

OPERATION MANUAL

FOR INFORMATION



Suido Kiko Middle East



END USER	Ministry of Water and Electricity General Directorate of Water in Eastern Region				
CLIENT	Ministry of Water and Electricity General Directorate of Water in Eastern Region				
CONSULTANT					
PROJECT	Supply & Installation of Compact Sewage Treatment Unit in Nairyah Governorate				
PJT CODE					
PLANT	Mobile MBR STP 1000CMD				
JO No.	ME13001				
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This operation manual contains the information and instruction on the design, operation and maintenance of this plant.

Be sure to read this operation manual carefully before use in order to ensure that you will operate the plant safely and correctly. Operating the plant incorrectly in disregard of these instructions may lead to death, injury and/or cause property damage.

Be sure to keep this operation manual in a place where it will be easily available for reference.

1. FOR SAFETY OPERATION

 DANGER	
	Turn off the power supply before starting maintenance or inspection.
	Check whether the concentration of oxygen is enough before inspecting the inside of tank, or any other enclosed space.
	Use a safety belt and other lifelines and protective helmet, when working in high places.
	Do NOT touch any electrical wiring and electrically connected parts.
	Do NOT attempt to disassemble any parts such as piping, housing and manhole during operation.

2. GENERAL

This plant is to treat Municipal Sewage by using MBR (Membrane BioReacor) system. Influent sewage is transported by tanker trucks and dumped out at Dumping Area in this plant.

- Plant Location : Nairyah City – 250km north of Dammam City

2.1 Plant Capacity and Water Quality

- Plant Capacity : 1,000 CMD (m³/day) as daily maximum

- Design Water Quality (gwt)

ITEM		INFRUENT SEWAGE	TREATED WATER (REFERENCE)
Temperature	deg. C	20 – 40	
pH		6.0 – 9.0	6.0 – 8.5
BOD	mg/L	350	< 6
TSS	mg/L	350	< 3
NH4-N	Mg-N/L	40	< 5
COD	mg/L	750	< 40
Oil & Grease	mg/L	50	-

Note:

- 1) Assumed maximum total heavy metals is less than 3mg/L.
- 2) Assumed maximum aromatic compounds and halogenated solvents are less than 1mg/L

2.2 Process Flow

General process flow with mass balance is shown in "Process Flow Diagram" (DWG No.: ME13001-M01-001), and the detail of process flow and component in "Piping & Instrument Flow Diagram" (DWG No.: ME13001-M02-002).

APPENDIX – 1 "Process Flow Diagram" (DWG No.: ME13001-M01-001)

APPENDIX – 2 "Piping & Instrument Flow Diagram" (DWG No.: ME13001-M02-001)

2.3 Equipment Specification

Equipment specification is mentioned on "Equipment List". Equipment has its own unique tag number to be specified in short word, and it is also mentioned on "Equipment List".

APPENDIX – 3 "Equipment List"

3. PROCESS DESCRIPTION

Process flow and component of this plant are described herein.

3.1 Pretreatment

Raw sewage is dumped out at Dumping Area and passes through the pretreatment system (Coarse Screen (S101), Grease Removal Tank (T101), and Grit Removal Tank (T102)), and flows into Lifting Tank (T103). Air Diffusers (AD101) are installed in Grease Removal Tank to help oily matters to float.

Then, sewage is transferred to Equalization Tank (T201) by Lift Pump (P103). Two (2) Lift Pumps are installed in Lifting Tank. The quality and quantity of sewage are equalized in Equalization Tank. Air Diffusers (AD201) are installed in Equalization Tank just for mixing. It serves somewhat to reduce odor. Three (3) Equalization Pumps (P201, 2 duties & 1 standby) are installed and transfers sewage to the following treatment system. One (1) Flow Meter (FIT201) is installed at the line of sewage from Equalization Pump to the following treatment system, in order to monitor and adjust its flow rate.

3.2 Biological Treatment

Three (3) steel tanks (1 tank consists of Anoxic Tank (T301) & Aeration Tank (T302), the other 2 tanks consist of Aeration Tank (T303) & MBR Tank (T304)) are installed as a biological reactor of this plant.

Sewage from Equalization Tank goes into Anoxic Tank though Fine Drum Screen (S301) to protect MBR Membrane Module from damage or trouble.

Air Diffusers (AD301) which diffuse air in coarse bubble are installed in Anoxic Tank (T301) just for mixing. Air Diffusers (AD302 & 303) which diffuse air in fine bubble are installed in Aeration Tank (T302 & 303) for aeration, in order to keep a certain amount of DO in Aeration/MBR Tank.

One (1) Circulation Pump (P301) is installed in each MBR Tank (T304) in order to transfer sludge from MBR Tank to Anoxic tank for the purpose of return sludge and de-nitrification. It can prevent sludge from concentrating in MBR Tank and prevent pH from decreasing to

some extent. The circulation ratio is four (4); 4 times amount of influent sewage is returned from MBR Tank to Anoxic Tank.

In anoxic condition, nitrite nitrogen ($\text{NO}_2\text{-N}$) and nitrate nitrogen ($\text{NO}_3\text{-N}$) in re-circulated sludge is removed as nitrogen gas (N_2) by denitrifying bacteria. In aerobic condition, ammonia nitrogen ($\text{NH}_4\text{-N}$) is oxidized to nitrite nitrogen ($\text{NO}_2\text{-N}$) and nitrate nitrogen ($\text{NO}_3\text{-N}$) by nitrifying bacteria. Organic substances (indicated by such as BOD or COD) are oxidized and decomposed.

Three (3) MBR Membrane Modules (**MB301**) are installed in each MBR Tank. Sludge is filtered through membranes by Suction Pump (**P302**). Solid matters are separated from treated water and remain in MBR Tank. Clear treated water is transferred to Product Water Tank (**T401**) by Suction Pump. One (1) Flow Meter (**FI301**) is installed at the each line of treated water from Suction Pump, in order to monitor and adjust its flow rate. One (1) Pressure Transmitter (**PIT301**) is installed at the each line of treated water between MBR Membrane Module and Suction Pump, in order to monitor the filtration pressure.

Excess sludge is stored in Sludge Holding Tank (**T501**). It is necessary to discharge sludge periodically from the biological reactor to maintain the concentration of sludge (MLSS; Mixed Liquor Suspended Solid, mg/L) for stable operation. Circulation Pump is also used to transfer sludge from MBR Tank to Sludge Holding Tank. Open manual valve (**BL303**) installed in the sludge circulation line. Air Diffusers (**AD501**) are installed in Sludge Holding Tank just for mixing. It serves somewhat to reduce odor. Excess Sludge in Sludge Holding Tank needs to be discharged periodically to the outside of this plant. Sludge Discharge Pump and any other treatment system for sludge such as dewatering machine are out of scope.

Four (4) Blowers (2 Aeration Blowers (**B301**), 1 MBR Blower (**B302**) and 1 Common Standby Blower (**B303**)) are installed. Aeration blowers are to supply air for Aeration Tank, Anoxic Tank, Grease Removal Tank, Equalization Tank and Sludge Holding Tank. MBR Blower is for MBR scouring air. One (1) Flow Meter (**FI601**) is installed at the each line of air to MBR Membrane Module, in order to monitor and adjust its flow rate.

3.3 Product Water Facility

Product water is stored in Product Water Tank (T401).

Sodium hypochlorite (NaOCl) is dosed to the line-of treated water between Suction Pump and Product Water Tank for disinfection. One (1) Disinfection Pump (P601) and one (1) Chlorine Tank (T601) are supplied.

One (1) Utility Pump (P401) is installed for the cleaning of Fine Drum Screen. Two Product Water Pumps (P402, 1 duty & 1 standby) are installed to transfer treated water from Product Water Tank to Discharge Area.

3.4 CIP Facility (MBR Membrane Module Cleaning)

CIP facility consists of one (1) CIP Pump (P602) and one (1) CIP Tank (T602) and is used for periodical and on demand cleaning of MBR Membrane Module.

4. CONTROL SYSTEM

Control Philosophy is described on "Control Philosophy". Set value of instrument is shown on "Instrument Setting List".

APPENDIX - 4 "Control Philosophy"

APPENDIX - 5 "Instrument Setting List"

5. OPERATION PROCEDURE

CAUTION

Do NOT operate Suction Pump without MBR scouring air. It may result in fouling of membrane.

CAUTION

Do NOT leave MBR Membrane Module aerated more than 10 minutes without filtration (Suction Pump operation). It may result in damage on MBR Membrane Module.

CAUTION

Do NOT transfer any sewage including seed sludge into MBR system without the screening by the fine screen or equivalent. It may result in damage on MBR Membrane Module.

CAUTION

Do NOT dry out MBR Membrane Module. Dried membrane would become hydrophobic and decline in permeability.

5.1 Daily Operation

This plant is operated automatically in daily operation.

Normal selection of select switch in daily operation is as follows;

No	ITEM	SELECT SWITCH (Control Panel)	SELECTION
1	Lift Pump	P103A	Auto
		P103B	Auto
2	Equalization Pump	common	2 pump
		P201A	Auto
		P201B	Auto
		P201C	Auto
3	Fine Drum Screen	S301	On
4	Circulation Pump	P301A	Auto
		P301B	Auto
5	Suction Pump	P302A	Auto
		P302B	Auto
		P302C	Auto
		P302D	Auto
6	Utility Pump	P401	Auto
7	Product Water Pump	P402A	Auto
		P402B	Auto
8	Aeration Blower	B301A	On
		B301B	On
9	MBR Blower	B302	Auto
10	Common Standby Blower	Aeration / MBR	(not specified)
		On / Off / Auto	Off
11	Disinfection Pump	P601	Auto
12	CIP Pump	P602	Off

CAUTION

Do NOT use **On** switch in daily operation for the equipment which has **Auto** switch.

Automatic operation sequence does not work at the operation by **On** switch.

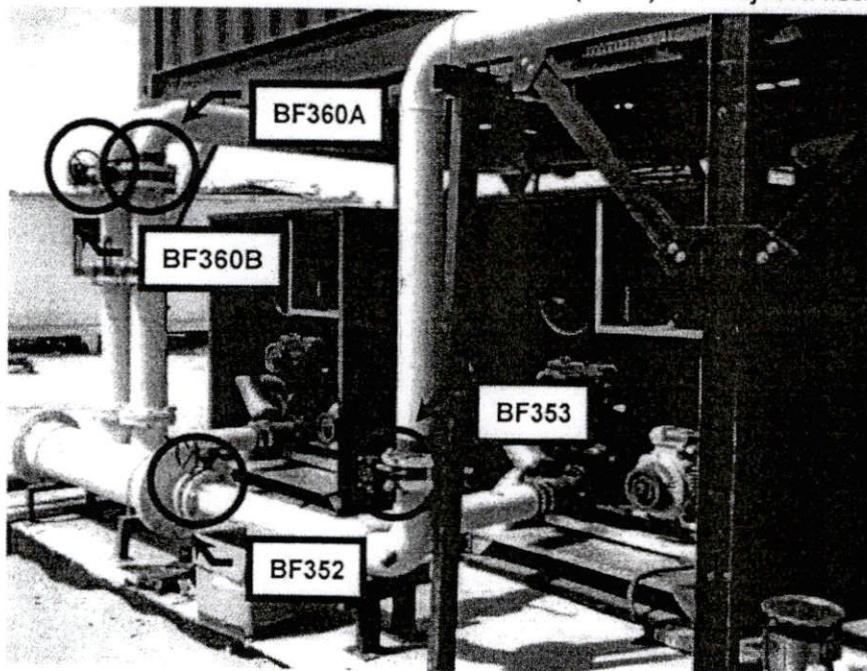
5.2 Temporary Shutdown of One (1) MBR Train (within a few hours)

CAUTION

Control the amount of influent (tanker truck) to avoid flooding. Plant capacity of one (1) MBR train is 500CMD only. Lift Pump (P103) does not run in case the water level of Equalization Tank (T201) is high.

