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A WCS Group Company

## **VSF04 SANDFILTER**

# **INSTALLATION, OPERATION & MAINTENANCE MANUAL**

**SITE NAME:**

**REFERENCE NUMBER:**

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## 1. SAFETY

It is extremely important that maintenance procedures in this document are followed. Any deviation from this could cause serious injury or have a detrimental effect on the filter and its operation.

### 1.1 Health and safety at work act 1974:

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

The user's attention should be drawn to the following:

- All sections of this manual should be read before undertaking work on the equipment.
- Suitably trained personnel must carry out the installation.
- Normal safety precautions must be taken and appropriate procedures observed to avoid accidents.
- Refer to WCSEE Ltd for further technical advice or product information.

### 1.2 General health and safety:

The layout of the Croesgoch plant has been laid out to ensure that health and safety on site is optimised. It will be vital that the routes to all of the equipment are laid out in a proper manner and they are followed implicitly. Lone working in the plant should be prohibited.

### 1.3 Leptospirosis:

The following is extracted from a health warning card issued to WCSEE Ltd's staff. It is the client's responsibility to ensure that the relevant Personal Protective Equipment (PPE) is available and used.

There are two types of Leptospirosis that effect people in the UK and they are as follows:

1. Weil's disease, which is a serious infection transmitted to humans by contact with soil, water or sewage that has become contaminated with urine from infected rats.
2. Hardjo-type Leptospirosis, which is transmitted from cattle to humans.

The typical symptoms for both diseases start with a flu like illness, with a persistent and severe headache, muscle pains and vomiting. Jaundice generally appears on the fourth day of the illness.

The bacteria can enter your body through cuts and scratches or through the lining of the mouth, throat and eyes.

### 1.4 Sensible precautions:

After working with contaminated fluid or other materials it is important that hands and forearms are washed thoroughly with soap and water. If your clothing or boots become contaminated then they should also be washed immediately after use.

Immediate action should be taken, so that any cuts scratches or abrasions are washed thoroughly with clean water, prior to applying any protective covering (plaster or bandage).

Do not handle food, drink or smoking material without first washing your hands. If you display any of the symptoms described after coming in to contact with sewage; report to your doctor immediately advising them of the circumstances.

### 1.5 Vaccinations:

To avoid the possibility of illness it is recommended that all site personnel have the following vaccinations. WCSEE Ltd also recommends that you that you consult your doctor for any additional vaccinations that you may require. The general vaccinations WCSEE use for all personnel are as follows:

- Hepatitis A
- Hepatitis B
- Polio
- Tetanus
- Typhoid/cholera – probably carried out as a child.

## 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. WCSEE 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. WCSEE 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. WCSEE 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, WCSEE 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 WCSEE 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

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 WCSEE 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.

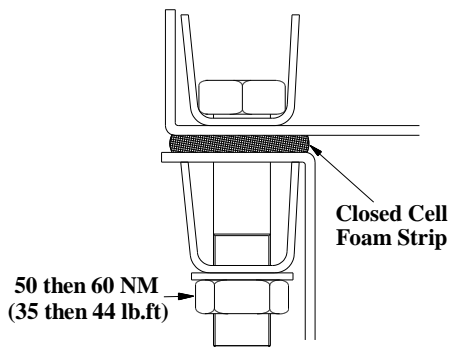
### 4.3 Electrical Equipment

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. (Data Sheets for electrical components can be found in appendix 3).

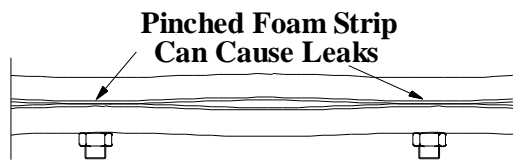
### 4.4 Bolts and Bolt Strips

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.



### CAUTION Do Not Over Tighten



### 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.

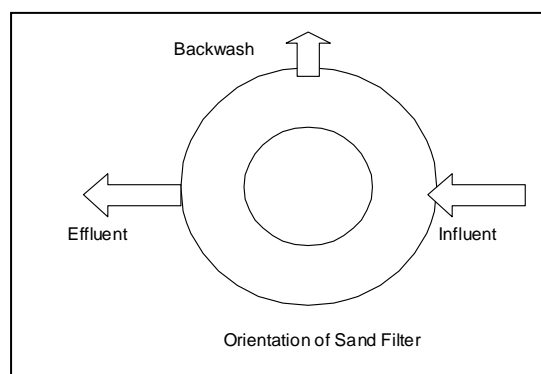
During the course of installation the following will be required:

- 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 WCSEE 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 WCSEE 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.

