Specification number 04044-MEC-6-GEN-1 for the supply of the MIXERS FOR SELECTOR and RECIRCULATION PUMP M-4-01A, M-4-01B, M-4-01C, M-4-01D and M-4-01

version 2.01

1. General

The Ashdod sewage treatment plant uses an activated-sludge Carrousel 2000 process. Sludge from secondary clarifiers is recycled to selector chambers.

This specification details the specification for:

a. low speed submersible mixers for maintaining solids suspension in two tanks of the selector
b. Submerged horizontal low head pump for recycling the mixed liquor.

Both pieces of equipment must be sourced from the same manufacturer. Figures 1- 3 detail the location of the misers and pump installation.

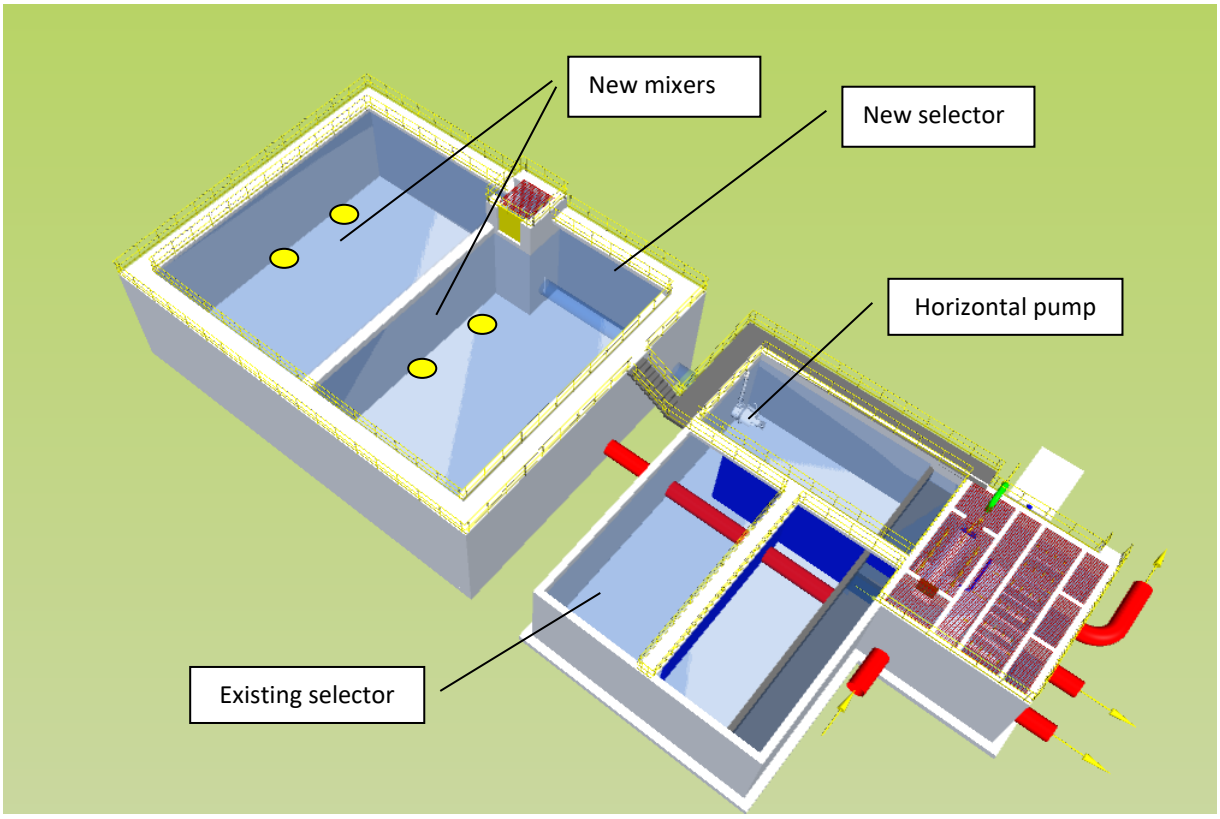

Figure number 1: Location of required horizontal pump and mixers.

