Tricel PhosClear

Installation and Service Manual

Phosphorus Removal in Packaged Wastewater Treatment

Tricel PhosClear 6-8PE and 10-12PE

Ensuring Compliance and Peace of Mind

Representation of a Tricel Novo sewage treatment plant followed by a Tricel PhosClear unit.

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This manual concerns procedures and guidelines for installation, commissioning, operation, trouble shooting and maintenance of the Tricel PhosClear post treatment. Instructions for pre-treatment and other equipment included in the specific project are found in separate manuals.

Picture 1 – Representation of a Tricel Novo sewage treatment plant followed by a Tricel PhosClear unit.

1 Introduction

The PhosClear system is designed to treat ordinary household wastewater. Only treated domestic wastewater is permitted to enter the wastewater treatment plant unless specifically approved by Tricel.

1.1 Maximum load

The Tricel PhosClear systems allow for fluctuations in both concentrations and volume of the incoming water. However, if the average daily load exceeds the capacity of the designed system, a larger system must be installed.

1.2 Operation cost

System operation settings and power consumptions can be seen in the project specific commissioning, operation and maintenance manual.

2 Precautions when working with wastewater

Protecting Workers from Infection

Along with “good” micro-organisms that break down sewage, wastewater contains disease-causing bacteria, viruses, fungi and parasites. When workers can’t avoid contact with sewage, management should provide the following protective equipment and services:

- Elbow-length rubber gloves
- Protective clothing
- Goggles
- Disposable mask to be worn in dusty sludge areas or areas with heavy aerosols
- Commercial high temperature washing machines for work clothing

Workers should also take the following precautions:

- Wash gloves before removing them.
- Wash hands before smoking and eating.
- Keep protective clothing and equipment out of eating areas.
- Keep work clothes and street clothes in separate lockers.
- Shower and change into street clothes before going home.
- Consider all cuts or abrasions to be infected. Flush them with large amounts of clean, running water and soap, and bandage them with a sterile dressing.
- Workers should have a tetanus booster every 10 years and workers, who have never been vaccinated for polio, should consult a physician about getting a vaccination.
- Workers should receive the hepatitis A vaccination. Workers working in sewers that may contain fresh blood or come into regular contact with used syringes or body parts should receive the hepatitis B vaccination.
- Trucks that carry materials contaminated with sewage should be washed frequently.
- Records should be kept of workers’ major and minor illnesses and complaints of irritation and discomfort.

Seek medical attention when you have diarrhea or are ill. Since doctors are often unaware of the connections between occupation and disease, be sure to inform your personal physician of job exposure to sewage.