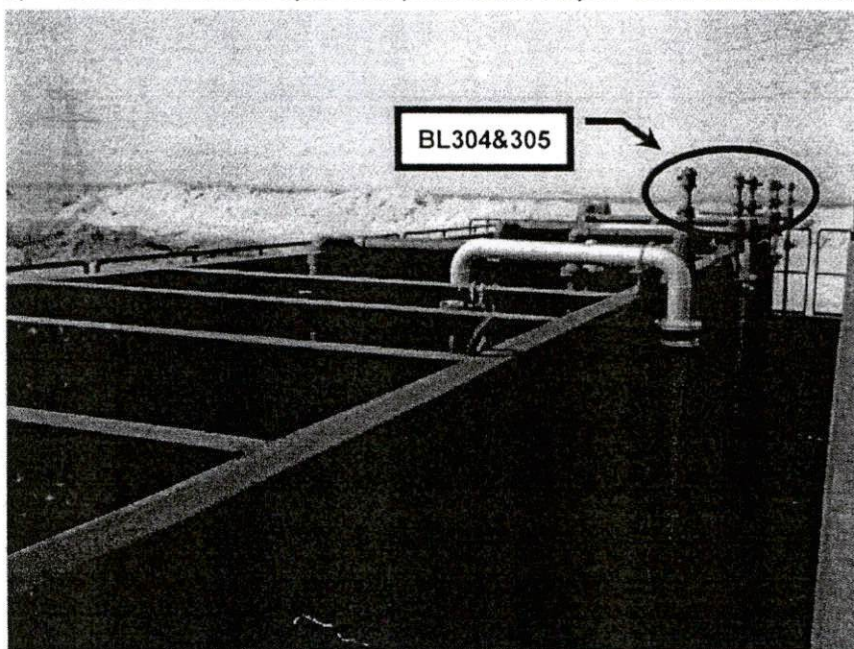
5.2.1 Shutdown

- 1) Set Equalization Pump (P201) ☐ 1 pump.
- 2) Check the flow rate of sewage (FIT201) and adjust if necessary.
- 3) Set Suction Pump (P302) of relevant train ☐ Off.
- 4) Set one of Aeration Blower (B301) (or Common Standby Blower (B303) in case used instead of Aeration Blower) ☐ Off. Keep the other ☐ On.
- 5) Open partly manual valves (BF352 and/or BF353, depends on the operation of Common Standby Blower (B303)) to make the line from MBR blower to Aeration Tank.
- 6) Close manual valve (BF360A or BF360B, one of these valve at the relevant train) to stop MBR scouring air for the relevant train.
- 7) Adjust the air flow rate (FI601) for the other MBR train.
- 8) Check the flow rate of MBR treated water (FI301) and adjust if necessary.



5.2.2 Restart

- 1) Check whether all lines to be used is ready, such as open/close or direction of manual valve, and whether there is anything wrong in each component and system.
- 2) Open manual valve (BF360A or BF360B).
- 3) Close manual valve (BF352 and/or BF353, depends on the operation of Common Standby Blower (B303)).
- 4) Adjust the air flow rate (FI601) for the other MBR train.
- 5) Set Suction Pump (P302) of relevant train ☐ On. Fill clear water from manual valve (BL304 & BL305) into the line between MBR Membrane Module and Suction Pump before Suction Pump starts, if filtration does not start.
- 6) Adjust the flow rate of MBR treated water (FI301).
- 7) Set Equalization Pump (P201) ☐ 2 pump.
- 8) Check the flow rate of sewage (FIT201) and adjust if necessary.
- 9) Check and record operation parameters as per "O&M Check Sheet".



5.3 Temporary Shutdown of both MBR train (within a few hours)



CAUTION

Control the amount of influent (tanker truck) to avoid flooding. Lift Pump (P103) does not run in case the water level of Equalization Tank (T201) is high.

5.3.1 Shutdown

- 1) Set Suction Pump (P302) ☐ Off.
- 2) Set MBR Blower (B302) (or Common Standby Blower (B303) in case used instead of MBR Blower) ☐ Off.

5.3.2 Restart

- 1) Check whether all lines to be used is ready, such as open/close or direction of manual valve, and whether there is anything wrong in each component and system.
- 2) Set MBR Blower (B302) (or Common Standby Blower (B303) in case used instead of MBR Blower) ☐ On.
- 3) Adjust the air flow rate (FI601) for the other MBR train.
- 4) Set Suction Pump (P302) of relevant train ☐ On. Fill clear water from manual valve (BL304 & BL305) into the line between MBR Membrane Module and Suction Pump before Suction Pump starts, if filtration does not start.
- 5) Adjust the flow rate of MBR treated water (FI301).
- 6) Check and record operation parameters as per "O&M Check Sheet".

5.4 Short-term Shutdown of Plant (within a few days)

5.4.1 Shutdown

- 1) Stop receiving sewage.
- 2) Transfer sewage from Lifting Tank (T103) to Equalization Tank (T201), and then set Lift Pump (P103) ☐ Off.
- 3) Transfer sewage from Equalization Tank (T201) to Anoxic Tank (T301), and then set Equalization Pump (P201) ☐ Off.
- 4) Confirm that Fine Drum Screen (S301) is stopped, and then set Utility Pump (P401) ☐ Off.
- 5) Wait for a while so that Suction Pump (P302) is automatically stopped, and then set Suction Pump (P302) and Disinfection Pump (P601) ☐ Off.
- 6) Discharge sludge in Sludge Holding Tank (T501), and set Aeration Blower (B301) (or

Common Standby Blower (B303) in case used instead of Aeration Blower) ☐Off.

Note:

- 1) Keep Utility Pump (P401) ☐Auto during Fine Drum Screen is running, in order to supply cleaning water.
- 2) Keep Circulation Pump (P301) and MBR Blower (B302) (or Common Standby Blower (B303) in case used instead of MBR Blower) ☐Auto for mixing during shutdown, unless it is really necessary to stop their operation. MBR Blower is intermittently run automatically at Auto mode.
- 3) Operate Aeration Blower periodically for mixing during shutdown.

5.4.2 Restart

- 1) Check whether all lines to be used is ready, such as open/close or direction of manual valve, and whether there is anything wrong in each component and system.
- 2) Check the condition of sludge, and aerate for one (1) hour if sludge has putrefactive odor.
- 3) Start to receive sewage and operate Lift Pump (P103), Utility Pump (P401), Fine Drum Screen (S301), and Aeration Blower (B301) at ☐Auto.
- 4) Set Equalization Pump (P201) Auto, and Check the flow rate of sewage (FIT201) and adjust if necessary.
- 5) Set MBR Blower (B302) (or Common Standby Blower (B303) in case used instead of MBR Blower) ☐On.
- 6) Adjust the air flow rate (FI601) for the other MBR train.
- 7) Set Suction Pump (P302) of relevant train ☐On. Fill clear water from manual valve (BL304 & BL305) into the line between MBR Membrane Module and Suction Pump before Suction Pump starts, if filtration does not start.
- 8) Adjust the flow rate of MBR treated water (FI301).
- 9) Check and record operation parameters as per "O&M Check Sheet".

5.5 Long-term Shutdown of Plant (10days or more)

Please make inquiry if necessary.

6. OPERATION AND MAINTENANCE

This section gives general guidance on daily operation & maintenance work. Be sure to also read manufacture's operation manuals carefully for the handling of individual equipment, and follow instructions not only in this operation manual but also in manufacture's.

CAUTION

Do NOT operate Suction Pump without MBR scouring air. It may result in fouling of membrane.

CAUTION

Do NOT leave MBR Membrane Module aerated more than 10 minutes without filtration (Suction Pump operation). It may result in damage on MBR Membrane Module.

CAUTION

Do NOT transfer any sewage including seed sludge into MBR system without the screening by the fine screen or equivalent. It may result in damage on MBR Membrane Module.

CAUTION

Do NOT dry out MBR Membrane Module. Dried membrane would become hydrophobic and decline in permeability.

6.1 Work Summary

Be sure to conduct daily operation & maintenance work. These works include, but are not limited to, the items shown in the following table.

Table 6.1 General Operation & Maintenance Work List

No	Item	Frequency (Reference)	Summary
1	Status Review	Daily	Check the position of select switch. Review alarm logs and any other issues in previous work shift.
2	Operation Parameter Check & Adjustment	Daily	Check operation parameters and adjust as necessary.
3	Excess Sludge Discharge	Daily	Discharge excess sludge.
4	Screen Cleaning	Daily	Remove the screen residues and clean up
5	Preventive Maintenance	Daily	Check whether conditions is usual such as current value, pressure, noise, vibration, heat, leak and oil level, etc.
6	Chemical Refill	Weekly	Refill chemicals as necessary.
7	Instrument Calibration	Monthly	Calibrate instrument as per manufacture's instruction.
8	Water Analysis by Third Party	Monthly	Take water samples and analyze its quality.
9	Lubrication	Monthly	Replace and/or refill lubricants as per manufacture's instruction.
10	MBR Cleaning	Every 6 month or as necessary	Conduct chemical cleaning every 6 month, or filtration pressure increases by 10kPa from the initial value, whichever comes earlier.

6.2 Work Description

6.2.1 Status Review

Understand the status of operation at the beginning of daily routine work, such as the position of select switch (On / Off / Auto), alarm logs and any findings, problems or remarks in previous work shift. The things in previous work shift should be handed over whether orally or in written according to End User's policy.

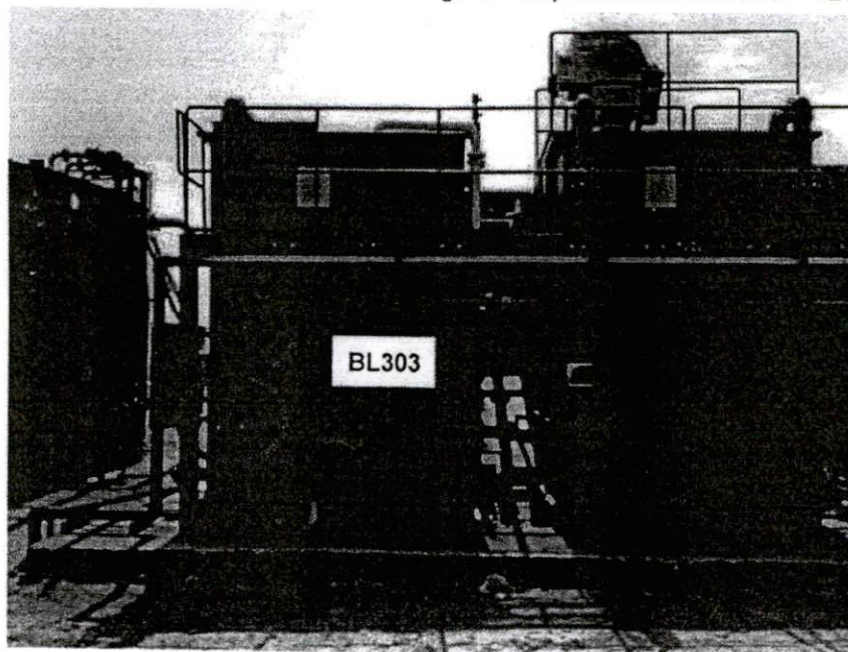
6.2.2 Operation Parameter Check & Adjustment

Check operation parameters and adjust as necessary in compliance with "O&M Check Sheet"

APPENDIX – 6 "O&M Check Sheet"

6.2.3 Excess Sludge Discharge

Open manual valve (BL303) to transfer sludge from MBR Tank to Sludge Holding Tank. The duration of discharge will be determined according to the measuring result of MLSS in MBR Tank. Manage the amount of discharge to keep the MLSS at 8000 – 12000mg/L.



6.2.4 Screen Cleaning

Remove the screen residues and clean up screening bar, mesh and perforated drum as necessary.

6.2.5 Preventive Maintenance

Check for the following items, in order to detect incipient failures either before they occur or before they develop into major defects. This section gives general guidance on maintenance work. Be sure to also read manufacture's operation manuals carefully for the handling of individual equipment, and follow instructions not only in this operation manual but also in manufacture's.