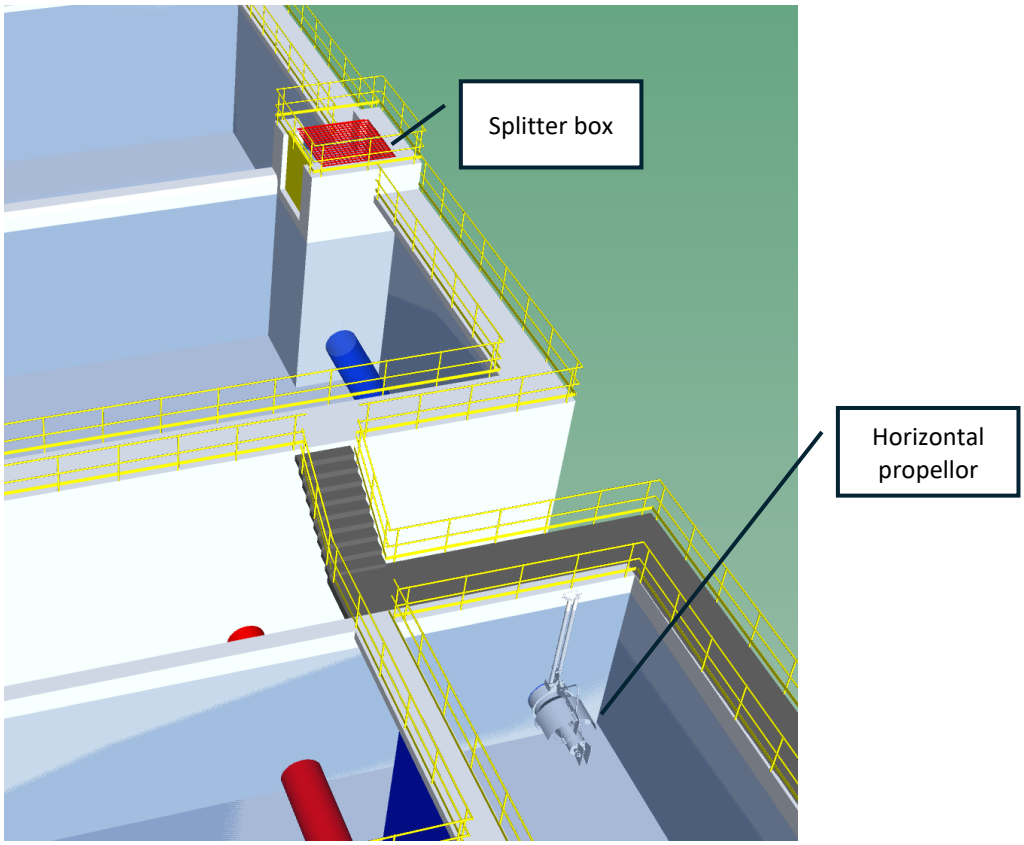

Figure number 2: New pumping station from existing selector to new selector

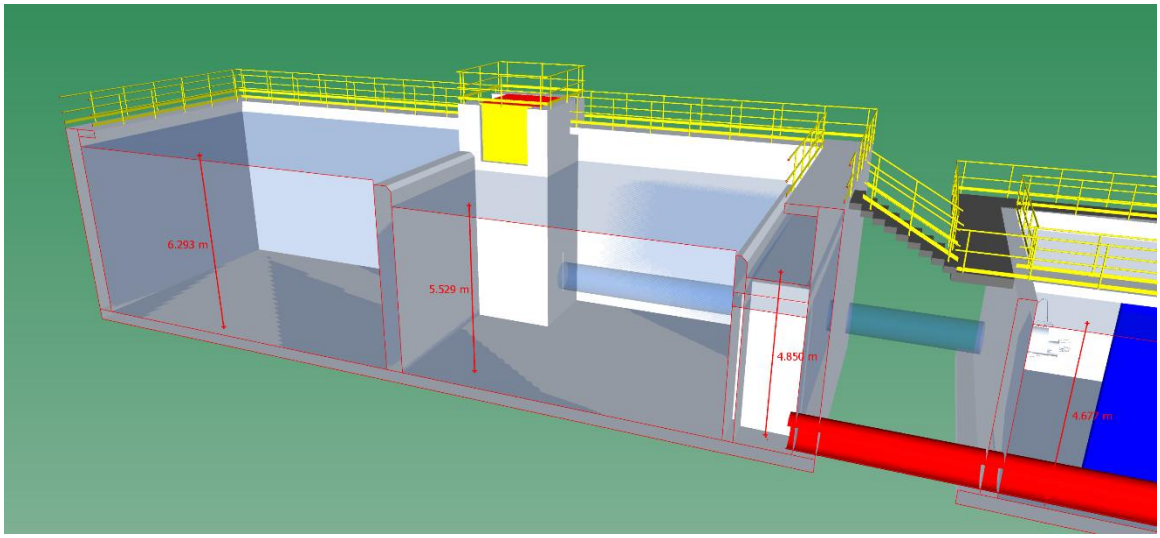

Figure number 3: Hydraulic profile in the new selector at peak flows

The mixing system shall be designed to allow the development of perfect mixing conditions inside the tanks of the biological reactors. 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 tanks under conditions of mixing shall not exceed 10% under varying conditions – see testing procedure below.

