Specification number 04044-MEC-14.31-GEN-2.01 for the supply of the MIXER SYSTEMS FOR ANAEROBIC DIGESTERS

version 2.01

1. General

The Ashdod domestic sewage treatment plant is based on primary clarifiers followed by an activated-sludge process.

Primary sludge from the primary clarifiers and secondary sludge is further treated in two anaerobic digesters. The current design utilizes gas mixing. This specification calls for converting the gas system to a jet mixing system. The proposed system for mixing the sludge shall be based on an in-basin jet mixer.

The current mixing system is equipped with four pumps and a jet system manufactured by Vaughan (Rotamix). This specification requests the additional equipment for anaerobic digester #3, which shall also be sourced from Vaughan (Rotamix) to ensure consistency

This specification details the specification for a mixing system for the anaerobic digester #3.

The mixing system shall be comprised of a combination of mixing pumps and mixing nozzles.

The nozzles shall be designed to produce a rotational mixing pattern within the tank, while also producing flow across the middle portion of the tank thereby preventing solids from migrating towards the center. Solids shall be effectively drafted by the nozzle discharge to the outer 30 percent of the tank where the peripheral rotation shall create a homogeneous state throughout the entire process suspending both organic and inorganic solids. The mixing pattern shall effectively prevent mounding in the center of the process and shall mix floatables such as scum and foam into the bulk liquid. The equipment manufacturer shall be responsible for determining mixing assembly quantity, location, and appropriate nozzle angles, and shall provide recommendations on mixing pipe support locations inside of the digesters.

The mixing system shall be designed to allow the development of perfect mixing conditions inside the anaerobic digesters. The time required for development of perfect mixing conditions inside the tanks from the start of operation of the aeration/mixing system shall not exceed 10 minutes.

The difference between the concentration of the suspended solids at any two sampling points inside the digesters under conditions of mixing shall not exceed 10% under varying conditions – see testing procedure below.

The water level within the digester shall be 14.00 meters.

The mixing system pumps shall be specifically designed to pump sludge at heavy consistencies (3 percent to 6 percent typical). Materials shall be macerated and conditioned by the pump as an integral part of the pumping action. The pump shall be able to chop through and pump high concentrations of solids such as plastics, heavy rags, grease and hair balls, wood, paper products and stringy materials without plugging, both in tests and field applications.

The equipment provided shall consider the digester design as seen in drawing 04044_14.3_PID_GEN-075_01.

Quantity	:	1 (one) complete system
Location/position for jet mixing	:	jet equipment in digester, recirculation pump in separate room

Medium:

-	type		:	anaerobic sludge
-	temperature min./max.	°C	:	20 - 45
-	pH		:	5 - 8
-	density	kg/m^3	:	1,050
-	solids			
	average	gr/m3	:	up to 25,000
	max	gr/m3	:	up to 45,000
-	dissolved oxygen	gr/m3	:	0
-	oxidation/reduction value	mV	:	-300 to -500 (anaerobic conditions)
-	chlorides content	gr/m3	:	up to 300
-	TDS	gr/m3	:	up to 1,500

Site conditions:

-	ambient temperature min/max.	°C	:	5 / 45
-	area classification for in basin equipment		:	explosion proof as required in the NFPA 820 Class 1, division 1, group D
-	humidity	%	:	up to 85
-	sandstorm		:	not applicable
-	site elevation		:	30 m above sea level
-	site location		:	approx. 3.3 km from the Mediterranean Sea

Anaerobic digester #2 dimensions – see drawings:

