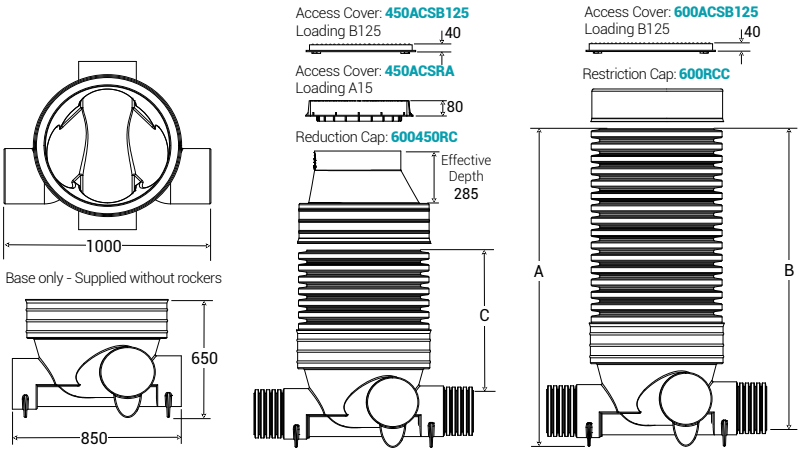
blue range
SURFACE WATER SYSTEMS
600 SERIES

ACCESSO CHAMBER MADE

MODEL: **AIC600225225B**

600mm internal diameter - Factory built inspection chambers, delivered to site as single piece units, ready to install, no assembly required.

All chambers feature a robust, impact resistant, rota moulded base. This model has 225mm twinwall connections to main channel and optional 225mm twinwall side connections at 90°, which are provided with blind ends that can be cut off on site if required. Chambers come with 225mm twinwall rocker pipes to main channel and 225mm rocker pipes are available for side inlets, as well as a wide range of adaptors to fit both main and side channels.

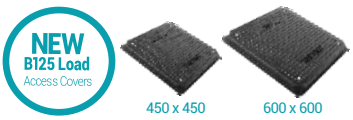


Product Code	Main channel pipework Ø (mm)	Optional Side Inlets Ø (mm)	Overall Depth A (mm)	Inlet Invert B (mm)	Soffit Depth C (mm)	Approx. Weight (kg)
AIC600225225B (Base Only)	225	2 x 225 @ 90°	650	590	365	10
AIC600225225B/1	225	2 x 225 @ 90°	1090	1030	805	30
AIC600225225B/1.5	225	2 x 225 @ 90°	1570	1510	1285	38
AIC600225225B/2	225	2 x 225 @ 90°	1960	1900	1675	48
AIC600225225B/2.4	225	2 x 225 @ 90°	2350	2290	2065	56
AIC600225225B/3	225	2 x 225 @ 90°	3010	2950	2725	68

Please Note: Chambers deeper than 1000mm to soffit of pipework, require a Restriction Cap 600RCC to comply with DCG.

Adaptors & Rocker pipes

WSA138110	EPDM seal connection to 110mm EN1401 pipe	1
WSA180160	EPDM seal connection to 160mm EN1401 pipe	1.5
TW150160SPSP	Adaptor - 150mm twinwall to 160mm EN1401	0.5
225TWRP	225mm twinwall rocker pipe and seal	1.5
TWR225160	225mm twinwall to EN1401 160mm pipe socket - reducer	1
TWR225150	225mm twinwall to 150mm twinwall pipe socket - reducer	1
TW225225UR	Adaptor - 225mm twinwall to 225mm UltraRib	2
TW225225PS	Adaptor - 225mm twinwall to 225mm POLYSEWER (also fits 225mm Marley Quantum)	2
TWR300225	300mm to 225mm twinwall socket reducer	3



Restriction/Reduction Caps & Access Covers

600RCC	Restriction Cap to 320mm Ø access	3.5
600450RC	Reduction Cap from 600 to 450mm Ø to accommodate 450ACSRA access cover	5
600SR	Sealing Ring for 600RCC Restriction Cap & 600450RC to access shaft	3
450ACSRA	450mm Ø access cover - square section with integral 350mm restricted access - Class BS EN 124 - A15, suitable for loading up 1.5 tonnes	14
450ACSB125	450mm x 450mm composite access cover - Class BS EN 124-B125, suitable for use in situations requiring a loading up to 125kN (12.5 tonnes). **Please Note: The frame of this cover must be supported by a concrete plinth.**	7
600ACSB125	600mm x 600mm composite access cover - Class BS EN 124-B125, suitable for use in situations requiring a loading up to 125kN (12.5 tonnes). **Please Note: The frame of this cover must be supported by a concrete plinth.**	12

Pre - assembled chambers

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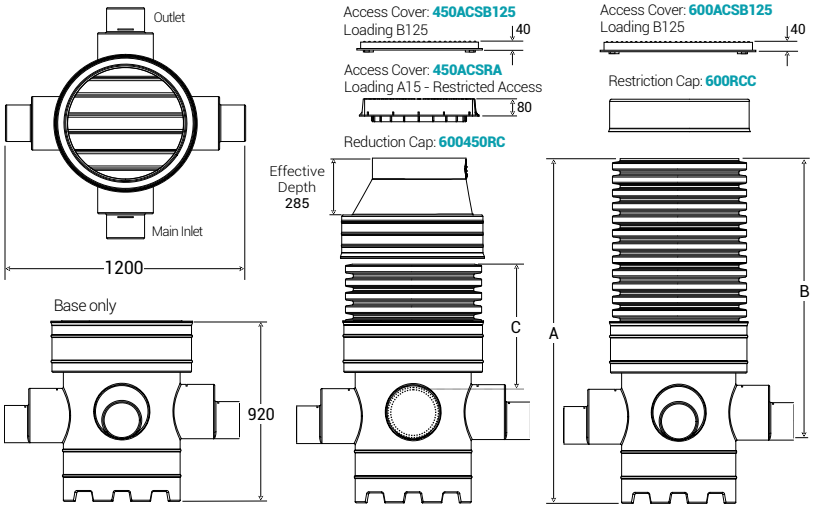
blue range
SURFACE WATER SYSTEMS
600 SERIES

ACCESSO CHAMBER MADE

MODEL: **AICCP600225150B**

600mm internal diameter - Factory built inspection chamber catch-pits, delivered to site as single piece units, ready to install, no assembly required. All chambers feature a robust, impact resistant, rota moulded base with four moulded socket connections, that accommodate, both 225mm and 150mm twinwall pipe. Socket connections are supplied blind for optional



Product Code	Main pipework connections Ø (mm)	Optional side inlets Ø (mm)	Overall Depth A (mm)	Inlet Invert B (mm)	Soffit Depth C (mm)	Approx. Weight (kg)
AICCP600225150B (Base Only)	150-225	150-225	920	580	355	16
AICCP600225150B/1	150-225	150-225	1055	715	490	28
AICCP600225150B/1.5	150-225	150-225	1450	1110	885	36
AICCP600225150B/2	150-225	150-225	1965	1625	1400	46
AICCP600225150B/2.4	150-225	150-225	2355	2015	1790	54
AICCP600225150B/3	150-225	150-225	3005	2665	2440	66

Please Note: Chambers deeper than 1000mm to soffit of pipework, require a Restriction Cap 600RCC to comply with DCG.

Catch-pit chambers

Application

- Above ground access for inspection and maintenance of surface water pipework systems
- Suitable for Adoptable and Non-Adoptable applications
- Maximum installation depth to soffit of pipe - Adoptable 3000mm and Non-Adoptable 3000mm

Compliance

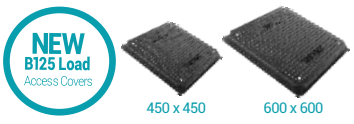
- Design & Construction Guidance (DCG) - Type D & E chambers
- EN 13598 Part 1 & 2 (2009)
- Building Regulations - Part H1

Features & Benefits

- Single piece - Factory built units
- Robust - Impact resistant rota moulded body
- Quick and simple to install
- 300mm sump depth
- High Strength profiled base
- Base and five standard depths available
- Compatible with all UK twinwall pipe systems
- Lightweight - No machinery or lifting equipment required
- Restriction Caps are available for chambers deeper than 1 metre to soffit of inlet pipe to meet DCG
- Option of Reduction Cap 600450RC - This reduces the access diameter from 600mm to 450mm to accommodate a 450mm diameter access cover
- Choice of Access Covers - A15 loading or **NEW:** B125 Loading
- Access shafts can be easily cut onsite to required depth
- Granular backfill

Adaptors & Rocker pipes

WSA138110	EPDM seal connection to 110mm EN1401 pipe	1
WSA180160	EPDM seal connection to 160mm EN1401 pipe	1.5
150TWRP	150mm twinwall rocker pipe and seal. Fits all UK 150mm twinwall systems except Naylor	0.5
225TWRP	225mm twinwall rocker pipe and seal	1.5
TW225225UR	Adaptor - 225mm twinwall to 225mm UltraRib	2
TW225225PS	Adaptor - 225mm twinwall to 225mm POLYSEWER (also fits 225mm Marley Quantum)	2
TWR300225	300mm to 225mm twinwall pipe socket reducer	3



Restriction/Reduction Caps & Access Covers

600RCC	Restriction Cap to 320mm Ø access	3.5
600450RC	Reduction Cap from 600 to 450mm Ø to accommodate 450ACSRA access cover	5
600SR	Sealing Ring for 600RCC Restriction Cap & 600450RC to access shaft	3
450ACSRA	450mm Ø access cover - square section with integral 350mm restricted access - Class BS EN 124 - A15, suitable for loading up 1.5 tonnes	14
450ACSB125	450mm x 450mm composite access cover - Class BS EN 124-B125, suitable for use in situations requiring a loading up to 125kN (12.5 tonnes). **Please Note: The frame of this cover must be supported by a concrete plinth.**	7
600ACSB125	600mm x 600mm composite access cover - Class BS EN 124-B125, suitable for use in situations requiring a loading up to 125kN (12.5 tonnes). **Please Note: The frame of this cover must be supported by a concrete plinth.**	12

Pre - assembled chambers | Lightweight, quick and easy to install | No plant or lifting equipment required | DCG Designed to meet Adoptable Standard | 60 YEAR Design Life | Made in the UK | Quick Delivery

email: sales@turtleenviro.co.uk | sales & technical support: tel. 0191 3036315 | **www.turtleenviro.co.uk**

ADSAICCP600225150B/7/22V2

FP McCANN

Middlewich Road, Byley, Middlewich, Cheshire, CW10 9RJ

DESIGN OF PRECAST CONCRETE BOX CULVERTS
(BC to EC2)

Contract Name:	HERNE BAY
Contract Number:	BC22-126
Client:	CILVILS STORE
Reference:	BC22-126-01

By:	JC
Date:	19/12/2022
Checked:	TP
Date:	20/12/2022

Codes of practice:

BS EN 1992-1-1	**Design of Concrete Structures**
PD6694-1: 2011	**Recommendations for the design of structures subject to traffic loading to BS EN1997-1: 2004**
Loading *(BCA Factsheet)*	Motorways/Trunk Roads/Principal Roads (α = 1.00)

Rev No.	Description	By	Date

Drawing number(s) :
File name: C:\Users\Taonga.Phiri\Desktop\Da Folder\Calcs\[DesignCalcs.xlsm]RC Bar
Folder: C:\Users\Taonga.Phiri\Desktop\Da Folder\Calcs\

FP McCann	By: JC	Checked: TP	
	Date: 19/12/2022	Date: 20/12/2022	Sheet: **GL/**

Middlewich Road, Byley
Middlewich, Cheshire
CW10 9RJ

Contract Name: HERNE BAY
Contract Number: BC22-126
Client: CILVILS STORE
Reference: BC22-126-01

Rev: **0**

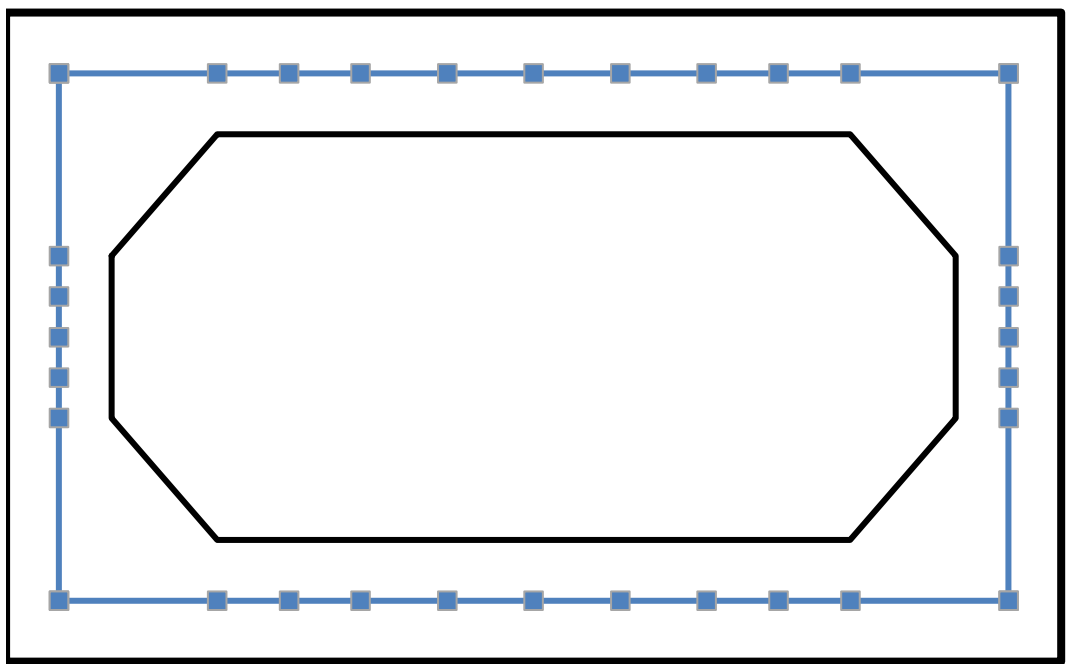
GEOMETRY AND LOADING

Internal Width =	1200	mm
Internal Height =	500	mm
Unit length =	2000	mm
Wall thickness =	150	mm
Deck thickness =	150	mm
Base thickness =	150	mm
Haunch =	150	mm

Additional Geometry

Invert Profile =	Flat Invert
DWF Diameter =	N/A
Benching = 1:	N/A
Benching Rise =	N/A mm

Overall Width =	1500	mm
Overall Height =	800	mm
Model Width =	1350	mm
Model Height =	650	mm
Unit spacing =	10	mm
Section Area =	0.65	m2
Unit Volume =	1.29	m3
Unit weight =	3.35	T
Internal Area =	0.56	m2



Concrete

Design Life =>	120	years
Class =	C45/55	
Elastic modulus =	36	Gpa
Concrete density =	2.6	t/m3

	Internal	External	
XF =	XF4	XF4	
XD =	XD1	XD1	
XS =	N/A	N/A	
Deviation, ΔC =	5	5	mm
Min Cover =	30	30	mm
Nominal Cover =	35	35	mm
Max Cover =	40	40	mm

Site Conditions

Surface Layer =	100	mm
Minimum Backfill =	700	mm
Maximum Backfill (<11m) =	1100	mm
Foundation type:	Elastic	
Surfacing density =	23	kN/m^3
Soil dry density =	19	kN/m^3
Soil saturated density =	19	kN/m^3
Increase in soil density due to external water pressure =	0	kN/m^3
Soil Friction angle, ϕ =	30	degrees

Allowable Crack width, wk1

Water Tightness Class: 0

EN 1992-3:2006 section 7.3.1

	ho (mm)	h (mm)	wk1 (mm)
Deck	1200	150	0.3
*Walls	1600	150	0.3
Base	2000	150	0.3

*ho calculation for wall is for half of the unit height.

Water Level

Include external water pressure?	No	
Water table depth below ground level	0	mm

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Middlewich Road, Byley
Middlewich, Cheshire
CW10 9RJ

Contract Name:	HERNE BAY	
Contract Number:	BC22-126	
Client:	CILVILS STORE	
Reference:	BC22-126-01	Rev: **0**

Loading

Min overburden = 0.80 m
Max overburden = 1.20 m
Loading α = 1.00 (BCA Factsheet)

LC1 - Selfweight: Deck = 3.90 kN/m^2 Walls = 2.54 kN each

LC2 - Minimum Overburden: Deck = 17.94 kN/m^2 γsd;ec = 1.15

Supplementary model factor for negative arching applied according to clause 10.2.2 of PD6694-1

LC3 - Maximum Overburden: Deck = 26.68 kN/m^2

LC4 to 7 - Earth pressure:

	LC	Qt	Qb
Min OB	LC4&5	17.02	29.37
Max OB	LC6&7	24.62	36.97

with water:

LC	Qt	Qb
LC29	0.00	0.00
LC30	0.00	0.00

LC8 to 9 - Surcharge: Use surcharge: Normal 20 kN/m^2

Note that as the values for ka vary depending on the load combination, these are analysed with a unity factor here.

