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**Offer No.: P 190014 UB2**

Thank you for your inquiry. Herewith please find our quotation based on your request and our terms and conditions.

Biomar® Waste Water Treatment Plant

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# **1 THE FLOMAR® CONCEPT**

## 1.1 Basis of design

The Flomar® plant in the quotation is designed based on following feed water specification as provided by the client:

Table 1: Characteristic data for the waste water

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Inlet values | Designated outlet values |
| Quantity of waste water | m³/d | 168- 192 |  |
| Average over 24 h | m³/h | 14-16 |  |
| Maximum short duration | m³/h | 16 |  |
| COD | mg/l | 2200 | 1000 |
| Max. daily loading | kg/d | 423 |  |
| Fat, Oil and Grease (FOG) | mg/l | 8 | 5 |
| TDS | mg/l | 301-452 | 300 |
| Total suspended solids | mg/l | 261-799 | 500 |
| Waste water temperature | °C | 15 – 35 |  |
| pH | [ ] | 6 – 8 | 6.5 – 8.5 |

Comments:

It is assumed that inlet parameter neither specified nor mentioned as inlet values in table above are already below outlet requirements.

The MWS WWTP is designed for the following general construction site conditions if not otherwise specified:

* Earthquake: Zone 0
* Windload: Zone 1
* Good construction ground quality

## 1.2 Description of the selected Flomar® concept

The Flomar® plant consists of the following essential modules:

* EC - RDSDrum sieve
* EC- DPSPump station
* Flomar® - ILF High performance reactors
* Flomar® - HF High performance dissolved air flotation
* EC-Dos Dosing stations
* EC-Asic® Process control system

1.2.1 Equalization tank

The equalization tank provides a buffer for the downstream waste water treatment plant ensuring that the flow and pollution load is evened out. The equalization tank is provided with an agitator and an aeration system in order to avoid sedimentation and anaerobic conditions.

The equalized waste water is pumped by an heavy duty submersible pump to treatment system. The outlet flow is controlled via a level sensor.

1.2.2 Flomar® - Drum screen

The waste water will be pumped via centrifugal pumps to the drum screen where the fine solids will be removed from the water phase. The treated waste water will be directed to the equalization tank.



Figure: Example of a drum screen

By screening about 30 % of BOD will be eliminated

1.2.3 Flomar® – ILF High performance chemical stage

Many of the particles contained in the waste water are present in a form that is unsuitable for flotation without adding chemicals. By applying a coagulant followed by a flocculant, these particles (colloidal dissolved material) are brought into a form that allows separation via flotation. Also a special blood coagulant can be dosed. As these are pH-dependent reactions, a neutralization stage is necessary.

Flomar® - ILF chemical stage consists of 3 reactors, where the optimum mixing for chemical addition is achieved by selecting the correct flow velocity and retention time and thus ensure sufficient mixing of the chemicals with the waste water. Coagulation and flocculation produce solid particles that include large parts of the pollution load (especially oil, grease, and colloidal dissolved solids).This pre-treated wastewater flow is feed into the flotation unit.

1.2.4 Flomar® - HF High performance dissolved air flotation unit

The waste water is fed into the Flomar® high performance dissolved air flotation unit where the recycle flow method is used to generate micro gas bubbles. A multi-staged centrifugal pump takes a portion of the clarified waste water and pressurizes it to approximately 6 - 7 bar. Air is introduced into the suction pipe of the pump where intense mixing takes place and the air dissolves into the water. Once the pressure drops to ambient conditions the dissolved air outgases in form of very small gas bubbles. The micro bubbles (optimal size: 30 - 50 µm) are produced by valves installed in the pressure line of the saturation system.

Compared to other types of dissolved air units, the valves are resistant to clogging and require only minimum maintenance. The bubble size is easy to regulate so production of larger bubbles that would disturb the flotation process is significantly reduced.

The recycle flow is about 20 – 30 % of the total flow. The air is drawn from the environment via a variable-area flow meter and broken into very fine bubbles.

