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BBA APPROVAL INSPECTION TESTING CERTIFICATION
TECHNICAL APPROVALS FOR CONSTRUCTION

Agrément Certificate
09/4632
Product Sheet 1

ATLANTIC STORMWATER ATTENUATION TANKS AND CULVERTS

PRODUCT SCOPE AND SUMMARY OF CERTIFICATE

This Certificate relates to Atlantic Stormwater Attenuation Tanks and Culverts, used for underground attenuation/storage and transportation of stormwater run-off from permeable surfaces, eg soft landscape areas, and impermeable surfaces such as roofs, roads and hard standings.

AGRÉMENT CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.

KEY FACTORS ASSESSED

Practicability of installation — the tanks and culverts must be installed by trained and competent operatives (see section 4).

Hydraulic and structural design — data is provided in the Certificate to assist in the hydraulic and structural design of the stormwater attenuation tanks and culverts (see sections 5 and 6).

Mechanical properties — the tanks and culverts have adequate strength and stiffness to resist loads when used in accordance with this Certificate (see section 7).

Tightness — the tanks and culverts can provide an air and watertight pipe joint (see section 8).

Durability — the design life of the tanks and culverts is defined by structural calculation carried out by the Certificate holder on each project (see section 12).

The BBA has awarded this Agrément Certificate to the company named above for the product described herein. This product has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Date of First issue: 4 March 2009

Brian Chamberlain
Head of Approvals — Engineering

Greg Cooper
Chief Executive

The BBA is a UKAS accredited certification body — Number 113. The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk

Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

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Regulations

In the opinion of the BBA, Atlantic Stormwater Attenuation Tanks and Culverts, if used in accordance with the provisions of this Certificate, will meet or contribute to meeting the relevant requirements of the following Building Regulations:

The Building Regulations 2000 (as amended) (England and Wales)

Requirement:	H3(3)	Rainwater drainage
Comment:		The products can be used in a construction to satisfy this Requirement. See sections 5.1 to 5.5 of this Certificate.
Requirement:	Regulation 7	Materials and workmanship
Comment:		The products are acceptable. See sections 12.1 to 12.3 and the *Installation* part of this Certificate.

The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)(2)	Fitness and durability of materials and workmanship
Comment:		The products are acceptable. See sections 11.1 to 11.4, 12.1 to 12.3 and the *Installation* part of this Certificate.
Regulation:	9	Building Standards - construction
Standard:	3.6	Surface water drainage
Comment:		The products can be used in a construction to satisfy this Standard, with reference to clauses 3.6.3[1][2] and 3.6.4[1][2]. See sections 5.2 to 5.5 of this Certificate. (1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic)

The Building Regulations (Northern Ireland) 2000 (as amended)

Regulation:	B2	Fitness of materials and workmanship
Comment:		The products are acceptable. See sections 12.1 to 12.3 and the *Installation* part of this Certificate.
Regulation:	B3(2)	Suitability of certain materials
Comment:		The products are acceptable. See sections 11.1 to 11.4 of this Certificate
Regulation:	N5	Rain-water drainage
Comment:		The products can be used in a construction to satisfy this Requirement. See section 5.2 to 5.5 of this Certificate.

Construction (Design and Management) Regulations 2007
Construction (Design and Management) Regulations (Northern Ireland) 2007

Information in this Certificate may assist the client, CDM co-ordinator, designer and contractors to address their obligations under these Regulations.

See sections: 1 *Description* (1.6), 2 *Delivery and site handling*, and *Installation* part of this Certificate.

Non-regulatory Information

NHBC Standards 2008

In the opinion of the BBA, the use of Atlantic Stormwater Attenuation Tanks and Culverts, in relation to this Certificate, is not subject to the requirements of these Standards.

Zurich Building Guarantee Technical Manual 2007

In the opinion of the BBA, the use of Atlantic Stormwater Attenuation Tanks and Culverts, in relation to this Certificate, is not subject to the requirements of this Technical Manual.

General

This Certificate relates to Atlantic Stormwater Attenuation Tanks and Culverts, used for underground attenuation/storage and transport of stormwater run-off from permeable surfaces, eg soft landscape areas, and impermeable surfaces such as roofs, roads and hard standings.

The approval of the tanks and culverts for 'adoptable' purposes remains at the discretion of the relevant Regional Water Company, whose approval must be sought before installation.

In Highways Agency (HA) and county highway projects, the tanks and culverts are subject to approval under BD 12/01, therefore, approval from the HA and the relevant County Council Highways Authority should be obtained.

This Certificate does not cover the upstream/downstream drainage network connected to the tanks and culverts. Information relating to this matter can be obtained from the Certificate holder.

1 Description

1.1 The Atlantic Stormwater Attenuation Tanks are assembled from galvanized steel corrugated pipes, coupling bands, fabricated access shafts and, when used with multi-legged layouts, the pipes running parallel are connected with fabricated manifolds. In single linear layouts, bulkheads are used to close the end of the pipes. Typical layouts of these tanks can be seen in Figure 1. Factory fitted steel ladders are used to provide access to the tanks.

Figure 1 Typical layouts

1.2 The culverts are fabricated from galvanized steel corrugated pipes with open ends and are connected using coupling bands.

1.3 Flow control units and pumps can be supplied to the tanks but these devices are outside the scope of this Certificate. Silt traps, trapped gullies, catchpits, and hydrocarbon interceptors should be included in the drainage network to prevent excess debris and silt from entering the stormwater attenuation tank; these items are outside the scope of this Certificate.

1.4 The helically corrugated steel pipes are available in different sizes and corrugation (see Table 1) and manufactured from galvanized steel to BS EN 10326 : 2004 (typical grade S250GD + Z600).

