SAND FILTER COMBINED INSTALLATION OPERATION & MAINTENANCE MANUAL

INSTRUCTIONS

In-ground Sand Filters

INDEX

1. HEALTH AND SAFETY

1.1. United Kingdom Health and Safety at Work Act 1974

Section 6a of this act requires manufacturers to advise their customers on the safety and the handling precautions to be observed when operating, maintaining and servicing their products.

The user's attention is drawn to the following:
All the sections of this manual must be read before working on the equipment.

Suitably trained and qualified personnel must carry out installation.

Normal safety precautions must be taken and appropriate procedures observed to avoid accidents.

The design factors for the lid loads and materials comply with the British Water Code of Practice, BW:COP.22.96. The lids have been tested with a load at 1.0Kn/m2 and will withstand accidental passage. THEY ARE NOT DESIGNED AS PEDESTRIAN WALKWAYS.

Refer to WPL Ltd for any further technical advice or product information.

1.2. Health

The following is extracted from a health-warning card supplied to all WPL Ltd staff. It is the client's responsibility to ensure that all necessary protective clothing/ equipment is available.

Leptospirosis
There are two types of Leptospirosis affect people in the UK:

Weil's disease. This is a serious infection transmitted to humans by contact with soil, water or sewage that has been contaminated with urine from infected rats.

Hardjo-type Leptospirosis, which is transmitted from cattle to humans.

Typical symptoms?
Both diseases start with flu-like illness with a persistent and severe headache, muscle pains and vomiting. Jaundice appears about the fourth day of illness.

How is it caught?
The bacteria can enter your body through cuts and scratches and through the lining of the mouth, throat and eyes.

1.3. Sensible Precautions

After having worked in sewage or with anything contaminated with sewage, wash your hands and forearms thoroughly with soap and water. If your clothing or boots are contaminated with sewage, wash thoroughly after handling them.

Take immediate action to wash thoroughly with clean water any cut, scratch or abrasion of the skin immediately prior to applying any protective covering.

DO NOT HANDLE FOOD, DRINK OR SMOKING MATERIAL WITHOUT FIRST WASHING YOUR HANDS.

IF YOU CONTRACT THE SYMPTOMS DESCRIBED AFTER COMING INTO CONTACT WITH SEWAGE, REPORT TO YOUR DOCTOR IMMEDIATELY AND ADVISE HIM/HER OF THE CIRCUMSTANCES

Vaccinations
To avoid illness, it is recommended that site personnel have the following vaccinations. (Your doctor may recommend further).

i. **Hepatitis A**
ii. **Hepatitis B**
iii. **Polio**
iv. **Tetanus**
v. **Typhoid/Cholera (probably carried out as a child).**

1.4. Safety

Sewage gases are potentially explosive and toxic**. DO NOT enter any of the below ground compartments of the Sand Filter UNLESS PROPERLY QUALIFIED AND EQUIPPED TO DO SO.**

2. Risk Assessment Notes

This section of the manual is intended as a guide and as such does not cater for every situation that may be experienced on site. WPL Ltd assumes that the installer/end user has ensured that all necessary permissions have been sought and granted and that the installation procedures will be carried out observing the requirements of the Health & Safety at Work Act and will involve good building and sound civil engineering practice. Please ensure that due consideration has been given to and appropriate action taken with regard to the following:

- Planning permissions & Building Regulations and other regulating or interested parties.
- Environment Agency consent to discharge.
- The legal responsibility for the plant as far as operation and maintenance and ongoing discharge is concerned.
- **Note – failure to comply with any regulation may result in pollution, odour and nuisance and health hazards, which may lead to legal action.**
- The size of the plant relevant to the number and type of people that will be using it, e.g. domestic, light industrial, etc. Consideration should be given to any unusual conditions such as B & B accommodation, special laundry requirements and frequent entertaining.
- Costs, legal implications and siting in consideration to shared systems.
- The whereabouts of wells, bore holes and springs used as sources of potable water; existing non-mains sewerage systems and soakaways; water courses, ponds and lakes and designated protected areas.
- The whereabouts of other services, pipes, cables, ducts, etc.
- Local ground conditions. Is specialist knowledge of civil engineering required to cater for unusual soil conditions such as underground rivers, running sand, chemicals in the soil, etc?
- The water table at the time of installation. Specialist knowledge is required when installing in an excavation that allows water to enter.
- The water table in winter. Special consideration should be given to installations that will be subject to high water table pressure or flood conditions. The treatment plant will need to be installed so that it cannot "float" out of the ground and provision made for continued discharge of treated effluent, should the discharge pipework/soakaway be under water.
- **Note – failure to maintain the ability to discharge may result in pollution, odour and nuisance and health hazards, which may lead to legal action. WPL can not be held responsible for failure to discharge due to poorly designed, constructed or positioned soakaways and discharge pipework systems.**
- Siting. The plant must be sited within 30m of heavy vehicle access for de-sludging. The plant should, where possible, be sited above the high water table mark and above or beyond the flood plain. See items above and accompanying note. The plant should be sited as far from the habitable parts of the dwelling as possible. Many local authorities recommend 10m as a minimum, but easements are possible for smaller sites.
- Gas & odour ventilation. WPL recommend that the plant be vented. This can be via the vent pipe, normally attached to the building, or by additional venting (high or low level) off of the inlet or outlet pipework or the sample chamber.
- Sample point. A safe and adequate sampling point is usually a requirement of the Environment Agency. This can be an off the shelf item or constructed using standard drainage components. Open pipe discharges to ditches, watercourses, etc, through pipework of less than 5m in length, do not require a sampling point if the effluent can be sampled from the end of the pipe.
- Electrical supply. A qualified electrician (see Electrical Installation section) should only undertake electrical installation. A safe and reliable power supply is required at all times, as the air blower is required to run continuously. Adequate means of air or power failure indication should be provided. This can be an audible or visual alarm or by regular manual checks.
- Due to the health risks associated with raw sewage, WPL recommend that the sewage treatment plant is not used until the system is complete, commissioned and handed over.
- **Before carrying out any maintenance or installation work, the equipment must be electrically isolated. Do not leave covers open for any longer than necessary. Temporary barriers and warning signs should be erected around any open covers or manholes as appropriate, in particular warning of deep water in the tanks.**
- **Any visiting personnel must report to site office on arrival and fully acquaint themselves with safety regulations applicable.**

3. INTRODUCTION

The WPL range of sand filters has been designed to treat the treated effluent from sites with population equivalents in the range of 1 up to 600 persons

The inclusion of the sand filter on a HiPAF process has been developed to meet the more stringent discharge consents now being imposed by the Environment Agency. Use of the sand filter can achieve BDO and TSS standards better than 10mg/l.

The plant is designed for either above or in ground installation. This installation manual deals only with in ground installation. Blowers and controls to provide air to the unit are housed in a kiosk adjacent to the plant. All tanks, covers and kiosk are manufactured in GRP for corrosion resistance and long life.

4. DELIVERY

4.1. Off-Loading

The purchaser may be responsible for off-loading at the nearest roadway to site that is suitable for heavy goods vehicles. A minimum height clearance to 16' 6" (5m) is required. If there are electrical cables overhead, ensure that there is a means of turning the power off. For off-loading from a lorry mounted HIAB, there needs to be a firm area for the stabilisers, the total width being a minimum of 15 feet (4.6m).

If the nearest road access for a heavy goods vehicle is not adjacent to the site, it is the responsibility of the purchaser to arrange transport from the road to the site. If in doubt, contact WPL as soon as possible with any queries.

Inspect the unit for any damage to the base before placing on the ground and then inspect the sides. The unit should only be placed on level ground with no sharp stones, bricks etc as they may damage the base of the unit.

The control panel and blowers should be stored in suitable conditions i.e. dry and condensation free.

