



1.0 PLANT DESIGN CRITERIA

The design of the system is based on information obtained from the client and professional experience.

The client should inform Nijhuis H2OK, if (s)he feels that the design parameters listed below do not reflect the actual situation.

Type of waste water : Waste water from existing pre-treatment from gelatin production
Quantity : 1695 m³/day, 24 hrs/day

Pre-treatment system

Plant design capacity : 71 m³/hr, 1695 m³/day for biological system
COD : 2000 mg/l
BOD : 1000 mg/l
TSS : 180 mg/l
TKN : 130 mg/l
P_{total} : 20 mg/l
Oil and grease : 100 mg/l
pH : 6-8
Temperature : 20-30 °C

Biological system

Type : continuous system based on aeration tank with carrier material and activated sludge flotation unit

Anoxic tank

Tank volume : 487 m³
Tank dimensions : round: diameter 9,4 m x height 7 m

MBBR tank

Aeration system : bottom aeration with carrier material
Power : approx. 90 kW total for blowers
Tank volume : 487 m³
Tank dimensions : round: diameter 9,4 m x height 7 m

Aeration tank

Aeration system : bottom aeration
Power : approx. 60 kW total for blowers
Tank volume : 905 m³
Tank dimensions : round: diameter 12,8 m x height 7 m

**Activated sludge flotation unit**

Type	: GDF 032
Effective area	: 32 m ²
Excess sludge production	: 680 - 1150 kg/day dry solids, wet sludge production 22,5 - 38,8 m ³ /day with approx. 3% dry solids

Sludge dewatering system**Dewatering**

Type	: decanter centrifuge (including sludge from pre-treatment)
Wet sludge	: 78 m ³ /day at 5 % d.s. 3950 kg d.s./day
Design capacity	: 4 m ³ /hr at 5 % d.s. 200 kg d.s./hr
Cake after dewatering	: approx. 20-25 m ³ /day at 16-20 % d.s.

General

Electricity	: 230/400 Volt +/- 5% 3 Phase 50 Hz.
Control voltage	: 24V AC

Treated effluent characteristics

Based on and for the given design parameters we expect to reach the following treated water parameters after total treatment (aerobic treatment):

COD	: ≤ 150 mg/l
BOD	: ≤ 10 mg/l
TSS	: ≤ 30 mg/l
TKN	: ≤ 20 mg/l
Ammonia	: ≤ 10 mg/l

The performance is based on condition that sufficient biodegradability of organics and no inhibiting harmful or toxic components are present in concentration which inhibit or stop biological activity and growth.

We also assume that sufficient nutrients are available in the waste water.

2.0 PROCESS DESCRIPTION

According to our experience and the information we received from you, we propose the following design for your waste water treatment system:

- Continuous aerobic biotreatment with activated sludge flotation
- Sludge dewatering

Continuous aerobic biotreater MBBR



The MBBR biofilm technology is based on specially designed plastic biofilm carriers or biocarriers that are suspended and in continuous movement within a tank or reactor of specified volume. The biocarriers have a high specific area.

The waste water after the flotation unit is led to the MBBR treatment reactor where biofilm, growing within the internal structures of the biocarriers, degrade the pollutants.

These pollutants that need to be removed in order to treat the wastewater are food or substrate for growth of the biofilm. The biocarrier design is critical due to requirements for good mass transfer of substrate and oxygen to the microorganisms.

Due to the high biomass concentration in the reactor, the bacteria growth is relatively low.

The excess biofilm is sloughs off the biocarrier in a natural way and will be released with the effluent. In this way the excess bacteria do not have to be disposed on a separate way. This means no costs for excess sludge disposal.

An aeration grid located at the bottom of the reactor supplies oxygen to the biofilm along with the mixing energy required to keep the biocarriers suspended and completely mix within the reactor.

Treated water flows from reactor through a grid or a sieve, which retains the biocarriers in the reactor to meet the treated water requirements for discharge.

The advantages of this MBBR biofilm system are:

- compact build system due to large contact area by using the biocarriers
- relative low bacteria growth, the excess biofilm will be disposed with the cleared water, so no disposal costs for excess sludge.
- effluent quality is met without additional sludge separation system.
- air input is done by rootsblowers via a bottom aeration grid



Continuous aerobic biotreater with activated sludge flotation

The offered biotreater is based on a continuous system with an aeration tank and separate clarifier due to the continuous water flow from the factory. For the clarifier tank we have offered an activated sludge flotation so the sludge/water separation is done by dissolved air flotation.

This process has the following specific features:

- relatively high dry solids in the recycle/excess sludge (3-4 %)
- higher MLSS in the aeration tank allowed so the aeration tank is relatively compact
- no problems with sludge bulking or floating sludge
- no denitrification will occur, resulting in carry over



Sludge dewatering, decanter centrifuge

The sludge from the system (so including excess sludge from biological treatment) is collected in a sludge storage tank with top mixer. From here the decanter centrifuge will be fed. In the feed line to the decanter polyelectrolyte will be dosed to form separable floc.

By the centrifugal forces of the decanter the dry solids will shift to the side. By the spinning of the decanter the dry solids will be carried out of the decanter. The water will leave the decanter at the other side.

