

# Harlequin Continuous Aeration Plant

CAP 6 & CAP 9

## Installation and Operating Instructions



**Harlequin**<sup>®</sup>  
MANUFACTURING FOR TOMORROW



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Harlequin CAP Key Data.

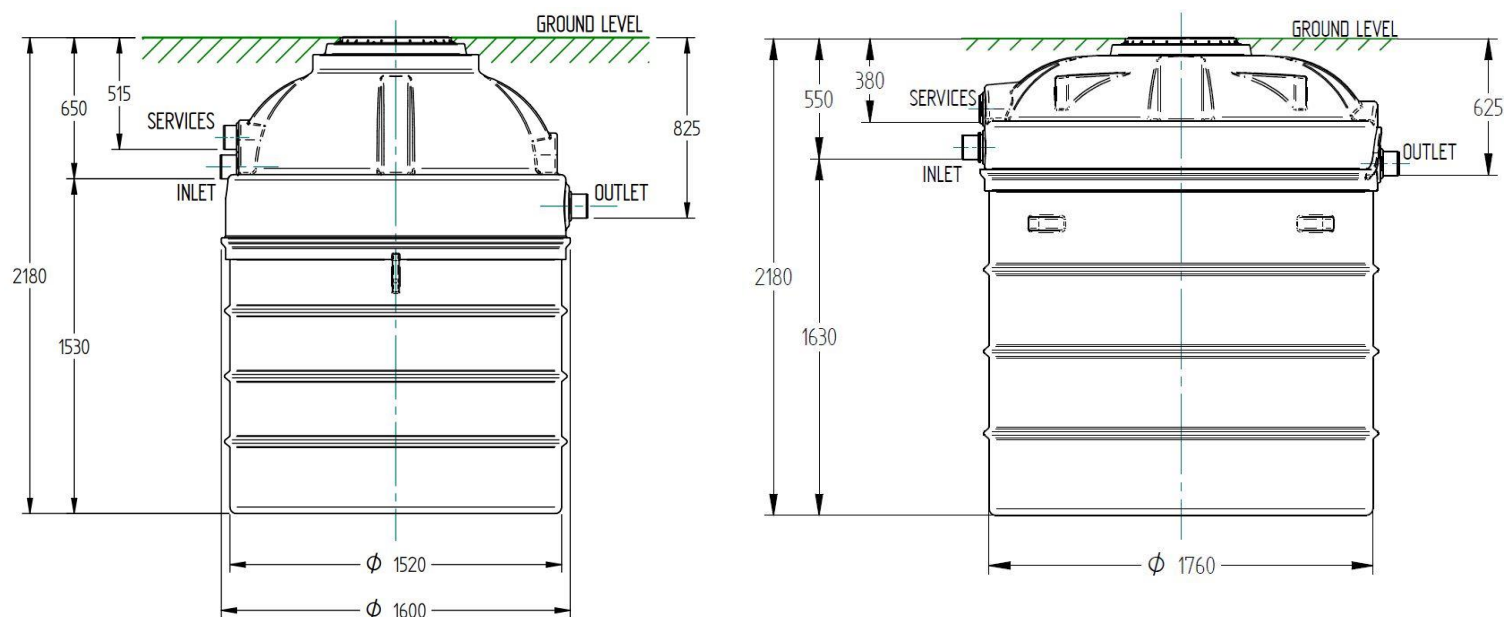


Figure 1: Harlequin CAP 6 and CAP 9 Key Dimensions (Gravity versions)

	CAP 6	CAP 9
<b>Nominal organic daily load</b>	0.34 kg/d	0.51 kg/d
<b>Nominal hydraulic daily load</b>	1.20 m <sup>3</sup> /d	1.80 m <sup>3</sup> /d
<b>Treatment efficiency (nominal sequences – same for both models)</b>	Efficiency	Effluent
COD	91.4%	56 mg/l
BOD <sub>5</sub>	96.2%	11 mg/l
NH <sub>4</sub> -N	83.3%	5.9 mg/l
SS	95.5%	16 mg/l
<b>Number of desludging</b>	Not more than once	
<b>Electrical consumption</b>	1.4 kWh/d	
<b>Max Dimensions</b>	L 1660 W 1600 H 2180 mm	L 1840 W 1760 H 2180 mm
<b>Material</b>	Polyethylene	
<b>Watertightness</b>	Pass	
<b>Structural behaviour (pit test)</b>	Pass (also wet conditions)	
<b>Durability</b>	Pass	
<b>Inhabitants Served</b>	1 - 6	7-9
<b>Desludging Intervals (months)</b>	12	12

Figure 2: Harlequin CAP 6 and CAP 9 Key Data

### General Information

#### Introduction

It is strongly recommended that you read all sections of this manual before installing and operating your new Harlequin CAP Product. Some installation and operation requirements are specific to CAP products and it is important to familiarise yourself with these.

***This information is supplied as a best practise guide and it is the responsibility of the user/installer to verify that it is used appropriately for the ground and load conditions.***

***Installation of the equipment should only be undertaken by a qualified specialist who is covered with professional indemnity insurance.***

#### End-user responsibilities

It is the end-user's responsibility to ensure that their drainage and sewage treatment system complies with statutory requirements and does not cause pollution to the environment. Guidance can be found at Planning & Building Control departments as well as environmental agency offices regarding statutory obligations.

A professional consultant (architect/consulting engineer/drainage consultant) with experience in off-mains systems should be appointed to carry out a detailed site assessment evaluation and design of the groundworks.

***The plant must be installed, operated and maintained in accordance with the requirements of this document***

The Harlequin CAP is designed to provide full treatment of normal domestic wastewater to discharge direct to surface waters, removing the need for a soakaway system (subject to a "Consent to discharge" license). The discharge from a treatment plant will be require a Discharge Permit from the Environment Agency if the volume of discharge is greater than 5.0m<sup>3</sup>/day direct to watercourse or 2.0m<sup>3</sup>/day to soakaway, which must be obtained before installation.

In all cases, approval should initially be sought through the local authority Building Regulator. It may also be necessary to obtain the consent of:

- The Environment Agency (EA - England and Wales)
- The Scottish Environment Protection Agency (SEPA - Scotland)
- Environmental Protection Agency (EPA - Ireland)
- The Northern Ireland Environment Agency (NIEA)

#### Health and Safety

The advice given in this document is provided with your safety in mind. This document should be retained for future reference and remain in the household should a new occupier take ownership. The following health and safety guidelines should always be strictly adhered to in relation to the operation and maintenance of any wastewater treatment plant. It is important that:

- ***All electrical work is carried out by a qualified electrician***
- ***All plumbing work is carried out by a qualified plumber or groundworks engineer***

- ***All maintenance activities include appropriate measures to safely isolate electrical and water sources.***

At all times, safe working practices should be observed and adopted to avoid accident and injury when working with the equipment.