4.2. Extent of Supply

See the delivery note for full details. The standard unit comes with the following:

A GRP tank, incorporating the two sections
A blower kiosk with blower and control panel fitted
Items supplied loose will be found either inside the filter section or on a separate pallet.

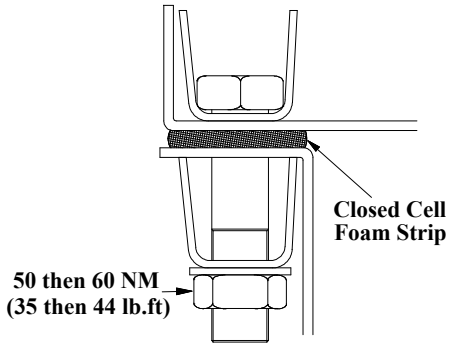
4.3. Electrical Equipment

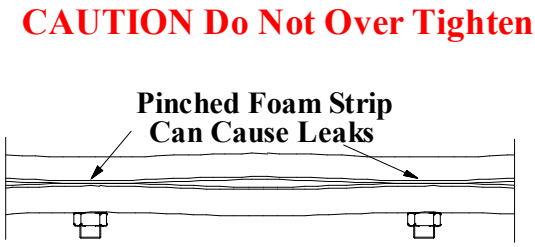
All electrical equipment, including blowers, must be stored in clean dry conditions until required for use. If the electrical equipment is fitted into the kiosk, some form of anti-condensation heater will be required if the unit is not to run immediately.

4.4. Bolts and Bolt Strips

Due to the settling of the joints during transportation of the unit, the bolts may become loose and need tightening. It is important that the bolt strips are not overtightened as this can cause leaks.

Tighten all bolts in the metal strips to 50nm to ensure all the foam is compressed then tighten up to a final value of 60nm. Silo Bolts (with no metal strips) around the top of the unit should only be tightened to 30nm.





4.5. Lifting

See Appendix II for lifting points.

DO NOT walk on top of the units with muddy boots, as this will scratch the surface.

NOTE: Units with extensions, for inverts greater than 0.5m, turrets with covers are supplied separately and therefore the unit may collect rainwater.

When moving across rough ground, great care should be taken to avoid increased loads due to sudden movement of the unit.

5. TANK INSTALLATION - IN GROUND

5.1. Introduction

All installation procedures should be carried out observing the requirements of the Health and Safety at Work Act and involve good building practice.

During the course of installation the following will be required:
Normal construction equipment and plant

Concrete for base. This MUST be designed to support the unit for normal operation.

Calculate the amount of backfill required. THIS IS VERY IMPORTANT. Lean mix or dry mix concrete must be used to backfill the excavation. However, prevailing local ground condition may override this requirement. If wet mix concrete is to be used, a qualified civil engineer must be consulted and the pour cannot take place in a single operation. Contact WPL for further information

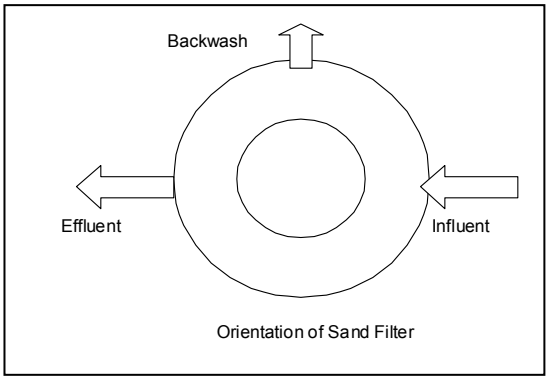
Adequate supply of water to fill unit

Pumping equipment where necessary.

N.B. Installing in an excavation that allows water to enter (i.e. is not dry) requires special advice. Water table and flood conditions are typical examples that will cause problems during installation. It may also affect the operation of the plant. Again, specialist advice must be taken in these conditions.

5.2. Installation of Unit.

Step 1 Excavate to tank dimensions (see GA Drawings) with minimum of 150mm clearance all round and under base of unit. Allow adequate clearance for all pipes and any other connectors to the unit.