Current Value:

Measure the current value of each motor periodically and compare with its initial value. In case a rotating device has any damages, or runs out of the design condition, current value increases.

Pressure Value:

Monitor the discharge pressure of each pump and blower. It can provide a sign of any leakage of fluids, plugging of piping, or wearing of impeller, etc.

Sensory Check:

Check rotating devices whether there is anything unusual in vibration, noise, heat, and leak, etc. It can provide a sign of incipient failures as follows;

- Vibration: loosened blot, shaft alignment failure
- Noise: foreign matter contamination, lubrication failure, shaft alignment failure
- Heat: excess current, lubrication failure, shaft alignment failure
- Leak: loosened blot, mechanical seal failure

Oil & Grease Check:

Check for the level of oil, and refill if necessary. In case water, other liquid, or any other foreign matter was found, drain from oil drain plug and add new oil. In addition, oil should be replaced and grease should be refilled periodically as per manufacture's instruction.

Others:

Check piping whether there are a loosened bolt or a leakage at connection points such as flanges.

6.2.6 Chemical Refill**WARNING**

When working with chemical, be sure to follow safety regulations indicated in material safety data sheets of chemical. Wear suitable protection, such as protective glasses, protective gloves, and so on.

Check the level of each chemical solution and refill chemicals as necessary. Daily use chemicals are designed as follows;

Table 6.2 Daily Use Chemical List

No	Chemical	Procurement Plan	Design Usage	Specification for Use
1	Sodium Hypochlorite (NaClO)	12% Liquid 100L / week	10mL/min (2mg/L)	12% Liquid (no dilution)

6.2.7 Instrument Calibration

Make calibration for instrument in compliance with manufacture's instruction manuals.

**INSTRUCTION**

Be sure to wash sensors with pure water after each use.

6.2.8 Water Analysis by Third Party

Take a sample of water and make analysis by third party periodically for the following items;

1) Influent Sewage (at Equalization Tank)

- BOD
- S-BOD
- COD

- NH₄-N
- TKN
- T-N
- TSS
- pH (measure not only by third party but also on site)
- Temperature (measure not only by third party but also on site)

2) Sludge (at MBR Tank)

- MLSS
- pH (measure not only by third party but also on site)
- Temperature (measure not only by third party but also on site)

3) Treated Water (at the outlet of Suction Pump)

- BOD
- COD
- NH₄-N
- TKN
- T-N
- TSS
- pH (measure not only by third party but also on site)
- Temperature (measure not only by third party but also on site)

6.2.9 Lubrication

Refill and/or replace oil and/or grease in compliance with manufacture's instruction manual.

6.2.10 MBR Cleaning

WARNING

When working with chemical, be sure to follow safety regulations indicated in material safety data sheets of chemical. Wear suitable protection, such as protective glasses, protective gloves, and so on.

WARNING

Do NOT mix Sodium Hypochlorite (NaClO) and acid. It will produce toxic chlorine gas.

Conduct chemical cleaning every 6 month, or in case the filtration pressure increases by 10kPa (decreases by 10kPa at the indication of Pressure Transmitter (PIT301)) from the initial value, whichever comes earlier.

- 1) Prepare the chemical solution in CIP Tank (P602). Mix the solution well, so that particle matters does not remain in the tank.

Note:

- a) *Organic fouling can be cleaned with Sodium Hypochlorite (NaClO). On the other hand, inorganic fouling can be cleaned by acid such as Citric Acid, Oxalic Acid or Hydrochloric Acid.*
- b) *If calcium carbonate precipitates in the tank, do NOT use Oxalic Acid.*

Sodium Hypochlorite (NaClO):

Concentration for use: 0.5 – 0.6 % when MLSS is more than 10000mg/L
0.25 – 0.3 % when MLSS is 10000mg/L or less

Volume: 3600L (for 3 modules in one (1) train, 1200L/module)

Prepare 3420L of clean water in CIP Tank, and then pour 180L of 12% NaClO solution; diluted by 20 times in case MLSS is more than 10000mg/L (or prepare 3510L of clean water and 90L of 12% NaClO; diluted by 40 times in case MLSS is less than 10000mg/L).

Citric Acid:

Concentration for use: 0.5 – 1.0 %

Volume: 3600L (for 3 modules in one (1) train, 1200L/module)

Prepare 3600L of clean water in CIP Tank, and then pour 36kg of Citric Acid powder (nearly 100%).

Oxalic Acid:

Concentration for use: 0.5 – 1.0 %

Volume: 3600L (for 3 modules in one (1) train, 1200L/module)

Hydrochloric Acid:

Concentration for use: 2 %

Volume: 3600L (for 3 modules in one (1) train, 1200L/module)

- 2) Stop the operation of relevant MBR train (see another section for detail).
-

Note: do not aerate during the MBR cleaning.

- 3) Close manual valve (BF314 & BF315, at the suction line **between** MBR Membrane Module and Suction Pump).
- 4) Open manual valves for air vent (BL304 & BL305, total 12 **valves** in one (1) train).
- 5) Open manual valves (BL613, BL614 & BL311). Open fully **the** return valve (BL614), open slightly the feed valve (BL613) at the beginning.
- 6) Check whether all lines to be used is ready, such as open/**close** or direction of manual valve, and whether there is anything wrong in each **component** and system.
- 7) Feed the chemical solution; set CIP Pump (P602) **On**. Pay **attentions** so that the chemical solution does not overflow from the air vent valves (BL304 & 305).
- 8) Open gradually and keep adjusting the feed valve (BL613) **while** CIP Pump is running. Pay attentions so that the chemical solution does not **overflow** from the air vent valves (BL304 & 305).
- 9) Stop the operation of CIP Pump, before CIP Tank empties.
- 10) Keep the air vent valves (BL304 & BL305) open, and **wait for 2** hours. Do NOT aerate during the cleaning.

 CAUTION

Do NOT close the air vent valves during cleaning, and NOT **approach** or look inside its piping carelessly. The gas would be generated by chemical **reaction** and it may cause a pressure increase.

- 11) Close manual valves for air vent.
- 12) Restart the system (see another section). Before restart, **check** whether all lines to be used is ready, such as open/close or direction of manual **valve**, and whether there is anything wrong in each component and system.
- 13) Neutralize the waste chemical solution as necessary.

 CAUTION

Do NOT lift MBR Membrane Module immediately after the **cleaning**. It may cause chemical trickle and/or damage in MBR Membrane Module. Operate the **MBR** system for at least 30 minutes.

7. Trouble Shooting

7.1 Equipment

When any abnormality or damage is found in the equipment, stop the operation of that equipment and use the standby one. Please proceed with its trouble shooting in compliance with manufacture's operation manual.

7.2 Biological Treatment

7.2.1 Abnormal MLSS at MBR Tank

Recommended: 8000 – 12000 mg/L

In case of High: Transfer sludge from MBR Tank to Sludge Holding Tank (open manual valve (BL303)) for a longer time.

In case of Low: Transfer sludge from MBR Tank to Sludge Holding Tank (open manual valve (BL303)) for a shorter time.

7.2.2 Low DO at MBR Tank

Recommended: 1.0 mg/L or more

- 1) Check the operating condition of Aeration Blower.
- 2) Regulate manual valve at the line to Anoxic Tank, Grease Removal Tank, Equalization Tank and Sludge Holding Tank.
- 3) Decrease MLSS by transferring sludge from MBR Tank to Sludge Holding Tank, keeping MLSS at 5000mg/L or more.

7.2.3 Abnormal pH at MBR Tank

Recommended: 6.0 – 8.0

- 1) Check the operating condition of Circulation Pump.
- 2) Check the water quality of influent.
- 3) Dose acid or alkaline chemicals as necessary into Equalization Tank.



WARNING

When working with chemical, be sure to follow safety regulations indicated in material safety data sheets of chemical. Wear suitable protection, such as protective glasses, protective gloves, and so on.

7.2.4 Abnormal Treated Water Quality

If the BOD (COD) is high at treated water, measure the DO in MBR Tank. The DO value needs to be kept 1mg/L or more in MBR Tank. (see another section "DO low at MBR Tank"). Also, measure the MLSS in MBR Tank. If the MLSS is low, the F/M (Food to Biomass) ratio is high, and the BOD (COD) cannot be treated well (see another section "MBR abnormal at MBR Tank"). Also, check the water quality of influent sewage.

If the NH₄ (or TKN) is high at treated water, measure the DO in MBR Tank. The DO value needs to be kept at 1mg/L or more in MBR Tank. (see another section "DO low at MBR Tank"). Also, check the SRT (Solids Retention Time). In case excess sludge is discharged too much, the SRT becomes low and nitrification bacteria cannot grow up. Also, check the water quality of influent sewage.

If the TSS is high at treated water, check the line of treated water and MBR Membrane Module itself. Stop the operation of relevant MBR train (see another section for detail). Decrease the water level of MBR Tank and/or pull out MBR Membrane Module from MBR Tank to inspect and research the membrane surface in compliance with manufacture's instruction manual.

7.2.5 High Filtration Pressure

- 1) Check the flow rate of MBR treated water (FI301), and adjust as necessary.
Designed: 23.1m³/hr (386L/min)
- 2) Conduct "MBR Cleaning". (see another section for detail)
- 3) Stop the operation of relevant MBR train (see another section for detail). Decrease the water level of MBR Tank and/or pull out MBR Membrane Module from MBR Tank to inspect and research the membrane surface and to wash them with clear water in compliance with manufacture's instruction manual.

7.2.6 Low Filtration Flow

- 1) Check the operating condition of Suction Pump.
 - 2) Conduct "MBR Cleaning". (see another section for detail)
 - 3) Stop the operation of relevant MBR train (see another section for detail). Decrease the water level of MBR Tank and/or pull out MBR Membrane Module from MBR Tank to
-

inspect and research the membrane surface and to wash them with clear water in compliance with manufacture's instruction manual.

7.2.7 - Abnormal Foaming

- 1) Discharge sludge slightly more than usual and see how it works for a while, keeping MLSS at 5000mg/L or more.
- 2) Use alcohol based anti-foaming agent to control abnormal foaming with required minimum quantity. Excess use of anti-foaming agent would cause adverse effects on sludge properties.

WARNING

When working with chemical, be sure to follow safety regulations indicated in material safety data sheets of chemical. Wear suitable protection, such as protective glasses, protective gloves, and so on.

CAUTION

Do NOT use silicone based agent. It may cause a membrane fouling.

8. AFTER SERVICE

8.1 Warrantee Period

For a period of twelve (12) months from the completion date of commissioning, or a period of eighteen (18) months from the completion date of on-site installation inspection, whichever comes earlier

8.2 Request for inspection

In case anything unfavorable happens and/or any inspections are required, please confirm the following and contact us.

- What happen?
- When happen?
- Are there any warnings before something happens?
- Operation record in recent 6 month
- Something else concerned

8.3 Contact us

Please contact the following for service, inspection, spare parts supply and so on.

