



Balmoral HydroClearTM

Sewage treatment plant

Installation and operating instructions

CE

An environmental asset



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Balmoral HydroClear key data

Figure 1
Balmoral HydroClear 6pop



Figure 2
Balmoral HydroClear 12pop



Figure 3
Balmoral HydroClear 20pop



Figure 4
Balmoral HydroClear 30pop



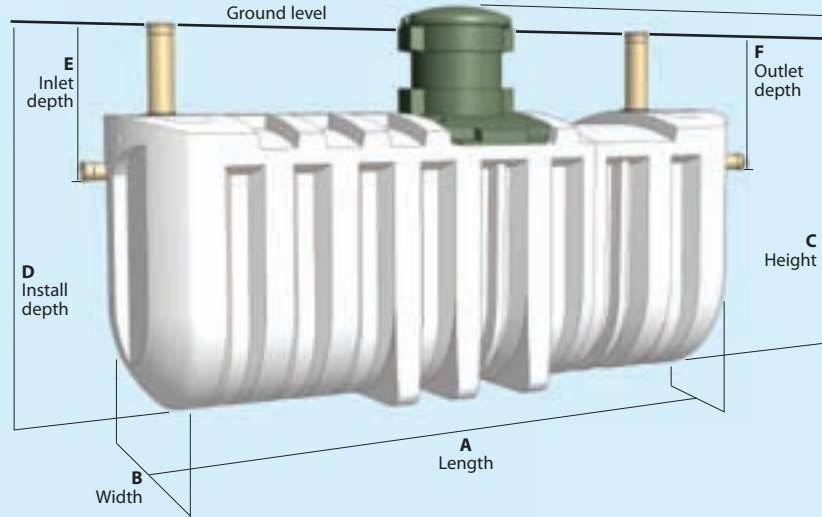
Figure 5
Balmoral HydroClear 40pop



Figure 6
Balmoral HydroClear 50pop



Key dimensions



Key dimensions

Tank pop size	Total Capacities	Tank 1						Tank 2						Tank 3						
		A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	
		Length	Width	Height	Install depth	Inlet depth	Outlet depth	Length	Width	Height	Install depth	Inlet depth	Outlet depth	Length	Width	Height	Install depth	Inlet depth	Outlet depth	
6 pop	4400	3400	1250	2635	2450	1000	1050													
12 pop	5950	4500	1400	2635	2450	1000	1050													
20 pop	7960	5680	1400	2635	2450	1000	1050													
30 pop	11410	4500	1400	2635	2450	1000	1050	4500	1400	2635	2450	1050	1050							
40 pop	14920	4500	1400	2635	2450	1000	1050	5680	1400	2635	2450	1050	1050							
50 pop	18400	5680	1400	2635	2450	1000	1050	4500	1400	2635	2450	1050	1050	3400	1250	2635	2450	1050	1050	

General information

Introduction

It is strongly recommended that you read all sections of this manual before installing and operating your new Balmoral HydroClear. Some installation and operation requirements are specific to Balmoral 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. In addition, the following requirements must be met:

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

The Balmoral HydroClear 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).

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. 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.

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.

Balmoral After Sales

Balmoral After Sales offers advice covering all aspects of maintenance on the company's environmental product range. Services are available to suit your requirements from commissioning and annual maintenance contracts to ongoing support and advice through approved service companies.

- National coverage
- Fully qualified and experienced staff
- Advice and support on installation and maintenance
- Advice and support on environmental and local authority guidelines and legislation.

Advisory service, product registration and maintenance contracts

For technical advice, to register your product or to arrange a visit by one of Balmoral's representatives or service engineers, please contact Balmoral Site Services: Tel +44 (0)1224 859000 Fax +44 (0)1224 859123 Email siteservices@balmoral.co.uk

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.

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
- Building Control Regulations 2000, part H Drainage and Waste Disposal, 2002 edition
- British Water Flows and Loads – 3, Code of Practice

Relevant British design and testing standards

- BS EN 12566-3:2005
- BS 6297:2007

Tank sizes and construction

The Balmoral HydroClear is produced in six sizes - 6, 12, 20, 30, 40 & 50 populations - and are rotationally moulded in tough polyethylene which offers a very high level of impact resistance.