- The site should preferably be fenced off to prevent unauthorised access, particularly for small children
- The air blower housing should be kept closed at all times when in operation
- The manhole covers should never be removed and left unattended, even during service visits
- The air blower housing contains electrics operating at 240v. All equipment must be isolated before any maintenance is carried out
- Misuse can lead to serious injury and damage to the plant
- Protective clothing and gloves should be worn at all times and careful attention paid to personal hygiene, especially if there is any potential contamination with sewage products
- Medical attention must be sought if a user is feeling unwell after coming into contact with wastewater products

Leaving the tank unattended during servicing should be strictly discouraged in accordance with the health and safety procedures.

Warning: Wastewater treatment processes can produce hazardous gas concentrations even when vessels are fully drained. Never enter vessels without appropriate training and protective equipment.

#### Maintenance

It is important to note that it is the end user's responsibility to ensure that maintenance is performed on the system at the appropriate period. Maintenance will ensure good operation and avoid breakdown which could lead to environmental pollution. Environmental enforcement agencies responding to pollution will hold the owner of the system responsible for ensuring compliance with any consent parameters imposed on the site.

The Maintenance and Service requirements for the CAP product are listed on Page 11 of this document. The warranty for the product will be dependent on all the installation and servicing guidelines being followed.

#### Regulations and Guidelines

The following documents provide guidance on the requirements of design and installation of wastewater treatment plants.

#### Publicly available guidance documentation

- Environment Agency Pollution Prevention Guidelines Part 4 (PPG4: 2006)
- Northern Ireland Environment Agency Water (Northern Ireland) Order 1999 (97.5%)
- Building Control Regulations 2010, part H Drainage and Waste Disposal, 2015 edition
- British Water Flows and Loads – 4, Code of Practice

### Relevant British design and testing standards

- EN 12566-3:2005+A2:2013
- BS 6297:2007

### Tank sizes and construction

The Harlequin CAP is produced in two sizes, suitable for a 6 and a 9 population equivalent - and is rotationally moulded in tough polyethylene which offers a very high level of impact resistance. It has been independently tested to ensure a robust construction and a long service life.

### Tank design features

The CAP unit is provided with 2 moulded in lifting eyes or lifting slings on the side of the tank. These are not intended for transportation of the units and are only to be used when the tank is empty. The lifting hook should be connected to the tank lifting eyes by separate slings of equal length. Ensure that the slinging angle does not exceed 60° at the hook in order to eliminate excessive compressive loads on the side of the unit.

Secure pedestrian duty manhole covers are supplied as standard to comply with statutory regulations.

The tanks have a flat base for stability during transportation and storage prior to installation.

### Storage prior to installation

Tanks should be set on a smooth level base and securely tied or propped to prevent them from overturning and causing damage or injury.

### Handling

The rotationally moulded polyethylene tanks should be handled by crane or other designated and suitably rated lifting equipment using the moulded lifting slots provided (only when empty). Please contact Harlequin if you require specific product drawings and dimensions of your product.

Harlequin Manufacturing Ltd can accept no responsibility for incorrect offloading or installation. The contractor is responsible for offloading all items of equipment with due regard to the following:

- DO NOT use chains or wire ropes.
- DO NOT lift the tank if it contains any water.
- DO NOT subject the tank to sharp impacts.
- DO check that all items delivered correspond with the delivery note.

When working in deep excavation, make sure that all necessary safety precautions are taken to ensure the stability of the excavation and provide safe working conditions for site personnel. The only time anyone needs to be working at the bottom of the excavation is when levelling the base and ensuring that the first backfill is correctly placed.

### Plant siting

Wastewater treatment plants serving single dwellings should be sited a minimum of 7m from any habitable buildings and as far away as possible. Some local

authorities will permit significantly closer installation for single houses, however this may vary from area to area. Local building control office advice should always be sought through planning permission, where required.

The direction of the prevailing wind should also be taken into account when considering the plant location as odours may be present when the plant is being desludged or during maintenance. No odour should be present around the tank under normal operation providing the plant has been installed with the venting system (see 'ventilation' on page 8) and the plant has been correctly sized and installed.

For installation, consider the space required on site to allow an excavator to operate; for the removal of soil, delivery of concrete, gravel, etc. For maintenance, consider the access space required for a sludge emptying tanker. Maximum distance of 20m is needed to ensure hose length is sufficient.

Approval for the tank position should always be sought from the controlling authority at an early stage and planning signed off by the local authority building inspector prior to installation.

If using a soakaway system, attention is drawn to the minimum recommended distances to other buildings and sources of water which may affect your plant location:

- Soakaway from habitable dwelling = 10m
- Soakaway from water course = 10m
- Soakaway from well/drinking water source = 50m

### Drain gradients

Drain gradients from the dwelling to the treatment plant should be 1:40, although 1:80 can sometimes be permitted with approval of Building Control Officer. The gradient of pipes within a soakaway system, if applicable, must be <1:200. The drain from the plant to the start of the soakaway should be in the range 1:40 to 1:80. These are only typical recommendations and must be approved by the Building Control Officer for specific sites.

### Ground and drain levels

Site plans should show existing and proposed ground levels and invert depths of the drain throughout its length. If the drain is too shallow, or if it passes under walls and foundations, it should be protected by concrete surrounds.

### Percolation tests and soakaway system, if applicable

A soil percolation test should be carried out over the proposed soakaway system area where necessary. The calculations and drainage layout plan must be submitted to the Council Building Control dept along with the other drawings. The percolation tests should be carried out by a qualified specialist consultant who should be covered with professional indemnity insurance.

### Superimposed loads/protected areas

Harlequin does not recommend that superimposed loads, such as vehicles, be allowed within 3m of any part of the tank.

## HARLEQUIN CAP INSTALLATION AND OPERATING INSTRUCTIONS

The tank should not be situated close to a driveway or roadway, or anywhere there is a risk of it being subjected to additional superimposed loads. The protected area should also be fenced off.

If vehicular or other superimposed loads are required to come within the protected area a qualified civil/structural engineer must be employed to design the installation. This design must prevent loads being transmitted onto the tank.

Harlequin Tanks may not cover the warranty for the tank body under superimposed load conditions; this responsibility must be covered by the civil/structural engineer. It is thus a requirement that the installation is signed off by this third party engineer.

### Installation Instructions

Before any tank is installed, appropriate ground condition checks should be made to determine the soil constitution, position of the water table and any flood possibility in the area.

These checks should be performed through test holes in the proposed area and checks with Building Control and the appropriate environmental regulator on any history of level alterations of the local water table. Once the site information has been gathered, the installation type can be selected as either 'Dry' or 'Wet' ground conditions. If there is any doubt as to the summer/winter water table

level, etc, a Wet site installation must be selected. Failure to follow the guidance instructions during installation may render the warranty null and void.

### Modifying the tank invert depth

The standard CAP is designed to cater for drain invert depths of 650mm (CAP 6) and 550mm (CAP 9). The invert depth cannot be reduced any further but standard  $\varnothing$ 450mm risers can be used to increase the invert depth where ground conditions are suitable.

