



**Commissioning
Operation and Maintenance Manual
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BUSSE GT

NSF/ANSI Standard 40, Class 1 and Standard 245

BUSSE WEST

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**MANUAL FOR COMMISSIONING AND MAINTENANCE
BUSSE MODELS – 400, 500, 600, 800, 1000, 1200**

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1 Commissioning



The first commissioning of the system is only permitted by the manufacturer or an authorized company. A disregard will lead to the loss of the warranty.

1.1 First Commissioning

Action	Checked
Assembly inspection	
Check the setup of the place to install (frost free location on a firm and level surface)	
Check the connections of the plug-in system "technical air"	
Check the connections of the plug-in system "filtrate"	
Check the connections of the activated sludge transport	
Check the connections of the sludge recirculation	
Check the connections of the venting system	
Check the correct installation of the equipment in the precleaning tank V01 and M01	
Check the readiness of the power connection to the system	
Check the correct installation of the membrane modules inside the tanks B01-AM1 and B02-AM1	
PID Check (piping and instrumentation diagram)	
Loop Checks	
Activation of the fuse in the control box	
Activation earth-leakage circuit breakerFI01	
Activation of the power for the system with the main switch S1 at the control box	
<p>Check the functionality of the floating switches LA/LC by manually lifting them and checking if the associated signals can be seen on the display of the control unit</p> <ul style="list-style-type: none"> ⇒ Lifting the float V01-LA1 in the tank V01 triggers the level alarm ⇒ Lifting the float V02-LS1 in tank V02 starts the transport of water via the airlift pump to tank B01. The float has a programmed time delay of 5 sec <p>By lifting the float B01-LS1 in the tank B01 the filtration is started (time delay). Perform this test only for a short time and observe that the compressor B01-VM1 has started and the filtration pump has started</p> <p>Precleaning tank: / V01-LA1 / V02-LC1 B02-LC1</p>	



Action	Checked
Functional check of equipment	
Functional check of all pumps with fresh water or sewage by plugging them into one of the three permanent current sockets per unit, the correct function can be seen at the transparent hoses or at the water meter	
Leakage test of the flexible hoses from the optional collecting tank G01 to the V01 tanks and sludge recirculation from B01/B02 to G01/V01 for leaks	
<i>Functional check of the motor valve F01-MF1</i>	
<i>Ready for commissioning</i>	
Commissioning	
<i>Assembly inspection successful passed</i>	
<i>Loop checks successful passed</i>	
<i>Functional check of equipment successful passed</i>	
<i>Deactivate the system with the main switch S1 at the control box</i>	
Filling of the precleaning tank G01/V01/V02 with activated sludge (from aerobic wastewater treatment plant, screened, optimal dry-matter content 5-10 g/L, ca. 50 – 75 % of tank volume)	
Disconnect the filtrate discharges at the tanks B01/B02 from the collector/outlet to exhaust the air out of the membrane modules when filling these tanks with water. Reconnect the filtrate connection after the filling of the tank is completed	
Activate the system with the main switch S1 at the control box Display of the control logic says "run" ⇒ the plant automatically starts filling the tanks with the pumps ⇒ the airlift pumps (PM) automatically transport the sludge until the connected tank is filled to normal operational level (modules are completely covered with a sludge / water mixture)	
Meanwhile check the transporting processes and calculate the flow by measuring the rise of the level in the according tank in a certain time. The flow of the airlift pumps (PM) should be at least 50 L / min when the tank, where the airlift pump is installed, is full	



Action	Checked
<p>When the filtrate is coming out of the filtrate outflows at the MBR tanks:</p> <ul style="list-style-type: none">⇒ Check the filtrate at the single discharges for suspended solids with a transparent vessel. This would be a sign that a filtrate connection inside a MBR tank is not right or the associated membrane is damaged <p>When the filtrate has a good visual quality:</p> <ul style="list-style-type: none">⇒ connect the PE filtrate-outflow to the collector / outlet	
<p><i>Close the tanks correctly</i></p>	
<p>Activate the sludge recirculation B01-G01/V01 depending on TS concentration after 2-3 months after first commissioning at the control box (sludge recirculation automatic ON) or by plugging in the related compressor</p>	
<p>It should be noted that when starting a plant with dry biology, several days are required to build up a microbiology and only gradual load increase can take place.</p> <p>Only a start-up with available activated sludge from a wastewater treatment plant allows an immediate normal loading of the plant put into operation.</p>	
Action	Checked
<p>Filtration check</p>	
<p><i>If the filtration process doesn't run, activate the filtration for 120 seconds by pushing the green H1.1 "filtration indicator"</i></p> <p><i>Calculate the flow of the filtrate by measuring the volume of filtrate produced in 1min and convert the value to gal per hour. (Multiply with 60)</i></p> <p><i>The flow should be at 25 gal / h per membrane module</i></p> <p><i>It can take up to 24 hours until the membranes are hydrophilic, and the final value of the flow is reached</i></p>	