SUIDO KIKO MIDDLE EAST

Web site: www.suikime.com

- Head office (Jeddah, Saudi Arabia)

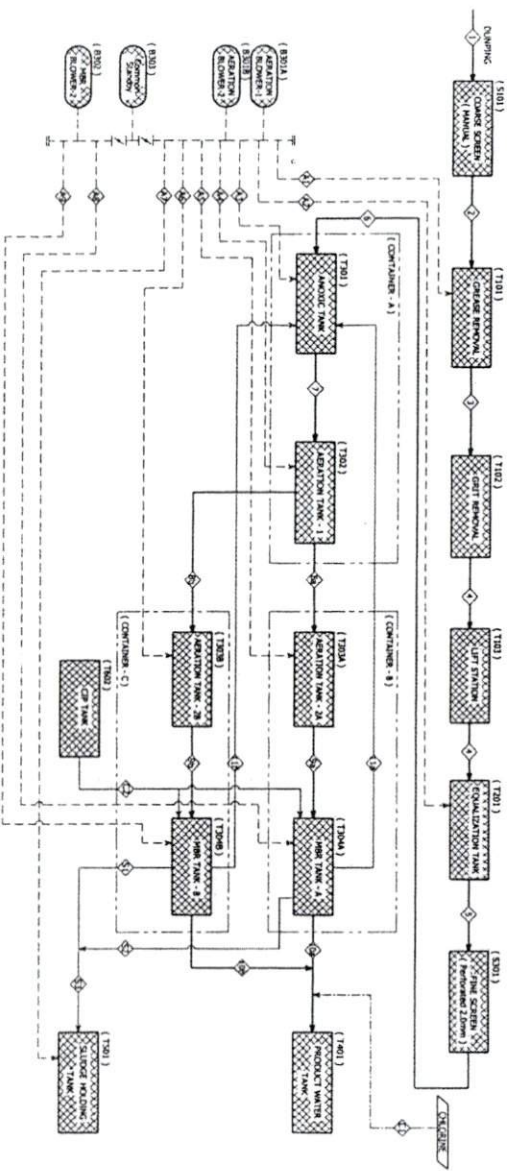
Postal address: P.O.Box 11286, Jeddah 21453, Saudi Arabia

Tel: +966 (2) 6608427 / +966 (2) 6607986

Fax: +966 (2) 2832593

APPENDIX – 1

Process Flow Diagram



(FLOW: WATER)

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Flow (m³/s)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.0

(FLOW: SLUDGE)

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Flow (m³/s)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.0

(FLOW: CHEMICAL)

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Flow (m³/s)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.0

(TANK)

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Flow (m³/s)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.0

(FLOW: AIR)

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Flow (m³/s)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10.0

NOTE: This drawing is for the purpose of showing the layout of the plant and is not to be used for construction purposes. The actual layout of the plant may vary from the layout shown in this drawing.

Scale: 1:1000

Project: Sewerage Treatment Plant

Client: [Name]

Design: [Name]

Drawn: [Name]

Checked: [Name]

Approved: [Name]

Date: [Date]

APPENDIX – 2

Piping & Instrumentation Diagram

APPENDIX – 3

Equipment List

Tag No	Name	Quantity			Specification	Connection		Manufacturer	Model	Remarks
		D	S	T		Dia	Type			
1. DUMPING AREA (Water Quality: Sewage)										
S101	Coarse Screen (Dumping Area)	1	0	1	Flow Rate: 83.3m3/hr, Spacing: 20mm, SS304	-	-	SKME	-	
AD101	Air Diffuser (T101)	5	0	5	Fine Disc Type, 3/4" NPT, EPDM/ABS	3/4"	Thread	EDI	FlexAir Disc	
P103	Lift Pump	1	1	2	Submersible Non-Clog Type, Cast Iron 1.39m3/min x 1.0bar x 5.5kW x 380V x 60Hz x 3ph	100A	Flange	EBARA	100DL65.5	
LIS103	Level Switch (T103)	1	0	1	Float Type, 5 point, PP	-	-	-	-	
2. EQUALIZATION TANK (Water Quality: Sewage)										
P201	Equalization Pump (T201)	2	1	3	Submersible Type, Cast Iron, 0.35m3/min x 1.1bar x 1.5kW x 380V x 60Hz x 3ph	65A	Flange	EBARA	65DL61.5	
AD201	Air Diffuser (T201)	26	0	26	Coarse Disc Type, 3/4" NPT, EPDM/ABS	3/4"	Thread	EDI	Perma Cap	
LIS201	Level Switch (T201)	1	0	1	Float Type, 5 point, PP	-	-	-	-	
FIT201	Flow Meter (P201)	1	0	1	Electromagnetic Type, 41.7m3/h, 4-20mA, SS304/PTFE	DN100	Flange	Badger	ModMAG	
3. AERATION / ANOXIC TANK (Water Quality: Sludge)										
S301	Fine Drum Screen	1	(1)	2	Flow Rate: 41.7m3/hr, Spacing: 2.0mm Perforated, 0.25kW x 380V x 60Hz x 3ph, SS304	DN150 DN200	Flange	TORO	TR40/75	
AD301	Air Diffuser (T301)	6	0	6	Coarse Disc Type, 3/4" NPT, EPDM/ABS	3/4"	Thread	EDI	Perma Cap	
AD302 AD303	Air Diffuser (T302, 303)	46	0	46	Fine Tube Type, EPDM/ABS	4" - 6"	Special Kit	EDI	Magnum 84P	
LIS301	Level Switch (T301)	1	0	1	Float Type, 2 point, PP	-	-	-	-	
4. MBR SYSTEM (Water Quality: Sludge / Permeate)										
MB301	MBR Membrane Module (T304)	6	0	6	Type: Flat Sheet, Membrane Area: 300m2, Pore Size: ave. 0.2µm	3"	Socket	KUBOTA	SP300	
P301	Circulation Pump (T304)	2	(1)	3	Submersible Type, Cast Iron, 1.39m3/min x 0.3bar x 3.7kW x 380V x 60Hz x 3ph	100A	Flange	EBARA	100DV63.7	
P302	Suction Pump (MB301)	2	2	4	Centrifugal Type, Cast Iron, 0.39m3/min x 0.7bar x 1.5kW x 380V x 60Hz x 3ph	80A 65A	Flange	EBARA	80x65 FS4GA81.5	
F1301	Flow Meter (P302)	2	0	2	Float Meter, 23.4m3/h, PVC 3m3/h ~ 30m3/h	DN65	Socket	GF	335	
LIS302A,B	Level Switch (T301)	2	0	2	Float Type, 4 point, PP	-	-	-	-	

PROJECT : NAIRYAH STP 1000CMD

EQUIPMENT LIST (2 / 2)

SUIDO KIKO MIDDLE EAST

Tag No.	Name	Quantity			Specification	Connection		Manufacturer	Model	Remarks
		D	S	T		Dia	Type			
I301A,B	Pressure Transmitter (P302)	2	0	2	Pressure Transmitter, -1.0bar ~ 1.0bar, 4-20mA, Stainless Steel	1/2"	Thread	STS	ATM	
PRODUCT WATER SYSTEM (Water Quality : Permeate)										
P401	Utility Pump (T401)	1	0	1	Centrifugal Type, Cast Iron, 0.05m3/min x 4.8bar x 1.3kW x 380V x 60Hz x 3ph	1"	Thread	EBARA	MATRIX 3-4T6/1.3	
402A,B	Product Water Pump (T401)	1	1	2	Centrifugal Type, Cast Iron, 0.70m3/min x 0.7bar x 2.2kW x 380V x 60Hz x 3ph	100A 80A	Flange	EBARA	100x80 FS4GA62.2	
JS401	Level Switch (T401)	1	0	1	Float Type, 5 point, PP	-	-	-	-	
SLUDGE HOLDING TANK (Water Quality : Sludge)										
AD501	Air Diffuser (T501)	13	0	13	Coarse Disc Type, 3/4" NPT, EPDM/ABS	3/4"	Thread	EDI	Perma Cap	
JS501	Level Switch (T501)	1	0	1	Float Type, 2 point, PP	-	-	-	-	
AIR SYSTEM (Air)										
B301A,B	Aeration Blower	2	0	2	Positive Displacement Blower, Cast Iron 17.9m3/min x 0.35bar x 22kW x 380V x 60Hz x 3ph	DN100	COUPLING	MAPRO	SEM11.7TR	
B302	MBR Blower	1	0	1	Positive Displacement Blower, Cast Iron 15.9m3/min x 0.35bar x 18.5kW x 380V x 60Hz x 3ph	DN100	COUPLING	MAPRO	SEM11.7TR	
B303	Common Standby Blower	0	1	1	Positive Displacement Blower, Cast Iron 17.9m3/min x 0.35bar x 22kW x 380V x 60Hz x 3ph	DN100	COUPLING	MAPRO	SEM11.7TR	
FI601	Flow Meter (MBR Air)	2	0	2	Orifice Type, 477m3/h x SS304 80degC ~ 120degC	DN150	Wafer	Tokyo Keiso	O-181-WC-150-2F	
CIP SYSTEM (Water Quality : CIP (Acid, Sodium Hypochlorite))										
T601	Chlorine Tank	1	0	1	PE 100 L (Fluoro Rubber)	-	Flange or Socket	ProMinent	Chem.Tank 100L	
T602	CIP Tank	1	0	1	PE 4000 L	-	Flange or Socket	AL ZAMIL	BV 300	
P601	Disinfection Pump (T601)	1	0	1	Diaphragm Type, 0.025kW x 220V x 60Hz x 1ph Max 0.9L/hr	4-9mm hose	hose	TACMINA	AP2D-31-CL 1.0W-30-ATF	Diaphragm=PTFE, Check ball=Ceramic Pump Head=PVC, O-ring=Fluoro
P602	CIP Pump (T602)	1	0	1	Centrifugal Type, SS304 0.23m3/min x 1.0bar x 1.5kW x 380V x 60Hz x 3ph	G2/G2		EBARA	DWO2006	
LS601	Level Switch (T601)	1	0	1	Electrode (Conductive) Type 2point+com (Titanium)	-	-	OMRON	PS-3S	

Rev 2 (19-02-2014)

APPENDIX – 4

Control Philosophy

Document No

ME13001-G54- 001

CONTROL PHILOSOPHY
(Naeriyah STP 1000CMD)



APPROVED	
DATE: 2/12/2013	BY: [Signature]
SUIDO KIKO KAISHA, LTD.	

ISSUED	
DATE: 2/12/2013	BY: [Signature]
SUIDO KIKO KAISHA, LTD.	

SUIDO KIKO MIDDLE EAST

END USER	MINISTRY OF WATER & ELECTRICITY Directorate of Wafer in the Eastern Province				
CLIENT	MINISTRY OF WATER & ELECTRICITY Directorate of Wafer in the Eastern Province				
CONSULTANT					
PROJECT	Supply, Install Mobile (Containerized) 1000 CMD System For Sewage Treatment at Naityah				
PJT CODE					
PLANT	STP 1000CMD				
PROJECT NO	ME13001				
Rev	Description	Date	Approved	Checked	Prepared
0	FIRST ISSUE	3-Jun-2013	K.K	A.Y	Y.K
2	REVISED	25-Nov-13	H.Y	R.N	T.H

CONTENTS

0	GENERAL	-----	P-3
1	DUMPIN AREA & LIFTING TANK	-----	P-4
2	EQUALIZATION TANK	सकलिलिजैसन टैंक	P-7
3	BIOLOGICAL SYSTEM & MBR	-----	P-11
4	PRODUCT WATER TANK	प्रोडक्ट टैंक	P-19
5	SLUDGE HOLDING TANK	सलज टैंक	P-23
6	CHEMICAL SYSTEM	-----	P-24

0. GENERAL

This sewage treatment plant receives sewage from Nairyah Governorate.

This sewage treatment plant is consist of following.

- Dumping Area
- Grit & Grease Removal
- Lift Station
- Equalization Tank
- Bio Logical Treatment Tank
- MBR System
- Chemical System
- Sludge Holding System

All equipment is controlled by the main PLC.

The operating condition of each equipment is described hereinafter

.. Dumping Area & Lifting Tank

1-1. Fault List

- | | | |
|--------------------------------------|---|------------------------------|
| a) LIFTING TANK (T103) HH Alarm | = | Water level HH ↑ ("LS103") |
| b) LIFTING TANK (T103) LL Alarm | = | Water level LL ↓ ("LS103") |
| c) LIFT PUMP LS-24 (P103A,B) Fault | = | Overcurrent or Earth leakage |

1-2. System Configuration

(1) Coarse Screen

a) Tag No : S101

b) Description

This coarse screen is manual screen of the inclined bars. Debris is removed to a trash bin by hand.
Bar spacing is 20mm.

c) Control : by Manual

d) Monitoring Parameters and interlocks

Tag	Parameter	Field	PLC
S101	Coarse Screen	x	x

(2) LEVEL SWITCH FOR T103

a) Tag No : LIS103

b) Description

Level Switch for T103 is installed at the top of the Lifting Tank.

