Harlequin®
MANUFACTURING FOR TOMORROW

PUMP STATIONS

INSTALLATION AND OPERATING INSTRUCTIONS

An environmental asset

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Contents

	Page
Pump Station Overview	3-4
Introduction	5-6
Design Features and Dimensions	6-8
Storage and Handling	9
Plant Siting	9
Installation Instructions	10
Pump Specification	11
Control Panels/Alarms	11
Operating Instructions	13
Maintenance and Warranty	13
Installation checklist	14
Fault Finding	15
Appendices	16

Harlequin Pump Station Overview:

Figure 1: 450L Pump Station Mini

Figure 2: 800LT Pump Station

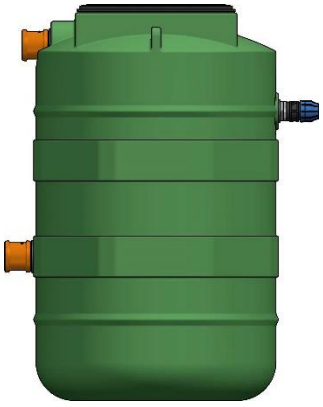

Figure 3: 1100LT Pump Station

Figure 4: 1550LT Pump Station

Figure 5: 3200LT Pump Station

System	PE.	Install Depth	Width	Total Cap.	Single Pump	Twin Pump	Water/ Effluent	Sewage	Grinder
450L Mini	N/A	1700MM	Ø 600MM	450LT	●		●	●	
800LT Pump Station	5 PE.	1225MM	Ø 1000MM	820LT	●	●	●	●	●
1100LT Pump Station	7 PE.	1645MM	Ø 1000MM	1140LT	●	●	●	●	●
1550LT Pump Station	10 PE.	1625MM	Ø 1200MM	1605LT	●	●	●	●	●
3200LT Pump Station	21 PE.	3205MM	Ø 1200MM	3340LT	●	●	●	●	●

Single Pump Systems

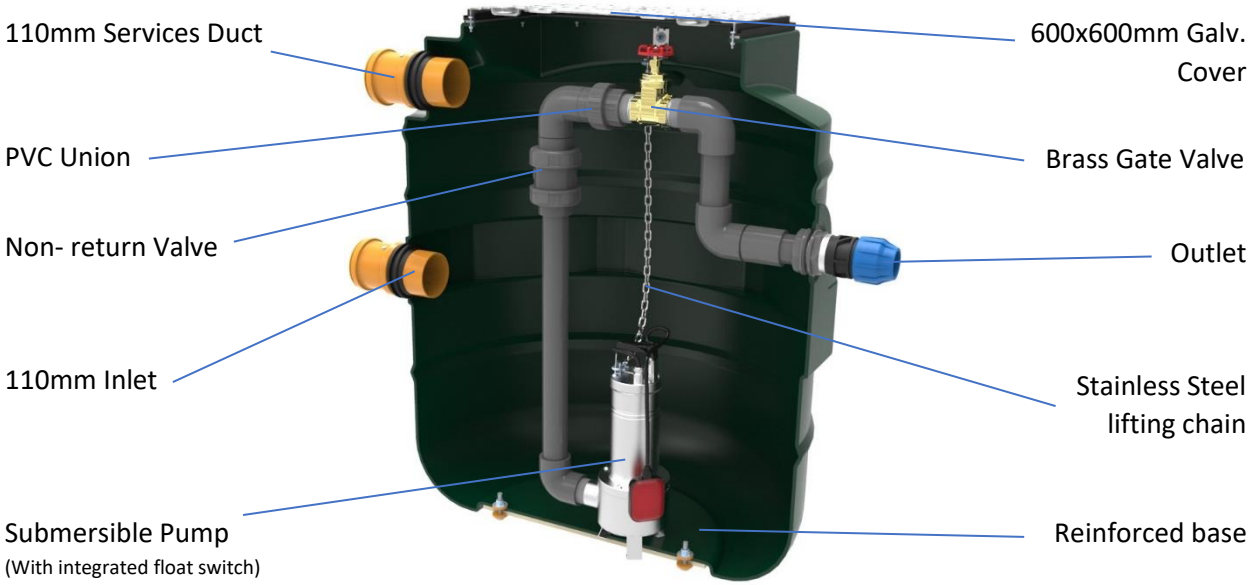

Figure 6: 800LT Pump Station (Model 800PSV1)

