Operating manual

WWTP TOPAS 30-50

TOPAS

wastewater treatment plant with a control unit TOM

TOPOLWATER

1. CONTENTS

2. APPLICATION RANGE OF THE WASTEWATER TREATMENT PLANT

TOPAS wastewater treatment plants (WWTPs) are designed to treat wastewater from small sources of contamination that means from households, recreation centres and small businesses if the characteristics of these waters are as specified in Table 1. When used for other than the household type of wastewater, wastewater must be biologically treatable and its volume and BOD load should correspond to the capacity of the plant.

SUBSTANCES WHICH ARE NOT WASTEWATERS

The following substances may not get into the inflow pipe of the WWTP unless they are part of wastewater in the volume permitted by water management regulations:

a. Wet wipes;
b. Radioactive substances;
c. Infectious substances;
d. Poisonous substances;
e. Caustic substances;
f. Explosives;
g. Herbicides;
h. Flammable substances, or substances which when mixed with air or water produce explosive, choking or toxic mixtures;
i. Petroleum substances in the quantity exceeding 20 mg per l of wastewater;
j. Other substances harmful to WWTP operators' health or safety
k. Rainwater.

PERMITTED LIMITS

The following table shows the limit values for the pollution of domestic sewage and basic civic amenities. The specific indicators given in the table should be monitored especially if the installed waste water treatment plant TOPAS provides operations and services assuming the content of these substances in waste water (e. g. car repair shops, medical facilities, laundries, dry-cleaners, meat industry, livestock production, oil stores etc.).

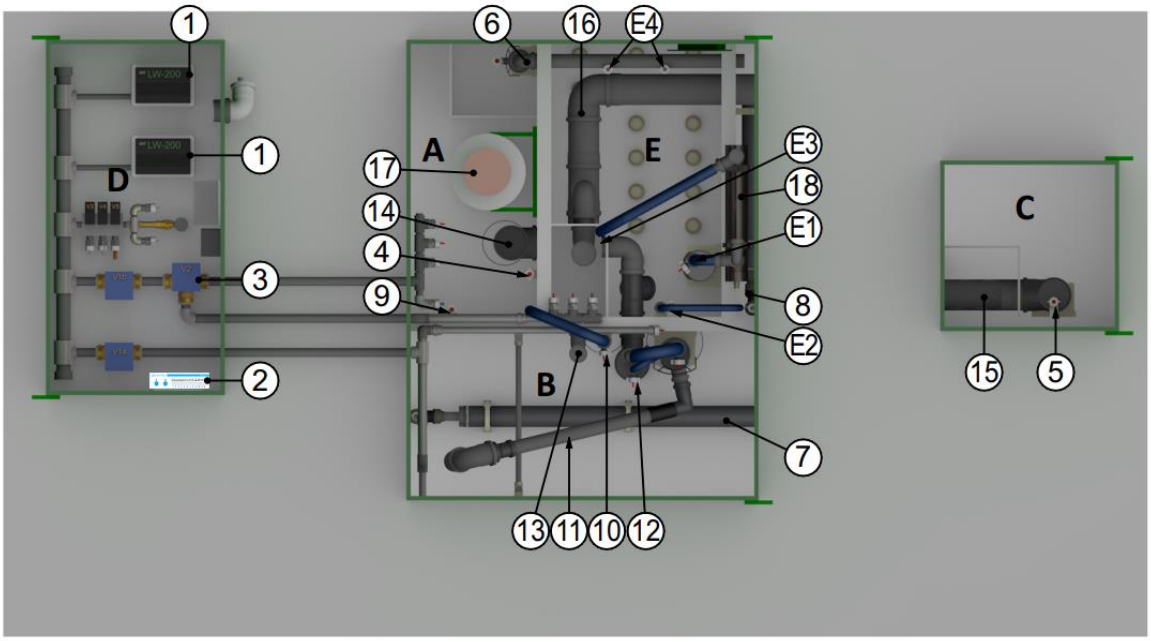
INDICATOR	PARAMETER	LIMITED VALUE	UNIT
Biochemical oxygen demand	BOD	150 - 500	mg/l
Chemical oxygen demand	COD	300 - 1000	mg/l
Total nitrogen	N_T	25 - 100	mg/l
Total phosphorus	P_T	5 - 20	mg/l
Water reaction	pH	6,5 – 8,5	
Suspend solids	SS	200 - 700	mg/l
Temperature	t	30°C	°C
Dissolved inorganic salts	DIS	1000	mg/l
Petroleum and petroleum products	TPH	5	mg/l
Grease	O&G	80	mg/l
Anionic surfactants	AS	10	mg/l
Chlorides	CL´	400	mg/l
Adsorbed organic substances	AOS	100	µg/l

Table 1: Limit values of indicators of polluted waste water

3. BASIC DESCRIPTION OF THE WATER TREATMENT PLANT

The WWTP TOPAS S consists of four separate tanks:

- Inflow (accumulation) tank, pumping station
- Activation tank (bio-reactor)
- Sludge tank
- Sand filter (SF)



Description of tanks:	**Standard equipment:**	
A - Accumulation tank	**1 -** Blower Nr.1+Nr.2	**9 -** Accumulation aeration
B - Bioreactor	**2 -** Control unit (TOM)	**10 -** Desludging air-lift pump
C - Sludge tank	**3 -** Electrovalves V1a,V1b,V2,V3,V4,V6	**11 -** Decanter arm
D - Box for technology	**4 -** Pressure probe in accumulation	**12 -** Decanter container + decanter filling air-lift pump
E - Sand filter	**5 -** Pressure probe in bioreactor	**13 -** Bioreactor emergency overflow
E1 - SF filtration air-lift pump	**6 -** Raw water air-lift pump	**14 -** Accumulation emergency overflow
E2 - Desludging air-lift pump	**7 -** Bioreactor aeration	**15 -** Bioreactor inflow
E3 - SF overflow	**8 -** Sludge tank aeration	**16 -** Treated water outlet
E4 - SF aeration		

Figure no. 1: Ground plan of WWTP TOPAS SF

Description of the respective tanks and treatment plant components are as follows:

INFLOW TANK (ACCUMULATION TANK)

Wastewater enters the WWTP by flowing in this tank. The inflow (equalising, accumulation) tank is highly important for the functioning of the WWTP.

The following processes occur there:

- Balancing the irregular inflow of wastewater;
- Drawing sewage to the activation tank - serves as a sewage pumping station into the sludge tank, which has a gravity overflow into the bioreactor;
- Capturing and disintegrating rough impurities;
- Pre-treatment; and

The control unit senses and evaluates the following water levels:

- Minimum
- Operating
- 100% mode
- Hydraulic overload
- Emergency.

ACTIVATION TANK (BIO-REACTOR)

This tank is the place where biological treatment itself is carried out using micro-organisms hovering in sludge. To stay alive, micro-organisms (activated sludge) need both organic pollutions, supplied in wastewater, and oxygen, supplied in the compressed air by the compressor (blower) of the WWTP. Compressed air mixes the activated sludge with wastewater. The activated sludge is heavier than water. After the end of aeration, which is accompanied with a stirring of the content of the tank, the activated sludge forms a layer at the bottom of the activation tank, separated from the layer of treated water which is periodically drawn from the plant.
The control unit senses and evaluates the following water levels:

- Emergency
- Filling
- Discharge
- Minimum

SLUDGE TANK

It is used for accumulating excess activated sludge which is produced during the treatment process in the bioreactor and is regularly drawn from the bioreactor first to accumulation and then with raw water to the sludge tank where it accumulates and removes at the required intervals. The sludge tank thus also serves to catch coarse impurities especially wet wipes which are then removed together with the excess sludge.

AIR-LIFT PUMP

The air-lift pump consists of a tube where one end of the tube is immersed in water and the other end is at the height where we want to pump the water. Compressed air is supplied to the submerged end of the pipe. Air is lighter than water and therefore rises in the pipe to the upper end and at the same time water is pumped alternately between the bubbles. For the system to work properly the air distribution must be tight and the amount of air must be regulated by calibrated hole tokens.

DECANTER

The decanter is a special, patented system which is used for drawing treated water from the bioreactor. Treated water is drawn from the layer approx. 10 cm below the water level in the bioreactor. The decanter

consists of a decanter arm - movably connected to a treated-water tank (vertical plastic pipe) from which the water is pumped by an air-lift pump to the outlet or to a sand filter.