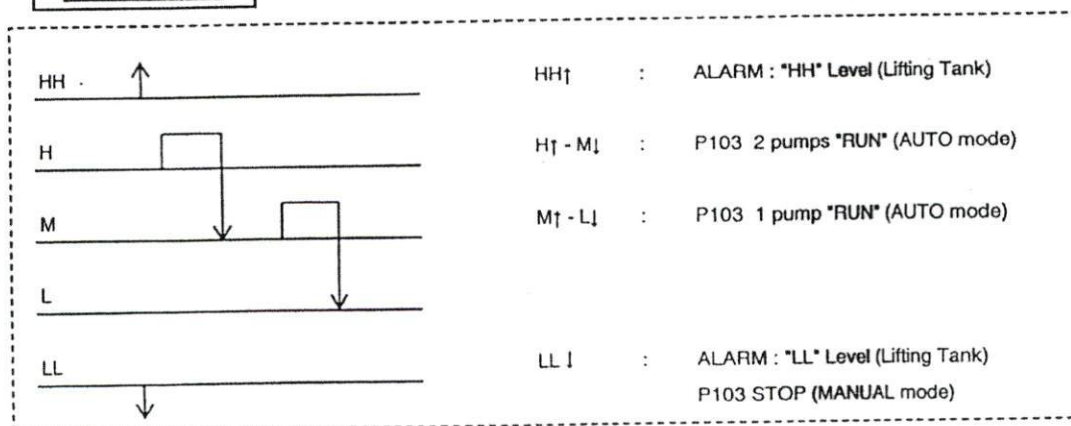
This level switch (LIS103) monitors the water level of the Lifting Tank and send the signal to main PLC

c) Control : by MAIN PLC

d) Monitoring parameters and interlocks

Tag	Parameter	Field	PLC
LIS103	Lifting Tank Water Level	x	O

Interlock - LIS103



(3) LIFT PUMP

a) Tag No : P103A,B

b) Description

Two (2) submersible pumps are installed. They are 1 duty and 1 standby.

Each pump has the capacity of 1.39m³/min (capacity of Plant Peak Flow).

Normally, only 1 pump works to deliver raw water to the Equalization Tank.

2 Pump Operation is done for emergency (when the water level of Lifting tank is over "H").

c) Control : by MAIN PLC

d) Monitoring Parameters

Tag	Parameter	Field	PLC
P103A	CONDITION (ON-OFF-FALUT)	x	O
P103B	CONDITION (ON-OFF-FALUT)	x	O

e) Select Switch for each equipment

1. "ON": Manual ON

2. "OFF": Manual OFF

3. "AUTO": Automatic Operation

f) Interlocks ("RUN" Condition / "STOP" Condition)

[Manual ON]

"RUN" Condition			"STOP" Condition		
1		Water level (LIS103) LL ↑	1		Water Level (LIS103) LL ↓
	AND	Water level (LIS201) HH ↓		OR	Water Level (LIS201) HH ↑

[Auto]

"RUN" Condition			"STOP" Condition		
1		Water level (LIS103)	1		Water Level (LIS103) L ↓
	AND	-H ↑ - M ↓ = 2 pump operation start		OR	
		-M ↑ - L ↓ = 1 pump operation start			
		Water level (LIS201) H ↓			Water Level (LIS201) H ↑

* 1 = Change over duty pump each cycle.

* 2 = If duty pump go for fault, change to the standby automatically.

1-3. Cause and Effect Chart

Cause and Effect Chart		Function Performed	LIFT PUMP (AUTO)	LIFT PUMP (MANUAL)				Alarm
Process Component		Tag, No	P103A	P103B	P103A	P103B		
Identification	Service							
LIFTING TANK (T103)	LL ↓	LIS-103		x	x			o
	L ↓		x					
	M ↓		x					
	H ↓							
	HH ↓							
EQUALIZATION TANK (T201)	LL ↓	LIS-201						o
	L ↓							
	M ↓							
	H ↓		o	o				
	HH ↓							
NOTE			*1 *2					T201 "H" Pre-alarm

* 1 = Change over duty pump each cycle.

* 2 = If duty pump go for fault, change to the standby automatically.

.. EQUALIZATION TANK

2-1. Fault List

- | | | |
|--|---|-------------------------------|
| a) Equalization Tank (T201) HH Alarm | = | Water level HH ↑ ("LIS201") |
| b) Equalization Tank (T201) LL Alarm | = | Water level LL ↓ ("LIS201") |
| c) Equalization Pump(P-201A,B,C) Fault | = | Overcurrent or Earth leakage |
| d) Fine Drum Screen (S301) Fault | = | Fault Signal from Local Panel |

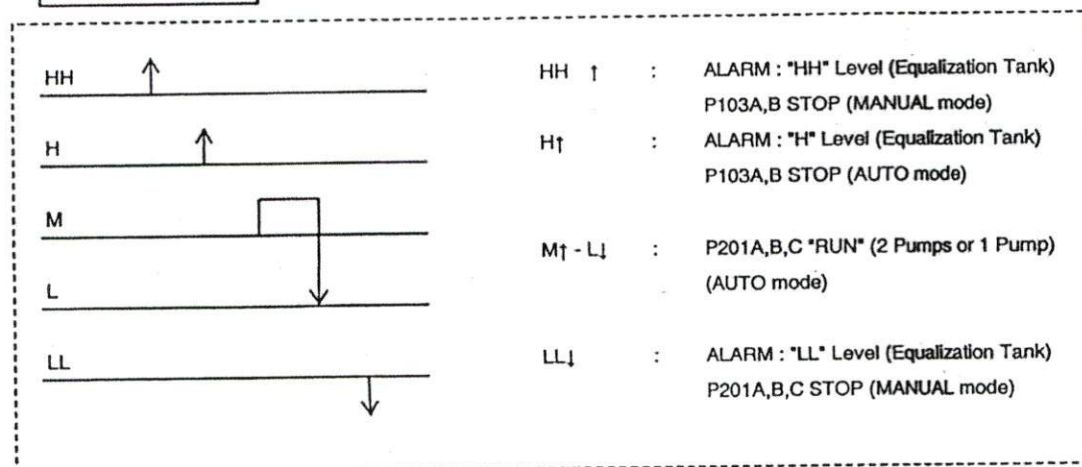
2-2. System Configuration

(1) LEVEL SWITCH FOR T201

- a) Tag No : LIS201
- b) Description
Level switch for T201 is installed at the top of the equalization tank.
This level switch (LIS201) monitors the water level in the equalization tank and sends the signal to main PLC
- c) Control : by MAIN PLC
- d) Monitoring parameters and interlocks

Tag	Parameter	Field	PLC
LIS201	EQUALIZATION TANK WATER LEVEL	x	O

Interlock - LIS201



(2) EQUALIZATION PUMP

- a) Tag No : P201A,B,C
- b) Description
Three (3) submersible pumps are installed. They are 2 duty and 1 standby.
Each pump has the capacity of 0.35m³/min (500m³/day).
Normally, 2 pumps work to deliver raw water to Fine Drum Screen.
In case of 1 MBR Train Operation, when the CIP or other maintenance, select "1 Pump" operation
- c) Control : by MAIN PLC

d) Monitoring Parameters

Tag	Parameter	Field	PLC
P201A	CONDITION (ON-OFF-FAULT)	x	O
P201B	CONDITION (ON-OFF-FAULT)	x	O
P201C	CONDITION (ON-OFF-FAULT)	x	O

e) Select Switch for each equipment

1. *ON*: Manual ON
2. *OFF*: Manual OFF
3. *AUTO*: Automatic Operation

f) Interlocks (*RUN* Condition / *STOP* Condition)

[Manual ON]

RUN Condition			*STOP* Condition		
1	AND	Water level (LIS201) LL ↓ Water level (LIS301) HH ↓ Water level (LIS302 A or B) H ↓	1	OR	Water Level (LIS201) LL ↓ Water Level (LIS301) HH ↑ Water level (LIS302 A or B) H ↑

[Auto]

RUN Condition			*STOP* Condition		
1	AND	Water level (LIS201) M ↑ - L ↓ Water level (LIS301) HH ↓ Water level (LIS302 A or B) M ↓ - H ↑ S301 Not *FAULT*	1	OR	Water Level (LIS201) L ↓ Water Level (LIS301) HH ↑ Water level (LIS302 A or B) H ↑ S301 *FAULT*

* 1 = Change over duty pump each cycle.

* 2 = If duty pump go for fault, change to the standby automatically.

[Select the Pump Operation Number]Select Switch or

Select Switch	P201	Description	Treatment Flow
2 Pump	2 duty 1standby	Normal Condition	1000CMD
1 Pump	1duty 2 standby	In case of Chemical Cleaning or Emergency Stop of 1 MBR train	500CMD

[Flow control]

The flow is set manually.

Adjust the manual valve and check the the flow meter (FIT201).

(3) Fine Drum Screen

a) Tag No : S301

b) Description

One (1) fine drum screen is installed. There is one store standby.

The treatment capacity is 41.7m³/hr (1,000m³/day).

The Dia of perforation is 2mm.

c) Control : by Local Panel

d) Monitoring Parameters

Tag	Parameter	Field	PLC
S301	CONDITION (ON-OFF-FAULT)	o	o

e) Select Switch for each equipment

1. "ON": Manual ON

2. "OFF": Manual OFF

f) Interlocks ("RUN" Condition / "STOP" Condition)

[Manual ON]

"RUN" Condition			"STOP" Condition		
1		Controlled by Local Panel	1		Controlled by Local Panel

Signals from Local Panel to Main PLC

1 Fine Drum Screen (S301) "ON"

2 Fine Drum Screen (S301) "FAULT"

2-3. Cause and Effect Chart

Cause and Effect Chart		Function Performed	Equalization Pump (AUTO)			Equalization Pump (MANUAL)			Alarm
Process Component		Tag, No	P201A			P201B			
Identification	Service		P201A	P201B	P201C	P201A	P201B	P201C	
EQUALIZATION TANK (T201)	LL ↓	LIS201				x	x	x	o
	L ↓		x	x	x				
	M ↓								
	H ↓								
	HH ↓								
Fine Drum Screen Condition	Not Fault	S301	o	o	o				
Anoxic Tank Water Level	LL ↓	LIS301							o
	HH ↓		o	o	o				
MBR Tank Water Level	LL ↓	LIS302							o
	L ↓								
	M ↓		o	o	o				
	H ↓								
NOTE			*1						
			*2						
			*3						

* 1 = Change over duty pump each cycle.

* 2 = If duty pump go for fault, change to the standby automatically.