In a standard gravity feed CAP, there should be no more than three of the risers used. In the pumped outlet version, we recommend no more than two to allow access to the submersible pump. If you wish to increase the invert beyond those maximum number of risers (up to a 2.0m maximum invert), we recommend the use of 1200mm concrete rings above the 450mm risers to allow access to the manhole cover of the tank.

This should not be carried out unless the specific ground condition checks have been made and the installation appropriately modified. Installation for this situation should follow the Wet ground installation procedure unless a qualified structural engineer has specified the type of backfill.

**Failure to adhere to these design parameters may cause severe structural damage to the tank and will render any warranty null and void.**

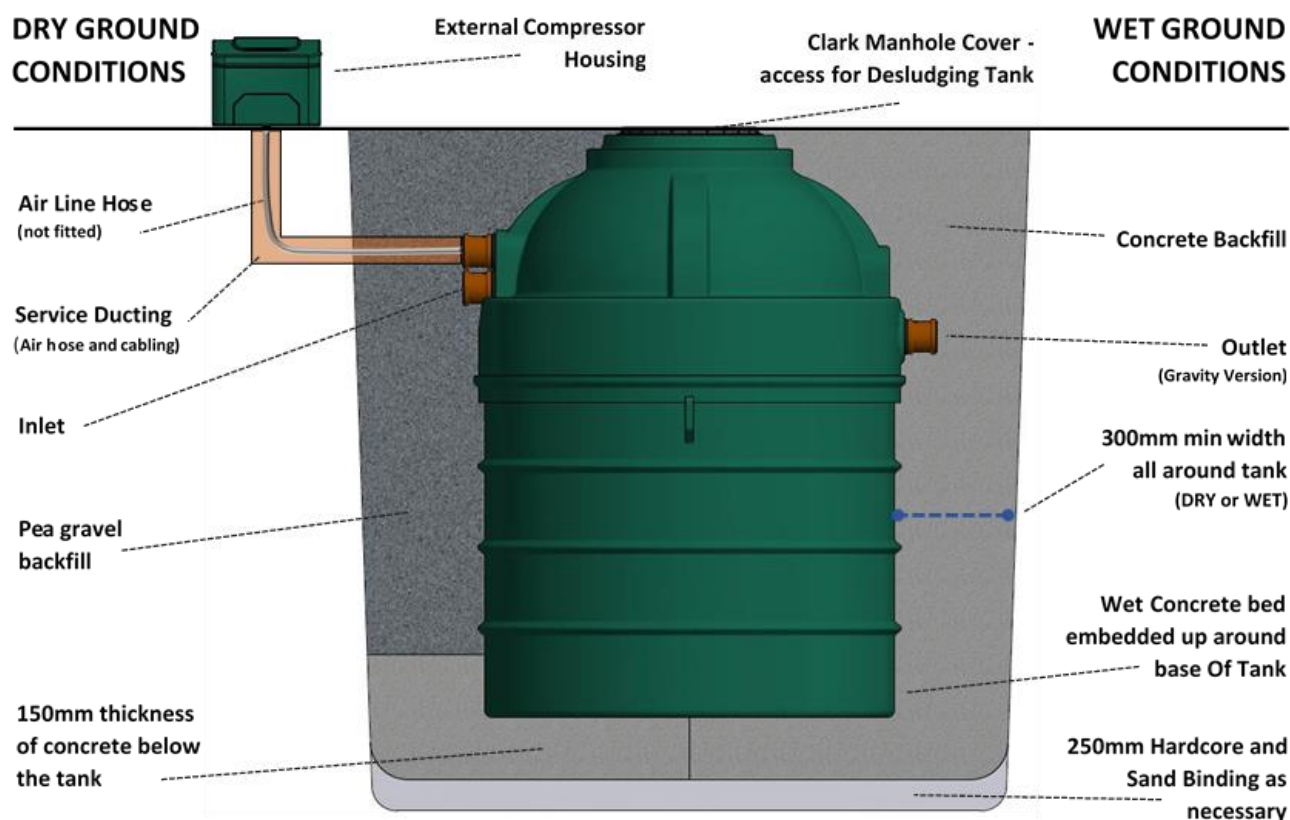


Figure 3: Typical Installation – Dry and Wet Ground Conditions (CAP 6 model Shown)

### 'Dry' ground installation conditions

A site is deemed as being dry when at no time does ground water rise above the base of the tank. This is a requirement throughout seasonal changes not just at the time of installation.

NB: If the complete surrounding soil structure is non porous, eg, clay, a danger exists of water pooling around the tank within the backfill. In this circumstance either a land drain should be installed to drain the installation to the base of the tank or the wet installation procedure should be used.

Provision should be made for temporary covers and fencing around the excavation site to comply with statutory health and safety requirements.

### Dry installation procedure

Excavation should allow for a minimum thickness of 300mm pea gravel all round and 150mm thickness of concrete below the tank(s). Where difficult ground conditions are encountered, ie, in unstable ground or shrinking clay, etc, an additional depth of 250mm should be excavated below the tank to allow for hardcore and sand blinding to provide a firm base for the concrete bed.

Place wet concrete (slump test 30mm, strength 25N/mm<sup>2</sup>) in base of the excavation to a depth of 150mm, grade and level to within 20mm. The concrete must extend a minimum of 300mm all round from the vertical sides of the tank(s). ***This is vital to ensure a stable base to prevent settling of the tank(s) which could damage the pipe connections. Lower the tank onto the dried concrete, taking care not to damage any external flanges or pipework and check it is true and level using a spirit level.***

Ensure correct orientation of the inlet and outlet pipework. Check that the tank is level in all directions. Fill each section of the tank starting with the media compartment and full until the liquid level reaches 450mm. Next, place and consolidate additional concrete carefully under the lower sides of the tank. This will ensure they are correctly supported once installed. Do not use a vibrating poker. **Note: Do NOT use a vibrating poker to compact the concrete.**

Continue to fill the tank with water<sup>(1)</sup> whilst simultaneously backfilling around the tank with 12-15mm pea gravel, ensuring the level of water in the tank is maintained at approximately 200mm higher than the level of backfill. This will maintain equal pressure inside and outside the tank and will prevent any chance of movement during installation. When the tank is full of water to the inlet/outlet height, connect the inlet/outlet pipes to the tank (as labelled) and continue to build up and around the tank with backfill to within 500mm of ground level.

### Pea gravel specification

Pea gravel or crushed aggregate of uniform particle size 12- 15mm, free of sharp edges. Chemically inert, washed clean and free of contaminants.

### 'Wet' ground installation conditions

A site is deemed as wet when ground water can rise above the base of the tank. If in doubt of water table position, these Wet ground installation instructions must be followed.

***The maximum permissible water table level is 1.25m from the base of the tank(s). Failure to follow the guidance instructions during installation may render the warranty null and void.***

In poor soil conditions it is essential to make substantial provision for planking, strutting and temporary shuttering.

Adequate pumps should always be provided to keep the excavation free from ground water during the work. Provision should also be made for temporary covers and fencing around the excavation site to comply with statutory Health and Safety requirements.