Note: Dimensions are detailed on the GA Drawing for each individual plant which is sent to the customer with confirmation of order. If this has been lost, please contact WPL for another copy.

Step 2 Cast the concrete base; ensure that the slab is designed to support the unit in its normal operation (i.e. full of water). The base must be level and to the correct height to suit the invert level of the sand filter. Allow for initial set before positioning the unit.

Step 3 Excavation must be kept dry during the installation and until the concrete has cured.

Step 4 Ensure the surface of the concrete base is free of water, stones etc. and lower the unit into correct position to suit pipe connections. Check the levels.

Step 5 Stabilise unit in excavation, taking care not to cause distortion of the unit. Fit temporary covers over all pipe connections.

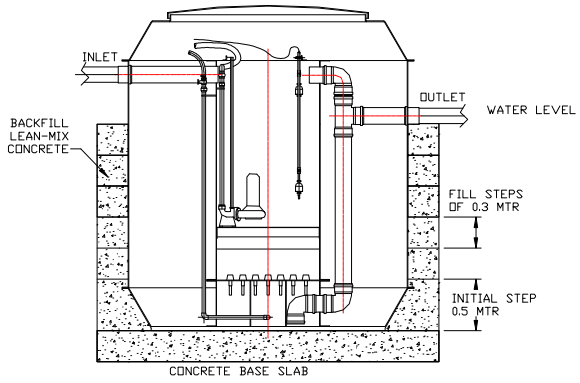
Step 6 Commence filling unit with water into all sections to a level of 500mm.

Step 7 Commence back filling with lean mix. The back fill must be evenly placed around the unit at all times and worked by hand up to a maximum level of 400mm above the base.

DO NOT USE VIBRATING POKERS

The water level in all sections must be increased and be kept at a level of 300mm above the top of the backfill, until final pour after step 8.

Step 8 When the backfill is approximately 0.5m below the lowest underground connections, pipe connections should be made. Remove lifting eye nuts and bolts and replace with green silo bolts supplied. Also provide for hose draw chamber, servicing ducts for the air lines and future cable connections to the unit via bulkhead connectors. Fit bulkhead connections through tank top or extensions with the orientation to suit the site.



Step 9 Continue to fill with water and backfill to the rim of the tank.

Step 10 Leave unit full of water

N.B. See G A Drawing for kiosk slab dimensions and type of kiosk supplied (See Appendix I for descriptions).

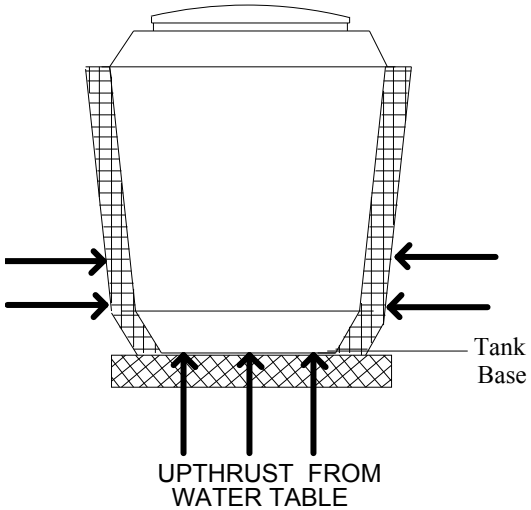
5.3. Local Ground Conditions

The local ground conditions must be taken into account when installing the unit. The amount of concrete backfill used must be sufficient to overcome the effects from the up-thrust of ground water.
The unit is designed for a maximum water table of 1.0m from the base of the tank unless specified otherwise. If the water table is higher than this maximum, damage may occur during backwash or emptying of the tank. The concrete backfill must be designed to stop the water table pressure damaging the tank. A qualified engineer must be consulted to determine the civil design.