The equipment shall be suitable for operation in wastewater treatment installations under harsh conditions both for continuous long-term operation and for intermittent operation. The system shall be designed for maintenance free (except for routine maintenance, long life at 24-hour per day operation.

See P&ID drawing for details 04044_4.0_PID_GEN-068_01

Quantity of mixers		:	4
Quantity of pumps		:	1
Location/position		:	new selector tanks
Medium:			
- type		:	mixed liquor
- temperature min./max.	°C	:	17 - 35
- pH		:	6 - 8
- density	kg/m^3	:	1,050
- solids			
average	gr/m3	:	up to 3,000
max	gr/m3	:	up to 10,000
- dissolved oxygen	gr/m3	:	0
- oxidation/reduction value	mV	:	0 to -500 (anoxic to anaerobic conditions)
- chlorides content	gr/m3	:	up to 300
- TDS	gr/m3	:	up to 1,500
Site conditions:			
- location		:	outdoors
- area classification		:	non-explosive
- ambient temperature min/max.	°C	:	5 / 45
- humidity	%	:	approx. 85
- sandstorm		:	not applicable
- site elevation		:	30 m above sea level
- site location		:	approx. 2.0 km from the Mediterranean Sea
Tank #1 dimensions:			
- volume each tank	m^3	:	1,503
- length	m	:	19.35
- width	m	:	12.35
- water depth	m	:	constant at 6.29
Tank #2 dimensions:			
- volume each tank	m^3	:	1,322
- length	m	:	19.35
- width	m	:	12.35
- water depth	m	:	constant at 5.53

2. Previous Experience

All equipment to be supplied shall be solely made in OECD countries.

Manufacturer shall be successful in the experience of manufacture, operation, and servicing the mixer type, pump type, size, quality, performance, and reliability equal to that specified. The manufacturer shall submit evidence of experience as detailed below:

a. having supplied in OECD countries (excluding Israel), at least twenty-five (25) installations of similar type and size that have been in successful operation for at least five (5) years.
b. having supplied in Israel, at least three (3) installations of similar type and size that have been successful for at least 3 years in the last 8 years.
c. having extensive experience in approving and conducting Factory Acceptance Tests of Mixers (of the type specified) in accordance with the ISO 21630 first edition August 15, 2007 Pumps — Testing — Submersible mixers for wastewater and similar applications.

The Israeli supplier-representative shall show that the company operates a qualified service team in Israel with at least 5 qualified technicians with previous experience in servicing the proposed equipment for at least 2 years.

3. General

Requirements:

- The complete mixer unit shall operate without overload on any component at any point along the entire full speed operating curve.
- 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
- The complete pumping unit shall operate without overload on any component at any point along the pump's entire full speed operating curve.
- The 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 efficient, reliable and trouble free to operate
- A client representative shall witness the pump's Factory Acceptance Test according to the ISO 9906 second edition May 1, 2012 and a Site Acceptance Test (SAT) as detailed below.
- Efficient, reliable and trouble free to operate
- The mixer shall be capable of adjustable swinging both in the vertical and horizontal plane.
- All equipment shall be quiet in operation and free from vibration
- The design shall include a rigid support of the mixer and operation without whip, vibration or undue deflection at all operating speeds and under all operating conditions

Scope of supply:

- four mixers
- one horizontal pump
- drive units
- support poles
- hoisting equipment, including davit
- 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
- integral motor

- all fastening accessories – screws, anchor bolts etc
- PT100 sensor
- water in oil, water in motor water, in connection chamber
- 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 initial clean water commissioning at the Ashdod WWTP as required by this specification.
- The presence of the manufacturers 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

Materials:

-	propeller blades	:	SS AISI 316
-	shaft	:	SS AISI 420
-	housing	:	cat iron with protective coating
-	support	:	SS AISI 316
-	support pole	:	SS AISI 316
-	hoisting cable hooks	:	SS AISI 316
-	electric cable hooks	:	SS AISI 316
-	base plate	:	SS AISI 316
-	hoist equipment	:	SS AISI 316
-	hoisting cable	:	SS AISI 316
-	mechanical seal, inner	:	tungsten carbide or silicon carbide
-	mechanical seal, outer	:	tungsten carbide or silicon carbide