3 System

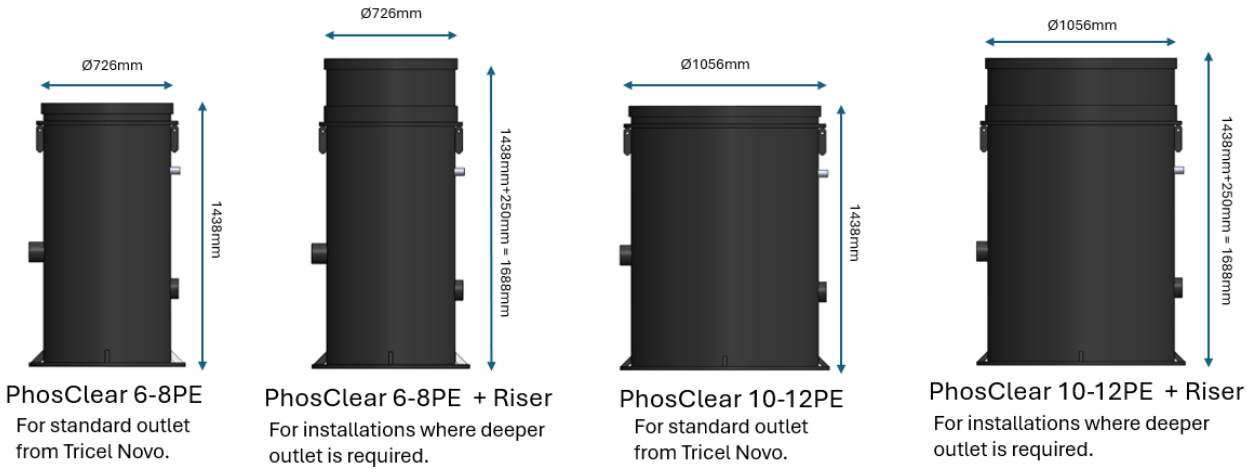
3.1 Configurations

PhosClear for single households comes in two different standard versions, PhosClear 6-8PE and PhosClear 10-12PE. In addition to the two sizes, there's also possible to include a riser, to increase the inlet depth by 250mm.

The riser can be installed on site in case a deeper inlet is required.

Customized sizes can be offered upon request.

For sizes, capacities etc. see separate PhosClear brochure.



Picture 2 – Possible combinations of PhosClear w. and wo. riser

3.2 Process

1. The treated water from the Tricel Novo system enters the PhosClear treatment unit with gravitation through the inlet.

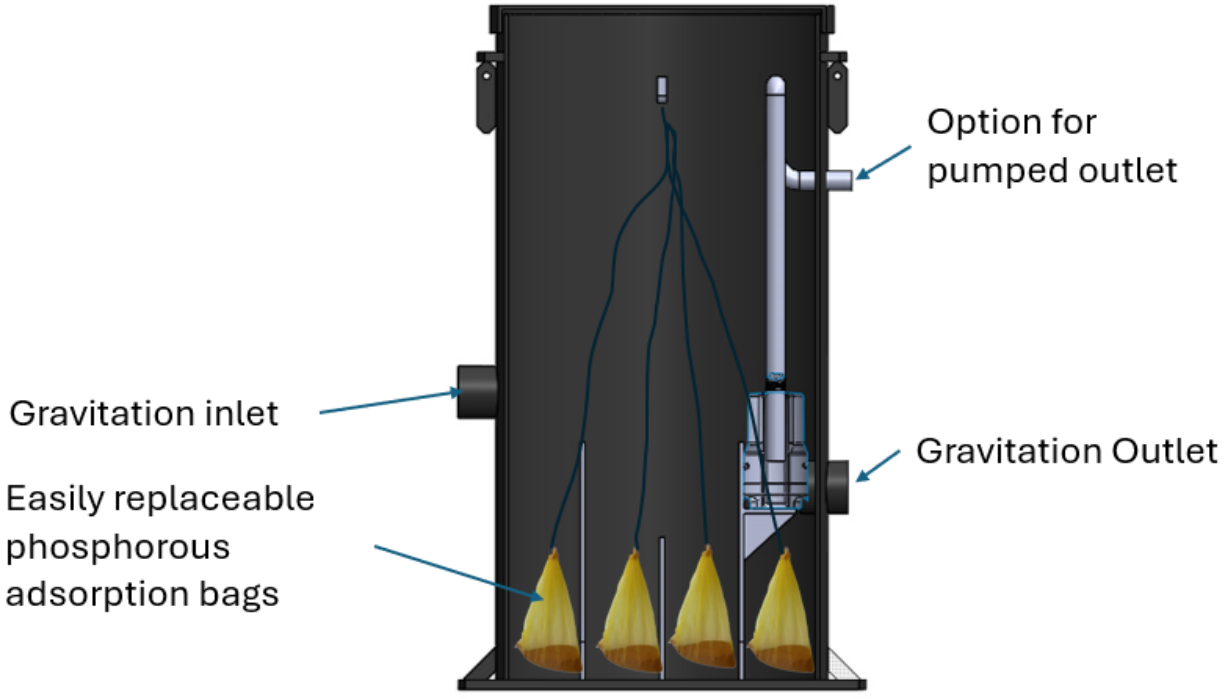
2. In PhosClear 6-8PE 4x 6,25kg bags with Polonite are placed in each of the four treatment chambers, and the water passes through the chamber alternately from top to bottom, and bottom to top.
   In PhosClear 10-12PE 6x 6,25kg bags with Polonite are placed in each of the four treatment chambers.