FAILURE TO DO THIS MAY RESULT IN DAMAGE TO THE TANK

REMEMBER –

THE WATER TABLE MAY BE SUBJECT TO SEASONAL VARIATION and THE MAXIMUM WATER TABLE ABOVE BASE = 1.0m.



5.4. Installation of Kiosk

Step 1 Lay a concrete slab to suit the kiosk, above the adjacent surface water level (and the flood plain) to avoid surface water ingress. Provision for servicing ducts for air lines, cables and mains power should be made.

Step 2 Lay the ducting from the kiosk to the unit, mains supply and any pumping chambers or sand filter.

Step 3 A mains electricity supply is required into the kiosk.

Step 4 Secure kiosk to the slab through the unistrut and seal to the concrete with mastic. Do not secure until the concrete slab has fully cured.

5.5. Connections to kiosk

Step 1 The air hoses will have been delivered lying on top of the filter section of the unit. Feed the hoses down the duct and connect to the bulk head connectors on the top of the unit (or turret if fitted). Jubilee clips are either secured to a blower or in the delivery envelope. Ensure there are no kinks in the lines. Then cut the air lines to length to allow connection to the blower in the kiosk without any sharp bends. It should be noted that the pipe becomes warm during operation, softens and may deform at sharp bends.

Step 2 Electrical connections – See Section 7, Page 10.

6. PIPEWORK, DUCTS AND SAMPLE CHAMBERS

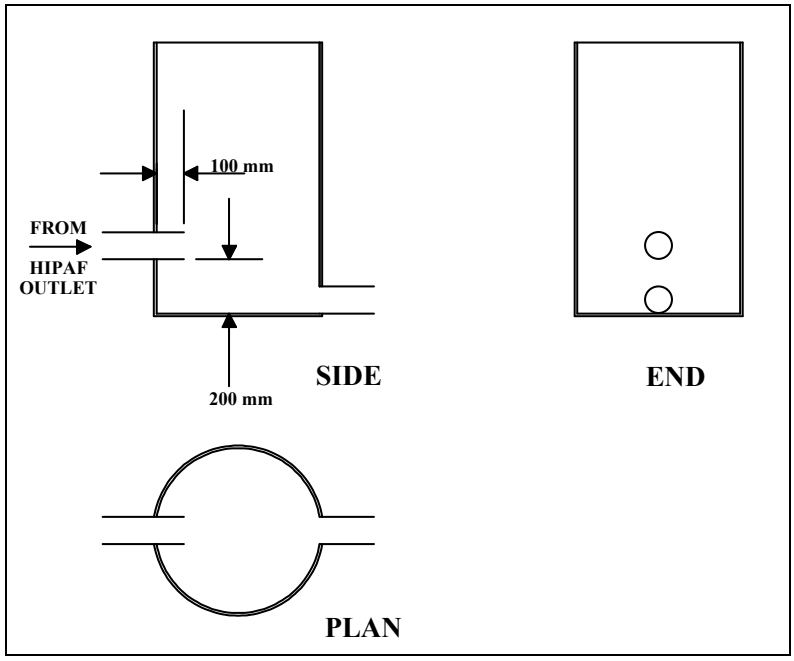
6.1. Pipework

Gradient. It must be ensured that there is sufficient fall (gradient) from the dwelling to the invert level of the inlet pipe, normally 0.5m below the top lip of the unit. A fall of between 1:50 and 1:100 is usually required to give a self-scouring velocity that prevents blockages in the pipes.

6.2. Sample Chamber

Positioning. This should be close to the outlet from the plant to provide a point at which the Environment Agency can take a sample.

Dimensions. The sample chamber should incorporate a large enough drop to allow a sample chamber to be filled with the treated discharge. The following drawings give an indication of dimensions.



7. ELECTRICAL INSTALLATION

It is not feasible to state a specific installation arrangement due to the variance of sites and installation configurations. Therefore it is important that the electrical installation be performed by a qualified electrician in accordance with 16th, or later, edition of the Institute of Electrical Engineers (I.E.E.) regulations, with appropriate current protection devices for the site configuration.