Tank design features

The tanks have moulded-in lifting slots for use during handling and installation. *NB: only to be used when the tank is empty.*

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.

Invert depths

The standard HydroClear is designed to cater for drain invert depths of 1000mm. The invert depth can be reduced to 750mm. Turret extensions are also available to increase the invert depth where ground conditions are suitable. See installation instructions on page 4.

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). Refer to product drawings supplied with your unit for specific weights and dimensions.

Plant siting

Wastewater treatment plants serving single dwellings should be sited a minimum of 15m from any habitable buildings and as far away as possible. This should be increased to a minimum of 25m if serving more than one building. 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 venting system (see 'ventilation' on page 6) and the plant has been correctly sized and installed as per Balmoral recommended guidelines and the system has been properly maintained.

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

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qualified specialist consultant who should be covered with professional indemnity insurance.

Superimposed loads/protected areas

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

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.

Balmoral 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 invert depth of each plant must not be exceeded unless the specific ground condition checks have been made and the installation appropriately modified. Installation for this situation must follow the Wet ground installation procedure. Failure to adhere to these design parameters may cause severe structural damage to the tank and will render any warranty null and void. Invert depths may also be reduced to a minimum of 750mm. This can be achieved onsite by cutting and dropping the turrets. Full instructions on fitment and installation modifications are available.

'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/mm²) 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(s) onto the dried concrete and check it is true and level using a spirit level.

Fill the tank(s) to approximately 450mm water depth selecting specific product method as explained below:

6 population unit (HC6)

The tank may be filled either through the inlet pipe or directly into the large central primary chamber through either of the access turrets. From here all other chambers will naturally equalise.

12-50 population units (HC12-50)

Ensure that all compartments within the tank(s) have been filled to the required level through the access turrets. This will ensure that the full length of the tank is correctly weighted. The order in which the chambers are filled is not crucial.

Next, place and consolidate additional concrete carefully under the lower radii of the tank(s). This will ensure they are correctly supported once installed. *Do not use a vibrating poker.*

Continue to fill the tank with water 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.

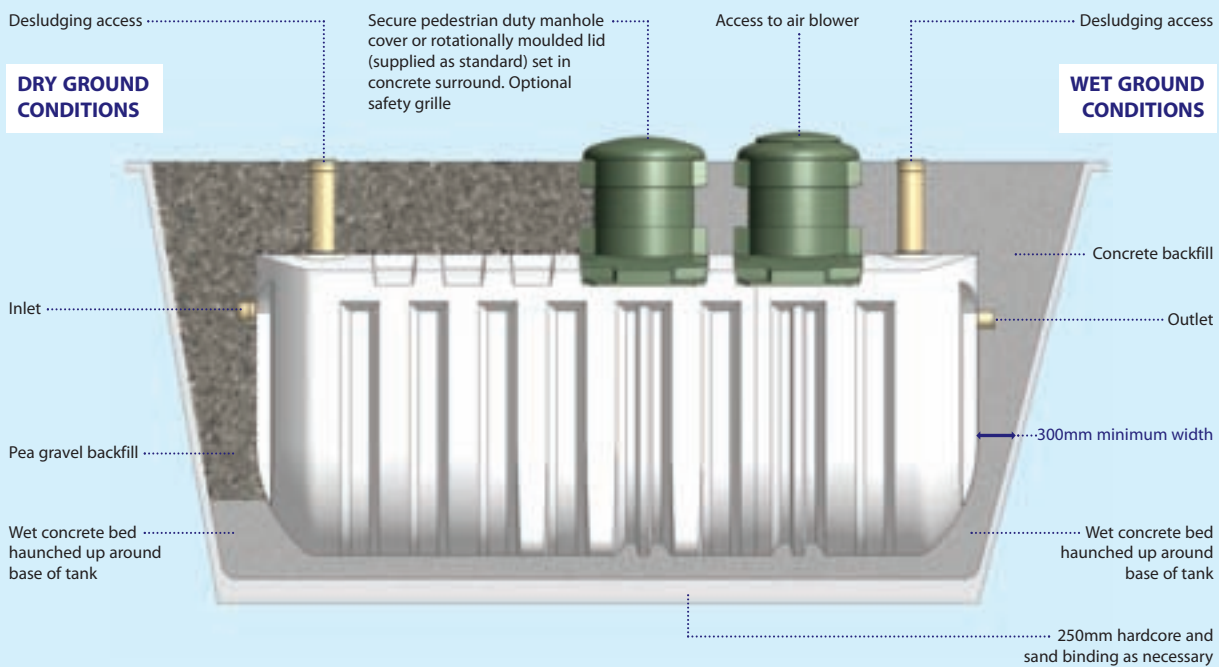


Figure 7 - Typical installation
Dry and wet ground conditions

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.