Table 1 Galvanized steel thickness and pipe specification

Grade	Corrugation Pitch x depth (mm)	Internal diameter (mm)	Base steel thickness (mm)
Atlantic 125	125 x 26	0.8—3.6	1.25—3.50
Atlantic 112	112 x 20	0.3—2.2	1.25—3.50
Atlantic 107	107 x 25	0.3—2.2	1.25—3.50
Atlantic 76	76 x 25	0.6—3.6	1.25—3.50
Atlantic 68	68 x 13	0.3—1.4	1.25—3.50

1.5 Fabricated components for the attenuation tanks, such as manifolds are manufactured from the same raw material and with the same thickness and corrugation as the pipes. The pipes are cut to pattern, the elements welded and the weld treated with three coats of zinc-rich paint (eg Zinga). The prescribed sizes of the manifolds depending on the diameter are laid down in the manufacturer's production procedure under the Certificate holder's Quality Management Plan agreed by the BBA (see also section 7.5). As an alternative to equal diameter branches on the manifolds, a portal access of 1200 mm by 600 mm diameter can be supplied for man-access to each parallel leg of the tank (see Figure 2).

1.6 Access shafts for the tanks can be placed at the crown of the pipe or offset with a minimum usual diameter of 1200 mm as recommended in BS EN 752 : 2008, Table NA.22. The depth of each manhole shaft is defined by the depth of cover to the tank. Fabricated steel ladders are attached to the wall of the shafts (see section 1.9). The access shaft is finished at the surface in traditional construction of a 150 mm thick concrete surround to the top 300 mm of the shaft (see Figure 3). Pre-cast concrete slabs, brick courses and manhole covers and frames are used to prepare the upper part of the access shafts; these items are outside the scope of this Certificate. It is usual to design the tank layout with a minimum of two access man-entry shafts at a maximum of 90 metres apart for entry and escape. All access must be compliant to Health and Safety requirements for confined space working and risk assessments must be carried out on each project.

Figure 2 Portal access

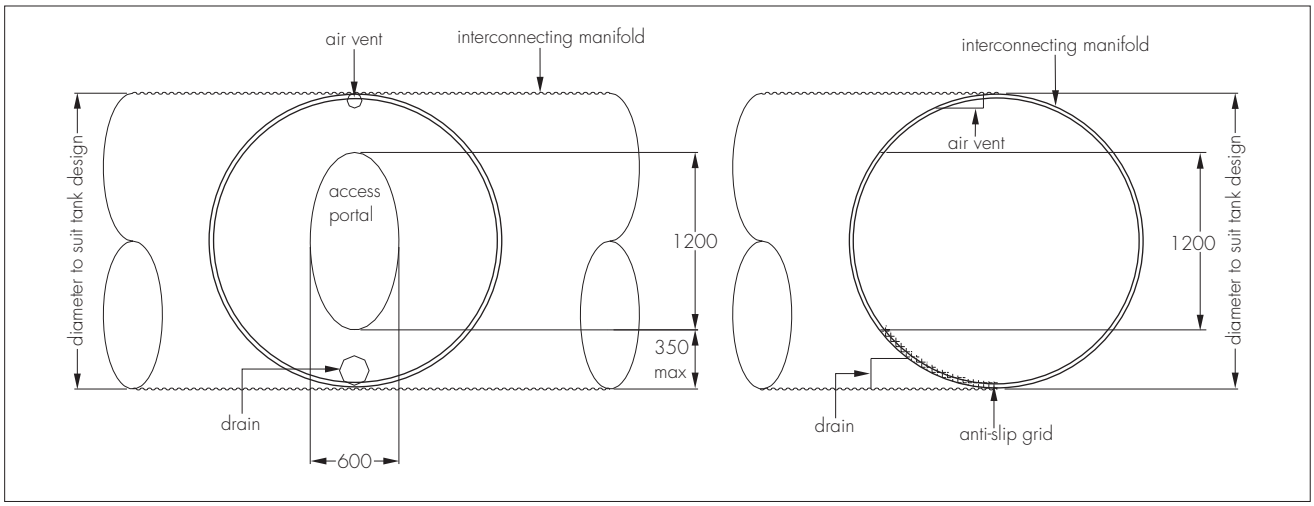
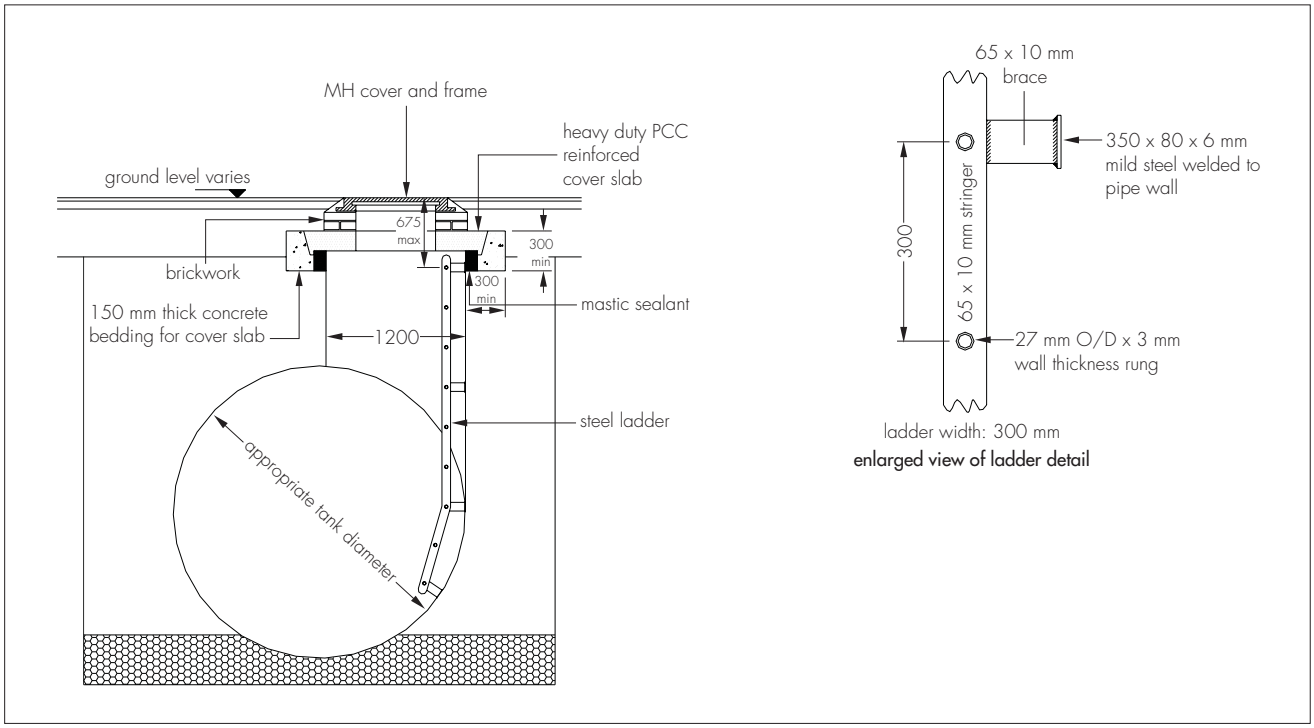