3. For a house with a nominal load, with PhosClear 6-8 PE, each year the eight bags in the first two chambers are removed, and the bags in the other chambers are moved two chambers forward.

   With PhosClear 10-12 PE, each year the 12 bags in the first two chambers are removed, and the bags in the other chambers are moved two chambers forward.

4. The bags remove phosphorous through adsorption, and will also disinfect the treated water removing remaining E.coli bacteria.

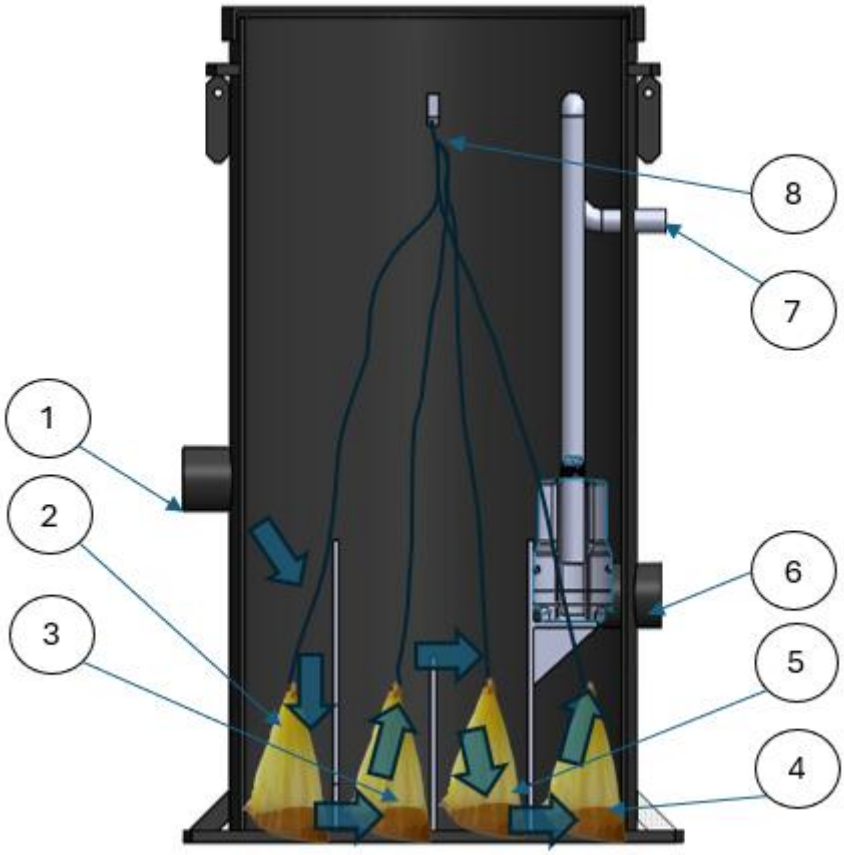
5. In the final chamber the treated water gravitates out of the system to the recipient. If it's required to lift the water out of the system, an optional outlet pump can be installed.



Picture 3 – How does a PhosClear unit work (the process)?

3.3 Features

Item #	Function
1	Inlet
2	Treatment chamber 1
3	Treatment chamber 2
4	Treatment chamber 3
5	Treatment chamber 4
6	Gravitation outlet
7	Pumped outlet
8	Hook for polonite bag cords



Picture 4 – How does a PhosClear unit work (the features)?