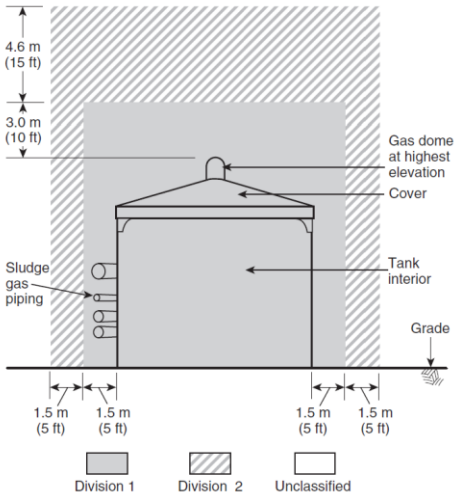
-	number		:	1
-	volume each tank	m^3	:	5,400
-	Inner height	m	:	15.00
-	Water height	m	:	13.00
-	Internal diameter	m	:	23.00
-	Slope of internal floor		:	flat

2. General

Requirements:

- The guaranteed minimum mixing velocity shall be 0.17 m/sec.
- The turnover rate shall be at least 5 per hour.
- The complete mixer system shall operate without overload on any component at any point along the entire full speed operating curve.
- The mixer system shall adhere the explosion proof requirements around the anaerobic digester as required by NFPA-820-16 -for clarity see figure 1 below. As for equipment installed outside this area, confer to the NFPA-820-16 requirements.

Figure 1: Anaerobic Digester with Fixed or Floating Cover Above Grade Not Enclosed in a Building – from NFPA 820-16



- Mixers shall be furnished with motors sized to operate continuously at the power requirement for every condition even though the power requirements at the rated condition may be less
- Efficient, reliable and trouble free to operate
- Mixer shall be capable of operating at variable water heights from 13 to 14.4-meter depth
- Quiet in operation and free from vibration – see specifications below

Scope of supply:
- One (1) tank mixing assemblies
- Two (2) foam buster assemblies
- Four (4) recycle chopper pumps with drive units
- Four (4) Base frames for chopper pumps
- 15 m electrical cables ending on the platform in a terminal box
- all parts required for on-site erection, ready for operation, including lubricants
- additional requirements as described
- all fastening accessories – screws, anchor bolts etc
- sampling probe module with retractable probes
- All documentation including but not limited to, shop drawings for installation, O&M manuals, installation manuals etc.
- Project engineering including submittal preparation, design drawings, reviewing the contractors detailed design in applying the manufacturer's equipment, preparing the FAT and SAT tests etc.
- Preparing and allocating all necessary resources for conducting a full FAT procedure in accordance with these specifications witnessed test by client and the manufacturer at the manufacturer's factory site.
- On-site supervision by a qualified representative of the manufacturer of the installation
- Providing approval that the equipment has been installed by the contractor in full accordance with the manufacturer's specific instructions.
- The presence of the manufacturer's or approved representative technician during the specific equipment performance test at the Ashdod WWTP as required by this specification.
- The presence of the manufacturer's or approved representative technician during the initial clean water commissioning at the Ashdod WWTP as required by this specification.
- The presence of the manufacturer's technician or approved representative during the initial wastewater

water commissioning at the -Ashdod WWTP as required by this specification.
- The presence of the manufacturer's technician or approved representative 45 days after initial operation with wastewater for operation evaluation of the system.
- The presence of the manufacturer's technician at the Ashdod site in case of a substantial malfunction as required by this specification.
- On-site training by the manufacturer's technician or approved representative

3. In Basin Equipment

3.1 General

One tank mixing system and two foam-buster assembly system shall be provided for the digester.

Manufacturer : Vaughan (Rotamix)

3.2 Tank mixing system

The tank mixing system shall be configured as four (4) double floor mounted assemblies (total of 8 mixing nozzles per tank) receiving a total recirculation flow of at least 360 m3/hr.

Recirculation flow	m3/hr.	:	at least 636
Number of floor assemblies'	units	:	4
Number of nozzles per floor assembly		:	2
Total number of nozzles per digester		:	8
Materials of construction:			
- Assemblies		:	glass lined with hardness of Rockwell 73C
- Nozzles		:	cast ductile iron, 1.0-inch nominal wall thickness.