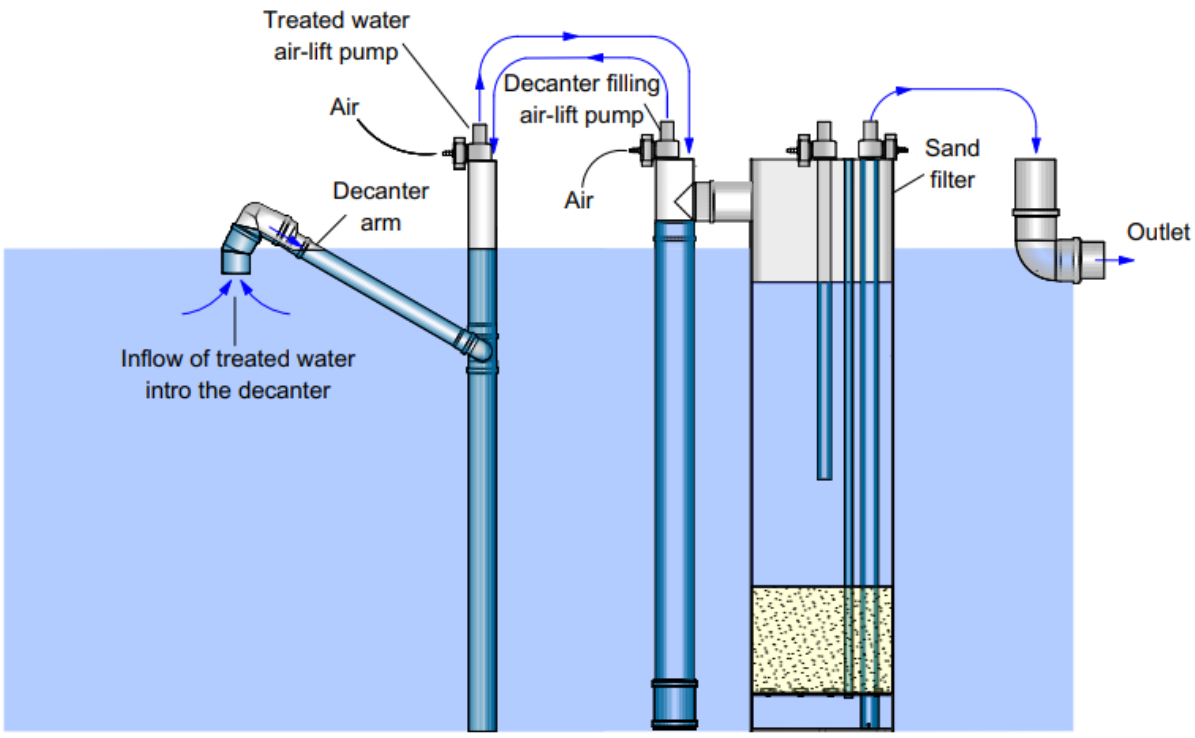


Figure no. 2: Principle of the decanter functioning

4. TREATMENT PROCESS TECHNOLOGY

Wastewater flows usually by gravity and without rough pre-treatment into the accumulation tank of the treatment plant. From there, they are pumped by a raw water air-lift pump into a sludge tank which has a gravitational overflow into the SBR type reactor and also has the function of primary sedimentation. Biological treatment takes place in the SBR reactor. Wastewater pumping is intermittent and the level of water in the accumulation is maintained between the minimum level (switching off) and operating level (switching on) according to the control unit TOM. The air-lift pump works for about 7 minutes and fills the reactor usually for 5 switching's. The output of the air-lift pump is always greater than the design maximum hourly inflow, therefore a reduced level of accumulation is maintained during the filling stage.

The reactor volume between the filling level and the safety overflow from the reactor to the accumulation is greater than the one-time pumped out of the accumulation. The raw water air-lift pump is then switched off until the next filling stage. If the level in the accumulation rises to the level of the accident overflow (WWTP bypass) the raw water air-lift pump will be put into operation even outside the filling stage. But only for the time necessary to reduce the accumulation water level below the level of the safety overflow. At the same time a fault is signalled.

After filling, the next treatment stages take place in the reactor - sludge sedimentation at the bottom, sludge removal and treated water pumping. Then follows the next filling stage. Outside the filling stage, the reactor is not aerated. The reactor is equipped with a safety overflow connected to the treated water outlet (or to the SF). Because the raw water supply from the sludge tank is led to the bottom of the reactor the entire reactor temporarily has the function of a settling tank. When the accumulation is overfilled to

pump the reactor outside the filling stage the treated water will drain through the reactor overflow after sedimentation - in the same quality as it will be subsequently pumped out.

Wastewater treatment in the treatment plant takes place in the following stages:

1. Bioreactor filling stage
1a. Post aeration
2. Sedimentation stage
3. Decanter filling stage
4. Desludging stage
5. Discharge stage – treated water pumping
6. Recirculation stage

BIOREACTOR FILLING STAGE

Wastewater flows into the accumulation and is cyclically pumped by an air lift pump to the sludge tank and then to the bioreactor. At the same time, the bioreactor is aerated and thus the wastewater is biologically treated including ammonia oxidation (nitrification). The control unit (TOM) measures the length of the filling stage. During the filling stage, the blower operates continuously or intermittently if the treatment plant does not operate at 100% and the design capacity of the treatment plant is not fully utilized. The filling stage lasts until the water level in the reactor rises to the set filling level (maximum) or the set maximum filling stage time has elapsed.

The raw water air lift pump switches on when the set level (operating) is reached and switches off again when the required level reduction (minimum) in the accumulation is reached. SF is being pumped out.

V1a valve is open, other valves are closed. The V5 opens and closes according to the level in accumulation.

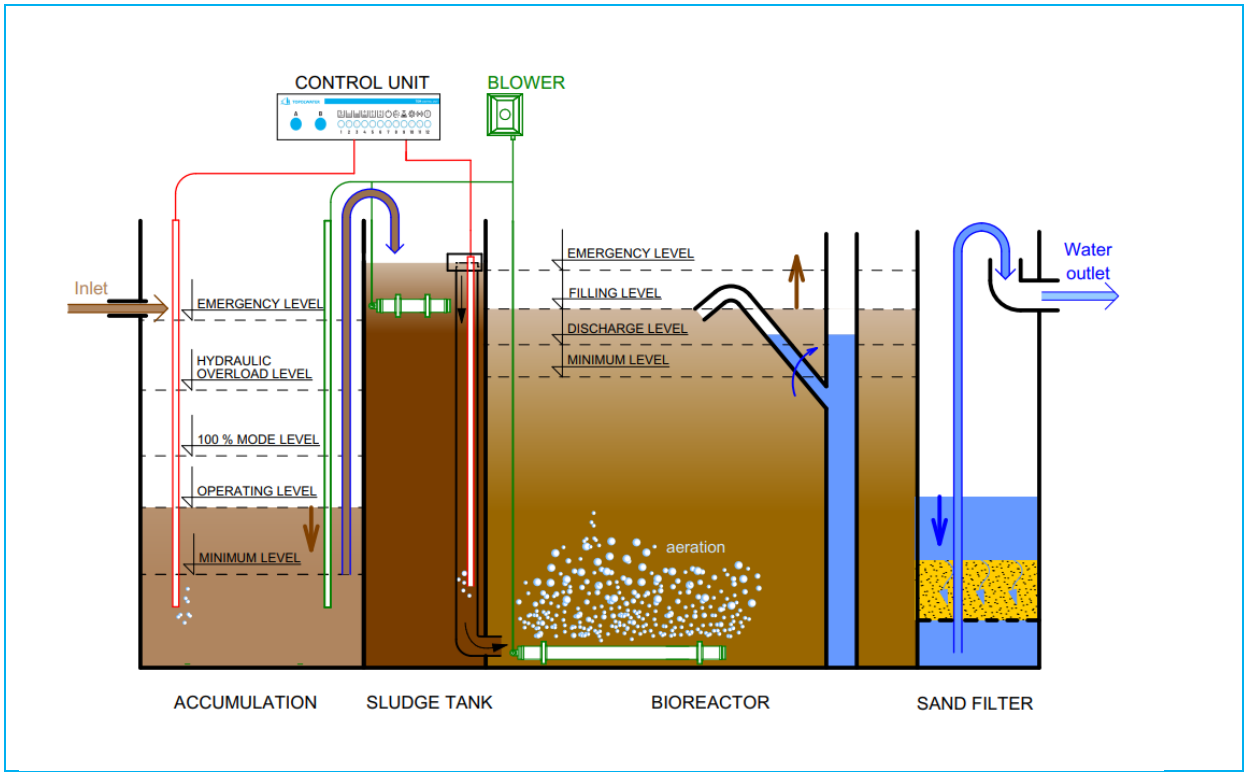


Figure no. 3: Bioreactor filling stage

SEDIMENTATION STAGE

The sludge is sedimented at the bottom in the bioreactor and the treated water is separated from the sludge layer. Sedimentation takes a set time. During this time, the accumulation and sludge are aerated and screens are operated.

V1b is open, V2 is open to the accumulation. Other valves are closed.

DECANTER FILLING STAGE

It runs for a set period of time. The decanter filling air-lift pump is working, the accumulation and sludge tank are aerated and the screens are working.

V1b is open, V3 is open, V2 is open to accumulation. Other valves are closed.

DESLUDGING STAGE

Excess sludge is pumped from the bioreactor into the accumulation. The accumulation and the sludge tank are aerated. The level in the bioreactor decreases during the desludging process by the preset sludge layer. The desludging continues until the set level reduction in the bioreactor is achieved but no longer than the set sludging limit. Desludging is terminated or does not occur at all if the level in the accumulation is above the set 100% mode level.

V1b is open, V4 is open, V2 is open to the accumulation. Other valves are closed.

DISCHARGE STAGE (DECANTING)

During this stage the water level of the bioreactor decreases from the filling level (max.) to the discharge level when the discharge is stopped. The treated water air lift pump is in operation. It is placed in the decanter and drains the water from the bioreactor into the inlet to the SF. It is designed so that after filling the SF water from the decanter goes directly to the outlet and does not mix with the water in the SF. The SF is aerated and discharged into the inlet from the sludge tank to the reactor. The sludge tank is aerated.

V1b is open, V2 is open to the SF. Other valves are closed.