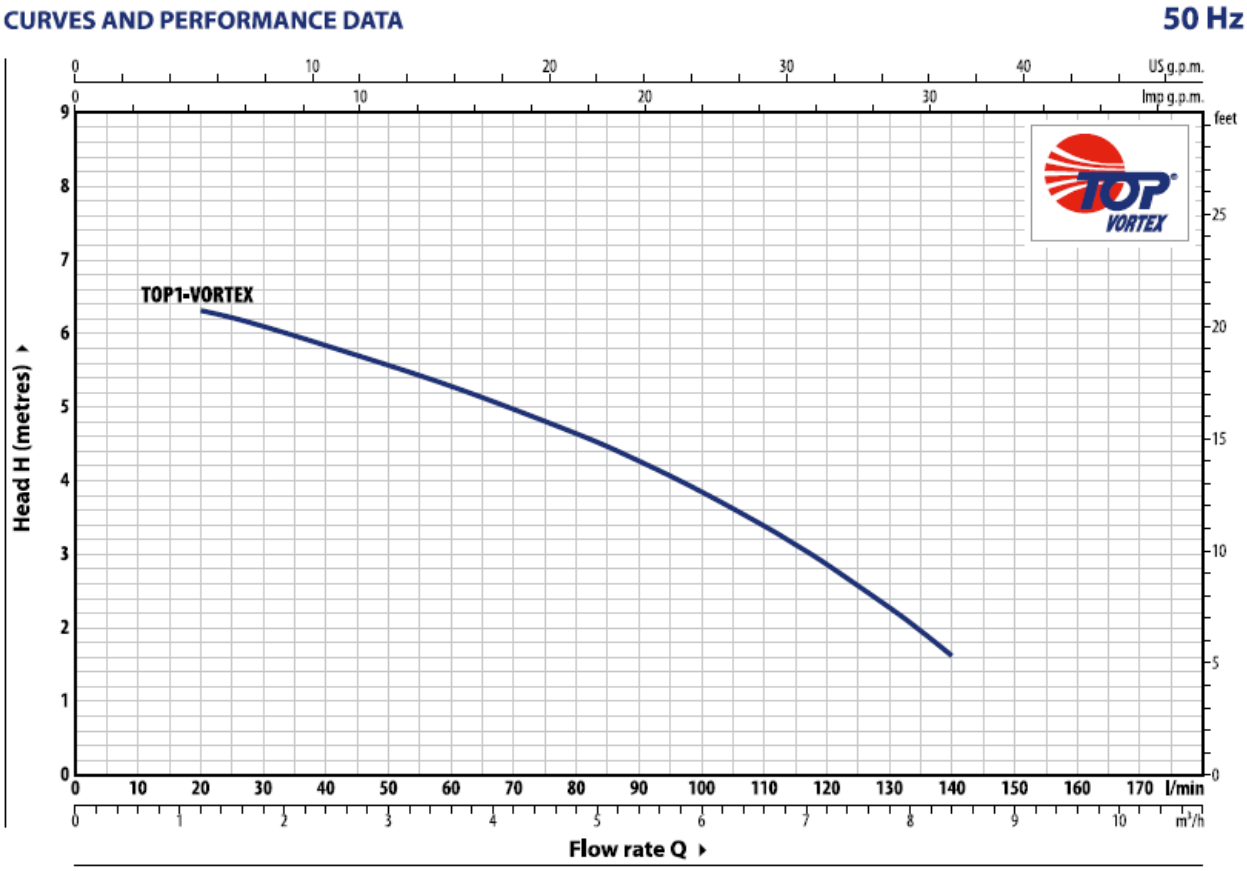
3.4 Pumped Outlet

A pumped outlet option available for all population.

A non-return valve installed on the pumped outlet will prevent backflow into the plant.

Outlined below is the standard pump specification. Other pump options are available to customer specifications if required; please contact your Tricel supplier.

3.4.1 Standard pump specification:



Picture 5: Pump specification

For greater pump distance requirements, contact Tricel.

4 Installation

4.1 Foundation

Civil works can be completed prior to the arrival of the PhosClear system, which will make the installation faster when the equipment is delivered.

The foundation must be leveled. Local norms and standards apply when determining design loads, material strength and dimensions of concrete and reinforcement.

The leveled load bearing surface with a maximum level variation of +/- 0,5 cm high per 1 meter across. Surface must consist of either (i) stable compressed gravel, (ii) concrete slab built on stable soil, or (iii) a checker plate capable of handling the load.

4.1.1 Concrete specifications

Semi-dry concrete 25n grade with a ratio of 4.5/1 parts aggregate to cement.

Important: 

• Standard concrete mixes should not get used where sulphates or similarly aggressive chemicals are present in the groundwater.

• Lift height (rate of rise): Determine the lift height (m), or rate of rise (m/h) for the specific concrete type used, to ensure that a design pressure (P max) of 15kN/m2 on the tank does not get exceeded.