4. Mixers for the new selector

4.1 General

Manufacturer			:	Flygt or approved equivalent by the Client's Designer
Propeller:				
-	Number of blades		:	2 -3
-	Shape of blades		:	non-clogging, backward-curved leading edges
-	Total thrust per mixer	N	:	at least 650
-	Number	units	:	4 (two per tank)
-	Diameter	mm	:	no less than 400
-	Thrust/power ratio	N/KW	:	no less than 200
-	Speed	rpm	:	no more than 680

- Control : direct drive to motor – no gear

The propeller shall be horizontally and vertically swivable.

4.2 Drive unit for mixer

Principle		:	submerged electric motor, direct coupled to the propeller
Motor type		:	squirrel type rotor inductive
Power supply	V/Hz	:	3 x 400 / 50
Motor efficiency standard		:	IE3
Starting method and control		:	VFD
Rated speed (max.)	rpm	:	no more than 700
Pole		:	no less than 8
Operating mode		:	S1 – constant operation duty
Life time bearings (L_{10h} according to ISO)	h	:	more than 100,000
Lubrication		:	oil bath
Insulation class		:	H
Protection class		:	IP68
Cable support and clamps		:	the cable shall be supported and guided by a SS-cable to avoid damage to the electric cable during handling and operation

4.3 Support pole for mixer

Purpose:
- supporting the mixer unit
- supporting the hoisting equipment, including davit
- guide the mixer/pump unit when lifting / lowering
- guide the cable hooks

The mixer position (angle) to the support pole must be adjustable both in the horizontal and vertical directions.

5. Horizontal Pump

5.1 General

Manufacturer		:	Flygt, or approved equivalent by the Client's Designer
Type		:	horizontal submersible, non-clogging, propeller
Guaranteed Duty Point			
Flow	m^3/hr	:	4,800
Head	meter	:	0.8
Minimum efficiency	%	:	50
Maximum flow			
Flow	m^3/hr	:	6,000
Head	meter	:	0.5
Permissible fluctuations of testing equipment		:	grade 2 as detailed in tables 3, 5, 6, 7 in ISO 9906:2012
Number of readings required for FAT and SAT		:	minimum 6 (six)
Pump acceptance tolerance band		:	2B as detailed in table 8 in ISO 9906:2012
Volute type		:	open
Impellor type:		:	skewed

Free passage	mm	:	at least 85
Provision		:	hoisting cable of stainless steel AISI 316 of sufficient length with eyes and hooks to lift the pump out of the wet pit

5.2 Motor for Pump

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 470
Pole		:	12
Operating mode		:	S1 – continuous duty
Lifetime bearings (L_{10h} according to ISO)	h	:	≥ 50,000
Lubrication		:	oil bath
Insulation rating		:	H
Protection rating		:	IP68

5.3 Materials for Pump

-	propeller	:	SS 316
-	shaft	:	SS 316
-	casing	:	cast iron EN-GJL-250
-	connection unit	:	cast iron (EN-GJL-250)
-	motor shaft	:	SS420
-	lifting handle	:	SS316
-	O-rings	:	nitrile buna rubber
-	mechanical seal, inner	:	silicon carbide
-	mechanical seal, outer	:	silicon carbide
-	brace for giul lines	:	SS316

Hoisting equipment

Purpose	:	to enable to take the mixer/pump unit out of the water and to place it on the platform without disassembling any part of the support and/or railing; the height of the railing is 1100 mm.
Type	:	davit, constructed on top of the support pole
Structure	:	SS316

The hoisting equipment forms an integral part of the support and includes a steering handle to position the mixer/pump in the tank as well as to swing the mixer/pump onto the platform. One hoisting davit shall be provided per tank.

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

6. 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

7. 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

8. 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.

9. 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 (as required in the specification),
- **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 manufacturers 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

Document 5: Previous Experience –

- **Document 5A:** Manufacturers list of previous installations in OECD countries (not including Israel) – the list shall be in the following format:

No.	Year of installation	WWTP name	Country	Design capacity of WWTP [m3/day]	Model type of installed equipment	Contact name, telephone, e-mail
1						

- **Document 5B:** Manufacturers list of previous installations in Israel) – the list shall be in the following format:

No.	Year of installation	WWTP name	Country	Design capacity of WWTP [m3/day]	Model type of installed equipment	Contact name, telephone, e-mail
1						

- **Document 5C:** Name list of the service team in Israel – a list shall be in the following format:

No.	Name of qualified technician (first and last name)	Number for years working on equipment from the specific manufacturer	Number of years' experience	Contact name, telephone, e-mail
1				
2				
3				
4				

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.