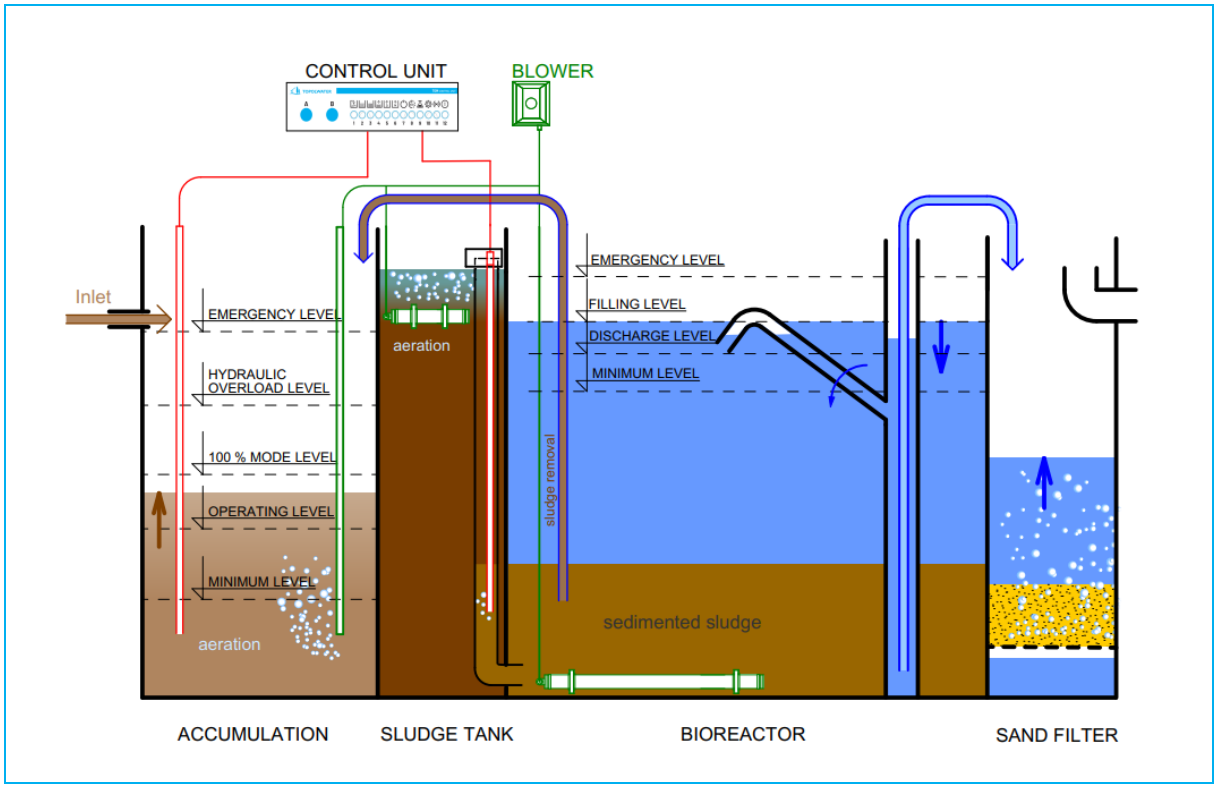


Figure no. 4: Discharge stage (decanting)

RECIRCULATION STAGE

If the level in the bioreactor is between the filling level and the discharge level, at the same time the set maximum filling stage time has elapsed, sedimentation occurs. Accumulation and sludge tank are aerated and sludge and the screens work. After the set sedimentation time has elapsed the desludging air-lift pump is activated. Nitrified water with excess sludge is pumped through the desludging air-lift pump from the bioreactor to accumulation. This reduces the water level in the bioreactor and fills the accumulation at the same time. The recirculation stage lasts until the level in the accumulation rises above the set operating level or the level in the bioreactor drops to the minimum level or the set maximum recirculation time has elapsed. After the recirculation is completed the next bioreactor filling stage is started. At the same time, the time from the beginning of the filling stage begins to be measured. At the end of the recirculation stage the organic substrate is added from the sludge tank to the reactor with insufficient wastewater inflow.

V1a is closed, V1b is open to the accumulation, V2 is open to the accumulation, V4 is open.

5. ADDITIONAL EQUIPMENTS OF THE WWTP

SAND FILTER (SF)

The sand filter is a separate tank with an intermediate tank that is located in the treatment plant. A layer of sand with a grain size of 1-3 mm is placed on the intermediate tank. The water seeps through the sand layer into the area to the bottom of the SF below the intermediate tank. The intermediate bed has openings of a size smaller than the sand grain size. By hydrostatic pressure, the filtered water, free of small suspended solids, is forced through the sand layer and the intermediate bed into the filtered water tank, from which it is pumped to the outlet. The hydrostatic pressure required for filtration is maintained by the difference in the water level above the sand in the SF and in the filtered water tank. The filtered water tank consists of a vertical plastic pipe in which an air-lift pump is inserted to pump the filtered water to the outlet.

Filtration takes place at the time of filling the reactor. The sand filter is washed and desludged at the time of filling, i.e., at the desludging stage (pumping the water out of the bioreactor). During the washing of the SF the pressurised air is led under the intermediate bed which penetrates through the filter holes into the sand layer, clarifies the sand and brings the turbidity to the surface. This turbid water is returned to the bottom of the reactor into the settled sludge layer.

It must be taken into account that the flow rate of the SF is limited by the time for which the SF is pumped out, i.e. the reactor filling time. Necessary time is required for proper filtering of the filter filling. During hydraulic peaks, when the flow of wastewater into the accumulation is increased, the raw water air-lift pump, which pumps wastewater from the accumulation to the bioreactor also has an increased output. This then fills faster than the SF can be pumped out. Consequently, the SF then cannot accommodate the entire volume pumped from the bioreactor. The water then overflows from the influent to the PF directly into the outlet of the treatment plant.

Subsequently, the entire volume pumped from the bioreactor does not fit in the SF. Water then flows from the inlet to the SF directly into the outflow from the treatment plant.

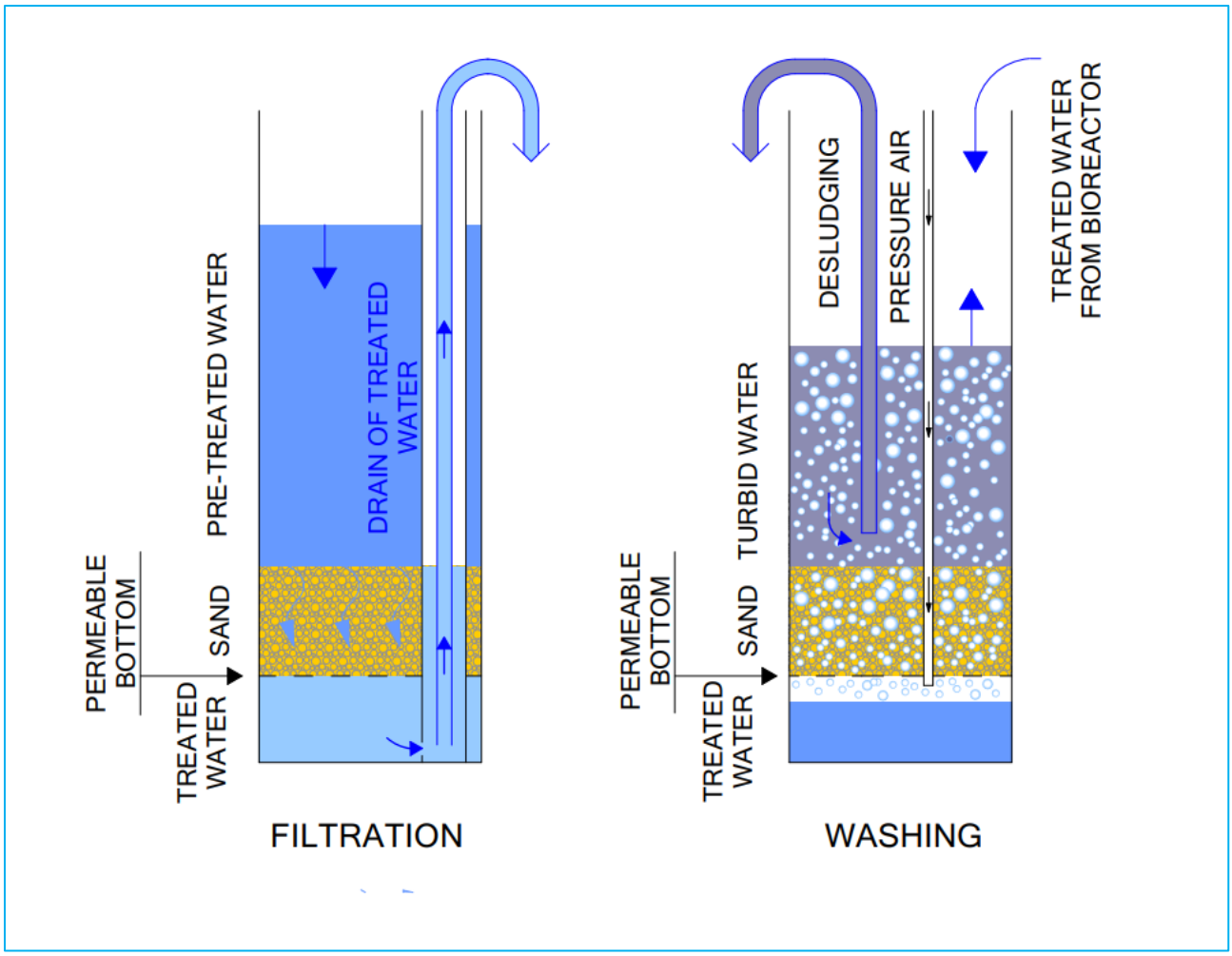


Figure no. 5: Technological diagram of the sand filter functioning

CHEMICAL ELIMINATION OF PHOSPHORUS

The WWTP is programmed to be ready for a controlled dosing of chemicals to eliminate phosphoric salts. The WWTP is retrofitted with a dosing pump and a coagulant tank. Depending on a sewage composition, a required phosphorous concentration at the outflow and a type of coagulant, a required concentration of coagulant per volume of treated wastewater is to be determined first, i.e. volume of chemical in 1 m^3 of wastewater. The control unit monitors the volume of water that was flown into the activation and accumulation tank during its filling from the minimum to the maximum water level. After the activation tank is filled to the maximum water level, the chemical is dosed in such a quantity to achieve, after mixing, the required concentration of coagulant.

Sedimentation thus does not occur immediately, but the filling continues together with the aerating of the activation tank for a pre-set time (usually 5 minutes) which is necessary for mixing the chemical.

A precise chemical dosing is thus provided even at various hydraulic load of the WWTP. This is followed by the next process of the flow stage – by sedimentation.