• Vibration: The tank design assumes minimal compaction of the surrounding concrete. Where necessary, this may be extended to include internal light vibration. Never use deep revibration which will substantially increase the pressure on the tank, possibly causing failure.

• Impact of concrete on discharge: Under no circumstances should concrete be discharged directly onto the tank.

4.2 Unloading the PhosClear unit

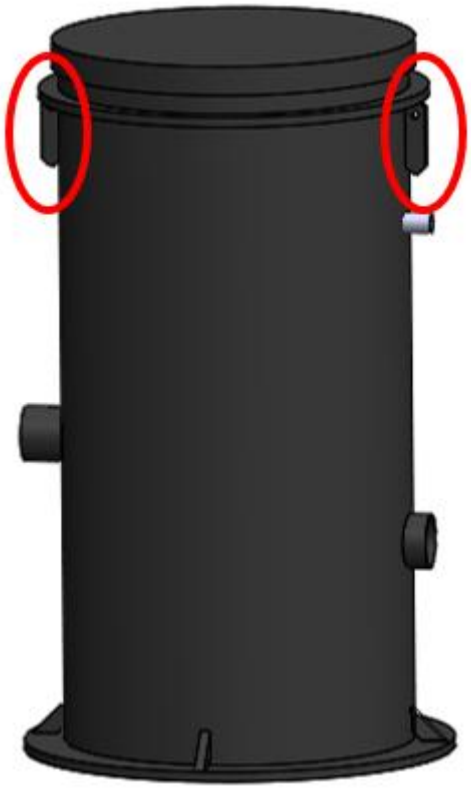
The system will normally be shipped to site on a standard trailer. It is important that precaution is taken during unloading to avoid impact and damage on the tanks and equipment. Tank dimensions are found on the PhosClear brochure.

Tricel do not accept liability for any damage caused during the offloading procedure.

4.2.1 Recommended handling tools (not included)

It is important that precautions are taken during unloading to avoid impact and damage on the equipment.

The system comes with pre-installed lifting straps, installed in the lifting eyes on the side of the tank. This makes it easy to handle the units when installing the equipment, see Picture 6 – Eyes for lifting straps. The low weight of the unit makes it easy to handle with a forklift or a small excavator.



Picture 6 – Eyes for lifting straps

Notice: Do not lift the PhosClear units with water inside.

4.3 Control of packing list

Always check that the components and parts received are in accordance with your order and packing list. Also ensure that the goods are without visible damages or faults.

All pipe dimensions in this manual are external diameter.

4.4 Inspection of vital components

Treatment Plant: Tricel PhosClear

Check all tanks and filters are not damaged in any way.

All equipment is installed internally in the PhosClear unit, so only connections are in- and outlet and main power to the control box.

Polonite bags

Check that Polonite bags are undamaged and correctly installed in the bottom of the four treatment chambers.

Outlet pump System (if included)

If the system is delivered with an integrated pump system, check components for pump system are in accordance with the check list in this manual.

Float Switch System (for outlet pump system if included)

The float switch system is installed directly on the outlet pump and will operate on a water level of ±5cm.

Other parts

Check that all remaining parts are undamaged and according to parts list.

4.5 Installation of PhosClear

The system must be installed according to guidelines described in this manual or the project specific layout drawings approved by Tricel.

4.5.1 Placing the units

The unit is placed on a flat and leveled load bearing surface with a maximum level variation of +/- 0,5 cm high per 1 meter across. Surface must consist of either (i) stable compressed gravel, (ii) cast concrete slab built on stable soil, or (iii) a checker plate capable of handling the load, see Picture 7 - Backfill example

