Marine Sector

H1033 / National Security Multi-Mission Vessel (NSMV)

Installation Operation and Maintenance Manual

for Vacuum toilets and vacuum collecting unit

DSEC CO.,LTD

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Evac

Cleantech Solutions.
Anywhere.

⟩⟩ Operation and Maintenance Manual

Evac OnlineFlex

Vacuum Collection

28 Nov 2018 | 006203 | REVISION 1

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1. Introduction

1.1 General

The Evac OnlineFlex unit is designed for cargo vessels and small passenger vessels. The Evac OnlineFlex unit is optimal for small and medium size vacuum systems with high flow capacity requirements.

- Extremely small footprint, 1m^2
- Reliable and robust technology
- Low maintenance

Vacuum is generated, and sewage is pumped by special type of rotary lobe pump. Vacuum generation is controlled by the vacuum sensor and PLC.

1.2 Manual overview

This manual provides instructions and notices for the commissioning and operation of the Evac OnlineFlex units, as supplied by Evac Oy. Manual includes important safety instructions and covers the operation and maintenance of the all OnlineFlex units.

Unit	Evac PN Number	Data page
OnlineFlex FX30	6545599	002539
OnlineFlex FX30	6550112	002539
OnlineFlex FXi 30	6545600	002540
OnlineFlex FXi 30	6550113	002540
OnlineFlex 2 FX30	6545601	002541
OnlineFlex 2 FX30	6550114	002541
OnlineFlex 2 FXi 30	6545602	002542
OnlineFlex 2 FXi 30	6550115	002542
OnlineFlex FX 60	6545595	002535
OnlineFlex FX 60	6550108	002535
OnlineFlex FXi 60	6545596	002536
OnlineFlex FXi 60	6550109	002536
OnlineFlex 2 FX 60	6545597	002537
OnlineFlex 2 FX 60	6550110	002537
OnlineFlex 2 FXi 60	6545598	002538
OnlineFlex 2 FXi 60	6550111	002538

It is important that this manual is reviewed by all relevant personnel and all procedures are fully understood before Evac unit maintenance, so that all activities are completed safely and correctly.

The following notices are used in this user's manual:

! DANGER: **Indicates an imminently hazardous situation, which could result in a fatality or a serious injury if the appropriate precautions are not taken.**

! WARNING: **Indicates a potentially hazardous situation, which could result in serious damage or failure of the equipment if the appropriate precautions are not taken.**

! CAUTION: **Indicates a potentially hazardous situation, which could result in minor damage or failure of the equipment if appropriate precautions are not taken.**

! NOTE: **Indicates that there are important matters related to the process that the operator should be aware of.**

1.3 Short description of Evac OnlineFlex features

The inlet pipe of the Evac OnlineFlex is connected to the vacuum manifold of the ship. The outlet pipes for sewage is connected directly to the discharge pipe.

The vacuum is generated, and sewage is discharged by Evac Online pump FX30 or FX60.

The vacuum level is controlled by the vacuum sensor (PIC).

2. Safety instruction

2.1 General

These operating instructions contain the basic procedures to be followed during installation, operation and maintenance of the equipment. Please keep the handbook in a safe and accessible location next to the unit.

Carefully read these instructions before operating the system. Always comply with the safety instructions listed in this document, the existing shipboard accident prevention regulations and any internal Work Health and Safety rules.

Persons could be endangered, and damage of the machine may result if the machine is not used for the intended purpose. Inadequately trained personnel and incorrectly performed work may also cause harm.

! NOTE: A first aid kit should be available at all times.

2.2 Personnel qualification and training

Ensure that all personnel involved in the installation, commissioning, operation and maintenance of the Evac units are properly qualified and trained to carry out these tasks. Work on the electrical system and equipment of the Evac plants must be carried out by a properly qualified electrician only. Lack of personnel's skills and knowledge of the operation instructions can cause risk to life and damage to the equipment. Evac systems must be used according to the following instructions, and only by authorized personnel who are fully aware of the risks involved in the operation of the unit.

Moreover, the operating company has the responsibility to ensure that personnel fully comprehend the contents of the operating instructions.

The Evac units receives, treats and discharges sewage waste. Personnel must, at all times, observe safety regulations while performing maintenance or repairs which carries certain hazards. Every practical safety feature has been incorporated into the design and manufacture of this equipment; however, personnel must be aware of the potential hazards.

2.3 Disease hazard

Sewage is a common mode of transmission for parasitic organisms such as bacteria, fungi, protozoa, viruses and worms. Some of these may be pathogenic; they are capable of causing serious communicable diseases. Most diseases associated with sewage result from hand-to-mouth transfer of the pathogenic organisms. After coming into contact with sewage or any contaminated equipment items, personnel should thoroughly wash themselves with a disinfectant soap solution. This precaution is an absolute requirement before eating, drinking or performing hand-to-mouth functions. Skin abrasions, punctures or any other wounds require immediate and proper medical attention. Also, it should be avoided to perform maintenance work on the Evac units if there are any kinds of wounds on the skin in areas that can get into contact with the wastewater or sludge.

2.4 Mechanical hazards

Before maintenance is performed on any motor driven equipment, disconnect the motor's power cord. Prevent the motor from switching on unexpectedly. Motors should also be labelled "OUT OF SERVICE". Only authorized maintenance personnel should make repairs to this equipment.

! CAUTION: Safety devices may only be opened, dismantled or removed when the machine is standstill and safety secured.

2.5 Electrical hazard

Evac equipment is supplied with voltages that are dangerous and potentially fatal. To avoid electrical shock, cut the electrical current by placing the main circuit breaker in 'OFF' position. Do this before performing any maintenance work on electrical equipment or motors. Personnel should exercise extreme caution when opening the electrical cabinet door although the main circuit breaker is in 'OFF' position; the terminals of incoming electrical current are still live.

2.6 Hazard during installation

Proper placement can extend equipment life time. All Evac units shall be installed on straight and steady base. The unit is to be levelled horizontally. There should be sufficient space for operation and maintenance. The machine must be anchored securely to the foundation or supporting structure. Ensure that in case of a leak any surrounding equipment is not damaged. Before installation, operators should be aware of the contents of this manual. Mechanical installation must be completed before any electrical work commences.

Switching the machine on for operational check, trail run, wet testing, etc. may only be performed by skilled electricians performing the electrical connection work.

! DANGER: The combination of water and electricity can be fatal.

2.7 Operation and maintenance hazards

Evac plants shall be operated and maintained by authorized and trained personnel only. All work and modifications to the system shall be approved by the manufacturer. Under no circumstances shall the equipment power be switched on, or the equipment be pressurized when work is performed. Be aware of the rotating parts of pumps and screw conveyors.

Before the start-up of the Evac unit, ensure that no one is in danger. Take all necessary measures to ensure that the Evac unit is used only in a safe and reliable state.

Once per day check the Evac unit for obvious damage and defects. In case of damage or a change in the normal operation of the unit, stop the unit immediately and refer to the trouble shooting section. In case of the ship's crew is unable to bring the system to its normal operation, please contact Evac Oy.

The electrical parts of the unit should to be inspected at regular intervals. Defects like loose connections or scorched cables must be repaired without delay. Inspection, servicing and maintenance work is only allowed to be carried out when the machine is at standstill and safety secured. Ensure that the unit is completely switched off before any maintenance and repair work is undertaken.

Restart is only permitted after malfunctions, faults and/or damages have been completely rectified. Never use the Emergency-STOP palm button for normal stopping of the machine, malfunctions/damages may be the result.

! CAUTION: **The Evac plant is exclusively designed to treat black and grey water and it should not be used for any other purposes. The manufacturer cannot be held responsible for any damage caused by improper use of the plant. The user is totally responsible of risks caused by such misuse.**

! CAUTION: **Before starting the plant, it shall be ensured that no unauthorized persons are close the machine, either working on it or at risk from its start up.**

2.8 Disposal and Environmental protection

The operator is responsible to disposing of materials which result from maintenance. This may involve, waste water and solid residue, cleaning and care agents, auxiliary material, e.g. lubricants, other waste materials of all sorts, including worn machine components.

Disposal must be performed according to, the law for protection of emission, for waste disposal, for protection of water resources, etc.

2.9 Evac component nameplates and tag numbering

Component tag plates should not be removed during maintenance and if removed must be attached back to correct place after maintenance work. The name plates with equipment tag number, label plates, caution plates, marking notice boards, instruction plates, safety markings etc. are supplied by Evac and engraved with letters in English language.

3. Preservation

The functional requirements for preservation are to apply and maintain the preservation condition and operability of systems and equipment before taken into use.

The minimum requirements for preservation maintenance shall be as detailed on the preservation checklists. Preservation maintenance checklists have been developed for the mechanical, electrical and instrument disciplines. The mechanical checklist also covers preservation for piping, insulation and surface protection of equipment.

3.1 Preservation principles

3.1.1 Inspection of equipment on receipt.

All equipment shall, on delivery to the next phase, be checked with respect to the condition of the preservation. Any anomalies shall be rectified according to requirements. For equipment packages supplied internally preserved, hermetically sealed with humidity detectors fitted, no further action except external inspection is required during storage period. If preservation material is removed or damaged due to normal construction or commissioning activities, or for any other reason, the receiver shall rectify or reinstate the preservation.

3.1.2 Storage

The receiver shall be solely responsible for the care and cleanliness of the equipment during off-loading, handling, storage and construction period and shall ensure a standard of care and cleanliness appropriate to the type and duty of the equipment. Outdoor storage is only acceptable for equipment prepared for it by the supplier. Maintenance preservation according to this standard shall be performed during the storage period. For special or sensitive equipment, designated storerooms shall be heated, vented, clean and dry. The storage environment has to fulfil the suppliers' requirements.

3.1.3 Construction/weather protection

During fabrication, installation and construction, a temporary protective slanting roof with sidings shall be erected around the equipment. This temporary protection shall be non-flammable. Other types of equipment such as instruments, shall be protected with an aluminium sheeted glass fibre cloth, min. 0,3 kg/m2 and sealed or equivalent. The receiver shall design and install a temporary covering enclosure for protection. The enclosure must be provided with access for lifting, hook up of piping, hook up of electrical/instrument cables and access for periodic maintenance of preservation without the removal of the entire enclosure.

3.1.4 Corrosion Protection

For all equipment the minimum requirements will be stated in the technical specification forming part of the Purchase Order. All internal parts shall be protected from physical damage and corrosion after cleansing with a readily biodegradable cleaning fluid. A list of specific rust preventatives and current Material Safety Data Sheets used to protect the material shall be securely attached to the packed equipment or enclosed in the packing container.

Included in the above list shall be any special instructions deemed necessary for the removal or replacement of any rust preventative together with any special precautions to be taken in the care of this material during the period of storage.

All openings in equipment and materials (including piping) shall be fully sealed to protect against ingress of water, dirt, sand, etc.

All exposed weld-preparations shall be protected from mechanical damage by suitable means. The machined face of all exposed flanges shall be protected from mechanical damage by suitable means.

For machines having ball or roller bearings, adequate precautions shall be taken to prevent damage to the bearings during transit and storage, including, if necessary, the dismantling and separate packaging of the same.

HSE issues regarding protective coatings shall be identified and all hazards and control measures to ensure no harm comes to the Goods being supplied or to anyone likely to come into contact with the coatings applied. Copies of the Material Safety Data Sheets (MSDS) must be available prior to shipment and included within the transit documentation.

3.1.5 Exclusion of Moisture

Equipment shipped in cases or boxes, and susceptible to corrosion in a marine environment, or in accidental contact with seawater shall be wrapped and heat-sealed in moisture resistant polyethylene sheeting, not less than 0.3 mm thick. Other materials shall only be used with Customer's written acceptance / approval.

All equipment to be packed shall be dry and all moisture is to be excluded before sealing.

The enclosure shall be suitably robust as to exclude rain and seawater under normal shipping conditions. The provision of a moisture vapour barrier will minimise the penetration of moisture during transportation and storage. All moisture vapour barrier materials have an accepted vapour phase transmission rate, and to include desiccative material within the moisture vapour barrier. The common material used to provide the moisture vapour barrier is polythene sheet while Silica Gel is used as a desiccant.

It is recommended that desiccants for moisture absorption should be regenerable, noncorrosive and colour indicator type to show loss of activity.

When equipment is being prepared for a desiccated pack, all sharp edges and protruding items shall be covered with felt or moldable wrap, so that no risk of puncturing the film barrier, either during its shrinking onto the equipment or during transit and storage, occurs. Similarly, all supporting timbers which could trap or puncture the film barrier shall have a layer of felt at the contact points, both inside and outside the barriers. Felt shall be placed on the base at all points, where it comes into contact with the film barrier.

3.2 Short term and Long-Term Preservation of OnlineFlex

3.2.1 Short term preservation instructions

The following guidelines shall be followed for short term preservation:

- All manual valves shall be closed, and all open pipe ends etc. shall be covered.
- Electric motors and electrical instruments shall be covered by waterproof overlapping material.
- A dehydrator shall be installed inside the control panel enclosure.
- Control panel switches and all displays if any, shall be protected by plywood (or similar) and the control panel shall be covered by a waterproof overlapping material.
- The entire OnlineFlex plant shall be covered by a waterproof overlapping material.

3.2.2 Long term preservation instructions

The following guidelines shall be followed for long term preservation:

- Shafts on rotating equipment which are not locked shall be rotated 1 1/4 turn in the rotating direction to avoid brinelling when located in one position for long periods. Make sure that the new shaft position varies from check to check.
- Bearings with lube oil housing, check that the oil level is adequate prior to rotation.
- Check that compartment heater is working.
- Check and report that preservation of control instruments and switch-gear are maintained as per preservation requirements.
- Inspect and list any damage to the equipment.
- Check that painted and machined surfaces, which shall be coated with a rust preventive wax or oil are maintained.
- Check that the protective covers are maintained.
- Sensitive equipment shall be stored indoor in heated and humidity controlled storage areas.
- All in/outlets from OnlineFlex shall be plugged/blanked. Flanges shall be blanked with oil resistant rubber gaskets and steel or water resistant plywood plate with 4 off galvanised bolts sufficient to provide mechanical protection and water/dust tight sealing.
- Bulk carbon steel piping shall be delivered coated with a corrosion inhibitor (inside and outside) and fitted with end caps. The corrosion inhibitor shall be an easily removable preservation agent.
- All exposed unpainted-machined surfaces shall be coated with rust preventive wax.
- Aluminium sheeted glass fibre cloth shall be used to envelope pressure gauges, controllers, panels, junction boxes, instruments, detectors, transmitters, heaters, push-buttons, and connection boxes.
- All ball valves shall be locked in the open position.
- All exposed valves spindles shall be covered with grease tape, teflon lubricant and vulcanizing tape or equal.
- General clean up routine and good housekeeping is a prerequisite for successful execution of preservation.
- Desiccative material shall not be in direct contact with metallic surfaces.