LC10 to 11 - Line load due to Surcharge (According to Case B from Table 7 PD6694-1 Table 7)

Reduction factor = $(1 - Hc/2)^2$ (= 0 if overburden > 2m): Line Load = 330 • Kd* • Df

Df = 0.67 (>=0.67) 330 • 1.0 • 0.67 = 221.1 kN per m width

	Reduction Factor		Line Load
Min Overburden	0.36	=>	79.60 • Kd kN per m width
Max Overburden	0.16	=>	35.38 • Kd kN per m width

Kd is the design value of Ka or Ko (as appropriate) based on Φ'd;
**A value of unity is used for Kd here, as Kd varies depending on the load combination.*

LC12 - Braking & acceleration (According to 4.4.1)

Overall unit Width, L_L = 1.500 m
Lane Width = 3 m
αh = Height / (Height + Hc) = 0.8

Reduction factor, η = $(L_L - HC)/(L_L - 0.6)$

2 units per lane
4 m loaded
Qlk = $0.6 \bullet \alpha_{Q1} \bullet (2 \bullet Q_{1k}) + 0.1 \bullet \alpha_{q1} \bullet q_{1k} \bullet w_1 \bullet L$
Qlk = 291.2 kN per lane
Qlk • α = 72.8 kN per m width

	Reduction Factor		Factored Qlk
Min Overburden	0.76	=>	55.3 kN per m width
Max Overburden	0.32	=>	23.3 kN per m width

Traffic Load Models

According to BS EN 1991-2:2003 - EC1 Part 2 & NA BS EN 1991-2 2003 (UK)

	Thickness	Spread
Surface Layer	100	100 mm (@ 45°)
Min Backfill	700	404 mm (@ 30°)
Max Backfill (<11m)	1100	635 mm (@ 30°)
Centre of Deck	75	75 mm (@ 45°)

Spread at one side for Min OB = 579 mm
Spread at one side for Max OB = 810 mm

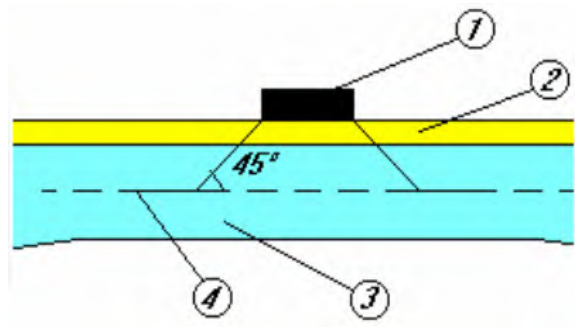

Figure 4.4 from 4.3.6
1 Wheel
2 Pavement
3 Concrete slab
4 Centroid of slab

Note:
Traffic loads are applied for min / max overburden and at locations for most onerous bending moments and shear forces
Loads are dispersed at 45° through road surface and concrete deck according to 4.3.6
Loads are dispersed at 30° through backfill according to 10.2.7 of PD6694-1:2011 and 4.9.1(1) Note 2

[1] *This is for horizontal loading (+ water pressure), whereas* [2] *is for vertical loading.*
[2] *Note: As internal water pressures are relieving, these are not catered for here. Uplift is not part of this design.*

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LC13 to LC16 - Load Model 1 (According to 4.3.2)

Apply LM1? TRUE

Lane Width = 3000 mm
Spacing between wheels = 2000 mm
Distance between axles = 1200 mm
*Wheel side = 400 mm
(Also LM2 - NA.2.15)

Lane	LM1 Wheel loads			UDLs		
	αQ1	Qik (axle)	Wheel	αq1	qik	UDL
1	1.00	300	150	0.61	9.0	5.50
2	1.00	200	100	2.20	2.5	5.50
3	1.00	100	50	2.20	2.5	5.50

(Table 4.2 from BS EN 1991-2:2003)

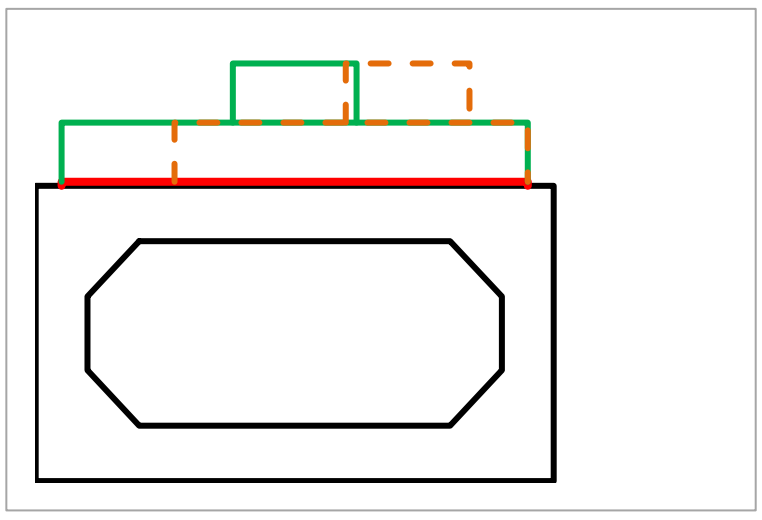
The maximum loading for LM1 is found by 'moving' the culvert from left to right under the Max & Min overburden load spreads, until the maximum load is found **(see Appendix 1 LM1 load distribution)**. The loads for minimum and maximum overburden are:

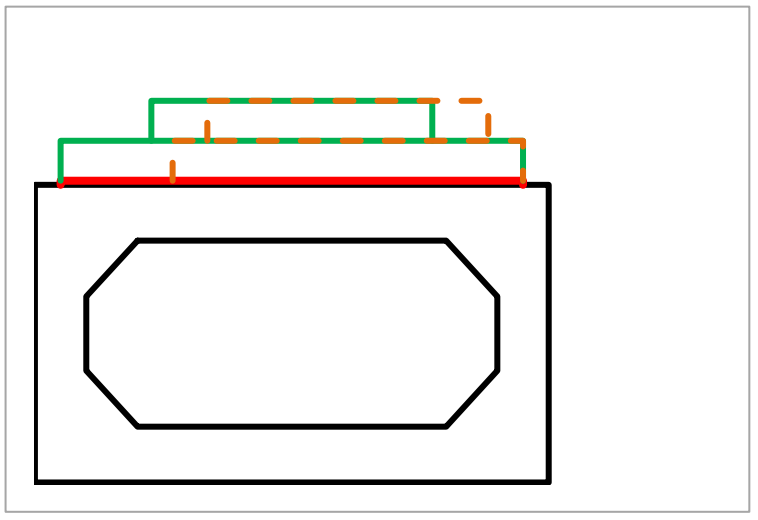
Min Overburden

Depth to NA = 875 mm
Single patch side = 1558 mm
Transverse Load length = 2758 mm
Centre overlap (1200 c/c) = 358 mm, 2 Patches
Basic UDL = 80.1 kN/m²
Overlap UDL = 160.3 kN/m²

Max Overburden

Depth to NA = 1275 mm
Single patch side = 2020 mm
Transverse Load length = 3220 mm
Centre overlap (1200 c/c) = 820 mm, 2 Patches
Basic UDL = 53.7 kN/m²
Overlap UDL = 107.4 kN/m²





LC17 to LC20 - Load Model 2 (According to 4.3.3)

Apply LM2? TRUE

Lane	LM2 Wheel loads			
	αQ1	Qik (axle)	αQ1 * Qik	Wheel
1	1.00	400	400	200

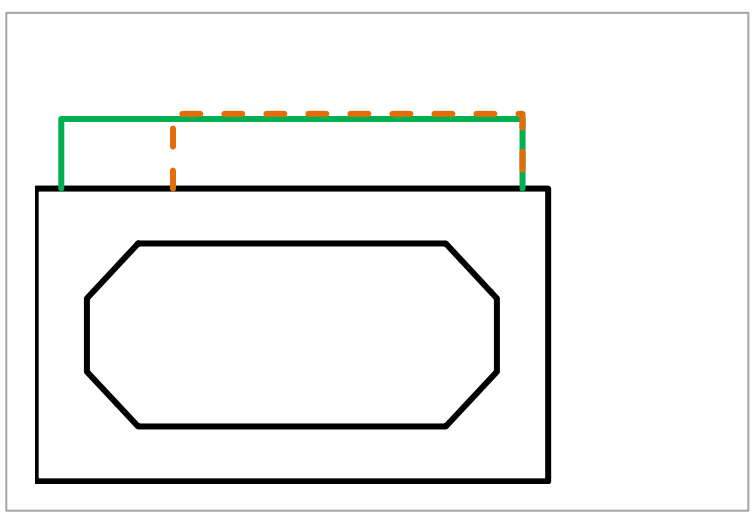
Width to distribute load for Mom* = 1350 mm
Width to distribute load for V* = 1258 mm

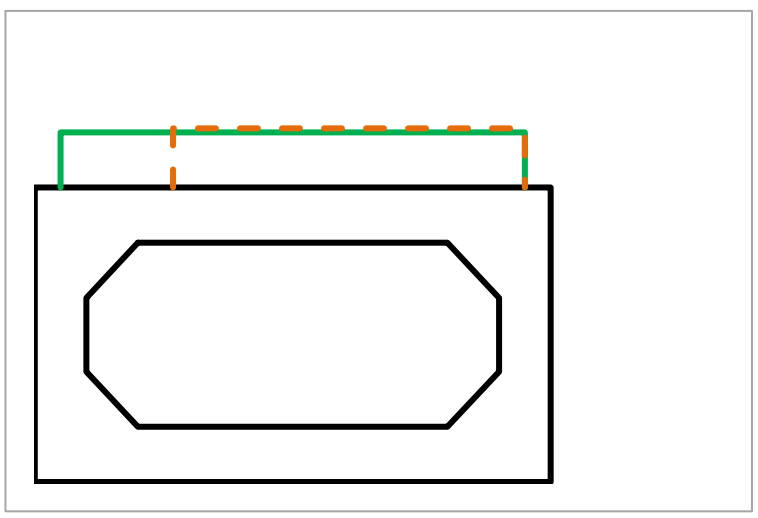
Min Overburden

Depth to NA = 875 mm
Single Patch Side = 1558 mm
Patch Pressure = 82.4 kN/m²
Centre overlap (2000 c/c) = 0 mm
Total load due to overlap = 100%
Load for M = 95.1 kN/m
Load for V = 102.0 kN/m

Max Overburden

Depth to NA = 1275 mm
Single Patch Side = 2020 mm
Patch Pressure = 49.0 kN/m²
Centre overlap (2000 c/c) = 20 mm
Total load due to overlap = 102%
Load for M = 74.8 kN/m
Load for V = 80.3 kN/m





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LC21 to LC24 - Load Model 3 (According to 4.3.4 & NA)

Apply Vehicle SV196

Model	NA	Max Axle Force	*DAF	Wheels Per Axle	Wheel Force
SV80	(2.16.1.2)	130	1.16	2	75.4
SV100	(2.16.1.3)	165	1.12	2	92.4
SV196	(2.16.1.4)	180	1.10	2	99.0
SOV	(2.16.2)	225	1.07	4	60.1

*Dynamic Amplification Factors for SV and SOV vehicles to Table NA.2

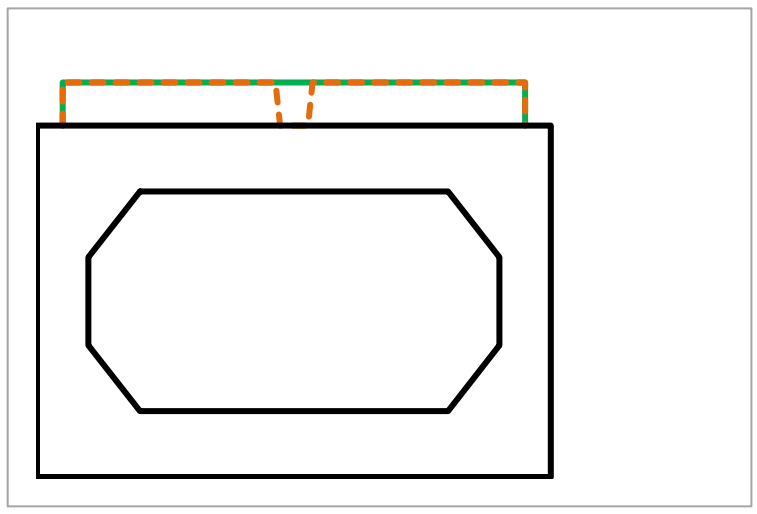
Overall Vehicle width = 3000 mm
Spacing between wheels = 2650 mm
Wheel side = 350 mm

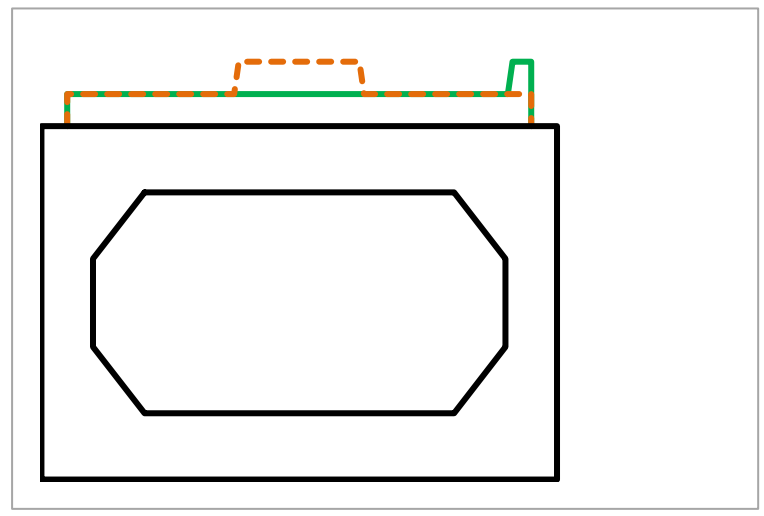
Min Overburden

Depth to NA = 875 mm
Single Patch Side = 1508 mm
Min Nr of Axles applied = 1 axles
Typical Patch Pressure = 43.5 kN/m2
Min UDL = 30.5 kN/m
Max UDL = 32.7 kN/m

Max Overburden

Depth to NA = 1275 mm
Single Patch Side = 1970 mm
Min Nr of Axles applied = 1 axles
Typical Patch Pressure = 25.5 kN/m2
Min UDL = 22.7 kN/m
Max UDL = 48.6 kN/m





LC25 to LC28 - Field or Accidental Loading

	Accidental Wheel loads (kN)			
	αQ1	Q_{SV}	αQ1 * Qik	Wheel
Q_{SV1}	1	120	120	60
Q_{SV2}	1	120	120	60

Values for QSV from NA.2.43 & NA.2.38

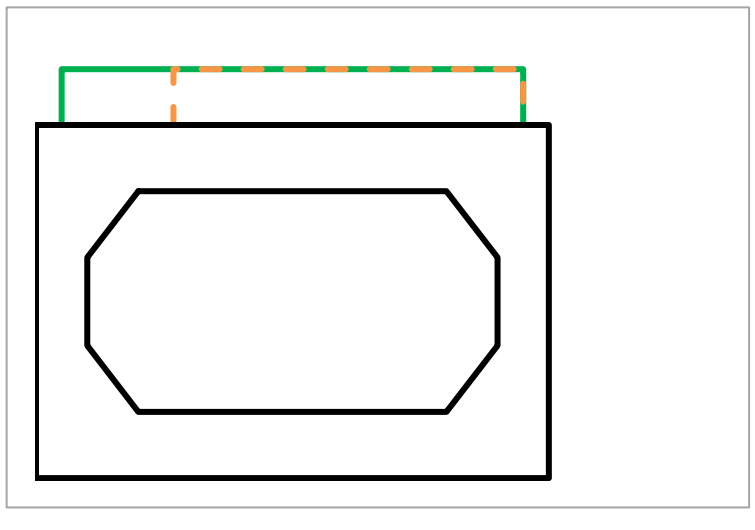
Spacing between wheels = 1000 mm
Distance between axles = 2000 mm
Wheel side = 400 mm

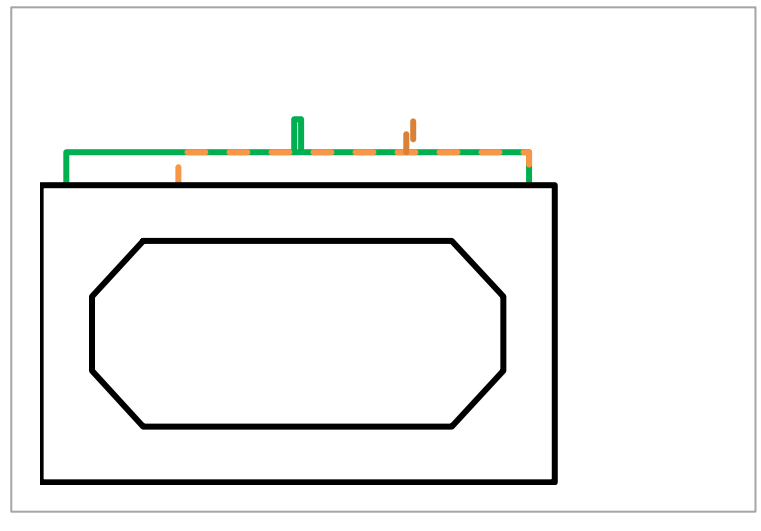
Min Overburden

Depth to NA = 875 mm
Single Patch Side = 1558 mm
Transverse Load length = 1558 mm
Centre overlap (3000 c/c) = 0 mm
Front Patch UDL = 31.6 kN/m2
Rear Patch UDL = 31.6 kN/m2
Overlap UDL = 0.0 kN/m

Max Overburden

Depth to NA = 1275 mm
Single Patch Side = 2020 mm
Transverse Load length = 4020 mm
Centre overlap (3000 c/c) = 20 mm
Front Patch UDL = 22.2 kN/m2
Rear Patch UDL = 22.2 kN/m2
Overlap UDL = 44.4 kN/m





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Middlewich Road, Byley	Contract Name:	HERNE BAY
Middlewich, Cheshire	Contract Number:	BC22-126
CW10 9RJ	Client:	CILVILS STORE
	Reference:	BC22-126-01

Rev: **0**

Thermal Actions:

Bridge Length (overall Width), LL = 1.5 m Minimum Overburden = 0.80 m

Condition	Check?	Clause
Buried structures designed to BS EN 1991-1-5 if LL > 3m	FALSE	Chapter 10.2.11 of PD 6694-1
Changes in uniform bridge temps ignored if overburden > 1.5m	TRUE	NA to BS EN 1991-1-5 Clause NA.2.2.2
Heating / cooling temp differences ignored if overburden depth is > 500mm	FALSE	NA to BS EN 1991-1-5 Clause NA.2.2.3

Comments

Thermal Actions may be ignored according to Chapter 10.2.11 of PD 6694-1

Load Combinations:

SLS Not critical to this design, thus not used

EQU Not critical to this design, thus not used

STR/GEO (C1) Worst case, thus combination used

STR/GEO (C2) Not critical to design, thus not used

PD6694-1:2011 - Table B:

	Vertical loads		Earth Pressure				Surcharge				Braking & Accel
	Max	Min	Max Equal	Max One side	Min Equal	Min One side	Max Equal	Max One side	Min Equal	Min One side	
B1	Y		Kmax				Ko				
B2		Y	Kmax				Ko				
B3	Y				Kmin						
B4	Y			Ka		Kmax		Ka			Y
B5		Y		Ka		Kmax		Ka			Y
B6	Sliding is not considered as part of this design.										