Figure 3 Access manhole with a ladder

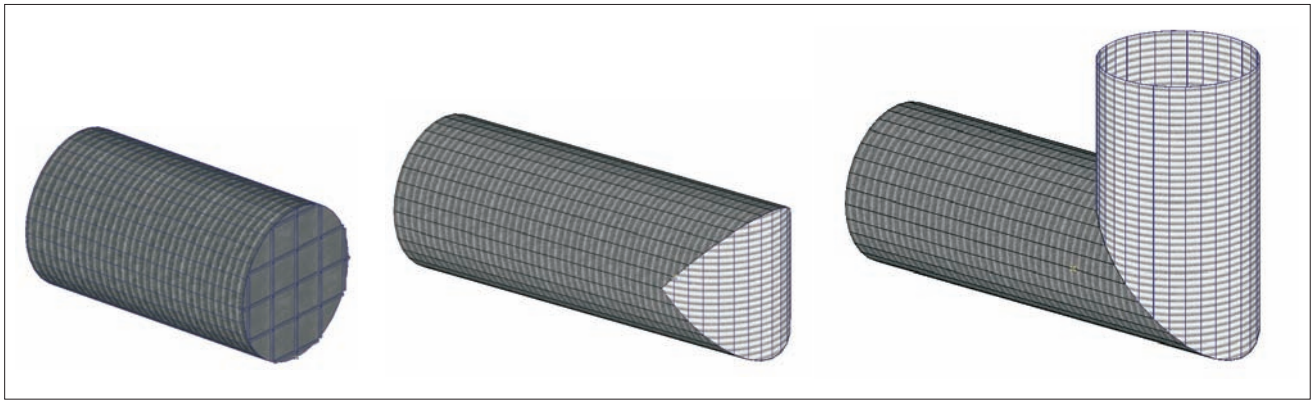


1.7 Steel coupling bands are supplied in two segments and are used for joining lengths of Atlantic pipes and fabricated components. The bands are manufactured from the same raw material as the corrugated pipes. Coupling bands are of two types, either with two annular corrugations rolled into the ends, or without corrugations, depending on the joint type (see section 1.10).

1.8 For the attenuation tanks, bulkheads can be used at the end of the pipes, manufactured from mild steel plates to BS EN 10025-2 : 2004 (typical grade S275) and galvanized to BS EN ISO 1461 : 1999 (with a typical coating weight 610 gm^{-2}). Bulkheads are of a different thickness and are reinforced by a square grid of 500 mm by 500 mm of square, solid, steel bars with a cross-section of 32 mm by 32 mm (see also section 7.4 and Figure 4). Bulkheads are welded to the pipes and the weld is treated with three coats of zinc-rich paint. Alternatively, bulkhead ends are either manufactured from standard pipe, being mitred and welded to the end of the tank section, or as turned-up vertical elbows on to which a proprietary pre-cast concrete cover slab is placed (see Figure 4).

1.9 Steel ladders for the attenuation tanks consist of two stringers and tubular rungs (see Figure 3). The stringers are manufactured from 65 mm by 10 mm solid mild steel bars to BS EN 10025-2 : 2004 (grade S275). The rungs are punched through and welded to the stringers and spaced at 300 mm centres. The rungs are manufactured from mild steel tubes to BS EN 10219-1 : 2006 (grade S235) with an outside diameter of 27 mm and a wall thickness of 3.0 mm. The stringers are welded to the wall of the tank with 65 mm by 10 mm mild steel plates (the same material as the stringers). The maximum distance between the plates supporting the stringers is 2200 mm. The ladders are galvanized to BS EN ISO 1461 : 1999 with a coating weight of 610 gm^{-2} and the welded areas are treated with three coats of zinc-rich paint. The fixed ladders satisfy the requirements of BS EN 14396 : 2004.