Electrical power requirements

Power requirement is single phase 240V, through a 3-core steel wired armoured (SWA) cable. Refer to the product drawings supplied with your unit for location of the air blower housing unit and specific power ratings to size the electrical cable.

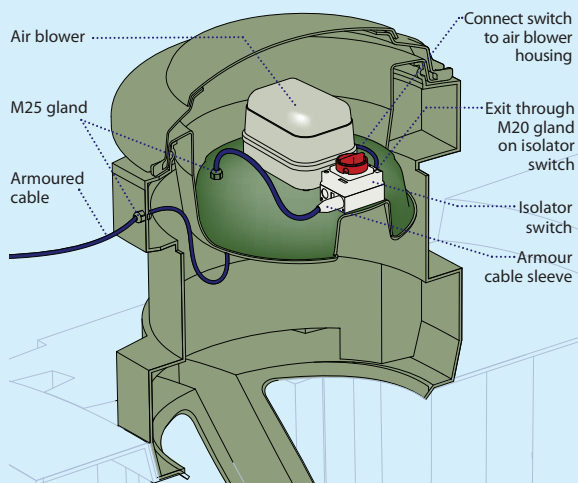
Remove the air blower housing from the turret and feed the SWA cable into the tank through the gland connection in the turret. Pull through sufficient slack, approx 750mm, into the tank and route the cable through the base of the air blower housing via the gland connection. Cable slack is required to facilitate removal of the lid.

Inside the air blower housing

Remove the four screws securing the top of the air blower housing to access the internals. The SWA supply should be wired into the supplied rotary switch using the gland package supplied. Remove the plug on the end of the air blower cable (if fitted) and wire into the output side of the rotary switch using the gland provided. Secure the switch to the air blower housing, positioning it next to the air blower using two screws and close the switch housing.

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

Figure 8
Inside the air blower turret



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

'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 1.2m from the base of the tank(s). Failure to follow the guidance instructions during installation may render the warranty null and void.

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In poor soil conditions it is essential to make substantial provision for planking, strutting and temporary shuttering. Adequate pumps should be provided to keep the excavation free from ground water at all times during the course of 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

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

Place wet concrete (slump test 30mm, strength 25N/mm²) 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(s) onto the concrete and check it is true and level using a spirit level.

Fill the tank(s) to approximately 450mm water depth selecting product specific method as below.

6 population unit (HC6)

The tank may be filled either through the inlet pipe or directly into the large central primary chamber through either of the access turrets. From here all other chambers will naturally equalise.

12-50 population units (HC12-50)

Ensure that all compartments within the tank(s) have been filled to the required level through the access turrets. This will ensure that the full length of the tank is correctly weighted. The order in which the chambers are filled is not crucial.

Next, place and consolidate additional concrete carefully under the lower radii of the tank(s). This will ensure they are correctly supported once installed. *Do not use a vibrating poker.*

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 400mm higher than that of the concrete backfill.

Fill the tank with water until it reaches the height of the outlet pipe and bring the concrete level up to within 400mm of this

level. 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.

Electrical power requirements

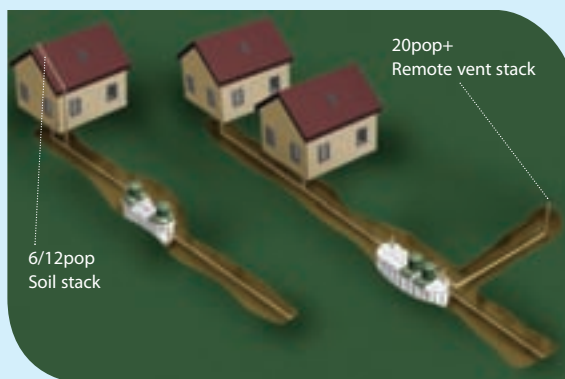
Refer to 'Electrical power requirements' and 'Inside the air blower housing' information on page 5.