3.3 Instructions for electrical and electronic equipment

- All electrical and electronic equipment exposed to humidity shall be protected with desiccant or a vapour corrosion inhibitor.
- Special precaution is to be taken on electrical heaters. To be specified in supplier's preservation instruction.
- Shafts on electrical motors and mechanical seals shall be protected with grease tape, silicon-based lubricant and vulcanizing tape or equivalent.
- All non-terminated cable ends shall be fitted with a shrinking shroud.
- All spare cable entrances in panels and boxes shall be plugged.
- All space / motor heaters on motors, generators, panels etc. should be energised during storage and installation phase.
- Gaskets / O-rings on electrical and electronic equipment shall be greased with acid free Vaseline.

3.4 Instructions for instrument equipment

- Instrument equipment containing electronics shall be protected with desiccant or a vapour corrosion inhibitor.
- All openings in hydraulic/pneumatic tubing shall be provided with steel caps or solid shank steel plugs of metallurgy equal to the metallurgy of the component being capped or plugged. Non-metallic plugs shall not be used.
- Gaskets / O-rings on instrument equipment shall be greased with acid free Vaseline or equivalent.
- All non-terminated cable ends shall be fitted with a shrinking shroud.
- All spare cable entrances in panels and boxes shall be plugged.

3.5 Instructions for mechanical equipment

- Coat all carbon steel flanges on gasket faces, including access hatch covers with rust preventive wax.
- Open flexible hose connections shall be plugged.
- All greased bearings shall be greased.
- All spools / lines shall be protected with min. 10 mm water-resistant plywood plate with 4 off galvanized bolts and a form of gasket sufficient to provide mechanical protection and water / dust tight sealing.
- All ends that have been bevelled for welding shall be provided with a closure designed to prevent foreign material entering and damage to the bevel.
- All factory prepared pipes delivered from the pipe supplier shall be capped at both ends with a heavy plastic cap.
- Carbon steel pipes that are internally sandblasted or chemically cleaned shall be preserved internally with a water based / soluble inhibitor without the content of solvents.
- All threaded openings shall be provided with steel caps or solid-shank steel plugs of metallurgy equal to the metallurgy of the component being capped or plugged.
- Valves supplied for stock are to be preserved for long term storage, all exposed valves spindles shall be covered with grease tape, teflon-based lubricant and vulcanizing tape or equivalent.
- Gate valves shall be stored and installed in their closed position, globe and gate valves shall be locked in their open position.

3.6 Long term preservation of pumps

In correct storage; and under the consideration of the preservation instructions, the storage of pump is possible for a maximum of 2 years.

! NOTE: **In case of a longer storage period, the dimensions and shore hardness of elastomers and rubber materials can change. The function of the pump can be impaired. Before recommissioning, the elastomer parts (stator, joint seals, gaskets, etc.) have to be checked for crack formations and / or a change in the surface material. All hoses should be dismantled.**

Pumps or other units, which are stored over a longer period before start-up (max. 6 months), must be protected from moisture, vibrations and dirt (eg. by wrapping in oil paper or plastic). Pumps must be stored in an environment where they are protected from the weather, eg. under a dry cover. During this time, all suction and discharge branches and all other intakes and outlets must be closed with dummy flanges or plugs, or for longer periods of storage, conservation measures of machined surfaces by packing with moisture protection will be necessary!

Pumps must be stored in dry and airy containers free from gases, liquids and casting vapours which are harmful for the winding insulation of the motor. The ambient temperature must be +5....+40°C and relative humidity must not exceed 70%. Long periods of storage must include outside cleaning of the motor and checking if the bearings run free and operate correctly and if not, damaged bearings must be replaced.

Measurement of the winding insulation resistance (in a cool state) should be undertaken and if it is found to be lower than 20 MΩ the motors must be dried in a temperature not higher than +80°C. The shaft end must be protected against corrosion by the layer of corrosion preventing grease or easily removed varnish. To avoid adhesion of the mechanical seal faces a pump needs to be rotated (at least 1 1/4 revolutions) once a month when not in service.

Most components of the pumps can be stored without problems. But, due to high humidity levels we recommend wrapping the pump cartons in plastic bags, and putting enough desiccant (drying agent) material therein, then evacuate all air and seal the bag.

3.6.1 Freezing Weather Condition Precautions

If pumps are stored after use in conditions which are near or below freezing, this can cause problems for equipment when pumping water based fluids that expand in volume when changing from a liquid to a frozen solid state.

! WARNING: **When water based fluids are left in a pump fluid end and exposed to freezing temperatures, the expansion of the water as it freezes can rupture the fluid cylinders of the pump and can cause permanent damage to equipment. If damage is undetected, and the pump is operated, personnel injury could occur.**

Remove any water based fluids from the pump. Run the pump for 10 to 15 seconds with the suction and discharge lines disconnected or open to the atmosphere. Blow compressed air through the fluid end to remove all traces of

fluid. If possible, remove the pipe plugs and push open the suction valve seat to ensure that all fluid is drained from the pumping chamber. As an alternative to draining and drying the fluid end, a compatible

antifreeze solution can be circulated through the fluid end. Propylene glycol, is recommended for this purpose.

3.6.2 Storing of the pump

Complete pumps, cartridge mechanical seals, individual O-rings and seal components. If not stored and handled properly, the physical characteristics of products made of rubber may change. Possible consequences include excessive hardening, softening, lasting deformation, peeling, cracking or other surface damage.

Long-term storage is possible under the following conditions (longer than 6 months to a maximum of 5 years):

- The storage area should be dry (relative humidity under 65%) and the temperature should be between 5 °C and 30 °C.
- The pump chamber can be sealed with a preservative that is compatible with the material of the lobes and gaskets.
- The products should be protected against light, especially direct sunlight and strong artificial light with a high ultraviolet component.

After a storage period of five years or more and before start-up we recommend:

- Checking and renewing (if necessary) all wetted gaskets and lobes.
- Changing the gear oil and the buffer or quenching fluid.

For pumps with a mechanical seal that has the mating materials SiC-SiC, the shaft must be turned (at least one revolution) every two months so that the sealing surfaces of the mechanical seal rings do not stick together.

4. Operation description

4.1 General

This document provides a detailed process description of the all Evac OnlineFlex Vacuum unit. The Evac OnlineFlex unit is a fully automatic generator. The Vacuum is created using one or Evac Online pumps. OnlineFlex FX and OnlineFlex FXi has one online pump and OnlineFlex 2 FX and OnlineFlex 2 FXi has two pumps.

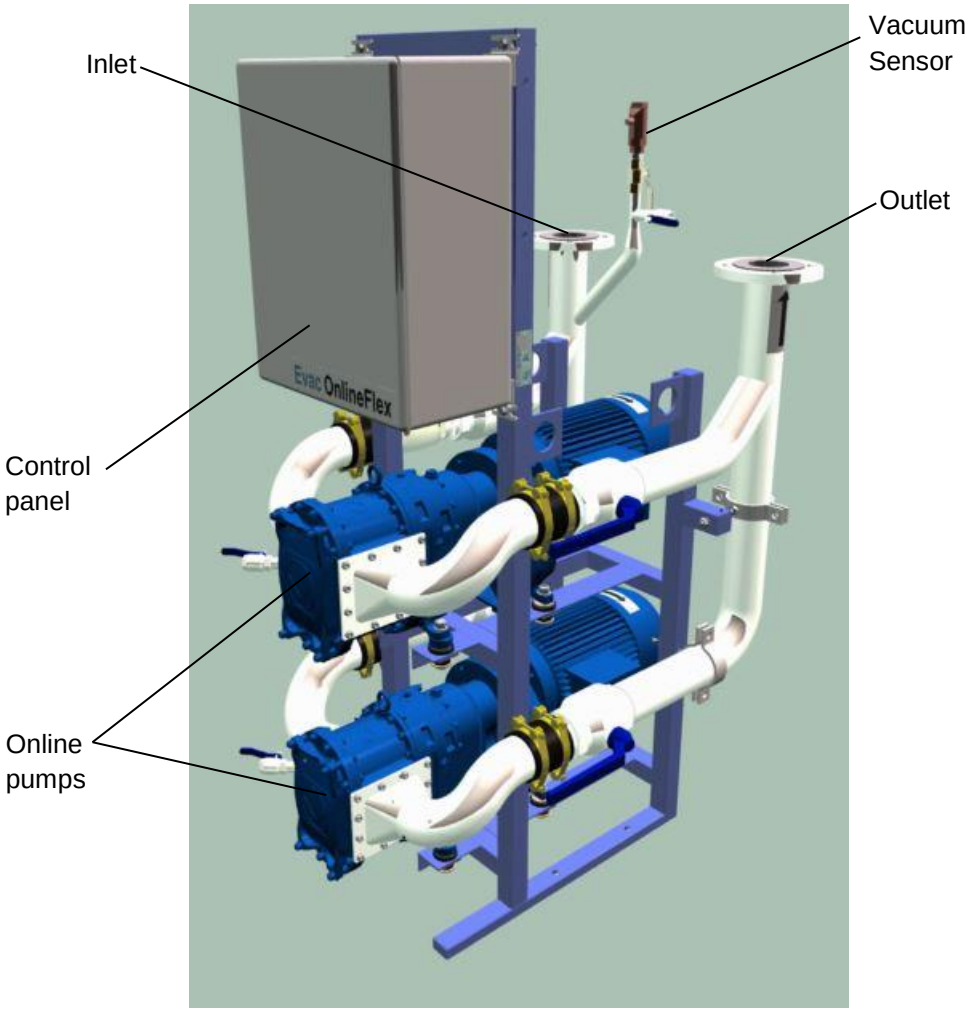


Figure 1 Evac OnlineFlex 2 FX60 unit

! NOTE: Cabling outside the Evac OnlineFlex framework is not an Evac supply

! NOTE: All pumps can be operated manually.

4.2 Short introduction for unit start up and shut down

4.2.1 Start up

1. Open the shut-off valves (V003, V006, V007, V010)
2. Open valve V002
3. Check that valves V001, V005, V009 is closed.
4. Fill the unit / pipes with water before you start the unit.
5. Turn Power on
6. Check always that the pumps are running at the right direction.
7. Turn the operation switch / switches to AUTO.
8. Turn all switches to AUTO
9. Press the restart button

4.2.2 Shut down

- Close the shut-off valve (V003, V006, V007, V010) in inlet line
- Turn all switches to 0
- Turn power off from the close all isolation valves in outlet line

! WARNING: Only work on the machine after complete standstill. Switch the main/power "OFF" and interlock the switch position.

4.3 Guidance notes for safe operation

! NOTE: Only start the machine when the protective and safety devices function correctly and are closed. Safety devices may only be opened, dismantled or removed when the machine is at standstill and safety secured!

It is not permitted to dismantle, switch off or bridge safety/protective devices and equipment. All safety devices shall be kept closed to prevent touching of moving or rotating machine parts and for prevention of emission when the machine is in operation.

Mechanical safety devices are, for example:

- Removable, screwed and locked covers.
- Arrow for direction of rotation

Warning and danger signs and instructions on the machine must not be removed and must always be readable.

The personnel entrusted with operating, maintenance, inspecting and mounting must have the corresponding qualification for this work. The machine is not designed to be used by persons with limited physical, sensory or mental capabilities or with a lack of experience or knowledge. If the personnel do not have the required knowledge, the respective persons are to be trained and instructed.

! NOTE: Every person involved work on the machine on-site which is mentioned above must have read and understood the complete operating instructions, in particular this section.

4.4 Flow diagram and components lists

4.4.1 Flow diagram

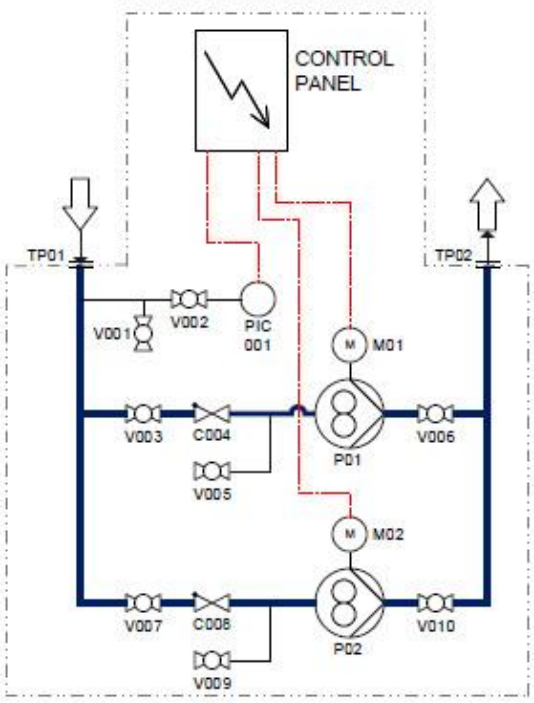


Figure 2 Example P&ID for OnlineFlex 2 unit

4.4.2 Component list

All components in the Evac OnlineFlex units are gathered to the tables below.