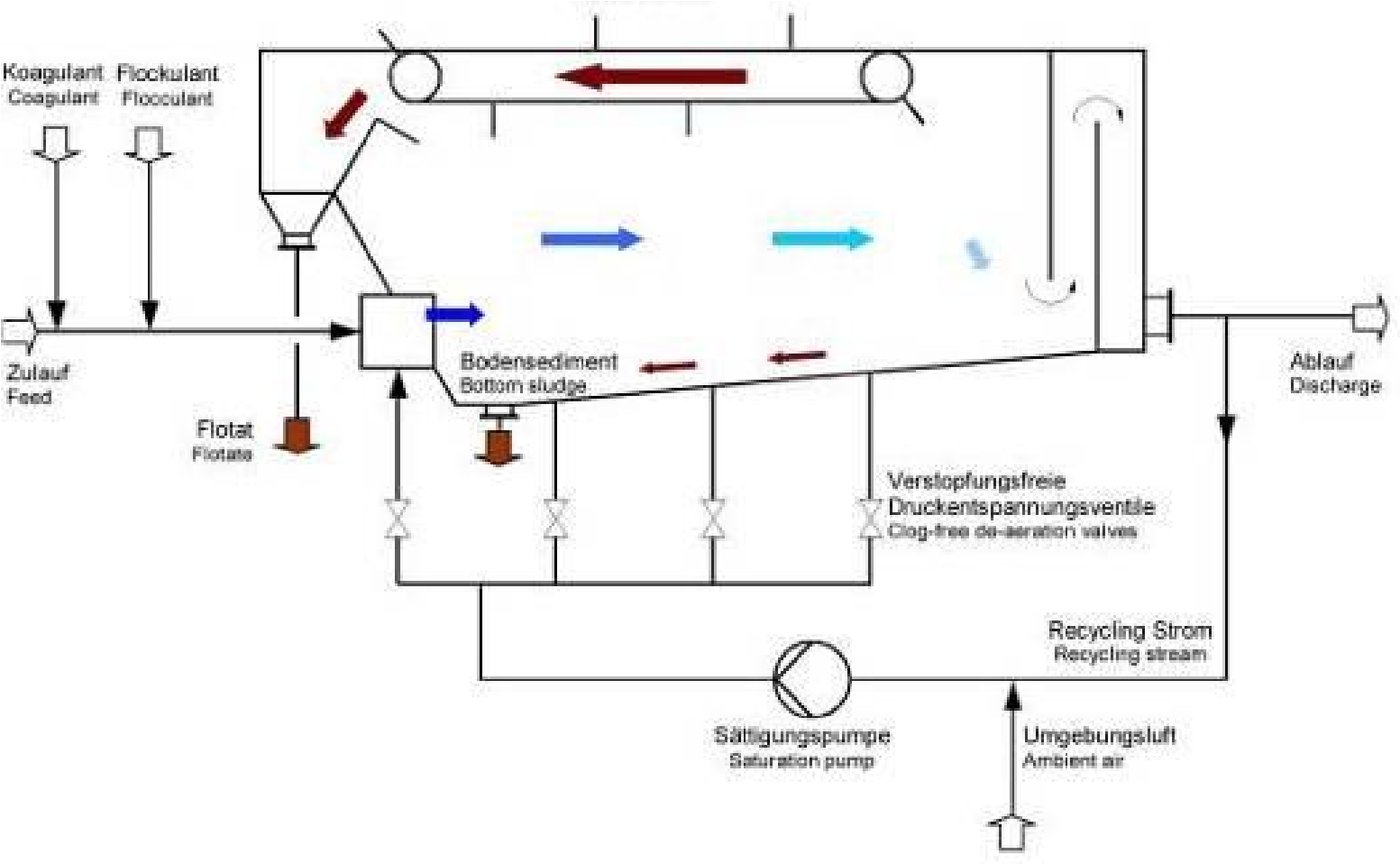


Figure: Operation principle of the Flomar® Flotation

In the mixing zone of the Flomar® unit the waste water is intensively mixed with water from the recycle flow. The generated micro gas bubbles attach to the solid particles producing solids/gas agglomerates that float up to the tank surface.