This system has the following specific features:

- the system is continuous
- the system is fully automatic

3.0 SCOPE OF SUPPLY

Equipment:

Make-up station for pre-treatment system consisting of:

- Flocculant dosing unit + post-dilute station + pressure measurement
- Automatic flocculant make-up station for liquid polymer NMA 2000 L

Biological system consisting of:

- 2 Influent pumps biological system (1 duty/1 stand-by) + flowmeter + level controller + valve
- Denitrification mixer
- Level controller anoxic tank + level switch bund
- Foam sensor
- Anti-foam dosing unit
- 3 Blowers (3 duty) for MBBR aeration + 1 airflow meter
 - 1 Coarse bubble aeration grid for MBBR tank
- Biomass carrier material (including screen/filter at outlet)
- Level controller for MBBR tank + level switch bund
- O₂ measuring and control system for MBBR tank
- 1 Fine bubble aeration grid for aeration tank
- 3 Blowers (2 duty/1 common stand-by) for aeration tank + airflow meter + 2 valves
- Level controller for aeration tank + level switch bund
- O₂ measuring and control system
- MLSS measurement
- 2 Recirculation pumps aeration tank – anoxic tank (1 duty/1 stand-by) + flowmeter + valve
- 2 Feed pumps to activated sludge flotation unit (1 duty/1 stand-by) + flow meter + valve
- 2 Flocculant dosing units + post-dilute station + pressure measurement
- Automatic flocculant make-up station for liquid polymer NMA 2000 L
- Flocculator PFR 080
- Flotation units GDF 032
- 2 Recirculation pumps (1 duty/1 stand-by)/aeration system
- Pneumatical control panel



- 2 Sludge return/Excess sludge pumps (1 duty/1 stand-by) + selection valves + level controller
- Sediment trap
- Flow sampler
- Compressor (1 duty/1 stand-by) on single receiver
- Electrical control panel based on Siemens S7-300 PLC with touchscreen
- Documents and drawings
- Operation and maintenance manuals
- Transport CIP Pontypridd
- Supervision during installation based on 20 days on site divided over 4 trips, including travel and accommodation cost
- Start-up and training of operator based on 25 working days on site divided over 5 trips including travel- and accommodation cost
- Engineering

Sludge dewatering system consisting of:

- Mixer for sludge tank
- Level controller for sludge tank
- 2 Sludge feed pumps (1 duty/1 stand-by) + pressure measurement + level controller + valve
- Flocculant dosing unit + post-dilute station
- Automatic flocculant make-up station for liquid polymer NMA 10000 L
- Decanter centrifuge
- Centrate return pumps (1 duty/1 stand-by) + level controller + valve
- Additions to electrical control panel
- Documents and drawings
- Operation and maintenance manuals
- Transport CIP Pontypridd
- Start-up and training of operator based on 5 working days on site in 1 trip including travel- and accommodation cost
- Engineering

Detailed design:

- Detailed design for civil, structural works including
- Detailed design for mechanical and electrical works including production of P&ID
- Detailed construction drawings
- As built drawings for insertion in the project H+S file

Preliminaries:

- Mobilisation/Demobilisation
- Set up site
- Hutting
- Fencing of site & excavations
- H&S
- Welfare
- Transport
- Skips
- Pipe pressure testing



- Craneage & concrete pumping
- Subsistence

Civil Works:

- Formation and subsequent removal of a site compound/site mobilisation
- Supply, installation and subsequent removal of the temporary site accommodation/welfare comprising of an office, canteen, drying room, toilets and secure storage.
- Provision and maintenance of site fencing, temp services from the site boundary.
- Acting as principle contractor under the CDM regulations.
- Excavation and disposal of material off site
- Piling for anoxic tank, MBBR tank, aeration tank and sludge tank
- Tank bases for anoxic tank, MBBR, aeration tank and sludge tank
- Tanks (glass-fused to steel) with self contained bunding annulus
 - Anoxic tank
 - Main tank 9.3.9m X 7.030m
 - Bund tank 11.100m X 5.630m
 - MBBR tank
 - Main tank 9.3.9m X 7.030m
 - Bund tank 11.100m X 5.630m
 - Aeration tank
 - Main tank 12.808m X 7.030m
 - Bund tank 14.516m X 7.030m
 - Sludge tank
 - Main tank 5.123m X 5.630m
 - Bund tank 6.831m X 4.230m
- Gantry bases
- Gantry structures
 - Between Anoxic and MBBR tank
 - Between MBBR and aeration tank
- IPF 8.5m³ Polypropylene transfer tank
- Plinths
 - Container room raft slab
 - Container raft slab for decanter and dosing
 - Blower units
- Trenching and backfilling service trenches
- Overflow trenches
- New drain diversion
- Existing building modifications to better accommodate DAF
- New pump station and rising main
- Headwall construction for pumped effluent reception at watercourse

Electromechanical Installation

- Site inductions will be carried out and all approved risk assessments and method statements communicated to engineering staff.
- The equipment listed above will be offloaded, positioned and secured as per our layout drawing



- Confined space works will be undertaken by trained and certificated engineers and entry will be permitted.
- All cabling will be carried out using steel wire armoured cable and managed on medium duty post galvanised return edge tray with supports in galvanised steel.
- Rotary isolators will be telemechanique and will be positioned by all rotary / mechanical equipment.
- E-Stop push buttons will be of a "stay in type" with red mushroom button and yellow body also manufactured by telemechanique.
- All cables will be marked using Critchley labels at both ends and noted on the wiring diagram.
- The electrical installation will be installed and tested to BS7671:2008 (2011) by CG2391 certificated electrical engineers. We are an NICEIC registered contractor.
- All above ground pipe to be uPVC min 10 bar rated supported by corresponding bracketry in post galvanised steel.
- We have included for isolation and non return valves for all pumping equipment.
- Supply & install all interconnecting wiring from quoted components to e-panel
- Installation of all interconnecting pipework and cabling as per attached layout

4.0 DESCRIPTION OF PROCESS COMPONENTS

AEROBIC BIOLOGICAL TREATMENT SYSTEM

Flocculant dosing unit

Pumptype	: eccentric screw pump	
Capacity	: 90-540 l/hr	
Material	: housing	: cast iron GG 25
	: rotating part	: stainless steel
	: rotor	: stainless steel
	: stator	: Hypalon
Drive motor:		
Type	: frequency controlled motor	
Power	: 0,55 kW	
Insulation class	: IP 55	
Quantity	: 1	
Accessories	: - run dry protection	
	: post dilute station consisting of pressure switch, solenoid valve, watermeter, manual valve, in-line static mixer	
Quantity	: 1	