Table 1 Components

TAG code	Description	Evac PN Number (FX30)	Evac PN Number (FX60)
P01	Online pump 1	TBA	TBA
M01	Online pump 1 motor	TBA	TBA
P02*	Online pump 2	TBA	TBA
M02*	Online pump 2 motor	TBA	TBA
V001	Ball valve for sensor connection	5970501	5970501
V002	Pressure sensor root valve with drain bore	5437666	5437666
V003	Isolation valve in pump P01 suction	6543739	6541525
C004	Non-return valve in pump P01 suction	6543738	6541524
V005	Seed water valve for pump P01	5970501	5970501
V006	Isolation valve in pump P01 pressure side	6543739	6541524
V007	Isolation valve in pump P02 suction	6543739	6541524
C008	Non-return valve in pump P02 suction	6543738	6541525
V009	Seed water valve for pump P02	5970501	5970501
V010	Isolation valve in pump P02 pressure side	6543739	6541524

4.5 Evac OnlineFlex operation

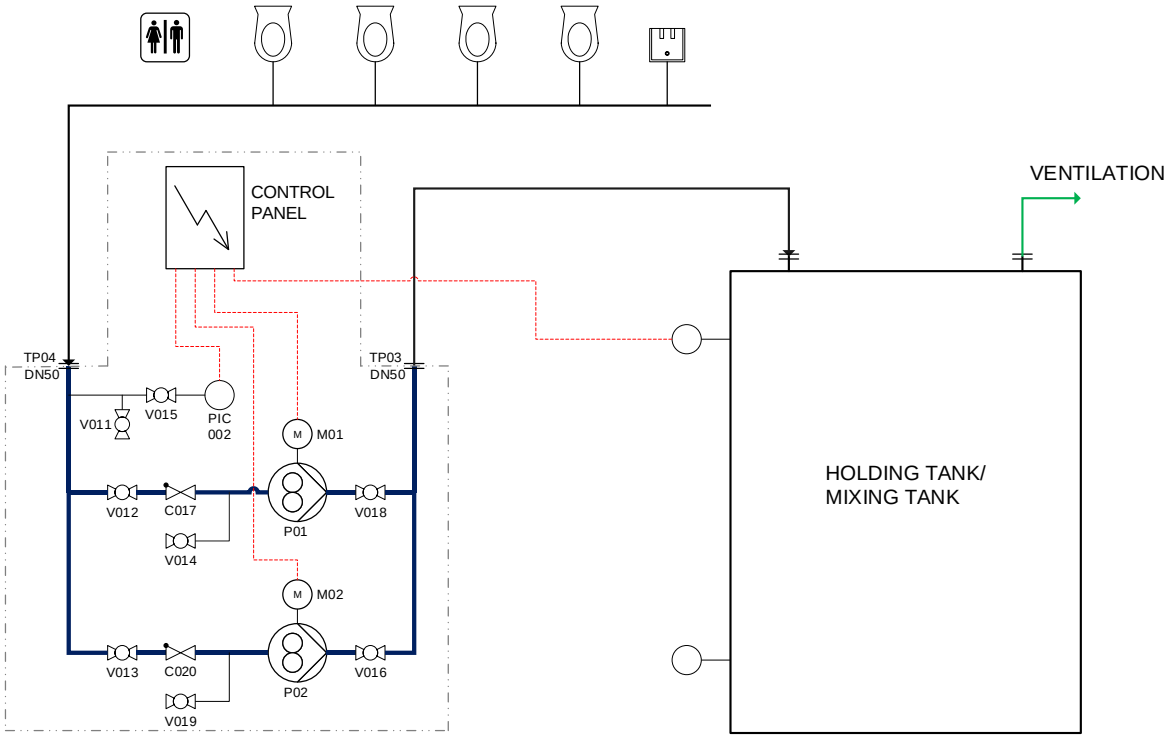


Figure 3 OnlineFlex system

The Evac OnlineFlex unit has two operation modes for vacuum generation and discharge operations:

- Automatic
- Manual

4.6 Automatic operation

Operator turn the pump motor MAN-0-AUTO switch to AUTO. The Sewage pumps starting and stopping pre-set setpoints are -40kPa - -60kPa. The pressure indicating transmitter is installed to OnlineFlex units vacuum manifold. When vacuum level drops to -40 kPa, the first pump starts to generate vacuum. Stopping set point of the vacuum pump is set at -60 kPa. If the vacuum pump does not meet the required vacuum level in 10 seconds, the second vacuum pump will start to generate vacuum. Both pumps shall run until the stop point -60 kPa is reached. If the vacuum level drops directly above -20 kPa, both pumps will start immediately generating vacuum. Pump starting turns alternates.

4.6.1 Manual

Manual mode is totally manual process and operator is responsible pump operation when operating the unit in manual mode. Operator turns all pumps MAN-0-AUTO switch to 0 and then by turning one or both pumps to MAN, the built-in vacuum generation logic is by-passed. A pump(s) selected to run in MAN mode will be operating until stopped by the operator.

4.6.2 Alarms

The control panel alarms are reset by pressing the control switch “ALARM RESET” unless other has been stated.

All the control panel alarms can be conduct into ship monitoring via common alarm. The common alarm contact is open, when at least one alarm is activated. In case new alarm is activated whilst common alarm contact is already open, contact first closes for 5 seconds and then opens again to indicate, that new alarm is activated.

! DANGER: **Never run a pump against closed or partially closed valve! It might cause extremely high pressure into pipe line.**

5. Control panel operation

5.1 Control panel layout

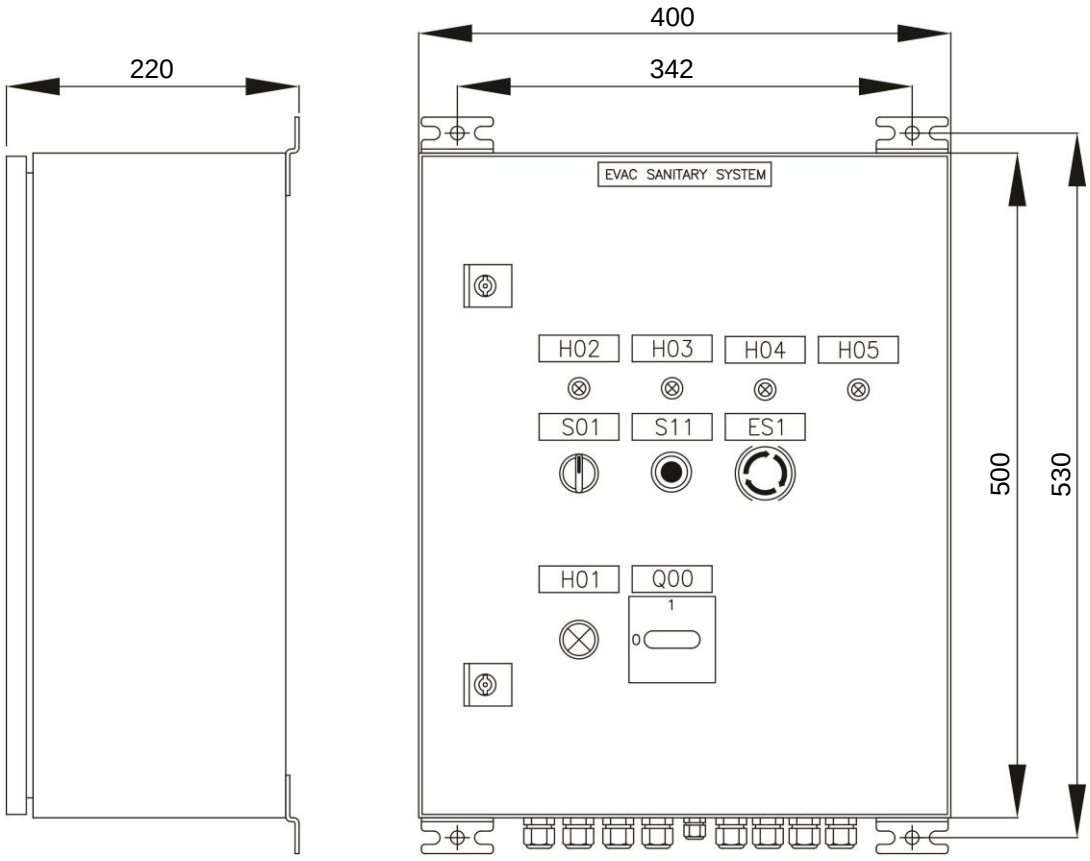


Figure 4 Control panel layout

5.2 Default parameters

Table 2 Vacuum pump start and stop level

Type	Parameter
Vacuum pump start and stop level	Gain=2.5+
	Offset=1250
	On=-300
	Off=-500
	Point=0

Table 3 Vacuum collapse alarm set and reset level

Type	Parameter
Vacuum collapse alarm set and reset level	Gain=2.5+
	Offset=1250
	On=-200
	Off=-500
	Point=0

Table 4 Excess run alarm delay time

Type	Parameter
On-Delay Excess run alarm delay time	Rem = off 20:00m+

5.3 OnlineFlex alarm and notification

Control panels alarms are reset by pressing the control switch “ALARM RESET” unless stated otherwise.

All control panels can be connected to the ship monitoring system via a common alarm. The common alarm contact is open, when at least one alarm is activated. In the event of a new alarm activating whilst the common alarm the contact is already open, contact first closes for 5 seconds (time adjustable at the logo) and then opens again to indicate that a new alarm has been activating.

6. Commissioning and start up

Before commissioning, the operating staff must be informed about the operating controls. The introductions in chapter “guidance notes for safety operation” shall be observed.

Before installing the unit ensure that it is safe and operating equipment is secured reliably against unintentional switching on.

6.1 Installation requirements

Unit is welded to the structure

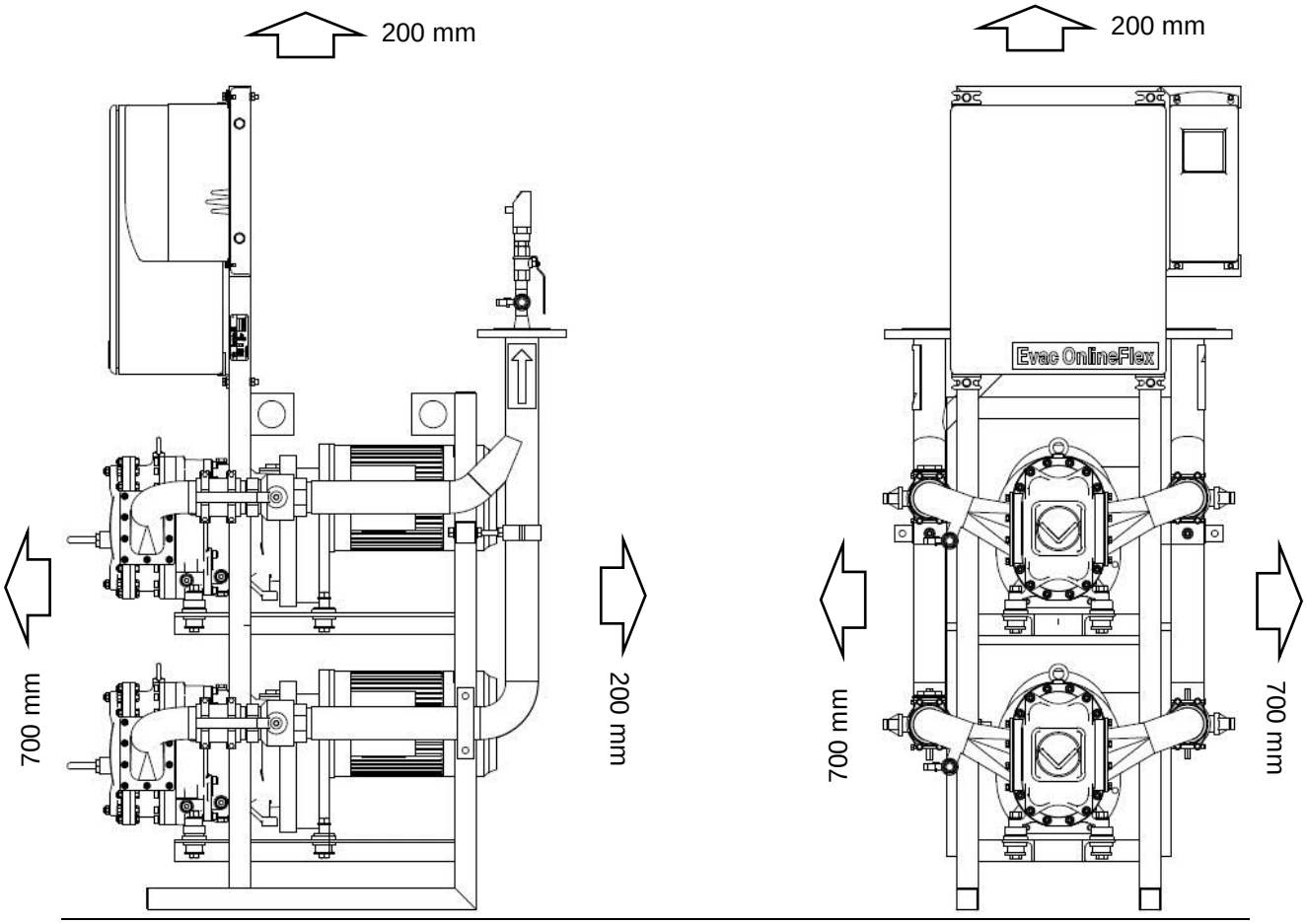


Figure 5 Service area of the OnlineFlex unit

Installation site must be cleared of all foreign objects. Sufficient space on the installation site must be provided. Space for the lifting apparatus, to lay down disassembled machine parts and to perform operating, inspection and maintenance work must be provided.

Required maintenance spaces are shown in the Figure 5 Also see specified technical data sheet of the OnlineFlex unit.

Installation site must be frost free.

The horizontal alignment of the installation site shall be checked with a spirit level or hose level. The Unit shall be Welded or bolted to the structure.

The dimensional stability of existing connecting pipes shall be checked before installing the machine. The operator must install a drain to let possible leakage or wash water run off during the cleaning process.

Make sure that there is no backflow in the outlet pipe. The pipe connections must always be connected tension-free.

The Vacuum pump has to be inspected under observance of the specified conditions and subjected to a functional check before commissioning. Install the transfer pump to the base and ensure that no load is transferred to the pump from the pipework.

6.2 Pre-commissioning

Pre-commissioning checks and trial runs shall only be carried out by competent persons who are familiar with the machine.

Checks shall be carried out after:

- Installation work is completely finished
- Clean the tanks and pipework from any foreign objects.
- Repair or rebuilding work
- A standstill of more than approx. 3 months.

Unscrew the transport locking screws of the gear unit if necessary.

