

The Dunes Pumping Station Specification Mornington Flood Alleviation



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1.0 General Requirements

1.1 General Conditions, Materials & Installation Procedures

1.1.1 General Requirements

This Specification states the requirements for the design, supply, assembly, fixing in position, connecting inspecting, commissioning, testing and leaving in working order, the Dunes Pumping Station mechanical and electrical installation. The work shall comprise the whole of the labour and, unless otherwise indicated, all the materials necessary to form a complete installation, including such tests, adjustments and commissioning as are prescribed in subsequent clauses and as may otherwise be required to give an effective and satisfactory working installation.

The words “complete installation” shall mean not only the items of mechanical and electrical equipment conveyed by this Specification, but all the incidental sundry components necessary for the complete execution of the Works and for the proper operation of the installation, whether or not these sundry components are mentioned in detail in the tender documents issued in connection with the Contract.

The Mechanical and Electrical Engineering Specification shall be read in conjunction with all or any of the specifications included for this Contract. The complete Specification of the Works to be carried out shall include all forms of tender, forms of contract and contract drawings. These maybe separate or combined together in one or more documents to comprise the Tender Documents which shall be read as a whole and all items shall be included for the submitted priced Tender with no exclusions or qualifications.

The Mechanical and Electrical works shall include the following main elements and all associated works:

- Liaison with Electric Ireland regarding low voltage power supply connection to the Pumping Station complete with Supply Authority Metering Equipment; (Electric Ireland have been paid for this connection already)
- Motor Control Centre kiosk;
- Xylem MultiSmart Powered by Nexicon Preprogrammed Wastewater Pumping Controller;
- Pumping station kiosk heating, ventilation, lighting and small power installation;
- Level instrumentation and control installation;
- Submersible pump sets, station pipe work and valves installation;

- Guiderails, low level couplings, stainless steel lifting chains, davit installation;
- Wet well ladder access installation;
- Cabling and protective devices installation from customer service pillar to motor control centre incoming section;

1.1.2 Communications

Where the Contract is made between the *Contractor* and the Office of Public Works all written correspondence shall be with, and instructions taken from, the Office of Public Works.

1.1.3 Visits to Site

The *Contractor* shall prior to Tendering, be deemed to have visited the site, examined and surveyed the site, taken all necessary measurements, investigated the drawings and specifications and satisfied itself as to the extent of Works to be done, the full nature of local conditions as regards accessibility, transport and storage of materials, the supply of and conditions affecting labour and to have obtained all necessary information on all matters affecting the execution of the Works. Adrian Nevin may be contacted in relation to the site visit on 087 7021558 if required.

Claims on the grounds of want of knowledge in such respect will not be admitted

1.1.4 Compliance with Regulations

The whole of the installation carried out under this Contract shall comply with all relevant statutory instruments and regulations including, but not limited to, the following:

- Safety Health and Welfare at Work (General Application) Regulations, 2007 to 2023;
- Relevant European Standards whether applicable in part or in whole;
- Relevant European Standard Codes of Practice;
- The National Rules for Electrical Installations, Fourth Edition I.S. 10101:2020. With current amendments;

The *Contractor* shall fulfil the relevant duties under the Safety, Health and Welfare at Work (Construction) Regulations SI No 291 of 2013 and shall co-ordinate with the Principal *Contractor* as appropriate.

The *Contractor* shall ensure the whole installation will include for appropriate surge protection and lightning protection measures, including protection of electrical, instrumentation, control and telemetry circuits, where required to provide a complete and satisfactory installation.

1.1.5 Tender Drawings and Specifications

The intent of the Tender drawings issued with this contract is for guidance only. All as built information (where provided) and site conditions to be confirmed on site by the *Contractor* prior to works commencing. The *Contractor* shall include for all items necessary for the proper execution of the works under this Contract. The costs submitted at the time of Tender should fully reflect the extent of plant, equipment and works required to achieve a fully operational installation.

Where any item has been shown on the Drawings but not included in the Specification and vice versa it shall be deemed to be required as part of the Works.

Where the requirements of the Tender drawings or specifications conflict with each other than the *Contractor* shall seek clarification as to which requirements shall be deemed to take precedence. Any such conflicts must be reported to the *Project Manager* at the time of tendering and will not be accepted as a basis for extra claims and work during the progress of the Contract.