10. Factory Acceptance Test

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 factory visit, the supplier shall send the following:

Updated submittal documents (1 through 5) as required above in a final version, stamped with "final version", with no marked changes on it.

Document 6: 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 7: Electrical drawings – The following technical data shall be provided:

- **Document 7A:** Complete wiring diagrams for the all the components supplied,
- **Document 7B:** Complete P&ID drawings of the equipment including the required control diagrams
- **Document 7C:** Control Narrative for Process Control
- **Document 7D:** Complete I/O lists and other process related information
- **Document 7E:** 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 8: Manufacturer's recommended procedures for jobsite storage and handling of equipment.

Document 9: 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 inline 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 10: Complete part list of the equipment to be tested. This shall be identical to what is required to be supplied by the manufacturer.

Document 11: Copy of the internal quality acceptance tests to be performed by the manufacturer

Document 12: 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 factory acceptance test shall proceed only after the documentation has been approved by the Client and the Client's Designer.

In case the local control panel is manufactured in Israel, the manufacturer shall conduct the FAT test with the specific equipment at manufacturer's factory with manufacturer's control panel that has identical functional hardware and software to what will be provided for the Ashdod project.

The factory acceptance test shall be witnessed by the client's representative.

The factory acceptance test shall include but not limited to:

a. Verifying that the equipment has passed the manufacturers acceptance test procedure and a report of compliance has been provides proof of this.
b. Visual inspection that the equipment is of high quality as detailed below:
    1) no damages or flaws are seen.
    2) no corrosion is seen.
    3) all critical sizes including – blade diameter, thickness, length, width conform to the specifications
    4) all materials provided are accordance with specifications this shall be conducted by proof of material tracing and using a hand held calibrated spectrometers that shall be on-site and operational during the FAT.

5) complete passivation on stainless steel components has been conducted and proper internal documentation has been provided.
6) no non-similar metals have been connected
7) all fastening equipment has been provided
8) motors plates are in accordance with specs and what has been offered
9) plastic/rubber parts are new and not cracked
10) name plate is identical to what was required

b. Client's witness in full the ISO 21630 first edition August 15, 2007 Pumps — Testing — Submersible mixers for wastewater and similar applications.
c. Validate the guaranteed thrust, electric power thrust to power ratio.
d. Show that all the protective switches are operational.

10.1 ISO 21630:2007 – Mixers - Acceptance Test

This mixer test, as aforementioned above, shall be conducted at the manufacturers testing facilities on each mixer and witnessed onsite by the client's representative to verify the initial performance of new mixers as well as checking for repeatability of test results.

Testing procedures shall be in full accordance with the ISO 21630 first edition August 15, 2007 standard.

All permissible fluctuations of readings shall be in accordance with 5.4.2.2.as stated in ISO 21630.

Number of observations per mixer (A set of observation readings consists of a reading of each of the individual variables) shall be in accordance with ISO 21630 first edition August 15, 2007 standard.

Clean "cold water" shall be 20 C. The results for the thrust, power and thrust/power ratio shall be normalized for working in the entire temperature range.

Mixer performance test acceptance grade shall be as stated in table 6 (see ISO 21630 first edition August 15, 2007 standard standard) and given below:

Maximum tolerance allowed during the Factory Acceptance Tests

Parameter	**Negative [%]**	**Positive [%]**
Thrust guaranteed N	8	-
Electric power	-	5
Thrust to power ratio	8	-

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 mixer manufacturer. This report shall record all the necessary information on the procedure and the results of the test and it shall specify the following:

1. the test data, the place of the test and the names of the supervisor and other participants;

2. the following technical data:
    a. for the compressor:
        i. the owner, site and purpose of installation, manufacturer,
        ii. the type and serial number,
        iii. the year of manufacture, and
        iv. a short technical description giving operational data, auxiliaries and their drive and any other special features (intercooling and lubricating system, etc.);
    b. for the driving unit, generally the same items specified for the compressor, but in particular those which are essential for establishing the specified performance;
3. the conditions and scope of the guarantees according to the contract;
4. the program of the procedure and diagram of the test arrangement indicating location of measuring points, instruments used and their calibration records;
5. a record of the test run together with a table of the average values of the important readings and the time they were taken. If possible, a record of the maximum and minimum readings. Copies of the log sheets and of any readouts from an automatic recorder, etc.;
6. an indication of any unscheduled occurrence which was noted during the test;
7. the formulae used for the calculation of the results, with due regard to the propagation of the mean uncertainties as they influence the final results;
8. a statement of the method used for converting the test results to specified conditions with reference to the tables and charts used; a clear definition of the reference process chosen;
9. a comparison of the actual performance with the guaranteed values or data and a statement of whether the contract values have been met or not.