6.2.1 Pre-commissioning checks

Pre-commissioning checks shall be carried out by following

- Correct unit installed (check yard tag plate)
- Unit mounted permanently and correctly
- Yard pipes connected to unit
- Water hose available
- Electric supply cable connected and power available
- Common alarm connected to ship’s monitoring system
- Running allowed signal available from discharge location

Visual inspection

- Quality of coated and painted surface
- All motor circuit protectors are adjusted and correct
- All valves on pipe line open to discharge location

6.2.2 Verifying the direction of rotation

Rotation direction check of the Vacuum pump drive motor:

- Switch the operating mode selector to MAN location
- In “MANUAL MODE”, switch pump selector switch “ON” and immediately “OFF” again.

If rotational direction is incorrect:

1. Switch the main/power switch “OFF” at the optional switch cabinet. The switch position must be interlocked.
2. Have an electrician to disconnect the motor and switch /change two main connections in terminal box.
3. Repeat the rotational direction check.
4. Vacuum pump rotation direction check before installing the pump. Switch the pump on only briefly (max 3 s) and verify the direction of rotation using the motor ventilator. If the rotation is incorrect, two wires of the power connection have to be swapped.

! NOTE: **The normal rotational direction must correspond to the rotational direction arrow on the drive motor resp. on the machine housing.**

! CAUTION: **Switch the vacuum pump off immediately after the start-up. Dry running of the pump destroys the seals.**

6.2.3 Operational Check of emergency STOP system

Check the emergency – STOP system as follows:

- In “MANUAL MODE” Switch the machine on with correct rotational direction mode with the operating mode selector switch.
- Switch the machine off with the Emergency – STOP button.
- Reset the Emergency – STOP control with the Acknowledgement or reset pushbutton.

! NOTE: **If the machine does not stop. Skilled electrician should check the connections. If the problem is not solved contact Evac oy.**

6.3 Commissioning and trial runs

It is Operator’s full responsibility to ensure that the commissioning of the machine is performed safely.

Before commissioning, the operator must ensure that all installation work has been completed. The vacuum pump and lines have to be filled with pumped liquid.

! DANGER: **The covers and all protecting/safety applications must be fixed correctly before starting the machine.**

! WARNING: **Never reach into rotating parts and/or live components and/or behind covers! Danger to life!**

6.3.1 Evac OnlineFlex Trial runs

! DANGER: **Protective devices may not be disabled even for trial runs.**

A trial run shall be carried out:

- After completely finishing the operational checks
- Before starting-up the machine for the first time
- After repair or rebuilding work
- After a machine standstill of more than approx. 3 months

Stop a trial run immediately in case of:

- Abnormal noises

- Vibrations
- Too much supply current
- Overheating of motor and gear unit

In Trial tests following shall be carried out:

- Pumps rotation direction
- Pressure switch operation
- All pumps start and stops in “MANUAL” mode
- All pumps start and stops in “AUTO” mode
- Led test/shut down reset correct
- Emergency stop operation
- Vacuum collapse alarm
- Excess run alarm
- Common alarm received at monitoring system
- Running disallowed signal will stop pump
- Vacuum test for piping

! NOTE: Vacuum test max. 2 kPa/h drop in pressure, e.g. from -60 kPa to -58 kPa

7. Maintenance

7.1 General

The Evac OnlineFlex has to be serviced at regular intervals according to operating and maintenance instructions to guarantee reliable function over a long period of time. Therefore, these maintenance instructions must be available and followed by operators and maintenance staff at all times.

- Ensure that there is a free circulation of the cooling air. Do not cover the Evac OnlineFlex unit or pumps.
- Room temperature should not exceed +45°C.

By doing these preventive actions, trouble free operation is guaranteed.

7.2 Periodic maintenance

All components and parts are designed to meet the requirements of the heavy duty sewage systems with minimal maintenance procedures.

7.2.1 Every day

- Check and clean catcher (The interval of catcher cleaning can be extended to suitable for each vacuum system)

7.2.2 Every Month

- Check and clean pressure transmitter with water jet.
- Check tightness of fastening bolts.

7.2.3 Every 2000h

- Change pump gear and sealing oil

7.2.4 Every four Months

- Check pump gear and sealing oil and refill

7.2.5 Every year

- Check shut-off valve operation
- Open pump and clean pump housings, check lobes and wear plates

7.2.6 Every five years

- Change mechanical seal
- Change electrical motor bearings

7.3 Introduction for maintenance

7.3.1 Checking the oil level of the online pump

! NOTE: For more information see Online pump manual 002449.

Check the buffer/quenching fluid for visible contamination:

- after the first 20 operating hours
- then every 200 operating hours

If strong contamination is visible, change the buffer/quenching fluid. Change the buffer/quenching fluid every 2000 operating hours (see Manual 002449).

Change the mechanical seal in case of strong leakage.

! NOTE: A slight contamination of buffer/quenching fluid such as a slight rise or fall of buffer/quenching fluid - level is determined by the hydrodynamic lubrication-film of mechanical seal and temperature fluctuations

7.3.2 Changing the online pump gearbox oil

Every 2000 operating hours, but if the gear oil gets another quality (colour) the oil has to be changed earlier.

Changing the quenching oil has to be carried out after changing the gear lubricant oil.

The oil should be checked and filled up (when the gearbox is not running):

- Every 500 operating hours, however not more than 3 months between fill ups.
    - The oil level must be visible in the oil sight glass.
    - Fill the oil until it reaches the oil sight glass.

Lubricant:
Evac Standard Oil Mineral oil Titan Gear MP90 SAE 90
Combustion point: 215°C

If you need other lubricants, please ask us for a table (TINF lubricants) of alternative oils. Quantity of oil in litres[l]: 1.3

! NOTE: For rotary lobe pumps in vertical arrangement please take contact Evac.

8. Troubleshooting

Table 5 Troubleshooting for OnlineFlex Unit

Problem	Possible cause	Remedy
Pumps are running, but unit does not create vacuum.	Pumps are running in wrong direction.	Check electrical wiring.
	Shut off valves are closed.	Open valves.
	Pump housing is dry.	Fill the pump with water.
Low vacuum capacity	Partially blocked discharge line.	Clean discharge line.
	Low supply voltage.	Check electrical supply.
	Missing phase.	Check electrical supply.
	Faulty electrical connection in motor.	Check electrical connection of motor.
	Pump internal check valve leaks or is open	Clean pump and check valve
Unit does not start when start level is reached	Dirty or faulty vacuum sensor	Clean or change sensor and sensor tube
Unit does not stop when stop level is reached.	Dirty or faulty vacuum sensor	Clean or change sensor and sensor tube
Pumps are not starting at all.	Blocked pump	Remove blockage from pump
	Partially blocked discharge pipe	Clean discharge pipe
	External tank is full, if connected.	Empty tank
Unit starts immediately after it has stopped (not peak hour)	Dirty vacuum sensor	Clean sensor
	Pipeline leaks	Repair pipeline
	Pump internal check valve leaks or is open	Clean pump and check valve

9. Technical data

9.1 OnlineFlex unit dimension

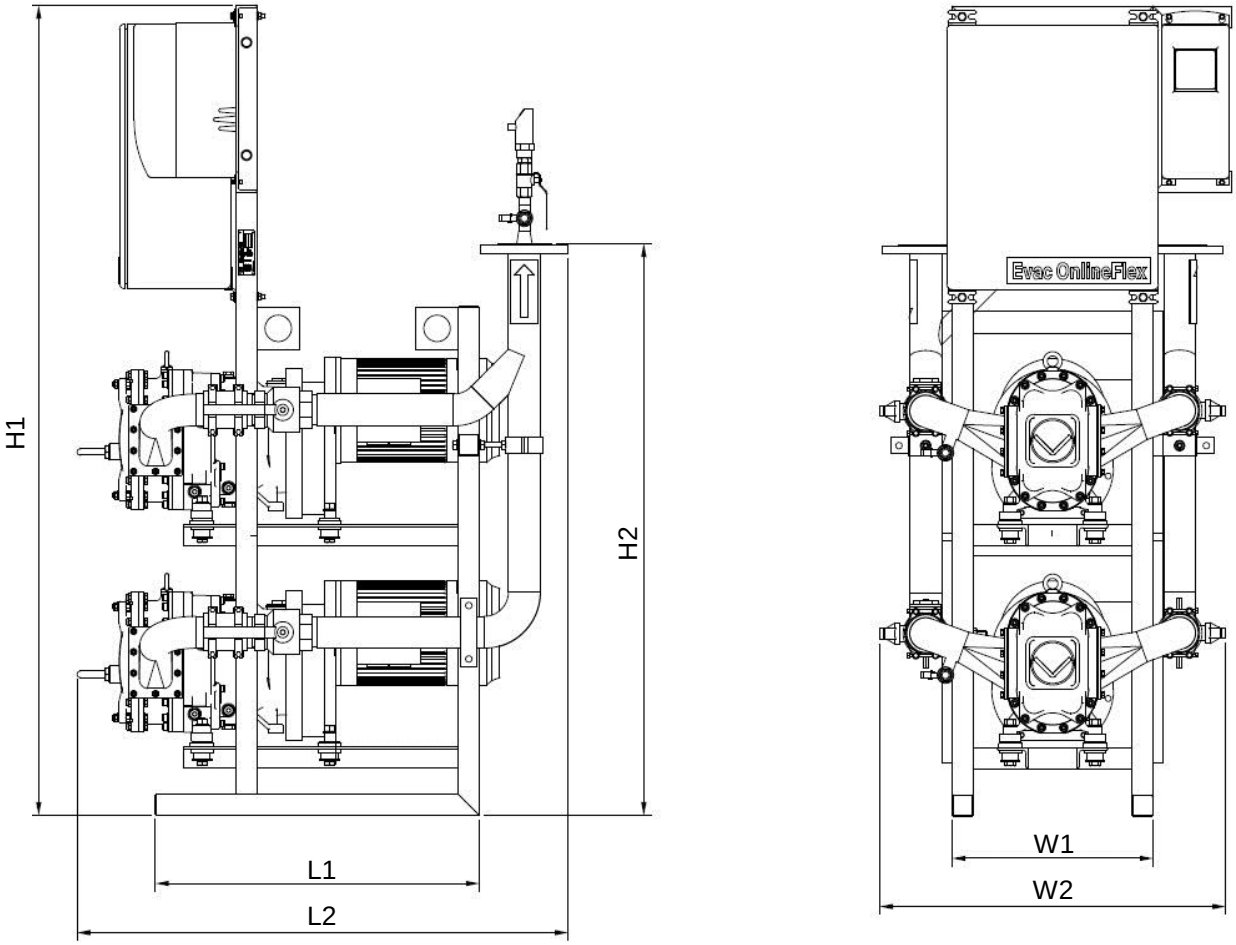


Figure 6 Main dimensions

Table 6 Main dimensions

OnlineFlex Unit	H1	H2	L1	L2	W1	W2
OnlineFlex FX 30	1150	635	612	918	380	655
OnlineFlex FXi 30	1150	635	612	918	380	655
OnlineFlex 2 FX 30	1530	1080	612	928	380	654
OnlineFlex 2 FXi 30	1530	1080	612	928	380	654
OnlineFlex FX 60	1150	710	612	971	380	721
OnlineFlex FXi 60	1150	710	612	971	380	721
OnlineFlex 2 FX 60	1530	1150	612	939	380	721
OnlineFlex 2 FXi 60	1530	1150	612	939	380	721

9.2 Electrical data and capacity

OnlineFlex Unit	Voltage: 380-690 V, 50/60 Hz		
	Nominal power 50/60 Hz	Vacuum capacity 50/60 Hz (-0.3 bar)	Lifting height 50/60 Hz
OnlineFlex FX 30	2.2/2.6 kW	8.5/10 m^3/h	15 m
OnlineFlex FXi 30	2.2/2.6 kW	12 m^3/h	15 m
OnlineFlex 2 FX 30	4.4/5.2 kW	17/20 m^3/h	15 m
OnlineFlex 2 FXi 30	4.4/5.2 kW	23/25 m^3/h	15 m
OnlineFlex FX 60	4.0/4.8 kW	17/20 m^3/h	15 m
OnlineFlex FXi 60	4.0/4.8 kW	25 m^3/h	15 m
OnlineFlex 2 FX 60	8.0/9.6 kW	34/40 m^3/h	15 m
OnlineFlex 2 FXi 60	8.0/9.6 kW	42/45 m^3/h	15 m

9.3 Connections

OnlineFlex Unit	Connection	Size	Pressure class	Type
OnlineFlex FX 30	Vacuum inlet	DN50	PN10	Flange
	Sewage discharge	DN50	PN10	Flange
OnlineFlex FXi 30	Vacuum inlet	DN50	PN10	Flange
	Sewage discharge	DN50	PN10	Flange
OnlineFlex 2 FX 30	Vacuum inlet	DN50	PN10	Flange
	Sewage discharge	DN50	PN10	Flange
OnlineFlex 2 FXi 30	Vacuum inlet	DN50	PN10	Flange
	Sewage discharge	DN50	PN10	Flange
OnlineFlex FX 60	Vacuum inlet	DN65	PN10	Flange
	Sewage discharge	DN65	PN10	Flange
OnlineFlex FXi 60	Vacuum inlet	DN65	PN10	Flange
	Sewage discharge	DN65	PN10	Flange
OnlineFlex 2 FX 60	Vacuum inlet	DN65	PN10	Flange
	Sewage discharge	DN65	PN10	Flange
OnlineFlex 2 FXi 60	Vacuum inlet	DN65	PN10	Flange
	Sewage discharge	DN65	PN10	Flange

9.4 OnlineFlex Unit Shipping data

OnlineFlex Unit	Weight (dry)	Shipping weight	Shipping Volume
OnlineFlex FX 30	150 kg	180 kg	1.5 m^3
OnlineFlex FXi 30	160 kg	190 kg	1.5 m^3
OnlineFlex 2 FX 30	270 kg	300 kg	1.7 m^3
OnlineFlex 2 FXi 30	280 kg	310 kg	1.7 m^3
OnlineFlex FX 60	170 kg	200 kg	1.5 m^3
OnlineFlex FXi 60	180 kg	210 kg	1.5 m^3
OnlineFlex 2 FX 60	320 kg	350 kg	1.7 m^3
OnlineFlex 2 FXi 60	330 kg	360 kg	1.7 m^3

10. Customer support

10.1 Technical support

All requests for After-Sales Service intervention must be sent to the following email address:
Technical support: evac.technicalsupport@evac.com

Specifying:

- Type of unit;
- Serial no.;
- Defect found;
- Evac p/n number
- Vessel name and /or IMO number

Useful websites:
Evac web site: http://www.evac.com/services
Agents and distributors: http://www.evac.com/contactsearchtool

10.2 Replacement parts

All requests regarding replacement parts must be sent to the following email address:
evac.spareparts@evac.com

Specifying:

- Type of unit
- Serial no.
- Evac p/n Number
- Required quantity
- Manner of transport

10.3 Warranty and liability

Warranty
Warranties are defined in the general terms and conditions of sale.
Email: evac.warranty@evac.com

Liability
Evac cannot be held liable for operation faults or generic failures caused by improper use of the unit or operations carried out by persons not authorized by Evac

Cleantech Solutions.
Anywhere.