### Wet installation procedure (continue from <sup>(1)</sup> above)

Continue to fill the tank with water and carefully place concrete around the tank building up the layers, ensuring that there are no voids remaining around the tank. Do not use a vibrating poker. Ensure that the level of water inside the tank is maintained at a level approximately 200mm higher than that of the concrete backfill.

Commence backfilling with concrete in 500mm lifts, and at the same time, fill each tank compartment with water starting with the media bay section, ensuring that the progressive concrete and water levels are approximately equal (never exceed a difference of 200mm max). The concrete must be evenly distributed around the unit, ensuring spigot connections are not covered at this stage. The concrete must now be allowed to harden – approx 24hrs. This is to prevent an unbalanced buoyancy force from the wet concrete from lifting the tank from the excavation as the backfill is raised above the internal water level.

Once the backfill concrete has hardened, connect the inlet/outlet pipes to the tank and continue to backfill with concrete, covering the top body of the tank by 200mm thick layer.

***Never partly or wholly fill the tank with water before surrounding it in concrete.***

This will maintain equal pressure inside and outside the tank and will prevent any chance of movement during installation. When the tank is full of water to the inlet/outlet height, connect the inlet/outlet pipes to the tank (as labelled) and continue to build up and around the tank with backfill to within 500mm of ground level. Continue placing the concrete in 500mm lifts, terminating at the shoulder of the unit. Allow an initial set of the concrete between lifts and wait at least 24 hours for the concrete to harden.

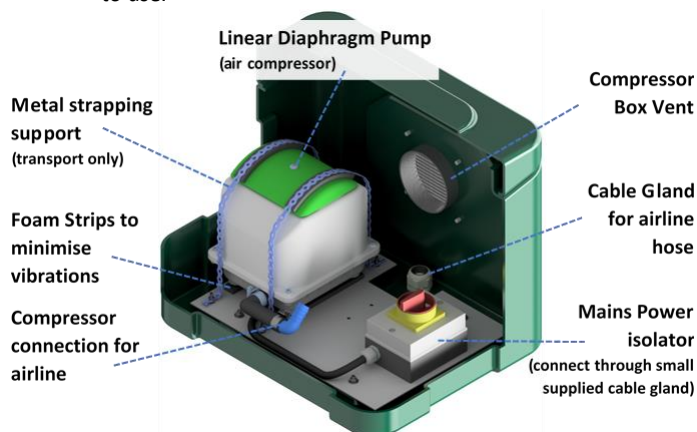
Finally, complete backfilling up to ground level with earth or reinforced ground slab as required.

### Electrical power requirements

Power requirement is single phase 240V, through a 3-core steel wired armoured (SWA) cable. Refer to the Compressor specification supplied with your unit for the specific power ratings to size the electrical cable but 1.5mm is usually adequate. The supply to the unit should be by means of a dedicated circuit with isolation and protection devices consistent with the requirements for fixed equipment and in accordance with the latest regulations. The electrical installation of this equipment must only be carried out by a fully qualified electrician.

### Inside the External Blower Housing

The standard external Blower Housing contains a linear diaphragm pump (air blower) pre-wired to a 20A Isolator (see Figure 4), 10m of airline hose and connection components for the airline and SWA power cable. The unit should be positioned close to the tank at ground level and this distance is limited by the length of airline provided. The perforated metal straps used for transport to hold the compressor in place should be removed prior to use.



**Figure 4:** Inside the External Air Blower Housing

The mains power can be brought into the unit through the cable gland (supplied) with the drill location on the unit determined by the end user and then connected directly to the Isolator.

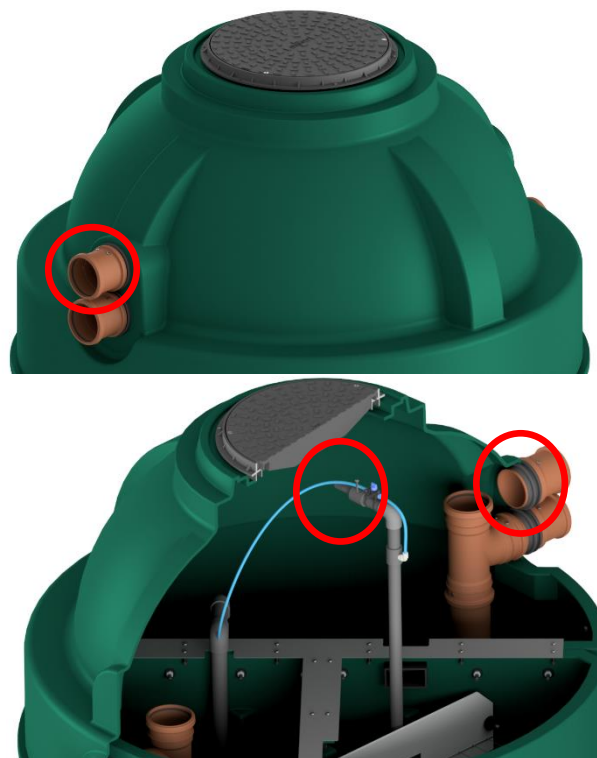
The incoming power supply to the tank must be installed with a separate earth leakage circuit breaker in the source building. Ensure the SWA cable is correctly installed, earthing the outer steel armouring at both ends.

### Connecting the airline to the tank

The supplied airline should be fed through the large cable gland at the bottom of the unit (Highlighted in Figure 4) and connected to the blue plastic elbow/hose-tail on the air blower using a jubilee clip that comes in the kit.

The other end of the airline should be cut to length and brought into the tank through the service ducting above the tank inlet as shown in Figure 5. This should then be joined to the fixed pipework connected to the diffuser system as also highlighted in the same images. This pipework can be accessed through the main access manhole lid.

The flow regulator tap, which is connected to the diffuser pipework should be set to achieve an effluent return rate of a limited but regular flow (the desired setting is where the flow is just gently “spitting” back). Under no circumstances should this tap be fully open or have a constant flow as this will detrimentally affect the efficiency of the performance of the plant.



**Figure 5:** Airline connections inside and outside the tank

### Ventilation

It is important that a specific air venting point is provided by the installer to allow the system to freely vent and disperse gas. For these products, this should be achieved through the installation of a soil stack running to the top ridge of the dwelling(s), this must not terminate at eave height. The air from the system must be allowed to freely vent back the inlet pipe from the tank to this soil stack. The internal pipe work of the tanks allows ventilation from all chambers to the inlet pipe work. The soil stack can usually be installed through vertical extension of the dwelling’s wastewater pipe where it leaves the building.

### Pumped Outlet Version (Optional)

Integrated pump outlets can be used where gravity drainage is not possible. The pump process operates through the submersible pump system situated in the Final Settlement Chamber, which is controlled with the use of a float switch. The float switch is set to turn on and off at predefined levels for pumping a specific volume of effluent out to a sample chamber or to discharge. This version of the product comes fitted with a 50mm MDPE Pipe Adaptor as an outlet connection on the tank as opposed to the standard 4” PVC pipe.