STR/GEO (C1) Load Factors

	Vretical		Earth Pressure			Surcharge			Line Load due to Surcharge		
	DL	IL	Kmax	Kmin	Ka	K0	Ka (LHS)	Ka (RHS)	K0	Ka (LHS)	Ka (RHS)
B1	1.35	1.35	0.72			0.50			0.50		
B2	0.95	0.00	0.72			0.50			0.50		
B3	1.35	1.35		0.20							
B4	1.35	1.35	0.72		0.40		0.33	0.00		0.33	0.00
B5	0.95	0.95	0.72		0.40		0.33	0.00		0.33	0.00

These are in the opposite direction to the braking & accelerating force

External water pressure is also applied if selected

LC	Description	Annex B from PD6694-1-2011 B1	B2	B3	B4	B5	SLS DL	SLS IL	Fatigue LM1	Fatigue LM2
1	Self-weight	1.35	0.95	1.35	1.35	0.95	0.95	0.00	0.00	0.00
2 to 3	Min/Max Overburden	1.35	0.95	1.35	1.35	0.95	0.95	0.00	0.00	0.00
4 & 6	Min/Max Earth Pressure LHS	0.72	0.72	0.20	0.40	0.40	0.20	0.00	0.00	0.00
5 & 7	Min/Max Earth Pressure RHS	0.72	0.72	0.20	0.72	0.72	0.20	0.00	0.00	0.00
8	Surcharge on LHS	0.50	0.50	0.00	0.33	0.33	0.00	0.33	0.00	0.00
9	Surcharge on RHS	0.50	0.50	0.00	0.00	0.00	0.00	0.33	0.00	0.00
10	Min/Max Line Load LHS	0.50	0.50	0.00	0.33	0.33	0.00	0.95	0.00	0.00
11	Min/Max Line Load RHS	0.50	0.50	0.00	0.00	0.00	0.00	0.95	0.00	0.00
12	Braking & Accelaration	0.00	0.00	0.00	1.35	1.35	0.00	0.00	0.00	0.00
13 to 16	Load Model 1	1.35	0.00	1.35	1.01	0.95	0.00	0.95	0.70	0.00
17 to 20	Load Model 2	1.35	0.00	1.35	1.01	0.95	0.00	0.95	0.00	0.48
21 to 24	Load Model 3	1.35	0.00	1.35	1.01	0.95	0.00	0.95	0.00	0.00
25 to 28	Accidental Vehicle Load	1.35	0.00	1.35	1.01	0.95	0.00	0.95	0.00	0.00
29 & 30	External Hydrostatic pressure	1.35	1.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Permanent Actions

Variable Actions

Earth pressure coeffieients Ka & Kmax have been multiplied by 1.35 for worst case ULS horizontal action

$\psi 1 = 0.75$ also applied for frequent loads to load group gr2 from Table 4.4a of BS EN 1991-2 and Table NA.A2.1 of NA BS EN 1990

EN1991-2:4.6.2 - 0.7 for Q_{ik} & 0.3 for q_{ik}

EN1991-2: 4.6.3 & Table 4.6 = 190/400, i.e. max fatigue axle divided by LM2 axle load used

$\gamma Q = 1.35$ for variable traffic actions according to Table NA.A2.4(B) of NA BS EN 1990

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Middlewich Road, Byley Middlewich, Cheshire CW10 9RJ	Contract Name: HERNE BAY Contract Number: BC22-126 Client: CILVILS STORE Reference: BC22-126-01		Rev: **0**

Min Overburden Results (/m width)

	B1:		B2:		B3:		B4:		B5:		Minimum		Maximum	
	M	V	M	V	M	V	M	V	M	V	M	V	M	V
Deck	20.7	-116.1	3.4	-13.3	19.5	-116.1	7.1	-77.5	5.5	-67.6	3.4	-116.1	20.7	-13.3
	-2.5	-84.6	0.8	-8.7	-3.6	-84.6	-7.9	-52.3	-7.6	-45.4	-7.9	-84.6	0.8	-8.7
	-9.9	-69.2	-0.1	-6.6	-11.1	-69.2	-12.3	-40.0	-11.3	-34.5	-12.3	-69.2	-0.1	-6.6
	-16.3	-53.6	-0.7	-4.4	-17.5	-53.6	-15.9	-27.5	-14.4	-23.5	-17.5	-53.6	-0.7	-4.4
	-21.8	-31.3	-1.2	-1.9	-23.0	-31.3	-18.4	-9.9	-16.5	10.1	-23.0	-31.3	-1.2	10.1
	-23.7	-9.0	-1.3	0.6	-24.9	-9.0	-18.2	15.0	-16.2	14.8	-24.9	-9.0	-1.3	15.0
	-21.8	33.4	-1.2	3.2	-23.0	33.4	-14.9	40.3	-13.0	37.7	-23.0	3.2	-1.2	40.3
	-17.0	55.6	-0.7	5.6	-18.2	55.6	-9.5	57.8	-8.0	53.3	-18.2	5.6	-0.7	57.8
	-12.3	71.0	-0.1	7.7	-13.4	71.0	-4.2	70.0	-3.2	64.1	-13.4	7.7	-0.1	71.0
	-4.9	88.6	0.8	9.9	-6.1	88.6	6.3	84.0	6.6	76.5	-6.1	9.9	6.6	88.6
	20.7	123.1	3.4	13.3	19.5	123.1	26.2	111.0	24.6	100.8	3.4	13.3	26.2	123.1
RHS Wall	20.7	123.1	3.4	13.3	19.5	123.1	26.2	111.0	24.6	100.8	3.4	13.3	26.2	123.1
	14.1	-18.0	-2.3	-14.2	18.3	-4.5	9.8	-51.7	8.2	-51.7	-2.3	-51.7	18.3	-4.5
	13.5	-11.9	-2.7	-8.1	18.1	-4.0	7.8	-40.1	6.2	-40.1	-2.7	-40.1	18.1	-4.0
	13.2	-6.7	-2.9	-2.9	17.9	-3.7	6.3	-30.1	4.7	-30.1	-2.9	-30.1	17.9	-2.9
	13.1	2.8	-2.7	2.7	17.7	-3.2	5.3	-19.8	-4.3	-19.7	-4.3	-19.8	17.7	2.8
	13.3	8.2	-2.4	8.2	17.6	-2.7	4.8	-9.7	-4.7	-9.7	-4.7	-9.7	17.6	8.2
	17.4	31.3	2.6	31.3	17.3	3.5	8.2	33.4	6.6	33.2	2.6	3.5	17.4	33.4
Base	17.4	31.3	2.6	31.3	17.3	3.5	8.2	33.4	6.6	33.2	2.6	3.5	17.4	33.4
	-3.9	-76.5	1.0	-6.4	-5.3	-81.0	-7.7	-53.0	-7.3	-45.6	-7.7	-81.0	1.0	-6.4
	-9.7	-59.5	0.4	-5.0	-11.4	-63.0	-11.3	-36.7	-10.2	-30.8	-11.4	-63.0	0.4	-5.0
	-14.2	-43.1	0.0	-3.6	-16.2	-45.6	-13.7	-21.6	-12.2	-17.4	-16.2	-45.6	0.0	-3.6
	-17.8	-24.4	-0.3	-2.1	-20.0	-25.8	-14.8	7.9	-13.0	9.5	-20.0	-25.8	-0.3	9.5
	-19.0	-4.9	-0.4	-0.4	-21.3	-5.1	-14.0	17.0	-12.1	17.1	-21.3	-5.1	-0.4	17.1
	-17.8	19.9	-0.3	1.2	-20.0	20.8	-11.4	28.9	-9.6	27.3	-20.0	1.2	-0.3	28.9
	-14.2	34.2	0.0	2.9	-16.2	36.1	-7.1	38.4	-5.6	35.1	-16.2	2.9	0.0	38.4
	-9.4	51.3	0.4	4.3	-11.1	54.3	3.4	49.3	4.0	44.2	-11.1	4.3	4.0	54.3
	-2.9	67.8	1.0	5.7	-4.3	71.7	5.9	58.9	6.1	52.3	-4.3	5.7	6.1	71.7
	17.4	-31.3	2.6	-31.3	17.3	-3.5	19.3	-35.2	17.7	-35.1	2.6	-35.2	19.3	-3.5
LHS Wall	17.4	-31.3	2.6	-31.3	17.3	-3.5	19.3	-35.2	17.7	-35.1	2.6	-35.2	19.3	-3.5
	13.3	-8.2	-2.4	-8.2	17.6	2.7	13.0	-24.9	11.4	-24.8	-2.4	-24.9	17.6	2.7
	13.1	-2.8	-2.7	-2.7	17.7	3.2	12.0	-22.7	10.4	-22.6	-2.7	-22.7	17.7	3.2
	13.2	6.3	-2.9	2.4	17.9	3.5	11.0	-20.9	9.4	-20.7	-2.9	-20.9	17.9	6.3
	13.5	11.9	-2.7	8.1	18.1	4.0	10.1	-18.8	8.5	-18.6	-2.7	-18.8	18.1	11.9
	14.1	18.0	-2.3	14.2	18.3	4.5	9.3	-16.5	7.7	-16.4	-2.3	-16.5	18.3	18.0
	20.7	-116.1	3.4	-13.3	19.5	-116.1	7.1	-77.5	5.5	-67.6	3.4	-116.1	20.7	-13.3

Max Overburden Results (/m width)

	B1:		B2:		B3:		B4:		B5:		Minimum		Maximum	
	M	V	M	V	M	V	M	V	M	V	M	V	M	V
Deck	19.6	-110.0	4.0	-18.7	18.7	-110.0	11.8	-82.9	10.0	-71.3	4.0	-110.0	19.6	-18.7
	-2.4	-83.6	0.3	-12.3	-3.3	-83.6	-4.6	-60.8	-4.1	-52.7	-4.6	-83.6	0.3	-12.3
	-10.2	-66.1	-0.9	-9.3	-11.1	-66.1	-10.2	-46.7	-9.0	-40.4	-11.1	-66.1	-0.9	-9.3
	-16.1	-53.9	-1.7	-6.2	-17.0	-53.9	-14.3	-36.4	-12.5	-31.8	-17.0	-53.9	-1.7	-6.2
	-20.5	-29.5	-2.4	-2.7	-21.4	-29.5	-17.1	-16.9	-14.9	-14.7	-21.4	-29.5	-2.4	-2.7
	-22.0	-2.1	-2.6	0.9	-22.9	-2.1	-17.5	7.4	-15.2	7.0	-22.9	-2.1	-2.6	7.4
	-20.5	25.6	-2.4	4.4	-21.4	25.6	-15.6	26.8	-13.4	24.1	-21.4	4.4	-2.4	26.8
	-16.2	48.6	-1.7	7.8	-17.1	48.6	-11.4	45.3	-9.6	40.3	-17.1	7.8	-1.7	48.6
	-11.0	68.5	-0.9	10.8	-11.9	68.5	-6.5	61.2	-5.3	54.3	-11.9	10.8	-0.9	68.5
	-3.8	86.2	0.3	13.8	-4.6	86.2	2.2	75.5	2.6	66.8	-4.6	13.8	2.6	86.2
	19.6	115.7	4.0	18.7	18.7	115.7	20.1	99.4	18.2	87.5	4.0	18.7	20.1	115.7
RHS Wall	19.6	115.7	4.0	18.7	18.7	115.7	20.1	99.4	18.2	87.5	4.0	18.7	20.1	115.7
	14.4	-15.0	-0.4	-10.8	17.3	-5.2	11.0	-28.0	9.1	-27.9	-0.4	-28.0	17.3	-5.2
	13.8	-10.2	-0.8	-6.0	17.1	-4.6	9.9	-21.1	8.0	-21.1	-0.8	-21.1	17.1	-4.6
	13.5	-6.3	-0.9	-2.1	16.9	-4.1	9.1	-15.5	7.3	-15.5	-0.9	-15.5	16.9	-2.1
	13.4	2.4	-0.8	2.4	16.8	-3.5	8.7	-9.3	6.8	-9.2	-0.8	-9.3	16.8	2.4
	13.6	6.9	-0.4	6.8	16.6	-2.9	8.5	-3.1	6.6	-3.1	-0.4	-3.1	16.6	6.9
	16.9	26.6	3.7	26.5	16.5	4.3	11.4	26.0	9.5	25.9	3.7	4.3	16.9	26.6

FP McCann	By: JC	Checked: TP	
	Date: 19/12/2022	Date: 20/12/2022	Sheet: **GL/**

Middlewich Road, Byley
Middlewich, Cheshire
CW10 9RJ

Contract Name: HERNE BAY
Contract Number: BC22-126
Client: CILVILS STORE
Reference: BC22-126-01

Rev: **0**

Max Overburden Results cont'd

Base	16.9	26.6	3.7	26.5	16.5	4.3	11.4	26.0	9.5	25.9	3.7	4.3	16.9	26.6
	-3.9	-75.0	0.4	-12.5	-4.9	-77.1	-5.1	-57.9	-4.6	-49.2	-5.1	-77.1	0.4	-12.5
	-9.7	-58.4	-0.7	-9.8	-10.9	-60.0	-9.5	-43.1	-8.3	-36.3	-10.9	-60.0	-0.7	-9.8
	-14.1	-42.3	-1.5	-7.1	-15.4	-43.4	-12.6	-29.1	-10.8	-24.2	-15.4	-43.4	-1.5	-7.1
	-17.7	-23.9	-2.1	-4.0	-19.1	-24.5	-14.7	-13.5	-12.6	-10.7	-19.1	-24.5	-2.1	-4.0
	-18.8	-4.8	-2.3	-0.8	-20.3	-4.9	-14.9	7.0	-12.6	7.3	-20.3	-4.9	-2.3	7.3
	-17.7	18.3	-2.1	2.4	-19.1	18.7	-13.2	20.4	-11.1	18.6	-19.1	2.4	-2.1	20.4
	-14.1	33.6	-1.5	5.6	-15.4	34.5	-9.7	32.3	-8.0	28.5	-15.4	5.6	-1.5	34.5
	-9.4	50.3	-0.7	8.4	-10.6	51.7	-5.4	44.8	-4.3	39.0	-10.6	8.4	-0.7	51.7
	-3.1	66.4	0.4	11.1	-4.0	68.3	2.1	56.4	2.5	48.8	-4.0	11.1	2.5	68.3
	16.9	-26.6	3.7	-26.5	16.5	-4.3	16.2	-26.5	14.3	-26.4	3.7	-26.6	16.9	-4.3
LHS Wall	16.9	-26.6	3.7	-26.5	16.5	-4.3	16.2	-26.5	14.3	-26.4	3.7	-26.6	16.9	-4.3
	13.6	-6.9	-0.4	-6.8	16.6	2.9	12.1	-13.7	10.2	-13.6	-0.4	-13.7	16.6	2.9
	13.4	-2.4	-0.8	-2.4	16.8	3.5	11.5	-10.9	9.7	-10.8	-0.8	-10.9	16.8	3.5
	13.5	5.7	-0.9	1.5	16.9	4.0	11.2	-8.6	9.3	-8.5	-0.9	-8.6	16.9	5.7
	13.8	10.2	-0.8	6.0	17.1	4.6	10.9	-5.9	9.0	-5.8	-0.8	-5.9	17.1	10.2
	14.4	15.0	-0.4	10.8	17.3	5.2	10.8	-3.1	8.9	-3.0	-0.4	-3.1	17.3	15.0
	19.6	-110.0	4.0	-18.7	18.7	-110.0	11.8	-82.9	10.0	-71.3	4.0	-110.0	19.6	-18.7

Summary of Results
(/m width of unit)

Design Symmetrically, ULS

			Minimum ULS		Maximum ULS		Min	Max	Extreme		SLS;DL	SLS;lL	Fatigue
	Node ID	Dist.	M	V	M	V	M	M	M	V	M	M	M
Deck	D0	0.000	3.4	-116.1	20.7	-13.3	3.4	26.2	26.2	123.1	3	11.6	8.5
	D1	0.225	-7.9	-84.6	0.8	-8.7	-7.9	6.6	-7.9	88.6	-0.5	-1.6	-1.3
	D2	0.327	-12.3	-69.2	-0.1	-6.6	-13.4	-0.1	-13.4	71.0	-1.7	-6.3	-4.7
	D3	0.429	-17.5	-53.9	-0.7	-4.4	-18.2	-0.7	-18.2	57.8	-2.6	-10.2	-7.6
	D4	0.552	-23.0	-31.3	-1.2	10.1	-23.0	-1.2	-23.0	40.3	-3.2	-13.6	-10.1
	D5	0.675	-24.9	-9.0	-1.3	15.0	-24.9	-1.3	-24.9	15.0	-3.5	-14.8	-11
	D6	0.798	-23.0	3.2	-1.2	40.3	-23.0	-1.2	-23.0	40.3	-3.2	-13.6	-10.1
	D7	0.921	-18.2	5.6	-0.7	57.8	-18.2	-0.7	-18.2	57.8	-2.6	-10.2	-8
	D8	1.023	-13.4	7.7	-0.1	71.0	-13.4	-0.1	-13.4	71.0	-1.7	-6.3	-6
	D9	1.125	-6.1	9.9	6.6	88.6	-7.9	6.6	-7.9	88.6	-0.5	-1.6	-2.8
	D10	1.350	3.4	13.3	26.2	123.1	3.4	26.2	26.2	123.1	3	11.6	8.5
RHS Wall	R6	0.7	3.4	13.3	26.2	123.1	3.4	26.2	26.2	123.1	3.0	11.6	Deck
	R5	0.4	-2.3	-51.7	18.3	-4.5	-2.3	18.3	18.3	51.7	2.5	10.4	Only
	R4	0.4	-2.7	-40.1	18.1	-4.0	-2.7	18.1	18.1	40.1	2.5	10.2	
	R3	0.3	-2.9	-30.1	17.9	-2.1	-2.9	17.9	17.9	30.1	2.5	10.0	
	R2	0.2	-4.3	-19.8	17.7	2.8	-4.3	17.7	17.7	22.7	2.5	9.9	
	R1	0.2	-4.7	-9.7	17.6	8.2	-4.7	17.6	17.6	24.9	2.6	9.8	
	R0	0.0	2.6	3.5	17.4	33.4	2.6	19.3	19.3	35.2	3.2	9.8	
Base	B10	1.350	2.6	3.5	17.4	33.4	2.6	19.3	19.3	35.2	3.2	9.8	
	B9	1.125	-7.7	-81.0	1.0	-6.4	-7.7	6.1	-7.7	81.0	-0.5	-2.3	
	B8	1.023	-11.4	-63.0	0.4	-5.0	-11.4	4.0	-11.4	63.0	-1.8	-6.3	
	B7	0.921	-16.2	-45.6	0.0	-3.6	-16.2	0.0	-16.2	45.6	-2.7	-9.2	
	B6	0.798	-20.0	-25.8	-0.3	9.5	-20.0	-0.3	-20.0	28.9	-3.4	-11.3	
	B5	0.675	-21.3	-5.1	-0.4	17.1	-21.3	-0.4	-21.3	17.1	-3.6	-12	
	B4	0.552	-20.0	1.2	-0.3	28.9	-20.0	-0.3	-20.0	28.9	-3.4	-11.3	
	B3	0.429	-16.2	2.9	0.0	38.4	-16.2	0.0	-16.2	45.6	-2.7	-9.2	
	B2	0.327	-11.1	4.3	4.0	54.3	-11.4	4.0	-11.4	63.0	-1.8	-6.3	
	B1	0.225	-4.3	5.7	6.1	71.7	-7.7	6.1	-7.7	81.0	-0.5	-2.3	
	B0	0.000	2.6	-35.2	19.3	-3.5	2.6	19.3	19.3	35.2	3.2	9.8	
LHS Wall	L0	0.0	2.6	-35.2	19.3	-3.5	2.6	19.3	19.3	35.2	3.2	9.8	
	L1	0.2	-2.4	-24.9	17.6	2.9	-4.7	17.6	17.6	24.9	2.6	9.8	
	L2	0.2	-2.7	-22.7	17.7	3.5	-4.3	17.7	17.7	22.7	2.5	9.9	
	L3	0.3	-2.9	-20.9	17.9	6.3	-2.9	17.9	17.9	30.1	2.5	10.0	
	L4	0.4	-2.7	-18.8	18.1	11.9	-2.7	18.1	18.1	40.1	2.5	10.2	
	L5	0.4	-2.3	-16.5	18.3	18.0	-2.3	18.3	18.3	51.7	2.5	10.4	
	L6	0.7	3.4	-116.1	20.7	-13.3	3.4	26.2	26.2	123.1	3.0	11.6	

Axial due to min SLS Shear (/m width):

Deck =	18.70	kN/m
Base =	4.23	kN/m
Wall Top =	1.03	kN/m
Wall Bottom =	1.27	kN/m

Axial Force per m

Deck Axial = 2• Wall Top =	2.05	kN/m
Base Axial = 2• Wall Bot =	2.54	kN/m
Wall Axial = Deck + Base =	22.93	kN/m

Normal Stress

0.014	N/mm²	
0.017	N/mm²	
0.153	N/mm²	

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Middlewich Road, Byley
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Contract Name: HERNE BAY
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Rev: **0**

RC DESIGN

fck = 45 Mpa
fyk = 500 Mpa
fywk = 500 Mpa

Deck thickness = 150 mm
Wall thickness = 150 mm
Base thickness = 150 mm
Unit length, b = 2000 mm

fctm = 3.80 MPa
Min Tension As = 0.20%
n = 0.6•(1-fck/250) = 0.49
Min Asv/sv = 2.15 mm
Max v = 7.38 MPa

	Thickness	Ext.	Int.	Link Ø	Max Bar	Dist btw layers
Deck	150	40	40	0	12	46 mm
Walls	150	40	40	0	12	46 mm
Base	150	40	40	0	12	46 mm
		Max Link =		0		

Socket = 70 mm
Side cover = 40 mm
Mesh overhang = 25 mm
Max bar used = 12 mm
Max Link used = 0 mm
Working width = 1790 mm
+ *This allows for the socket and/or the sprigot.*
Min Distance between bars = 25 mm

The following calculations use the Design values from the previous page
but are based upon the entire unit length, b rather than per metre width.