Twin Pump Systems

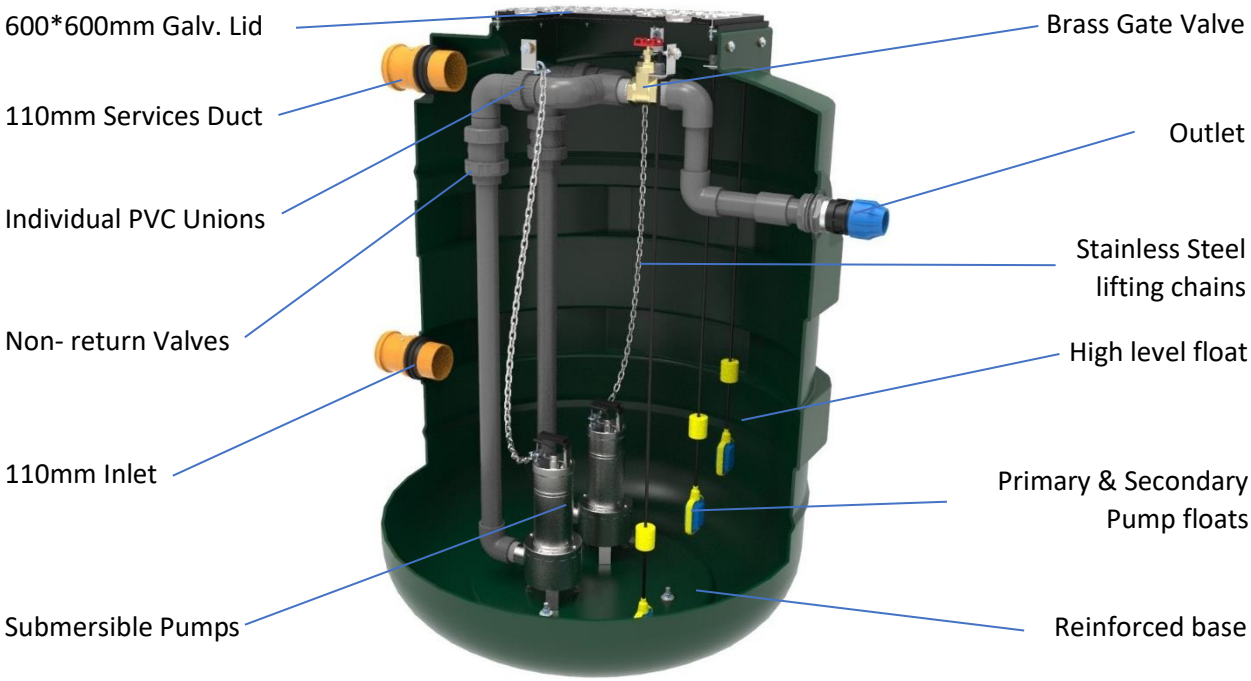

Figure 7: 1100LT Twin Pump Station (Model 1100PSV2)

Introduction

General Information

It is strongly recommended that you read all sections of this manual before installing and operating your new Harlequin Pump Station. Some installation and operation requirements are specific to Pump Station 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 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 tank must be installed, operated and maintained in accordance with the requirements of this document***

Harlequin Pumps Stations are designed to collect and pump effluent, treated wastewater or wastewater where gravity drainage is not possible. When the pump is activated the contents are then discharged to a higher-level point such as a sewer or drainage field.

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 Pump Station. 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
- Where applicable control panel or alarm housings should always be kept closed when in operation
- The manhole covers should never be removed and left unattended, even during service visits
- The control panel or alarm housings 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 always be worn 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 Pump Station products are listed from Page 13 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 Pump Stations.

Publicly available guidance documentation

- The Environmental Permitting (England and Wales) Regulations 2016
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011
- 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

- BS EN 12050
- BS EN 12056-4
- BS EN 752-6

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.

Harlequin Mini Pump Station:

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

Tank sizes and construction

The Harlequin Pump Station is produced in five sizes – 450 Litres (Mini), 800 Litres, 1100 Litres, 1550 Litres and 3200 Litres - and are rotationally moulded in tough polyethylene which offers a very high level of impact resistance.

All Pump Stations ranging from 800 Litres – 3200 Litres are available in single or twin pump configurations for rainwater, effluent or sewage. Mini Pump Stations are only available as single pump systems. All pumps are supplied with lifting chains and heavy-duty grinder pumps are fitted onto guiderails as standard.

See below for tank dimensions for each Harlequin Pump Station:

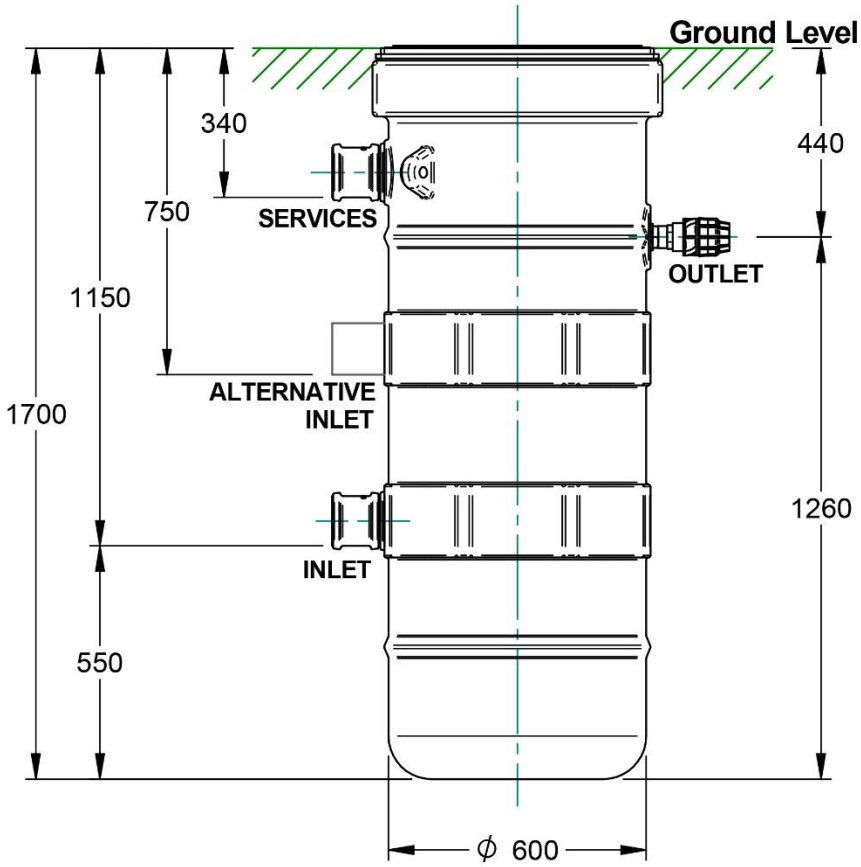

Figure 8: Mini Pump Station dimensions

Harlequin 800 Litre Pump Station:

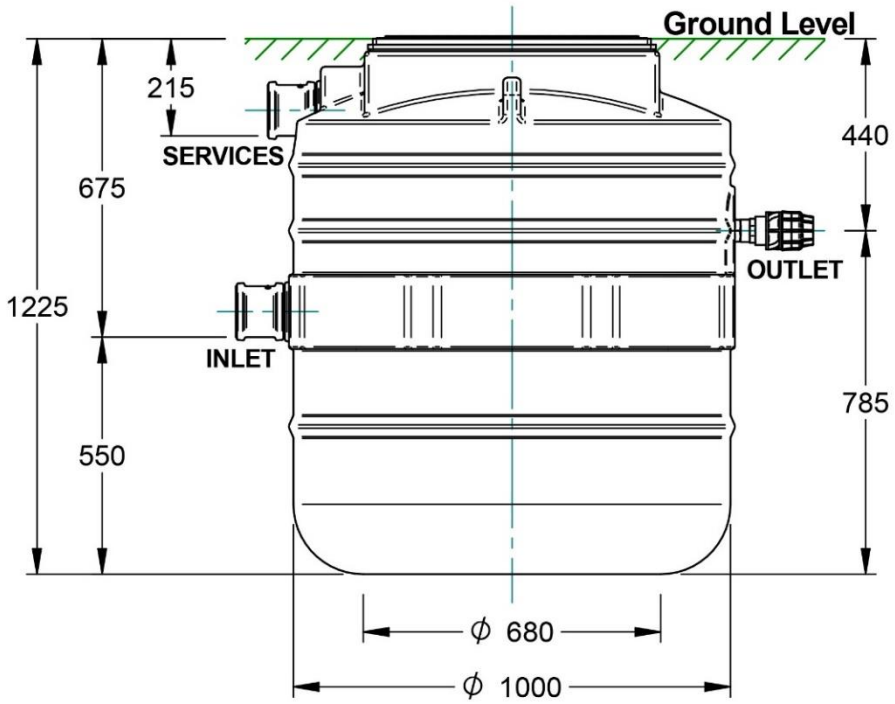

Figure 9: 800LT Pump Station dimensions

Harlequin 1100 Litre Pump Station:

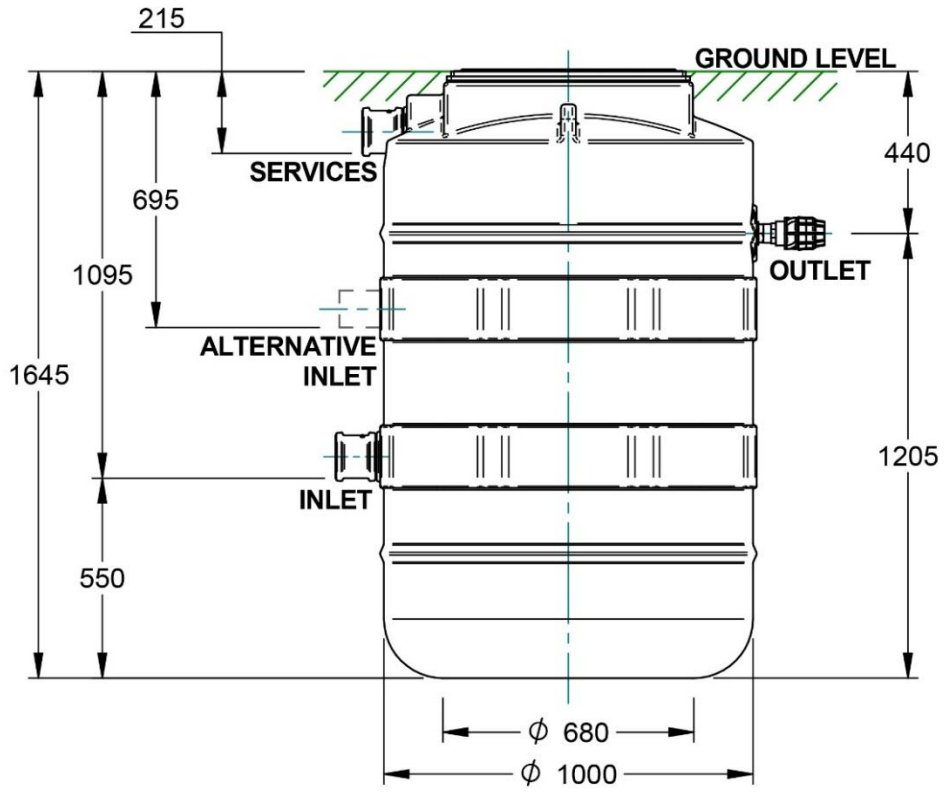

Figure 10: 1100LT Pump Station dimensions

Harlequin 1550 Litre Pump Station:

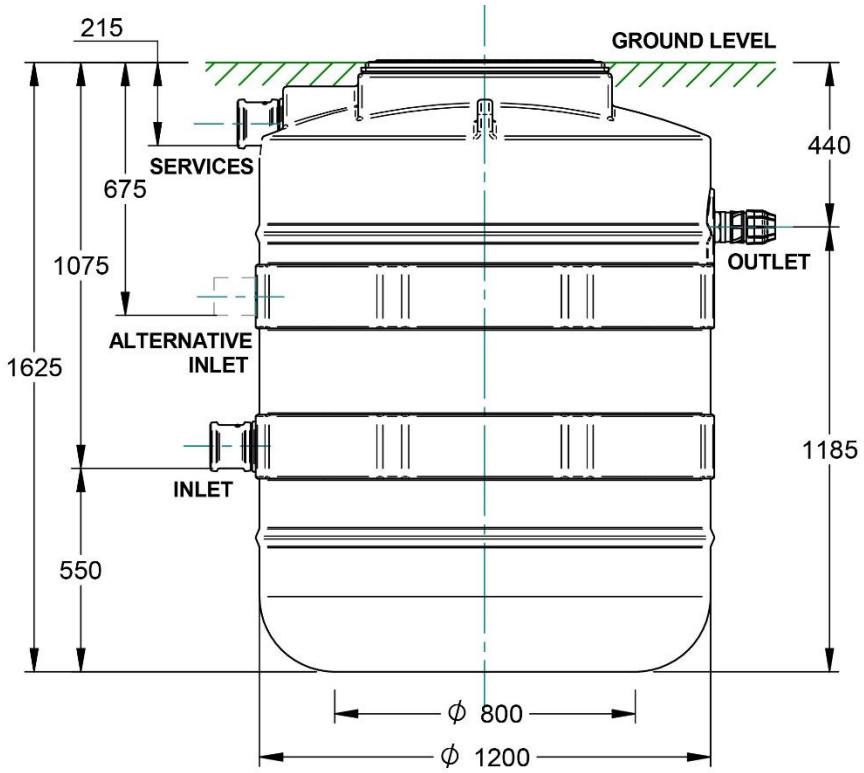

Figure 11: 1550LT Pump Station dimensions

Harlequin 3200 Litre Pump Station:

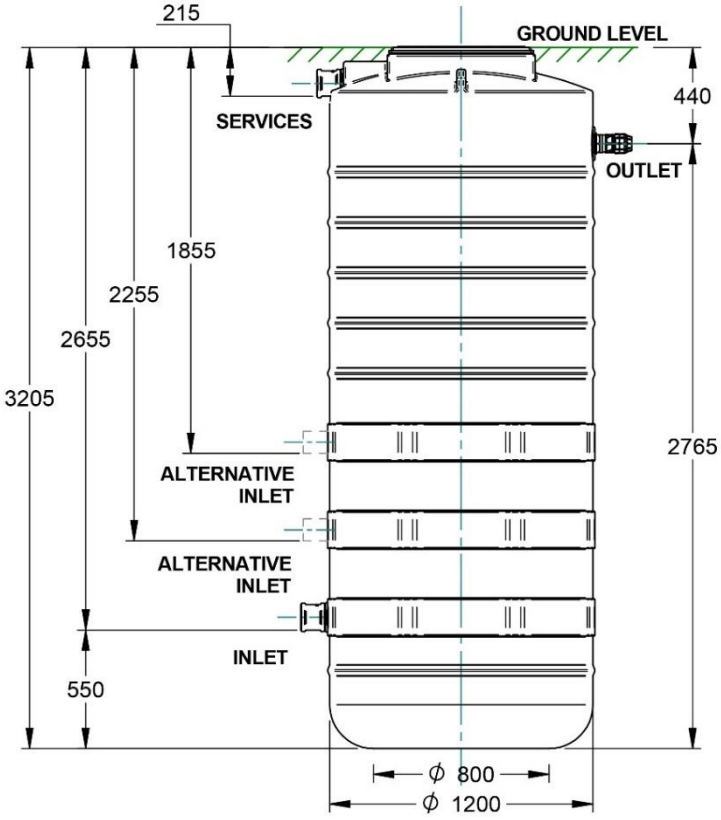

Figure 12: 3200LT Pump Station dimensions

Storage and Handling

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.

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 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

The discharge from a Pumpstation should be sited a minimum of 10m from any watercourses or other buildings (not applicable when discharging direct to a sewer system). The distance of the plant from properties may vary from area to area but attention should be paid to the invert on the tank, the subsequent drain gradient on the inlet pipework and the potential of superimposed loads. 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 during maintenance for example. 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 13) 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, hardcore, etc.

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 drainage field, attention is drawn to the minimum recommended distances to other buildings and sources of water which may affect your plant location:

- Drainage Field from habitable dwelling = 15m
- Drainage Field from water course = 10m
- Drainage Field from well/drinking water source = 50m

Superimposed loads/protected areas

Harlequin 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.

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 Manufacturing 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.

Drain gradients

Drain gradients to the Pumpstation should be 1:40, although 1:80 can sometimes be permitted with approval of Building Control Officer. The gradient of pipes within a drainage field, if applicable, must be <1:200. 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 drainage fields

A soil percolation test should be carried out over the proposed drainage field 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.

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

Installation of all Harlequin Pump Stations require 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. Figure 13 (see below) highlights a typical installation of a Harlequin Pump Station and the installation measurements which are required. Failure to follow the guidance instructions during installation may render the warranty null and void.

Place wet concrete (slump test 30mm, strength 25N/mm2) in base of the excavation (above any hardcore – where required) to a depth of 150mm, grade and level to within 20mm. The concrete must extend a minimum of 300mm all around 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.

Connect the inlet pipework and then fill the tank to a minimum of 600mm water depth (or to max fill level of the outlet pipe). Next, place and consolidate additional concrete carefully under the lower radii of the tank. This will ensure they are correctly supported once installed. Do not use a vibrating poker.

Continue to fill the tank with water (if not already at maximum level) 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 higher level than that of the concrete backfill.

Fill the tank with water (if not already) until it reaches the height of the outlet pipe and bring the concrete level up to within 200mm 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 outlet/service pipes to the tank and continue to backfill with concrete, covering the top body of the tank to within 50mm of ground level

Modifying the tank invert depth

Harlequin recommends that the tanks are always installed to ground level and that the maximum invert will be dependent on the tank size. It is possible to decrease the invert (excluding the 800L version) by using the alternate Inlet position, but this is dependent on the individual models. See Figures 8 to 12 for schematics of the tanks highlighting the alternate Inlet positions.