1.1.6 Working Drawings

The *Contractor* shall familiarise itself with and make due allowance for, the restrictions of the site, particularly in respect of plant accommodation, duct routes and pipe work installation. The *Contractor* shall ensure that it has all necessary civil engineering drawings for this purpose.

The *Contractor* shall submit detailed drawings and proposals for the various items of the works for the approval of the *Project Manager*. Notwithstanding the submission, approval and issue of working drawings the *Contractor* shall agree on site with the *Project Manager* the exact locations of plant, equipment, service routes and all other items of works in advance of their installation.

Notwithstanding the provision of Tender drawings, the *Contractor* shall be responsible for ensuring that the installation as represented on its working drawings is fully co-ordinated with the proposed site. It shall also be responsible for the integration and co-ordination, throughout the preparation of the working drawings and during the construction phase of all aspects of the mechanical and electrical installation as detailed herein, including any Builders Work in connection with this installation.

1.1.7 Record Drawings

The *Contractor* shall provide final “As Installed” record drawings, including diagrams and schedules which shall show all the information necessary so that the installation can be operated, maintained, inspected and tested to prevent danger, as far as is reasonably practical. It shall incorporate the information necessary for the identification of the devices performing the functions of protection, isolation and switching, and their locations.

The values of prospective short circuit current and earth fault loop impedance at all material locations of the installation shall be recorded on the appropriate documentation.

The record drawings shall include, but not restricted to, the following:

- General layout drawings showing the location of all equipment including cable, cable tray, conduit, trunking, ducting and earth electrodes;
- Assembly drawings of factory-built assemblies and site-built assemblies;
- Detailed layout drawings showing the connection of cable, conduit and trunking to equipment;
- General layout drawings showing the location of all equipment including plant and pipe work,
- Detailed layout drawings showing the connection of pipe work to plant and equipment;
- P&I.D. system diagrams, single line diagrams, circuit diagrams and wiring diagrams for all installations and equipment.

Drawings and diagrams shall comply with BS EN 60617. Interconnection diagrams shall indicate the type of cable, conductor size and terminal numbering.

1.1.8 Design Calculations

The *Contractor* shall prepare and submit to the *Project Manager* for approval, a full set of design calculations for the installation including, but not restricted to, the following:

- Three phase and earth prospective short circuit current calculations for each part of the installation;
- Cable sizing and protective device calculations;
- Surge protection and lightning protection coordination calculations, including selection and coordination of surge protective devices (SPDs) for incoming power, control, instrumentation and telemetry circuits, where applicable.
- Low voltage design calculations in accordance with The National Rules for Electrical Installations, I.S. 10101:2020. With current amendments;
- Load analysis for the provision of mains electricity supply;
- Electrical works in association with the mechanical installation.
- Plant sizing calculations;
- Pipe work sizing calculations;

In each of the above, the *Contractor* shall clearly show that the calculations are based on the actual equipment which it proposes to install. All the calculations shall be produced in both electronic format and hard copy for inclusion in the final Operation and Maintenance Manuals for the project.

1.1.9 Operation and Maintenance Manuals

For each mechanical and electrical installation, system and individual equipment forming the Works, the Operation and Maintenance Manual shall include the following:

- A general description of the scope, purpose and manner of working of each system or apparatus forming part of the Works;
- A detailed description of the scope, purpose and manner of working of each system of automatic controls and monitoring instruments;
- Data on general design parameters and normal operating conditions (e.g. voltage, current, flow rates, etc.) based on commissioning tests;
- Clear and comprehensive instructions for dealing with emergency conditions for each system or apparatus;
- Instructions for any precautionary measures necessary;
- Instructions in respect to the care of the apparatus when subject to periodic disuse;
- Instructions as to the nature, extent and frequency of servicing necessary to properly maintain the Works in good condition and as to the materials to be used for the purpose. This information may be supported in detail, but not replaced by, maintenance instructions provided by the suppliers of particular component apparatus;
- Supplier's details of all major components of the Works together with recommended spares lists.

The Operation and Maintenance manuals shall be provided in triplicate and shall have the contents indexed and contained in ring binders with rigid heavy duty covers. Each manual shall bear the name of the project on the binder cover together with the Volume identification number where necessary and the date of completion of the Works.