1) External design:

Bending

1.1) Deck

(RHS)

Dist	Max M	Design M	h	d	k	z/d	As req Bending	As req + Shear	As req Min As
0.675 mid	-2.6	0.0	150	104	0.0000	0.95	0	0	411
0.798	-2.3	0.0	150	104	0.0000	0.95	0	0	411
0.921 2d	-1.4	0.0	150	104	0.0000	0.95	0	0	411
1.023 d	-0.2	0.0	150	104	0.0000	0.95	0	0	411
1.125 chamfer	13.2	13.2	150	104	0.0135	0.95	307	307	411
1.350 corner	52.5	52.5	318	272	0.0079	0.95	467	467	1074

**As req = 1078 mm2
As prov = 1357 mm2
Bar size = 12 mm
Bar Qty = 12 bars
Bar c/c = 155 mm

1.2) Walls

(top to bottom

Dist	Max M	Design M	h	d	k	z/d	As req Bending	As req + Shear	As req Min As
0.650 corner	52.5	52.5	318	272	0.0079	0.95	467	467	1074
0.425 chamf	36.6	36.6	150	104	0.0376	0.95	851	851	411
0.429 2d	36.1	36.1	150	104	0.0371	0.95	841	841	411
0.325 mid	35.8	35.8	150	104	0.0367	0.95	833	833	411
0.221 2d	35.4	35.4	150	104	0.0364	0.95	825	825	411
0.225 chamf	35.2	35.2	150	104	0.0361	0.95	819	819	411
0.000 corner	38.7	38.7	318	272	0.0058	0.95	344	344	1074

1.3) Base

(RHS)

Dist	Max M	Design M	h	d	k	z/d	As req Bending	As req + Shear	As req Min As
1.350 corner	38.7	38.7	318	272	0.0058	0.95	344	344	1074
1.125 chamf	12.2	12.2	150	104	0.0125	0.95	284	284	411
1.023 2d	8.1	8.1	150	104	0.0083	0.95	188	188	411
0.921 d	0.0	0.0	150	104	0.0000	0.95	0	0	411
0.798	-0.6	0.0	150	104	0.0000	0.95	0	0	411
0.675 mid	-0.8	0.0	150	104	0.0000	0.95	0	0	411

'"+ Shear" considers the additional steel required to resist the tensile force resulting from the inclusion of links
*As;req may be greater than values shown in tables if more steel is required to satisfy serviceability, shear and / or fatigue checks

FP McCann	By: JC	Checked: TP	
	Date: 19/12/2022	Date: 20/12/2022	Sheet: **GL/**
Middlewich Road, Byley Middlewich, Cheshire CW10 9RJ	Contract Name: HERNE BAY Contract Number: BC22-126 Client: CILVILS STORE Reference: BC22-126-01		Rev: **0**

2) Internal Design

Bending

2.1) Deck

(RHS)

Dist		Min M	Design M	h	d	k	z/d	As req Bending	As req + Shear	As req Min As
0.675	mid	-49.8	49.8	150	104	0.0512	0.95	1160	1160	411
0.798		-45.9	45.9	150	104	0.0472	0.95	1069	1069	411
0.921	2d	-36.5	36.5	150	104	0.0375	0.95	849	849	411
1.023	d	-26.9	26.9	150	104	0.0276	0.95	626	626	411
1.125	chamfer	-15.8	15.8	150	104	0.0162	0.95	368	368	411
1.35	corner	6.7	0.0	318	272	0.0000	0.95	0	0	411

**As req =	1160	mm2
As prov =	1357	mm2
Bar size =	12	mm
Bar Qty =	12	bars
Bar c/c =	155	mm

2.2) Walls

(top to bottom)

Dist		Min M	Design M	h	d	k	z/d	As req Bending	As req + Shear	As req Min As
0.650	corner	6.7	0.0	318	273	0.0000	0.95	0	0	415
0.425	chamf	-4.6	4.6	150	105	0.0046	0.95	105	105	415
0.429	2d	-5.4	5.4	150	105	0.0055	0.95	125	125	415
0.325	mid	-5.7	5.7	150	105	0.0058	0.95	132	132	415
0.221	2d	-8.6	8.6	150	105	0.0086	0.95	198	198	415
0.225	chamf	-9.4	9.4	150	105	0.0094	0.95	216	216	415
0.000	corner	5.3	0.0	318	273	0.0000	0.95	0	0	415

**As req =	415	mm2
As prov =	628	mm2
Bar size =	10	mm
Bar Qty =	8	bars
Bar c/c =	245	mm

2.3) Base

(RHS)

Dist		Min M	Design M	h	d	k	z/d	As req Bending	As req + Shear	As req Min As
1.350	corner	5.3	0.0	318	272	0.0000	0.95	0	0	411
1.125	chamf	-15.4	15.4	150	104	0.0158	0.95	359	359	411
1.023	2d	-22.8	22.8	150	104	0.0235	0.95	532	532	411
0.921	d	-32.5	32.5	150	104	0.0334	0.95	756	756	411
0.798		-40.1	40.1	150	104	0.0412	0.95	933	933	411
0.675	mid	-42.6	42.6	150	104	0.0438	0.95	992	992	411

**As req =	992	mm2
As prov =	1357	mm2
Bar size =	12	mm
Bar Qty =	12	bars
Bar c/c =	155	mm

'"+ Shear" considers the additional steel required to resist the tensile force resulting from the inclusion of links

*As;req may be greater than values shown in tables if more steel is required to satisfy serviceability, shear and / or fatigue checks

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3) Shear

	d	Max Spc (0.75*d)	Lateral (1.5d)	No of legs	Link Diameter
Deck	104	75	155	5	0
Wall	104	75	155	5	0
Base	104	75	155	5	0

Deck Dist	V	v =V/bw*z	As prov	vrdc	2*d/av	vrd,c'	Cot ()	Req Asv/sv	Spc	Prov Asv/Leg	Prov Asv/sv	Vrd,max	Chk
0.675 mid	30.1	0.152	1357	0.744	1.0	0.744	2.5	0	75	0	0	147.0	Ok
0.798	80.5	0.407	1357	0.744	1.0	0.744	2.5	0	75	0	0	147.0	Ok
0.921 2d	115.5	0.584	1357	0.744	1.0	0.759	2.5	0	75	0	0	150.0	Ok
1.023 d	142.1	0.719	1357	0.744	2.0	1.488	2.5	0	75	0	0	294.0	Ok
1.125 chamfer	177.2	0.896	1357	0.744	2.0	1.488	2.5	0	75	0	0	294.0	Ok
1.35 corner	246.3	0.476	1357	0.599	2.0	1.198	2.5	0	75	0	0	619.1	Ok

Possible without links? **TRUE**

Walls Dist	V	v =V/bw*z	As prov	vrdc	2*d/av	vrd,c'	Cot ()	Req Asv/sv	Spc	Prov Asv/Leg	Prov Asv/sv	Vrd,max	Chk
0.65 corner	246.3	0.476	1357	0.641	2.0	1.282	2.5	0	75	0	0	662.5	Ok
0.425 chamf	103.5	0.523	1357	0.786	2.0	1.572	2.5	0	75	0	0	310.6	Ok
0.429 2d	80.2	0.406	1357	0.786	2.0	1.572	2.5	0	75	0	0	310.6	Ok
0.325 mid	60.1	0.304	1357	0.786	2.0	1.572	2.5	0	75	0	0	310.6	Ok
0.221 2d	45.5	0.23	1357	0.786	1.0	0.802	2.5	0	75	0	0	158.5	Ok
0.225 chamf	49.9	0.252	1357	0.786	2.0	1.572	2.5	0	75	0	0	310.6	Ok
0 corner	70.5	0.136	1357	0.641	2.0	1.282	2.5	0	75	0	0	662.5	Ok

Possible without links? **TRUE**

Base Dist	V	v =V/bw*z	As prov	vrdc	2*d/av	vrd,c'	Cot ()	Req Asv/sv	Spc	Prov Asv/Leg	Prov Asv/sv	Vrd,max	Chk
1.35 corner	70.5	0.136	1357	0.6	2.0	1.200	2.5	0	75	0	0	620.2	Ok
1.125 chamf	161.9	0.819	1357	0.745	2.0	1.490	2.5	0	75	0	0	294.4	Ok
1.023 d	126.0	0.637	1357	0.745	2.0	1.490	2.5	0	75	0	0	294.4	Ok
0.921 2d	91.3	0.461	1357	0.745	1.0	0.760	2.5	0	75	0	0	150.2	Ok
0.798	57.8	0.292	1357	0.745	1.0	0.745	2.5	0	75	0	0	147.2	Ok
0.675 mid	34.1	0.172	1357	0.745	1.0	0.745	2.5	0	75	0	0	147.2	Ok

Possible without links? **TRUE**

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4) Serviceability

Material Properties

Short term or long term? (S or L) L
Cement type R (S, N, or R)

Relative humidity = 75 %
Age at cracking 28 days
Es = 200 GPa

Max crack width, wk1

Deck wk1 = 0.3 mm
Walls wk1 = 0.3 mm
Base wk1 = 0.3 mm

mean concrete tensile strength (fct, eff) = 3.80 MPa (T3.1)
E concrete = 22[(fck+8)/10]0.3 (Ecm) = 36.3 GPa (T3.1)
mean concrete strength at cracking (fcm, t) = 53.0 MPa (T3.1 & Eqn3.4)

ρ0 = 0.01
Width = 2.000 m
ψ2 = 0.3 (0->0.6, 0.3 for Vehicle>30kN, 0.6 else)

Geometry & Loading

	h	As prov	d	As2	d2	ρ	SLS x	Perm M	Variable M	SLS M	QP M
Deck Int	150	1357	104	1357	46	0.65	38.4	7.0	29.6	36.6	15.9
Deck Ext	150	1357	104	1357	46	0.65	38.4	6.0	23.2	29.2	13.0
Walls Int	150	628	105	1357	46	0.30	31.2	0.0	0.0	0.0	0.0
Walls Ext	150	1357	104	628	45	0.65	37.6	6.4	23.2	29.6	13.4
Base Int	150	1357	104	1357	46	0.65	38.4	7.2	24.0	31.2	14.4
Base Ext	150	1357	104	1357	46	0.65	38.4	6.4	19.6	26.0	12.3

Bar Spacing

	σc	σs	ρs	S max	S used	Chk
Deck Int	11.1	283.9	123.2	346	155	Ok
Deck Ext	8.8	225.1	99.9	376	155	Ok
Walls Int	0	0	0	500	245	Ok
Walls Ext	8.8	232.8	105.1	369	155	Ok
Base Int	9.4	240.4	111	362	155	Ok
Base Ext	7.9	202.1	95.5	381	155	Ok

Concrete Stress

	Creep f. ϕ(t,t0)	Cracking Mod. Rat. (αe) =	xu	lu	Mcr	chk	xc	σc	Chk
Deck Int	2.398	18.729	75.0	603	30.5	uncracked	40.3	4.4	Ok
Deck Ext	2.398	18.729	75.0	603	30.5	uncracked	40.3	3.6	Ok
Walls Int	2.398	18.729	73.9	592	29.5	uncracked	29.8	0.0	Ok
Walls Ext	2.398	18.729	76.1	592	30.4	uncracked	40.3	3.7	Ok
Base Int	2.398	18.729	75.0	603	30.5	uncracked	40.3	3.9	Ok
Base Ext	2.398	18.729	75.0	603	30.5	uncracked	40.3	3.4	Ok

Crack Width

	Ac, eff	σs	Chk	As /Ac,eff (ρp,eff)	Cover*	Sr, max	εsm-εcm	Wk	Chk
Deck Int	71807	129.2	Ok	0.019	30	210	388	0	Ok
Deck Ext	71807	105.4	Ok	0.019	30	210	316	0	Ok
Walls Int	79534	0.0	Ok	0.008	30	156	0	0	Ok
Walls Ext	71807	108.7	Ok	0.019	30	210	326	0	Ok
Base Int	71807	117.1	Ok	0.019	30	210	351	0	Ok
Base Ext	71807	99.9	Ok	0.019	30	210	300	0	Ok

*This is Minimum cover - DC (10mm here)

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5) Fatigue in the deck (Clause 6.8 EN 1992-1-1)

This is designed to traffic loading and thus fatigue may need to be catered for. The specific clause is:

The NA to BS EN 1992-2 Clause 6.8.1 has 2 clauses which specify if this is required or not:

1) If the minimum fill is > 1m, a fatigue check is not required.
2) if span/depth < 18 then fatigue is not critical.

Min fill =	800 mm		Check required.
Distance between haunches =	900 mm		
Deck Depth =	150 mm		
Span/Depth =	6.0	<=18 ?	No check required.

No Fatigue check required

6) Haunches

6.1) Deck Haunch

Des M	h	d	k	z/d	As req	Min As	Use As	Ø	No. Bars	As prov	Chk
0.0	318	150	0.0000	0.95	0	593	593	10	8	628	Ok

6.2) Base Haunch

Des M	h	d	k	z/d	As req	Min As	Use As	Ø	No. Bars	As prov	Chk
0.0	318	150	0.0000	0.95	0	593	593	10	8	628	Ok

7) Distribution Steel

overall width =	1500 mm			top haunch =	150 mm	
overall height =	800 mm	Deck thickness =	150 mm	bottom haunch =	150 mm	
internal cover =	40 mm	Wall thickness =	150 mm	Min Distr bar spc =	150	mm
external cover =	40 mm	Base thickness =	150 mm	Max Distr bar spc =	400	mm

	Main Ø	**Main As_{req}**	**Min Proj.**	**Dist Length**	**Dist As per m**	**Dist As req**	**Dist Ø**	**Target Bar c/c**	**No. bars**	**per culvert**	**Start As_{prov}**	**Start Proj.**	**Chk**
Deck Int	12	1357	325	850	136	134	8	280	4	4	202	330	OK
Deck Ext	12	1357	190	1120	136	134	8	370	4	4	202	195	OK
Walls Int	10	628	325	150	63	45	8	150	2	4	101	325	OK
Walls Ext	12	1357	140	520	136	45	8	170	4	8	202	145	OK
Base Int	12	1357	325	850	136	134	8	280	4	4	202	330	OK
Base Ext	12	1357	190	1120	136	134	8	370	4	4	202	195	OK
*Total (including 4 additional bars in external corners)										32			

8) Design summary

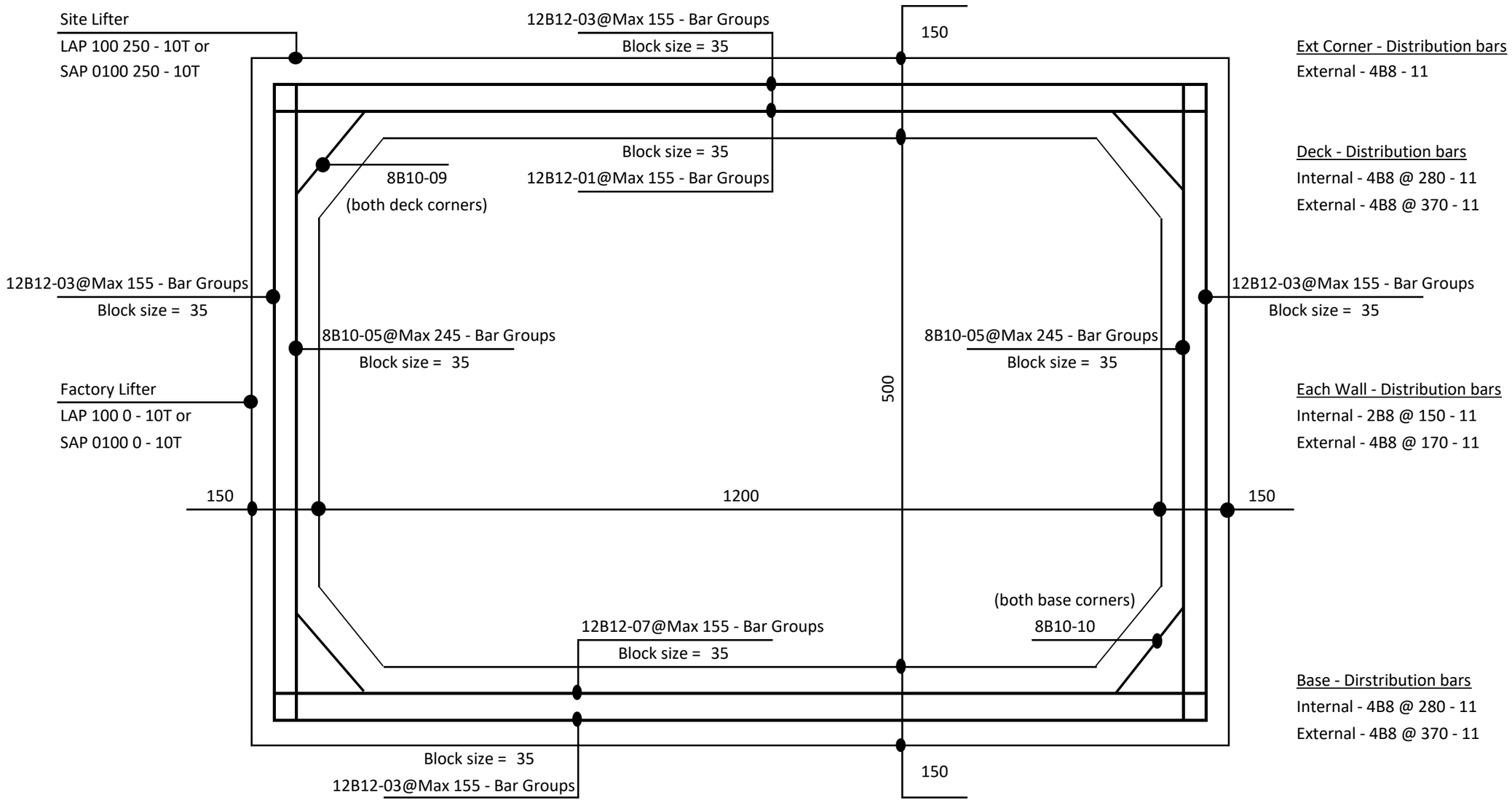
	Moment	Shear	Links?
External	ok	ok	No
Internal Deck	ok	ok	No
Internal Walls	ok	ok	No
Internal Base	ok	ok	No
Service	ok		
Fatigue	ok		
Distribution	ok		