Evac is the world's leading provider of integrated waste-, wastewater-, and water management systems for the marine, offshore, and building industries. The company was established in 1975 and it now has completed over 20,000 marine and 2,000 building projects worldwide. Evac has employees in Finland, Germany, France, China, Korea, the USA, Brazil, Norway, and representatives in more than 40 countries.

Our contact information at www.evac.com/contacts

www.evac.com

* Sold under different trademarks for building industry.

Table of contents

1. General

It is important that this manual is reviewed by all relevant personnel and all procedures are fully understood before the installation, operation, and maintenance of the EVAC Optima 5 Toilet. All activities must be completed safely and correctly.

NOTE!

If there are a huge amount of product numbers, use this table to list them all. And remove the box for product number in the Header.

This IOM manual D003991-4 applies to the product numbers below:

Table 1 Product numbers

Evac product number	Product name/product model
6559513	Evac Optima 5, wall model, Prestige
6559517	Evac Optima 5, wall model, Prestige soft close
6559514	Evac Optima 5, wall model USPH, Prestige
6559518	Evac Optima 5, wall model USPH, Prestige soft close
6559524	Evac Optima 5, wall model USPH, open front
6559515	Evac Optima 5, floor model, Prestige
6559519	Evac Optima 5, floor model, Prestige soft close
6559516	Evac Optima 5, floor model USPH, Prestige
6559520	Evac Optima 5, floor model USPH, Prestige soft close
6559526	Evac Optima 5, floor model USPH, open front
6588204	Evac Optima 5, floor model USPH, no push button (US PN: 5800428)

1.1 Scope

This manual provides instructions and notices for the installation, operation, and maintenance of the EVAC Optima 5 Toilet as supplied by Evac. This manual also includes important safety instructions.

1.2 Abbreviations

Add and update Abbreviations for the specific product range.

The abbreviations used in this document are listed in Table 2 below.

Table 2 Abbreviations and definitions

Abbreviation	Term	Description
IOM	Installation, Operation, and Maintenance	It is a manual that contains instructions on the proper installation, operation and maintenance of a system or equipment.
PID	Piping and Instrumentation Diagram	A piping and instrumentation diagram is a detailed diagram of the process which shows the piping and process equipment together with the instrumentation and control devices.
PN	Product Number	Evac Product Number

1.3 Virtual patent marking notice by Evac

The following products may be protected by patents in the U.S. and elsewhere for Evac Oy. A website is provided to satisfy the virtual patent marking provisions of various jurisdictions including the virtual patent marking provisions of the America Invents Act and provide notice under 35 U.S.C. §287(a) for products that are protected by patents. The list of products and patents on the website may not be all inclusive. For example, some products listed may be covered by patents in the United States and elsewhere that are not listed, and other products not listed here may be protected by one or more patents in the United States and elsewhere.

For more info visit: https://evac.com/patent-notice/

1.4 References

Use this table template to refer to all documents of a product **mentioned in this document** such as Technical Specification, Bill of Materials, GA drawing, PID with component list, etc.

Table 3 Reference documents

Document Name	Document type	Document Number
Evac equipment	Storage and preservation information	002848
	Operation	004058
	Troubleshooting	004068
	Installation	003606

2. Safety procedure

2.1 General

These operating instructions contain the procedures to be followed during installation, operation and maintenance of the equipment. Please keep the handbook in a safe and accessible location near the unit.

Carefully read these instructions before operating the system. Always comply with the safety instructions listed in this document, the existing shipboard accident prevention regulations and any internal Work Health and Safety rules.

Persons could be endangered and damage to equipment may result if the machinery is not used for the intended purpose. An inadequately trained person and incorrectly performed work may also cause harm.

NOTE!

A first aid kit must always be available.

2.2 Personnel qualification and training

Ensure that all personnel involved in the installation, commissioning, operation and maintenance of the Evac units are properly qualified and trained to carry out these tasks. Work on the electrical system and electric parts of the Evac supplied equipment must only be carried out by a properly qualified electrician. Lack of personnel's skills and knowledge of the operation instructions can cause risk to life and damage to the equipment. Evac systems must be used according to the following instructions, and only by authorized personnel who are fully aware of the risks involved in the operation of the unit.

Moreover, the operating company has the responsibility to ensure that personnel fully comprehend the contents of the operating instructions.

The Evac unit receives, macerates and discharges sewage waste. Personnel must, always, observe safety regulations while performing maintenance or repairs which carries certain hazards. Every practical safety feature has been incorporated into the design and manufacture of this equipment; however, personnel must be aware of the potential hazards.

2.3 Disease hazard

Sewage is a common mode of transmission for parasitic organisms such as bacteria, fungi, protozoa, viruses, and worms. Some of these may be pathogenic; they can cause serious communicable diseases. Most diseases associated with sewage result from hand-to-mouth transfer of the pathogenic organisms. After meeting sewage or any contaminated equipment items, personnel must thoroughly wash infected areas of themselves with a disinfectant soap solution. This precaution is an absolute requirement before eating, drinking, or performing hand-to-mouth functions. Skin abrasions, punctures or any other wounds require immediate and proper medical attention. Additionally, it must be avoided to perform maintenance work on the Evac units

if there are any kinds of wounds on the skin in areas that can get into contact with the wastewater or sludge.

2.4 Chemical hazard

When using chemicals which are hazardous and/or dangerous for ground water or marine biology, it is essential to follow the corresponding regulations and laws regarding hazardous substances and water balance. Such dangerous chemicals are, for example, solvents, cleaning agents, care agents etc.

CAUTION!

ALWAYS refer to official Safety Data Sheets (SDS) provided for hazardous materials when handling chemicals. These must always be provided by the chemical supplier.

2.5 Electrical hazards

Before maintenance is performed on any motor driven equipment, disconnect the motor's power supply and perform electrical lock-out/tag-out (LO/TO) as per local regulations. Prevent the motor from switching on unexpectedly. Motors must also be labelled "OUT OF SERVICE". Only authorized maintenance personnel must make repairs to this equipment.

CAUTION!

Safety devices may only be opened, dismantled, or removed by authorized personnel and when the machine is standstill, safety secured and isolated.

Evac equipment is supplied with high voltages. The high voltages of the electricity and the available electrical current are dangerous and potentially fatal. To avoid electrical shock, cut the electrical current by placing the main circuit breaker in OFF position. Do this before performing any maintenance work on electrical equipment or motors. Personnel must exercise extreme caution when opening the electrical cabinet door although the main circuit breaker is in OFF position; the terminals of incoming electrical current are still live.

2.6 Hazard during installation

Proper placement can extend equipment lifetime. The EVAC Optima 5 Toilet [Keywords] are to be installed on a straight and steady base. The unit is to be levelled horizontally. There must be sufficient space reserved around the unit for operation and maintenance. The machine must be anchored securely to the foundation or supporting structure.

Ensure that in case of a leak any surrounding equipment is not damaged. Before installation, operators must be aware of the contents of this manual. Mechanical installation must be completed before any electrical work commences.

Switching the machine on for operational check, trial run, wet testing, etc. may only be performed by skilled electricians performing the electrical connection work.

DANGER!

The combination of water and electricity can be fatal.

2.7 Operation and maintenance hazards

Evac equipment must be operated and maintained by authorized and trained personnel only. All work and modifications to the system must be approved by the manufacturer. Under no circumstances, the equipment power is switched on, or the equipment is pressurized when work is performed. Be aware of the rotating parts of pumps.

Before the start-up of the Evac unit, ensure that no one is in danger. Take all necessary measures to ensure that the Evac unit is used only in a safe and reliable state.

Once per day check the Evac unit for visual and auditory signs of damage and/or defects. In case of abnormalities, damage, or a change in the normal operation of the unit, stop the unit immediately and refer to the troubleshooting section. In case the ship's crew is unable to bring the system to its normal operation, please contact Evac service representative.

The electrical parts of the unit must be inspected at regular intervals. Defects such as loose connections or scorched cables must be repaired without delay. Inspection, servicing, and maintenance work is only allowed to be carried out when the machine is at standstill and safety secured. Ensure that the unit is completely switched off before any maintenance and repair work is undertaken.

Restart is only permitted after malfunctions, faults and/or damages have been completely rectified. Never use the Emergency-Stop push button for normal stopping of the machine, malfunctions/damages may be the result.

CAUTION!

Before starting up, ensure that no unauthorized persons are close to the machine, either working on it or at risk from its start-up.

2.8 Disposal and environmental protection

The operator is responsible for disposing of materials which result from maintenance. This may involve wastewater and solid residue, cleaning and care agents, auxiliary material, lubricants and other waste materials of all sorts, including worn machine components.

Disposal must be performed according to local legislation for protection of emissions, waste disposal, protection of water resources, etc.

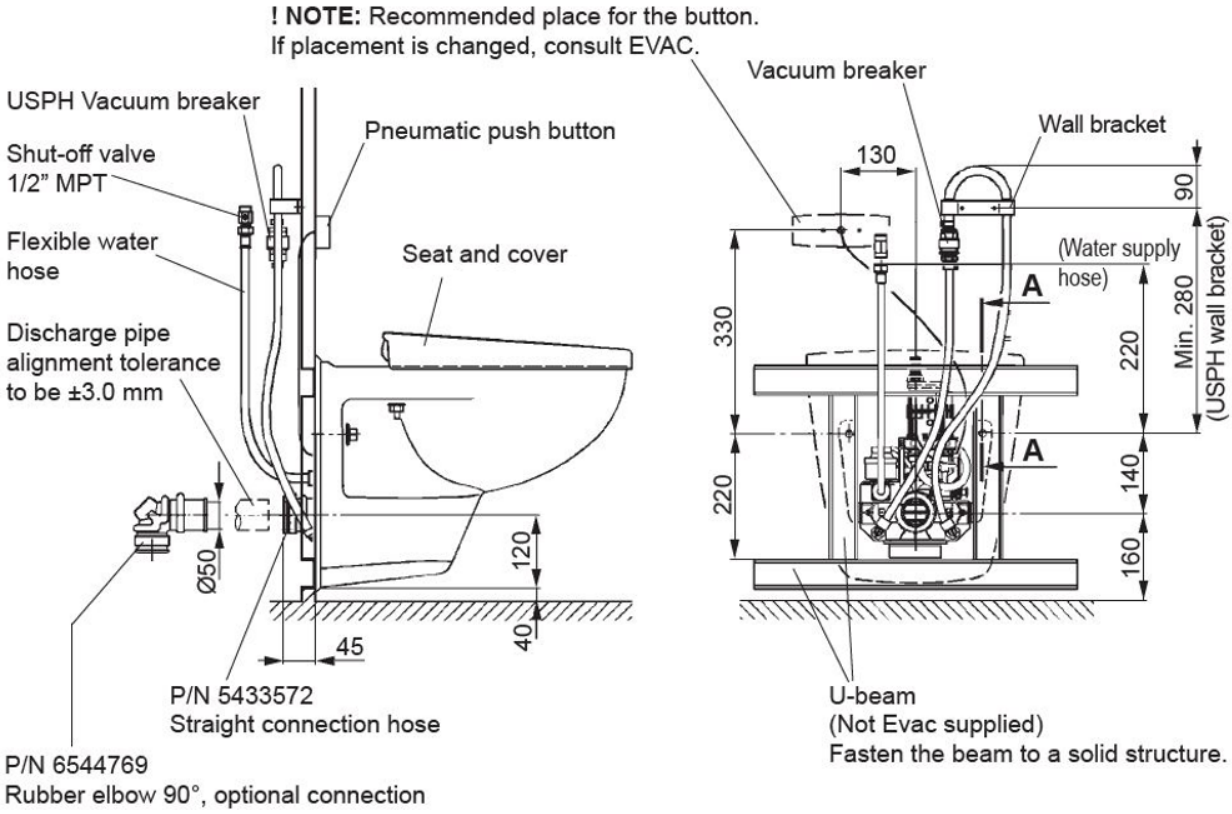
2.9 Evac component nameplates and tag numbering

All Evac units and components are identified and marked according to the SFI Group numbering system. Marking equipment and pipes is always of the utmost importance to safety. Accidents, injuries and damage to machines and equipment can be caused by ignorance of substances that flow through pipes.

Do not remove component tag plates during maintenance and if removed must be attached back to the correct place after maintenance work. The nameplates with equipment tag number, label plates, caution plates, marking notice boards, instruction plates, safety markings etc. are supplied by Evac and engraved with letters in the English language.

3. Installation

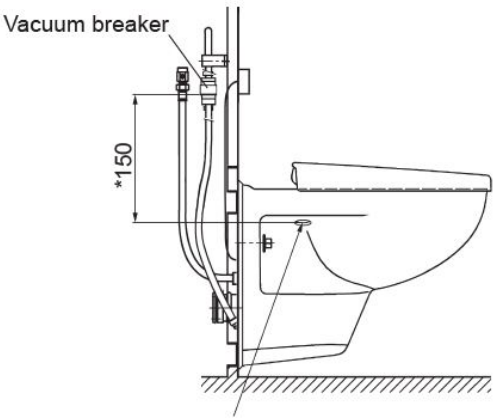
3.1 EVAC Optima 5



NOTE!

If the installation location does not have a floor drain adjacent a water block (6588256) is strongly recommended to be installed in the water inlet.