* 3 = Pump operation number is due to the select switch (2pump or 1pump)

J. Biological System & MBR

3-1. Fault List

- | | | |
|--|---|-------------------------------------|
| a) Anoxic Tank (T301) HH Alarm | = | Water level HH ↑ ("LIS301") |
| b) Anoxic Tank (T301) LL Alarm | = | Water level LL ↓ ("LIS301") |
| c) MBR Tank (T304A,B) LL Alarm | = | Water level LL ↓ ("LIS302A,B") |
| d) Circulation Pump (P301A,B) Fault | = | Overcurrent or Earth leakage |
| e) Suction Pump (P302A,B,C,D) Fault | = | Overcurrent or Earth leakage |
| f) Suction Pressure (PIT301A,B) LL Alarm | = | Suction Pressure LL ↓ ("PIT301A,B") |

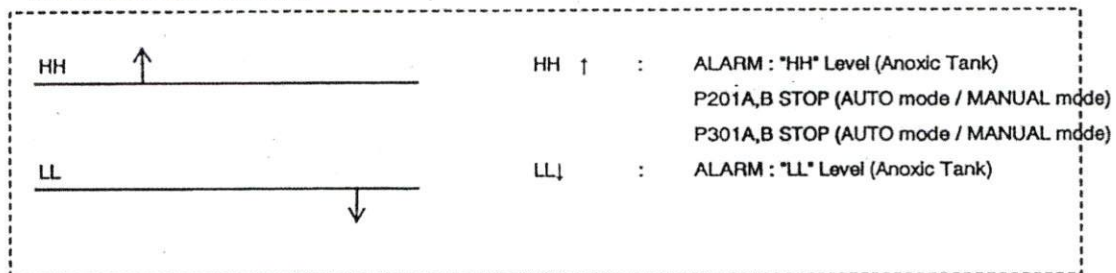
3-2. System Configuration

(1) LEVEL SWITCH FOR T301

- a) Tag No : LIS301
- b) Description
Level switch for T301 is installed at the top of the Anoxic tank.
This level switch (LIS301) monitors the water level in the Anoxic tank and sends the signal to main PLC
- c) Control : by MAIN PLC
- d) Monitoring Parameters and interlocks

Tag	Parameter	Field	PLC
LIS301	AERATION TANK WATER LEVEL	x	o

Interlock - LIS301



(2) LEVEL SWITCH FOR T304A,B

a) Tag No : LIS302A,B

b) Description

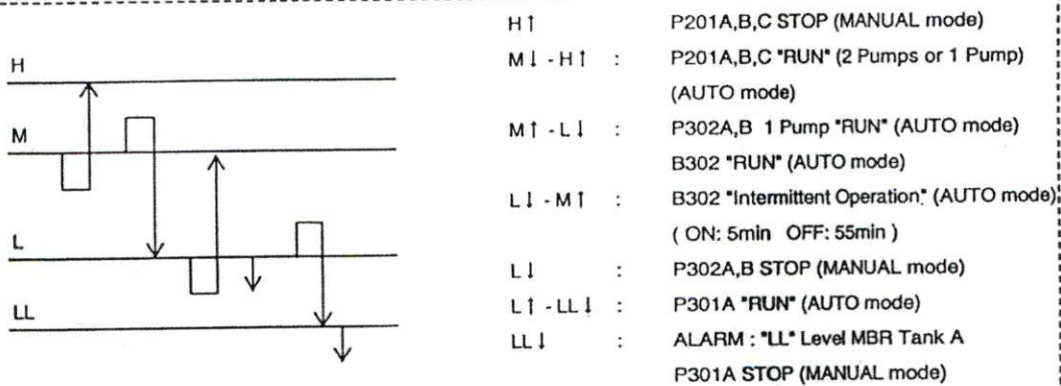
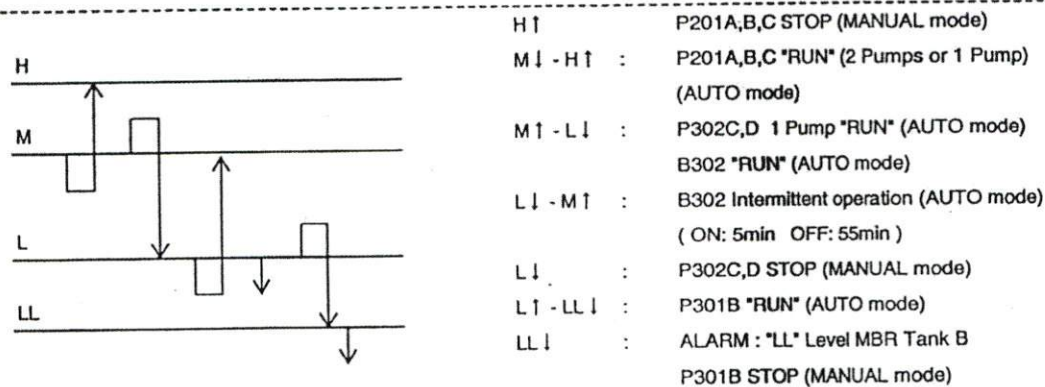
Level switches for T304A,B are installed at the top of the MBR Tank A,B

This level switches (LIS302A,B) monitor the water levels in the MBR tanks and send the signal to main PLC

c) Control : by MAIN PLC

d) Monitoring Parameters and interlocks

Tag	Parameter	Field	PLC
LIS302A,B	MBR Tank A,B	x	o

Interlock - LIS302AInterlock - LIS302B

NOTE	P201A,B,C STOP (MANUAL mode)	LIS302A H ↑ OR LIS302B H ↑
	P201A,B,C "RUN"	LIS302A M ↓ OR LIS302B M ↓
	P201A,B,C STOP	LIS302A H ↑ OR LIS302B H ↑
	B302 "RUN"	LIS302A M ↑ OR LIS302B M ↑
	B302 STOP	LIS302A L ↓ AND LIS302B L ↓
	B302 START	LIS302A L ↓ AND LIS302B L ↓
	B302 STOP	LIS302A M ↑ OR LIS302B M ↑

(3) Suction Pressure Transmitter (PIT301A,B)

a) Tag No : PIT301A,B

b) Description

Suction Pressure Transmitters (PIT301A,B) are installed on the suction pipe lines of suction pumps.

These pressure transmitters monitor the MBR suction pressure and send the signal to main PLC.

If the suction pressure goes down below the setting value, output the alarm

c) Control : by MAIN PLC

d) Monitoring Parameters and interlocks

Tag	Parameter	Field	PLC
PIT301A	MBR-A Suction Pressure	O	O
PIT301B	MBR-B Suction Pressure	O	O

PIT301A,B	Alarm	System Operation	Default
LL ↓	Suction Pressure *LL*	-	** bar

(4) Circulation Pump

a) Tag No : P301A,B

b) Description

One (1) submersible pump is installed in each MBR tank. Total 2 pumps are installed. There is one(1) store standby.

Each pump has the capacity of 1.39m³/min (2000m³/day).

This pump circulates the activated sludge from MBR tank to Anoxic tank to equalize the sludge concentration

c) Control : by MAIN PLC

d) Monitoring Parameters

Tag	Parameter	Field	PLC
P301A	CONDITION (ON-OFF-FALUT)	x	O
P301B	CONDITION (ON-OFF-FALUT)	x	O

e) Select Switch for each equipment

1. *ON*: Manual ON

2. *OFF*: Manual OFF

3. *AUTO*: Automatic Operation.

f) Interlocks (*RUN* Condition / *STOP* Condition)

[Manual ON]

RUN Condition			*STOP* Condition		
1	AND	Water level (LIS302) LL ↓ Water level (LIS301) HH ↓	1	OR	Water Level (LIS302) LL ↓ Water Level (LIS301) HH ↑

[Auto]

RUN Condition			*STOP* Condition		
1	AND	Water level (LIS302) L ↑ - LL ↓ Water level (LIS301) HH ↓	1	OR	Water Level (LIS302) LL ↓ Water Level (LIS301) HH ↑

(5) Suction Pump

a) Tag No : P302A,B,C,D

b) Description

Two (2) centrifugal pumps per MBR tank, totally 4 pumps, are installed. They are 1 duty and 1 standby for each tank.

Each pump has the capacity of 0.39m³/min (500m³/day)

These pumps transfer the permeate water to product water tank.

The permeate flow is set manually by adjusting the manual valve. The permeate flow is shown on FI301A,B.

c) Control : by MAIN PLC

d) Monitoring Parameters

Tag	Parameter	Field	PLC
P302A	CONDITION (ON-OFF-FAULT)	x	O
P302B	CONDITION (ON-OFF-FAULT)	x	O
P302C	CONDITION (ON-OFF-FAULT)	x	O
P302D	CONDITION (ON-OFF-FAULT)	x	O

e) Select Switch for each equipment

1. "ON": Manual ON

2. "OFF": Manual OFF

3. "AUTO": Automatic Operation

f) Interlocks ("RUN" Condition / "STOP" Condition)

[Manual ON]

"RUN" Condition			"STOP" Condition		
1		Water level (LIS302) L ↑	1		Water level (LIS302) L ↓
	AND	Water level (LIS401) HH ↓		OR	Water level (LIS401) HH ↑
		MBR Blower (B302 or B303-MBR) "ON"			MBR Blower (B302 or B303-MBR) "OFF"

[Auto]

"RUN" ³ Condition			"STOP" Condition		
1		Water level (LIS302) M ↑ - L ↓	1		Water Level (LIS302) L ↓
	AND	Water level (LIS401) H ↓		OR	Water level (LIS401) H ↑
		MBR Blower (B302 or B303-MBR) "ON"			MBR Blower (B302 or B303-MBR) "OFF"

* 1 = Change over duty pump each cycle. * 2 = If duty pump go for fault, change to the standby automatically.

* 3 = "RUN" at AUTO mode means intermittent operation. 9 min ON and 1 min OFF.

(6) Aeration Blower

a) Tag No : B301A,B

b) Description

Two(2) Blowers are installed. They are 2 duty. One (1) common standby (B303) is installed.

Each blower has the capacity of 17.9m³/min.

These blowers are started manually, and run continuously until switched off.

c) Control : by MAIN PLC

d) Monitoring Parameters

Tag	Parameter	Field	SCADA
B301A	CONDITION (ON-OFF-FALUT)	x	O
B301B	CONDITION (ON-OFF-FALUT)	x	O

e) Select Switch for each equipment

1. "ON": Manual ON

2. "OFF": Manual OFF

f) Interlocks ("RUN" Condition / "STOP" Condition)

[Manual ON]

"RUN" Condition			"STOP" Condition		
1		No condition	1		No condition

(7) MBR Blower

a) Tag No : B302

b) Description

One (1) Blower is installed. One (1) common standby (B303) is installed.
This blower has the capacity of 15.9m³/min.

c) Control : by MAIN PLC

d) Monitoring Parameters

Tag	Parameter	Field	SCADA
B302	CONDITION (ON-OFF-FALUT)	x	O

e) Select Switch for each equipment

1. "ON": Manual ON
2. "OFF": Manual OFF
3. "AUTO": Automatic Operation

f) Interlocks ("RUN" Condition / "STOP" Condition)

[Manual ON]

"RUN" Condition			"STOP" Condition		
1		No condition	1		No condition

[Auto]

"RUN" Condition			"Intermittent Operation" Condition		
1	OR	Water level (LIS302A) M ↑ - L ↓ Water level (LIS302B) M ↑ - L ↓ → Continuous operation	1	AND	Water level (LIS302A) L ↓ - M ↑ Water level (LIS302B) L ↓ - M ↑ → Intermittent operation (5min ON, 55 min OFF)

* 1	B302 "RUN"	B302 START	LIS302A M ↑ OR LIS302B M ↑
		B302 STOP	LIS302A L ↓ AND LIS302B L ↓
	B302 "Intermittent Operation"	B302 START	LIS302A L ↓ AND LIS302B L ↓
		B302 STOP	LIS302A M ↑ OR LIS302B M ↑

(8) Common Standby Blower

a) Tag No : B303

b) Description

One(1) Blower will be installed. There is one (1) common standby for Aeration Blower and MBR Blower.

c) Control : by MAIN PLC

d) Monitoring Parameters

Tag	Parameter	Field	PLC
B303	CONDITION (ON-OFF-FALUT)	x	O

[Select the operation target]

Select Switch

Aeration

or

MBR

Select Switch	Description
Aeration	Will control the same as B301A,B
MBR	Will control the same as B302

e) Select Switch for each equipment

1. "ON": Manual ON

2. "OFF": Manual OFF

3. "AUTO": Automatic Operation

3-3. Cause and Effect Chart

Cause and Effect Chart		Function Performed	Circulation Pump (AUTO)	Circulation Pump (MANUAL)	Suction Pump (AUTO)	Suction Pump (MANUAL)	Aeration Blower	MBR Blower (AUTO)	Common Standby Blower			Alarm
Process Component		Tag, No										
Identification	Service											
ANOXIC TANK (T301)	LL ↓	LIS301										o
	HH ↓		o o									
MBR TANK A (T302A)	LL ↓	LIS302A	x	x								o
	L ↓				x x	x x		Δ				
	M ↓											
	HH ↓											
MBR TANK A (T302B)	LL ↓	LIS302B	x	x								o
	L ↓				x x	x x		Δ				
	M ↓											
	HH ↓											
Product Water Tank (T401)	LL ↓	LIS401										o
	L ↓											
	M ↓											
	H ↓				o o	o o						
	HH ↓											
NOTE					Intermittent operation (9 min ON, 1 min OFF) Backup & Change over B302 or B303-MBR "RUN"		countinuous operation	Intermittent Operation (5min ON, 55 min OFF)	Select the operation target			