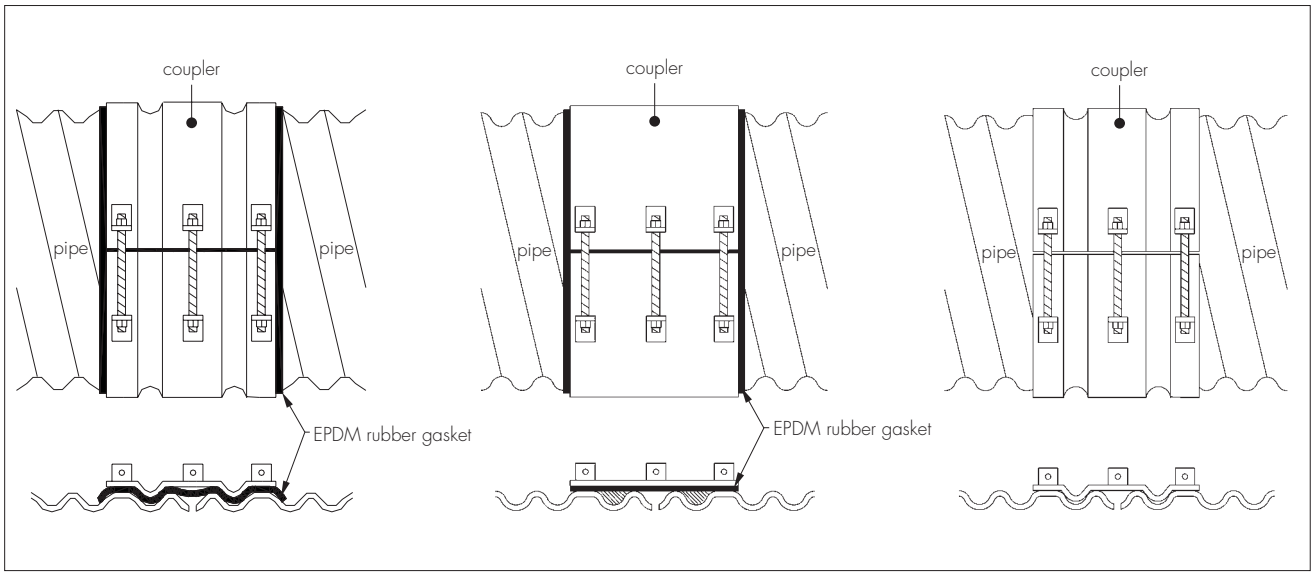
Figure 4 Bulkhead end



1.10 There are three different joint systems to connect the tank and culvert sections (see Figure 5):

- watertight and airtight joint system with standard corrugated coupling bands, 9.5 mm thick closed cell ethylene propylene dienne monomer (EPDM) gaskets and re-corrugated (radial) pipe spigot ends
- watertight joint system with bridged corrugation, flat coupling bands, 9.5 mm thick closed cell EPDM gaskets and helical pipe spigot ends
- backfill-tight joint system with standard corrugated coupling bands and re-corrugated (radial) pipe spigot ends without gasket (for use with applications not requiring watertight joints).