In addition, zinc anodes prevent galvanic corrosion shall be provided. The exterior of the mixing equipment shall be SSPC-SP5 sandblasted, finished with 3M™ Scotchkote™ 134 Fusion Bonded Epoxy. Ten-year non-prorated warranty for nozzle assembly components.

3.3 Foam-buster assembly

The foam-buster assembly piping shall extend up along the inside wall up to a location 0.3-0.6 m above the top water level, while receiving a portion of the flow noted above. The foam-buster may run continuously and include valving for operation as needed. The number of foam busters shall be three (3). Each foam buster shall receive 115 m3/hr. Foam buster piping will extend up along the wall to a location approximately 0.5-1m above the surface and create an evenly dispersed spray pattern of droplets across the surface. Assemblies are glass lined with hardness of Rockwell 73C. Nozzle is cast ductile iron with 1.0-inch nominal wall thickness. Deflector is hardened CD4MCu SS. Exterior (non-SS) parts are SSPC-SP5 sandblasted and finished with 3M™ scotchkote™ 134 Fusion Bonded Epoxy. Ten-year non-prorated warranty for nozzle assembly components.

3.4 Chopper pumps

3.4.1 General

Requirements:

- The chopper pump shall be supplied by the manufacturer of the tank mixing system.
- The complete pumping unit shall operate without overload on any component at any point along the pumps entire full speed operating curve.
- Pumps shall be furnished with motors sized to operate continuously at the power requirement for every condition even though the power requirements at the rated condition may be less
- The chopper pump shall be specifically designed to pump waste solids at heavy consistencies without plugging or dewatering of the solids. Materials shall be chopped/macerated and conditioned by the pump as an integral part of the pumping action
- Efficient, reliable and trouble free to operate
- Require a client representative witnessed Factory Acceptance Test in accordance with the ISO 9906 second edition May 1, 2012, Rotodynamic pumps — Hydraulic performance acceptance tests — Grades 1, 2 and 3– hydraulic performance, hydrostatic pressure mechanical and electrical acceptance tests.
- Quiet in operation and free from vibration
- Adequately designed to assume a rigid support of the impeller and to rotate without whip, vibration or undue deflection at all operating speeds and under all operating conditions

3.4.2 Pump – for the mixing system

Manufacturer		:	Vaughan or approved equivalent by the Clients Designer
Type		:	horizontal, end-suction, heavy duty, solids handling, non-clogging, chopper
Number of units:		:	three (3)
Guaranteed Duty Point			
Flow	m^3/hr	:	636
Head	meter	:	10
Minimum combined efficiency	%	:	70
Permissible fluctuations of testing equipment		:	grade 1
Pump acceptance tolerance band		:	1U
Volute type		:	open
Discharge Flange	inch	:	6

3.4.3 Pump – for the foam busters

Manufacturer		:	Vaughan or approved equivalent by the Clients Designer
Type		:	horizontal, end-suction, heavy duty, solids handling, non-clogging, chopper
Number of units:		:	one (1)
Guaranteed Duty Point			
Flow	m^3/hr	:	320
Head	meter	:	10
Minimum combined efficiency	%	:	70
Permissible fluctuations of testing equipment		:	grade 1

Pump acceptance tolerance band		:	1U
Volute type		:	open
Discharge Flange	inch	:	6

3.4.4 Motors for pumps

Principle		:	electric motor, direct coupled to the pump
Motor type		:	squirrel type rotor inductive
Power supply	V/Hz	:	3 x 400 / 50
Motor efficiency standard		:	IE3
Starting method and control		:	frequency converter
Frequency at max. capacity	Hz	:	50
Frequency at min. capacity	Hz	:	30
Rated speed (max.)	rpm	:	no more than 1500
Pole		:	4
Operating mode		:	S1 – continuous
Lifetime bearings (L_{10h} according to ISO)	h	:	≥ 50,000
Cooling method		:	air fan
Lubrication		:	oil bath
Insulation class		:	H
Protection class		:	IP56