If the volume of the chemical storage tank and the delivery of the dosing pump are set in the control unit, the display shows the number of days that remain until the storage tank becomes empty.

The dosages set for different types of coagulants with respect to the required phosphorus concentration on the outlet (according to the water permit) are given in the following table:

Required phosphorus concentration in the outlet	Dosage (ml/m³) A residual PO4 concentration after biological treatment of 5-8 mg / l is assumed.			
	Ferric sulphate	**Aluminum sulphate**	**Ferric chloride**	**Polyaluminium chloride**
	41% $Fe_2(SO_4)_3$	$Al_2(SO_4)_3$	$FeCl_3$	Al_2O_3
0,5 mg/l	115	186	103	79
1 mg/l	107	174	96	74
2 mg/l	92	149	82	64
3 mg/l	76	124	69	53
4 mg/l	61	99	55	42
5 mg/l	46	74	41	32

Table 2: Coagulant dosage

DISINFECTION BY UV LAMP

The UV lamp is connected to the filtered water air lift pump from the sand filter. The UV lamp switches on when the filling stage begins. It switches off at the end of the filling stage or after 10 hours if there is no waste water supply.

6. REGULATION OF THE WWTP OPERATION (DEPENDING ON THE VOLUME OF WASTEWATER)

AUTOMATIC MODE

The control unit compares the actual amount of treated wastewater that has been pumped out of the bioreactor with the design amount. The actual quantity of wastewater against which the design capacity of the treatment plant is compared is determined as the arithmetic average of the last few days (control interval).

If the actual quantity is greater than 90% of the design capacity, the treatment plant operates at 100% capacity, i.e. the blower runs continuously for 24 hours. If the actual quantity of effluent is less than 90% of the design capacity, the treatment plant's performance starts to regulate continuously.

The regulation of the treatment plant performance consists in the fact that during the filling of the bioreactor, which is associated with its aeration, the blower is switched off and on automatically at set intervals, according to the amount of incoming wastewater. The total length of the filling stage is thus extended by the time when the blower is switched off, because only the time when aeration is taking place is included in the set maximum length of the filling stage. During the recirculation stage and the other stages, the blower is not switched off. The control switches to 100% mode when the level in the accumulation rises to the specified 100% mode level. Control is terminated when the treatment plant output is reduced to 10% of capacity. The blower then operates for only 12 minutes during the 120-minute interval and is shut down for the remaining 108 minutes. In this situation, if the maximum length of the filling stage with aeration is set to, for example, 8 hours (480 min), the total length of the filling stage is approximately 3 days. Only then does the switchover to the recirculation stage occur. This is the maintenance mode, where nutrients from the sludge are added to the treatment plant regularly (approx. 1 x every 3 days). At the same time, if the treated water is not pumped out even once within the set time (24 h) the treatment plant will go into the 10% maintenance mode.

If the treatment plant is in maintenance mode, it will go into 100% mode when the maximum level in the bioreactor is reached or when the level in the accumulation increases to the 100% mode level, whichever comes first.

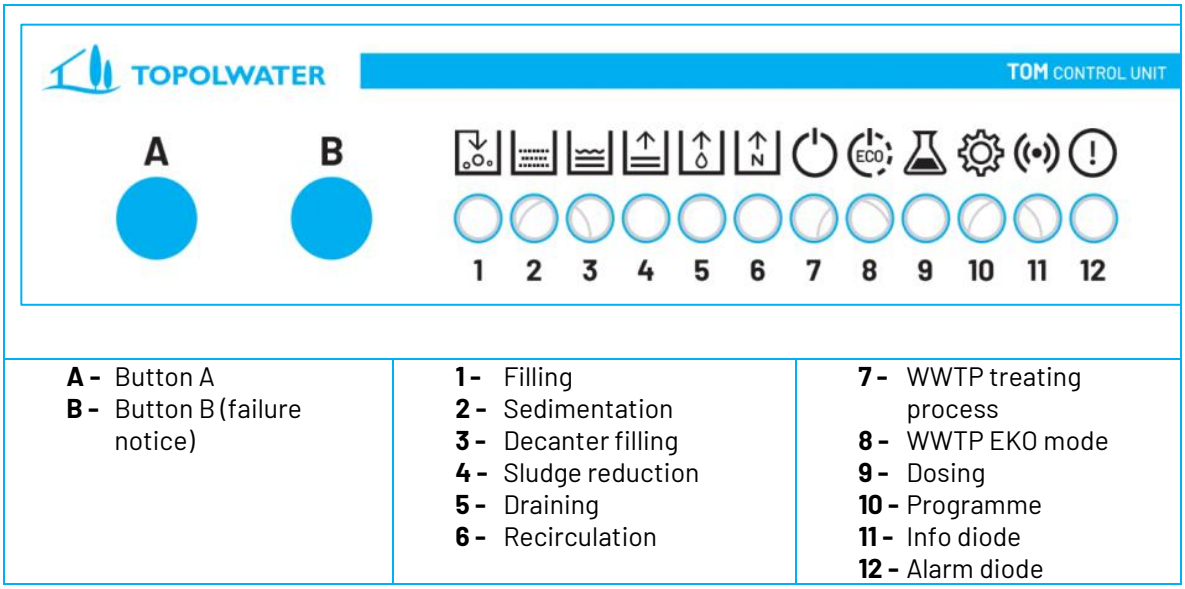
CAPACITY CONTROL DEPENDING ON WASTEWATER CONTAMINATION

Depending on the pollution of the wastewater, the pollution coefficient is set on the display. For standard (design) pollution, it is set to 50%-200%. Both heavily organically polluted water (water import from cesspits, water saving, food industry, etc.) and diluted water (water wastage, groundwater, etc.) can flow to the treatment plant. In these cases, regulating the performance of the treatment plant only according to the quantity of wastewater is not optimal. Therefore, the basic regulation of the blower running time according to the measured wastewater quantity is multiplied by the pollution coefficient. If the water is heavily polluted, a coefficient greater than 100% is set. If the wastewater is diluted, the pollution coefficient is set to less than 100%.

PUTTING THE WWTP INTO OPERATION AND ELECTRICITY FAILURE

When the power supply is interrupted and the treatment plant is started, the water level in the activation is first measured. If the water level is below the maximum level, the filling stage starts and the beginning of the stage is measured. Filling is terminated when the set filling level is reached or after 10 minutes if the filling level would have been reached earlier. If the emergency level is reached in the bioreactor, the sedimentation phase starts immediately.

7. CONTROL UNIT



A - Button A **B -** Button B (failure notice)	**1 -** Filling **2 -** Sedimentation **3 -** Decanter filling **4 -** Sludge reduction **5 -** Draining **6 -** Recirculation	**7 -** WWTP treating process **8 -** WWTP EKO mode **9 -** Dosing **10 -** Programme **11 -** Info diode **12 -** Alarm diode

Figure No. 6: Control panel description

CONTROL PANEL OPERATING

BASIC DISPLAY

The diodes (LEDs) always lit according to actual process in compliance with the control panel at the starting process:

LED	Signalization	Process description
1	**On**	The **filling stage** is in progress
2	**On**	The **sedimentation stage** is in progress
3	**On**	**Decanter filling** stage
4	**On**	**Desludging** stage is in progress
5	**On**	**Discharge stage** – pumping of treated water
6	**On**	The **recirculation stage** is in progress
7	**On**	WWTP operates in a treating mode in the range of **90 - 100% output,** ie the blower operates 24 hours/day without shutting down
8	**Flashes**	WWTP operates in maintenance mode **below 10%** of output
8	**On**	WWTP operates in Eko mode, ranging from **10% to 90%** of output
9	**On**	Chemical dosing in progress
10	**On**	Signalling of additional equipment switched on, e.g. UV lamp, pump, etc.
11	**On**	Information signalling, e.g. network connection (WiFi)
12	**Flashes**	**Emergency or warning of non-standard action** during treating process (WWTP check recommended)
	On	**Malfunction** - immediate check of the WWTP is necessary, there is a risk of outflow of untreated water

Table 3: Meaning of individual LEDs signalling

SIGNALIZATION OF EMERGENCY (LED FLASHES) AND MALFUNCTION (LED LITS)

Emergency or malfunction in WWTP is indicated by LED 12 (see Table 3). If:

- LED 12 flashes - this is an **emergency**

- LED 12 is on - this is a **malfunction.**

If LED 12 is on or flashing, we can identify the type of fault state by **pressing the "B" button**. The type of emergency or malfunction can then be determined according to the following table.