Figure 5 Joint system

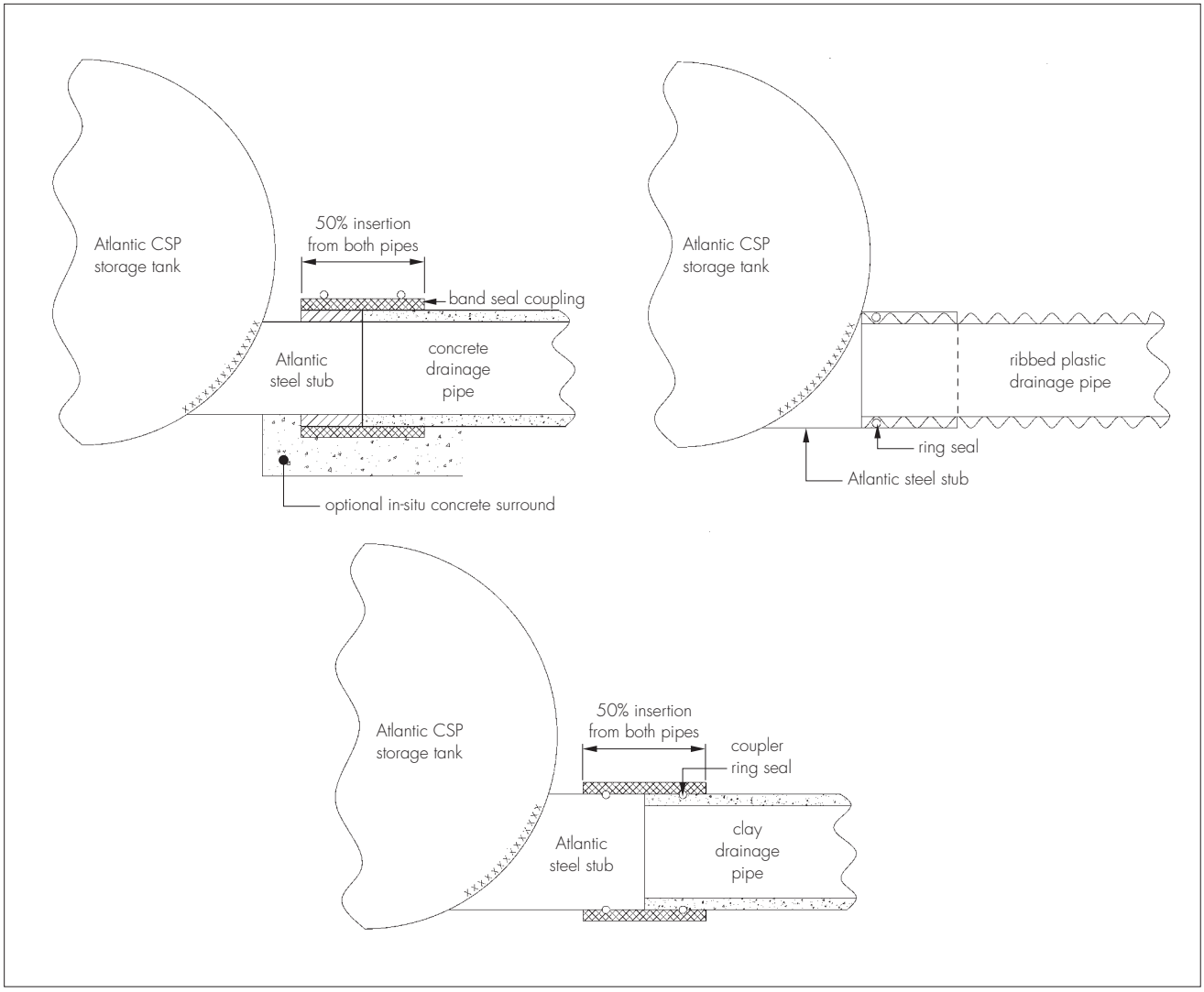


1.11 Inlet and outlet pipe connection steel stubs for the attenuation tanks are factory welded to required level, angle and orientation and can be produced to accept any pipe diameter and material. The welded areas are treated with three coats of zinc-rich paint. The stub pipes are usually provided with an internal diameter equivalent to the incoming/outgoing pipe. The connection is made with a proprietary band seal coupling (see Figure 6). Alternatively, the stub can be produced to a compatible dimension to suit varying types of drain pipe materials; this stub will be either a spigot or a socket push-fit connection (see Figure 6).

1.12 A secondary protective coating system can be applied to all galvanized steel surfaces by either brush or airless spray in accordance with BD 35/06 (DMRB 2.4.1) to achieve a minimum requirement as defined in BD 12/01 (DMRB 2.2.6). For structural design purposes, the secondary coating is not taken into account when calculating the design life.

1.13 Ventilation of the attenuation tanks is provided by the vented manhole covers used on the access manholes within the system. Manhole covers are outside the scope of this Certificate.

Figure 6 Inlet and outlet pipe connection



Manufacture and quality control

1.14 Coils of galvanized steel are decoiled, progressively corrugated and helically wound to the required pipe diameter. The edges of the galvanized steel sheet are rolled over and linked together to form a continuous lock seam. The ends of the pipe can be re-rolled to form two annular corrugations parallel to the face of the pipe, for jointing.

1.15 All welded joints are treated with three coats of zinc-rich paint.

1.16 After forming, either or both the internal and external surfaces of the attenuation tanks or culverts and the coupling bands can be coated with the secondary protective system.

1.17 The galvanized steel coils and assembly nuts and bolts for the coupling bands are obtained from quality-assured suppliers, approved to BS EN ISO 9001 : 2000.

1.18 Quality controls include visual and dimensional checks on incoming galvanized steel coils, on manufactured pipes, fabricated components and ladders, and checks for wet-film thickness, dry-film thickness and visual appearance of the secondary protective coating, where appropriate.

1.19 The whole production procedure and process control is in accordance with the Certificate holder's Quality Management Plan agreed by the BBA.

2 Delivery and site handling

2.1 Components of Atlantic Stormwater Attenuation Tanks and Culverts are delivered to site stacked on trailers, secured with straps over protective padding, complete with coupling bands and gaskets (where necessary) for jointing of the elements.

2.2 Reasonable care must be taken during unloading and erection to avoid damage. Lifting equipment should have padded contact areas or nylon slings, and the pipes and fabricated components should not be dropped or dragged.

2.3 Where necessary, pipes and fabricated components should be handled with a double or triple sling to prevent excessive localised stresses in the pipe barrel that could damage the lock seams.

2.4 On site, components should be stored on a firm base, fully supported on bearers and away from the possibility of damage.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on Atlantic Stormwater Attenuation Tanks and Culverts.

Design Considerations

3 General

3.1 The design of Atlantic Stormwater Attenuation Tanks and Culverts must be in accordance with the Certificate holder's instructions. Guidance on the application of sustainable drainage systems (SUDS) for new developments, such as the Atlantic Stormwater Attenuation Tanks, can also be found in the Planning Policy Statement PPS25 *Development and Flood Risk*.

3.2 The tanks are suitable for the control of stormwater run-off from roofs, roads and hard standing, utilised as attenuation. Water is collected in the tanks during rainfall and released at a reduced flow rate through a flow control device, into an appropriate outfall. This reduces peak flows into the watercourse and, therefore, helps to minimise the risk of flooding.

3.3 Design of the appropriate units for a specific project must always be preceded by a detailed audit of the proposed site to establish:

- existing factors and considerations applicable to the site
- predicted factors relating to the site's use following the planned development, and the parameters within which the installation is required to function
- the type of function or application suggested by this audit.

3.4 Once the project criteria have been established from the site audit, there are two main parts to the design procedure: hydraulic design and structural design.

4 Practicability of installation

The product should only be installed by installers who have been trained and approved by the Certificate holder. Any installation work should follow the details and information contained in the construction drawings, as prepared by the Certificate holder.

5 Hydraulic design

Calculation principles

5.1 Guidance on the design of surface water drainage systems can be found in Approved Document H. As an alternative approach, BS EN 752 : 2008 with its relevant National Annexes can also be used to meet the requirements.

5.2 The volume of attenuation (tanks) or flow rate (culverts) will be calculated by the Designer under an Industry Accepted Design Method and the Hydraulic Model will be based on the required storm event; the attenuation volume (tanks) or flow rate (culverts) is calculated from the run-off and the imposed discharge restriction. Backflow into the attenuation tanks will also be considered by the Designer in low-lying, high-flood-risk areas when the attenuation volume is calculated. The allowable discharge rate to an appropriate outfall is normally imposed by the Environment Agency, Water Company or Planning Authorities. The Atlantic Stormwater Attenuation Tanks and Culverts will be designed by the Certificate holder based on the attenuation volume (tanks) or flow rate (culverts), the drainage levels, the available footprint and the cover required for structural integrity under static and dynamic loading.

Connections

5.3 Information for inlet and outlet pipe connections to the attenuation tanks and culverts is given in section 1.11.

Flow control

5.4 The outflow from the tank must be controlled to comply with the discharge rate consent of the site. The main methods to achieve outflow control are: vortex control device, Orifice Plate or pumps, integrally fitted within the tank. Comparative features and benefits of these various control flow devices should be considered prior to selection. These devices are outside the scope of this Certificate.