The flow rate is greatly reduced after the mixing area in order to convert the turbulent flow into a laminar flow. While the solids/gas agglomerates float to the surface the cleaned waste water flows downwards. Thus particles that do not float that easily are also separated. Particles that do not float at all sediment to the bottom of the flotation tank where they are pumped out on a time controlled basis. The clarified water flows via gravity into the splitting pit. The flotation level and thus also the immersion depth of the paddle scraper is variable through an adjustable weir in the outlet of the clarified water tank. The clarified water tank serves mainly as an intermediate storage facility for the saturation pump that produces the air-saturated water.

The flotate sludge layer that builds on the surface is removed by a circulating paddle scraper and discharged into the flotate collecting chamber. A special type of flow-stabilizing grate arranged below the paddle improves the sludge thickening efficiency. The flotate sludge will be pumped to the sludge storage tank.

1.2.5 EC-Dos dosing station

The EC-Dos P polymer preparation and dosing station is a fully automatic device for the preparation of ready-made flocculant solutions including dosing equipment.

Features

* Continuous and automatic preparation
* Dry or liquid polyelectrolyte components useable
* Standard integrated PLC-controller

Function

* Mixing of polymer and fresh water in the first chamber
* Developing of the full efficiency of the dissolved polymer after mixing
* Discharging and dosing of the ready-made polymer solution from the dosingchamber

1.2.6 EC-FMS Final sampling and monitoring system

The EC –monitoring system is installed in a sampling well at the outlet of the waste water treatment plant. It includes flow measurement, pH measurement, temperature measurement. The values of the measurements are automatically recorded by the control system.

# 

# **2 DESCRIPTION OF THE SCOPE OF SUPPLY**

The entire Flomar® plant is supplied according to the tried-and-tested MWS standard for industrial waste water treatment systems based on the generally recognised rules of the technology. The used equipment meets the present local design standards.

The Flomar® concept suggested in this quotation includes the supply of the following items:

2.1.1 Collection tank equipment

The tank shall have 50 % of the daily capacity (90 m3), made in concrete by client

Supplied by MWS:

1 Mixing device for collecting tank

1 Pump system (1 pump operating; 1 stand-by; total: 2 pieces)

Type: EC-DPS

Installation: submergel

Pump type: heavy duty with cutter system

Capacity: - 16 m³/h, each pump

1 Level-measurement, continuous

Type: ASIC®

1 pH-measurement

Type: ASIC®

1 Temperature-measurement

Type: ASIC®

1 Flow meter

Type: MID

Make: E+H

2.1.2 Flomar® - Drum sieve

Supplied by MWS:

1 Drum sieve

Type: EC - RDS

Capacity: - 16 m³/h

Description: Rotary drum gap screen with

externally fed gap-screen drum,

discharge tank with wastewater

discharge connections on the back.

Screened material discharged into

container provided by the client.

1 Spraying device for hot water provided by the client

2.1.3 Flomar® – ILF High performance reactor

Supplied by MWS:

1 High performance reactor

3 reactors, complete with agitator

Material: concrete ( by client)

Make: MWS

Hydraulic capacity: - 16 m³/h

incl. 3 dosing points 3 sampling points pH sensor

2.1.4 Flomar® HF High Performance dissolved air flotation plant Supplied by MWS:

1 Dissolved-air flotation unit

Type: Flomar® HF20

Capacity: up to 16 m³/h

With multi-phase pump (no compressed air necessary)

With automatic clog-free de-aeration system

Equipped with:

Flotation tank

Material - product touching parts: stainless steel 1.4301

Material - other parts: stainless steel 1.4301

The tanks / functional elements are equipped with pipes made of stainless steel. The flange connections are also made of stainless steel.