## HARLEQUIN CAP INSTALLATION AND OPERATING INSTRUCTIONS

### Installation

The pumped outlet version of the product should be installed physically by the same procedure as the standard tank. The cables for the high-level float and submersible pump should be brought out through the service ducting as shown in Figure 6 below to the external blower box. The high-level float is attached to the submersible pump and does not need to be disconnected. The submersible pump can be accessed in the final chamber through the removal of the manhole access lid and disconnecting the union fitting as also shown in Figure 6. If the pump is secured to the inner

chambers for transport reasons, these ties should be removed prior to operation. The external blower box for this version will contain several extra fittings as shown in Figure 7 below. The cable for the high level float should be connected to the Overflow Alarm Control box and the power connection from the submersible pump should be connected to the junction box within the blower chamber. We recommend installing a separate power connection/isolation for the Overflow Alarm Control in the External Blower Box to ensure continued operation in the event of a pump power failure (see Figures 8 & 9 below for schematics of the connections).

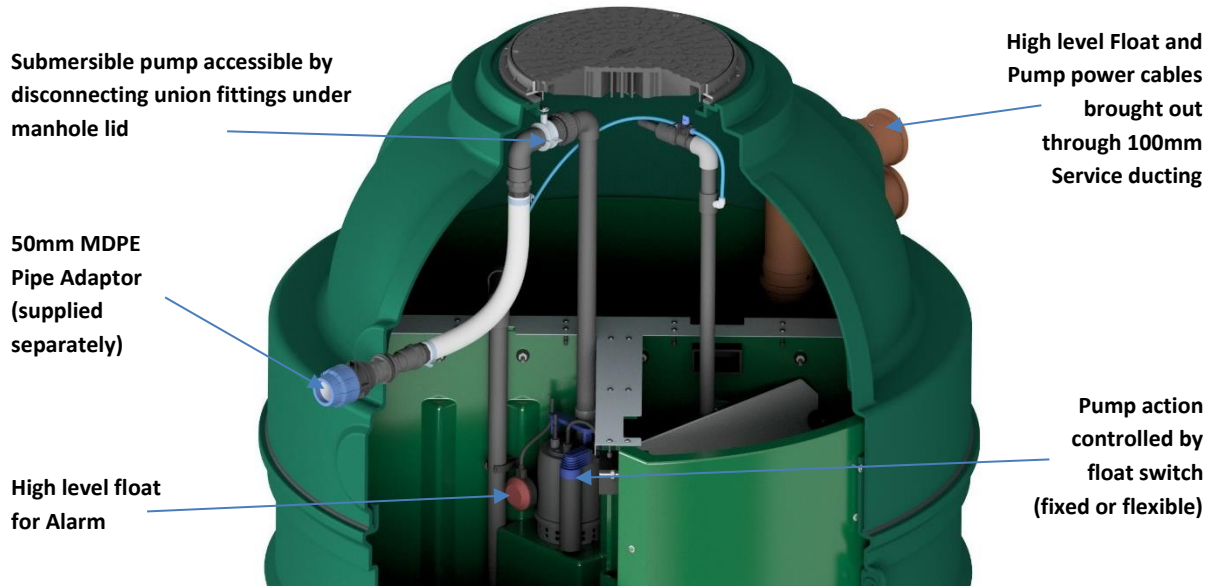


Figure 6: Connections in Pumped Outlet version (CAP 6 Model Shown)

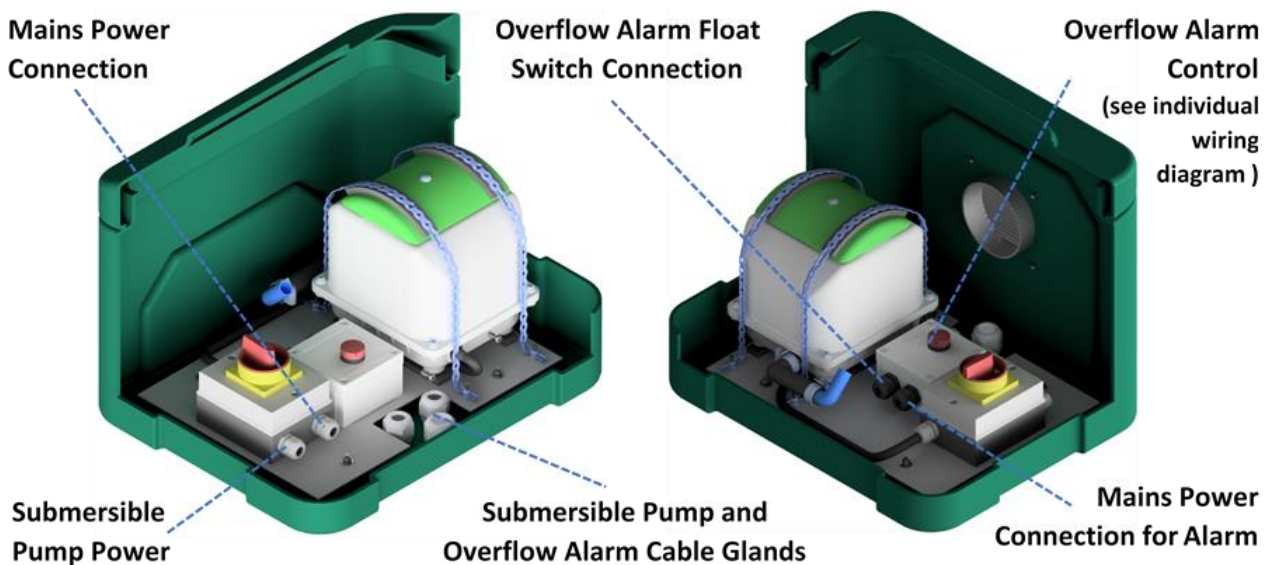


Figure 7: Inside the External Air Blower Housing (Pumped Outlet Version)

WIRING DIAGRAM (PUMPED OUTLET VERSION)

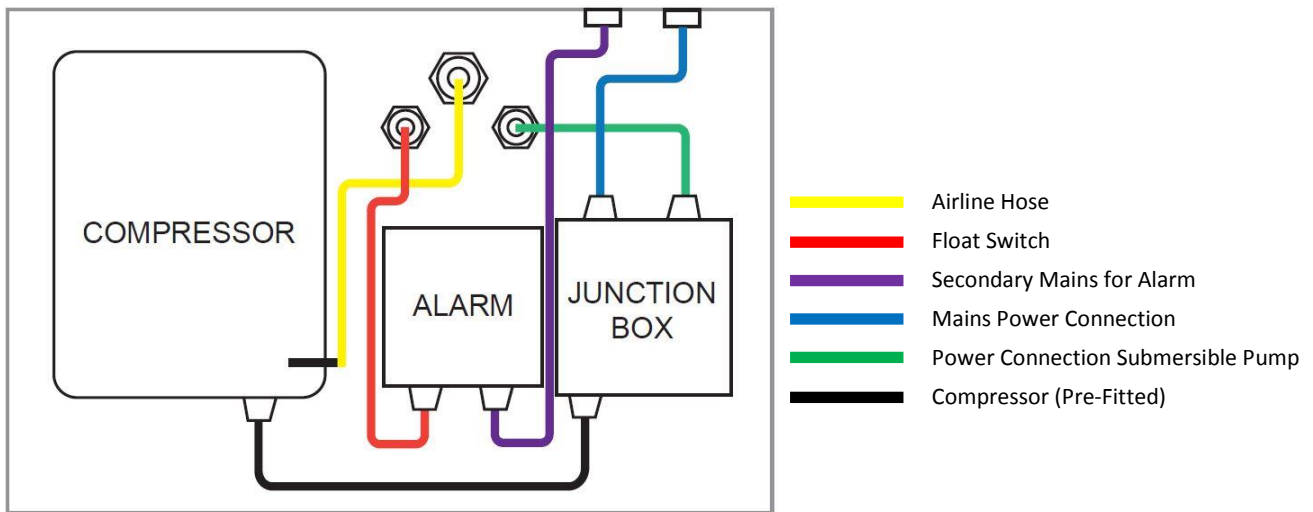


Figure 8: Connections inside External Air Blower Housing (Pumped Outlet Version)