Outflow positioning and head calculations

5.5 The invert level of the outflow pipe should be flush with the bottom of the lowest section to allow the tank to drain. As the tank fills, a depth of water develops on the upstream side of the outflow control. For design purposes, the head used in calculations is taken as that above the soffit line of the outflow device.

6 Structural design

6.1 The tanks and culverts may be placed under a wide variety of landscaped or trafficked areas and must be designed to carry all loads that will be applied, including dead and imposed loads.

6.2 The Certificate holder will produce site-specific structural calculations to validate the installation and design life using particular computer software *Buried Corrugated Metal Structures* based on the design methodology set out in BD 12/01. In the calculation, the properties of the pipe (such as diameter, grade of the steel, wall thickness, corrugation type and inertia, galvanized coating thickness), the properties of the soil and the appropriate dead and imposed loads are considered. As an option for a service yard, a reinforced concrete slab can be used to dissipate the imposed loads and thus allow a reduced depth of cover. By calculation, the required thickness of the steel, as a total thickness of structural and sacrificial material required to give the appropriate design life, can be established. The calculation method has been checked by the BBA and found to be satisfactory to use for such application.

6.3 The life of the secondary protective coating system, where applied, is not taken into account when calculating the required sacrificial steel thickness.

7 Mechanical properties

7.1 The lock seams, coupling bands and welded joints have adequate mechanical strength to maintain the integrity of the tank during its serviceable life, allowing for the effects of any reduced end corrugation dimensions. The minimum tensile strengths of the lock seams for the various steel thicknesses available are given in Table 2.

Table 2 Minimum tensile strengths of lock seams

Base steel thickness (mm)	Minimum tensile force across seam (Nmm^{-1})
1.25	49
1.50	61
2.00	88
2.80	136
3.50	182

Table 3 Sectional properties of the profiles

Profile	Thickness (mm)	Area (mm^2mm^{-1})	Inertia (mm^4mm^{-1})
125 x 26	1.25	1.383	119.04
	1.50	1.660	143.15
	2.00	2.213	191.76
	2.50	2.761	240.90
112 x 20	1.25	1.396	66.64
	1.50	1.671	77.78
	2.00	2.217	98.07
	2.50	2.757	115.90
107 x 25	1.25	1.492	118.03
	1.50	1.786	138.58
	2.00	2.368	176.84
	2.50	2.944	211.52
76 x 25	1.25	1.542	112.09
	1.50	1.851	135.03
	2.00	2.471	181.55
	2.50	3.092	229.01
68 x 13	1.25	1.354	26.75
	1.50	1.625	32.28
	2.00	2.167	43.59
	2.50	2.720	55.30

7.2 The sectional properties of the different profiles are given in Table 3.

7.3 The loadbearing capacity of the ladders including resistance of the rungs against vertical imposed load, strength of the stringers and connection strength to the Atlantic Tanks conforms to the requirements of BS EN 14396 : 2004.

7.4 Using calculations, it can be shown that the bulkhead reinforcement solid steel bars in a square grid of 500 mm by 500 mm with a cross-section of 32 mm by 32 mm have adequate strength up to a pipe diameter of 3 m and a maximum burial depth of 1.4 m. In the calculation, a surcharge load of 10 kNm^{-2} and a 100 kN wheel load acting on a 300 mm square have been considered. The depth of the reinforcement bar can be reduced by the thickness of the bulkhead plate.

7.5 Laboratory tests have been carried out to compare the ring stiffness of pipes and fabricated fittings. The test results and supporting calculations have proven that the fabricated manifolds with appropriate spigot lengths depending on the diameter have equivalent stiffness to the standard pipes. The specification regarding the spigot lengths are included in the manufacturer's production procedure under the Certificate holder's Quality Management Plan agreed by the

BBA. Therefore, the structural design method for pipes detailed in section 6 can be applied to these fabricated components provided the dimensions of the manifolds are within the specification.

7.6 Where a steel stub is not supported by the drainage pipe it has to be designed to have a strength equivalent to, or greater than, the drainage pipe.

8 Tightness

8.1 When coupling bands and gaskets are installed in accordance with the Certificate holder's instructions (see section 1.10), the pipe joint detail shown in Figure 5 (left-hand drawing) will be airtight and watertight and the joint detail shown in Figure 5 (centre drawing) will be watertight in accordance with WRC's *Sewers for Adoption*, 6th Edition, Clauses 5.7.4 and 5.7.5 respectively.

8.2 Pipe joints made without gaskets see Figure 5 (right-hand drawing) are deemed to be backfill-tight and can be used where watertight joints are not required, eg where ground water is not present.

8.3 Adequately watertight or airtight joints between the steel stubs and drainage pipes can be achieved by proprietary band seals. Where push-fit joints are applied, the joint method recommended by the drainage pipe system should be used with suitable seals and the spigot or socket diameter of the steel stubs should be designed to allow for making an adequately tight joint.

9 Venting

Venting of the system is achieved by the use of vented manhole covers on the integral access shafts.

10 Resistance to chemicals

The chemical resistance of the tanks and culverts is considered for each site. The Certificate holder will determine the performance of the system based on the Soil Investigation Report or chemical analysis of contaminated ground water. The Certificate holder will produce evidence to validate the suitability of the galvanized steel and the EPDM gasket.