Flotate scraper

|  |  |
| --- | --- |
| Type: | automatic paddle sludge scraper |
| Installation: | integrated in the upper part of the |
|  | flotation tank |
| Chain material: | stainless steel |
| Scraper drive make: | Nord or equal |
| Power of gear: | 0,25 kW |
| Electrical connection: | 400 V (at 50 Hz) |

Saturation system

Type EC Flowjet

The pressure release pipe is equipped with pressure expansion valves and pressure gauges

1 Flotate sludge collecting hopper

Material: stainless steel 1.4301

1 Level measurements, continuous

Type: ASIC®

2.1.5 Flomar® Flotate and sediment sludge transport pump Supplied by MWS:

1 Flotation sludge pump

|  |  |
| --- | --- |
| Type: | mono pump |
| Capacity: | 4 m³/h |
| Installation: | dry; close to the flotation plant |

2.1.6 Collection tank for sludge

The tank shall have 1 week capacity, made by client

Supplied by MWS:

1 Level-measurement, continuous

Type: ASIC®

2.1.7 EC – FMS Final sampling and monitoring system

integrated in the discharge pipeline or in a pit provided by the client Supplied by MWS:

1 pH/Temperature measurement

1 Flow meter

Type: MID

Make: E+H

2.1.8 EC - NaOH – Storage and dosing station:

1. Storage tank for NaOH solution

Capacity: 1 m3 IBC provided by the client /

chemical supplier

Version: IBC Standard

1. Dosing pumps

1 Level-measurement

Type: ASIC®

2.1.9 EC - Acid – Storage and dosing station:

1 Storage tank for acid solution

Capacity: 1 m3 IBC provided by the client /

chemical supplier

Version: IBC Standard

1 Dosing pump

1 Level-measurement

Type: ASIC®

2.1.10 EC - Cogulant – Storage and dosing station:

1 Storage tank for acid solution

Capacity: 1 m3 IBC provided by the client /

chemical supplier

Version: IBC Standard

1 Dosing pump

1 Level-measurement

Type: ASIC®

2.1.11 DOS P fully automatic polymer preparation and dosing station Supplied by MWS:

1 Fully automated batching station for polymer

Type: EC – DOS P150 Capacity: 150 l/h consisting of:

* Water connection
* Stirrer
* Two-chamber container, cylindrical
* Polymer powder dosing device

1 Dosing pump

Pump type: eccentric screw pump

1 Frequency converter for dosing pump

## 2.2 Control engineering/automation technology and PLS scope of supply

2.2.1 Control cabinet

Mains voltage: 400/230 V, 50 Hz

Control voltage: 230 V, 50 Hz via control transformer

Control voltage: 24 VDC

Lamp voltage: 24 VDC

Protection class, front: IP 54

Design and standard test in accordance with DIN EN 60439-1 (VDE 0660,

Section 500), for explosion-risk areas in accordance with DIN EN 60079 (VDE0165).

Control cabinet housing:

Module width: 800 mm

Module height: 1800 mm

Separate base: 200 mm

Paint finish outside: RAL 7035 light grey

Paint finish inside: RAL 7035 light grey

The control cabinet is assembled from the necessary number of modules with main switches and emergency stop, interior lighting, connection diagram pocket for the circuit diagram in the control panel, warning plate for external power circuits and 20% extra space.

2.2.2 Control and visualisation

The plant is controlled via the Flomar® Asic software developed by MWS.

A freely programmable controller with S7 modules is installed.

The central controller for the complete plant with the control group is provided in the main control cabinet.

Operation is carried out via a user-friendly 15" touch panel with type EC Asic TFT display which is integrated directly in the control cabinet door. The entire process technology, including the measurement values which are continuously updated, is displayed on the touch panel. The operating values can therefore be easily read off and the operating settings can be changed by the operator directly on the display. Approx. 5 process images are available as standard for operation.Electrical field equipment

The electrical field equipment is delivered according to the latest VDE regulations including galvanized cable racks with a separator between the power cables and control cables and is prepared for installation on walls, tanks, basins and steel structure provided by the client.