1.2 Shutdown



If the system must be switched off completely with the main switch or the fuses for more than 1 day the sludge in the tanks must be aerated manually with the compressors and an external power source for 10 minutes every hour (f.ex. with timer switch). Otherwise, the bacteria that are necessary for the degradation process will start to die and the biological system in the MBR will not function again when the system is restarted.

Bacteria cannibalism occurs but if concentration is high enough to leave sufficient bacteria at start up, that will allow efficient treatment on day-one of startup



It is important to ensure that older Kuboda membrane modules do not dry out. If this option exists, remove the modules from the tanks and clean and dry them according to the instructions. (see chapter 2.2 Membrane Cleaning. This is not an issue with Weise membranes

Action	Checked
Switch the system off with the main switch S1 and secure it against reactivating with a lock	
Lowering of the sludge level in the tanks <ul style="list-style-type: none">• Only if necessary for getting at the equipment inside the tanks (for example aeration cylinders)• With a submersible pump (f.ex. Robu JS 150) into the precleaning tank G01/V01• Alternatively, a disposal vehicle can also lower the sludge in the tanks• If not absolutely necessary, the activated sludge in the MBR tanks should not be lowered more than 30cm from the bottom of the tank for keeping the biological system alive	

Action	Checked
Switch the system off with the main switch S1 and secure it against reactivating with a lock	
Emptying and disposal of the tank contents (sludge / wastewater)	
Removing, cleaning and storing of the membrane modules (disconnect the JG Hose, use belt and hose to get the module out)	
Cleaning of all pipelines with fresh water jet from a hose	
Cleaning of the coarse matter screens in the pit with a fresh water jet	
Cleaning of the pumps PK1 / PK2 and all airlift pumps with fresh water	
Cleaning of the inside of the tanks with a high pressure water jet	
Draining of the used water from the tanks	

**Homeowner and Service Operator ongoing care and checks**

The items listed below are the responsibility of the Operator (service provider) The homeowner should not service the system but should be aware of the following items and contact the service provider as needed

Action	Checked
Unusual noise and smell	
Be sure all fuses in the control boxes are activated	
Three white power lamps are always ON	
Report any leakage from tanks / pipelines / flexible hoses	
Operator to check the filtrate for suspended solids by manually activating the filtration for 120 sec in the control box (push green "filtration indicator") and taking a sample at the outflow	
Operator to check that the MBR compressors are running when the green H1.1 "filtration indicator" is activated	
Operator to check when the green "filtration indicator" is activated the water meter and the operating hours counter should be running	
Operator to check that the tanks are closed correctly	

Operator Service Check List

Action	Checked
The date, the time, the operating hours counter of the filtration and the filtrate water meter are to be filled in the operators log	
Check the functionality of all single compressors (VM) and pumps (P)	
Clean the suction filters of the compressors (see manual chapter "Error! Reference source not found.")	
Activate the filtration for 120 seconds by pushing the green "filtration indicator" <ul style="list-style-type: none">• Calculate the flow of the filtrate by measuring the volume of filtrate produced in 1 min and convert the value to liters/gallon per hour (multiply with 60).• The flow should be at 100 L/h (27 gal/h) per membrane module	
When the water level in the septic tank is low enough: clean the coarse matter screens (AF) in the septic tank (G01/V01) with a freshwater jet	
Check the functionality of the float switches (LC, LA) by lifting them up and see if there is the associated signal coming in at the displays of the PLC (for assignment see wiring diagram).	
Check and clean (if necessary) the venting of the tanks	
Transmit the data recorded in the operators log to BUSSE GT	