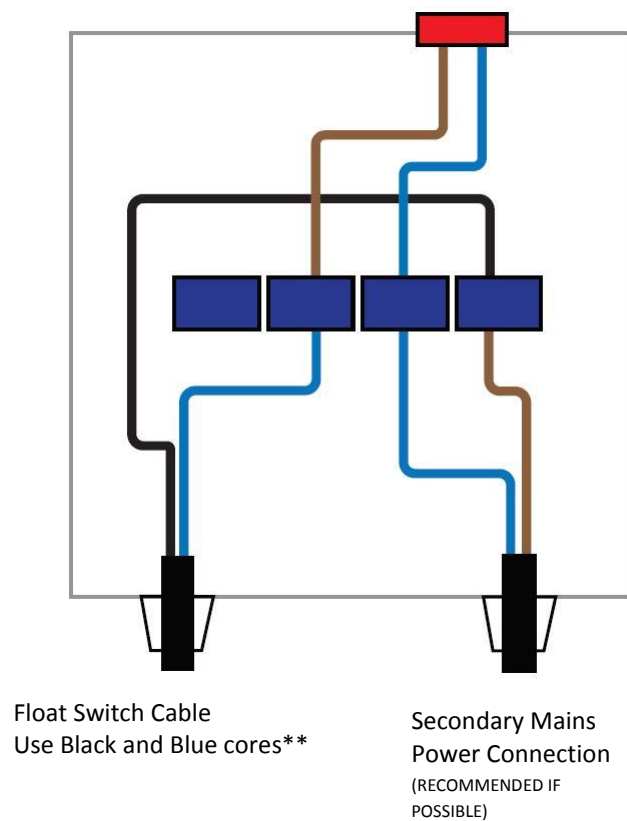


Figure 9: Wiring Connections inside Alarm box (Pumped Outlet Version)

\*\* Use Black and Grey cores with alternate floats

## Operating Instructions

### Process description

The CAP Sewage treatment plant is specifically designed to treat domestic sewage and other biodegradable waste in a simple and compact system comprising three basic stages, namely:

Primary settlement

Biological Filtration

Final settlement

The CAP system utilizes microorganisms growing on the surface of the filter media to breakdown the sewage. It is very important that toxic chemicals such as those listed in the Warranty Section (Page 12) do not enter the system and poison the microorganisms.

Wastewater enters the first of three chambers (as shown in Figure 10 below), the Primary, where settlement takes place with the heaviest solids sinking (primary sludge) and the floating matter rising. These solids are retained and stored in this chamber where anaerobic bacteria, ie, bacteria which do not utilise oxygen, break down the organic matter.

The clarified water is transferred to the aeration chamber where it is mixed with freely moving plastic media elements. The media is made from Polypropylene and provides a large surface area on which the bacteria, required for the purification process, can grow. The media is supported on an open mesh panel fixed above the base of the tank.

Through contact with the bacteria, the organic and nutrient constituents of the water are removed. The chamber is continuously aerated by a fine bubble diffuser which provides the oxygen to nourish the bacteria. The air diffuser is installed below the media filter bed and is connected to the external air supply (blower) by uPVC pipework. The air blower which drives the bubble diffuser is easily accessed for maintenance in the housing atop the plant.

The treated water finally flows through into a smaller final settlement chamber where any sloughed off bacteria or escaping solids are collected.

There is also recirculation pipework (sludge return) connecting the bottom of the final settlement chamber back to the primary settlement chamber. The recirculation flow comes from an airline installed within that pipework. This airline is connected to the main air supply by means of a control tap which ensures the correct balance of flow between the recirculation pipe and the diffuser. This pipework allows the system to recirculate the effluent to prevent stagnation, especially in times of low influent loading.

The final effluent will either flow by gravity through the 4" Water Pipe outlet or will be pumped out through the 50mm MDPE Plain Adaptor connection by a submersible pump (Optional Pumped Outlet version). From here the completely treated water flows to the outlet where it is discharged back into the environment either directly to a water course or through an underground soakaway system

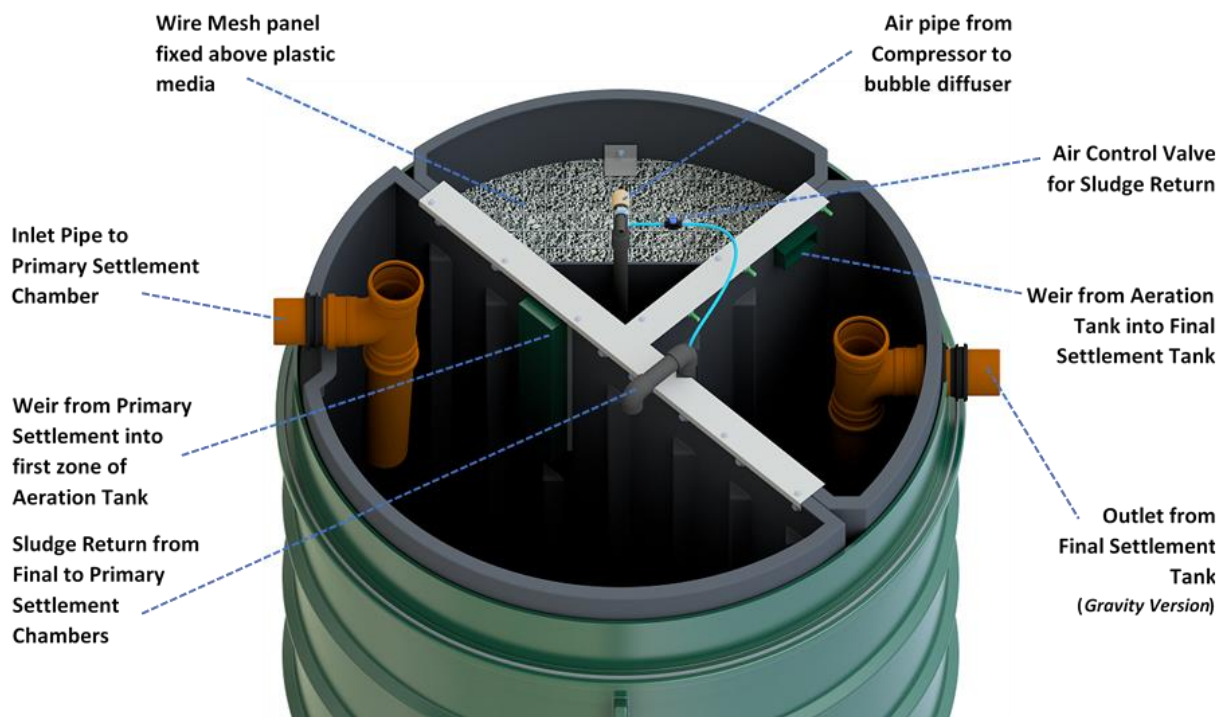


Figure 10: Harlequin CAP Internal Process Description (CAP 6 Gravity model shown)

### Components inside the tank

There are no electro/mechanical moving parts within the standard plant, making the system very reliable and simple to maintain.