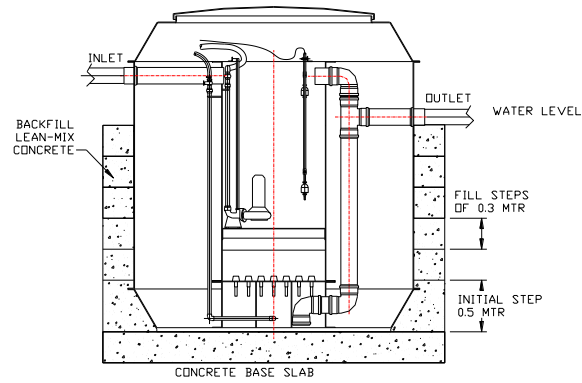
Step 6 Commence filling unit with water into all sections to a level of 500mm.

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).

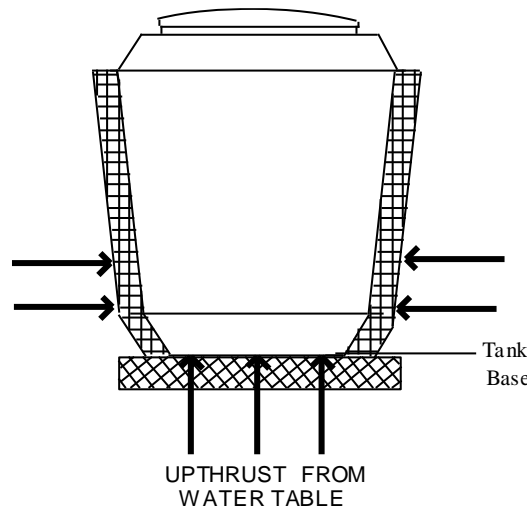
### 5.3 Local Ground Conditions

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**

**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 14.

## 6. PIPEWORK, DUCTS AND SAMPLE CHAMBERS

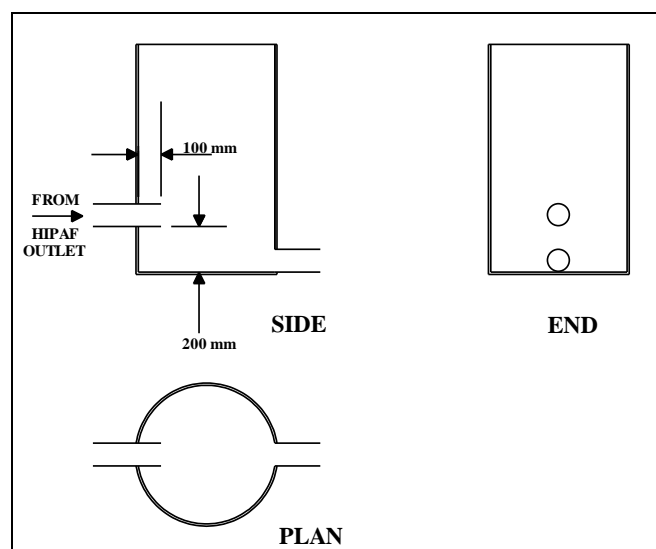
### 6.1 Pipework

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 17th, 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 WCSEE 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 WCSEE 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 backup 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 contaminants 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.

WCSEE sand filters are immediately effective once they are commissioned.

## 9. Operation and Maintenance

### 9.1 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:

- Pump draws down the waste level
- The air scour initiates
- The backwash water is drawn from the holding tank around the sand filter body
- The air scour ends
- 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. In doing so, the level of the sand in the centre tube needs to be kept topped up. On experience this should be topped up every year, although the amount of sand required varies from site.

The sand should be kept at level of 450mm from the steel plate. 2mm-4mm Dry Quartz sand should be used and can be purchased from WCSEE directly.

### **Sand Filter Pump 1315 (Appendix 3)**

The condition of the Sand Filter Pump should be checked as per the manufacturer's instructions. Please see the Lowara O&M (attached with this document).