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 a single or double dwelling (6 or 12 POP), 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 eve 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.

On larger population systems (20 POP+), a remote vent stack should be installed, terminating in an appropriate location. This is connected into the remote vent connection position on the vessel turret using the supplied 110mm grommet connection. The remote vent must be positioned at a suitable distance and height from any surrounding dwellings to allow dispersal of air from the system. Consideration should be given to the prevailing wind and any local site geography that might inhibit air dispersion. If in doubt as to the installation of an appropriate vent, please contact Balmoral Tanks for advice.

Figure 9
Ventilation



Operating instructions

Process description

Wastewater enters the first of three chambers, the Primary, where settlement takes place with the heaviest solids sinking 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 elements support large bacterial populations over their surfaces which are mixed with the water in the chamber. 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 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. 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.

Operating principle and features

The Balmoral HydroClear is a biological aeration treatment plant designed to produce high effluent quality in addition to overcoming several common problems associated with small domestic sewage treatment units:

Common sewage treatment problems include:

- Systems which use a fixed media block or discs can suffer from media blockage due to excessive bacterial growth. This can lead to channelling and may require replacement or cleaning of the media material at regular intervals
- Mechanical and electrical components within tanks can suffer from corrosion and reliability problems requiring regular maintenance to maintain operation
- The liquor is not spread evenly over the available bacteria and there is inadequate oxygen supply.

The Balmoral HydroClear overcomes these problems because:

- There is no "fixed" media within the system to become blocked. It operates using mobile media which cannot block as they are not static, their interactions also control over growth of bacteria
- There are no mechanical moving parts or electrical components within the tank. All functions are operated by air power generated by an air blower housed in the manhole cover. This allows safe and easy maintenance
- The bacteria receive a high quality air supply and are mixed and aerated by the high volume fine bubble diffuser.

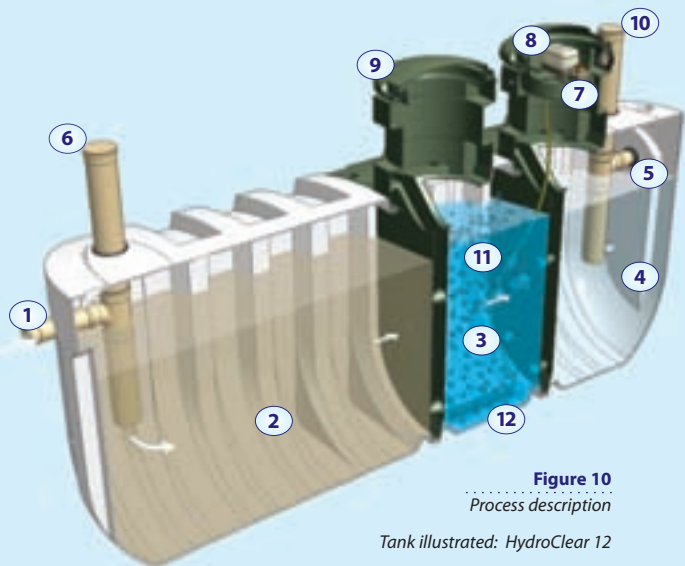


Figure 10
Process description

Tank illustrated: HydroClear 12

Process description key

1	: 110-160mm inlet depending on model
2	: Primary settlement chamber
3	: Aeration chamber
4	: Final settlement chamber
5	: 110-160mm outlet depending on model
6	: 160mm capped lid: desludge point
7	: Electrical isolator switch
8	: Air blower with warning system (240V)
9	: 600mm manway lid: bolted down and sealed
10	: 160mm capped lid: desludge point
11	: Bio media
12	: Bubble diffuser

Components inside the tank

There are no electro/mechanical moving parts within the plant, making the system very reliable and simple to maintain. The air bubble diffuser in the reactor vessel can be extracted through the main access turret using the rope provided. 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 HydroClear models. This style of air blower is proven to be very energy efficient, cool running with a low noise output.