The air bubble diffuser in the reactor vessel can be removed by unclipping the fixed solid pipe and extracting through the main access lid. Rodding access is also provided on all pipework as per normal Building Control guidelines for underground drainage.

### Air blower

The air supply is provided by a linear diaphragm type air blower and is used across all Harlequin Wastewater Systems. This style of air blower is proven to be very energy efficient, cool running with a low noise output. This is kept within the external Blower Housing as described above and shown in Figures 4 & 7.

### Plant Start Up

1. Fill the plant with clean water until there is a discharge from the outlet.
2. Check all the airline connections are connected per the installation instructions on Page 8 to ensure air tightness
3. Check the blower ventilation is unobstructed.
4. Turn on the main power supply to the blower unit.
5. Turn the isolator switch inside the External blower housing to the on position. This will start the blower running.
6. It will take a minute or so for the pressure to build up in the system depending on the distance of the blower from the treatment plant.
7. Check that bubbles are breaking the surface in the filter media section of the treatment plant.
8. The flow regulator tap (green) on the airlift recycle is factory set to achieve an effluent return rate of not quite a constant flow. This may need adjustment due to temperature conditions or distance of blower from the treatment plant. NOTE: It will take about a minute between adjustments for a change in flowrate. The desired setting is where the flow only just 'spitting' back. Under no circumstances must this tap be fully open or the flow constant, as this will detrimentally affect the process performance of the treatment plant.
9. If a discharge pump is fitted in the final settlement area, check for operation.
10. Fit the manhole cover and lock if necessary.

The CAP tank is now in an operational state. However, the treatment process relies on the growth of microorganisms on the filter media. The time taken for these naturally occurring organisms to develop is dependent on temperature and may take up to six weeks in winter.

Until the biomass is fully developed, the treatment process will be incomplete. During this time do not allow any strong cleaning agents or bleaches to enter the system.

### Plant Shut Down

Temporary absence of flow to the plant will not be detrimental as the air lift will continue to recycle sewage within the system. However, if the flow of sewage to the plant will be interrupted for more than two months, the following procedure should be completed:

1. Desludge the primary and final settlement tank compartments in accordance with the instructions below.
2. Refill the plant with clean water.
3. Fit the manhole cover and lock if necessary.
4. Stop the blower by turning the isolator switch to off.
5. Switch off the power supply to the blower enclosure.

### Warranty

It is ultimately the customer/house owners' responsibility to ensure that their drainage and sewage treatment system complies with all statutory requirements.

Harlequin Manufacturing cannot guarantee the quality of effluent produced as we cannot control what enters the plant. The warranty policy covers the plant only and does not cover or guarantee an effluent quality. Soakaways, drains and the emptying of primary tanks remain the responsibility of the treatment plant owner.

The plant will have a 2 year extended warranty (if the product is registered with Harlequin) that is valid from the date of sale – this warranty covers the body of the tanks and ancillary equipment (excluding consumables), where a replacement will be delivered to site. This is subject to the tank being installed correctly according to the instructions listed in this guide and the servicing requirements being met.

The warranty does not cover anything before or after the tank i.e. soak away, drainage, venting and it does not cover damage done to the plant by any other product within the system.

If a Harlequin Wastewater Treatment Plant arrives on site damaged, it is to be reported by the end user / installer at the time of delivery/installation.

It is the installer's responsibility to check the plant internally for damage. It is also the installer's responsibility for the electrical supply, safety, connection, suitability and testing non-interference with other electrical systems as well as the ducting, hoses, venting and sealing.

The plant is not designed to have any non-biological waste going into the tank and is not suitable for any waste out with the plants design parameters. If a fault develops with the tank due to unsuitable waste entering the system this is not covered by the warranty agreement.

To ensure that the plant continues to operate efficiently, your attention is drawn to the following points:

DO NOT exceed the maximum design loading of the plant.

DO NOT allow surface water to enter the system.

DO NOT allow high volume discharges such as from swimming pools or Jacuzzis to enter the system.

DO NOT allow large quantities of non-biological waste/chemicals such as water softeners, disinfectants, strong acids or alkalis, oil and grease, pesticides or photographic chemicals to enter the system.

DO NOT use chemical or biological emulsifiers in grease traps.

DO NOT allow fats, oil or grease from catering applications to enter the system.

### Maintenance Schedule:

#### Desludging:

As with any packaged treatment plant, it is extremely important that the CAP is desludged and serviced at the prescribed intervals so that the maximum working life of the components is obtained and that effluent quality does not deteriorate.

It is a requirement of the product warranty that desludging is performed at the required intervals. Proof of desludging, in the form of invoices clearly showing the desludging date, may be required. Failure to carry out regular desludging may affect your Harlequin product warranty. Failure to desludge the system at the appropriate time may cause excessive solids to build up. This could result in solids washout which can pollute water courses or block soakaway systems. Details of the desludging procedure can be found in the Maintenance Schedule.

1: To access the sections of the tank for desludging, the main manhole lid will need to be removed from the tank (see Figure 3 & 5 for images). This lid is held in by 2 screws.

2: Check the primary settlement tank with a probe, the top floating crust blanket should not exceed 200mm thick, arrange desludge if required

3: Desludge the primary and final settlement tanks every 12 months\* and desludge the aeration every 24 months\*. This should be done by an experienced local waste disposal company.

4: The tanker suction hose should be carefully lowered into the primary and final chambers ensuring all settled sludge is removed.

5: When desludging the biozone carefully lower the suction hose down the triangular section where the air diffuser pipework goes down making sure not to damage the pipework. Ensure the hose is down to the base of the tank so that all settled biomass sludge can be removed.

6: Once desludging is complete the plant should be refilled immediately with water (waste or clean) to re-balance internal and external pressures on the plant.

This can be done by using a hosepipe or by running several taps in the household(s).