DESIGN OK

*MSA = More Steel Added to satisfy design

FP McCann	By: JC		TP	BC to EC2
	Date: 19/12/2022	Date:	20/12/2022	Sheet: **SK01** **SK01**
Middlewich Road, Byley Middlewich, Cheshire CW10 9RJ	Contract Name: HERNE BAY Contract Number: BC22-126 Client: CILVILS STORE Reference: BC22-126-01			Rev: **0**

RC SKETCH *17.2*



Loading							
LM1, LM2 & LM3 - SV80 / SV100 / SV196	Unit Length =	2 m	Unit Weight =	3.35 T	Min Fill Depth =	800 mm
	Concrete cross sectional area =	0.65 m2	RC Weight =	126.2 kg	Max Fill Depth =	1200 mm
	Internal area =	0.56 m2	RC Density =	97.9 kg/m3		

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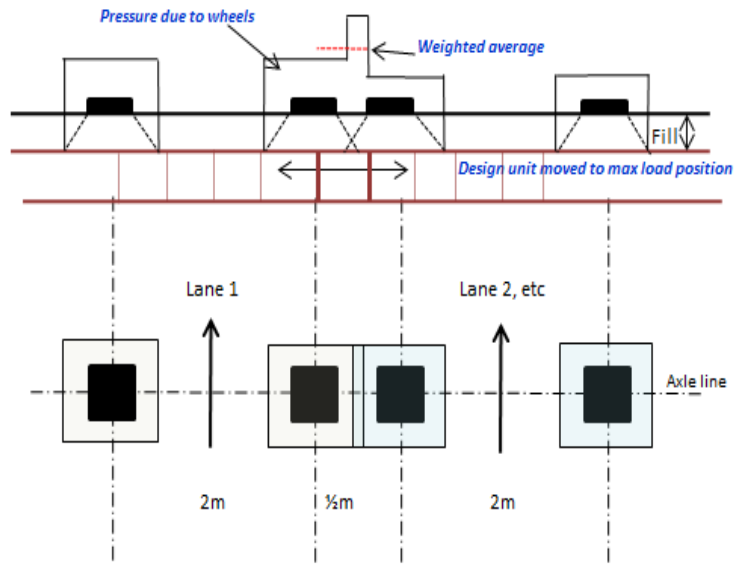
Middlewich, Cheshire	Contract Number:	BC22-126	
CW10 9RJ	Client:	CILVILS STORE	
	Reference:	BC22-126-01	Rev: 0

APPENDIX 1 - LM1 LOAD DISTRIBUTION

Culvert Length =	2.000	m
Wheel patch side =	400	mm

	Thickness	Spread	
Surfacing depth =	100	100	mm (@ 45°)
Min Fill depth =	700	404	mm (@ 30°)
Max Fill Depth =	1100	635	mm (@ 30°)
Deck depth to centre =	75	75	mm (@ 45°)

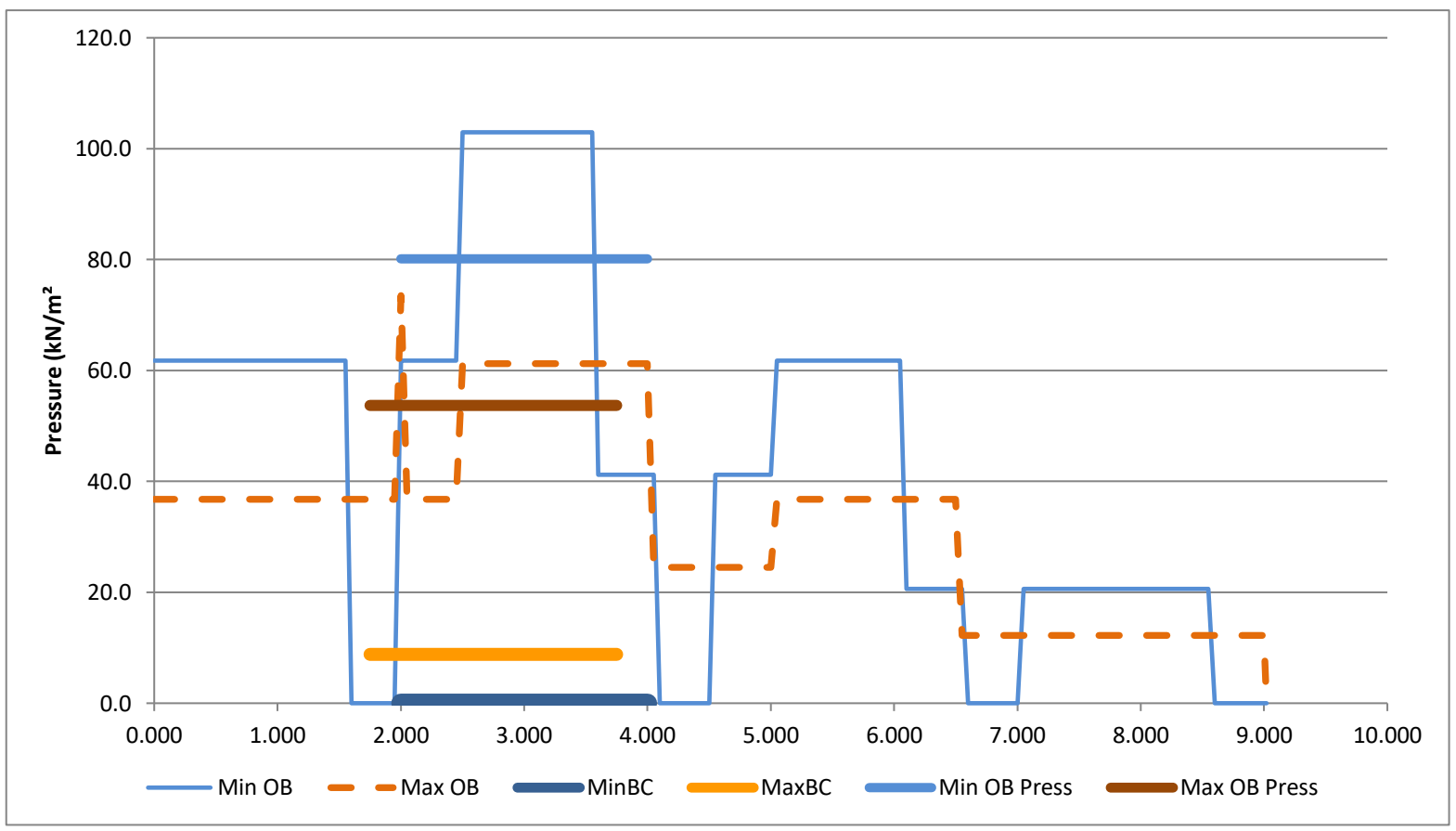


	Min OB	Max OB	
Spread at one side of wheel =	579	810	mm
Depth to NA =	875	1275	mm
Total spread to N/A =	1558	2020	mm
OA len =	8558	9020	mm
OA Width =	2758	3220	mm
Centre (axle) overlap =	358	820	mm
Patch Pressure from 300kN Axle:	61.8	36.8	kN/m²
Patch Pressure from 200kN Axle:	41.2	24.5	kN/m²
Patch Pressure from 100kN Axle:	20.6	12.3	kN/m²
Culvert Start's @ x from LHS =	2.000	1.750	m (found by optimizing the max load on the culvert)
Edge Pressure =	80.1	53.7	kN/m² (weighted transverse averages)
Max Pressure =	160.3	107.4	kN/m² (considers overlapping from different axles @ 1.2m)

Position **x** from LHS = 2.000 m, gives the following pressure:

	Min Overburden			
Wheel	Start	End	Patch Press	Press at x
1	0.000	1.558	62	0
2	2.000	3.558	62	62
3	2.500	4.058	41	0
4	4.500	6.058	41	0
5	5.000	6.558	21	0
6	7.000	8.558	21	0
				62

	Max Overburden			
Wheel	Start	End	Patch Press	Press at x
1	0.000	2.020	37	37
2	2.000	4.020	37	37
3	2.500	4.520	25	0
4	4.500	6.520	25	0
5	5.000	7.020	12	0
6	7.000	9.020	12	0
				74



FP McCann	By: *JC*	Check'd: *TP*	
	Date: *19/12/22*	Date: *20/12/22*	Sheet: **A1/1 of 1**

Middlewich Road, Byley
Middlewich, Cheshire
CW10 9RJ

Contract Name: HERNE BAY
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APPENDIX 2 - LOAD MODEL 3 DISTRIBUTION

LM3 vehicle type =	SV196	
Culvert Length =	2.000	m
Wheel patch side =	350	mm

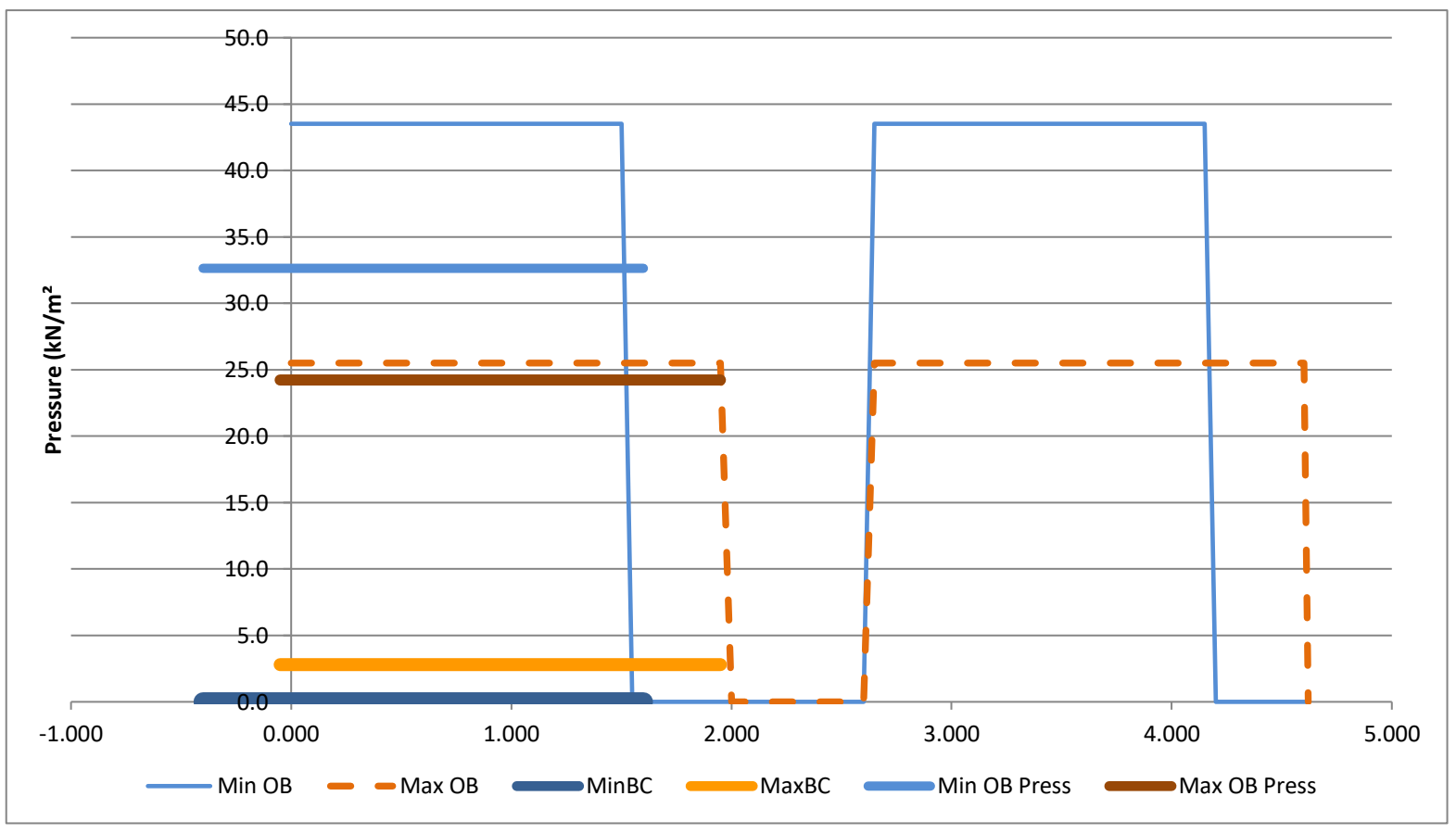
	Thickness	Spread	
Surfacing depth =	100	100	mm (@ 45°)
Min Fill depth =	700	404	mm (@ 30°)
Max Fill Depth =	1100	635	mm (@ 30°)
Deck depth to centre =	75	75	mm (@ 45°)

	Min OB	Max OB		
Spread at one side of wheel =	579	810	mm	
Depth to NA =	875	1275	mm	
Total spread to N/A =	1508	1970	mm	
OA len =	4158	4620	mm	
Patch Pressure from front axle:	43.5	25.5	kN/m²	
Culvert Start's @ x from LHS =	-0.400	-0.050	m	(found by optimizing the max load on the culvert)
Edge Pressure =	32.6	24.2	kN/m²	(weighted transverse averages)

Position **x** from LHS = 2.000 m, gives the following pressure:

	Min Overburden			
Wheel	Start	End	Patch Press	Press at x
1	0.000	1.508	44	0
2	2.650	4.158	44	0
3	0.000	0.000	0	0
4	0.000	0.000	0	0
5	0.000	0.000	0	0
6	0.000	0.000	0	0
				0

	Max Overburden			
Wheel	Start	End	Patch Press	Press at x
1	0.000	1.970	26	0
2	2.650	4.620	26	0
3	0.000	0.000	0	0
4	0.000	0.000	0	0
5	0.000	0.000	0	0
6	0.000	0.000	0	0
				0



APPENDIX 3 - METHOD OF ANALYSIS

The structural design of the box culverts has been performed using a finite element analysis to obtain design moments and forces. The use of only a single elastic support along the base generates unrealistic tensile forces between the culvert and the support resulting in higher shear forces and consequentially higher bending moments. This behaviour is not possible as the support is comprised of cohesion-less material. These negative effects are amplified in box culverts with greater height than width.

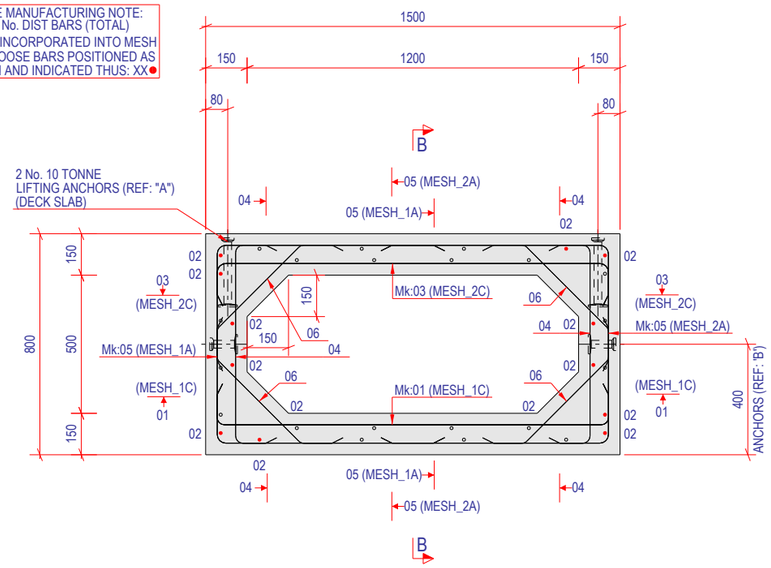
To prevent this, varying boundary conditions have been adopted for each respective loadcase depending on the orientation of the applied loading replicating insitu support conditions.

An elastic support provides vertical restraint along the base of the box culvert for all loadcases. Additional elastic restraints are introduced to the analysis for loadcases where load is applied horizontally at the walls. The horizontal elastic restraint is only applied to the opposite wall that the load has been applied.

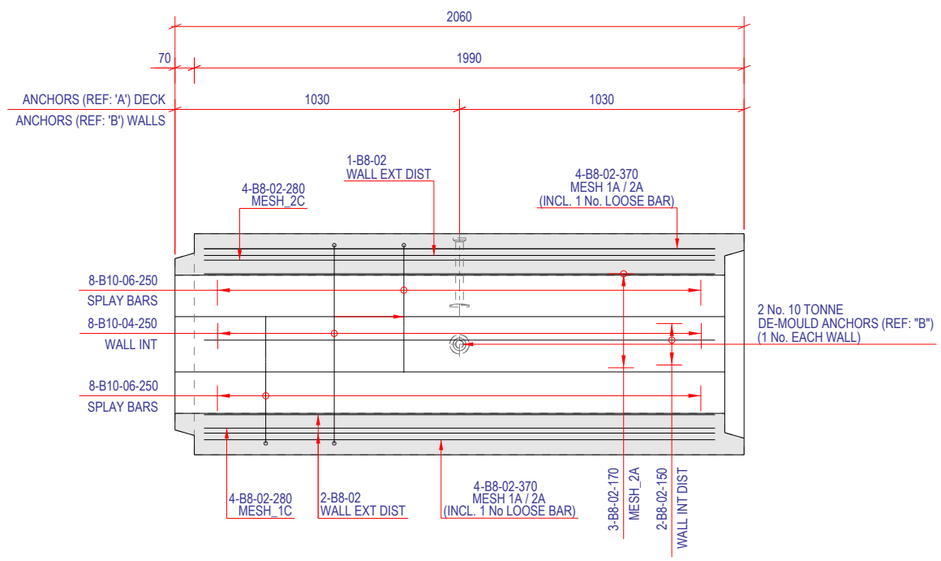
This method of analysis ensures that the overturning effects of horizontal loads are sufficiently restrained while still providing accurate and realistic support conditions. When considering the effects of braking and acceleration loads the culvert is fully embedded within layers representative of site conditions. To maintain a conservative approach the stiffness properties of the supports are based upon lower bound values for compacted backfill used in road design and additional safety factors applied.

DO NOT SCALE, IF IN DOUBT PLEASE ASK.