3.4.5 Materials

-	Impeller	:	cast alloy steel heat treated to minimum Rockwell C 60
-	Cutter Bar Plate	:	cast alloy steel or alloy steel heat-treated to minimum Rockwell C 60
-	Cutter Nut	:	cast alloy steel heat treated to minimum Rockwell C 60
-	Upper Cutter	:	cast alloy steel heat treated to minimum Rockwell C 60
-	Pump Shafting	:	heat treated alloy steel
-	Mechanical Seal system specifically designed to require no seal flush	:	Viton O-rings and silicon carbide faces

4. Protective coatings

All Stainless-steel components shall undergo a complete passivation - by immersion process. No spray treatment or painting shall be allowed. The internal process shall be documented.

All carbon steel surfaces shall be coated except for stainless steel surfaces.

Welding details between parts shall be conducted in accordance with best practices as outlined in chapter 5.5 “Geometric Considerations” given in Design of Municipal Wastewater Treatment Plants – Manual of Practice #8 fifth edition.

All welds shall be cleaned before passivation.

No field welds shall be allowed.

Any ferrous metal surfaces that are not SS shall be coated. The coatings shall be completely shop applied (no field finishing) and shall be verified by the following ISO standards tests or any other equivalent standard approved by the client:

-	Painting layers adhesion	:	ISO 2409:2007 – Cross cut test ISO 4624:2016 – Pull of test for adhesion
-	Preparation of steels before painting	:	ISO 8501-1:2007 - preparation of steel substrates before application of paints and related products - Visual assessment of surface cleanliness ISO 8503-1:2012 - Preparation of steel substrates before application of paints and related products - Surface ISO 8503-1- 5:2012 - Preparation of steel substrates Before application of paints and related products – surface roughness characteristics of blast-cleaned steel substrates

5. Fastening materials

Flanges		:	DIN
Bolts			
-	Thread type	:	M
-	Bolt head type	:	Hex
-	Identification	:	in accordance with ISO 3506-1
-	Length	:	thread shall protrude at least 2 thread pitches and no more than three thread pitches.
-	Material	:	SS316L
Nuts			
-	Style of nuts	:	Hex
-	Identification	:	in accordance with ISO 3506-2
-	Material	:	SS316
Washers - material		:	SS316
Spring washers - material		:	SS316

6. Nameplates

- a stainless steel 316 identification nameplate shall be fixed to the equipment.
- all information provided shall be engraved (not printed)
- the nameplate shall include the following information:

    - Manufacturer's name
    - Model number
    - Serial number
    - Tag number from P&ID
    - Date of manufacture
    - Power supply

- Protection rating
- Amperage
- Speed
- Rated capacity
- All other pertinent data

- motor data shall include in addition:

  - Number of poles
  - Electrical connection
  - Efficiency
  - Isolation class
  - Service factor

7. Spare parts

Spare parts to be supplied within the scope of supply shall adhere to the following:

- All spare parts shall be identical and interchangeable with the original parts.
- All spare parts shall be properly packed and clearly labelled separately and packed in containers.
- Each container will be labelled showing the contents of the container.
- Suitable provisions shall be made to protect the spare parts against corrosion.

8. Submittals

To obtain approval from the Client's Designer, submittal documents shall be prepared. The submittal shall provide standard documentation for easy reference. Submittals that are not in accordance with this requirement will be automatically disqualified. All submitted documents shall be in English only.

Document 1: First page:

a. Equipment Name
b. Tag number (or numbers) in accordance with the P&ID drawings
c. Manufacturer's name
d. Model Number
e. Equipment country of origin
f. Supplier's signature
g. Contractor's signature
h. Date
i. Version number

Document 2: Signed documents by manufacturer - Tender specification, the relevant P&ID and the specific drawings that pertain to the specific equipment shall be signed on each page by the manufacturer and the local certified supplier stating that the proposed equipment is in full compliance with all the tender and this specification requirements.