11 Maintenance

11.1 The owner of the structure is responsible for maintenance.

11.2 The design of the tanks and culverts will have satisfied all structural and hydraulic requirements and features of the upstream drainage network will include methods of trapping silts, to reduce the risk of build up of silts and debris within the system. Hydrocarbon interceptors are placed either upstream or downstream of the attenuation tanks to prevent contamination of the existing stormwater network. The design of stormwater attenuation tanks includes catchpit sumps at the outlet accompanied by an access manhole immediately above the outlet sump for maintenance and removal of silt from the surface by tanker suction. Where vortex flow control devices are fitted to control discharge, they are supplied with a drain-down facility in case of blockage, the use of which is outside the scope of this Certificate and covered by a manufacturer's warranty. The operation and maintenance requirements of the system are provided by the Certificate holder and involves routine visual inspection of the system by removing the access covers periodically to check for potential blockage of the system. Debris screens can be factory fitted to the outlet if required.

11.3 All cut and exposed areas of welded fabrications of the galvanized tanks, culverts and ladders should be treated with three coats of zinc-rich paint.

11.4 Damage to the secondary protective coating system, where applied, can be repaired on site by re-applying the system in accordance with the procedures detailed in sections 1.12 of this Certificate.

12 Durability

12.1 The durability of Atlantic Stormwater Attenuation Tanks and Culverts is calculated by the structural design method described in section 6.2; considering the required structural and sacrificial steel thickness, required for a specific application. Being site specific, the calculation defines the material thickness and sectional properties of the pipe required to give the design life of the product under the anticipated installation considerations. Therefore, the design life, as an input value, is used in structural calculations in each particular case depending on the customer's requirements.

12.2 The durability of three layers of zinc-rich paint applied onto welded surfaces is considered to be equivalent to, or greater than, the durability of galvanized coating of the original steel pipes.

12.3 The galvanized coating thickness of the ladders meets the requirements of BS EN 14396 : 2004. By calculation, the ladders can achieve a service life equivalent to that of the tanks.

Installation

13 General

The installation of Atlantic Stormwater Attenuation Tanks and Culverts should be conducted in accordance with the procedures detailed in the Certificate holder's *Installation Method Statement*, which covers excavation, handling, placing, and jointing and backfilling processes.

14 Excavation and base preparation

Excavation for the bedding of the tanks and culverts should extend to a depth below the invert level not less than one tenth of the pipe diameter and to a width not less than 500 mm beyond the pipe on each side. The bedding should be levelled and compacted and be of granular material (typically 20 mm) to MCHW1, Class 6K, Series 600. Wherever possible, the bedding material should be shaped to fit the pipe and support 20% of the circumference of the circular structure (see Figure 7).

15 Construction

15.1 The line and level of the stormwater attenuation tanks or culverts should be set out by a suitably qualified engineer, with corner pegs and preferably using string lines or laser.

15.2 Lifting and placing of the tank or culvert units should be carried out with slings of sufficient load capacity. In multi-legged layouts, the manifold section of the tanks should be placed first and the rows of pipes connected from this point in tandem. Care should be taken to maintain the gap between each row (usually 600 mm) in the entire run.

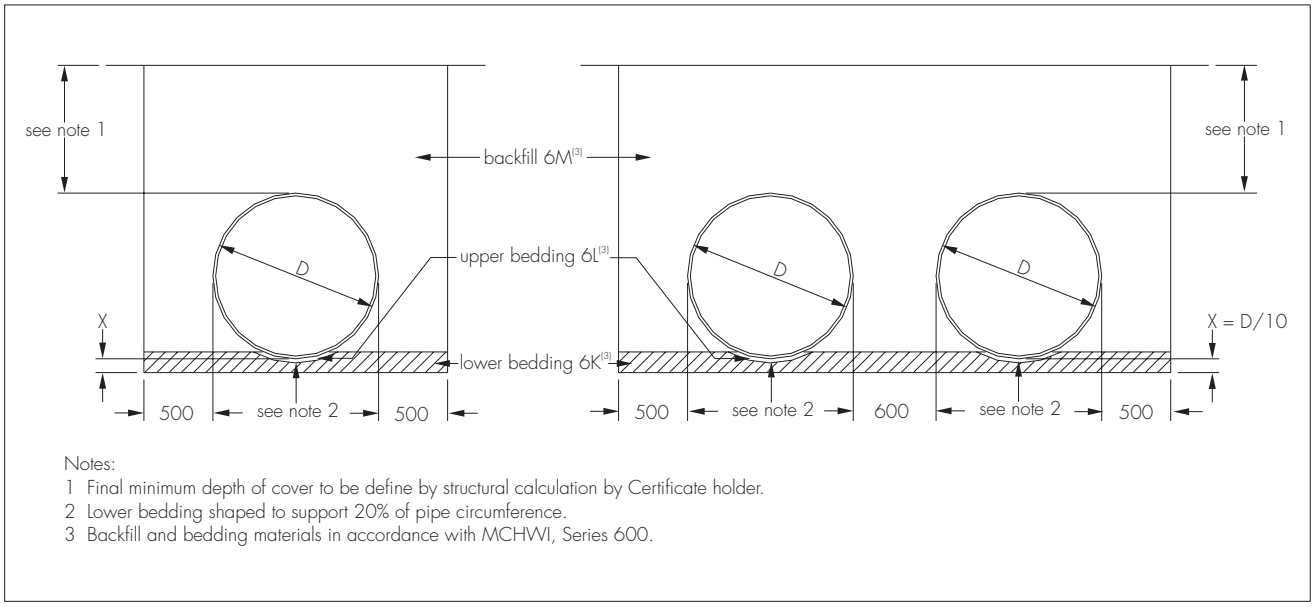
15.3 Tank or culvert sections are supplied with jointing couplings of two segments (and gaskets where applicable). Depending on customer requirements, the joint can be either watertight or backfill-tight (the watertight joint incorporates the EPDM gasket).