*\* These are the recommended minimum desludge intervals. On a full load capacity, the values should be halved. Consult your contractor carrying out the work if unsure if desludging intervals are sufficient.*

#### General Checks:

- Check the operation of the blower. If the blower has failed for any reason other than a mains power failure the warning beacon will be flashing.
- Check the operation of the diffusers (bubbles rising in the Biological zone).
- Check the recycle flow into the inlet zone. Look at the liquor being returned, it should run clear by the end of its cycle.
- Check the inlet and outlet stilling zones are clear of debris. (Remove any obstructions).
- Check the blower ventilation is un-obstructed.
- Check the biomass growth on the filter media. The biomass should be a light brown colour, not white or grey. The odour in the plant should be 'earthy'. There should not be a noticeable 'rotten eggs' smell.
- Check the final effluent. If this is cloudy or contains many suspended particles, then the final settlement tank is likely to require desludging.

**Filters:** It is a recommendation that the air blower filter be checked/cleaned/replaced (if necessary) every 3 months, particularly on sites which are prone to dusty conditions. Service kits and instructions for the checking/replacement of a filter are available on request. The warranty on the compressor is subject to the filter quality being maintained.

**Diaphragms:** The working life of the diaphragm depends on the operating conditions and the work environment but for optimal operation, it would be recommended to change both parts every 18 months. Diaphragms kits and instructions are available on request.

**Valve Boxes:** It is recommended by the manufacturer that these covers are replaced every three years to maintain optimum performance.

#### 24-monthly intervals

A full service on the plant should be performed. The service should ensure that all aspects of the system are functioning correctly.

Particular areas of detail include:

- Checking all chambers for damage
- Checking the full air system including the air blower and diffusers
- Checking lid seals and air blower chamber
- Checking ventilation system
- Checking electrical connections at the plant.

## HARLEQUIN CAP INSTALLATION AND OPERATING INSTRUCTIONS

### GENERAL FAULT FINDING GUIDE

Symptom	Cause	Action (all work must be performed by a specialized company)
Strong smell	Blocked or damaged air diffuser	Remove the diffuser; clean or replace if necessary
	Blocked or damaged air hose	Change the damaged hose, unblock it if necessary
	Kinks/bends in the air hose	Change damaged air hose
	Air escaping from joints	Check connections and tighten them if necessary
	The joints of the pipes are damaged	Check and replace the seals if necessary
	The air diffuser is no longer at the bottom of the tank	Re-Install the diffuser at the bottom of the tank, replace the weight if necessary
	High sludge level	Arrange a desludging of the tank
	The diaphragm of the compressor is damaged	Replace the diaphragm
Poor quality effluent	The air diffuser is clogged or torn	Remove the diffuser; clean or replace if necessary
	Blocked or damaged air hose	Change the damaged hose, unblock it if necessary
	Kinks/bends in the air hose	Change damaged air hose
	Air escaping from joints	Check connections and tighten them if necessary
	There is an organic overload because of the use of garbage grinders	Compost biological wastes
	High sludge level	Arrange a desludging of the tank
	There is no power supply	Check power
	The diaphragm of the compressor is damaged	Replace the diaphragm
Treated water contains large amounts of solids	High sludge level	Arrange a desludging of the tank
	Excessive use of the washing machine	Minimise continuous use of equipment that will dispose to the tank
Fat build up within the tank	Excessive use of the washing machine	Minimise continuous use of equipment that will dispose to the tank
	Excessive fatty components coming to tank through waste streams	Separate fatty waste streams and minimise amounts going to tank
	The air diffuser is clogged or torn	Remove the diffuser; clean or replace if necessary
	Blocked or damaged air hose	Change the damaged hose, unblock it if necessary
	Kinks/bends in the air hose	Change damaged air hose
	Air escaping from joints	Check connections and tighten them if necessary
High water level (above the pipes)	Blockage in the pipes	Clean all pipes (Inlet, outlet and inside the tank where possible)
Compressor warning	Issue with the compressor	Check the power supply, the diaphragm and air filter. Replace/repair if necessary
There is no recirculation flow from the final settlement tank	Issue with the compressor	As above
	Recirculation pipework is blocked	Use a wooden pole to agitate any sludge which has settled around the bottom of the recirculation pipework in the final settlement tank. If there is a substantial level of sludge, then arrange a service
	The air control jet is blocked	Remove and clean the jet. In cleaning the jet ensure the orifice is not enlarged.
Higher Noise Levels	Issue with the compressor	Ensure that the perforated metal straps holding the unit down within the external compressor housing have been removed

EN 12566-3 CERTIFICATION:



## TREATMENT PERFORMANCE RESULTS

**Clenviro Ltd.**  
 Unit 1C, Queensway Business Park, Telford, Shropshire, TF1 7UL, UK

**EN 12566-3 Annex B**  
 Results corresponding to EN 12566-3 and S.R. 66  
 PIA-SR66-1606-1067

**Small wastewater treatment system MATRIX CLF**  
 Submerged fixed film process (initial type test) in combination with  
 Harlequin tank

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Nominal organic daily load	0.34 kg/d		
Nominal hydraulic daily load	1.20 m <sup>3</sup> /d		
Treatment efficiency (nominal sequences)	Efficiency	Effluent	
	COD	91.4 %	56 mg/l
	BOD <sub>5</sub>	96.2 %	11 mg/l
	NH <sub>4</sub> -N	83.3 %	5.9 mg/l
	SS	95.5 %	16 mg/l
Number of desludging	Not more than once		
Electrical consumption	1.4 kWh/d		

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Performance tested by:

**PIA – Prüfinstitut für Abwassertechnik GmbH**  
 (PIA GmbH)  
 Hergenrather Weg 30  
 52074 Aachen, Germany

This document replaces neither the declaration of performance nor the CE marking.

  
Notified Body  
No.: 1739

  
Certified according to  
ISO 9001:2008

  
IAC-MRA

  
Deutsche  
Akreditierungsstelle  
D-PL-17712-01-00

  
geprüft - tested - teste

Elmar Lancé      October 2016



## TREATMENT PERFORMANCE RESULTS

### Harlequin Manufacturing Ltd.

21 Clarehill Road, BT670PB, Moira, County Armagh, United Kingdom

### EN 12566-3 Annex A, C

Results corresponding to EN 12566-3 and S.R. 66

PIA-SR66-1606-1067

### CAP 6

Polyethylene tank for submerged fixed film in combination with Clenviro Ltd. treatment kit

Material	Polyethylene
Watertightness	Pass
Structural behaviour (pit test)	Pass (also wet conditions)
Durability	Pass

Performance tested by:

### PIA – Prüfinstitut für Abwassertechnik GmbH

(PIA GmbH)

Hergenrather Weg 30

52074 Aachen, Germany

This document replaces neither the declaration of performance nor the CE marking.



Notified Body  
No.: 1735



Certified according to  
ISO 9001:2008



Deutsche  
Akreditierungsstelle  
D-PL-17732-01-00



Elmar Lancé

October 2016



## HARLEQUIN CAP INSTALLATION AND OPERATING INSTRUCTIONS

**SERVICE HISTORY:**

<b>Service Date</b>	<b>Maintenance Details</b> (Service/call out/de-sludge)	<b>Signature</b> (with Company name)

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