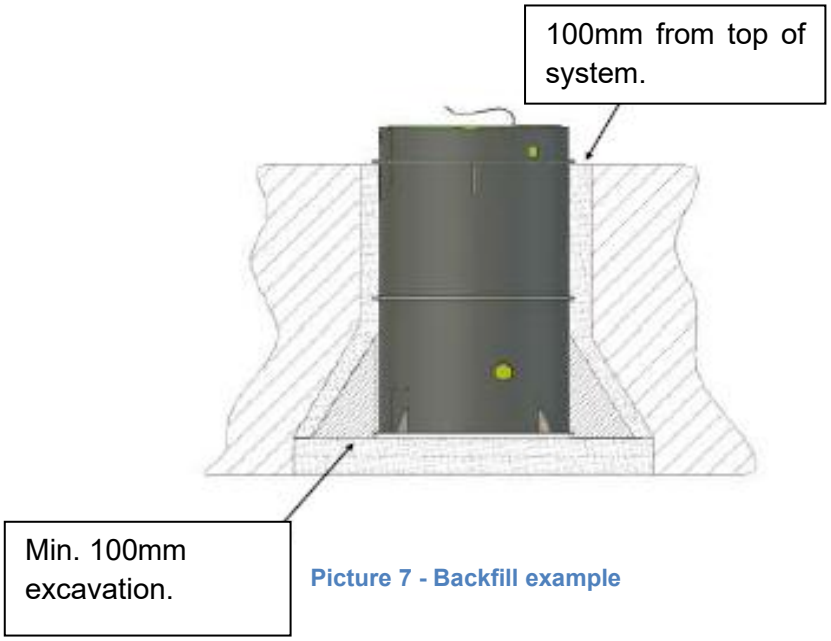
If the groundwater table is high, i.e. covers more than 300mm from the bottom of the plant, it's important that the ground around the unit is drained and sufficient groundwater lowering is done.

Before backfilling with gravel around the plant, the tank must be filled with water. The gravel that is backfilled with should be compacted by watering every 20 cm.

The filling around the pipes and PhosClear unit is done with gravel suitable for installing pipes in-ground. The rest of the backfill is done with suitable soil or friction material without stones.

The PhosClear unit is a very strong and rigid tank, but it's not recommended to use heavy compaction methods e.g. vibrators.

Note! The PhosClear must as standard not be installed above ground. Should this be a requirement, please contact Tricel.



Picture 7 - Backfill example

4.6 Gravel specification

Primary backfill specification

• Primary backfill material should be free-flowing granular material.

• Compaction should be by lightweight rollers or vibratory plate. Compact gravel evenly to ensure proper support for the tank. Ensure the vibrating machine does not come in contact with the shell of the tank.

• Tanks must get installed with primary backfill only within the region immediately

surrounding the tanks. This primary backfill must extend a minimum of 250mm outward from the tank, and directly beneath it.

• Backfill material shall not be frozen or contain lumps of frozen material at any time during installation.

• Use of other than specified backfill and bedding materials will void the tank warranty.

The following materials have approval as primary backfill:

Rounded pea gravel

• Minimum particle size 3mm, maximum 18mm, compacted to a relative density of >70%.

• Gravel shall be clean and free flowing, free from large rocks, dirt, sand, roots, organic materials or debris.

• Upon screening analysis, the backfill material shall have no more than 5% by weight passing 2.36mmsieve.

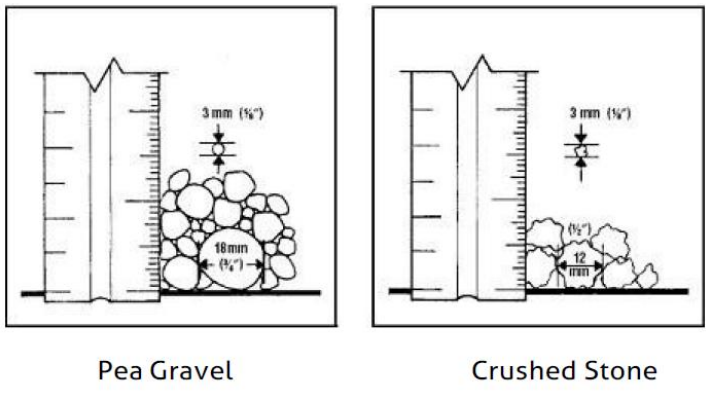
Or

Crushed or processed stone

• Minimum particle size 3mm, maximum 12mm, compacted to a relative density of >40%

• Dry Gravel density must be at least 1500 kg/m3. The material should be washed or screened to remove fine particles.

• Upon screening analysis, the backfill material shall have no more than 5% by weight passing 2.36mm sieve.