Possible Faults

Error indication	Possible faults	Remedial action
Odor nuisance	Venting (f.ex. over the roof) is insufficient or not available	Check the ventilation system
	Fouling processes because of insufficient aeration	Check the compressors and aeration system
Water is leaking from the system (leakage)	Hydraulic overload of the system	Reduce or stop the inflow, check the emergency overflow
	Pipeline or connection is leaking	reseal if necessary
	Filtrate discharge rate to low or completely blocked	Check filtrate piping you may have to change the modules
	Float switch is faulty	change the float switch
Foaming at the cover or the screws	Leakage at the cover or the cable bushings / hose inlets	Check gaskets, reseal if necessary
	too much surfactants in inflow	reduce surfactants in inflow
	Shortly after commissioning	Add 1 L of cooking oil into each tank
No filtrate flow when green H1.1 "filtration indicator" is activated	Float switch is faulty	change the float switch
	Filtrate pump is faulty	Change or repair the filtrate pump
	Manual valve (HK) is closed	Open manual valve (HK)
	Water/flow meter is faulty	Replace water/flow meter
Constant filtrate flow, even when green lamp green H1.1 "filtration indicator" is deactivated	vacuum breaker in filtrate pipeline missing	Install vacuum breaker in filtrate pipeline or let the filtrate flow freely into the storage
Filtrate is brown with suspended solids	Filtrate connection inside a MBR is faulty	Check the piping if there are any leaks
	Membrane module is faulty	change the module
Submersible pump PK1 does not deliver, when G01/V01-LC is activated and B01-LC1 is deactivated	Float switch is faulty	you may have to change the float switch
	Submersible pump PK is faulty	you may have to repair or change the submersible pump
	Fuse is deactivated	Activate fuse of pump PK



Error indication	Possible faults	Remedial action
Level of the precleaning tank is at the maximum, the visual and acoustic alarm indicator H2 (red) in the control box is activated	Submersible pump PK is faulty	repair or change the submersible pump
	Hydraulic overload of the system	Reduce the inflow
	V01/G01-LC2 is faulty	Replace G01-LC2
	B01-LC1 is faulty	Replace faulty floating switch
	Filtrate discharge rate to low or membranes completely blocked	Check filtrate piping you may have to change the membrane modules
	Flow rate through screens G01-AF1 to low or completely blocked	Clean G01-AF1 with a water jet Check aeration device for function
	Manual valve (HK) is closed	Open manual valve (HK)
	Airlift pump (PM) is out of work	Check the compressors (VM) and the solenoids (ML)
No aeration in a MBR tank when green H1.1 "filtration indicator" is activated	Air supply is interrupted	Check piping from the compressor to the aeration devices if there are leaks
	Compressor is faulty	Change or repair the compressor
Ground fault circuit interrupter (GFCI) activated	Power supply to the control box faulty	Check wiring, Reset circuit breaker, Remedy by qualified personnel only
	Electrical equipment faulty	Remedy by qualified personnel, you may have to change the faulty equipment



2 Maintenance

⚠ DANGER

The owner of the system is responsible for safe operational compliance and the regular operating readiness. He must perform or hire a qualified person to perform all the necessary measures including maintenance. This manual should be read and understood thoroughly before any work is executed. The system must not be maintained or operated by persons (including children) with reduced physical, sensory or mental capabilities and/or lack of experience or knowledge, unless they are instructed by a person responsible for their safety.

⚠ DANGER

The system may only be operated if the electrical connection is separately fused and equipped with a safety-switch.

⚠ WARNING

While handling with wastewater or sludge safety-gloves and safety-glasses have to be worn and every skin contact and food intake has to be avoided.

⚠ WARNING

After work a cleaning and disinfection of the skin that was exposed to the waste water or sludge is necessary. Please use a chemical disinfectant.

⚠ WARNING

Smoking in the container and the plant is prohibited

NOTICE

The manufacturer or an authorized agent provides maintenance instructions at the time of installation.



2.1 Regular compressor cleaning (XX-VM1)

NOTICE

The cleaning of the suction filters must be regular. The periods are depending on the environment.

The air for the aeration devices is provided by 200 L/min compressors. Different reasons can induce a malfunction. A dirty suction filter can affect the air capacity just as damaged membranes or damaged valves. If the suction filter dirty, he has to be cleaned. But if the valves or membranes are damaged the compressor must be replaced or the maintenance must be done by an authorized agent.

Cleaning of the suction filter:

Unplug the compressor from the power for the cleaning of the suction filter. Then unscrew the screws in the middle of the covering and lift it off. The foamed filter is to be cleaned with a vacuum. Put it back into the compressor and screw it down.



Picture 2: Exploded view



2.2 Membrane Cleaning

▲ WARNING

When working with sewage and activated sludge a protection provided by vaccination (especially against Hepatitis A and B) is required.