„12" ON + PRESS „B"

Defect type	Error	LED	State	Cause	Method of removal
Emergency	**E002**	**-**	**-**	Electricity power on	-
	E 104	**1**	**Flashes**	Raw water air-lift pump defect	- Remove and clean the raw water air-lift pump with the primary dirt filter if necessary
	E 105	**8**	**Flashes**	The increased level in the accumulation tank lasts longer than the set interval - Danger of drainage untreated water from the WWTP	- Check the volume of wastewater and the raw water-air lift pump function
	E 106	**4**	**Flashes**	Recirculation stage lasts over a max. set interval– defect of excess sludge air-lift pump	- Check the excess sludge air-lift pump function – remove and clean
	E 107	**4**	**On**	Desludging stage lasts over a max. set interval – defect of excess sludge air-lift pump	- Check the excess sludge air-lift pump function – remove and clean
	E 108	**5**	**Flashes**	Emergency water level in bioreactor - increased wastewater inflow - long interval of post aeration	- Check the function of decanter - Reduce post aeration interval -
	E 110	**-**	**-**	Air pressure drop in the accumulation tank	- Check the air supply to the sensor for leaks (the sensor must be bubbled through)
	E 111	**-**	**-**	Air pressure drop in the bio-reactor	- Check the air supply to the sensor for leaks (the sensor must be bubbled through)
	E 130	**9**	**On**	Dosing container is empty	- Fill in dosing container
	E 131	**9**	**Flashes**	Filling in dosing container gives out	- Fill in dosing container
	E 150			Critical temperature of control unit	- Check air inlet into the technical box
	E 155			Low voltage of backup battery of control unit	- Check the battery

Malfunction	**E 001**			**Electricity power off**	-
	E 101	**1**	**On**	Emergency water level in accumulation tank - emergency of outflow of untreated waste water: - increased wastewater inflow - clogged raw sewage air-lift pump	- Check the volume of wastewater - Remove and clean the raw water air-lift pump with the primary dirt filter - Check and, if necessary, clean the regulation nozzle on the air supply to the raw water air-lift pump
	E 102	**2**	**On**	Air pressure drop: - blower failure - leakage in air pressure distribution systems	- Check or repair the blower (in case of overheating, the blower is switched off by a thermal fuse until it has cooled down.) - Check the air supply to the sensor for leaks (the sensor must be bubbled through)
	E 103	**5**	**On**	The drainage stage lasts over a max. set interval - the decanter failure	- Remove, check and clean the decanter
	E 109	**8**	**On**	In the long term (more than 7 days) the treatment plant is overloaded above its design capacity	- Reduce wastewater and its pollution
	E 003			License is not valid (more than 10 day is WWTP overloaded 200% over the designed capacity)	-
Information					
	E131			Dosing container is nearly empty	- Fill in dosing container
	E151			External fault of input on D1 (230V)	-
	E152			External fault of input on D2 (5V)	-
	E153			External fault of input on D3 (5V)	-
	E154			External fault of input on D4 (5V)	-

Table 4: Defects scheme

Pressing the "B" button for 2 seconds clears the specific error that is lit. If the error is not corrected, the fault will be signalled again. The display returns to the basic state after 30 seconds from the first press!

DISPLAY OF OUTPUT STATUS – OPERATION OF MACHINES

When the **"A" button is pressed**, energized (running) devices light up:

1 - Blower 1
2 - Blower 2
3 - Valve V 1
4 - Valve V 2 – treated water
5 - Valve V 3 – decanter filling
6 - Valve V 4 - desludging air-lift pump
7 - Dosing pump – if installed
8 - UV lamp – if installed
9 - Inactive
10 - Inactive

60 seconds after the last press or by pressing the **buttons "A" and "B" together**, the control panel returns to the basic display.

CHECKING THE WWTP FUNCIONALITY

Pressing **the "A" button** and then pressing the **"B" button repeatedly** will switch the stages and thus check the functionality of the device. In this mode, repeated pressing of the "B" button allows switching of the WWTP between the individual stages to check the function (see Table 3), ie 1x Filling, 2x Sedimentation, etc..... The selection is confirmed by 3 seconds without pressing "B". At the same time, the active option is signalled by a fast-flashing diode for a particular option. After 30 seconds, the plant returns to its original state.

Diode nr.	Ongoing stages	Process description
1	**The filling stage**	The bioreactor is aerated and filled intermittently with a raw water air-lift pump. The SF filtration air-lift pump drains treated water into the outlet.
2	**The sedimentation stage**	The bioreactor not works, the accumulation is aerated, the screens works.
3	**The decanter filling stage**	The bioreactor not works, the accumulation is aerated, the decanter filling air-lift pump and screens work.
4	**The desludging stage**	The bioreactor not works, the accumulation is aerated, the sludge removal air-lift pump works.
5	**The discharge stage**	The bioreactor not works, the accumulation not works, the treated water air-lift pump works. SF is aerated and desludged.
6 - 12	**Not used**	

Table 5: Testing of WWTP functionality by repeated pressing of button „B"

Attention! When switching on „3"– the discharge stage without previous sedimentation for at least 10 min, the sludge mixture is drained into the treated water outlet.

WIFI SETTING

WWTP CONNECTION

TOPAS WWTP enables well-arranged setup and control via Wi-Fi application. Any device with OS Android or Windows can be used for control and you will choose connection to WiFi network of WWTP, SSID: Topas – serial number, **password: tom123456**.

If you do not have installed the application it is possible to access the WWTP directly by entering the address into the browser. Please see link: **http://www.topol.tom**
This address opens the WWTP baseline. There is information about the WWTP operation on this page.

OPERATING INFORMATION

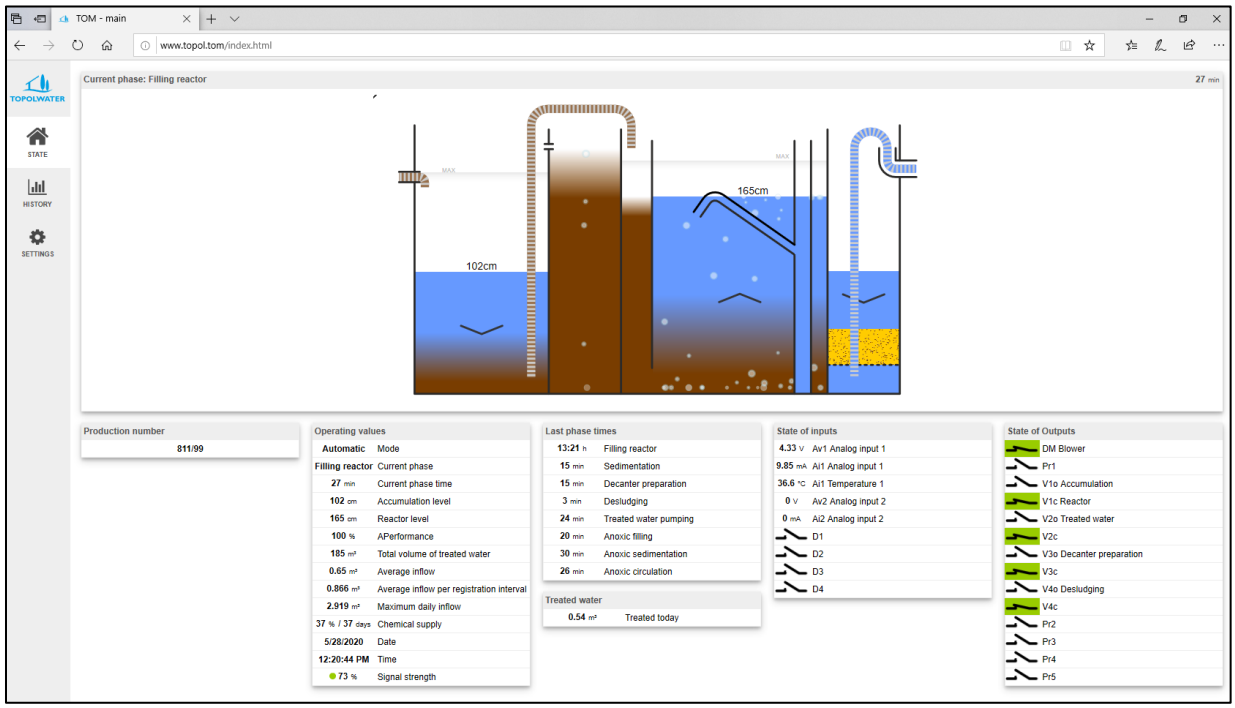


Figure No. 7: Operating information

WWTP SETTINGS

Pressing the WWTP settings are displayed and there is a possibility to change the basic WWTP user parameters.

BASIC SETTINGS

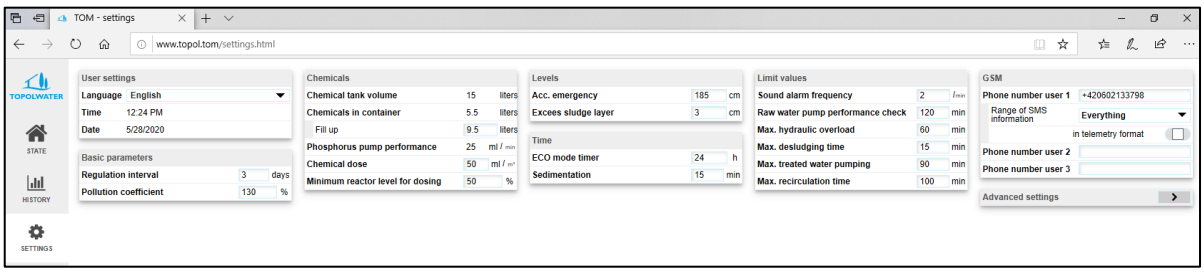


Figure No. 8: Basic WWTP setting

ADVANCED SETTING

You can also set some other parameters, which are used especially for service repairs of WWTP. Such advanced setting is displayed by clicking on the last link at the bottom right. A typical WWTP user does not normally use these settings. The following illustration shows an example of the advanced setting display.