The supply to the sand filter should have a dedicated circuit incorporating isolation and protection devices to the regulation requirements of the I.E.E. An earth leakage circuit breaker is recommended and should be incorporated into the supply to the sand filter. A device with a 30mA maximum trip current is recommended.

N.B. The wiring diagram is a separate sheet in the envelope containing all the other documents. If it is missing or lost, please contact WPL for another copy.

Three Phase Connection

When the 3-phase supply is switched on, check the rotation of the blowers is correct. Incorrect rotation will cause damage if run for more than a brief check. This observation must be done with all the air lines disconnected from the blowers.

IMPORTANT NOTE

IF THE THREE PHASE IS NOT CORRECTLY CONNECTED, SERIOUS DAMAGE CAN OCCUR. SHOULD A POWER FAILURE OCCUR, ISOLATE THE SUPPLY TO THE UNIT. WHEN POWER IS RECONNECTED, ENSURE THE PHASES AND ROTATION ARE CORRECT.

8. PLANT DESCRIPTION

This description is only supplied for interest and is not essential reading for plant installation, operation or maintenance.

8.1. Plant Description

The sand filter will be supplied as a one-piece unit, The function and operation is as follows: -

The WPL sand filter has been designed to physically filter an effluent that has already undergone primary settlement and biological treatment. The sand filter is composed of two chambers; the inner filter chamber contains a graded granular material referred to as sand. The sand sits on a perforated steel plate, which is installed approximately 450mm above the floor of the inner chamber.

Effluent flows into the inner chamber, where the head differential between the water level in the inner and outer chambers forces it through the sand and the perforated steel plate, into the outer holding chamber and ultimately out of the outlet.

As the filtering sand becomes blocked by contaminants, the passage of effluent is restricted and causes a back up in the filter chamber. This back up is monitored by a sensing device and at a pre-determined level the device activates a relay in the control panel to open one part of the “back-wash cycle” circuitry. The other part of the back-wash cycle circuitry is activated by a timer. Both the relay and the timer must be activated to initiate a back-wash cycle. During a back-wash cycle, a pump in the inner chamber pumps the effluent back to the beginning of the entire treatment system. This lowers the level in the filter chamber causing a reversal of flow through the sand. In conjunction with this, air is introduced under the steel plate, which bubbles through the sand and “scours” the contaminates off of the sand and puts them back into suspension in the effluent, which in turn is removed by the pump.

The timer should be set to come on during the periods of a low flow entering the beginning of the entire treatment system. This is to prevent a combination of new effluent and back-wash water overloading the system.

WPL sand filters are immediately effective once they are commissioned.

APPENDIX 1

KIOSKS AND BASE SLABS

WPL supplies a wide variety of blower types depending on the size of plant and site requirements. It is not possible therefore to demonstrate in a general manual the layout for the ducting exit for each kiosk. However, WPL will provide drawings on request showing the layout of the client's bespoke kiosk.

For each kiosk type there is however one standard concrete slab size and listed below are kiosk descriptions and slab sizes. In each case the slab should be cast deep enough to take the weight of the blower(s) designated. Please refer to WPL before laying the concrete.

Medium Kiosk
WPL's medium kiosk has a gull-wing type opening, with the front hinging upwards to give easy access.
The concrete slab should be 1200mm x 950mm.

Large Kiosk
The large kiosk has a standard front opening door. The concrete slab should measure 1400mm x 1600mm.

Extra Large Kiosk
This kiosk has a gas-strut supported opening lid and door for easy access. The concrete slab for this item should be 1400mm x 2200mm.