Automatic flocculant make-up station for liquid polymer

Type	: NMA 2000 L	
Capacity	: 400 l/hr max.	
Tank	: material	: HDPE
	: volume	: 400 litre total
Including	: - mixer	: stainless steel 304 (0,55 kW)



concentrated liquid polymer dosing pump

pump type	: eccentric screw pump (0,37 kW)
capacity	: 10 l/hr
water armature	
level switches	
Quantity	: 1

The motors and electrical switches are designed for safe area, IP 55
 The polymer should be supplied as concentrated liquid polymer in mini containers (IBC's) or drums

Influent pump biological system

Type	: centrifugal horizontal
Capacity	: 70 m ³ /hr at 7 mwc max.
Power	: approx. 4 kW installed
Speed	: 1500 rpm
Material	: housing : cast iron
	: impeller : cast iron
	: shaft : stainless steel
Including	: frequency controller (in control panel)
Quantity	: 2 (1 duty, 1 stand-by)

Electrical valve

Type	: electrical butterfly valve
Material	: shaft
	: stainless steel disc
	: stainless steel
housing	: GG 25
Including	: electrical actuator
Quantity	: 1

Flow meter

Type	: in-line, magnetic flowmeter with digital display
Capacity	: 30-150 m ³ /hr
Output signal	: 0/4-20 mA
Including	: - flow totalizer, actual flow read out
Quantity	: 1

Level control transfer tank

Type	: pressure sensor
Output signal	: 0/4-20 mA
Including	: - mounting materials
Quantity	: 1 set

Denitrification mixer



Type	: submersible	
Material	: motor	: stainless steel
	: impeller	: stainless steel
	: guide coupling	: stainless steel 304
Power	: 2,5 kW installed	
Including	: - guide rail	: stainless steel 304
	: - lifting chain	: stainless steel 304
	mounting materials	
Quantity	: 1	

Level control anoxic tank

Type	: pressure sensor
Output signal	: 0/4-20 mA
Including	: - mounting materials
Quantity	: 1 set

Level switch bund anoxic tank

Type	: conductive pentype for start/stop and high level alarm
Material	: stainless steel 304
Including	: - mounting materials
Quantity	: 1 set

Foam sensor

Output signal	: 0/4-20 mA
Including	: - mounting materials
Quantity	: 1 set

Anti-foam dosing unit

Brand	: Grundfos or equal	
Type of chemical	: Anti-foam	
Pumptype	: diaphragm	
Capacity	: 0-30 l/hr	
Material	: dosing head	: PVC
	: diaphragm	: PTFE
Operating pressure	: 2 bar	
Power	: 0,02 kW installed	
Electricity	: 230V/50 Hz	
Motor classification	: IP 55, safe area	
Accessories	: - pressure keeping valve (PVC)	
pressure relief valve		
solenoid valve in pressure line		
pumpskid HDPE		
piping on pumpskid (PVC, PN 10)		
Quantity	: 1	



Aeration system for MBBR tank

Type	: Roots blower
Capacity	: 800 m ³ /hr each, 7,5 m.w.c.
Power	: 30 kW installed each
Motor classification	: IP 55, safe area
Including	: - air inlet filter
pulsation damper	
airflow meter	
frequency controller (in control panel)	
Quantity	: 3 (3 duty)

Submersed aeration system for MBBR tank

Type	: coarse bubble bottom diffuser type
Material	: stainless steel
Including	: - mounting materials in stainless steel

Carrier media for growth of biomass in MBBR tank

Type	: plastic packing material
Including	: screen section for treated water overflow (2 screens) slotwidth 3 mm.

Level control for MBBR tank

Type	: pressure sensor
Output signal	: 0/4-20 mA
Including	: - mounting materials
Quantity	: 1 set

Level switch bund MBBR tank

Type	: conductive pentype for start/stop and high level alarm
Material	: stainless steel 304
Including	: - mounting materials
Quantity	: 1 set

O₂ measurement for MBBR tank

Type	: submersible, membrane covered amperometric cel bases on three electrodes
Protection class	: IP 67
Including	: - electric cable (7 m)
Amplifier	: microprocessor controlled
Output signal	: 0/4-20 mA
Alarm signal	: adjustable between 0-10 mg/l
Protection class	: IP 65
Including	: - mounting materials (stainless steel 304)
Quantity	: 1



Submersed aeration system for aeration tank

Air distribution header

Material	: plastic
Including	: - connections for air distribution pipes connection for grid feedpipe mounting materials (stainless steel)
Quantity	: 1

Air distribution pipes

Material	: plastic
Including	: - coupling for connection on the distribution header connections for aerators (fine bubble) mounting materials (stainless steel)

Fine bubbles aerators

Type	: - submersible suitable for fine bubble aeration in processes with intermittent operation
Material	: synthetic rubber, EPDM or equal
Quantity	: 1 set

Aeration system for aeration tank

Type	: Roots blower
Capacity	: 800 m ³ /hr each, 7,5 m.w.c.
Power	: 30 kW installed each
Including	: - air inlet filter pulsation damper noise reducing housing airflow meter frequency controller (in control panel)
Quantity	: 3 (2 duty/1 common stand-by)

Electrical valve for blower selection

Type	: electrical butterfly valve	
Material	: shaft	: stainless steel
disc	: stainless steel	
housing	: GG 25	
Including	: electrical actuator	
Quantity	: 2	

Level control for aeration tank

Type	: pressure sensor
Output signal	: 0/4-20 mA
Including	: - mounting materials
Quantity	: 1 set



Level switch bund aeration tank

Type	: conductive pentype for start/stop and high level alarm
Material	: stainless steel 304
Including	: - mounting materials
Quantity	: 1 set

O₂ measurement for aeration tank

Type	: submersible, membrane covered amperometric cel bases on three electrodes
Protection class	: IP 67
Including	: - electric cable (7 m)
Amplifier	: microprocessor controlled
Output signal	: 0/4-20 mA
Alarm signal	: adjustable between 0-10 mg/l
Protection class	: IP 65
Including	: - mounting materials (stainless steel 304)
Quantity	: 1