▲ WARNING

While handling with wastewater, sludge and while the cleaning of the membranes safety-gloves and safety-glasses have to be worn and every skin contact and food intake has to be avoided

▲ WARNING

After work a cleaning and disinfection of the skin that was exposed to the waste water or sludge is necessary. Please use a chemical disinfectant.

▲ WARNING

Smoking in the container and the plant is prohibited

NOTICE

The filtrate pipelines inside the MBRs must be closed when disconnected from the module, because sludge must not get into the filtrate system.

NOTICE

Don't let Kuboda membranes get dry before cleaning!

New Weise membranes (white membranes) (4th generation membrane) will be viable even after drying. Rinse aid helps keep membrane viable even when dry;

ie: With Weise membranes maintaining wet membranes is no longer required

The membrane modules have to be cleaned, if the entire filtrate flow (line I and line II) is lower than 1000 L/h (filtrate flow of each module is lower than 50 L/h). The changing of the membranes should be taking place while the system is fully operational. The membrane modules can be uninstalled separately while the other modules are still in operation. Therefore open the cover of the tank and use the belt and the hose to get the module out. Then disconnect the JG hose from the module. To close the disconnected hose watertight, connect it with a JG Coupling and a red plug.

After the maintenance every changes of the system that are made for the maintenance have to be reversed. Afterwards the filtration, aeration and transport processes have to be checked for the right function.

BUSSE is gradually shifting to the use of Weise membranes where appropriate



2.2.1 Pre-cleaning

Before you start cleaning the membranes, insert a "John Guest"- hose with 12 mm diameter and approximately 1 m length into the filtrate collector of each membrane module. This has to be done to avoid rests of sludge or dirt getting inside of the single membranes and the air can ascend. Don't use plugs for that reason. Then clean the soiled module and the space between the membrane plates with a water hose but with a low pressure water jet (maximum 4 barg). Do not use a pressure washer, because it can damage the surface of the membrane. For the same reason do not clean the space between the membranes with mechanical tools.

2.2.2 Washing (R01)

After the pre-cleaning put 2 modules in the washing box (R01) on top of the grid with the air distributor underneath. Fill the washing box with water (if possible warm water, approximately 20 °C ... 40 °C) until the water covers the top of the module. Now put in approximately 100 g laundry detergent on 250 L of water. After you have checked the water level, connect the compressor R01-VM1 (200 L/min) with the washing bin R01 and activate it. The compressor should be placed above the water level to prevent a backflow. The water / washing powder-mixture now circulates in the washing box and cleans the module of the remaining sludge. The duration of the washing process depends on the degree of pollution. Normally the washing process should last at least 1 hour. **Afterwards the polluted water must be discharged and the bin R01 have to be filled again with fresh water for a rinsing of the modules.** The compressor R01-VM1 should also be running during the rinsing. Let the module rinse for another 30 minutes. The water from the rinsing can be used afterwards for the washing process of the next modules.

2.2.3 Chemical cleaning - Bleaching (R02)

After the module is washed you can proceed with the chemical cleaning. Remove the "John Guest"- hose because the chemical cleaning solution must also get inside of the membranes through the filtrate collector. After you have removed the hose put the module in the next washing bin (R02) and fill it with potable water until the water covers the top of the module (approximately 250 liters). **During the filling of the washing box with clear water you also add the chlorine bleaching solution (sodium hypochlorite, NaClO, 12,5 % solution). On 250 liters water you have to add 2,1 liters sodium hypochlorite solution (equals 1500 ppm).** The module should now stay 60 to 120 minutes in the bleaching solution. Depending on the pollution it may be necessary to dose additional sodium hypochlorite solution. **After the bleaching the module has to be rinsed and neutralized. The polluted water must be discharged and the bin R02 have to be filled again with fresh water until the top of the modules are covered for the rinsing.** Let the module rinse for 30 minutes. The water from the rinsing can be used afterwards for the bleaching process of the next modules.



2.2.4 Optional: Chemical cleaning with citric acid (R03)

If there are yellow or white residues on the surfaces of the membranes it may be necessary to do an additional chemical cleaning with citric acid. Therefore fill the next washing bin (R03) with potable water and add the citric acid ($C_6H_8O_7$, 100% powder). **On 250 litres water you have to add approximately 2,5 kg citric acid (equals 1%).** The module should stay at least 2 hours in the solution.

2.2.5 Final Rinsing (R03)

After the treatment with citric acid the module has to be rinsed and neutralized. The water with the acid must be **discharged** and the bin R03 has to be filled again with fresh water until the top of the modules are covered for the rinsing. Let the module rinse for 30 minutes.