Note:

- **Ensure that there is unobstructed air flow from all the vents otherwise overheating will occur.**

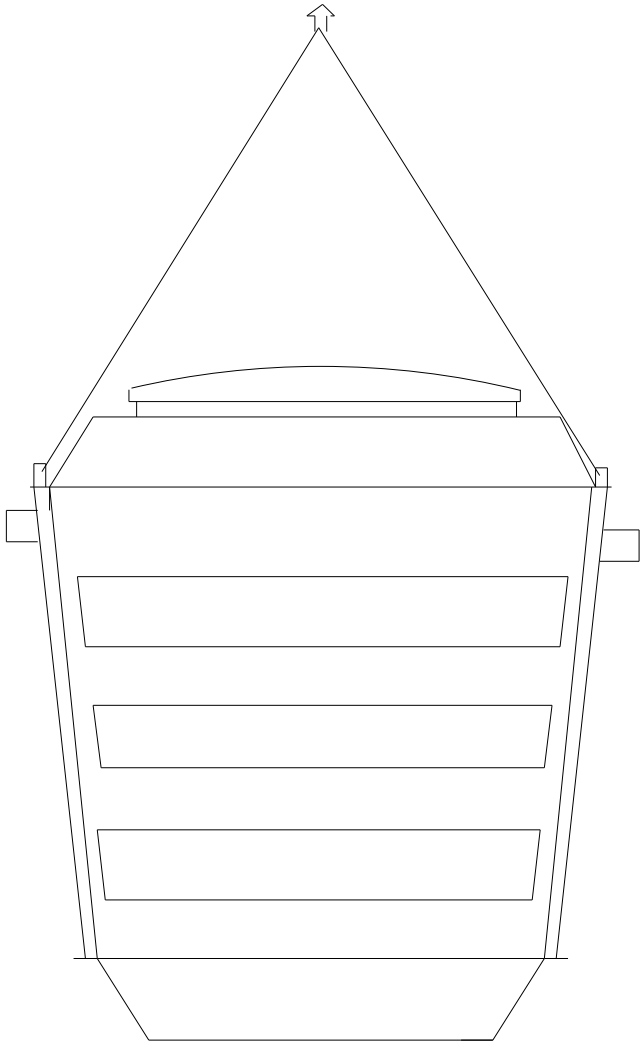
- **Ensure the kiosk is installed above any areas likely to flood.**

APPENDIX II

LIFTING

Lifting eyes are provided around the top flange of the unit for the attachment of suitable strops of equal length. These should create an angle of no less than 600 to the top of the unit to avoid excessive loads on the sides of the structure.

WARNING Care should be taken when attaching lifting equipment as the surface of the unit becomes very slippery when wet.



Operation and Maintenance

SAND FILTER COMMISSIONING AND OPERATING INSTRUCTIONS

These instructions form part of commissioning and MUST be performed to allow the sand filter to work. All settings are at the start point and should be verified by further trials after commissioning

The sand filter in this unit will function without attention when the timers are set correctly. It is designed to backwash automatically at times of low flow. The backwash is by a combination of reverse water flow and air scour. The times to initiate the backwash sequence are selected by a 7-day time clock. We would advise that the backwash cycle be initiated during periods of low flow.

For a plant with a minimum of flow during the evening, the time clock should initially be set to start at 04.00 hours and off at 04.04 hours. The time clock is provided with battery backup to retain the settings during normal short power failures. These times were set at the factory but they should be checked during commissioning. The time clock selector switch must be in the auto position for the backwash cycle to work.

The delay timer begins the backwash cycle by operating a solenoid valve to allow the air to flow through the sand. After the air scour the backwash pump operates until the timer expires.

Ensure that the unit is full, with flow discharging from the sand filter outlet, before starting trials. The backwash flow rate should be set by adjusting the butterfly valve on the return line.

The correct operation on backwash start-up is as follows:

1. Pump draws down the waster level
2. The air scour initiates
3. The backwash water is drawn from the holding tank around the sand filter body
4. The air scour ends
5. The pump continues to run until the delay timer switches off or the level sensor on the pump operates.

SAND FILTER MAINTENANCE

The sand filter requires no special routine maintenance but its correct operation should be checked every three months.

The condition of the backwash pump should be checked as per the manufacturer’s instructions.