MLSS measurement for aeration tank

Output signal	: 0/4-20 mA
Including	: - mounting materials
Quantity	: 1 set

Recirculation pump aeration tank – anoxic tank

Type	: centrifugal horizontal
Capacity	: 70-280 m ³ /hr at 7 mwc max.
Power	: approx. 15 kW installed
Speed	: 1500 rpm
Material	: housing : cast iron
	: impeller : cast iron
	: shaft : stainless steel
Including	: frequency controller (in control panel)
Quantity	: 2 (1 duty/1 stand-by)

Electrical valve

Type	: electrical butterfly valve
Material	: shaft : stainless steel
disc	: stainless steel
housing	: GG 25
Including	: electrical actuator
Quantity	: 1

Flow meter



Type	: in-line, magnetic flowmeter
Capacity	: 100-500 m ³ /hr
Output signal	: 0/4-20 mA
Including	: - flow totalizer, actual flow read out
Quantity	: 1

Feed pump to activated sludge flotation unit

Type	: centrifugal horizontal
Capacity	: 80 m ³ /hr at 7 mwc max.
Power	: approx. 4 kW installed
Speed	: 1500 rpm
Material	: housing : cast iron
	: impeller : cast iron
	: shaft : stainless steel
Including	: frequency controller (in control panel)
Quantity	: 2 (1 duty, 1 stand-by)

Electrical valve

Type	: electrical butterfly valve
Material	: shaft : stainless steel
disc	: stainless steel
housing	: GG 25
Including	: electrical actuator
Quantity	: 1

Flow meter

Type	: in-line, magnetic flowmeter with digital display
Capacity	: 30-150 m ³ /hr
Output signal	: 0/4-20 mA
Including	: - flow totalizer, actual flow read out
Quantity	: 1

Flocculant dosing unit

Pumptype	: eccentric screw pump
Capacity	: 90-540 l/hr
Material	: housing : cast iron GG 25
	: rotating part : stainless steel
	: rotor : stainless steel
	: stator : Hypalon
Drive motor:	
Type	: frequency controlled motor
Power	: 0,55 kW
Insulation class	: IP 55
Quantity	: 1
Accessories	: - run dry protection



post dilute station consisting of:

pressure switch, solenoid valve, watermeter, manual valve, in-line static mixer

Quantity : 2 (1 duty/1 stand-by)

Pressure measurement

Output signal : 0/4-20 mA
Including : - mounting materials
Quantity : 1 set

Automatic flocculant make-up station for liquid polymer

Type : NMA 2000 L
Capacity : 400 l/hr max.
Tank : material : HDPE
: volume : 400 litre total
Including : - mixer : stainless steel 304 (0,55 kW)
concentrated liquid polymer dosing pump
pump type : eccentric screw pump (0,37 kW)
capacity : 10 l/hr
water armature
level switches
Quantity : 1

The motors and electrical switches are designed for safe area, IP 55

The polymer to be supplied as concentrated liquid polymer in mini containers (IBC's) or drums

Flocculator

Brand : Nijhuis Water Technology B.V.
Type : Plug flow pipe flocculator
Capacity : 80 m³/hr
Model : PFR 080
Material : HDPE PN 6
Nozzles for : flocculant : 1 no.
: sample points : 2 nos.
Accessories - injection piece : 1 nos.
material : PVC for
- sample valve : 2 nos. ball valve
material : PVC
- mixing pipes flanged : 1
material : HDPE:
- flocculator support
: 1 no. stainless steel 304 flanges on in- and outlet
Quantity : 1

Flotation unit



Type	: GDF 032
Brand	: Nijhuis Water Technology B.V.
Capacity	: 80 m ³ /hr
Dimensions	: see dimension sketch
Material	: stainless steel 304
Plate thickness	: 3 mm
Flanges	: inlet : FF
	: outlet : FF
	: sediment : FF
Including sediment removal valves	: - sludge skimmer for floating sludge
recirculation pump	
aeration system	
pneumactical control panel	
Quantity	: 1

Skimmer system for floating sludge (top scraper)

Brand	: Nijhuis Water Technology B.V.
Type	: chain driven plate thickener with scraper motor
Material	: chain : stainless steel 304
	: scraper blades : stainless steel 304/PUR
	: chain wheels : nylon
	: side plates : stainless steel 304
Including	: - skimmer drive
Skimmer drive consisting of:	
Material	: housing : cast iron
Speed	: 0,5 - 2,7 rpm
Motor classification	: IP 55, safe area
Power	: 0,37 kW installed
Speed	: 1460 rpm
Including	: - frequency adjustable speed control for controlling the speed of
sludge discharge	
sludge compartment in stainless steel 304, conical shaped	
Quantity	: 1

Sediment removal valves

Type	: butterfly valve (electrical solenoid, pneumatic driven)
Connection size	: DN150
Pressure rating	: 10 barg.
Material	: body : cast iron
	: stem : stainless steel
	: disc : stainless steel
	: seat : EPDM
Actuator	: type : pneumatic driven, double
actuated	
Solenoid valve	: electricity : 24 V AC



	: classificatie	: IP 55, safe area
	: type	: direct installed on actuator
	including	manual override
Quantity	: 3	

Aeration system

Type	: Nijhuis Water Technology patented non clogging aeration-pieces
Material	: stainless steel 304
Including	: - interconnecting piping between air saturation pipe and aerators material
	: flexible tube nylon