Picture 8 - Gravel specifications

4.7 Concrete specification

Semi-dry concrete 25n grade with a ratio of 4.5/1 parts aggregate to cement.

Important

• Standard concrete mixes should not get used where sulphates or similarly aggressive chemicals are present in the groundwater.

• Lift height (rate of rise): Determine the lift height (m), or rate of rise (m/h) for the specific concrete type used, to ensure that a design pressure (P max) of 15kN/m2 on the tank does not get exceeded.

• Vibration: The tank design assumes minimal compaction of the surrounding concrete.

Where necessary, this may be extended to include internal light vibration. Never use deep revibration which will substantially increase the pressure on the tank, possibly causing failure.

• Impact of concrete on discharge: Under no circumstances should concrete be discharged directly onto the tank.

4.8 Topsoil requirements

Clean native topsoil shall not contain rocks larger than 36mm on largest dimension.

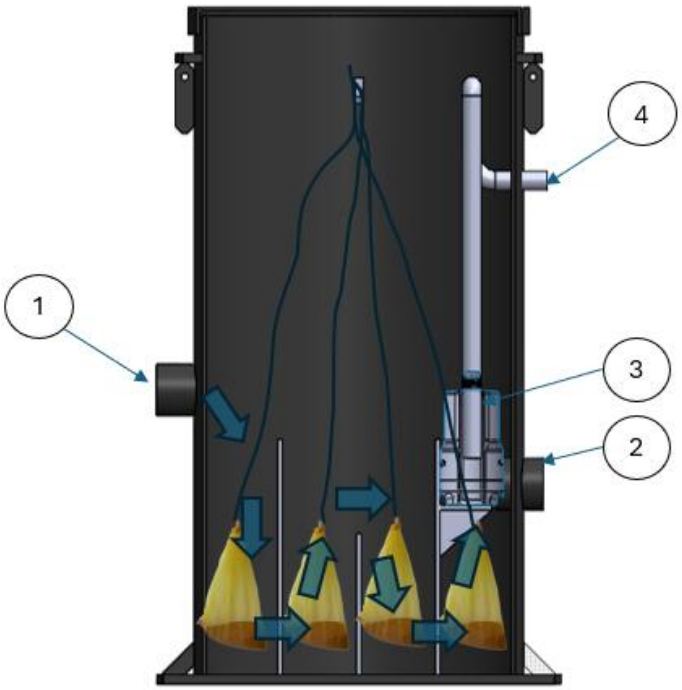
Note: The use of geotextile barrier fabrics surrounding the primary backfill material is considered good installation practice. This fabric must be chosen to allow the flow of water in and out of the excavation but to prevent the movement of fine soil particles into the primary backfill material.

4.9 Connections

The PhosClear system comes as a complete plug and play unit, and therefore as standard only has two connections, inlet and outlet, and for the optional pump versions also an electrical power supply.

- Inlet pipe from Tricel Novo or other treatment plants: Ø110 PVC.
- Outlet pipe for treated water: Ø110PVC for gravitation, Ø40mm for pumped outlet.
- Power cable (only for versions wit included outlet pumps) – For dimensions see electrical specifications.

Ensure that the in- and outlet pipes are fixed, and that the water flows freely to and from the system.



Picture 9 - Flow through a PhosClear unit

Item #	Connection
1	Inlet – Ø160 PVC
2	Outlet for gravitation outlet – Ø160 PVC
3	Power cable – See electrical specification
4	Outlet for pumped outlet – Ø40mm

Picture 10 - Item list (describing the flow through a PhosClear unit)

4.10 Electrical specifications

If there's a pumped outlet installed, the system must be powered directly from HMI with a single phase 230V connection. The cable size must be 3 x 1,5mm² and the maximum load will be 5A.