Overflow point

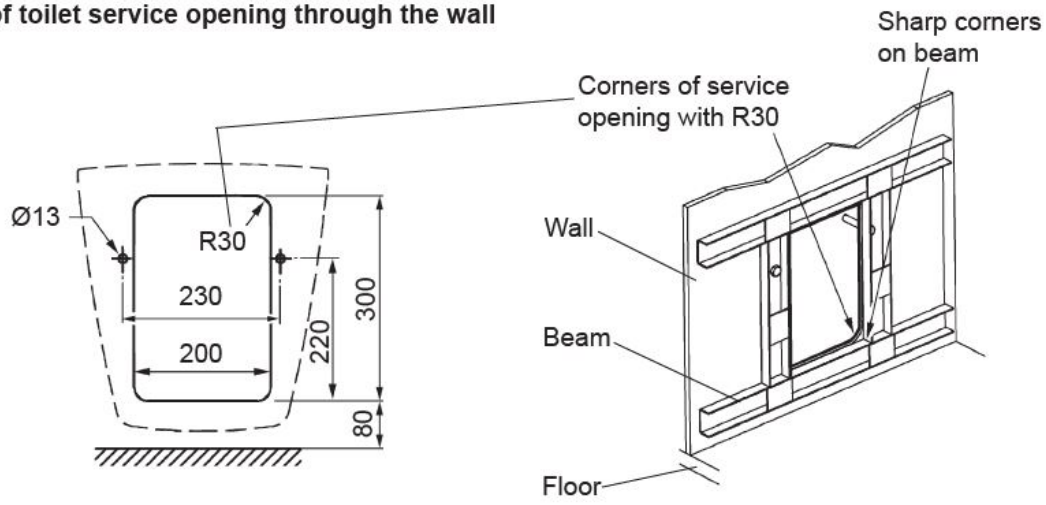


NOTE!

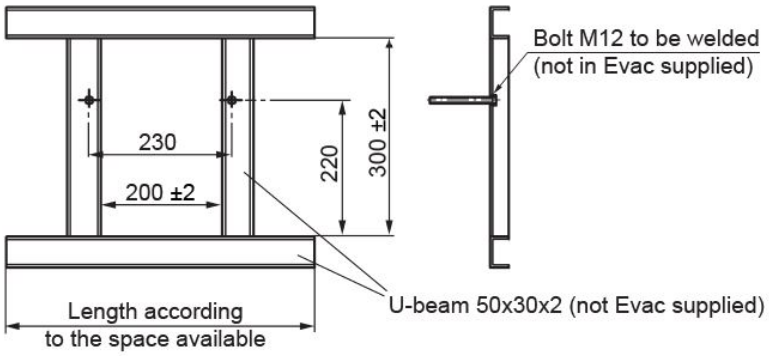
Overflow point is inside the toilet bowl

* The vacuum breaker air inlet must be located at a minimum of 150 mm (6”) above the overflow point of the toilet.

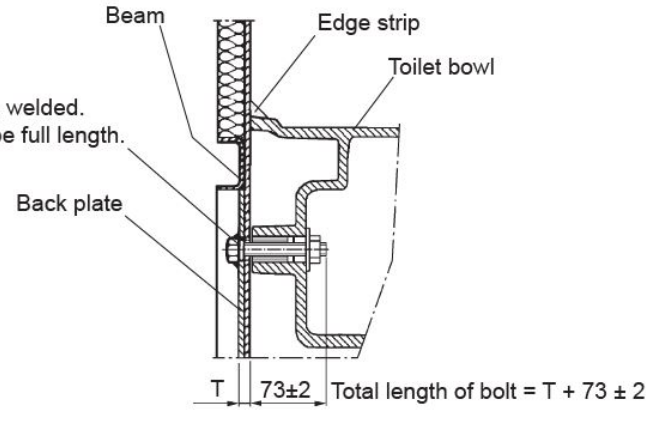
Dimensions of toilet service opening through the wall



Toilet supporting beams for wall models



Cross section A - A



Bolt M12 (not Evac supplied) to be welded.
! NOTE: Thread on the bolt must be full length.

Installation kit P/N 6560986 consists of:

Plastic nut M12	2 pcs
Guiding nut	2 pcs
Edge strip	1 pc
Connection sleeve	1 pc
Hose clamp	2 pcs

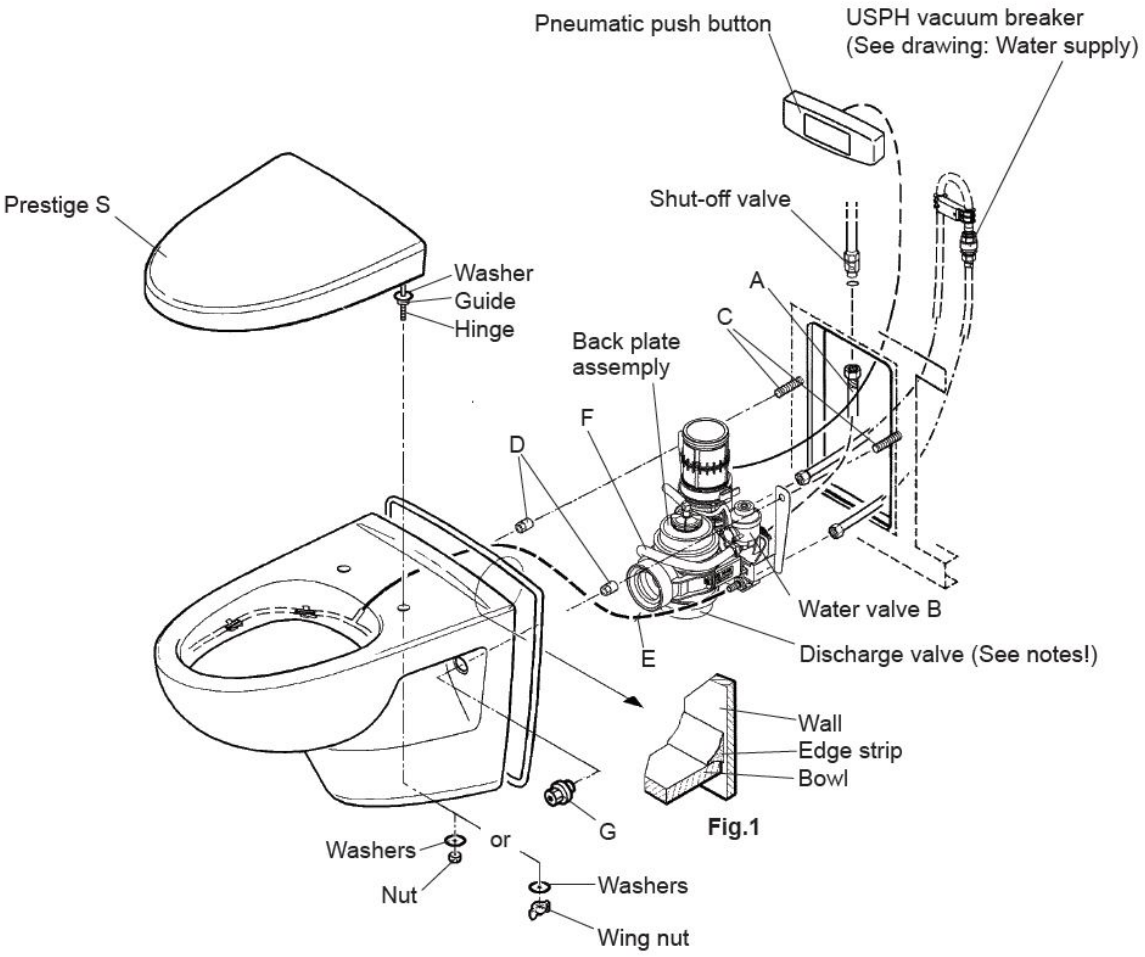


Fig.1

- Connect the water connection hose (A) to the water valve (B).
- Install the back plate assembly on the wall using the bowl fastening bolts (C) (M12, not included) and the guiding nuts (D) (M12). The guiding nuts are necessary.
- Connect the hose (E) from the flushing ring to the connecting nipple on the back plate (see drawing: Water supply). Do not use any kind of grease during installation! Secure with hose clamps. Tighten the hose clamps with pliers.

NOTE!

Protect the water valve (B) during and after installation, especially from sharp objects / welding sparks.

NOTE!

Install the hose (E) to the right side of the discharge valve and below the hose (F).

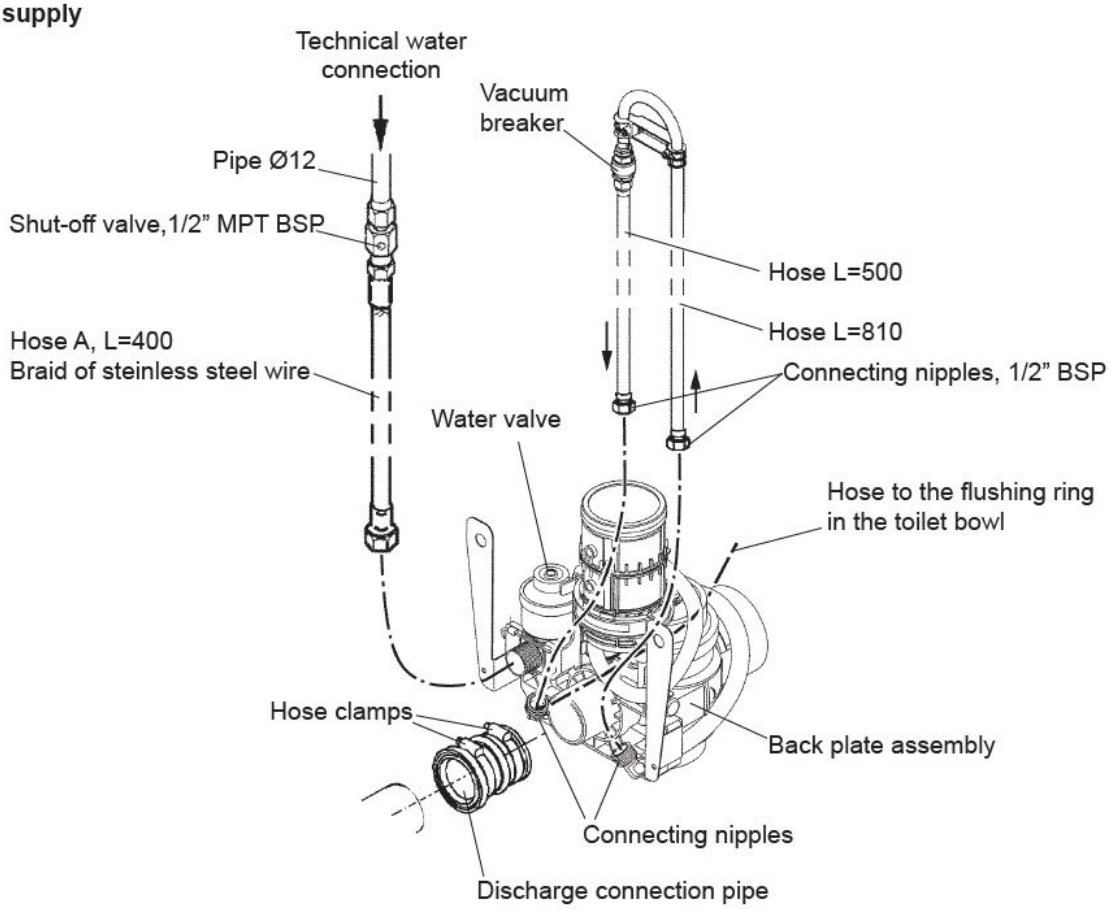
- Lift the bowl onto the fastening bolts and tighten the securing nuts (G). Tightening torque is 10 Nm.

NOTE!

Check through the toilet service opening in the wall that the hoses run smoothly. The hoses shall not have any kinks.

- Fit the edge strip as shown in the figure 1. Place the joint of the strip to the bottom side of the bowl.
- Install the seat and the cover. See the installation of the seat and cover Prestige Soft Close.
- Connect the USPH vacuum breaker to the connecting nipples of the back plate (see drawing: Water supply).
- Fix the USPH vacuum breaker to the wall.
- Connect the discharge connection pipe. Secure with the hose clamps.
- Connect the shut-off valve to the water supply. The shut-off valve must be installed to the water supply piping's side to ensure the correct flow direction in the vacuum breaker. Note the vacuum breaker must be installed vertically as shown.
- Connect the water connection hose (A) to the shut-off valve.
- Install the pneumatic push button.

Water supply



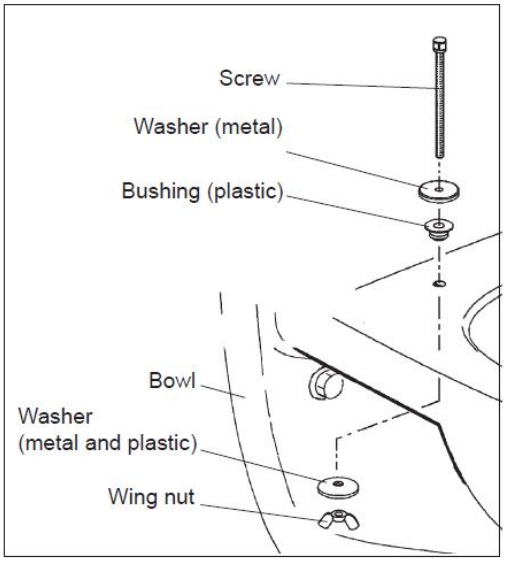
NOTE!

For non-U.S. flag vessels

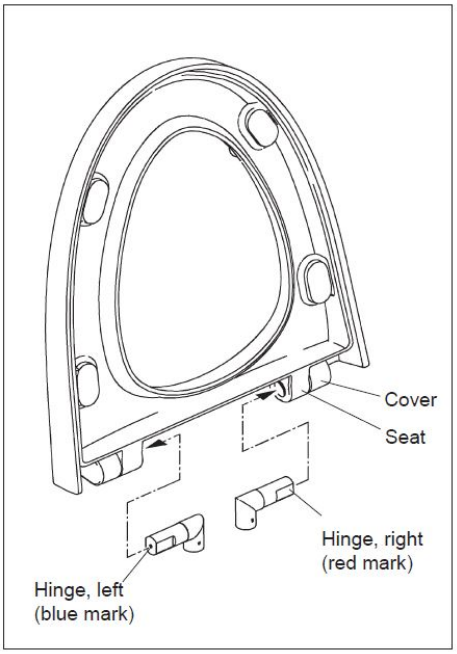
3.2 Toilet seat and cover products

This chapter reviews the installation of the Prestige soft closing, seat, and cover AM (N10006302) & Prestige plus soft closing, seat, and cover (6593661).