Recirculation pump/aeration system

Type	: horizontal, centrifugal pump
Brand	: Nijhuis Water Technology B.V.
Capacity	: 60 m ³ /hr at 6 bar
Classification	: IP 54, safe area
Speed	: 3000 rpm
Power	: 18,5 kW installed
Material	: housing : cast iron
	: impeller : cast iron
	: shaft : steel C 45
Seal	: mechanical seal
Including	: - base plate (cast iron)
	coating conform manufacturer standards
Accessories	: - manual valves
quantity	: 1 in suction side
	: 1 in pressure side
	1 pressure switch for recirculation pump
brand	: SMC
set point	: 5 bar
adjustable range	: 0,5 - 9 bar
location	: in pneumatical control panel
duty	: fail safe operation of recirculation pump
	1 pressure indicator for recirculation pump
range	: 0 - 16 bar
including	: cock valve
	recirculation pump piping/air saturation pipe
material	: stainless steel 304
Quantity	: 1

Pneumatical control panel

Type	: mounted on DAF tank, polyester closed panel
Including	: - pressure switch for compressed air
brand	: SMC



set point	: 7 bar
adjustable range	: 0,5-9 bar
air filter/pressure reducer	
brand	: SMC
air flow indicator	
brand	: Kytola
type	: flow indicator
solenoid valve for air inlet	
interconnecting piping for compressed air	

Sludge return/Excess sludge pump

Type	: eccentric screw pump	
Capacity	: 10 m ³ /hr	
Power	: 3 kW	
Material	: housing	: cast iron GG 25
	: rotor	: hardened steel
	: stator	: Perbunan
Including	: - run dry protection	
frequency controller (in control panel)		
Quantity	: 2 (1 duty, 1 stand-by)	

Pressure measurement

Output signal : 0/4-20 mA
Including : - mounting materials
Quantity : 2

Electrical valve

Type	: electrical butterfly valve	
Material	: shaft	: stainless steel
disc	: stainless steel	
housing	: GG 25	
Including	: electrical actuator	
Quantity	: 2	

Level control

Type : pressure sensor
Output signal : 0/4-20 mA
Including : - mounting materials
Quantity : 1 set

Sediment trap

Type : open topped
Brand : Nijhuis Water Technology B.V.
Material : stainless steel 304



Including : - influent and effluent flanges
Quantity : 1

Automatic flow sampler

Type : flow proportional or timer controllable sample station
Method : vacuum metric, sample volume adjustable
Including : - refrigerator for temperature control of sample
1 sample can of 20 liter
Quantity : 1

Compressor

Type : piston type, air cooled compressor
Capacity : 2x 450 l/min
Power : 2x 2,4 kW
Maximum pressure : 10 bar
Quantity : 2 (1 duty/1 stand-by)
Including : - pressure vessel (approx. 350 litre)
V belt drive
pressure switch
pressure relief valve
pressure gauge, air filter and pressure reducer
Quantity : 1

SLUDGE DEWATERING SYSTEM

Mixer for existing sludge tank

Type : top mixer
Material : motor : stainless steel
: impeller : stainless steel
Power : 10 kW installed
Quantity : 1

Sludge feed pump

Type : eccentric screw pump
Capacity : 4 m³/hr
Power : 2.2 kW
Material : housing : cast iron GG 25
: rotor : hardened steel
: stator : Perbunan
Including : - run dry protection
frequency controller (in control panel)
Quantity : 2 (1 duty, 1 stand-by)

Pressure measurement



Output signal : 0/4-20 mA
Including : - mounting materials
Quantity : 2

Electrical valve

Type : electrical butterfly valve
Material : shaft : stainless steel
disc : stainless steel
housing : GG 25
Including : electrical actuator
Quantity : 1

Level control

Type : pressure sensor
Output signal : 0/4-20 mA
Including : - mounting materials
Quantity : 1 set

Flocculant dosing unit

Pumptype : eccentric screw pump
Capacity : 140-1800 l/hr
Material : housing : cast iron GG 25
: rotating part : stainless steel
: rotor : stainless steel
: stator : Hypalon

Drive motor:
Type : frequency controlled motor
Power : 0,75 kW
Insulation class : IP 55
Quantity : 1
Accessories : - run dry protection
post dilute station consisting of:
pressure switch, solenoid valve, watermeter, manual valve, in-line static mixer
Quantity : 1

Automatic flocculant make-up station for liquid polymer

Type : NMA 10000 L
Capacity : 2000 l/hr max.
Tank : material : HDPE
: volume : 2000 litre total
Including : - 2 mixers : stainless steel 304 (1,1 kW each)
concentrated liquid polymer dosing pump
pump type : eccentric screw pump (0,18 kW)
capacity : 10 l/hr



water armature
level switches
Quantity : 1

The motors and electrical switches are designed for safe area, IP 55
The polymer should be supplied as concentrated liquid polymer in mini containers (IBC's)
or drums

Decanter centrifuge

Type : 2 phase horizontal decanter centrifuge
Capacity : 4 m3/hr at 5 % d.s.
Material : drum : stainless steel screw
: stainless steel
housing : steel
Power : 27,5 kW installed
Including : - V belt driven motor
Quantity : 1

Centrate pump for centrate return to balance tank

Type : centrifugal horizontal
Capacity : 10 m3/hr at 7 mwc max.
Power : approx. 1,5 kW installed
Speed : 1500 rpm
Material : housing : cast iron
: impeller : cast iron
: shaft : stainless steel
Including : frequency controller (in control panel)
Quantity : 2 (1 duty, 1 stand-by)

Level control

Type : pressure sensor
Output signal : 0/4-20 mA
Including : - mounting materials
Quantity : 1 set

Electrical valve

Type : electrical butterfly valve
Material : shaft : stainless steel
disc : stainless steel
housing : GG 25
Including : electrical actuator
Quantity : 1



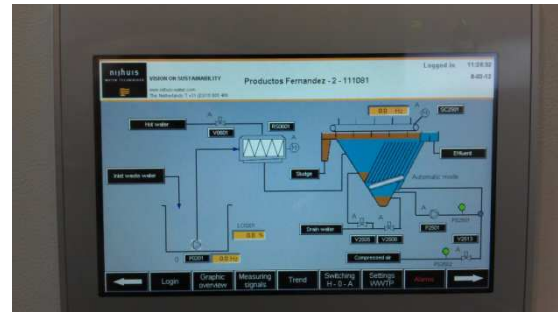
Electrical control panel (Nijhuis Water Technology Standard) (combined control panel for total treatment system)

The delivery includes a NWT standard control panel, that consists of all safety- and control equipment for the quoted waste water treatment. The control panel exists of one (or more) floor-standing enclosures of Eldon or Rittal. These enclosures are build together to form one control panel.