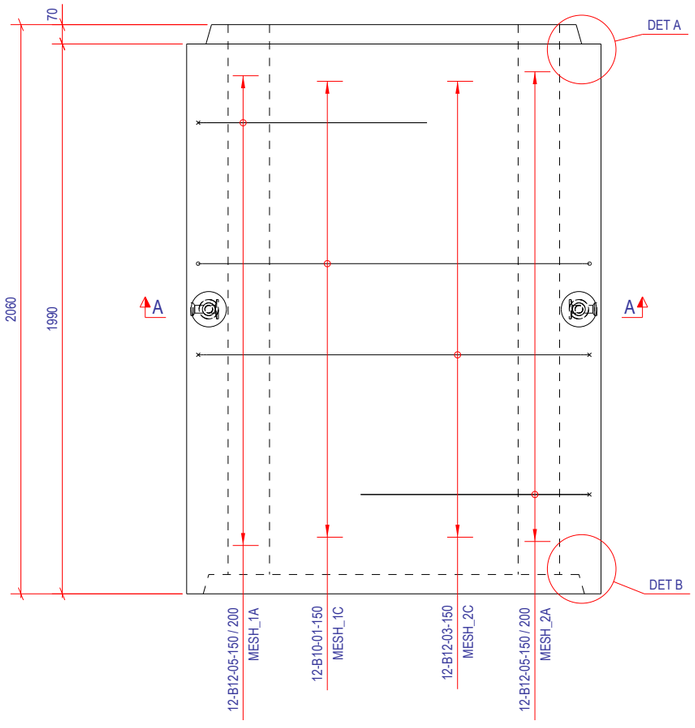
CAGE MANUFACTURING NOTE:
32No. DIST BARS (TOTAL)
20 No. INCORPORATED INTO MESH
12No. LOOSE BARS POSITIONED AS SHOWN AND INDICATED THUS: XX●



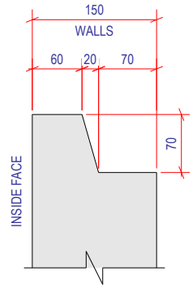
SECTION A-A THRO' CULVERT CROSS SECTION
1:15



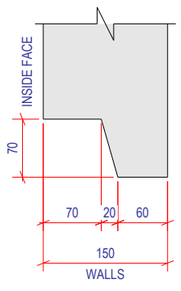
SECTION B-B THRO' CULVERT UNIT LENGTH
1:15



PLAN VIEW ON DECK SLAB - INTERMEDIATE CULVERT UNIT
UNIT REF: BC-0001



DETAIL A (SPIGOT)
1:5



DETAIL B (SOCKET)
1:5

The Construction (Design and Management) Regulations 2015

a) If you are unsure of your responsibilties please refer to the HSE website.
b) The notes below and design details in (5) should be read by all CDM dutyholders. Whilst we do not go into specifics such as working heights, working over excavations, slips and trips etc, where ⚠ is shown in the notes and on the drawing some potential hazard / risks are identified and should be assessed accordingly by the main contractor and his design team prior to any site works commencing.
c) The F.P.McCann GA should be read in conjunction with all other relevant drawings from the contract design team e.g. Engineers, M&E sub-contractors etc.
d) **Installation** - The Culvert units should be lifted using only the lifting equipment noted in (1) and all elements must be lifted in accordance with the main contractor's lifting plan / method statement. It is the responsibility of the overall scheme designer to ensure that the Culvert base provides a uniform support under the full width and length of the Box Culverts. For further information, refer to the FP McCann Box Culvert installation guide.
e) **Voids & Openings** - Additional small voids may be formed subject to a design check by F.P. McCann. Non-percussion equipment should be used and particular care should be taken when forming holes post installation using a diamond core drill. Silica dust can be generated during all cutting activities of precast concrete units. Controls and protection against the inhalation of silica dust can be found in the HSE publications.
f) **Temporary Works** - F.P. McCann will not be responsible for the design, supply, erection, maintenance and dismantling of any temporary works. This is to be carried out by / in accordance with the main contractor's temporary works engineer.

1. Handling ⚠
a) Unit Volume / Weight:(based on a concrete density of 2.6T/m³)

Unit Reference	Total Unit Vol (m³)	Total Unit Weight (T)
BC-0001	1.28	3.34

+5% is recommended for sizing lifting equipment.
b) All lifting points shall be used as specified below:

	Site Handling System (Ref "A")	Qty	Lifter Reference	SWL
Lifting	Pin Anchor System	2	LAP100250	10T

	Factory System (Ref "B")	Qty	Lifter Reference	SWL
De-Mould	Pin Anchor System	2	LAP100100	10T

De-Mould Anchor recesses to be filled in by F.P. McCann prior to delivery.
c) Min. Lifting Chain length=1350.0mm
d) The site lifting / installation equipment may be purchased from Euro Accessories (Tel: 0845 052 4050).
Culvert Site Lifting: Anchor Pin Ring Clutch Ref:- LAPRC100
e) In the design of the lifting anchors, we have adopted a Dynamic Factor = 1.3 (Stationary Crane/Mobile Crane, (Hoisting speed>90m/min).

2. Concrete
a) Mix Ref: BYL 01
b) Lifting strength based on 2 cubes = 15N/sq mm.
c) Characteristic 28 day cube strength = 55 N/sq mm.
d) Conc. provides Design Chemical Class 4 (DC4) to Special Digest 1, Table F2.

3. Reinforcement
a) Reinforcement (500B or C) to BS4449.
b) Scheduling, dimensioning, bending and cutting to BS8666.
c) Cage to be tack welded and/or tied with 17 gauge annealed tying wire.
d) Bar centres adjusted locally to suit lifting anchors and to avoid excessive congestion.

4. Manufacture
a) Manufactured to Specification For Highways Works Series 1700.
b) Tolerances to Specification For Highways Works Series 1700.
c) Finishes:
- Top of exposed joint face: steel float finish, U3
- Joint face: struck from wooden mould, F1
- All faces: struck from steel mould, F2

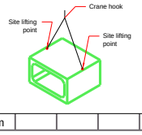
d) Marking: Units shall be indelibly marked to show:
- Manufacturer name and logo
- Unit reference and date of manufacture
- Unit weight + 5%

5. Design ⚠
a) Concrete design to Eurocodes & UK National Annexes.
b) Loading to BS EN 1991-2 Traffic Loads on Bridges.
PD6694-1:2011 Traffic Loading to BS EN 1991-2.
Live Load = LM1, LM2 & LM3-SV80 / SV100 / SV196
c) Depth of Cover (Roof to Surface Level): 800.0mm min / 1200.0mm max.
d) F.P. McCann have designed the concrete units only, the stabilty of the support conditions should be checked by the overall scheme designer.
e) Intended working life: At least 100 Years to BS8500 (120 Years to Specification for Highway Works Series 1700)
f) Cover to all surfaces:

	Block	Min Cover	Deviational Positioning
Internal	35mm	30mm	10mm
External	35mm	30mm	10mm

Internal	XC3/4	XD1	XF4
External	XC3/4	XD1	XF4

P01	20/12/22	APPROVAL ISSUE		TP



Lifting and Handling Instructions
Unit to be rotated from manufacturing orientation after production by factory lifting points and spinners hung from spreader beam.
Site to handle via clutches connected to Spherical-Head lifting anchors cast into roof.
Minimum chain angle from the horizontal is 60 degrees.
For minimum chain length refer to Note 1c.
Units should be stacked singly, on wooden bearers for protection.
For further information regarding handling and installing box culvert sections, refer to the Box Culvert Association's Guide to site practice, available from www.boxculverts.org.uk or from F.P. McCann.

Manufacturing Tolerances
permissible dimensional variations from mean dimension shall be as follows:

Length:
up to 3m: +/-6mm
3m to 4.5m: +/-9mm
4.5m to 6m: +/-12mm

Cross section: (each direction)
up to 500mm: +/-6mm
500 to 700mm +/-9mm
Additional for every subsequent 250mm: +/-3mm

Straightness or bow: (deviation from intended line)
up to 3m: +/-6mm
3 to 6m: +/-9mm
6 to 12m: +/-12mm
Additional for every subsequent 6m: +/-6mm

As per specification for Highway Works, Series 1700 & BS EN 13369 : 2018.

FP McCann
Bullhurst Lane, Weston Underwood, Derbyshire, DE6 4PH.
Tel: +44 (0)13 3536 1269
Fax: +44 (0)13 3536 1410
www.fpmccann.co.uk

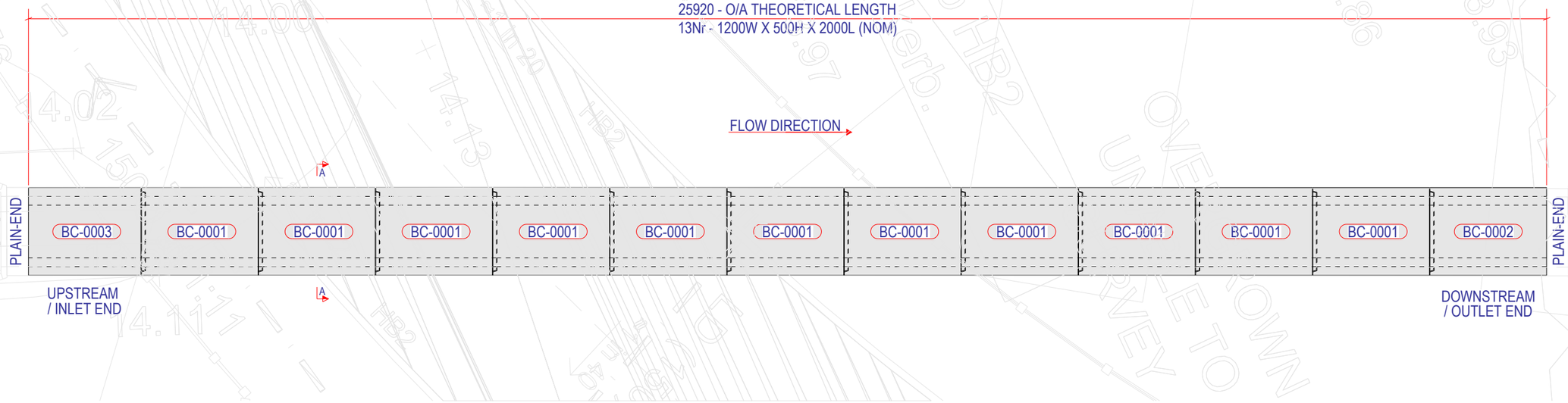
Contract / Title:
HERNE BAY
BULLOCKSTONE ROAD
INTERMEDIATE
UNIT REF: - BC-0001

Drawn: TP	Scale: As Shown	Status: APPROVAL
Date: 20.12.2022	Chk'd:	
Drawing no: BC22-126- BC-0001-GA		Rev: P01

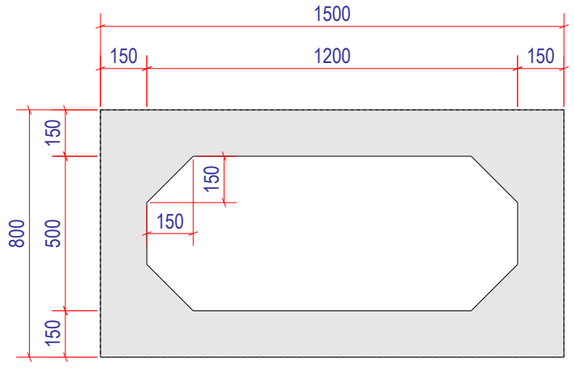
1cm A2

DO NOT SCALE. IF IN DOUBT PLEASE ASK.

PDF UNDERLAY INDICATIVE ONLY



PROPOSED CULVERT UNIT LAYOUT
1:40



SECTION A-A - TYPICAL CROSS SECTION
1:10

Design Notes

1. Units to be laid with a 10mm nominal joint.
2. All insitu work to be done by others.
3. Units detailed assuming sockets (female end) facing upstream.
4. This layout drawing is only to be used for information to indicate proposals for the arrangement of the p.c. units.
5. Units to be laid and backfilled in accordance with the Box Culvert Installation Guide.

Lifting and Handling Instructions

Unit to be rotated from manufacturing orientation after production by factory lifting points and spinners hung from spreader beam.

Site to handle via clutches connected to Spherical-Head lifting anchors cast into roof.

Minimum chain angle from the horizontal is 60 degrees.

For minimum chain length refer to Note 1c.

Units should be stacked singly, on wooden bearers for protection.

For further information regarding handling and installing box culvert sections, refer to the Box Culvert Association's Guide to site practice, available from www.boxculverts.org.uk.

Manufacture Tolerances

Permissible dimensional variations from mean dimension shall be as follows:

Length	Variation
Up to 3m	+/- 6mm
3 to 4.5m	+/- 9mm
4.5 to 6m	+/- 12mm

Cross section	Variation
Up to 500mm	+/- 6mm
500 to 700mm	+/- 9mm
Additional for every subsequent 250mm	+/- 3mm

Straightness or bow (deviation from intended line)	Variation
Up to 3m	+/- 6mm
3 to 4.5m	+/- 9mm
Additional for every subsequent 6m	+/- 6mm

As per specification for Highway Works, Series 1700.

Rev	Date	Revision Detail	By	Chk	App
P01	20-12-22	APPROVAL ISSUE	TP		

Status: For Approval

Suitability: S4

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Knockloughrim,
Magherafelt,
BT45 8QA
Tel: +44 (0)28 7964 2558
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Project.
HERNE BAY
BULLOCKSTONE ROAD

Title.
GENERAL ARRANGEMENT OF
RPOPOSED CULVERT
UNIT LAYOUT

Drawn:	Checked:	Approved:
TP		
Internal Ref: BC22-126	Date: 20-12-22	Scale: NTS
Drawing No : BC22-126-SK01		Rev: P01

A1
1cm

Fibre-reinforced Geosynthetic Clay Liner (GBR-C)

Bentofix® NSP 5300

NAUE GmbH & Co. KG
Gewerbestrasse 2
32339 Espelkamp-Fiestel
Germany
Phone:+49 5743 41-0 Fax: :+49 5743 41-240
E-Mail: info@naue.com Internet: www.naue.com

0799-CPR-20

Bentofix® NSP 5300 is a shear strength transmitting geosynthetic clay barrier (GBR-C), continuously needle-punched through all components. A GBR-C is also known as geosynthetic clay liner (GCL) or bentonite mat. Additional bentonite powder is impregnated into a 500 mm overlapping area on both longitudinal sides of the cover layer. The 300 mm length longitudinal overlapping areas are marked on the carrier layer.

Property	Test method*	Unit	
Geotextile layers:			
Cover layer (polypropylene nonwoven):			
Mass per unit area	EN ISO 9864	g/m²	220
Carrier layer (polypropylene woven):			
Mass per unit area	EN ISO 9864	g/m²	110
Bentonite layer (sodium bentonite powder):			
Mass per unit area	EN 14196 (ρ_{CLAY})	g/m²	5,000
Swell index	ASTM D5890	ml/2g	24
Fluid Loss	ASTM D5891	ml	≤ 18
Water content	DIN 18121 / ISO 11465 (5hrs, 105 °C)	%	approx. 10
Geosynthetic Clay Liner:			
Mass per unit area	EN 14196 (ρ_{GBR-C})	g/m²	5,330
Thickness	EN ISO 9863-1	mm	7.0
Max. tensile strength, md/cmd**	EN ISO 10319 / ASTM D6768	kN/m	12.0 / 12.0
Elongation at break, md/cmd**	EN ISO 10319 / ASTM D6768	%	10.0 / 6.0
Peel strength	ASTM D6496	N/10 cm***	≥ 60
		N/m	≥ 360
Static puncture strength	EN ISO 12236 / ASTM D6241	N	2,000
Permeability / Hydraulic Conductivity (k_{10})	EN 16416 / ASTM D5887	m/s	2×10^{-11}
Index Flux (q_{10})	EN 16416 / ASTM D5887	$(m^3/m^2)/s$	3.5×10^{-9}
Roll dimensions:			
width x length, / diameter	-	m x m / m	5.00 x 40 / Ø 0.65

** = based on; **md = machine direction, cmd = cross machine direction; ***max. peak*

The listed technical values are guiding values, achieved in our laboratories and/or independent testing institutes. Our products are subject to changes without prior notice.

Aggregate Properties Summary Data Sheet - Schedule of Testing

BPL Site	Material Description	Date of Issue
Ridham **Ridham Dock Industrial Complex** **Iwade** **Sittingbourne** **Kent** **ME9 8SR**	**Class 1A SHW 600 Series** **Class 6C SHW 600 Series** **EN 13242 0/10mm & 0/20mm** **EN 13260 0/10mm & 0/20mm**	**December 2022**

Blue Phoenix UK
Building a sustainable future

		Coarse		Fine	
Test Description	**Specification Reference**	**Result**	**Date**	**Result**	**Date**
Plastic Limit (%)	BS 1377 : Part 2 : 1990			Non-Plastic	07/07/2022
OMC (%)	BS EN 13286-4 : 2003			12	06/01/2022
Particle density (Mg/m^3) Apparent	EN 1097-6 : 2000			2.76	28/07/2021
Particle density (Mg/m^3) SSD	EN 1097-6 : 2000			2.56	28/07/2021
Particle density (Mg/m^3) Oven Dry	EN 1097-6 : 2000			2.45	28/07/2021
Water Absorption (%)	EN 1097-6 : 2000			4.6	28/07/2021
Determination of resistance to wear: Micro-Deval (MD)	EN 1097-1 : 2011				
Total Sulphur (%, As S)	EN 1744-1 : 2009 +A1 :2012, Clause 11.2			0.3	06/10/2022
Water Soluble Sulfate (mg/l, As SO4)	EN 1744-1 : 2009 + 1A : 2012, Clause 10.1			660	06/10/2022
Frost Heave (mm)	BS812 : Part 124 : 2009				
Los Angeles Coefficent (LA)	EN 1097-2 : 2010			35	28/07/2022
Magnesium Sulfate Soundness Value	EN 1367-2 : 2009			9	07/07/2022
Asbestos	HSE Guidance Note HSG 248.	Not detected	28/07/2021		
Dioxin analysis - IBAA specific					19/07/2021
Aluminium Content	SHW 800 CL 801.16			0%	07/02/2022
Bulk Density Loose (Mg/m^3)	EN 1097-3 : 1998			1.22	14/01/2022
Bulk Density Compacted (Mg/m^3)	EN 1097-3 : 1998			1.45	14/01/2022

Geogrid/nonwoven composite

NAUE GmbH & Co. KG
Gewerbestrasse 2
32339 Espelkamp-Fiestel
Germany
Phone:+49 5743 41-0 Fax: :+49 5743 41-240
E-Mail: info@naue.com Internet: www.naue.com

0799-CPR-20

Combigrid® 40/40 Q1 GRK 4 C

(former name: Combigrid® 40/40 Q1 151 GRK 3)

Product description:
Composite of a laid geogrid made of stretched, monolithic polypropylene (PP) flat bars with welded junctions and a mechanical bonded and calendered filter geotextile welded within the geogrid structure, used for the reinforcement in many fields of civil engineering including road construction, landfill and hydraulic engineering

Property	Test method*	Unit	
Geogrid			
Raw material	-	-	polypropylene (PP), white
Mass per unit area	EN ISO 9864	g/m²	240
Max. tensile strength, md / cmd**	EN ISO 10319	kN/m	≥ 40 / ≥ 40
Elongation at nominal strength, md / cmd**	EN ISO 10319	%	≤ 7 / ≤ 7
Tensile strength at 1% elongation, md / cmd**	EN ISO 10319	kN/m	8 / 8
Tensile strength at 2% elongation, md / cmd**	EN ISO 10319	kN/m	16 / 16
Tensile strength at 5% elongation, md / cmd**	EN ISO 10319	kN/m	32 / 32
Aperture size, md x cmd**	-	mm x mm	approx. 31 x 31
Production specific elongation	-	%	0
Geotextile			
Raw material	-	-	polypropylene (PP), white
Mass per unit area	EN ISO 9864	g/m²	≥ 150
Max. tensile strength, md / cmd**	EN ISO 10319	kN/m	7.5 / 11.0
Elongation at max. tensile strength, md / cmd**	EN ISO 10319	%	40 / 30
Puncture force	EN ISO 12236	N	≥ 1500
Characterstic opening size	EN ISO 12956	µm	90
Water permeability - VI_{H50}-Index - Flow $rate_{H50}$	EN ISO 11058	m/s l/(m² s)	$9{,}0 \times 10^{-2}$ 90
Detector tested	-	-	yes
Roll dimensions, width x length	-	m x m	4.75 x 100

**based on, **md = machine direction, cmd = cross machine direction*

The listed technical values are guiding values, achieved in our laboratories and/or independent testing institutes. Our products are subject to changes without prior notice.