Document 3: Technical data - Technical data that verifies full compliance with this specification. The data shall be submitted in the following manner, and shall include (but not limited to) the following:

- **Document 3A**: technical data sheets, including the manufacturer's technical offer

- **Document 3B**: electrical wiring drawings, control configuration, proposed software, proposed communications protocol, power requirements, electrical standards adopted, etc.
- **Document 3C**: brochures,
- **Document 3D**: performance curves and calculations
- **Document 3E**: drawings of proposed equipment (detailing dimensions and proposed installation),
- **Document 3F**: standard installation manual and O&M manuals.

Document 4: Bill of Materials – A Bill of Materials of all components to be supplied. The bill of materials shall be provided in a table format as detailed below:

No.	Name of component	Weight Static/dynamic/wet [kg]	Sub-component	Sub-component manufacturer's part number	Required sub-component material of construction in tender documents	Proposed sub-component material of construction	Quantity
1	TTTTTTTT	XXX/YYY/ZZZ	AAAAAA	GGG-HHH-FFF	JJJJJJ	SSSSSS	
			BBBBBB	GGG-HHH-FFF	JJJJJJ	SSSSSS	
			CCCCCC	GGG-HHH-FFF	JJJJJJ	SSSSSS	
			DDDDDD	GGG-HHH-FFF	JJJJJJ	SSSSSS	
			FFFFFFF	GGG-HHH-FFF	JJJJJJ	SSSSSS	
			GGGGGG	GGG-HHH-FFF	JJJJJJ	SSSSSS	

Note: Capitalized letters are to be replaced by actual information

If the submittal is not accepted, the contractor shall revise the submittal in accordance with the Client's/Client's designer's remarks.

The resubmittal shall include the entire submittal package, and all changes shall be marked (using "Track Changes"). The re-submittal shall be designated with an updated revision number.

Revised submittals that are not marked and with updated revision numbers shall not be checked and shall be handed back to the contractor and shall not be approved.

The contractor must use the approved submittal as the official document for procurement.

9. Factory Acceptance Test

For this equipment no client's witness factory acceptance test is required.

After complete manufacturing of the system the manufacturer shall notify the client that the entire scope of equipment supply has been completed and is ready for the factory acceptance test.

Sixty (60) days prior to the internal pump testing , the supplier shall send the following:

Updated submittal documents (1 through 4) as required above in a final version, stamped with “final version”, with no marked changes on it.

Document 5: Certified installation drawings – certified final drawings of the equipment including dimension prints detailing equipment dimensions, installation details including but not limited to all required anchor bolt locations, weights, grove locations, openings, access areas and channel connection details etc. All drawings will be also provided in electronic files – CAD 2025 format. The electronic file drawings shall be both in 2D and 3D.

Document 6: Electrical drawings – The following technical data shall be provided:

- **Document 6A:** Complete wiring diagrams for the all the components supplied,
- **Document 6B:** Complete P&ID drawings of the equipment including the required control diagrams
- **Document 6C:** Control Narrative for Process Control
- **Document 6D:** Complete I/O lists and other process related information
- **Document 6E:** Detailed communication tables. These communication tables shall include but not limited to addresses and data for all types of events, motor status, instrumentation information, valve positions, motor speeds, power consumption, input and output discrete and analog raw data.

Document 7: Manufacturer's recommended procedures for jobsite storage and handling of equipment.

Document 8: Dedicated Installation, Operation and Maintenance Manuals: Prior to delivery of equipment and updated as required during installation of the equipment, the manufacturer shall furnish complete and detailed installation, operation and maintenance manuals which shall include the following information as a minimum requirement:

1) A description of each equipment and item, normal operating characteristics and limiting conditions including but not limited to performance curves, engineering data etc.
2) Assembly, installation and adjustment instructions.
3) Electrical diagrams, control philosophy and shop drawings for installation
4) Complete descriptive literature of all materials and components furnished.
5) Erection drawings with equipment mark numbers
6) Guide for trouble shooting with easy to read tables and charts
7) Lifting instructions
8) Field test protocols in line with the specification tests
9) Start-up instructions
10) Operating instructions
11) Routine maintenance and preventive maintenance schedule instructions
12) Control software documentation
13) Malfunction detection instructions
14) Safety instructions
15) Spare parts list and ordering procedure, including recommended quantities of spare parts to be stored onsite.