15.4 The joint is assembled by placing the first pipe section on the levelled bedding, the bed is then scooped out to a depth of 100 mm under the pipe end to a length of 300 mm under the pipe and 300 mm in front of the pipe end to prevent fouling of the joint. The lower half of the coupling is offered under the pipe end and the gasket (where applicable) is laid between the pipe and the coupling. The adjacent pipe is lowered vertically into place and rested on the lower half of the coupling; care should be taken not to drag the pipe onto the coupling as this will foul the joint. The gasket is placed over and around the circumference of the two pipe ends, centred over the joint and taped to hold it in place. The upper half of the coupling is placed in position over the gasket overlapping the lower portion. The two halves are bolted together leaving a 50 mm gap between the bolt brackets on either side of the joint. For a successful joint, the pipes and couplings must be correctly aligned and the coupling must not be fouled.

16 Backfill

The material and the procedure should be in accordance with *Atlantic CSP Backfill Method Statement* (see Figure 7).

Figure 7 Bedding and backfill



Notes:
1 Final minimum depth of cover to be define by structural calculation by Certificate holder.
2 Lower bedding shaped to support 20% of pipe circumference.
3 Backfill and bedding materials in accordance with MCHWI, Series 600.

17 Access shafts

Access shafts are constructed at the surface in a traditional detail (see Figure 3) using a 150 mm thick by 300 mm deep in-situ concrete surround to the top of the access shaft; this supports the pre-cast reinforced concrete cover slab with a minimum of 600 mm by 600 mm clear opening. Two to four courses of brickwork are laid on the top of the cover slab to reach the ground level and to prepare a base for the manhole cover and frame. The connection between the vertical steel pipe shaft wall and the concrete bedding and slab is made in such a way that vertical loads from traffic are not transferred directly to the shaft wall. A proprietary mastic joint can be applied between the concrete surround and the access shaft.

18 Connection to drainage network

Connections to the upstream and downstream drainage network are made via steel stubs factory welded to the tanks or culverts applying proprietary band seals or push-fit joints suitable for the selected drainage pipes.

Technical Investigations

19 Tests

19.1 Large-scale comparison tests were carried out to determine the ring stiffness between the pipes and fabricated fittings.

19.2 Tests were carried out on the products to determine:

- airtightness
- watertightness
- backfill-tightness.

20 Investigations

20.1 The manufacturing process and application of the secondary protective coating system were examined and details obtained of the quality controls conducted on the raw materials and finished products, the material specifications and the method of manufacture.

20.2 An examination was made of data relating to:

- tensile strength of the lockseams to AASHTO T249-95 : 2000
- tensile strength of a welded joint to BS EN 895 : 1995
- structural design and durability of tanks
- ring stiffness comparison between pipes and fabricated fittings
- loadbearing capacity of bulkheads
- loadbearing capacity and dimensions of the ladders to BS EN 14396 : 2004
- watertightness and airtightness of pipe joints in accordance with WRC's *Sewers for adoption*, 6th Edition.

21 Other investigations

21.1 A site visit has been conducted to assess the practicability of installation.

21.2 Computer modelling calculations were conducted to determine the comparison of ring stiffness of pipes and manifolds.

21.3 Calculations were carried out to determine the long-term loadbearing capacity of the ladders.

Additional information

The management system of the manufacturer has been assessed and registered as meeting the requirements of ISO 9001 : 2000 by United Registrar of Systems Ltd (URS) (Certificate No 76750).

Bibliography

BS EN 752 : 2008 *Drain and sewer systems outside buildings*

BS EN 895 : 1995 *Destructive tests on welds in metallic materials — Transverse tensile test*

BS EN 10025-2 : 2004 *Hot rolled products of structural steels — Technical delivery conditions for non-alloy structural steels*

BS EN 10219-1 : 2006 *Cold formed welded structural hollow sections of non-alloy and fine grain steels — Technical delivery conditions*

BS EN 10326 : 2004 *Continuously hot-dip coated strip and sheet of structural steels — Technical delivery conditions*

BS EN 14396 : 2004 *Fixed ladders for manholes*

BS EN ISO 1461 : 1999 *Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods*

BS EN ISO 9001 : 2000 *Quality management systems — Requirements*

AASHTO T249-95 : 2000

BD 12/01 *Design of Corrugated Steel Buried Structures with Spans Greater Than 0.9 metres and up to 8.0 metres*

BD 35/06 *Design Manual for Roads and Bridges (DMRB), Volume 2 Highway Structures : Design (Substructures and Special Structures), Materials, Section 4 Paints and Other Protective Coatings — Part 1 Quality Assurance Scheme for Paints and Similar Protective Coatings*

MCHW1 Manual of Contract Documents for Highway Works, Volume 1 *Specification for Highway Works*, August 1998 (as amended)

22 Conditions

22.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is granted only to the company, firm or person named on the front page — no other company, firm or person may hold or claim any entitlement to this Certificate
- is valid only within the UK
- has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English law.

22.2 Publications and documents referred to in this Certificate are those that the BBA deems to be relevant at the date of issue or re-issue of this Certificate and include any: Act of Parliament; Statutory Instrument; Directive; Regulation; British, European or International Standard; Code of Practice; manufacturers' instructions; or any other publication or document similar or related to the aforementioned.

22.3 This Certificate will remain valid for an unlimited period provided that the product/system and the manufacture and/or fabrication including all related and relevant processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

22.4 In granting this Certificate, the BBA is not responsible for:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- individual installations of the product/system, including the nature, design, methods and workmanship of or related to the installation
- the actual works in which the product/system is installed, used and maintained, including the nature, design, methods and workmanship of such works.

22.5 Any information relating to the manufacture, supply, installation, use and maintenance of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used and maintained. It does not purport in any way to restate the requirements of the Health & Safety at Work etc Act 1974, or of any other statutory, common law or other duty which may exist at the date of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care. In granting this Certificate, the BBA does not accept responsibility to any person or body for any loss or damage, including personal injury, arising as a direct or indirect result of the manufacture, supply, installation, use and maintenance of this product/system.

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