Positive acceptance – All the mixers must pass the following tests: visual inspection, ISO 21630 first edition August 15, 2007 Mixer test.

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

10.2 ISO 9906:2012 -Pump - Hydraulic Performance Acceptance Test

This pump test, as aforementioned above, shall be conducted at the manufacturers testing facilities on each pump and witnessed onsite by the client's representative 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 2B 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	-8 to +8%
Total head	-5 to +5%
Minimum efficiency	-5 to +5%

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.

After completion of the factory acceptance test, a test report shall be completed by a certified engineer and signed by the mixer manufacturer. This report shall record all the necessary information on the procedure and the results of the tests. It shall specify the following:

10. Full documentation of the visual inspection as required above.

11. Documentation of the dry run tests including the test data, the place of the test and the names of the supervisor and other participants and the following technical data:
    a. for the mixer:
        i. the owner, site and purpose of installation, manufacturer,
        ii. the type and serial number,
        iii. the year of manufacture, and
        iv. a short technical description giving operational data, auxiliaries and their drive and any other specific features;
    b. for the driving unit, generally the same items specified for the mixer, but in particular those which are essential for establishing the specified performance;

    In addition, the documentation shall include:

    a. The program of the procedure and diagram of the test arrangement indicating location of measuring points, instruments used and their calibration records;

    b. a record of the test run together with a table of the average values of the important readings and the time they were taken. If possible, a record of the maximum and minimum readings. Copies of the log

sheets and of any readouts from an automatic recorder etc;

c. An indication of any unscheduled occurrence which was noted during the test;

d. A comparison of the actual performance with the guaranteed values or data and a statement of whether the contract values have been met or not.

Positive acceptance – All the mixers must pass the above-mentioned tests

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

11. Site Acceptance Tests (SAT)

11.1 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
Conducting and approved completion of wastewater tests

11.1 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.

11.2 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.

11.3 Clean Water Tests

Prior to operating the entire wastewater treatment with clean water for a 30-day period, the following documentation from the manufacturer shall be provided:

- Complete equipment submittals – Documents 1 through 12 – 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 new selector shall be operated by maintaining the new selector with clean water (defined as either tap water or reclaimed effluent with a TSS concentration of no more than 10 mg/l).

The manufacturer's technician or an authorised local technical representative must be present at the initial clean water commissioning at the Ashdod WWTP during testing, and shall provide written certification confirming that the equipment is functioning in full compliance with the manufacturer's instructions.

The equipment shall operate during the 30-day "Clean Water Tests" 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 the event of a significant malfunction, the clean test period will be restarted.

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 selector causes an issue that leads to a cascade of malfunctions, resulting in the existing selector to also fail. In such circumstances, the entire wastewater treatment 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 cost for the manufacturer's senior, all local technical representatives and all related tests and works done shall be solely borne by the contractor.

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

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

The plant shall operate during the 30-day wastewater test with no substantial equipment malfunctions. A substantial equipment malfunction is defined as above.

In addition, the wastewater tests shall include testing the guaranteed mixing capacity (achieving a uniform total suspended solids concentration at any two sampling points – see testing procedure below) at site during the actual operation of the plant with raw wastewater influent. The supplier's representative and client shall be present during the site acceptance test and they shall both sign off on the raw test data to certify that the test is performed satisfactorily.

The following test procedure for the verifying uniform suspended solids concentration test shall be conducted at each of the 6 tanks for the mixers (all mixers shall be tested):

1. The water depth in all the tanks shall be 6.00 meter
2. The mixers shall be shut off and the mixed liquor shall be let to settle for one hour.
3. The mixers shall be turned on.
4. After 10 minutes of mixer operation, an independent mutually agreed upon certified sampler shall sample mixed liquor at any two points at least 10 meters apart, at 0.5 meters below top water level 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.
5. This test shall be conducted 5 times.

6. All tests shall show that the suspended solids concentration between the two sampling points is less than 10%.

The plant shall operate during the 30-day wastewater test with no substantial equipment malfunctions as defined above.

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.

12. Warranty

The mixers 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.