2.2.3 Earthing/lightning protection

The material for grounding of the above specified mechanical equipment will be delivered according to the local regulations and is prepared to be linked to grounding connection points provided by the client. Lightning protection will be provided by the client.

**2.3 Packaging**

All equipment shall be packed as per the MWS standard.

## 2.4 Documentation

The supply quotation includes two copies of the following documents as well as an electronic version in accordance with MWS standard:

* Layout plan or setup plan 1:100 to 1:1000
* Load figures for the Flomar® plant components supplied
* Description of the requirements of the Flomar® plant technology for the construction engineering work

The client can use the information mentioned above to carry out the necessary construction execution planning.

The technical documentation for the delivered Flomar® plant equipment for the plant operation will be produced on basis of the German “Maschinenrichtlinie 2006/42/EG” and consist of the following partitions:

* Technical operation manual consisting of
  + Safety instructions
  + Listing of the basic data provided by the Client (hydraulic and chemical loading)
  + Process description
  + Commissioning instructions
  + Description of the operation under standard conditions
  + Instructions of the shutdown procedure
  + List of measurement devices, actuators and motors
  + Maintenance instructions
  + Parts lists and spare parts lists
* P + I flow chart (in AutoCAD)
* Layout (in AutoCAD)
* Circuit diagram according to DIN 40719 Part 3 subdivided into power, control and regulation (in WSCAD) parts
* Cable list (in WSCAD)
* Terminal diagram (in WSCAD)
* Operating instructions and manufacturers specifications for the units used
* Declaration of incorporation or declaration of conformity and CE-labelling
* Fixing of the hazardous areas as well as of applicable norms and guidelines
* Limits of the plant as the result of the risk evaluation according to DIN EN ISO

12100:2011-03

The Documentation will be delivered in English and, if available from the manufacturer of the equipment, in the language of the country where the equipment is installed.

Remark:

The Risk Assessment for workplaces, working- and manufacturing processes, operational procedures and working hours became national law based on an EU framework directive for occupational health and safety. The Risk Assessment is a duty of the employer and it is not limited to the scope of this proposal. Within the Risk Assessment it is to be evaluated if an explosion sensible atmosphere can be safely avoided and if not a document for explosion protection has to be developed. MWS is capable to execute these works upon separate agreement or can recommend a specialized Engineer to do so.

## 2.5 Work to be carried out by the client and limits of supply

In order to implement the Flomar® concept, the client must carry out work and supply items which are not contained in the MWS quotation.

Essentially, these are

* Construction above and below ground and steel construction such as concrete tanks, inc. covering, coating, openings, pipe penetrations, insulation and freeze protection, etc. if necessary, buildings with building services (HVAC, low-voltage distribution board, lighting and water supply), platforms and stairs, landings and gangways, pipe and cable bridges etc.
* Infrastructure (power, water, telephone, roadways, exterior installations and outside lights, etc.)
* Piping, fittings, armatures and cables
* Resources (power, water, chemicals, compressed air supply and activated carbon etc.) and activated seed sludge for commissioning and operation
* Permits, expertises (e.g. construction ground study, etc.) and fees

Our quotation is based on the following battery limits:

* Waste water inlet: collecting tank
* Waste water outlet: Final monitoring near DAF outlet
* Sludge management after sludge pump is not in scope
* Power line to EC control cabinet
* 1 Internet connection cable to EC control cabinet
* Residual substances to containers provided by the client
* Drinking water 1 m inside hall
* Compressed air 6 bar: 1 m inside hall
* Other items: 1 m inside hall or
* Upper edge of concrete foundation, concrete base

We are sure that offer is fully in compliance with your expectations and remain with best regards.

Sincerely yours,

**CORE MIND WATER STATIONS MAINTENANCE & CONTRRACTING L.L.C**

*\* This document has been electronically generated and does not require any signature \**