2.2.6 Quality Control

Before installing the membrane modules inside the MBR-Tanks you have to perform the quality control to identify maybe damaged membrane disks. Therefore check the membrane modules visual. A dark discoloration of a membrane disk is an indication of a mechanical damage. Do not reinstall damaged membrane modules inside the MBR-tanks again. They have to be replaced.

NOTICE

After cleaning and quality control the modules should be installed back inside the MBR-tanks while they are still wet. This is important because a dried membrane doesn't work without any special treatment.

2.2.7 Membrane Drying (only if necessary)

A membrane drying have to be done only if it's necessary (for example in case of a damaged membrane module or to store the membrane module).

After the chemical cleaning refill the washing bin (R03) with potable water and add approx. 50 ml clear rinsing agent (what is used in dish washers, for example "Calgonit") on 250 liters clean water. Fill the washing bin with the clear water / rinsing agent mixture until the top of the module is covered with it. Let the module rinse for 10 minutes and move them a bit during this process. After rinsing for 10 minutes drain the washing box.

The rinsing agent is added to make the pores of the membranes stay open during the drying process. If you used this clear rinsing aid you do not have to hydrophilize the membranes after drying and can put the module in the sludge as it is.



After the rinsing process dry the membranes in a vented, frostfree room. You have to make sure to provide a good air circulation in the drying room. The modules must not stay in sun light during the drying process and should not be stored outdoors.

For questions please get in contact with us: info@busse-is.de

	Cleaning stage	TAG	Duration	Comments
1	Pre-cleaning			<ul style="list-style-type: none"> • Don't let the membranes get dry before the cleaning • Use low pressure potable water (max. 4 barg) • Do not use a pressure washer • Do not clean the space between the membranes with mechanical tools
2	Washing	R01	60 min.	<ul style="list-style-type: none"> • Use potable water (if possible 20°C ... 40°C) and app. 100 g washing powder on 250 liters water • For washing start the compressor R01-VM1 • Duration depends on the degree of pollution
	Rinsing	R01	30 min.	<ul style="list-style-type: none"> • Use fresh potable water (if possible 20°C ... 40°C) • For rinsing start the compressor R01-VM1 • The water from the rinsing can be used afterwards for the washing process of the next modules
3	Chemical cleaning / bleaching	R02	60-120 min.	<ul style="list-style-type: none"> • Remove the "John Guest"- blind plug. • Use potable water and sodium hypochloride (NaClO-12,5 % solution) • On 250 liters water you have to add 2,1 liters sodium hypochlorite solution 12% (equals 1500 ppm). • Depending on the pollution it may be necessary to dose additional sodium hypochlorite solution.
	Rinsing	R02	30 min.	<ul style="list-style-type: none"> • Use fresh potable water • The water from the rinsing can be used afterwards for the bleaching process of the next modules.
4	Optional Chemical cleaning with citric acid	R03	At least 120 min.	<ul style="list-style-type: none"> • Only necessary if there are yellow or white residues on the surface of the membrane • Use potable water and citric acid (C₆H₈O₇; 100% powder) • On 250 liters water you have to add app. 2,5 kg citric acid powder (equals 1%).
5	Final Rinsing	R03	30 min.	<ul style="list-style-type: none"> • Use fresh potable water • Move the membrane module a bit during the rinsing process
6	Quality Control			<ul style="list-style-type: none"> • Check the membrane module visual • Do not reinstall damaged membrane modules (dark discoloration of one or more membrane disks) • Damaged membrane modules have to be dried and repaired
7	Reinstall			<ul style="list-style-type: none"> • After cleaning and quality control the modules should be installed back inside the MBR-tanks while they are still wet. A dried membrane doesn't work without any special treatment.

Membrane Drying

NOTICE

A membrane drying has to be done only if it's necessary (for example in case of a damaged membrane module or to store the membrane module)

	Drying stage	TAG	Duration	Comments
1	Rinsing	R03	10 min.	<ul style="list-style-type: none">• Use potable water and rinsing agent (what is used in dish washers, for example "Calgonit")• On 250 litres water you have to add app. 50 ml clear rinsing agent• Move the membrane module a bit during the rinsing process
2	Drying (Kuboda membrane only)			<ul style="list-style-type: none">• After the last rinsing process dry the membranes in a vented, frost-free room• provide a good air circulation in the drying room• The modules must not stay in sun light during the drying process and should not be stored outdoors.