### **Blower 2BH1610 (Appendix 4)**

The condition of the Sand Filter Blower should be checked as per the manufacturer's instructions. Please see the Elmo Rietschle O&M (attached with this document).

Below on page 18,19 are the servicing manuals for the blowers. Please read through these carefully.

9 Servicing

**⚠ WARNING**  
**Improper use of the unit can result in serious or even fatal injuries!**  
 Have you read the safety precautions in Chapter 1, "Safety", Pg. 3 f.?  
 Otherwise you may not carry out any work with or on the pump-motor unit!

**⚠ WARNING**  
**Improper use of the unit can result in serious or even fatal injuries!**  
 All maintenance work on the pump-motor unit must always be performed by the Service Department!  
 Maintenance work on the pump-motor unit may only be conducted by the operator itself when the related maintenance manual on hand!  
 Inquire with the Service Department!

9.1 Emptying/Rinsing/Cleaning

Before any maintenance/servicing work, empty, rinse and clean the outside of the unit.

- Empty unit with air and rinse until all residues have been removed.
- Clean the outside of the unit with compressed air.
  - Wear gloves and protective safety glasses.
  - Secure the surrounding area.
  - Clean the entire surface of the unit and exterior fan with compressed air.

9.2 Repairs/troubleshooting

Fault	Cause	Remedy	Carried out by
Motor does not start; no motor noise.	At least two power supply leads interrupted.	Eliminate interruption by fuses, terminals or power supply cables.	Electrician
Motor does not start; humming noise..	One power supply lead interrupted.	Eliminate interruption by fuses, terminals or power supply cables.	Electrician
	Impeller is jammed.	Open vacuum pump/compressor cover, remove foreign body, clean.	Service <sup>x1</sup>
		Check or correct impeller gap setting if necessary.	Service
	Impeller defective.	Replace impeller.	Service <sup>x1</sup>
	Rolling bearing on drive motor side or vacuum pump/compressor side defective.	Replace motor bearing or vacuum pump/compressor bearing.	Service <sup>x1</sup>
Protective motor switch trips when motor is switched on. Power consumption too high.	Winding short-circuit.	Have winding checked.	Electrician
	Motor overloaded. Throttling does not match specification on rating plate.	Reduce throttling.	Service <sup>x1</sup>
		Clean filters, mufflers and connection pipes if necessary.	Service <sup>x1</sup>
	Compressor is jammed.	See fault: "Motor does not start; humming noise." with cause: "Impeller is jammed.".	Service <sup>x1</sup>

Servicing

Fault	Cause	Remedy	Carried out by
Pump-motor unit does not generate any or generates insufficient pressure difference.	Leak in system.	Seal leak in the system.	Operator
	Wrong direction of rotation.	Reverse direction of rotation by interchanging two connecting leads.	Electrician
	Incorrect frequency (on pump-motor units with frequency converter).	Correct frequency.	Electrician
	Shaft seal defective.	Replace shaft seal.	Service <sup>*)</sup>
	Different density of pumped gas.	Take conversion of pressure values into account. Inquire with Service Department.	Service
	Change in blade profile due to soiling.	Clean impeller, check for wear and replace if necessary.	Service <sup>*)</sup>
Abnormal flow noises.	Flow speed too high.	Clean pipes. Use pipe with larger cross-section if necessary.	Operator
	Muffler soiled.	Clean muffler inserts, check condition and replace if necessary.	Service <sup>*)</sup>
Abnormal running noise.	Ball bearing lacking grease or defective.	Regrease or replace ball bearing.	Service <sup>*)</sup>
Compressor leaky.	Seals on muffler defective.	Check muffler seals and replace if necessary.	Service <sup>*)</sup>
	Seals in motor area defective.	Check motor seals and replace if necessary.	Service

<sup>\*)</sup> Only when the maintenance manual is at hand: rectification by the operator.

## APPENDIX 1

### KIOSKS AND BASE SLABS

WCSEE 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, WCSEE 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 WCSEE before laying the concrete.