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

Electrical power requirements

Power requirement is single phase 240V, through a 3-core steel wired armoured (SWA) cable. Refer to the Control Panel or Pump instructions 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.

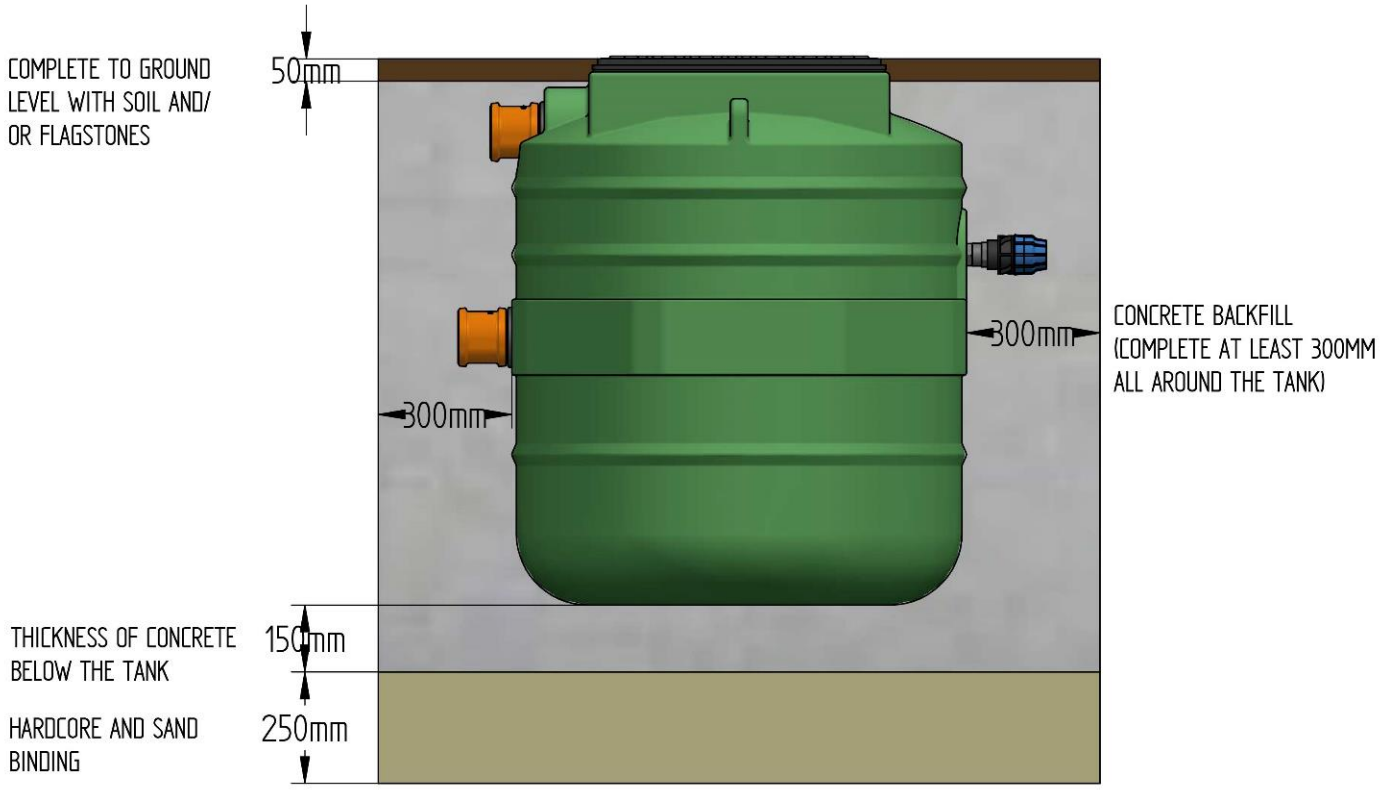

Figure 13: Typical Pump Station Concrete Backfill Installation

Pump Specification

Harlequin Pump stations are fitted with a submersible pump and are available in single or twin pump configurations for rainwater, effluent or sewage. All pumps are connected to a lifting chain and grinder pumps are fitted with an additional guide rail. Your new Pump Station will have either a 1.25" (50mm MDPE Adaptoror 2" outlet depending on the pump you require:

Single Pumps

Grinder Pumps

Pump Station models ranging from 800 Litres to 3200 Litres are all available in grinder pump configurations. As standard Grinder pumps come fitted with a 2" quick discharge coupler and stainless-steel guide rails and lifting chains.

Pump	1.5" Outlet	2" Outlet
Water/Effluent	●	
Sewage (Vortex)		●
Grinder		●

Twin Pump Systems

Harlequin Pump Station models ranging from 800 Litres to 3200 Litres are available in twin pump systems. Each twin pump system is supplied with three separate float switches which operate the submersible pumps:

1. Pumps Off switch
2. Duty pump on switch
3. Alarm on

Figure 14: 1550LT Twin Pump Station (Model 1550PSV2)

As the water level rises in the tank body, the float will rise above the pump handle and activate the pump. The pump will then switch off when the water level drops again. The high-level floats are attached to a bracket on the top of the main body of the tank which are connected to the submersible pumps. This switch activates the alarm in the control panel and is designed to only be triggered when the water level rises towards the top of the tank (failure of the pump). If the alarm activates while the pump is operating, the float has been installed too low.

Twin Pump systems are designed to operate by alternating the two pumps. Once a pump cycle is complete the other pump then becomes the duty pump, this remains the case until the float is activated again. If the duty pump fails for any reason the standby pump will then become the duty pump.