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West Midlands, WV5 8AP
t 01902 356220
f 01902 356221

sales@cpm-group.com
www.cpm-group.com

Precast Concrete Manhole and Inspection Chambers – Data Sheet

Purpose of use: For the permitting of access to, and to allow aeration of, drain or sewer systems for the conveyance of sewerage, rainwater and surface water under gravity or occasional low head of pressure, in pipelines that are generally buried.

Manufactured to: BS EN 1917 and BS 5911-3 & 4.

Certification of products: 'CE Marked' and 'Kitemarked' products as applicable.

Product strength class: Chamber sections - Class 15 to 30 dependent upon nominal size.
Cover/reducing slab – 2 or 3 x 112.5 kN loads as per BS5911-3
Landing slab – 1 x 35 kN load as per BS5911-3
Corbel slab – 1 x 112.5 kN load as per BS5911-3

Jointing materials: Bitumen, butyl or rubber based products (rubber seals conforming to EN 681-1).

Water/cement ratio of concrete: Not greater than 0.45.

Chloride content of concrete: Not exceeding 1.0% (unreinforced products), or 0.4% (reinforced).

Water absorption of concrete: Not exceeding 6% by mass.

Finish: Functional surfaces of joint profiles shall be free from irregularities that would preclude a durable watertight assembly. Other areas of the products are checked for surface evenness and surface voids.

Durabilty of product: Concrete mix to DC-4 of BRE Special Digest 1:2005.

Concrete strength: Not less than 40 Mpa (N/mm^2).

Water-tightness: Products with wall thickness of 125mm or less routinely tested to a hydrostatic test pressure of 50 kPA for manholes, 30 kPA for inspections chambers and 15 kPA for HIC units (not applicable to soakway units).

Tolerances: Internal bore/length: range of +/-(3+0.005DN)mm.
Internal effective height : +/-4% of nominal height.

Minimum concrete cover to reinforcement: 25mm nom slab and ring (slab 20mm min, other products 15mm min).

Products with installed lifting anchorage: Routine pull-out test.

Products with installed steps: Steps conforming to BS EN 13101 and routinely tested for pull-out and deflection under load.

CPM Group Ltd

Registered Office: CPM Group Ltd, Head Office, Mells Road, Mells, Frome, Somerset BA11 3PD Registered in England 1005164

Laboratory:
Unit 4
Rose Lane Industrial Estate
Lenham Heath
Kent ME17 2JN
01622 851176

UKAS TESTING
4727

XtraTec
CONSTRUCTION MATERIAL TESTING
A PHENNA GROUP COMPANY

TEST REPORT

Report No: **XTE 68564**
Page 1 of 1

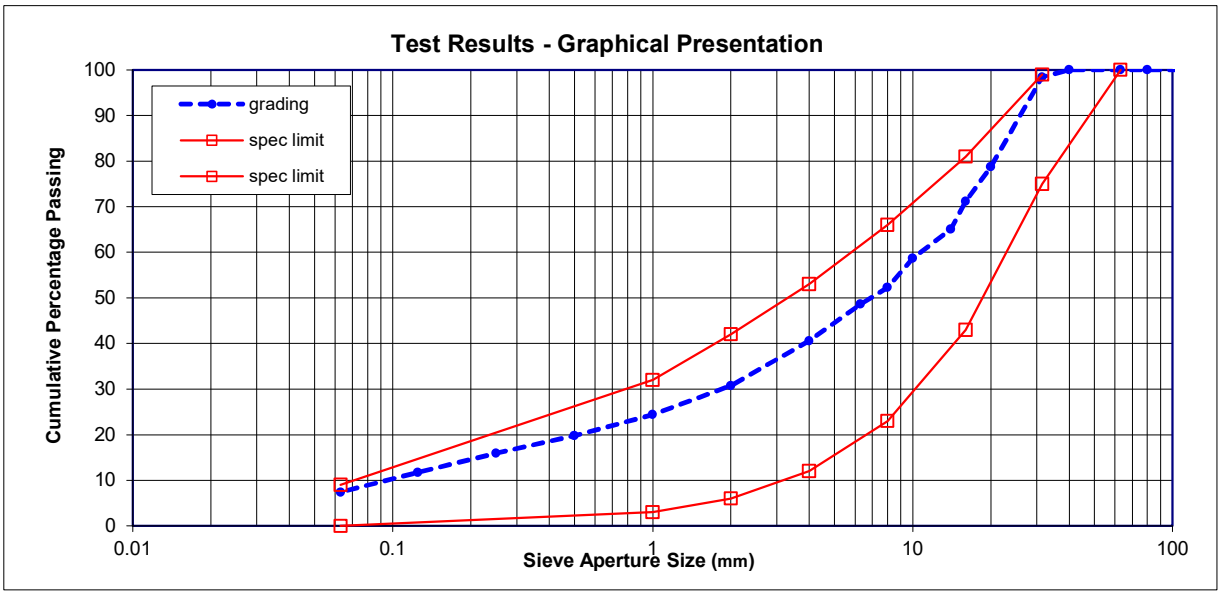
TEST REPORT OF PARTICLE SIZE DISTRIBUTION & WATER CONTENT OF AGGREGATES

Method: Particle Size Distribution: BS EN 933-1:2012. (washing & sieving)
Method: Water Content: BS EN 1097-5:2008

XTRATEC SAMPLE REF	XTE 68564
CUSTOMER/SITE SAMPLE REF	GM3
CLIENT	DC Aggregates Ltd
SITE	Dover Docks
TYPE OF MATERIAL	Type 1
AGGREGATE TYPE	Granite
NOMINAL SIZE	N/A
SPECIFICATION	SHW Series 800 Table 8/5
SUPPLIER/SOURCE	Halsvik Quarry, Norway
SAMPLING LOCATION	Stockpile
SAMPLING METHOD	DIHM 2.1
SAMPLED BY	Xtratec
DATE SAMPLED	06 April 2023
DATE RECEIVED	06 April 2023
DATE TESTED	11 April 2023

TEST RESULTS			
Sieve Size	Percent.	Specified	
		lower	upper
125	100		
80	100		
63	100	100	
40	100		
31.5	98	75	99
20	79		
16	71	43	81
14	65		
10	59		
8	52	23	66
6.3	49		
4	41	12	53
2	31	6	42
1	24	3	32
0.5	20		
0.25	16		
0.125	12		
0.063	7	0	9

Water Content (%)	4.2

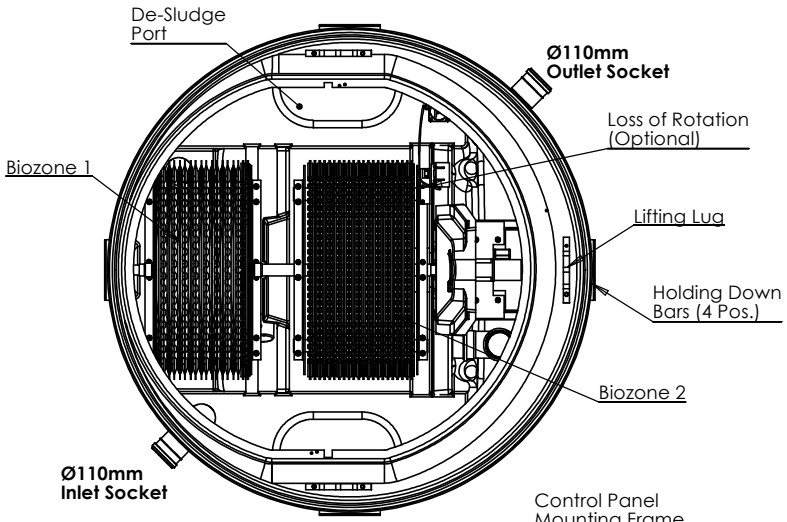


REMARKS: A certificate of sampling is available

ISSUE TO: DC Aggregates Ltd
64, The Avenue
Southampton
SO17 1XS

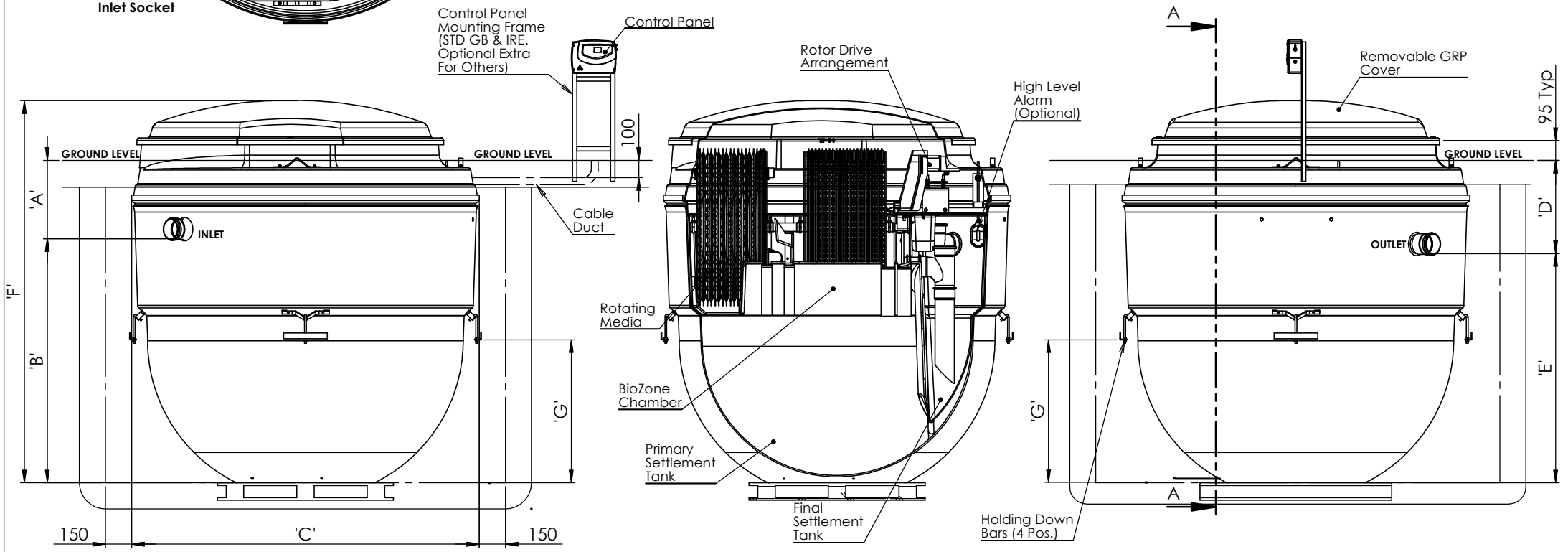
DATE: 17 April 2023

AUTHORISED BY: A Schofield Quality Manager



Notes:

1. This drawing is for 'Dimensional Information Only'. It is essential that this drawing is read in conjunction with the 'Installation Guidelines' supplied with the unit. (Copies available from our sales department).
2. BioDisc Tank & Cover are manufactured glass reinforced polyester (GRP). Cover is finished in Green to BS4800 Tint 18.B.25
3. For desludging procedure see Maintenance Handbook.
4. Electrical Supply - 240Volts, 2 Amps, Single Phase, Control Panel Supplied.
5. BioDisc must only be lifted by 3 lugs provided.
6. 3 no. Inlet Inverts available - 450mm , 750mm, 1250mm.
7. For Installation, Maintenance & Desludging details refer to 013103 (GL0010P) & 015098 (GL0011P).
8. Cable Duct hole diameter in case to suit conduit to be used.



SECTION A-A

Please check with Kingspan Environmental that this drawing is the latest issue				
Issue	Date	Drawn by	Approved by	Description
05	30/10/15	L.Steward		CC1241 - 1.0m Invert Option Included For Europe/ ROW
04	19.08.15	T.Kelly		CC1259 - Control Panel Mounting Frame Options Updated

Material : Various	Tolerance :
Finish :	Thickness : n/a
Weight : 566.42 Kg Kgs	Surface Area :

Drawing : DS1146P

BA-BB-BAx BioDisc Gravity Sales Drawing

All dimensions in mm

Scale: Not to scale

T:\Luke S\Drawings\CC1241\DS1146P

Kingspan Environmental

BA Gravity BioDisc Dimension & Weight Chart (**All Markets**)

Unit Dimension Chart (Gravity Systems).								
Dim 'A' (mm)	Dim 'B' (mm)	Dim 'C' (mm)	Dim 'D' (mm)	Dim 'E' (mm)	Dim 'F' (mm)	Dim 'G' (mm)	Dry Weight (Incl. Pallet) (Kgs)	Full Weight (Exclud. Pallet) (Kgs)
450	1400	1995	535	1315	2160	820	310	3290
750	1400	1995	835	1315	2460	820	325	3305
1250	1400	1995	1335	1315	2960	820	380	3360

BAx & BB Gravity BioDisc Dimension & Weight Chart (**All Markets Except France**)

Unit Dimension Chart (Gravity Systems).								
Dim 'A' (mm)	Dim 'B' (mm)	Dim 'C' (mm)	Dim 'D' (mm)	Dim 'E' (mm)	Dim 'F' (mm)	Dim 'G' (mm)	Dry Weight (Incl. Pallet) (Kgs)	Full Weight (Exclud. Pallet) (Kgs)
450	1400	1995	535	1315	2160	820	335	3315
750	1400	1995	835	1315	2460	820	350	3330
1250	1400	1995	1335	1315	2960	820	405	3385

BB Gravity BioDisc Dimension & Weight Chart (**France Only**)

Unit Dimension Chart (Gravity Systems).								
Dim 'A' (mm)	Dim 'B' (mm)	Dim 'C' (mm)	Dim 'D' (mm)	Dim 'E' (mm)	Dim 'F' (mm)	Dim 'G' (mm)	Dry Weight (Incl. Pallet) (Kgs)	Full Weight (Exclud. Pallet) (Kgs)
450	1650	1995	535	1565	2410	1070	355	3335
750	1650	1995	835	1565	2710	1070	370	3350
1250	1650	1995	1335	1565	3210	1070	425	3405

Material :	Tolerance :
Finish :	Thickness :
Weight : Kgs	Surface Area :

Drawing : DS1146P

BA-BB-BAx BioDisc Gravity Sales Drawing

All dimensions in mm

Scale: Not to scale

Kingspan Environmental

T:\Luke S\Drawings\CC1241\DS1146P

BA Gravity BioDisc 1.0m Invert Dimension & Weight Chart (**Europe & ROW Only**)

Unit Dimension Chart (Gravity Systems).								
Dim 'A' (mm)	Dim 'B' (mm)	Dim 'C' (mm)	Dim 'D' (mm)	Dim 'E' (mm)	Dim 'F' (mm)	Dim 'G' (mm)	Dry Weight (Incl. Pallet) (Kgs)	Full Weight (Exclud. Pallet) (Kgs)
1000	1400	1995	1085	1315	2730	820	345	3325

BB Gravity BioDisc 1.0m Invert Dimension & Weight Chart (**Europe & ROW Only**)

Unit Dimension Chart (Gravity Systems).								
Dim 'A' (mm)	Dim 'B' (mm)	Dim 'C' (mm)	Dim 'D' (mm)	Dim 'E' (mm)	Dim 'F' (mm)	Dim 'G' (mm)	Dry Weight (Incl. Pallet) (Kgs)	Full Weight (Exclud. Pallet) (Kgs)
1000	1400	1995	1085	1315	2730	820	373	3350

BB Gravity BioDisc 1.0m Invert Dimension & Weight Chart (**France Only**)

Unit Dimension Chart (Gravity Systems).								
Dim 'A' (mm)	Dim 'B' (mm)	Dim 'C' (mm)	Dim 'D' (mm)	Dim 'E' (mm)	Dim 'F' (mm)	Dim 'G' (mm)	Dry Weight (Incl. Pallet) (Kgs)	Full Weight (Exclud. Pallet) (Kgs)
1000	1650	1995	1085	1565	2980	820	373	3350

SALES QUOTE

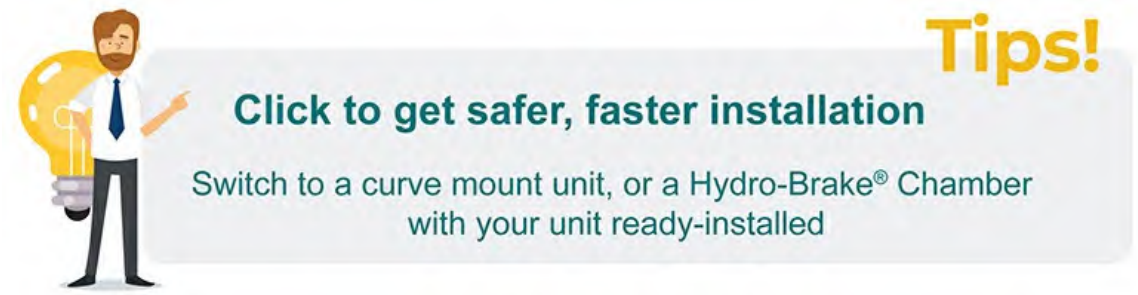
Quote No: HQT-124332
Quote Date: 20/12/2022

Sell To: Lewis Green
Civils Store Ltd
Bonham Drive
Eurolink Commercial Park
SITTINGBOURNE
ME10 3RY

Site Address:
Bullockstone Road
HERNE BAY
CT6 7NR

Account No: CUS-001319
Hydro Ref: 22_21_0583 Herne Bay Crematorium

Item No	Description	Quantity	Unit Price	Amount
	Manhole ref: SW58			
PQT1460.S	S-Type Flow Control 105mm S-Type Vortex Flow Control Design Flow = 5.7l/s; Design Head = 0.6m Material Thickness: 3 mm Mounting Style: Lugs Rope Length: 3m as standard if required	1.00	840.00	840.00
PQT1460.S	S-Type Flow Control 66mm S-Type Vortex Flow Control Design Flow = 2.8l/s; Design Head = 0.9m Material Thickness: 3 mm Mounting Style: Lugs Rope Length: 3m as standard if required	1.00	766.14	766.14
			TOTAL GBP Excl. VAT	**1,606.14**



Product design, fabrication, standard installation details and delivery to UK mainland site or port included.
Delivery via specialist vehicle (Hiab, FORS, Crossrail etc.) not included, rates available on request.
Off-loading (unless specified) and equipment installation at site excluded.
Prices valid for 30 days from issue, standard payment terms 100% due with order unless alternative credit terms have been agreed in writing.
Flow control lead time 2 to 3 working weeks (unless stated otherwise) from receipt of approved drawings and checklists.
Lead time for all other products is longer and should be confirmed before ordering.
Product warranty - one year from date of purchase, only considered for those defects or faults reported in writing.