Below you'll find two example photos of how a NWT standard control panel may look like. The size of the panel (and therefore the number of enclosures), are determined on the amount and sizes of the quoted equipment.



The communication between equipment (pumps, drive, valves etc.) and operator is done by a so called 'Touch screen panel', that is located in the door of the control panel. The NWT standard will be an 7" touch screens, full colour version.



Standard features that can be monitored / controlled from the touch screen :

- read out of all process measurements
- process overview screen
- calibration of the measurements
- hand – off – auto switches for all valves, drives, pumps, etc.
- actual status for all valves, drives, pumps etc.
- read out of the hour and flow counters
- read out and entry of all the process settings (protected by password)
- read out of all actual process alarms with date and start time, but also a large amount of alarm history with start and stop time

The E-panel will be set up in a way that the main power circuits (230/400VAC groups) and the low voltage circuits (PLC, interface relay etc.) are separated as much as possible. We intend to reserve the panel with approximately 15~20% free space for future expansions.

All control panels are delivered with a 200 mm high plinth. All cables are entering the panel (bottom entry) through the removable parts of this plinth.

All internal panel wiring will be colour coded conform IEC60204 :

- 400VAC circuits : Black
- Neutral : Blue
- 24VAC : Red
- 24VDC : Blue

Standard the internal wiring will not include wire identification

Electrical drawings are designed with Eplan software. Beside a print-out of the drawings we can also provide these drawings in PDF, Eplan, Autocad, or dxf format.

The control panel must be placed in a healthy environment, dry and clean. Preferably, the control panel should be placed in a separate room, apart from the waste water treatment. Maximum ambient temperature for the control panel room must be limited to 35°C.

Control panel will be designed and constructed conform IEC standards. Standard materials for a control panel in a safe area environment are :

Panel : Eldon or Rittal, Coated steel

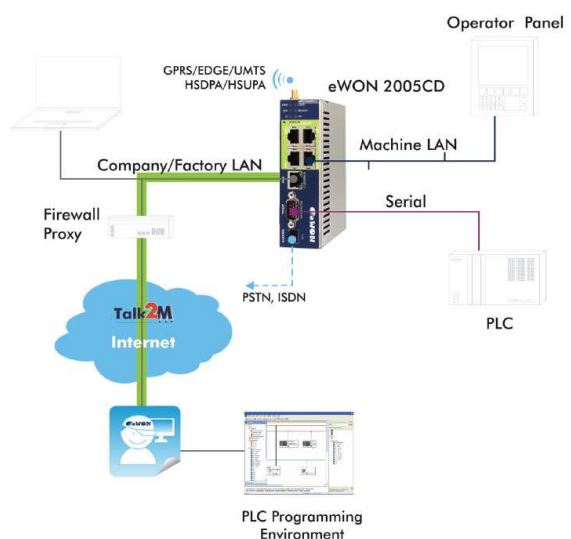


	: Plinth 200mm, IP rating IP55
Main switch	: Socomec or ABB
Motor protections	: Allen Bradley or Telemecanique Model U
Motor relays	: Allen Bradley or Telemecanique Model U
Miniature circuit breakers	: Allen Bradley or Telemecanique Model U
Interface relays	: Finder / Omron
Panel lamps	: Telemecanique
Soft starters	: Allen Bradley, Siemens or Emotron
Frequency drives	: Danfoss series
Emergency relay	: Telemecanique
PLC	: Siemens S7-300 series
Operator interface	: Exor UniOP Etop307 or Siemens Comfort panel
Quantity	: 1

Process control, monitoring and visualization (eWON system)

The eWON 2005CD/4005CD is a full industrial router featuring "Factory" LAN to "Machine" LAN routing functionalities with VPN tunnelling features. An optional embedded modem can also be used as a secondary or back up remote access to the "Machine" LAN. Seamlessly integrated with the PLC programming environment, an eWON 2005CD/4005CD still monitors and collects data into internal tags while PLC maintenance is performed. The eWON 2005CD/4005CD has a built-in Web server for configuration/HMI purposes and FTP functionalities for remote download/upload of data and configurations files. It provides also an independent alarm management system.

eWON 2005CD/4005CD are Talk2M ready. Machine Builders & OEMs, like system integrators, will use Talk2M to take full advantage of broadband or mobile Internet to remotely connect to their machines & installations worldwide.





Special features:

- Industrial LAN router with VPN tunnelling
- 1x Ethernet (WAN) 10/100mb port
- 4x Ethernet (LAN) 10/100mb port switch
- Ethernet and serial (DB9) interfaces supporting numerous PLC protocols
- Optional embedded PSTN, ISDN, GPRS/EDGE/UMTS/HSDPA/HSUPA modem
- Compliance with worldwide 3G/3G+ networks
- SNMP agent and server
- Alarm management on PLC variables with notification (SMS, email, FTP put or SNMP trap)
- Programmable (Basic or Java)
- Configuration by embedded web pages, files or remote FTP upload
- 1 x digital input and 1 x digital output
- Full industrial design (24 VDC power supply, DIN Rail mounting)
- Extended temperature : -20°C to +70°C

6.0 UTILITY CONSUMPTION (new plant components)

Continuous aerobic biotreatment system with activated sludge flotation

Compressed air for recirculation system	: 90 NI/min., min.press. 7 bar
Power	: approx. 281 kW installed
Utility water	: 560 l/hr. (chemicals only), min.press. 2 bar

Chemicals *

Flocculant type	: polyelectrolyte
Consumption	: 1-3 g/kg d.s.