Document 9: Complete part list of the equipment to be tested. This shall be identical to what is required to be supplied by the manufacturer.

Document 10: Copy of the internal quality acceptance tests to be performed by the manufacturer

Document 11: Written approval of the supplier that the equipment fully complies with all that required in the tender specifications and has passed all internal quality acceptance.

The internal acceptance test shall proceed only after the documentation has been approved by the Client and the Client's Designer.

9.1 ISO 9906:2012 - Hydraulic Performance Acceptance Test

This pump test, as aforementioned above, shall be conducted at the manufacturers testing facilities on each pump and to verify the initial performance of new pumps as well as checking for repeatability of test results.

Testing procedures shall be in full accordance with the ISO 9906 second edition May 1, 2012, standard.

All random fluctuations of the testing equipment shall be in accordance with table 3 ISO 9906 second edition May 1, 2012, standard – grade 1. Maximum permissible measurement device uncertainty at guaranteed point shall be in accordance with table 5 – grade 1 (see ISO 9906 second edition May 1, 2012, standard). The overall measuring uncertainty shall be in accordance with table 6 – grade 1 (ISO 9906 second edition May 1, 2012, standard) and overall uncertainties of efficiency shall be in accordance with table 7 – grade 1 (ISO 9906 second edition May 1, 2012, standard). Test results that are based equipment that does not achieve these gradings and levels shall be disqualified.

Pump performance test acceptance grade shall be 1U as stated in table 8 (see ISO 9906 second edition May 1, 2012, standard) and given below:

Maximum tolerance allowed during the Factory Acceptance Tests

Parameter	**Tolerance**
Rate of flow	0 to +10%
Total head	0 to +6%
Minimum efficiency	≥0%

Note: all tolerances are percentages of values guaranteed.

The test results shall be evaluated to the extent possible while the tests are in progress so that questionable measurements can be re-evaluated.

After completion of the acceptance test, full report by a certified engineer (and signed by the manufacturer) shall be prepared by the pump manufacturer. This report shall record all the necessary information on the procedure and the results of the test as detailed in Annex F ISO 9906 second edition May 1, 2012, standard

Positive acceptance – All the pumps must pass the following tests: visual inspection, ISO 9906 second edition May 1, 2012, standard Hydraulic Performance Acceptance Test with the clarifications given in this specification, ISO 2151, and verification of the 5 operating points as detailed.

Negative acceptance - if after a second set of witness tests show non-compliance the entire scope of supply shall be annulled.

10. Site Acceptance Tests (SAT)

10.1 General

The site acceptance tests shall include:

a. Conducting and approved completion of the dry-running tests
b. Conducting and approved completion of specific equipment performance tests
c. Conducting and approved completion of clean water tests
d. Conducting and approved completion of wastewater tests

10.1 Dry-running tests

Dry-running tests shall only be performed on equipment that allows dry-running, such as electric boards, blowers, some instruments, etc.

Complete I/O tests shall be conducted, and simulation of the process will be accomplished.

No dry-running tests may be performed on equipment that must be operated with water, such as pumps, etc.

The supplier shall provide the client, manufacturers written approval that supplied equipment is in accordance with the manufacturer's instructions.

The supplier shall provide calibration documents the equipment has been calibrated.

10.2 Specific Equipment Performance Tests

The specific performance tests shall be carried out along the complete designed operating range of each specific piece of equipment.

The performance tests shall be carried out in the presence of both the client's representative and the supplier's authorized representative.