#### Medium Kiosk

WCSEE'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:

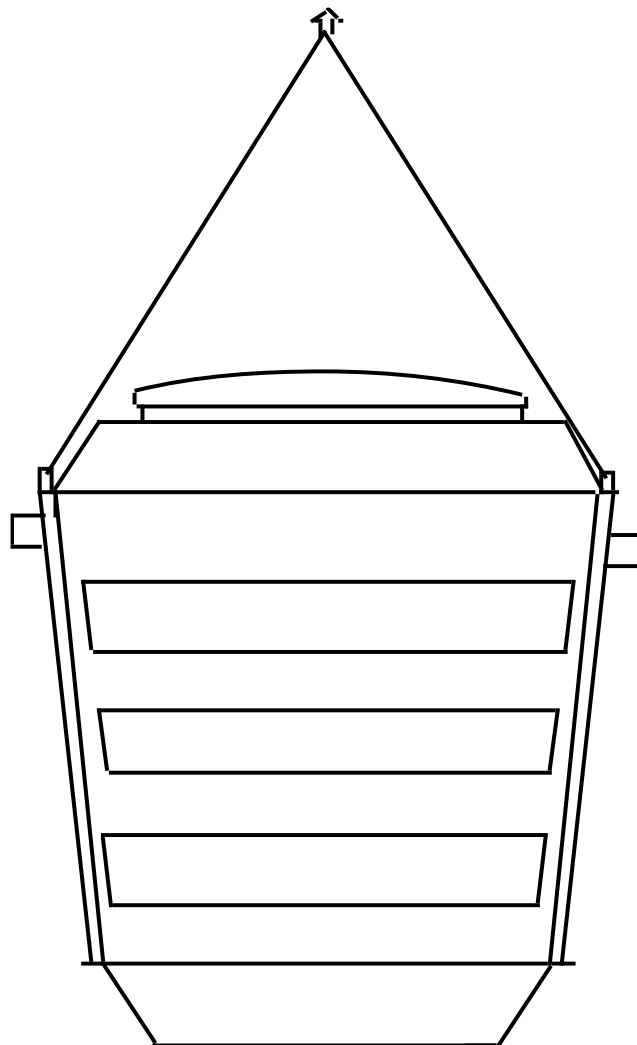
- **Ensure that there is unobstructed air flow from all the vents otherwise overheating will occur.**
  
- **Ensure the kiosk is installed above any areas likely to flood.**

## APPENDIX 2

### 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 60° 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.

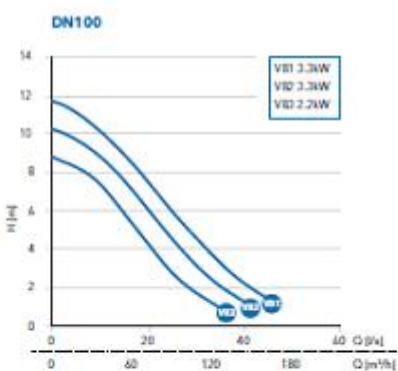


### APPENDIX 3

Lowara 1315 Pump – O&M Manual Attached on separate PDF.



Performance curves



Selection table

Model	DN	Installation*	Pole	Freq (Hz)	Phase	Rated Power	Curve no	Voltage	Cable	Order number**
1315S	80	X	2	50	3	[see chart]	V91, V92, V94	400	10	1315H-80X.253.....400/10
1315M	100	X	4	50	3	[see chart]	V81, V82, V83	400	10	1315M-100X.453.....400/10

\*X=Bare pump.

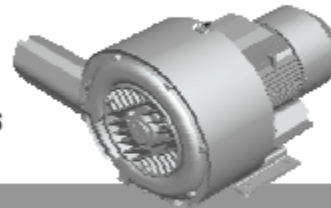
\*\*For information on configuring the right order number, see page 7. Pumps come standard with thermal switches