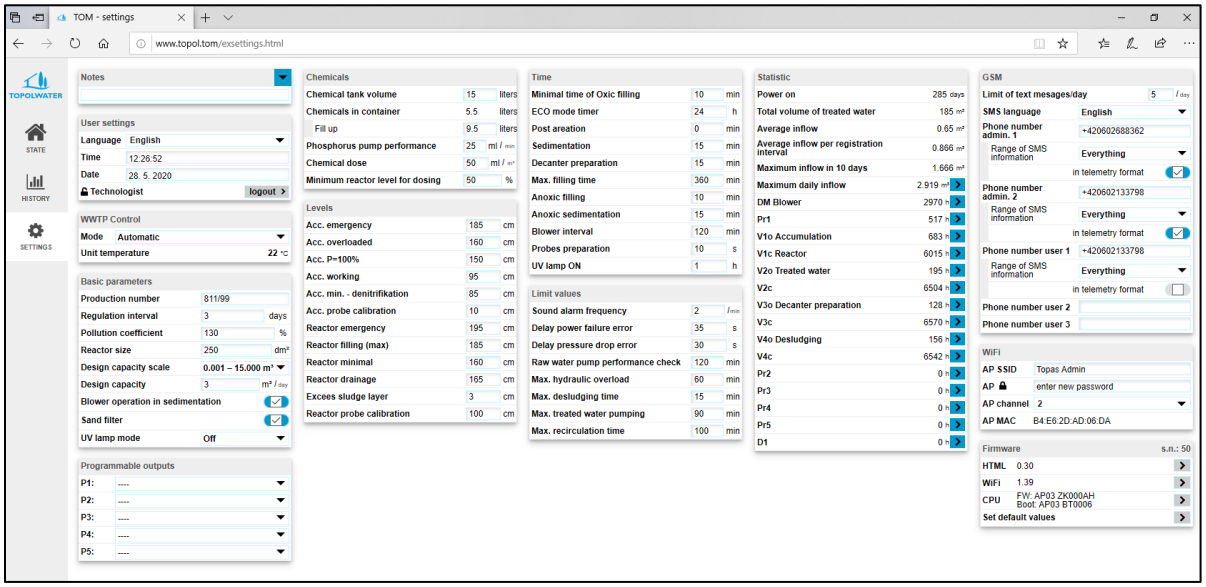


Figure No. 9: Advanced WWTP setting

BASIC AND ADVANCE SETTING

The user of the WWTP can set the parameters of the WWTP and the warning signaling according to the specifics for the installation site. The following table explains each of the adjustable items:

User settings		
Language	English	Set the required language version
Time	11:22:33	Set the current time
Date	28.05.2020	Set the current date

WWTP control		
Mode	automatic	When the automatic mode is set, the WWTP regulates the operation of the blower depending on the quantity of pumped water. When the manual blower mode is set, it works without switching off
Unit temperature	22°C	Temperature in the control unit

Basic parameters		
Production number	378/22	WWTP production number
Regulation interval	3 days	The basic regulation interval indicates for how many last days of operation of the WWTP the average daily inflow is calculated
Pollution coefficient	150%	It is set according to the actual wastewater pollution at the WWTP, which may differ from the standard values

Activation surface	1173dm^2	The reactor area is entered by producer according to the design of the WWTP
Designed capacity range	15-150m^3	Range of application of the given type of control unit
Designed capacity	30 m^3/day	Specifies the size type of the WWTP
UV lamp mode	Run with blower	On, off, run with blower

Chemicals		
Chemicals tank volume	160 liters	
Chemicals in container **Fill in**	20,0 liters 140,0 liters	Enter the number of liters of chemical added to the container
Phosphorus pump performance	25 ml/min	
Chemical dose	50 ml/m^3	Required chemical dosing in ml/m^3
Minimum reactor level for dosing	80 %	The parameter indicates at what stage the reactor is filled with chemical

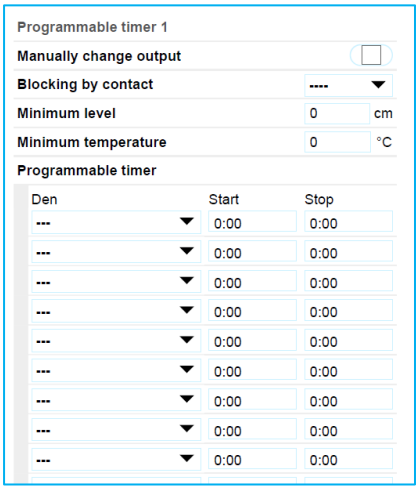
Levels		
Acc. emergency	175 cm	Fault signalling. The level in the accumulation has reached the level of safety overflow
Acc. overloaded	170 cm	The level in the accumulation is close to the emergency level
Acc. P=100%	155 cm	When this level is reached, the WWTP starts 100% regime, within 24 hours of the given day
Acc. working	130 cm	It ends the recirculation stage as well as the denitrification stage
Acc. min. denitrification	120 cm	Initiation of the denitrification stage. Change the discharge level
Acc. probe calibration	10 cm	Height of the sensor above the bottom of the WWTP
Reactor emergency	215 cm	Valve fault signalling V1
Reactor filling (max)	210 cm	Completion of the filling stage
Reactor drainage	185 cm	The discharge stage is complete if the accumulation level is lower than minimal level
Reactor minimal	180 cm	The discharge stage is complete if the accumulation level is higher than minimal level. The recirculation stage is complete
Exceed sludge layer	3 cm	Specifies the layer of sludge and water that is pumped from the reactor to the sludge tank during each cycle
Reactor probe calibration	100 cm	The end of the probe is above the bottom of the reactor

Time

Minimal time of Oxic filling	5 min	Min. aeration time after power failure
ECO mode timer	50 h	Setting the time to switch to ECO mode from the end of the last drain stage
Post aeration	5 min	Aeration time after filling the reactor to the filling level
Sedimentation	25 min	Setting the length of the sludge sedimentation stage in the bioreactor before sludge removal
Decanter preparation	5 min	Set decanter filling time
Max. filling time	360 min	In regulated mode, it is the sum of the times when the blower is switched on
Anoxic filling	5 min	Min. aeration time after turning on the blower in maintenance mode
Anoxic sedimentation	30 min	Sedimentation before the recirculation stage
Blower interval	120 min	In regulated mode, the blower is switched on and off at the set interval. Always at the beginning of the interval, the blower is switched on for the calculated time and is then switched off until the end of the interval
Probes preparation	30 s	The pressure is always checked after the interval has elapsed
UV lamp ON	10 h	Max. UV lamp on time without switching off

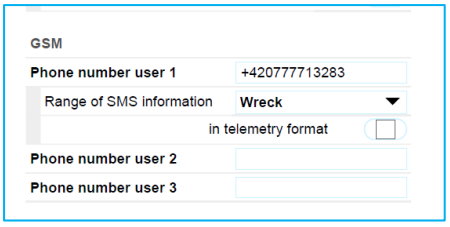
Limit values		
Sound alarm frequency	1 / min	Number of audible fault signals per minute
Delay power failure error	30 s	Time limit for sending SMS after a power failure
Delay pressure drop error	30 s	After the set time from switching on the blower, the pressure starts to be measured, or a blower fault is signalled
Raw water pump performance check	220 min	Max. set time when the air-lift pump of the raw water is to increase the level in the reactor by 3 cm - signalling the malfunction of the raw water air-lift pump
Max. hydraulic overload	60 min	The set maximum time for which the level of overload in the accumulation can last without reporting a failure of the air-lift pump of raw water.
Max. desludging time	30 min	Supervision of the function of the desludging air-lift pump. During the given time, it must drain the set layer of water from the reactor, otherwise a fault signal
Max. treated water pumping	90 min	Supervision of the decanter function. Purified water must be pumped out of the reactor at the set time - fault signalling.
Max. recirculation time	90 min	Supervision of the function of the desludging air-lift pump. If the recirculation stage does not end within the given time - reporting the failure of the desludging air-lift pump

Programmable timer (programmable, interval)



It is used to set the timer of connected external devices, e.g. for watering, draining, etc.

GSM



The telephone number (1-3) for the WWTP user checks is entered. From the entered numbers, the WWTP can be controlled and made user setting.

Entering the lowest level of non-standard activity of the WWTP for sending an information SMS.

Messages are sent in the TLM form.

Statistic

Power on	10 min	Number of days since the start of the WWTP
Total volume of treated water	24 h	Amount of treated water since WWTP installation
Average inflow	0 m^3	The average daily inflow from the start of the WWTP to the present day
Average inflow per registration interval	5 m^3	Average daily inflow in the set registration interval
Maximum inflow in 10 days	15 m^3	Max. daily inflow for the last 10 days
Maximum daily inflow	350 m^3	Max. daily inflow from the start of the WWTP
DM Blower	0 min	Operating hours of machines since the start of the WWTP
Pr1	30 min	
V1o Accumulation	120 min	
V1c Reactor	10 s	
V2o Treated water	1 h	
V2c		
V3o Decanter preparation		

V3c		
V4o Desludging		
V4c		
Pr2		
Pr3		
Pr4 Dosing pump		
Pr5 UV lamp		

Figure No. 10: Description of basic WWTP settings

8. SANITARY REQUIREMENTS

VENTILATION

Air from outside is drawn inside the WWTP and it is expected that venting will go through the sewerage inflow pipe to the area above the roof of the building. If the sewerage system is not vented (in old buildings or when a vacuum valve is used on the last floor of the house), the WWTP is vented to the outflow piping or to the surroundings, which is not an appropriate solution. During a regular operation the WWTP does not smell bad, because anaerobic processes are not in progress there.

NOISE

Noise levels of blowers are listed in the operating manual of each blower. The blower is under the insulated lid of the WWTP, therefore the running of the WWTP with membrane blowers is almost noiseless.

9. PUTTING THE WWTP INTO OPERATION

PRINCIPLES FOR THE WWTP CORRECT INSTALLING, COMMISSIONING AND RUNNING-IN

After connection to the inflow and outflow pipes, the treatment plant is filled with water. Accumulation at 1.2 m. Bioreactor at 1.8 m. The decanter fixation is then released and the connection to the power supply is made. The clean water tank of the decanter is filled with clean water until it overflows into the drain. Fill the decanter with water - preferably by immersing the decanter arm. The end of the arm is then raised above the surface and lowered freely.

Once the power is connected and the sewage is connected, the treatment plant will operate normally. Unless the bioreactor is inoculated with activated sludge from another treatment plant, it takes approximately 1 month for the treatment plant to start up. The first fine sludge, usually light brown in colour, appears after about 10 days of operation and after this time an improvement in the water quality of the outflow is already noticeable. In the following period the sludge in the reactor thickens and mostly darkens to a dark brown shade. Furthermore, the cleaning efficiency and the water quality of the effluent improves. In a well-functioning treatment plant, the water at the outlet is absolutely clear and odourless. Until a sufficiently thick sludge has formed in the activation tank (14-30 days), the bioreactor may foam considerably. This is due to the use of household detergents. The foam then gradually disappears as the sludge concentration in the activation tank increases.