PRODUCT WATER TANK

4-1. Fault List

- | | | |
|---|---|------------------------------|
| a) PRODUCT WATER TANK (T401) HH Alarm | = | Water level HH ↑ (LIS401*) |
| b) PRODUCT WATER TANK (T401) H Alarm | = | Water level H ↑ (LIS401*) |
| c) PRODUCT WATER TANK (T401) LL Alarm | = | Water level LL ↓ (LIS401*) |
| d) UTILITY PUMP (P401) Alarm | = | Overcurrent or Earth leakage |
| e) PRODUCT WATER PUMP (P402A,B) Alarm | = | Overcurrent or Earth leakage |

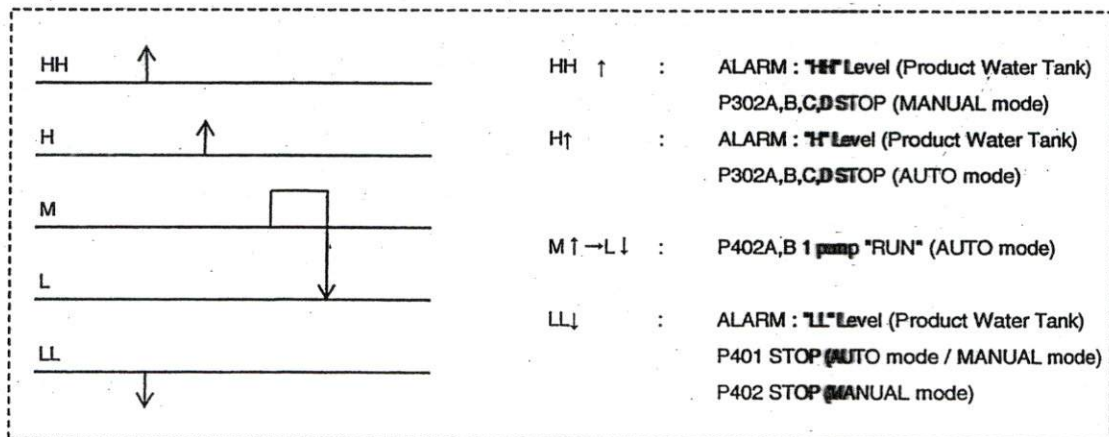
4-2. System Configuration

(1) LEVEL SWITCH FOR T401

- a) Tag No : LIS401
- b) Description
Level switch for T401 is installed at the top of the Treated water tank.
This level switch (LIS401) monitors the water level in the Product Water tank and sends the signal to main PLC
- c) Control : by MAIN PLC
- d) Monitoring Parameters and interlocks

Tag	Parameter	Field	PLC
LIS401	Product Water Tank Water Level	x	o

Interlock - LIT-401



(2) UTILITY PUMP

a) Tag No : P401

b) Description

One (1) Centrifugal type pump is installed. There is no standby. This pump is for washing the fine screen.
This pump has the capacity of 0.05m³/min.

c) Control : by MAIN PLC

d) Monitoring Parameters

Tag	Parameter	Field	PLC
P402	CONDITION (ON-OFF-FALUT)	x	0

e) Select Switch for each equipment

1. *ON*: Manual ON

2. *OFF*: Manual OFF

3. *AUTO*: Automatic Operation

f) Interlocks ("RUN" Condition / "STOP" Condition)

[Manual ON]

"RUN" Condition			"STOP" Condition		
1		Water level (LIS401) LL ↑	1		Water Level (LIS401) LL ↓

[Auto]

"RUN" Condition			"STOP" Condition		
1		Water level (LIS401) LL ↑ AND Fine Drum Screen (S301) "ON"	1		Water Level (LIS401) LL ↓ OR Fine Drum Screen (S301) "OFF"

(3) PRODUCT WATER PUMP

a) Tag No : P402A,B

b) Description

Two (2) Centrifugal type pumps are installed. They are 1 duty and 1 standby.

This pump is for discharging product water to outside the plant. Each pump has the capacity of 0.7m³/min (1000m³/day).

c) Control : by MAIN PLC

d) Monitoring Parameters

Tag	Parameter	Field	SCADA
P402A	CONDITION (ON-OFF-FALUT)	x	O
P402B	CONDITION (ON-OFF-FALUT)	x	O

e) Select Switch for each equipment

1. *ON*: Manual ON

2. *OFF*: Manual OFF

3. *AUTO*: Automatic Operation

f) Interlocks ("RUN" Condition / "STOP" Condition)

[Manual ON]

"RUN" Condition			"STOP" Condition		
1		Water level (LIS401) LL ↑	1		Water Level (LIS401) LL ↓

[Auto]

"RUN" Condition			"STOP" Condition		
1		Water level (LIS401) M ↑ - L ↓	1		Water Level (LIS401) L ↓

* 1 = Change over duty pump each cycle.

* 2 = If duty pump go for falut, change to the standby automatically.

4-3. Cause and Effect Chart

Cause and Effect Chart		Function Performed	Utility Pump (AUTO)		Utility Pump (MANUAL)		Product Water Pump (AUTO)		Product Water Pump (MANUAL)		Alarm
Process Component		Tag, No									
Identification	Service										
PRODUCT WATER TANK (T401)	LL ↓	LIS401	x	x	x	x			x	x	0
	L ↓						x	x			
	M ↓										
	H ↓										
	HH ↓										
NOTE			*RUN* at the condition of Fine Drum Screen *ON*				*1 *2				

*1 = Change over duty pump each cycle.

*2 = If duty pump go for falut, change to the standby automatically.

5. SLUDGE HOLDING TANK

5-1. Fault List

- | | | |
|---------------------------------|---|-----------------------------|
| a) SLUDGE HOLDING TANK HH Alarm | = | Water level HH ↑ ("LIS501") |
| b) SLUDGE HOLDING TANK LL Alarm | = | Water level LL ↓ ("LIS501") |

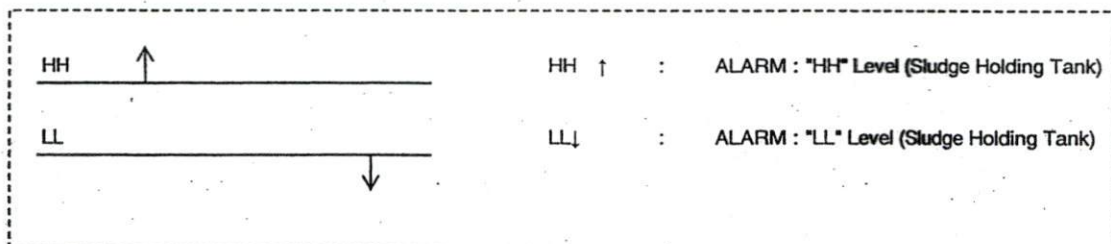
5-2. System Configuration

(1) LEVEL SWITCH FOR T501

- a) Tag No : LIS501
- b) Description
Level Switch for T501 is installed at the top of the Sludge Holding Tank. This level switch (LIS501) monitors water level of Sludge Holding Tank and send the signal to main PLC.
- c) Control : by MAIN PLC
- d) Monitoring Parameters and interlocks

Tag	Parameter	Field	PLC
LIS501	DRAIN WATER LEVEL	x	0

Interlock - LIT-311



CHEMICAL SYSTEM

6-1. Fault List

- | | | |
|------------------------------------|---|------------------------------|
| a) Chlorine Tank (T601) LL Alarm | = | LS601 LL ↓ |
| b) Chlorine Tank (T601) L Alarm | = | LS601 L ↓ |
| c) Disinfection Pump (P601) Fault | = | P601 * Earth leakage * |
| d) CIP Pump (P602) Fault | = | Overcurrent or Earth leakage |

6-2. System Configuration

(1) LEVEL SWITCH FOR T601

- a) Tag No : LS601

- b) Description

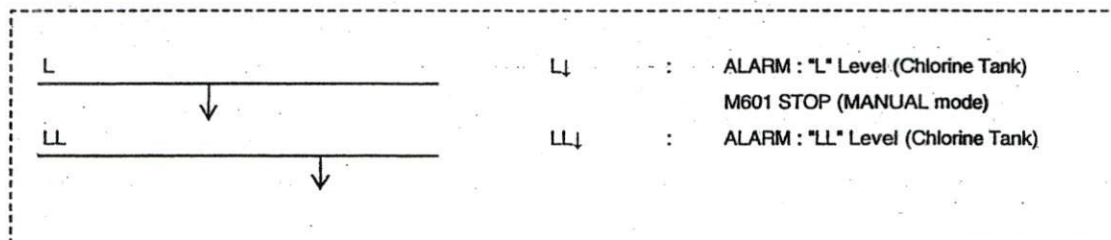
Level Switch for T601 is installed at the top of the Chlorine Tank. This level switch (LS601) monitors water level of Chlorine Tank and send the signal to main PLC.

- c) Control : by MAIN PLC

- d) Monitoring Parameters and interlocks

Tag	Parameter	Field	PLC
LS601	T601 WATER LEVEL	x	O

Interlock - LS-601



(2) DISINFECTION PUMP

a) Tag No : P601

b) Description

One (1) dosing pump will be installed. There is one(1) store standby.

This pump dose NaOCl for the disinfection of permeate water. The capacity is 0.9 L/hr.

c) Control : by MAIN PLC

d) Monitoring Parameters

Tag	Parameter	Field	SCADA
P601	CONDITION (ON-OFF-FALUT)	x	O

e) Select Switch for each equipment

1. "ON": Manual ON

2. "OFF": Manual OFF

3. "AUTO": Automatic Operation

f) Interlocks ("RUN" Condition / "STOP" Condition)

[Manual ON]

"RUN" Condition		"STOP" Condition	
1	Water level (LS601) LL ↑	1	Water Level (LS601) LL ↓

[Auto]

"RUN" Condition		"STOP" Condition	
1	P302A,B,C,D " Any Operation " Water level (LS601) LL ↑	1	P302A,B,C,D (All Pump Stop) Water Level (LS601) LL ↓

(3) CIP Pump

a) Tag No : P602

b) Description

One (1) dosing pump will be installed. There is no standby. This pump is used only for CIP

The capacity is 0.23m3/min

c) Control : by MAIN PLC

d) Monitoring Parameters

Tag	Parameter	Field	PLC
P602	CONDITION (ON-OFF-FALUT)	x	O

e) Select Switch for each equipment

1. "ON": Manual ON

2. "OFF": Manual OFF

f) Interlocks

No interlock

(4) Disinfection Tank Mixer

a) Tag No : M601

b) Description

One (1) mixer will be installed. There is no standby.

c) Control : by MAIN PLC

d) Monitoring Parameters

Tag	Parameter	Field	PLC
M601	CONDITION (ON-OFF-FALUT)	x	0

e) Select Switch for each equipment

1. "ON": Manual ON

2. "OFF": Manual OFF

f) Interlocks

[Manual ON]

"RUN" Condition			"STOP" Condition		
1		LS601 L ↓	1		LS601 L ↑

Continuou operation until switched off.