**APPENDIX 4**

**BLOWER - 2BH1610 – O&M Manual Attached on separate PDF**



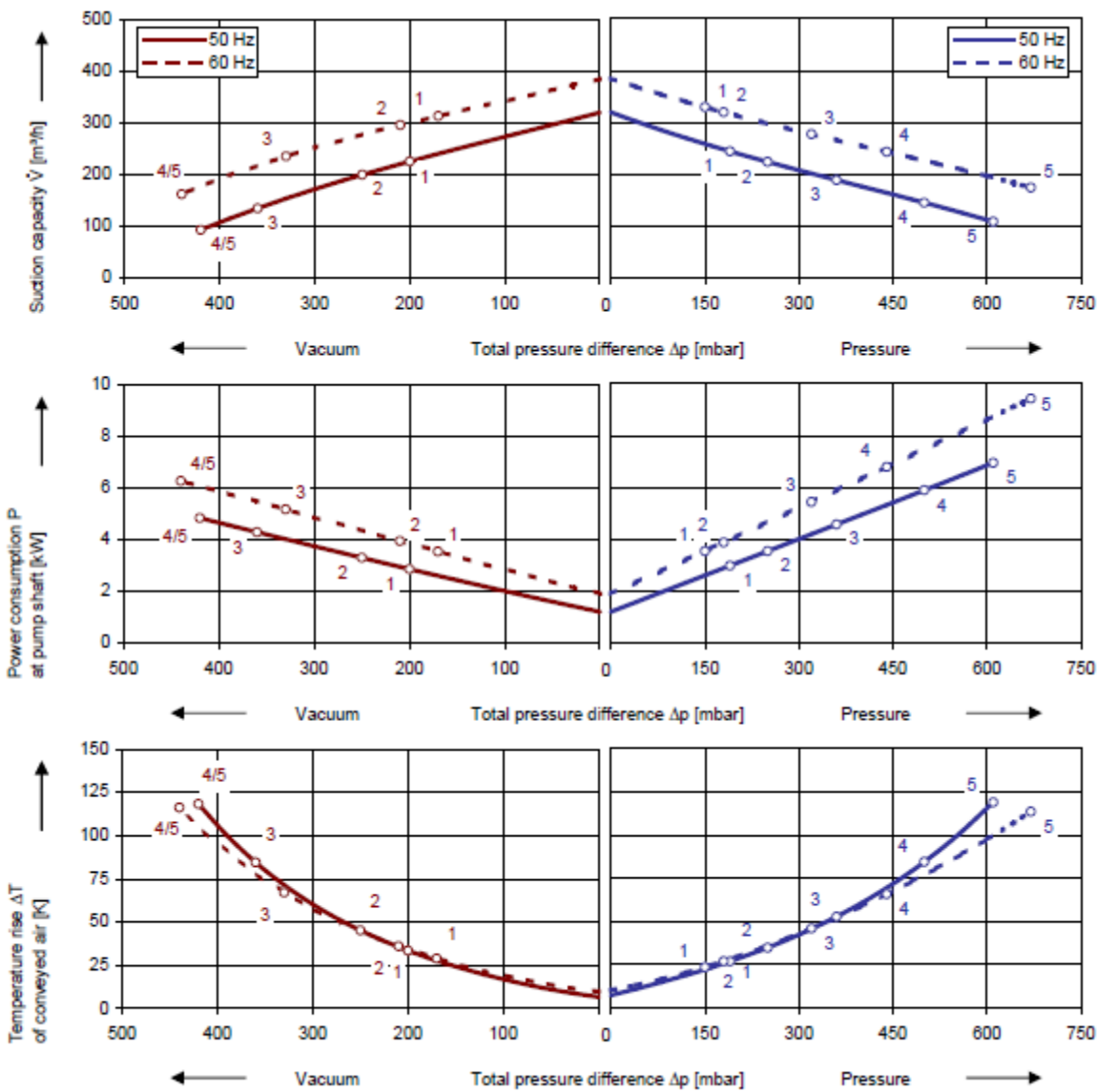
**G-BH1**  
**Data sheet 2BH1 610**  
 Side channel blower