During transport, all float switches are attached around the top of the tank underneath the manhole lid by cable ties, these will need installed after shipping.

Please check the operation of all floats when installing.

Control Panel/Alarms

High Level Alarms (as per Fig 15 below) can be supplied as optional extras for Single Pump Pumpstations and come as standard on all Twin stations. When factory fitted, a single high-level float will be attached inside the tank. The excess cable can be brought out the service duct and connected to the Alarm box as below.

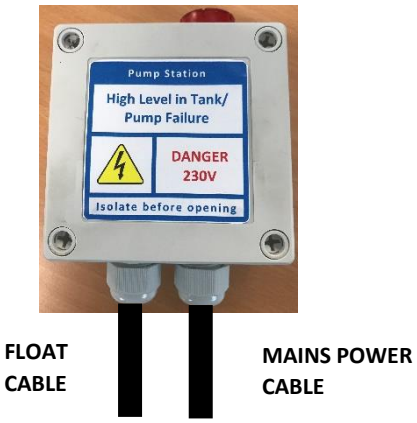

Figure 15: Alarm box for Single Pump Pumpstation

We recommend installing an individual power supply when fitting this alarm to maintain running in the event of a pump problem. The Alarm Box will need to be weather protected if installing outdoors but we recommend installing indoors where possible.

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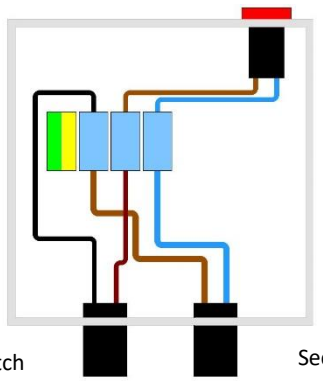

Float Switch Cable
(Use Black and Brown cores)

Secondary Mains Power Connection
(Recommended if possible)

Figure 16: Wiring for Single Channel Alarm Box

Figure 16 above shows the wiring for the installation of the Alarm box. For the float cable, you should use the BLACK and BROWN cores (terminate the BLUE core) to activate the float as a high-level switch and connect as shown above. CARE should be taken when re-assembling the alarm box, to ensure no cables are trapped (especially the cables connected to the alarm sounder)

Control panels (as shown in Fig 17 below) are provided as standard for all Harlequin Twin Pump Stations, they are installed to control the three float switches in the system. Wiring diagrams for both of these models can be found in Appendix 1.

When a control panel is set to 'auto' this means the operation of your pump station will be carried out by the float switches. Once the level rises in the tank a float switch will be triggered, which will then activate the pump. This will allow your pump to run and discharge until the liquid level has returned below the level of the initial float switch.

Your control panel will alternate the duty pump between discharge cycles. If for any reason both pumps fail, and the liquid level reaches maximum capacity the alarm float switch will be triggered. You will be alerted if there is a fault by your control panel. It is important to note that your alarm can also be triggered if the volume of liquid entering the tank exceeds the capacity of the pump.

E2D2M UNIT

1. Main isolator
2. Pump power indicators
3. Pump fault indicators
4. Pump switches:
   - Automatic
   - Manual
   - Off

E.BOX BASIC

1. Main isolator
2. Pump power indicators
3. Pump fault indicators
4. Pump switches:
   - Automatic
   - Manual
   - Off

Figure 17: DAB E2D2M and EBox Basic Control Panels

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. 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 to the inlet pipe from the tank to this soil stack. The internal pipe work of the tank allows ventilation from the tank body 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.

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Operating Instructions

Process description

Pump Stations work as an intermediate storage collection and transfer system which discharge effluent, treated wastewater or sewage to a higher level. Once the contents of the tank reach a specific level, a float switch is triggered which activates a duty pump. Pump Stations are normally installed in locations of low-lying ground with the purpose to transfer and discharge to a higher-level sewer system or local drain.

Pump Stations work in a continuous cycle and the process of collecting, transferring and discharge of its contents are run by the internal float switches. Once the tank has been emptied and discharged the cycle will continue.

Twin pump configurations are available which alternate which pump is the duty pump. These systems will allow your station to have a backup pump.

Plant Start up

1. During Installation, check the gasket seals around the tank while the tank is filling up to ensure there are no loose fittings which may cause any leaks.
2. Ensure the inlet and outlet pipes are installed correctly and are free from any blockages or obstructions.
3. Ensure any float switches are connected correctly and are positioned at the right heights. Float switches should not be sitting on the base of the tank.
4. On twin pump systems ensure all float switches are hanging freely from the top of the tank and there are no tangled cables.
5. Test the operation of the float switches, this can be done by pushing the float down as the tank is emptying.
6. Check to ensure all the water has been discharged after the initial pump cycle.
7. Refit all manhole covers and lock if necessary**.**

General Maintenance

Warranty Provisions

The Pump Station 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 tank 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. drainage field, venting and it does not cover damage done to the plant by any other product within the system.

If a Harlequin Pump Station 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 tank 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.

DO NOT dispose of any household items into the drain system via a toilet or sink. Items such as wipes and nappies will cause severe damage to the pump and can cause your system to fail.