6-3. Cause and Effect Chart

Cause and Effect Chart		Function Performed	NaOCl Dosing Pump (for Disinfection)	Disinfection Tank Mixer				Alarm
Process Component		Tag, No						
Identification	Service							
T601	LL ↓	LS601	x					0
	L ↓			x				0
Suction Pump- A,B,C,D	ALL OFF		x					
NOTE								

APPENDIX – 5
Instrument Setting List

Instrument Setting List

Client: MOWE General Directorate
of Water in Eastern Region

Project No. ME13001

Project: Supply & Installation Compact Sewage Treatment
Unit
in Nairyah Govenorate

Date : 20-Nov-13

Checked By: T. Handa

Checked By: _____

1. Dumping Area & Lifting Tank (Grease / Grit Removal)

Tag No.	Item Name	Setting Discription	Comment & Actual Setting Setting Date
LIS101	Lifting Tank Level Switch	* Tank height : 5m * Level setting HH 4.2 m H 3.0 m M 2.0 m L 0.6 m LL 0.3 m	

2. Equalization Tank

Tag No.	Item Name	Setting Discription	Comment & Actual Setting Setting Date
LIS201	Equalization Tank Level Switch	* Tank height : 4.116m * Level setting HH 3.7 m H 3.4 m M 1.2 m L 0.7 m LL 0.4 m	
FIT201	Equalization Pump Flow Meter	* Setting H 0.84 m3/min L 0.28 m3/min	

3. Biological System & MBR

Tag No.	Item Name	Setting Discription	Comment & Actual Setting Setting Date
LIS301	Anoxic Tank Level Switch	* Tank height : 3.5m * Level setting HH 3.3 m LL 2.6 m	
LIS302 A,B	MBR Tank Level Switch	* Tank height : 3.5m * Level setting H 3.1 m M 2.95 m L 2.8 m LL 2.6 m	
PIT301 A,B	MBR Suction Pressure (Pressure Transmitter)	* Setting LL *1 Kpa * 1 The setting pressure is 10kPa lower than the Initial Pressure.	Pressure (at P302 "OFF") ____ Kpa Initial Pressure ____ Kpa Setting Pressure ____ Kpa
FI301 A,B	Product Water Flow (Indicator, Float Type)	* Setting Flow 0.39 m3/min Adjust Product Water Flow by BF401 (Manual Butterfly Valve)	
FI601 A,B	MBR Aeration Flow (Indicator, Orifice Type)	* Setting Flow 7.95 m3/min Adjust MBR Aeration Flow by BF360 (Manual Butterfly Valve)	
P302 A,B	Suction Pump Intermittent Operation	Timer Setting 9 min ON, and 1 min OFF <i>This inttemittent operation will be done, when the Suction Pump is required to "RUN" at the AUTO Mode.</i>	
B302	MBR Blower Intermittent Operation	Timer Setting 5 min ON and 55 min OFF <i>This inttemittent operation will be done, when the MBR Blower is required to "OFF" at the AUTO Mode.</i>	

4. Product Water Tank

Tag No.	Item Name	Setting Discription	Comment & Actual Setting Setting Date
LIS401	Product Water Tank Level Switch	* Tank height : 4.116m * Level setting HH 3.7 m H 3.4 m M 1.0 m ^{*1} L 0.7 m ^{*1} LL 0.4 m	

*1 The product water is discharged automatically by Product Water Pump until the water level goes down
 Basically Water is stored in this Product Water Tank between "L" level and "M" level.
 If the client wants to keep more water in this product water tank, change the setting level.
 Much water M: 2.5m, L: 2.2m Midium water M: 2.0m, L: 1.7m
 Less water M: 1.0m, L: 0.7m

5. Sludge Holding Tank

Tag No.	Item Name	Setting Discription	Comment & Actual Setting Setting Date
LIS501	Sludge Holding Tank Level Switch	* Tank height : 2.72m * Level setting HH 2.4 m LL 0.3 m	

6. Chemical System

Tag No.	Item Name	Setting Discription	Comment & Actual Setting Setting Date
LS601	Chlorine Tank Level Switch	* Tank height : 1100mm * Level setting L 400 ^{*1} mm LL 200 ^{*2} mm *1 Confirm the level of Mixer. Prevent dry running *2 50mm above the Outlet Nozzle Level.	

APPENDIX – 6
O&M Check Sheet

O&M Check Sheet (PROCESS)

Date:

Filed Note for Daily Check

Preliminary for Review, 19-Feb, 2014

For the Operation at 1000CMD

Set the select switch of Equalization Pump (P201) 2 pump

Operate 2 Aeration Blower (B301) (or 1 Aeration Blower & 1 Common Standby Blower (B303)).

Tag No	Item	Unit	Reading	Design Value	Initial Value	Remarks
Flow Rate						
FIT201	Equalization Pump Flow Rate (Sewage)	m3/hr		42 (- 50)		for 2 pump operation
FI301A	Suction Pump Flow Rate -A (Treated Water)	m3/hr		23.2		
FI301B	Suction Pump Flow Rate -B (Treated Water)	m3/hr		23.2		
FI601A	MBR Blower Flow Rate -A (Scouring Air)	Nm3/hr		≥ 6.0 360		check the homogeneity of aeration
FI601B	MBR Blower Flow Rate -B (Scouring Air)	Nm3/hr		≥ 6.0 360		check the homogeneity of aeration
Pressure						
PIT301A	MBR Suction Pressure -A	kPa		-	(23.2m3/hr)	(Initial) 10) kPa or more if less, conduct MBR cleaning
PIT301B	MBR Suction Pressure -B	kPa		-	(23.2m3/hr)	(Initial) 10) kPa or more if less, conduct MBR cleaning
Excess Sludge Discharge						
-	MBR Tank -A	min		-		note the duration of discharge (Volume target: 12m3/day)
-	MBR Tank -B	min		-		note the duration of discharge (Volume target: 12m3/day)
Water Quality (Influent Sewage at Equalization Tank)						
-	Water Temperature	deg.C		20 - 40		
-	pH	-		6.0 - 9.0		
Water Quality (Sludge at MBR Tank)						
-	Water Temperature	deg.C		20 - 40		
-	pH	-		6.0 - 8.0		
-	DO	-		1.0 or more		
-	MLSS	-		12000		
Water Quality (Treated Water at Suction Pump)						
-	pH	-		6.0 - 8.5		
-	Turbidity	NTU		-		

Remarks:

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O&M Check Sheet (PROCESS)

Date:

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Preliminary for Review, 19-Feb, 2014

For the Operation at 500CMDSet the select switch of Equalitation Pump (P201) 1 pump

Operate 1 Aeration Blower (B301) (or 1 Common Standby Blower (B303)).

Switch over the operating blower periodically.

Tag No.	Item	Unit	Reading	Design Value	Initial Value	Remarks
Flow Rate						
FIT201	Equalization Pump Flow Rate (Sewage)	m3/hr		21 (- 27)		for 2 pump operation
FI301A	Suction Pump Flow Rate -A (Treated Water)	m3/hr		11.6		
FI301B	Suction Pump Flow Rate -B (Treated Water)	m3/hr		11.6		
FI601A	MBR Blower Flow Rate -A (Scouring Air)	Nm3/hr		≥ 6.0 360		check the homogeneity of aeration
FI601B	MBR Blower Flow Rate -B (Scouring Air)	Nm3/hr		≥ 6.0 360		check the homogeneity of aeration
Pressure						
PIT301A	MBR Suction Pressure -A	kPa		-	(11.6m3/hr)	(initial - 10) kPa or more if less, conduct MBR cleaning
PIT301B	MBR Suction Pressure -B	kPa		-	(11.6m3/hr)	(initial - 10) kPa or more if less, conduct MBR cleaning
Excess Sludge Discharge						
-	MBR Tank -A	min		-		note the duration of discharge (Volume target: 8.0m3/day)
-	MBR Tank -B	min		-		note the duration of discharge (Volume target: 8.0m3/day)
Water Quality (Influent Sewage at Equalization Tank)						
-	Water Temperature	deg.C		20 - 40		
-	pH	-		6.0 - 9.0		
Water Quality (Sludge at MBR Tank)						
-	Water Temperature	deg.C		20 - 40		
-	pH	-		6.0 - 8.0		
-	DO	-		1.0 or more		
-	MLSS	-		8000		
Water Quality (Treated Water at Suction Pump)						
-	pH	-		6.0 - 8.5		
-	Turbidity	NTU		-		

Remarks:

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O&M Check Sheet (EQUIPMENT)

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*) mark O in usual/appropriate condition, X in unusual/inappropriate condition

**) note "On Duty", "Standby" or "Fault"

Preliminary for Review, 19-Feb, 2014

Tag No.	Item	Spec	Status	Current		Flow (m³/h)		Pressure (MPa)		Sensor Check		Oil Check	Remarks
				Measured	Initial	Tag No.	Measured	Tag No.	Measured	Noise	Vibration	Leak	
P103A	Lift Pump -A	1.39m³/minx1.0bar 5.5kW (EBARA)											
P103B	Lift Pump -B	1.39m³/minx1.0bar 5.5kW (EBARA)											
P201A	Equalization Pump -A	0.35m³/minx1.1bar 1.5kW (EBARA)				FIT201							
P201B	Equalization Pump -B	0.35m³/minx1.1bar 1.5kW (EBARA)				FIT201							
S301	Fine Drum Screen	0.25kW (TORO)											
P301A	Circulation Pump -A	1.39m³/minx0.3bar 3.7kW (EBARA)											
P301B	Circulation Pump -B	1.39m³/minx0.3bar 3.7kW (EBARA)											
P302A	Suction Pump -A	0.39m³/minx0.7bar 1.5kW (EBARA)				FI301A		PG301A					
P302B	Suction Pump -B	0.39m³/minx0.7bar 1.5kW (EBARA)				FI301A		PG301B					
P302C	Suction Pump -C	0.39m³/minx0.7bar 1.5kW (EBARA)				FI301B		PG301C					
P302D	Suction Pump -D	0.39m³/minx0.7bar 1.5kW (EBARA)				FI301B		PG301D					
B301A	Aeration Blower -A	17.9m³/minx0.35bar 22kW (MAPRO)						PG351A					
B301B	Aeration Blower -B	17.9m³/minx0.35bar 22kW (MAPRO)						PG351B					
B302	MBR Blower	15.9m³/minx0.35bar 18.5kW (MAPRO)				FI601A FI601B		PG352A					
B303	Common Standby Blower	17.9m³/minx0.35bar 22kW (MAPRO)				FI601A FI601B		PG352B					
P401	Utility Pump	0.05m³/minx4.8bar 1.3kW (EBARA)						PG401					
P402A	Product Water Pump -A	0.7m³/minx0.7bar 2.2kW (EBARA)						PG402A					
P402B	Product Water Pump -B	0.7m³/minx0.7bar 2.2kW (EBARA)						PG402B					
P601	Disinfection Pump	0.025kW (TACMINA)					stroke no.	stroke no.					
P602	CIP Pump	0.23m³/minx1.0bar 1.5kW (Ebara)						PG602					

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O&M Check Sheet (EQUIPMENT)

General Schedule

Preliminary for Review, 8-Mar, 2014

EQUIPMENT	ITEM	REFERENCE CYCLE
<u>Common Items for all equipment</u>		
- (common for all)	Sensory check (appearance, noise, vibration, heat, odor, leak, damage, oil, grease... etc.)	daily
	Parameter check (flow, pressure, current... etc.)	daily
	Cleaning	monthly
	Insulation resistance check	monthly
	Tightness check for bolt, nut, screw and other connections	yearly
	Overhaul including the replacement of wearing or deteriorating parts	every 3-5 years
<u>Individual Items in addition to the above for each equipment</u>		
P103 Lift Pump	Oil replacement	yearly
P201 Equalization Pump		
P301 Circulation Pump		
P302 Suction Pump	Oil check & refill	daily
P402 Product Water Pump	Oil replacement	yearly
S301 Fine Drum Screen	Grease refill	every 3 months
B301 Aeration Blower	Oil check & refill	daily
B302 MBR Blower	Suction filter cleaning	weekly
B303 Common Standby Blower	Oil replacement	every 3 months
	V-belt tension/alignment check & adjustment	every 3 months
	Grease refill	every 6 months

Note:

This list shows the summary of maintenance work for individual equipment. Please refer to manufacture's operation manuals for details.