**Performance curves**

**Vacuum operation**

**Compressor operation**



Selection and ordering data									
Type 2BH1 610									
No.	Fre- quency	Rated			Max. differential pressure <sup>2)</sup>		Sound pressure level <sup>3)</sup>	Weight Approx.	Order No.
		Voltage <sup>1)</sup>	Current	Power	Vacuum	Pressure			
					mbar	dB(A)			
3~ 50/60 Hz, IP55, Insulation material class F, UL 507 and CSA 22.2 No 113 (certificate number E225239)									
1	50	200 - 240 Δ / 345 - 415 Y	9,7 Δ / 5,6 Y	2,20	-200	190	73	42	2BH1610-7HH16
	60	220 - 275 Δ / 380 - 480 Y	10,3 Δ / 6,0 Y	2,55	-170	150	75		
2	50	200 - 240 Δ / 345 - 415 Y	12,5 Δ / 7,2 Y	3,00	-250	250	73	47	2BH1610-7HH26
	60	220 - 275 Δ / 380 - 480 Y	12,6 Δ / 7,3 Y	3,45	-210	180	75		
3	50	345 - 415 Δ	10,0 Δ	4,30	-360	360	73	53	2BH1610-7HH37
	60	380 - 480 Δ	10,4 Δ	4,80	-330	320	75		
4	50	345 - 415 Δ	13,3 Δ	5,50	-420	500	73	70	2BH1610-7HH47
	60	380 - 480 Δ	13,3 Δ	6,30	-440	440	75		
5	50	345 - 415 Δ	16,7 Δ	7,50	-420	610	73	77	2BH1610-7HH57
	60	380 - 480 Δ	17,3 Δ	8,60	-440	670	75		
3~ 50/60 Hz, IP55, Insulation material class F, UL 507 and CSA 22.2 No 113 (certificate number E225239)									
1	50	500 Δ	4,5 Δ	2,20	-200	190	73	42	2BH1610-7HC15
	60	575 Δ	4,55 Δ	2,55	-170	150	75		
2	50	500 Δ	Δ	3,00	-250	250	73	47	2BH1610-7HC25
	60	575 Δ	Δ	3,45	-210	180	75		
3	50	500 Δ	7,5 Δ	4,00	-360	360	73	53	2BH1610-7HC35
	60	575 Δ	7,60 Δ	4,60	-330	320	75		
4	50	500 Δ	10,5 Δ	5,50	-420	500	73	70	2BH1610-7HC45
	60	575 Δ	10,4 Δ	6,30	-440	440	75		
5	50	500 Δ	13,0 Δ	7,50	-420	610	73	77	2BH1610-7HC55
	60	575 Δ	13,6 Δ	8,60	-440	670	75		

- 1) In case of frequency converter operation the standard motor insulation system is suitable for converter input voltages up to 460 V.
- 2) Relief valves available for limiting differential pressure.
- 3) Measuring surface sound pressure level acc. to EN ISO 3744, measured with an equivalent unit at a distance of 1 m. The pump is throttled to an average suction pressure, with piping connected, but no relief valves fitted, tolerance ±3 dB (A).

All G-BH fulfil the 2006/42/EC (machinery) and 2006/95/EC (low voltage) directives and the EN 60034-1 norm "Rotating electrical machines".

The motors comply with EN 60 034-1 / -2 / -30 (IEC 60034) and thermal class F.

For three phase motors tolerances are +/-10% for fixed voltage motors and +/-5% for voltage range motors. Single phase machines are designed with a +/- 5% tolerance.

The frequency tolerance is +/- 2 % maximum.

Other voltages						
50 Hz	50 Hz voltage range	60 Hz voltage range	86 Hz (5000 rpm)	100 Hz (6000 rpm)	2BH1...-7.	
3~						
—	185 - 225 V Δ / 320 - 390 V Y	200 - 240 V Δ / 345 - 415 V Y	—	400 V Δ		H 1
—	200 - 240 V Δ / 345 - 415 V Y	220 - 275 V Δ / 380 - 480 V Y	380 V Δ	—		H 6
—	345 - 415 V Δ	380 - 480 V Δ	—	—		H 7
—	500 V Δ	575 V Δ	—	—		C 5
IE2 3~ <sup>5)</sup>						
200 V Δ / 345 V Y	180 - 240 V Δ / 310 - 415 V Y	200 - 275 V Δ / 345 - 480 V Y	—	400 V Δ		P 1
500 V Δ	450 - 550 V Δ	520 - 600 V Δ	—	—		P 5
230 V Δ / 400 V Y	200 - 260 V Δ / 350 - 450 V Y	230 - 290 V Δ / 400 - 500 V Y	400 V Δ	—		P 6
400 V Δ / 690 V Y	350 - 450 V Δ / 610 - 725 V Y	400 - 500 V Δ / 690 - 725 V Y	—	—		P 7

- 5) Performance can differ if high efficiency motors are used. Please refer to corresponding data sheets.

Changes in particular of the quoted performance curve, data and weights may occur without prior notice. The data given do not constitute an obligation from our side to deliver as shown.



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**Disclaimer**

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