Maintenance Schedule:

Harlequin Pump Stations should be checked every 6 months. It is important to check for the following:

1. Sludge build up – Is there an excessive build up of sludge at the bottom of the tank (applicable to water and effluent Pumpstations)?
2. Blockages – Are the inlet and outlet pipes clear of debris? (Remove any obstructions)
3. Are any of the floats obstructed/twisted in any way?
4. Control panel – If you have a control panel has it failed for any other reason than a mains power failure? (Is the warning beacon flashing)

24-monthly intervals

A full service on the system should be performed. The service should ensure that all aspects of the system are functioning correctly.
Particular areas of detail include:

- Checking tank for damage
- Checking the internal pipework
- Checking lid and gasket seals
- Checking electrical connections

Final Installation Check List

All Versions:

- Tank Installed the correct distance from property ☐
- Tank installed on a flat concrete base ☐
- Tank fully backfilled with concrete ☐
- Customer has been given copy of the Installation and Servicing Guide ☐

Single Pump Version:

- Confirm integrated float activates pump when liquid level rises above pump (approx 200-300mm above top of pump) ☐

Single Pump with Alarm:

- Confirm high level float activates alarm when liquid level rises towards the top of the tank ☐

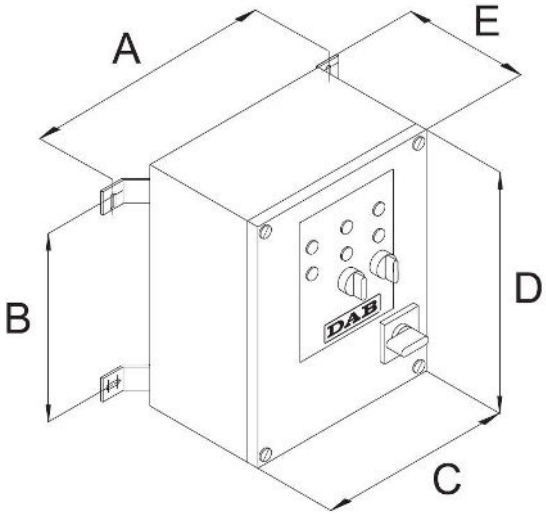
Twin Pump Version:

- A secondary power supply for High level alarm (recommended) ☐
- Float switch cables are free from any knots or tangles and hang freely from the top of the tank ☐
- Ensure the submersible pump starts operating as the float rises above the pump ☐
- Ensure the pump turns off as liquid level lowers below the top of the pump ☐
- Ensure secondary pump activates on next cycle ☐
- Ensure secondary pump turns off as liquid level lowers below the top of the pump ☐
- Ensure the high-level alarm operates if the water level rises towards the top of the tank ☐

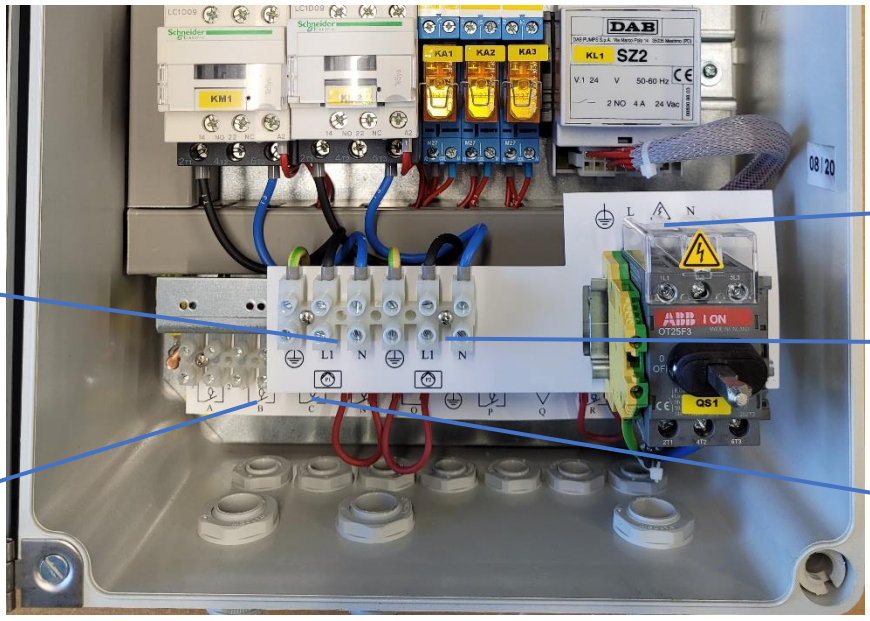
Fault Finding:

Symptom	Cause	Action (all work must be performed by a specialized company)
Strong smell	Damaged Lid seals	Check seals around manhole lid and replace if necessary
	The joints of the pipes are damaged	Check and replace the seals/connections if necessary.
	Pump malfunction	Ensure pump(s) is (are) working correctly
	Blocked pipework	Inspect the pipework for any blockages or debris and clear the pipes from any obstructions.
	Incorrect wiring	Contact a qualified electrician to check the wiring and the voltage line supplying the tank.
	Pump Malfunction	Contact a qualified installer to inspect the pump.
	Deflective non-return valve	Check the internal pipework to ensure the non-return valve is free from any obstructions and has not been installed backwards. This is done by checking the arrow direction on the valve.
	Faulty impeller	Contact a qualified installer to inspect the impeller, it could be worn out, damaged for blocked with debris. **Ensure pump is disconnected from power supply.**
Irregular running of pump	Faulty or damaged float switch	Contact a qualified installer to inspect the pump, a float switch may need replaced.
	Float switch not activating	Floats on twin or single pump systems could be caught in the internal pipework. Check the floats are not tangled if so, then untangle the cables.
Pump will not start	Pump malfunction	Contact a qualified installer to inspect the pump for any damage or faults.
	Electrical fault	Contact an electrician to inspect the voltage line connected to the tank. If your tank has a control panel check to see if there is any moisture in it.
	Blown fuse	Replace the fuse
	Electrical fault to control panel	Inspect wiring in the control panel. Contact an electrician to check that there is a sufficient electrical connection to run the control panel.
	Deflective float switch	Inspect float switches to check if they are positioned correctly.
Pump Station backs up and over fills above working water level	Faulty pump	Pump has malfunctioned, contact a qualified installer to inspect or replace the pump.
	Damaged float	Contact a qualified installer to inspect or replace the float.
	Deflective float switch	Inspect float switches to check if they are positioned correctly.
	Blocked Pipework/connections	Check all pipework/valves/connections (as above) to ensure no blockages are found in the system
Pump will not turn off	Defective float switch	Inspect float switches to check if they are positioned correctly or tangled.
	Flow of influent is the same or greater than the discharge capacity of the pump	Contact a qualified installer, you may need a bigger pump/tank.
Sounding alarm but system is still running	Defective float switch	Inspect the float switches for any tangles in the cables, a float switch could be caught/tangled and sitting in the ON position.
	Electrical fault	Contact an electrician to check the control panel for any damage.