4.11 Control scheme - installation

ID (SECTION)	TASK	REFERENCE DOCUMENTS	ACCEPTANCE CRITERIA
4	Follow instructions in section 3.1 prior to installing the equipment	Project specific layout drawings	Civil works is made according to project specific layout and no cracks or similar deviations are observed
4.3	Follow instructions in section 4.3 after equipment has arrived to customer	Project specific parts list and packing list	Supplied equipment is according to Specific parts list and packing list
4.4	Follow instructions in section 4.4 after equipment has arrived to customer	Project specific parts list and packing list	No damages or errors are observed on the supplied equipment
4.5	Follow instructions in section 4.5 when installing the system	Project specific detail drawings	the system is installed according to detail drawings and this manual

5 Commissioning

When commissioning the PhosClear system must be filled with water.

After commissioning the system, the following is observed (normal operation):

It is found that the water gravitates unobstructed from the inlet, under and over the divider plates to the outlet.

If an outlet pump is installed the activation of the pump is controlled by lifting the integrated float switch.

After the system has been commissioned, it must be ensured that the system is securely locked and sealed, see Picture 11 - Example of a sealed PhosClear unit.

Picture 11 - Example of a sealed PhosClear unit

6 Operations and Maintenance

6.1 Water Samples

To ensure that the plant performs according to specification, it is important to measure the water quality at the outlet.

To take samples that are as accurate as possible, make sure the sample bottles are clean and the sample is obtained in the last settling zone 10 cm below the surface. Water samples must be stored cold until they are analyzed, preferably in a freezer or alternatively in a refrigerator. Analysis must be done in a certified laboratory. Samples must be obtained as the first part of the maintenance procedure prior to functionality control.

The oxygen level shall be > 70 % in all chambers and is expected to increase through the system. The pH shall be > 6.5 and <8.5 in all chambers and is expected to fall only a little through the plant.

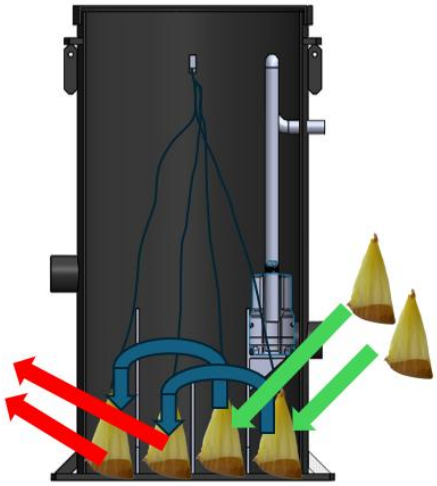
6.2 Confirmation of Connections

Confirm that connections are assembled according to the description in section 4.9 Connections.

6.3 Polonite bags

At annual service the condition of the Polonite bags is controlled. At normal load, for a PhosClear 6-8 PE, a total of eight bags in the first two chambers must be removed, and bags in the third and fourth chambers are moved two chambers forward, see below.

At normal load, for a PhosClear 10-12 PE, a total of twelve bags in the first two chambers must be removed, and bags in the third and fourth chambers are moved two chambers forward, see below.



Picture 12 - Replacement of Polonite bags

6.4 Outlet pumps

Prior to performing any maintenance on the pump, un-plug the pump to ensure that it is not accidentally powered during maintenance.

Assess the pump at each ordinary service. Confirm that the piping is safely fastened to the wall of the pump well.

Pull up the pump and confirm the following:

- Pump is intact and undamaged.
- Impeller is intact.

If the pump or impeller appears damaged or worn, the pump should be replaced. Confirm that all wires are intact and are not affected by weathering. If there is any doubt replace the wires.

6.5 Recommended Spare Parts List for PhosClear – 6-8PE

Component*	**Expected Component replacement frequency**
Polonite bags	8 x 6,25kg bags - 1 years (only from first two chamber)
Inlet pump and float switches	7 years

*For specific brand and model; see project specific parts list

6.6 Recommended Spare Parts List for PhosClear – 10-12PE

Component*	**Expected Component replacement frequency**
Polonite bags	12 x 6,25kg bags - 1 years (only from first two chamber)
Inlet pump and float switches	7 years

*For specific brand and model; see project specific parts list

6.7 Operation Without Wastewater for up to 6 Months

If limited or no wastewater is flowing to the PhosClear system for days or weeks at a time, Tricel recommends continually operating the system as normal.

For any questions not clarified in this instruction please contact Tricel directly.

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