Sludge dewatering system

Power	: approx. 54 kW installed
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Dewatering



Utility water
Chemical consumption*
Cleaning water for decanter

: 8-12 gr. /kg solids
: approx. 400 l per cleaning cycle
min.press. 2 bar with temp. 40-60 °C

7.0 ESTIMATED PROGRAMME FOR COMPLETION

Including the required civil works and based upon our experience, the total project duration from commencement on site to commissioning is estimated to be approximately 36-40 Weeks.

8.0 PLANT DESIGN LIFE

Design life for non-wear and tear parts is estimated at 20-25 years.

9.0 ESTIMATED IMPOSED LOADINGS

The site is made-up ground and will require piling, this has been accounted for within our proposal.

10.0 ADDITIONAL CHARACTERISTICS/CONSIDERATIONS

To be further defined in the Final Agreement.

11.0 NOISE AND ODOUR CONSIDERATIONS

All equipment will be limited to a noise level of 75 decibels measured 1 meter in any Direction and will not exceed the site noise boundary limit of 45dBA. The plant is designed to prevent mal odours.

12.0 ESTIMATED MAINTENANCE REQUIREMENT

We propose full time operation of the plant which would include 5 day a week operation, with reduced weekend operational support as described in section 14 and to be fully detailed in the Final Agreement.

13.0 ENGINEERING STANDARDS

- BS7671 – 17th edition IEE Regulations
- Health And Safety at Work Act
- Electricity at Work Regulations
- Electrical Supply Act
- British Standards
- Standards as identified within the specification

14.0 OPERATION AND MAINTENANCE



The manuals will be produced which are designed to facilitate the operation of the treatment system. In addition, various important set points of instruments (instructed during commissioning) are listed.

The manuals will include the following items:

- process description
- operation manual
- trouble shooting list
- maintenance instructions
- safety instructions for chemicals
- checklist for operation
- electrical drawings
- final drawings
- specific details various pumps, motors

2 sets of operating and maintenance manuals are included in our Scope of Supply

The operation of the plant will either be conducted as a part of the DBFOT or shared equity contracts or will be provided as an independent service under the plant purchase option.

Under all options the scope of operation shall include the below and be further defined in the Final Agreement.

Programmes

The Operator shall be responsible for the establishment and implementation of the following programmes, standards and procedures, which require Owner approval and which are included in the Services to be provided by the Operator.

The programme for establishing specific operating goals for each functional Project area.

The programme for communicating and cooperating with the Owner(s) and governmental agencies.

The Project management standards for conduct of operations, Project safety, conduct of maintenance, housekeeping, material condition, and records management.

The programme for preparing supporting documentation, meter readings and information necessary to accurately prepare, justify and support monthly invoices.

Developing the procedures used to operate the Plant as well as monitoring, evaluating, and proposing revisions to such procedures.

The Project operations and monitoring programme which provides the requirements for:

- Monitoring of Project performance
- Monthly Project performance calculations and report
- Monthly utility consumption calculations and report
- Shift routines/operating practices



- Control of equipment
- Project chemistry control and water treatment
- Training programmes
- Operator qualifications
- Operating procedures
- Status of major equipment

The maintenance programme which provides the requirements for:

- Maintenance planning
- Maintenance procedures
- Preventive maintenance
- Predictive maintenance
- Maintenance training

The materials management programme which provides the requirements for:

- Procuring materials and tools
- Inventory levels and control
- Renewal of inventories

The diagnostic testing programme for maintaining the Plant, including both system and component level testing.

The housekeeping / cleanliness programme which provides the requirements for:

- Hazardous material control
- General project cleanliness
- Equipment condition inspections
- Hazardous waste programme

The problem assessment programme which provides the procedure for determining the cause(s) of operational or equipment failures and preventing future failures through recommended improvements, including justification for such recommendations (ie, basis of recommendation and economic analysis).

The records management programme for maintaining the traceability and documentation of Plant performance.

The Plant safety programme which provides the requirements for establishing:

- Safety monitoring
- Accident prevention programme
- Accident reporting

Monthly and yearly reporting systems of Plant performance to the Owner.

The security programme for maintaining the security of the Plant and surrounding area.



Specific Requirements

The Operator will, to the extent required by the applicable Annual Project Operating Plan be responsible for:

Providing such trained personnel as is reasonably necessary to operate and maintain the Plant and provide the Services.

Planning and managing on site operations and maintenance activities, including:

- Assuring that operational goals and operating plans are consistent with the Annual Project Operating Plan.
- Assuring that the Plant is operated in accordance with this Agreement and in a safe, reliable, efficient and prudent manner.
- Assuring that operations and maintenance personnel are trained and qualified for their assigned responsibilities and tasks, and that such qualification is maintained.
- Managing and controlling costs consistent with budget requirements.
- Planning, scheduling and managing work and maintenance activities.
- Defining and documenting operational technical requirements.
- Defining and delineating responsibilities between the Operator and the Owner and identifying reporting requirements.
- Establishing personnel programmes that will meet regulatory requirements and encourage employee retention.
- Maintaining a current inventory of materials and procuring all services, spare parts, operational materials, consumables, office equipment, tools and engineering equipment, or any other items or materials required to operate or maintain the Plant. The Operator will

identify required items, cost and quantity. The cost of any item or service shall be reimbursed by the Owner in accordance with this Agreement.

- Controlling outages, both planned and unplanned, by using detailed and integrated plans and schedules, and resource management.
- Maintaining Plant performance levels by using routine system and component performance testing.
- Maintaining a file of pre-planned outage-related work to allow for efficient use of any forced outage downtime.
- Establishing open purchase order or contract agreements with necessary suppliers and maintenance contractors to ensure timely response to Plant maintenance needs.
- Promptly notifying the Owner in writing of any maintenance and overhauls of major equipment or capital improvements that the Operator believes are necessary or advisable together with a proposed schedule for completing such repairs or improvements.