The duration time of the performance tests shall be in accordance with the manufacturer's specific written instructions. At the end of each performance test the manufacturer's representative shall sign a document stating the equipment have been installed in according to the manufacturer's recommendations, the equipment has passed all performance tests for the specific equipment and that the equipment is entitled to have the extended warranty as required by the tender.

The tests required include:

- All pipework, flanges, and fittings are installed in accordance with the P&IDs
- All bolted connections are fully tightened to the correct torque
- All welds have been completed, and any radiographic or ultrasonic examination records are available
- All temporary construction blanks, spades, and test plugs have been removed (or are documented as intentionally in place)
- All pressure relief and safety devices are installed correctly and set to the correct values
- All instruments, transmitters, and analysers are installed and connected
- All gas detection equipment is installed and calibrated

- Earthing and bonding of all pipework, vessels, and equipment has been completed and tested
- All hazardous area equipment is certified ATEX/IECEx and records are available

10.3 Clean Water Tests

Prior to operating the entire wastewater treatment with clean water for a 10-day period, the following documentation from the manufacturer shall be provided:

- Complete equipment submittals – Documents 1 through 11F – in 5 copies in colour prints and in electronic file – PDF, DWG and WORD files
- Written approval from the manufacturer that the equipment is ready for operation

After successfully commissioning with clean water, the supplier will notify the client that the plant is ready for the clean water site acceptance test.

During the clean water site acceptance test period, the wastewater treatment plant shall be operated by recycling clean water (reclaimed effluent with a TSS concentration of no more than 10 mg/l).

During this period, the equipment shall be operated for the entire 10-day period without substantial malfunctions as defined as:

- The equipment has been inoperable for a period of more than 24 hours and requires a qualified technician from the manufacturer/supplier to mitigate the problem.

- The equipment has been inoperable for more than 3 times and required a qualified technician from the manufacturer/supplier to mitigate the problem regardless of the down-time period.

- The accumulative down-time for all types of malfunctions (with or without the assistance of a qualified technician of the manufacturer or supplier) shall be no more than 36 hours.

The supplier's representative and client shall be present during the clean water tests, and they shall both sign off on the raw test data to certify that the test is performed satisfactorily.

If the mixers malfunctions (with-in the allowed tolerance as stated above), the supplier shall replace the mixer and provide a new mixer that meets the above standard.

10.4 Wastewater (Sludge) Tests

Operating the plant with wastewater shall not commence until the clean water tests have been completed and approved.

After successfully commissioning with wastewater, the supplier will notify the client that the plant is ready for the wastewater site acceptance test using sludge.

A manufacturer's technician or authorised local representative must be present within three days of starting the "Wastewater Tests." If they arrive later, the test period will begin only upon their arrival.

The equipment shall operate during the 30-day “Wastewater Test” with no substantial equipment malfunctions due to defects in design, workmanship, material of the equipment and installation. A substantial equipment malfunction is defined as:

- The equipment has been inoperable for a period of more than 24 hours and requires a qualified technician from the manufacturer/supplier to mitigate the problem.

- The equipment has been inoperable for more than 3 times and required a qualified technician from the manufacturer/supplier to mitigate the problem regardless of the down-time period.

- The accumulative down-time for all types of malfunctions (with or without the assistance of a qualified technician of the manufacturer or supplier) shall be no more than 36 hours.

In addition, the Site Acceptance Test (SAT) shall include measurement of the guaranteed mixing capacity, demonstrated by achieving a uniform Total Suspended Solids (TSS) concentration at any two sampling points within the digester (refer to the testing procedure below). This test shall be conducted during actual plant operation with raw wastewater influent.

Both the supplier's representative and the client's representative shall be present during the Site Acceptance Test. Upon completion, both parties shall sign off on the raw test data to certify that the test has been performed satisfactorily and that the guaranteed mixing capacity has been achieved.