Accelerating the incorporation of the WWTP is achieved by inoculating the activation mixture from another treatment plant. The sludge is poured into the reactor or accumulation. If it may contain coarse impurities, then into the accumulation. If the sludge is of good quality (live), incorporation takes only a few days.

Sometimes it may happen that the imported sludge cannot adapt to a different composition of the effluent than that on which it was produced, and then it dies and takes longer to process. This is not often the case, but it cannot be ruled out or predicted.

CHECKING THE SLUDGE VOLUME IN THE ACTIVATION TANK

If the sludge occupies less than 1/3 of the volume of the vessel, the processing in the WWTP has not ended yet. If the sludge quantity is larger, desludging does not run correctly or the sludge tank is already filled up. It means the WWTP is overloaded and requires desludging.

		
After taking the sample	**After 5 minutes**	**After sedimentation**
A sample of the activated mixture should be taken to a transparent vessel of 0.2 to 1 litre and let resting for about 30 minutes. After this time the activated sludge remains settled at the bottom with a layer of clear water above. The line between clear water and sludge must be distinctly visible. The volume of sludge should be of about 30% of the content of the vessel and clear water makes up about 70%.		

Figure no. 11: Checking the sludge quantity in the activation tank

10. WWTP OPERATION AND MAINTENANCE

Operation, cleaning and maintenance of the WWTP is made as simple as possible. At normal wastewater, the WWTP does not require any adjustment and works in the automatic mode depending on the actual volume of wastewater. All potential defects, except for excess sludge in the WWTP, are signalled by the control unit. If a defect occurs, instructions in the Chapter no. 20 is to be followed (Chart of potential defects, their causes and methods of their removal). Standard preventive maintenance of the WWTP can be recommended in the intervals specified in the table below.

Once a day	- Check of sound or light signalling of the proper operation of the WWTP
Once a week	- Visual check of quality of treated water and of the overall functioning of the WWTP – by uncovering the lid. Screens checking.
Once in 3 months	- Checking the sludge concentration, or desludging of the sludge tank - Clean the sreens
As needed or once in 2 years	- Cleaning the calibrated nozzles in the air-lift pumps and air supply to the pressure probe - Cleaning air-lift pumps - Cleaning the decanting system - Cleaning the surface of the accumulation tank from plastics and fat
Once in 2 years	- Preventive replacement of membranes in the membrane compressor
Once in 3 years	- Emptying the inflow and activation tank entirely and cleaning them from mineralized sludge
Once in 10 years	- Replacement of aeration elements (carried out by a service engineer)

Table no.6: Intervals of WWTP maintenance

In terms of maintenance and servicing it is generally applicable that all the technological components of the WWTP can be easily removed and cleaned outside the plant (except for the aeration system in larger types of the WWTP). When mounting them back, it is necessary to keep the original location, connection and position of all the removed and maintained components.

Any handling of the decanting system requires the decanter as well as the treated water container to be filled with clean water!

The WWTP operation is fully automatic and does not require any adjustment or setup. Occasionally the proper WWTP operation should be checked visually by uncovering the lid. Operators of the WWTP are obliged to keep records about maintenance actions. Table no. 9 is designed for keeping these records. Activities described as maintenance do not fall under the warranty duties of the manufacturer.

DESLUDGING THE WWTP

The treatment plant is equipped with a separate sludge tank. The sludge can be exported periodically or if the sludge concentration in the reactor exceeds 40 - 60% of the volume after sedimentation, which takes about 15 minutes. If the sludge tank is full, the sludge is returned to the bioreactor through the sludge tank and accumulation and the sludge concentration in the reactor rises. Defecation of the sludge is carried out by a fecal truck. When the treatment plant is dewatered, the sludge is completely drained and the sludge from the accumulation is also drained.

Since the sludge also has a primary sedimentation function, it is a mixture of primary sludge and excess activated sludge. It is therefore a hazardous waste that must be exported to a larger WWTP for professional disposal.

Please note that sludge is never pumped out of the bioreactor!

SF WASHING

During normal operation, the PF is cleaned automatically at the beginning of the SF filling. During SF cleaning, pressurized air is introduced under the intermediate bed, which penetrates the filter holes into the sand layer, clarifies the sand and brings the turbidity to the surface. Should a major sludge leak occur (e.g. if the treatment plant is not desludged) and clog the sand bed, the PF must be manually cleaned. Clogging of the PF can occur when the treatment plant is overrunning or if the biological function is poor. In these cases, it may also occur that there is no normal clogging of the PF surface, but sludge forms on the surface of the sand grains and clogs them. If the sand filter is so clogged that it is not permeable, the mammoth filter is first removed, then the treatment plant is switched to TOM to Stage 5 - discharge and the end of the pipe containing the mammoth filter is sealed. This increases the pressure under the SF intermediate effectively to the pressure of the blower and the bottom of the SF subsequently starts to aerate. If this does not help and the SF clogs further, then the sand should be vacuumed out or manually removed and washed with clean water. It will then return.

11. EVALUATING THE WWTP FUNCTIONING BY QUALITY OF OUTFLOWING WATER

When the WWTP is operated correctly, the out flowing water is clear, transparent and odourless. If these criteria for the out flowing water are not fulfilled, it may imply the following defects.

TURBID OUTFLOWING WATER

In such case water is incompletely treated (cleaned).It usually occurs during the running-in period before sufficient amount of activated sludge is created. It may take up to 1 month. Another reason may consist in the worsened chemical quality of wastewater, e.g. decreased pH, temperature drop, or chemical contamination by e.g. use of strong washing powders, or by wastewater from the dishwasher.

This trouble will gradually disappear if everything works technically in a standard manner. Permanently turbid out flowing water is a sign of material overload of the WWTP, or a lack of oxygen in the activation tank which may be caused by leakage in the air distribution or excessive reduction of the plant capacity due to incorrect setting of the contamination coefficient. Typically, a lack of air manifests itself by bad smell.

FOAM FORMING ON THE SURFACE OF THE ACTIVATION TANK

DETERGENT FOAM

Such foam is thin, in most cases white and is caused by detergents in cleaning agents. Biological degradation of these chemicals is relatively rapid. The pre-requisite is that there is enough biological sludge in the WWTP.

Occurrence of detergent foam is a consequence of either a small amount of sludge, or an immense amount of detergents used in the household. The small amount of sludge is usually reason for the foam forming soon after the WWTP has been put into operation or during a prolonged low material load of the WWTP and the 100% running mistakenly manually set, when the biological sludge is suffering a lack of nutrients and gradually becomes mineralized.

BIOLOGICAL FOAM

When biological foam appears in some WWTPs, it does not represent a technical trouble of the WWTP that is covered by the manufacturer's warranty. The foam is caused solely by the nature of wastewater. The foam is usually thick, light to dark brown (of whipped cream consistency) and forms in the process of aeration of the activation tank. The foam represents biologically active sludge which treats water efficiently; however, its negative property is that it is lighter than water. The principle of biological treatment using hovering activated sludge is based on the fact that sludge is heavier than water and settles at the bottom after aeration is interrupted. If "filamentous" bacteria multiply, they make clumps (foam) which are, on the contrary, lighter than water, rising to the surface. When flowing to the outflow pipe, it worsens the quality of treated water and causes serious operating problems.

In some WWTPs a biological foam actually does not occur, in some only in certain seasons of the year – usually when temperature changes (spring, autumn) and some have problems of rather perennial nature. Nevertheless, those WWTPs differ neither in design, nor in the method of operation. Instructions for removing biological foam is never unambiguous and hundred percent effective.

What usually makes filamentous bacteria prosper?

- Fats in general, especially burnt plant oils;
- Very old sludge in the activation tank;
- Aerobic environment with enough oxygen.

Therefore, efforts should be made to set such environment that does not suit filamentous bacteria:

- To reduce the amount of fat in wastewater;
- To desludge the WWTP frequently – significantly more often than recommended in this Operating manual.

Provided these measures are not efficient enough, chemical or biological agents can be used against the biological foam. The WWTP manufacturer will send you these agents and application instructions upon your request.

TOPAS S has no settling tank; therefore, treated water is drawn from the layer approx. 20 cm below the water level in the activation tank. Therefore, unlike in other systems (with a settling tank) biological foam mostly does not worsen effluent parameters, because when treated water is drawn out, biological

foam remains on the surface and sludge at the bottom of the activation tank. Water drawn to the outlet is from the layer which is not contaminated with foam or sludge.

CHEMICALS HARMFUL TO THE WWTP

With regard to the market variety and regular innovations, we do not have, de facto no one can have, an exact list of chemicals which are harmful to the WWTP. In general, we can however state that the less chemicals, the better for the WWTP. In a small amount almost everything what is available in the market can be used the WWTP can normally cope with it. Water quality can worsen temporarily at an increased inflow of chemicals (e.g. extensive laundry on weekends), which evens out within 1–2 days. However, beware of two types of chemicals:

First, **purely biocidal and disinfectant chemicals;** if they were used in a large quantity, there would be a risk they may get into the activation tank in such concentration which may destroy microorganisms there. In usual concentrations, such as those used for household floor washing or toilet disinfection, they become neutralised without any problem in the first tank of the WWTP, in the accumulation tank, where water is still not treated by means of bacteria. It protects processes in the other parts of the WWTP. They are chlorine-based chemicals, sodium hydrochloride etc., and also purely biocidal chemicals.

The second type includes **chemicals that change pH significantly**, either to alkalinity, or acidity. Again, these are detergents for cleaning waste pipes, etc. They are based on e.g. sodium hydroxide, or hydrochloric acid. The rule of "everything in moderation" applies here again. Detergents are usually alkaline and could change the pH. It is irrelevant whether they contain phosphorus or not. The colour of sludge in activation tank changes to light brown or even to yellow and the sludge loses structure (it is as a mud). It is recommended to stop the work of washing machines and dishwasher to measure pH in activation tank and adjust the pH on 7. For pH measuring and adjusting use the same resources as for treatment of water in swimming pools where is also necessary to keep pH on 7. It's also possible to raise the inflow to WWTP then water will be diluted and subsequently the pH will be reduced. If the sludge becomes black it means that pH is reduced lower then 7.