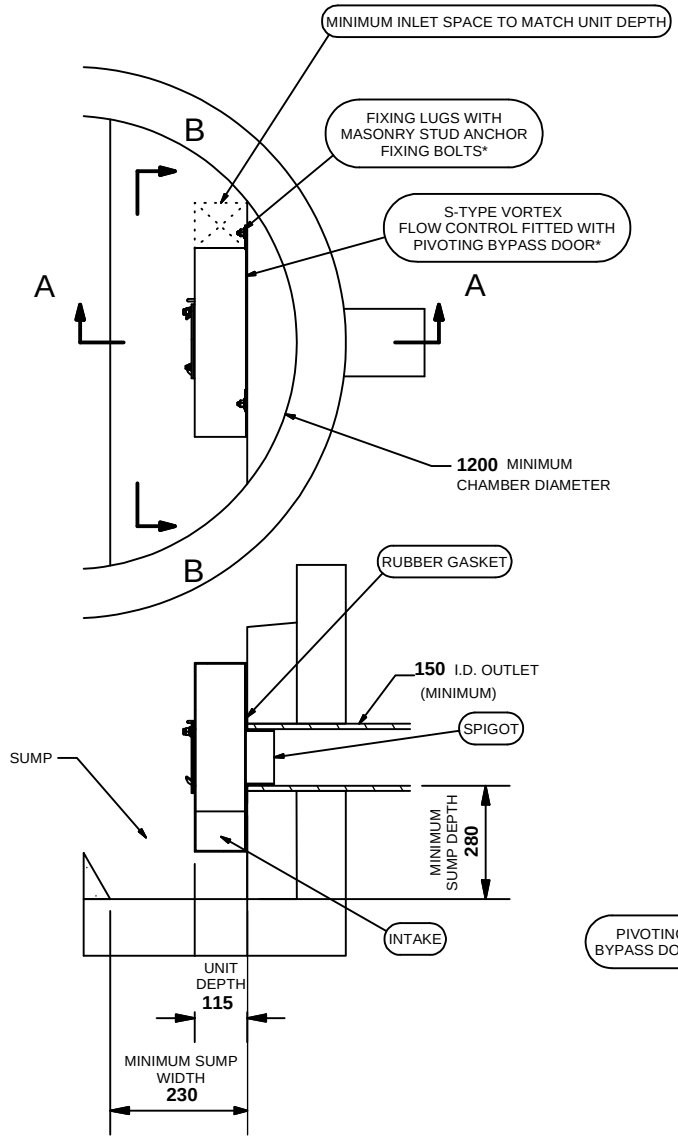
Hydro International (UK) Ltd, Shearwater House, Clevedon Hall Estate
Victoria Road, Clevedon, BS21 7RD
Tel: +44 (0)1275 878371 Fax: +44 (0)1275 874979 Web: www.hydro-int.com

Technical Specification

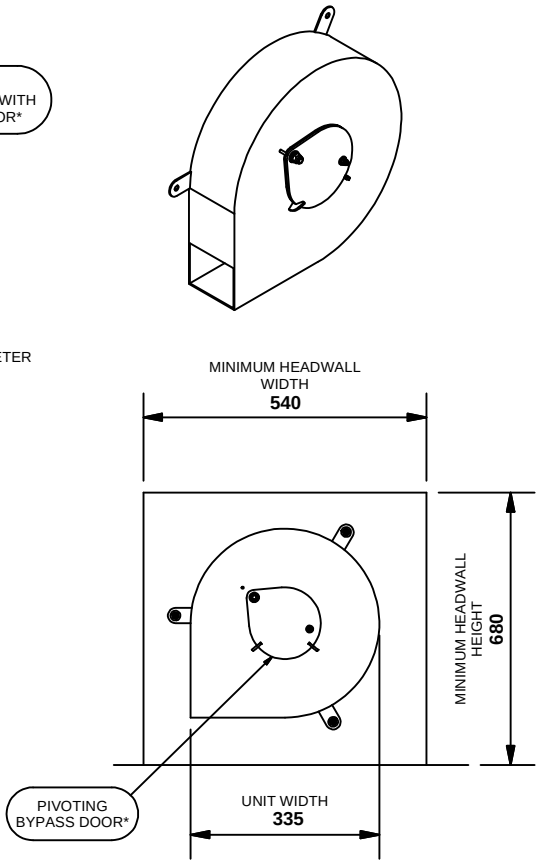
Control Point	Head (m)	Flow (l/s)
Primary Design	0.600	5.700

S-Type Vortex Flow Control including:

- **3 mm** grade 304L stainless steel
- Integral stainless steel pivoting bypass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Bead blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Identification plate on operating handle



SECTION A-A



SECTION B-B

* All measurements are in millimetres unless otherwise specified

IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS * WHERE SUPPLIED

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE

The head/flow characteristics of this S-Type Vortex Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

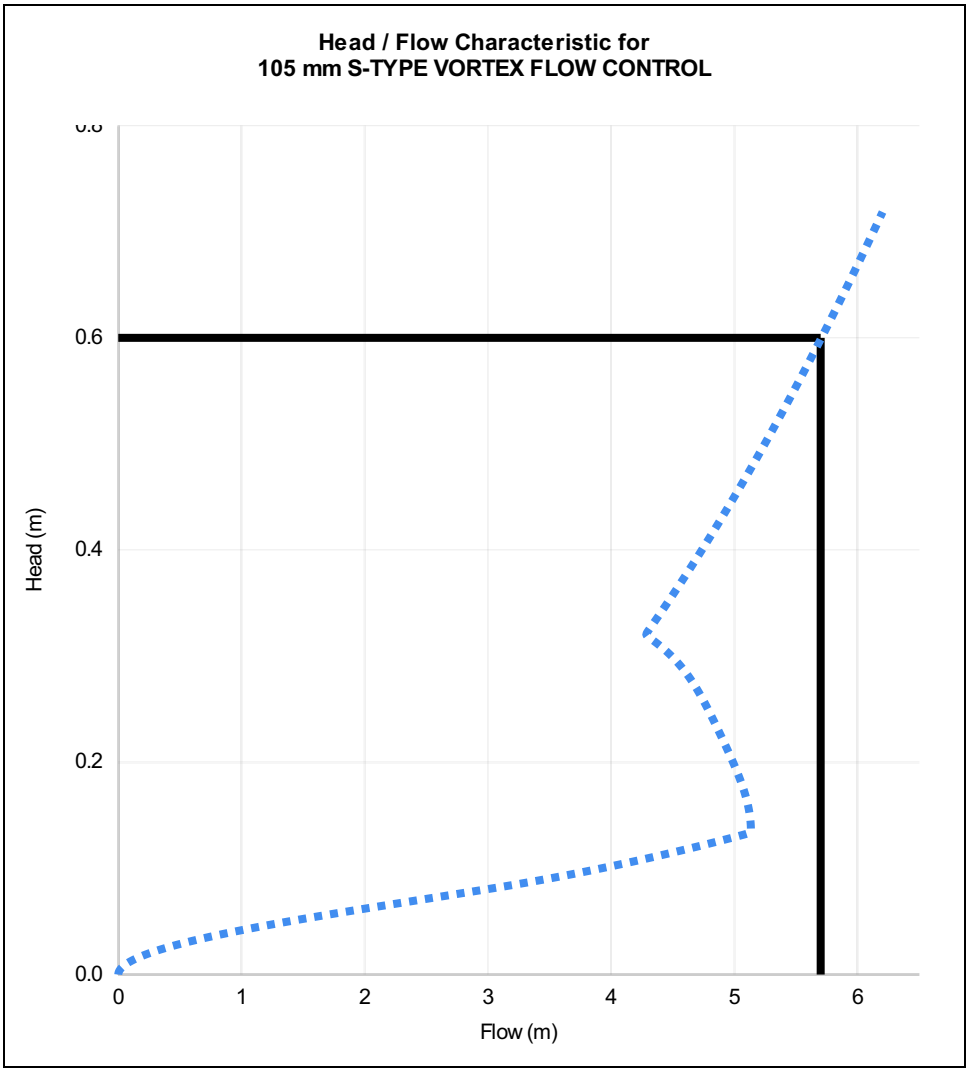
DATE	20/12/2022 11:12
SITE	22_21_0583 Herne Bay Crematorium
DESIGNER	
REF	HQT-124332 SW58

105 mm
S-Type Vortex Flow Control®

105 mm S-TYPE VORTEX FLOW CONTROL
SPECIFICATION SHEET

Project Information			
Date:	20/12/2022 11:12	**Site Ref:**	HQT-124332 SW58
Site Name:	22_21_0583 Herne Bay Crematorium		

Primary Design Point			
Flow (l/s)	5.70	**Head (m)**	0.60



Head (m)	Flow (m)
0.000	0.000
0.021	0.266
0.041	0.982
0.062	1.999
0.083	3.118
0.103	4.058
0.124	4.821
0.145	5.130
0.166	5.097
0.186	5.038
0.207	4.963
0.228	4.880
0.248	4.793
0.269	4.696
0.290	4.571
0.310	4.391
0.331	4.343
0.352	4.465
0.372	4.583
0.393	4.698
0.414	4.809
0.434	4.918
0.455	5.024
0.476	5.128
0.497	5.229
0.517	5.329
0.538	5.426
0.559	5.521
0.579	5.614
0.600	5.706

Shearwater House · Clevedon Hall Estate · Victoria Road · Clevedon · BS21 7RD

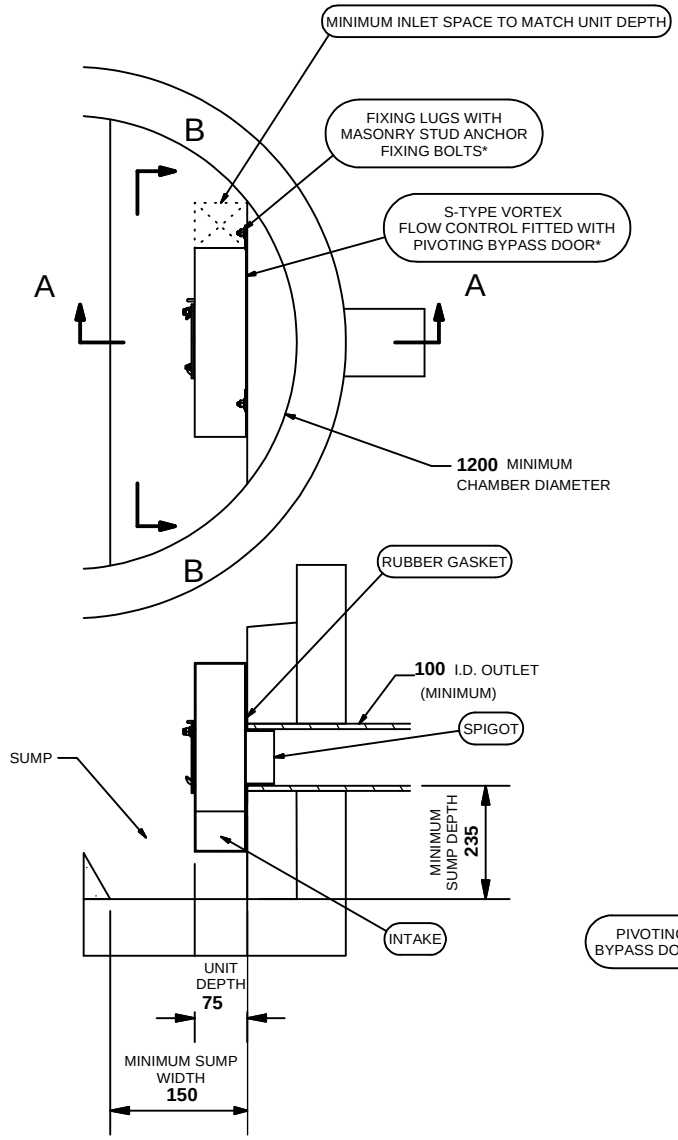
Tel: 01275 878371 · Fax: 01275 874979 · www.hydro-int.com

Technical Specification

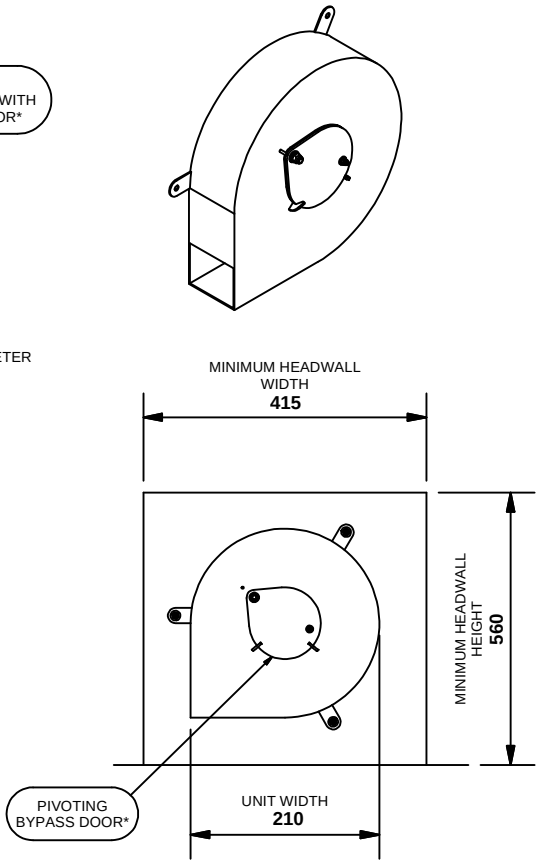
Control Point	Head (m)	Flow (l/s)
Primary Design	0.900	2.800

S-Type Vortex Flow Control including:

- **3 mm** grade 304L stainless steel
- Integral stainless steel pivoting bypass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Bead blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet
- Identification plate on operating handle



SECTION A-A



SECTION B-B

* All measurements are in millimetres unless otherwise specified

IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
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FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
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DESIGN ADVICE

The head/flow characteristics of this S-Type Vortex Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.
The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

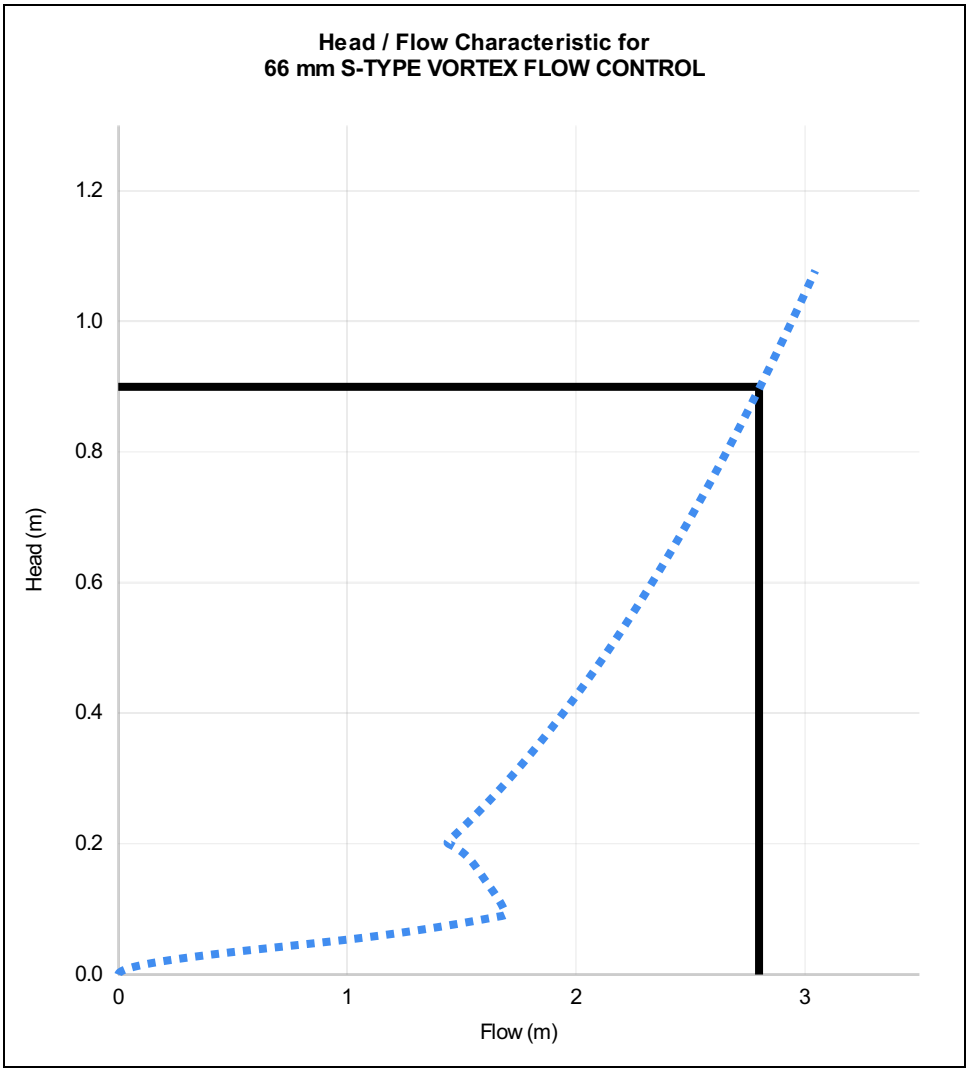
DATE	20/12/2022 11:14
SITE	22_21_0583 Herne Bay Crematorium
DESIGNER	
REF	HQT-124332

66 mm
S-Type Vortex Flow Control®

66 mm S-TYPE VORTEX FLOW CONTROL
SPECIFICATION SHEET

Project Information			
Date:	20/12/2022 11:14	**Site Ref:**	HQT-124332
Site Name:	22_21_0583 Herne Bay Crematorium		

Primary Design Point			
Flow (l/s)	2.80	**Head (m)**	0.90



Head (m)	Flow (m)
0.000	0.000
0.031	0.418
0.062	1.195
0.093	1.692
0.124	1.644
0.155	1.582
0.186	1.507
0.217	1.482
0.248	1.572
0.279	1.656
0.310	1.735
0.341	1.810
0.372	1.882
0.403	1.951
0.434	2.017
0.466	2.080
0.497	2.141
0.528	2.201
0.559	2.258
0.590	2.314
0.621	2.368
0.652	2.421
0.683	2.473
0.714	2.523
0.745	2.573
0.776	2.621
0.807	2.668
0.838	2.714
0.869	2.760
0.900	2.804

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