1. Install the parts of the installation kit. Note installation order.



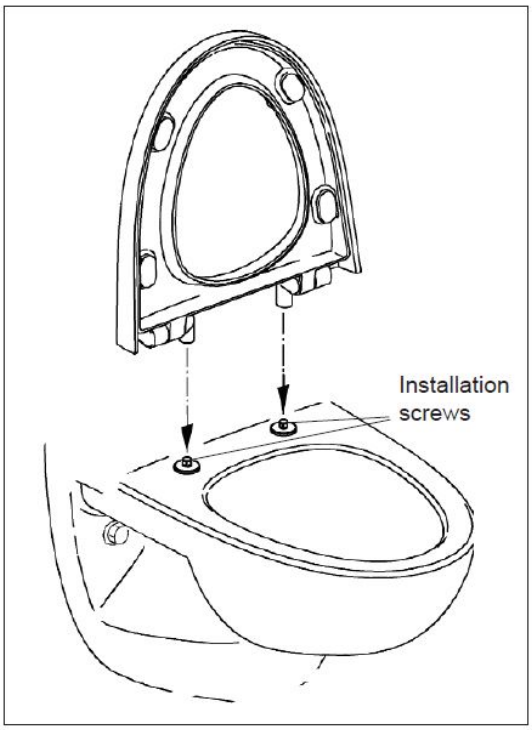
2. Push the hinges into the hole of the seat and the cover.



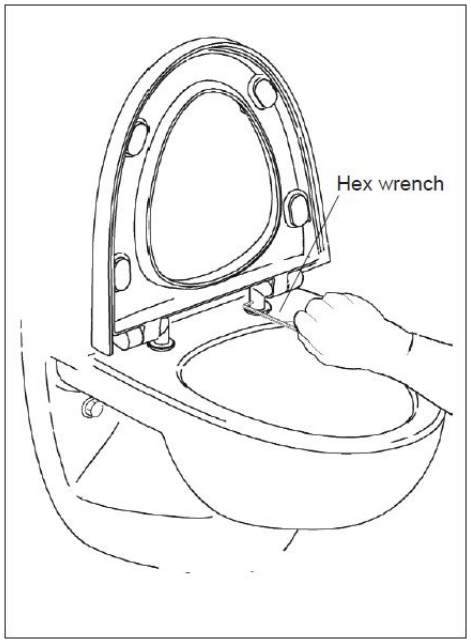
NOTE!

Do not open the seat (with the hinges inserted) hinges before assembly. The opening angle must not exceed 110°.

3. Install the seat and the cover with the hinges on the installation screws on the bowl.



4. Tighten the retaining screws with a hex wrench. (The installation kit includes two hex wrenches.)

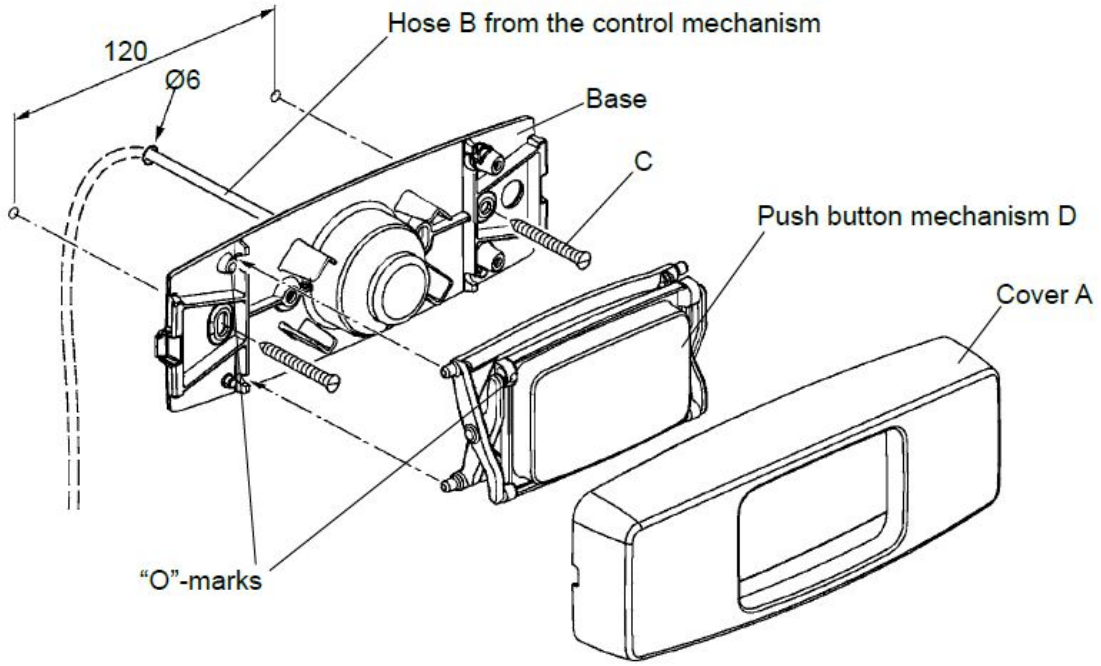


NOTE!

Do not use excessive force.

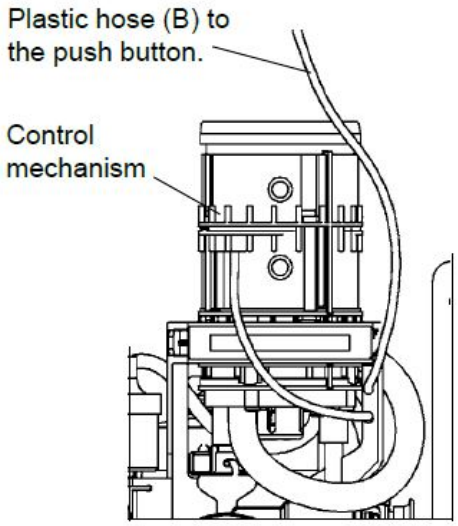
Do not use excessive force when closing, this may cause irreparable damage to the device.

3.3 Optima push button.



1. Drill Ø6 hole for the hose (B).
2. Loose the cover A from the base.
3. Connect the plasic hose (B) from the control mechanism to the nipple of the base. Warm the end of the hose if needed to help installation.
4. Install the push button base using screws (C) (not included) on to the wall.
5. Place the push button mechanism (D). Note “O”-marks.
6. Snap the cover (A) its place.

3.3.1 Control mechanism



NOTE!

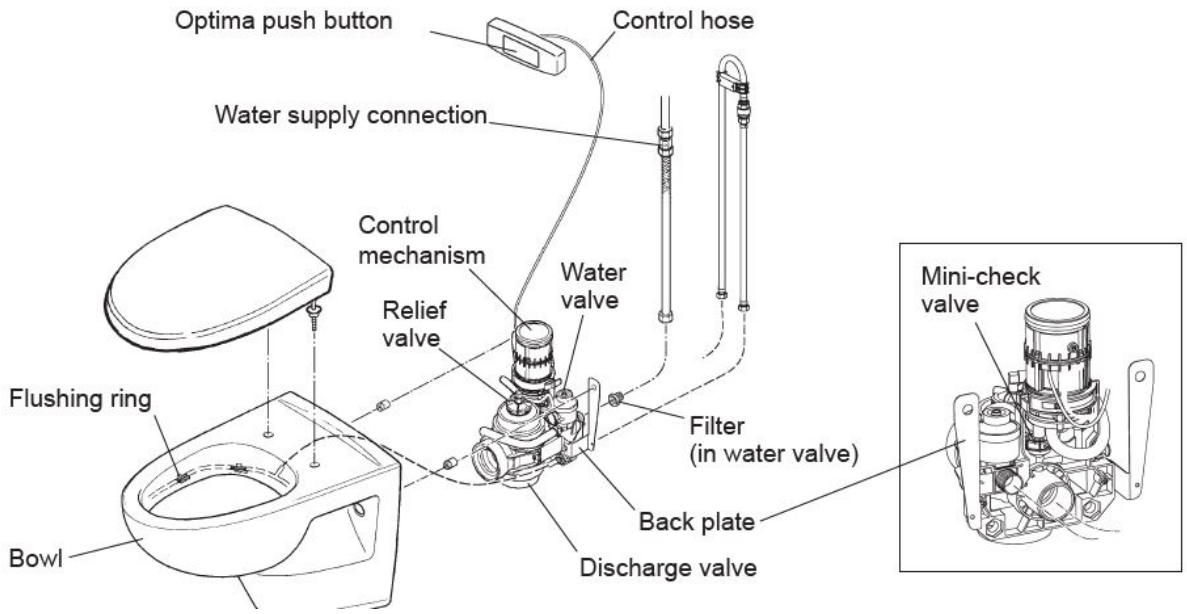
Note that the hose (B) is not flattened during installation. The air impulse must always flow free.

Make sure that the plastic hose is not detached from the control mechanism.

4. Operation

This chapter describes the operation of the EVAC Optima 5 Toilet unit. These instructions are thoroughly studied and understood by the operators prior to commencing operation of the unit

4.1 Operation



The toilet is flushed by pressing the push button. The pneumatic push button is connected to the control mechanism with a control hose, which transports the air pulse from the push button to the control mechanism. The air pulse starts the flushing sequence, and the control mechanism connects vacuum to the control connections of the water valve and the discharge valve. The water valve opens and lets rinsing water flow into the bowl through the flushing ring. After a short delay vacuum acts in discharge valve housing and forces the rubber diaphragm in discharge valve to open. Contents of the bowl is drained to the vacuum sewer by a pressure difference between the bowl and vacuum sewer. The flushing cycle in the control mechanism starts the closing cycle. Vacuum enters to the relief valve. The relief valve opens the port between atmospheric air and the discharge valve. Atmospheric air enters to the discharge valve which closes immediately. After a short delay, the atmospheric air pulse reaches to the water valve and the relief valve. The water valve closes and lets a certain level of water at the bottom in the bowl.

After the flushing cycle has stopped the push button and the system will be ready for the next flush.

4.2 Operation for Control mechanism

The functioning of the vacuum toilet/urinal is entirely controlled by the control mechanism. The operation of the control mechanism is based on vacuum in the sewage piping system.

Description of flushing sequence see document 003930-3.

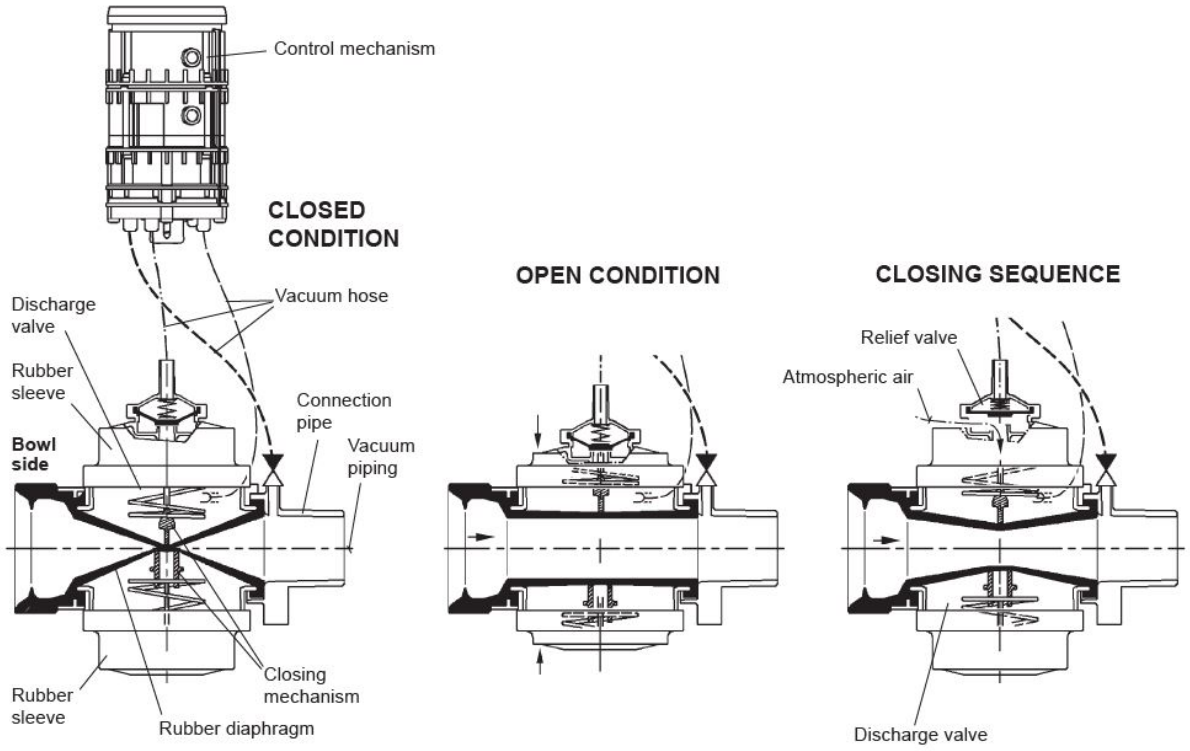
Jet 1 (document 003930-3, pos.5) controls the discharge valve opening time.

Jet 2 (document 003930-3, pos.4) counters the effect of quick changes in the vacuum supply.

Jet 3 (document 003930-3, pos.15) delays the vacuum changes in the chamber (14) (see document 003930-3).

This prevents a new flushing procedure to start before the previous procedure has stopped.

4.3 Operation for Discharge valve



Closed condition:

The control mechanism shuts off connection between the vacuum piping and the discharge valve housing. As the valve housing is under atmospheric pressure the spring-loaded closing mechanism closes the rubber diaphragm and isolates the bowl from the vacuum piping.

Open condition:

As the control mechanism opens the discharge valve, the housing is subjected to vacuum, thus forcing the closing mechanism to open. This in turn allows the rubber diaphragm to open and connects the bowl to the vacuum pipeline.