APPENDIX 1: DAB E2D2M Control Box Specifications



UNIT SPECIFICATIONS				
A	**B**	**C**	**D**	**E**
345	335	270	360	200
Weight (Kg)				
8				



Pump #1 Power Connections

Pump #1 Float **
- terminal B

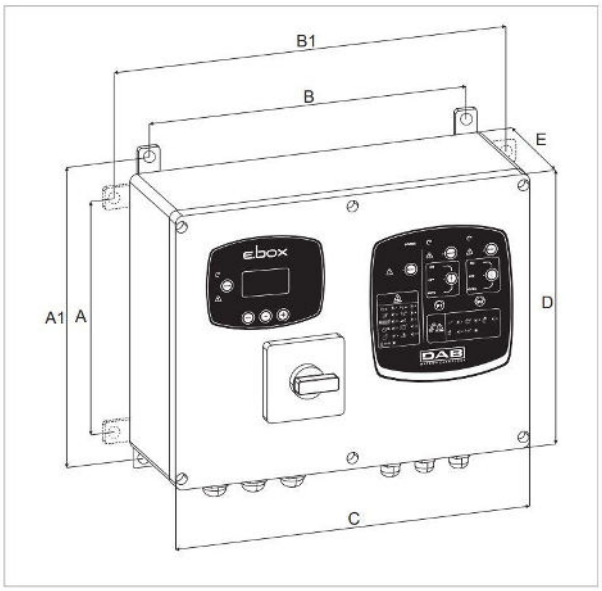
Mains Power Connections

Pump #2 Power Connections

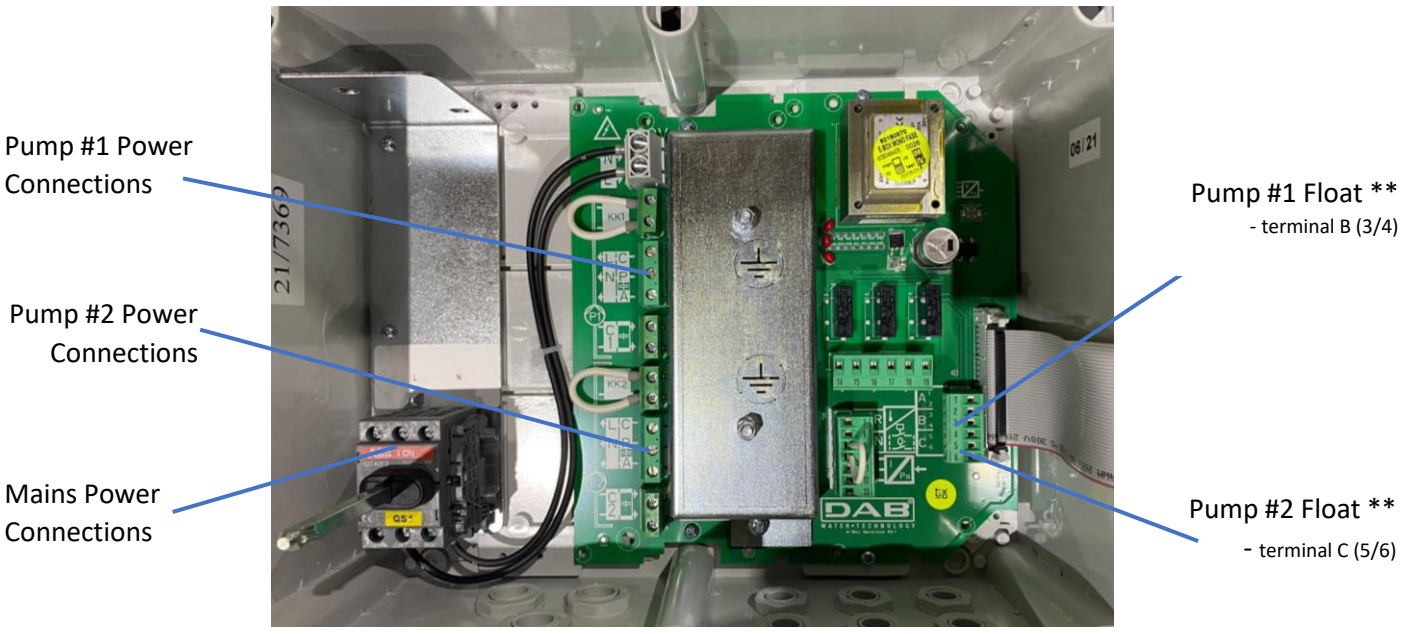
Pump #2 Float **
- terminal C

** Use Black and Brown cores for connecting floats (terminate blue core)

APPENDIX 2: DAB Ebox Basic D Control Box Specifications



UNIT SPECIFICATIONS				
A	**B**	**C**	**D**	**E**
212	282	320	260	120
A1	**B1**	**Weight (Kg)**		
265	337	4		



** Use Black and Brown cores for connecting floats (terminate blue core)