Air blower chamber

The air blower is contained in a moulded polyethylene chamber which sits atop the plant. This chamber is integrated into the vessel turret and also forms a low profile pedestrian cover. Easy access is provided to the air blower for maintenance by removing the top chamber cover only. There is no need to open the main plant access lid.

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Key design benefits:

- Integrated lifting eyes assist with handling and installation
- Engineered base provides stability, ease of handling and efficient storage
- Fully lockable pedestrian duty manhole cover complies with statutory regulations
- Mechanically reliable with no moving parts or electrics within tank
- Impact resistant body moulded in one-piece corrosion resistant, fully recyclable polyethylene
- Easy access to bubble diffuser and air blower components.

Plant selection

The tank selection table below indicates plant sizes to suit population requirements:

Plant selection table

Tank	Population served	Max flow loading per day (L)
HydroClear 6	1 - 6 people	1200
HydroClear 12	7-12 people	2000
HydroClear 20	13-20 people	4000
HydroClear 30	21-30 people	6000
HydroClear 40	31-40 people	8000
HydroClear 50	41-50 people	10000

*NB: Inlet and outlet pipework 110mm dia (6, 12 and 20 pop) and 160mm dia (30 pop+).
The Balmoral HydroClear is designed for domestic use and is unsuitable for industrial purposes.*

Commissioning

Balmoral Hydroclear is supplied with a 12 month warranty subject to the correct installation, operation and maintenance of the plant. Commissioning is not a requirement to activate the warranty, although a chargeable 'piece of mind' commissioning visit is available if desired. See Balmoral Wastewater Treatment Warranty Policy document for further details.

If a 'piece of mind' commissioning is scheduled the plant must be in the following condition in order to enable the commissioning to be performed. If the plant is not prepared as the instructions below, the commissioning will not be able to be completed and a charge may be made for a re-visit.

- Plant fully installed as per these instructions
- Plant full of clean water
- Plant power supply to be in a dry condition throughout and fully installed by a qualified electrician
- Free and safe access to the site and plant
- Presence of a 'responsible' person with the authority to sign and accept the results of the commissioning visit

Any faults, errors or omissions found during the commissioning visit will be brought to the customers attention at this time

Servicing and desludging

As with any packaged treatment plant, it is extremely important that the HydroClear 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.

Servicing and desludging should be carried out in accordance with the information below depending on the size of the plant.

Servicing (All models)**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 - replace airblower diaphragms
- Checking lid seals and air blower chamber
- Checking ventilation system
- Checking electrical connections at the plant.

It is a recommendation that the air blower filter be checked more frequently on sites which are prone to dusty conditions. This can be performed by following the instructions supplied with the air blower.

It is a requirement of the product warranty that servicing is performed at the recommended intervals. Proof of servicing, in the form of invoices clearly showing the servicing date, may be required. Failure to carry out regular servicing may affect your Balmoral product warranty.

Service call-outs and service kits are available from Balmoral Tanks. Maintenance contracts are also available on request to ensure you meet your full servicing requirements.

Desludging

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 Balmoral 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.

Please refer to the specific product drawings supplied with your unit for the location of the desludge points. In all cases both the primary and final settlement chambers must be emptied. This should be performed in this order to avoid excess transfer of solids through the aeration chamber.


NB: It is important not to desludge the aeration chamber which contains the active bacteria affixed to the media.

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.

Desludging intervals

HC 6	- 12 months
HC 12	- 9 months
HC 20, 30, 40 & 50	- 6 months

The desludging interval may be extended on sites where lower solid concentrations exist. A sludge gauge is included to measure sludge levels in the tank(s) and to maximise desludging intervals. Contact Balmoral Tanks for further information.

	"Balmoral HydroClear™ sewage treatment plant"	
	Nominal hydraulic daily load:	1.20-10m ³ /d
	Material:	Polyethylene
Balmoral Tanks Ltd Balmoral Park, Loirston, Aberdeen AB12 3GY 09 EN 12566-3	Watertightness (water test): pass Crushing resistance: pass Treatment efficiency (nominal sequences):	COD 91.2% BOD 96.6% SS 94.7% NH ₄ -N 85.8%
	Electrical consumption (6pop):	1.8 kWh/d

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