Closing sequence:

The vacuum pulse enters to the relief valve. The relief valve opens the port between atmospheric air and the discharge valve. Atmospheric air enters to the discharge valve which closes immediately. After a short delay, the atmospheric air pulse reaches to the water valve and the relief valve.

4.4 Start-up

- Clean the bottom of the toilet bowl.

- Check the mini-check valve and the discharge valve are clean and working correctly.
- Check the water supply hose and the filter of the water valve are not blocked up.
- Check sufficient vacuum (-0.3 bar) is available.
- Open the water supply valve in the water supply piping.
- Press the toilet push button. Pressing the button starts the flushing sequence. The discharge valve opens and
- the contents of the bowl are extracted by vacuum. At the same time the bowl is rinsed by water.
- When the discharge valve has been closed water level is restored in the bowl by the closing time delay of the water valve

4.5. Monitoring

- Check the water valve provides the rinse water to the bowl at the same time as the discharge valve extracts the bowl contents when the push button is pressed.
- Check the push button returns to its non-activated state.
- Check after the discharge valve closes, the water valve continues to provide water to the bowl. If the water valve time delay is correctly adjusted, there should be a pool of water at the bottom of the bowl.
- Check there are no water or air leaks.

NOTE!

Water consumption is dependent on the water supply pressure and the vacuum level.

Preparation for a toilet not to be used for a long period

- Close the water supply valve.
- Run a flush cycle by pressing the push button.
- Close the toilet seat cover.

5. Maintenance

The EVAC Optima 5 Toilet needs to be serviced at regular intervals according to the operating and maintenance instructions to guarantee reliable functionality over a long period of time. Therefore, these maintenance instructions must always be available and followed by operators and maintenance staff. By doing these preventive actions, trouble free operation is guaranteed.

5.1 Maintenance schedule

Scheduled maintenance program

Maintenance program is based on 20 toilet flushes per day and 20 years operation.

5.1.1 Every year:

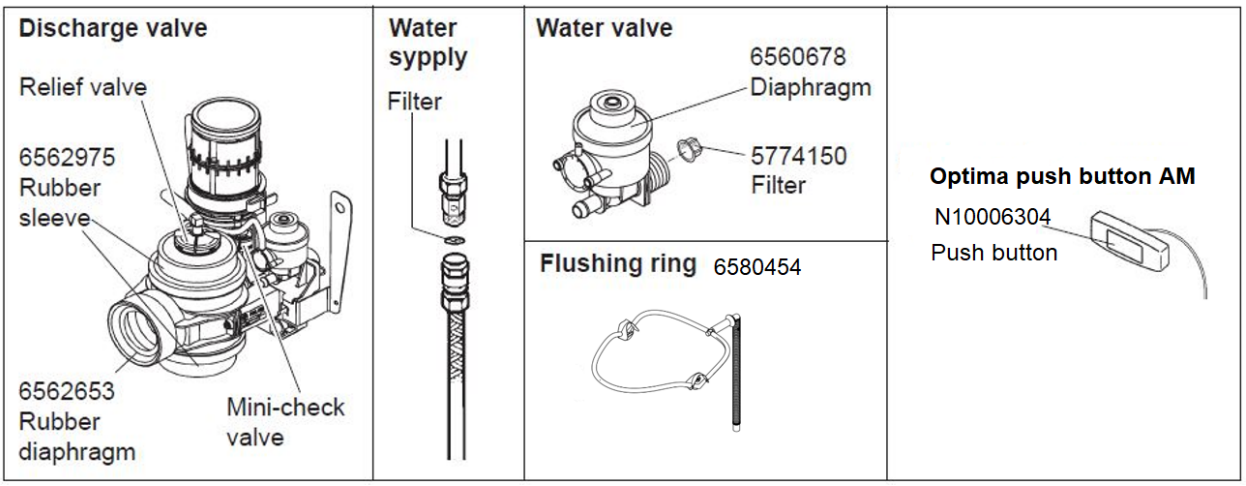
- Change the flap of the mini-check valve in every toilet.
- Check operation, the push button, the seat and cover, rinse pattern, discharge pattern.
- Check possible water and vacuum leakage.
- Clean the filter (not in USPH models) in the water supply.

5.1.2 Every 5 years; yearly maintenance plus:

- Open and clean the filter (5774150) of the water valve.
- Check the flushing ring and flushing operation.

5.1.3 Every 10 years; yearly and 5 years maintenance plus:

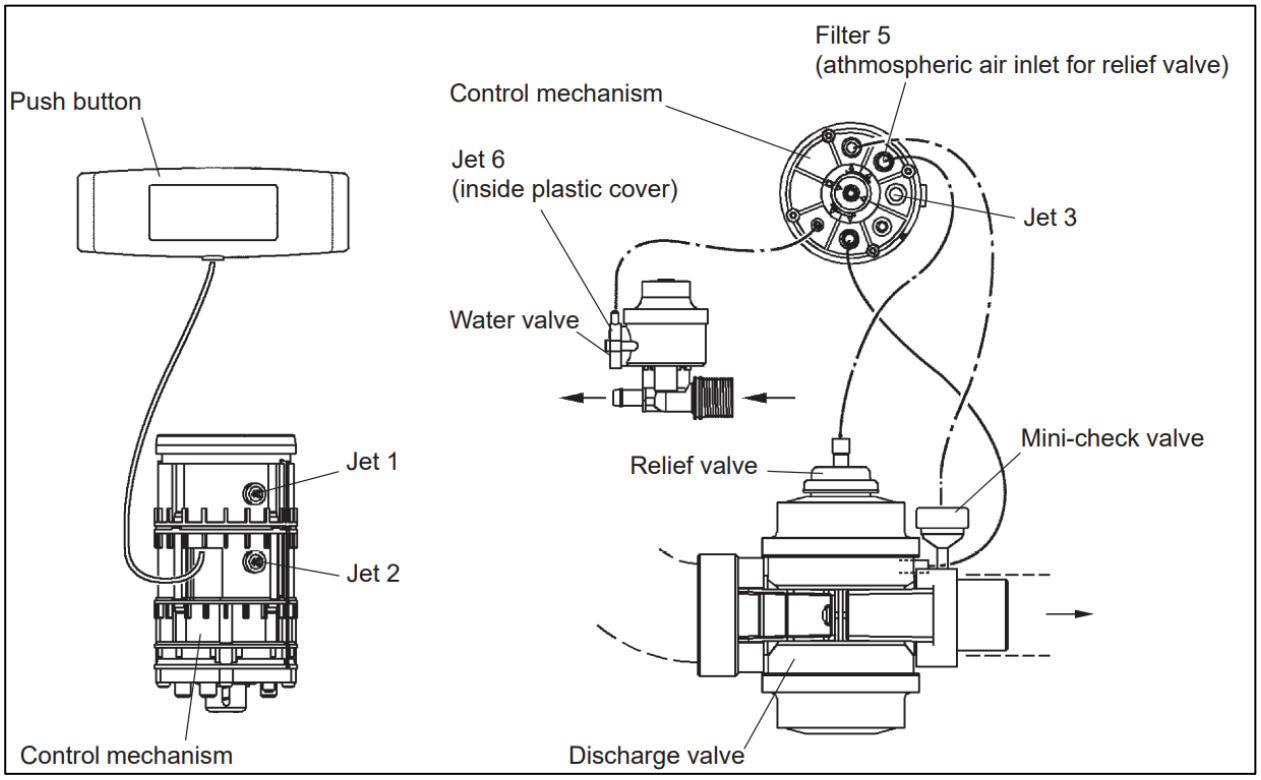
- Change the rubber sleeve (6562975, 2 pcs) and the rubber diaphragm (6562653) of the discharge valve and the diaphragm (6543134) of the relief valve.
- Change the water valve (6560680).
- Change the bowl securing nuts (5990759, 2 pcs, wall models).



NOTE!

Use only genuine Evac spare parts.

5.2 Maintenance for Control mechanism



Check that the air filter (5) is not blocked.

Check hoses and pipe connections for leaks.

Toilet discharge time

Jet 1	Short discharge period	Red jet	1.5 sec.
	Normal discharge period	Blue jet	2.0 sec.
	Longer discharge period	White jet	2.5 sec.
	Less restriction shortens the time		

Water valve opening time

Jet 6	Normal bowl water level	White jet
	Low bowl water level	Blue jet

5.2.1 Cleaning instruction

- The seat is easy to clean, with just a few simple directions for you to observe.
- Use a mild soap solution or biological cleaners.
- Seat and hinges should not be left damp but be dried with a soft cloth.
- When using abrasive, corrosive, or chlorine-based cleaners for the bowl, avoid contact with the seat and hinges. Therefore, when cleaning the bowl, make sure that seat and cover are in an upright position until all the cleaner has been flushed away.

5.3 Toilet seat and cover products

This chapter reviews the installation of the Prestige soft closing, seat, and cover AM (N10006302) & Prestige plus soft closing, seat, and cover (6593661).

The seat is easy to clean, with just a few simple directions for you to observe.

- Use mild soap solution or biological cleaners.
- Rince the seat and cover and the hinges with water and dry with a soft cloth.
- Do not use abrasive scouring powders for the seat, cover and hinges.
- Be careful with chemicals and cosmetics. Some of them may damage the seat.
- When you use abrasive, corrosive, or chlorine-based cleaners for the bowl, avoid contact with the seat, cover and hinges. Therefore, when you clean the bowl and flush cleaner away, make sure that the seat and the cover are in an upright position.

5.4 Troubleshooting

Trouble	Cause	Remedy
Toilet is discharging continuously(discharge valve open)	• Foreign object in bowl or indischarge valve • Blocked air relief tubing • Quick relief valve malfunction	• Shut off the problematic branch line valve • Remove foreign object • Change discharge valve • Check and if necessary changecontrol mechanism • Check relief valve operation
Bowl does not become empty when flushed	• Discharge valve blocked	•Clear stoppage, if any, in discharge valve
	• Leak in discharge valve housing • Discharge pipe blocked • Rubber sleeves leaking	• Sharp tools may damage rubber
		• Check that rubber sleeves are undamaged and correctly fitted
		• Check relief valve operation
No water or too little rinsingwater	• Water shut-off valve closed • No water pressure • Filter full or dirt in water valve • Flush ring loose • Flush ring clogged • Filter blocked up in water supply	• Open valve
		• Provide water pressure
		• Clean filter
		• Connect flushing ring
		• Clean flushing ring
		• Clean filter
Toilet is overflowing	• Water valve jammed in openposition • Bowl clogged or discharge valvenot operating • Misuse (buckets of water thrownin the bowl) • Too low vacuum (less than 30 kPa) to flush	• Close water shut-off valve
		• Clean / change water valve nozzles,springs, rubbers.
		• Discharge bowl, valve and piping with normally flushing
Toilet does not flush	• No vacuum or low vacuum (lessthan 30 kPa) • Clogged mini-check valve • No impulse from push button • Jammed control mechanism • Jammed quick relief valve	• Check vacuum level, remove blockagein piping • Clean / change mini-check valve • Check hoses and membrane of pushbutton • Change control mechanism • Check air filter condition. It should be place. • Check relief valve operation

5.4.1 Long term preservation instructions

- Shafts on rotating equipment which are not locked should be rotated 1 1/4 turn in the rotating direction every two months when not in service to avoid seizing in place when located in one position for long periods. Make sure that the new shaft position varies from check to check.
- Check that compartment heater is working.
- Inspect and list any damage to the equipment.
- Check that dust blinds are fitted on nozzles in and out from skids on single items of equipment and on free pipe ends and ducts.
- Check that painted and machined surfaces, which should be coated with a rust preventive wax or oil are maintained.
- Check that the protective covers are maintained.
- Sensitive equipment must be stored indoor in heated and humidity-controlled storage areas.
- All in/outlets from units/skids shall be plugged/blanked. Flanges shall be blanked with oil resistant rubber gaskets and steel or water-resistant plywood plate with 4 off galvanized bolts sufficient to provide mechanical protection and water/dust tight sealing.
- Threaded openings shall have metal plugs of metallurgy equal to the component being capped or plugged. If the IP rating is maintained, plastic plugs are acceptable for non-hydraulic/pneumatic systems.
- Flush through system with preservation medium. Drain out ensuring that no water is trapped in the system.
- All exposed unpainted-machined surfaces shall be coated with rust preventive wax.
- Aluminium sheeted glass fiber cloth shall be used to envelop pressure gauges, panels, junction boxes, instruments, pushbuttons, and connection boxes.
- Apply a thin layer of acid free Vaseline or equivalent to elastomer parts.
- All ball valves shall be locked in the open position.
- All exposed valves spindles shall be covered with grease tape, PTFE lubricant or vulcanizing tape or equal.
- General clean up routine and good housekeeping is a prerequisite for successful execution of preservation.
- Desiccative material shall not be in direct contact with metallic surfaces.

5.4.2 Special instructions for instrument equipment

- Instrument equipment containing electronics must be protected with desiccant or a vapor corrosion inhibitor.
- Gaskets / O-rings on instrument equipment must be greased with acid free Vaseline or equivalent.
- All non-terminated cable ends shall be fitted with a shrinking shroud.
- All spare cable entrances in panels and boxes must be plugged.

6. Customer support and warranty

6.1 Customer support

6.1.1 Web site access

Evac Service web site:
http://www.evac.com/services

Evac Agents and distributors:
http://www.evac.com/contactsearchtool

6.1.2 E-mail requests

All requests for After-Sales Service intervention must be sent to the following email address:

Technical support:
evac.technicalsupport@evac.com

Specifying:

- Type of unit
- Serial no.
- Defect found
- Evac part number
- Vessel name and /or IMO number.

Replacement parts:
evac.spareparts@evac.com

Specifying:

- Type of unit
- Serial no.
- Evac part number
- Required quantity
- Manner of transport
- Vessel name and /or IMO number.

6.2 Warranty and liability

6.2.1 Warranty

Warranties are defined in the general terms and conditions of sale.

evac.warranty@evac.com

6.2.2 Liability

Evac cannot be held liable for operation faults or generic failures caused by improper use of the unit or operations carried out by persons not authorized by Evac.

Revision history

Rev. no.	Description	Date
1	First release	25 Sep 2015
2	Second release with updates	03 Apr 2020
3	Move data to new template	28 Apr 2021
4	Updated a pushbutton number and corrected folder structure	1 June 2022