Performing certain tasks, duties, responsibilities and obligations assigned to the Owner including:

- Performing routine surveillance of all equipment routinely used to communicate with the Operator.



- Notifying the Operator of any routine maintenance from the Operator.
- Responding to dispatch orders from the Operator.

Execution or oversight of routine preventative maintenance ("PM") activities as follows:

- Lubrication checks.
- Cleaning/flushing.
- Fluid changes and replacement.
- Visual inspections.
- Operational monitoring.
- De-sludging.
- Chemical analysis.
- Trend analysis.
- Calibration.
- Measurements.
- Adjustments.
- Replacement of parts which are non-functional as a result of wear and tear.

Execution or oversight of routine corrective maintenance ("CM") activities to troubleshoot, inspect and repair the equipment upon identification of certain conditions, including:

- Physical fault conditions such as:
 - Blocked / stopped flow
 - Fractures / break / breaches
 - Cracks
 - Distortion / displacement
 - Corrosion / discolouration
- Out of specification conditions such as:
 - High / low flow, pressure, temperature, or chemistry
 - Off voltage
 - Out of limits / adjustments
 - Erratic output
 - Intermittent / spurious operation
 - Failure of controls
 - High / low output
 - Improper loading
- Demand fault conditions such as failure to:
 - Start / run / operate
 - Stop
 - Open
 - Close
 - Move / release / respond
- Abnormal characteristics such as:
 - Overheating
 - Noise
 - Vibration



- Chatter
 - False response
- Leakage conditions such as:
 - Leakage to surrounding environment
 - Leakage past seats / stems / packing / seals

The PM and CM activities will be inventoried and performed on a system-by-system basis and shall apply to the following equipment types:

- Circuit breakers (all types)
- PLC & HMI
- Generators
- Heat tracing
- Blowers
- AC Motors (synchronous / induction)
- DC Motors (synchronous / induction)
- Valves (all types)
- Valve Operators (air / motor / hydraulic)
- Control relays (AC / DC)
- Transformers
- Controllers
- Dosing pumps and stations
- Transmitters
- Switches (all types)
- pH Sensor
- Fans / compressors / blowers
- Heat exchangers
- Steam injection
- Pumps
- Filters / strainers
- Temperature sensor
- Tanks / vessels
- Pipe / pipe fittings / pipe supports
- VSDs'

The final operational contract if delivered under a direct plant purchase would include reimbursable costs.

- Reimbursable Cost items shall be paid to the Operator in accordance with this Agreement. Reimbursable Costs include :
 - Spare and replacement parts
 - All materials, tools and equipment necessary to operate and maintain the Plant
 - Dosing chemicals / gas (nitrogen)
 - Lubricants (including proper disposal costs)
 - Specialised instrumentation and calibration equipment
 - Rigging and handling equipment
 - Consumables and general supplies



- Cleaning supplies
 - Sample ampoules and re-agents
 - Authorised leased equipment
 - Specialised test and calibration equipment
 - Major equipment overhauls
 - Contract services if incorporated in the Annual Budget or otherwise approved in advance by the Owner
 - Taxes (excluding income tax) required to be paid by the Operator
 - Costs related to training of personnel involved in the Project
 - Consultant's fees and expenses if incorporated in the Annual Budget or otherwise approved in advance by the Owner
- The following will be Reimbursable Costs when specifically related to Project support:
 - Office supplies
 - Office equipment and furniture
 - Telephone and other communication service charges
 - Freight and express mail charges
 - Janitorial, cleaning and grounds keeping services

All Services by the Operator that support Project activities and all Reimbursable Costs shall be approved by the Owner, through the Annual Budget or otherwise, prior to implementation by the Operator.

15.0 DRAWINGS

The following drawings shall be submitted:

- process and instrumentation diagram
- lay out drawing
- dimensional drawings and foundation loading data
- control panel electrical schematic
- cable schedule
- As built drawings

16.0 EXCLUSIONS

- Existing structures to be removed/demolition by others
- Offer based on flat level site with hardcore surface and sufficient load bearing capacity
- Atex / DSEAR assessment have not been carried out at this time
- Freshwater supply and breaktank have been excluded
- Temporary and permanent water, power, steam and other utilities to be installed up to the site boundary by others for the construction, commissioning and operation of the Biogas plant
- Traffic management is to be provided by the client
- No allowance for security during construction
- No allowance for fencing
- No allowance for planning application or other permitting requirements
- No allowance for FRA, SI or other potentially required investigations
- Supply of suitable power supply to the LV panel
- Any rehabilitation work
- Lightning protection system has not been included at this stage



- Water supply and sewage, drainage and drain
- Telephone / Internet connection for remote monitoring
- Foundations and other structures unless specified in the offer
- Water testing of tanks with clean water
- No allowance for rock or underground obstructions/diversion of existing services
- OPRA charges for EA discharge permit not yet fully identified in operational costs
- Excluded unless otherwise mentioned in this budget indication.
- Entire offers are subject to further negotiation and subject to re-evaluation at the discretion of Nijhuis H2OK until Final Agreement is in place.
- Contractual protection for both parties in regards to plant performance and liabilities to be defined in the Final Agreement.

17.0 COMMISSIONING

Nijhuis H2OK will send a field engineer to the site for the commissioning of the plant. The client shall appoint an operator for the waste water treatment plant who will be available during the complete commissioning period. The work of the field engineer together with the operator will consist of the following steps:

- Inspection of the installation works
- Random check the electrical works
- Advice and assist with the preparations prior to commissioning
- Advice and assist with the clean water test
- Advise and assist with the commissioning with waste water
- Adjust and fine tune the settings of the installation
- Training of the operators and service engineers
- Review the operation and maintenance manual
- Review the settings of the waste water treatment plant
- Advice on regular analyses