WHAT SHOULD NOT DEFINITELY GET INTO THE WWTP?

- Rainwater or other sinking waters
- Petroleum and oil substances;
- Medicaments and poisons;
- Plastics (including condoms);
- Sanitary towels;
- Wet wipes from nonwoven
- Newspapers and magazines.

WHAT CAN GET INTO THE WWTP ONLY IN A LIMITED QUANTITY?

- Dishwasher water during the running-in of the WWTP;
- pH-changing chemicals (acids and alkalis);
- Disinfectants;
- Fats and oils (only in the amount corresponding to a usual washing up).

SAMPLE TAKING AND EFFICIENCY EVALUATION

TAKING SAMPLES OF TREATED WATER

Samples of treated water are taken at the outflow of the treated water inside the plant into a clean, closable jar or another vessel. **There is definitely no need to make a special point (well) behind the WWTP for taking samples.** Samples are taken directly from the sampling box.

TAKING SAMPLES OF SEWAGE

It is not usual to take samples of sewage. If required for an evaluation of wastewater quality at malfunctioning of the WWTP, the process of taking the sample is as follows:

1.	Switch off the WWTP at the moment when the water level in the accumulation tank has dropped to the minimum.
2.	The WWTP remains off until the accumulation tank fills up with inflowing sewage up to the emergency water level, i.e. approx. 5 cm below the emergency overflow.
3.	Then switch on the WWTP and set the valve no. 1 manually to mix the content of the accumulation tank (for about 2 minutes).
4.	After approx. 10 minutes after changing the valve no. 1 to the activation tank, when the accumulation tank is no longer being mixed, take a sample of the mixture from the accumulation tank.

The TOPAS S WWTP has a sufficient reserve capacity both in the activation system and in volumes, so that it can work efficiently at various loads. Essential is the quality of out flowing water.

12. MEASURES FOR WINTER OPERATION

The WWTP is designed for a sectional sewerage system, i.e. only for sewage waters temperature of which usually suits the WWTP operation in winter months. Generally, nitrification efficiency becomes significantly lower at temperatures below 11°C. In terms of elimination of organic contamination (BOD_5) the plant works reliably if the temperature of water in the plant ranges from 5°C to 8°C. When temperature drops below 5°C, it impacts the operation and it takes a certain time before microorganisms adapt to the decreased water temperature. The WWTP is equipped with a thermally insulated lid and the whole plant is installed underground. If ambient temperature does not drop below -25°C and at least 20% of sewage flow in, the WWTP does not require any special winter measures. When long-term heavy frost, it is advisable to set the 100% manual operation, i.e. the blower does not switch off so as to ensure a stable recirculation of water in the plant.

13. WWTP RUN AND OPERATION IN CASE OF EMERGENCY

ELECTRICITY FAILURE

At electricity failure wastewater accumulates in the equalising tank temporarily and the WWTP user must reduce wastewater production to avoid an overfilling of the equalising (accumulation) tank and an outflow of untreated water via emergency overflow. The volume of the equalising tank is usually 30% of average daily volume of wastewater. After the power supply is restored, the WWTP starts always working in the automatic mode. The WWTP must be changed to the manual mode manually.

INFLOW OF WASTEWATER INTERRUPTED IN THE LONG TERM

At interrupted inflow of wastewater, the WWTP in the automatic mode reduces its capacity gradually to 10% of the design capacity, which is the "stand-by mode". Under the stand-by mode, nutrients from the sludge tank are added, in a controlled manner, to the system, so that the flow stage lasts for about 50 hours, always followed by the backward stage, when organic substrate from the sludge tank is transferred to the accumulation tank. Through this process the WWTP remains biologically functioning for up to 3 months and is ready to restore its operation immediately. At an interrupted inflow of wastewater longer than 3 months or always when the WWTP is not supplied with electricity for a rather long time and sewage may decay and hydrogen sulphide may generate, it is necessary to remove the control unit from the WWTP. Both the blower and electric valves should also be removed.

INFLOW OF TOXIC SUBSTANCES

TOPAS WWTPs are designed primarily for a sectional sewerage system and only for municipal wastewater; therefore, the risk of contamination by hazardous substances is minimal. At any inflow of a toxic substance to the WWTP it is necessary to switch off the WWTP, prevent an outflow of contaminated water and call a dedicated company to liquidate the content of the WWTP safely. At the same time, the place of toxic substance leak to the WWTP must be secured and further contamination of wastewater prevented.

FIRE OR FLOOD

In case of fire, flood or at any similar cases of emergency, follow these steps:

- Switch off the circuit breaker of the WWTP first, i.e. disconnect the power supply from the network!
- If there is time available and if you are not in imminent danger of life, dismantle from the WWTP such components that can be damaged by water, fire or another element and put them to a safe place.

This applies particularly to blower, valve and control unit. (If in danger of your life, switch off the circuit breaker of the WWTP only.)

LONG-TERM TEMPERATURE DECREASE

If the WWTP is long exposed to frosts (with temperatures of -20°C or lower), switch it to the 100% manual operation, i.e. the blower does not switch off in order to ensure continuous water recirculation in the plant. If, however, some tanks have partly got frozen, it is recommended to supply lots of hot water from the house to the WWTP via the waste pipe or to pour hot water directly into the frozen tank. Try to melt ice or at least to break it into pieces in order to prevent expansion of the tank by ice pressure. Once the water circulation in the plant is resumed, set the 100% manual operation via the control unit.

14. SAFETY, FIRE AND SANITARY INSTRUCTIONS

At each and every work related to the maintenance and operation of the WWTP please follow general occupational health and safety instructions to protect not only your own health but also health of people being near the WWTP.

In particular, observe these rules:

- At each and every work related to the maintenance and operation of the WWTP please follow general occupational health and safety instructions to protect not only your own health but also health of people being in the vicinity of the WWTP.

- In particular, observe these rules:
- Always use adequate work clothes to prevent a direct contact with wastewater.
- Always use protective equipment at work, especially rubber gloves, or goggles.
- At exposure of your skin to wastewater from the WWTP disinfect the contaminated spot.
- In case of ingestion of water from the WWTP seek medical attention.
- In case of occurrence of an infectious disease follow instructions and orders by sanitary authorities.
- Do not eat, drink or smoke when working on the WWTP and after work, always wash your hands with water and soap.
- Prevent children from access, especially when the WWTP is open.
- Never leave the WWTP with its lid open!
- After opening the lid of the WWTP always make sure that the lid is secured by a safety catch against unwanted closing.
- Enter the inside of the WWTP only when absolutely necessary and in presence of another person (all the technological components of the WWTP are removable; therefore, their standard maintenance can be done only after their removal).
- Prevent slippage and subsequent fall to the inside of the WWTP!
- Any action on the WWTP wiring can be carried out only by an authorized person with necessary electro technical qualification!
- Wash and store safely all the tools used for maintenance of the WWTP and sludge sample taking.
- Do not store samples taken in the fridge that you use for food storage.

15. PRODUCT LIFETIME AND DISPOSAL

The WWTP is made of plastic (polypropylene) with almost unlimited lifetime. Lifetime of the aeration component is 5–10 years. Lifetime of the membrane blower is approx. 10 years. Lifetime of membranes in the blower depends on the type and manufacturer of the blower. Membranes must be usually replaced within 18,000 operating hours. Lifetime of the electric valves is long, approx. 1 million of operations.

Required service and spare parts are supplied by respective dealers!

At disposing and recycling the WWTP or its components, use waste collection points or other recycling facilities for a disposal of hazardous and bulky waste.

16. TECHNICAL DATA

DESCRIPTION OF THE WWTP OPERATION DURING THE FLOW STAGE

Nitrification stage	The valve V1 regulates air into:	In operation:
A. ACTIVATION TANK FILLING	Activation tank	• Central blower (potentially with interruption) • Raw sewage air-lift pump • Aeration of the activation tank • Aeration of the sludge tank
B. SEDIMENTATION **approx. 10 minutes**	Inflow tank	• Central blower– continuously • Aeration of the inflow chamber
C. DESLUDGING **a decrease in the water level by 4 cm** **max. 10 minutes**	Inflow tank	• Aeration of the inflow chamber • Desludging air-lift pump
D. EMPTYING OF THE ACTIVATION TANK (DECANTING)	Inflow tank	• Treated water air-lift pump • SF air-lift pump

Table no. 7: Nitrification

DESCRIPTION OF THE WWTP OPERATION DURING THE BACKWARD STAGE

Denitrification stage	The valve V1 regulates air into:	In operation:
DENITRIFICATION	Inflow tank	
0 - 10 minutes		Central blower - continuously
after the 10th minute		Central blower – continuously Desludging air-lift pump

Table no. 8: Denitrification

17. OPERATING RECORDS ON WWTP MAINTENANCE

Date	Maintenance performed (mark with a cross)												
	Desludging of the sludge tank –by a pump, by a septic truck	Cleaning of the dust filter of the blower	Cleaning of the desludging air-lift pump	Cleaning or replacement of nozzles in air-lift pumps	Cleaning of the decanting system	Cleaning of the surface of the inflow tank and activation tank	Reconfiguration of the control unit	Replacement of membranes (lamellas) of the blower	Removal of mineral. sludge from inflow and activ. tanks	Blower replacement	Electric valve replacement	Replacement of sand*	Replacement of aeration elements
Interval	6 months	6 months	6 - 36 months	6 - 36 months	6 - 36 months	6 - 36 months	As needed	2 years	3 years	As needed	As needed	As needed	10 years

Table no. 9: Records on WWTP maintenance – mark the action performed with a cross

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