The following test procedure for the verifying uniform suspended solids concentration test shall be conducted at each of the 2 tanks for the mixers (all mixers) shall be site tested:

1. The water depth in all the tanks shall be 13.00 meter
2. All the mixers shall be shut off and the liquid shall be let to settle for three hours.
3. All the mixers within the anaerobic digester shall be turned on.
4. After 10 minutes of mixer operation, an independent mutually agreed upon certified sampler shall sample mixed liquor at the following points as defined:
    a. Sample point A – 2.0 meters above the floor bottom
    b. Sample point B – 13.0 meters from the floor bottom

5. All samples shall be tested for suspended solids concentration (in accordance with standard method 2540B total solids dried at 103-105C – latest edition) by an independent third party mutually agreed upon laboratory.
6. This test shall be conducted 5 times.
7. All tests shall show that the suspended solids concentration between the two sampling points is less than 10%.

Should a substantial malfunction occur, the clean test period will be reset. In all cases, the manufacturer's local representative is required to arrive on site within 6 hours of the incident during standard weekday working hours, and within 24 hours during weekends or outside of regular work hours.

A senior manufacturers engineer (together with the local supplier’s technician) shall be present at the Ashdod WWTP site in the following circumstances:

a. **Scenario A** - The contractor has not been capable of passing the 30 day wastewater test within 80 days.
b. **Scenario B** – A serious event has occurred where the new screen causes an issue that leads to a cascade of malfunctions, resulting in the existing anaerobic digester to fail. In such circumstances, the entire plant would be affected.

In Scenario A, a senior manufacturer's engineer will arrive on site within one month.

In Scenario B, a local technician will arrive within 4 hours, while the manufacturer's senior engineer is expected on-site within one week of the incident.

The contractor shall be fully responsible for all expenses associated with the manufacturer's senior personnel (including work, travel, accommodations, etc.), as well as costs related to local technical representatives, testing, tasks, and any other necessary expenditures required to address malfunctions and equipment non-compliance issues.

Positive acceptance – pass the 30-day test with no substantial equipment malfunction.

Negative acceptance - if after 120 days the equipment does not pass the Wastewater Tests the entire equipment package shall be considered non-compliant as defined in the contract.

11. Warranty

The mixer package provided under this Specification will carry a warranty for **one (1) year, starting from the date the equipment passes the wastewater acceptance test.**

The manufacturer shall provide the client the manufacturer's warranty made in favour of the client, that the equipment supplied shall be warranted by the manufacturer to be free from defects in design, workmanship, and material for the duration of the Manufacturers warrantee period.

The manufacturer shall provide specific instructions on how to store the equipment until installation and from installation until continuous operation. The manufacturer's representative shall from time to time visit the storage facilities and update project management on the storage conditions. If the manufacturer's representative sees that the storage conditions are not satisfactory, due notice must be given promptly.

Equipment shall be tested in accordance with the manufacturer's instructions. The manufacturer shall provide documentation approving the installation and operation of the equipment.

If any part of the equipment supplied under this Specification should fail during the warranty period, the defective part shall be replaced immediately at the manufacturers' expense. All work associated with fixing the equipment will also be borne by the manufacturer. If for any reason the same equipment breaks down consecutively with the same malfunction, the manufacturer's technician shall provide a site visit for evaluation on the manufacturers' expense. If the equipment continues to malfunction (over a period of 5 months) the manufacturer shall replace the entire package at the manufacturers expense. If the malfunction continues to other units as well, the manufacturer shall replace all the packages in their entirety on the manufacturers expense. If despite all the replacements, the system continues to malfunction, the manufacturer shall rebate the client the complete cost of the system and pay all damages as a result of the equipment failure.

In addition, the manufacturer shall guarantee the following:

1. The equipment that is offered is represented in Israel and technical assistance shall be given locally for a period of at least 7 years.
2. The equipment manufacturer shall guarantee the availability of spare parts for 7 years from the day of commissioning.