Prior to the issue of Practical Completion Certificates for the Works, comprehensive Operation and Maintenance manuals shall be finalised in detail and approval obtained from the *Project Manager* as to their quality, accuracy, clarity and completeness. A complete draft copy of the Operation and Maintenance Manual shall be submitted to the *Project Manager* for review and approval at least 4 weeks in advance of Practical Completion. Any amendments necessary in the light of any comments shall be made and the Manual re-submitted for the *Project Managers* approval.

The finalised copies shall be made available to the *Project Manager* not less than 2 weeks before the date of practical Completion. Failure to issue the manuals on time will result in withholding the Practical Completion Certificate

1.1.10 Electrical Equipment CE Marking

CE marking and certification shall be provided on all electrical equipment supplied under this Contract. Provision of a CE mark shall be a visible declaration by the manufacturer or his authorised representatives that the electrical equipment to which it relates satisfies all the provisions of the European Union (Low Voltage Electrical Equipment) Regulations SI No. 345 of 2016.

The manufacturer or its authorised representative shall provide an EC Declaration of Conformity (Written declaration) stating that the equipment to which the CE marking has been affixed complies with the requirements of the European Union (Low Voltage Electrical Equipment) Regulations 2016. In addition, the manufacturer or its authorised representative shall provide technical documentation which will allow enforcement authorities the means of assessing the conformity of the electrical equipment to the requirements of the European Union (Low Voltage Electrical Equipment) Regulations 2016.

1.1.11 Builders Attendances

The *Contractor* shall be responsible for all minor Builders Works in connection with the mechanical and electrical installation. The following work shall be deemed to be Builders Works:

- Cutting access openings through the construction works for electrical services containment systems and making good after;
- Provision of supports for mechanical and electrical equipment
- All underground cable ducts, draw pits column bases, trenching and backfill;
- All underground pipe work trenching and backfill;
- Removal and replacement of demountable elements or other parts of the construction works to permit plant and services installation.
- All additional fixings, terminations, bonding and supports necessary for the installation of surge protection devices and any associated lightning protection earthing and equipotential bonding arrangements.

The *Contractor* shall ensure that none of its proposed works will be detrimental to the integrity of the construction works and its fabric. All holes cut through the construction works to enable the installation of the mechanical and electrical infrastructure shall be made good by the *Contractor* after installation by means of non-combustible materials. Provision of fire

barriers within the electrical services containment systems shall be the responsibility of the *Contractor*.

The *Contractor* shall include for all drilling, plugging fixing of metalwork, screws, clips, bolts, brackets, saddles and similar items necessary for the proper support of pipe work and cabling infrastructures, conduits, boxes cables and Motor Control Centre.

1.1.12 Named Products

Any reference to any particular manufacturer's product or item of equipment within this specification shall be used for tendering purposes to define the parameters required of that product or item of equipment. This shall include physical size, type, technical suitability, compatibility and standard of aesthetic finish.

Alternative products may be offered on an "equal and approved" basis against named products provided that full written details of that product are submitted at the time of tender for evaluation by the *Project Manager*. Details of any alternative product shall be listed on a separate schedule indicating any proposed cost savings and technical merits against the named product. Alternative products will not be considered after acceptance of Tender stage.

1.1.13 Works Planning

The *Contractor* shall provide a preliminary programme of Works to be submitted with his Tender. The programme shall outline the required sequence of events and order of construction which it would propose to carry out under this contract. The *Contractor* shall liaise with the Office of Public Works to produce a detailed and co-ordinated programme of works for submission to the *Project Manager*.

Planning and execution of the mechanical and electrical Works shall be the responsibility of the *Contractor*, subject to the approval of the *Project Manager*.

The *Contractor* shall be required to prepare and maintain up-to-date detailed Work Operational Procedures. The Work Operational Procedures shall consist of the following:

A Programme of Work consisting of one or several Bar Charts, The Bar Charts shall show the start and finish times of each work element, indicate milestones, show requirements for interfacing with others, show float times and critical paths. The Bar Charts shall also show dependencies between work elements. The programme shall be regularly up dated and revised copies issued to the *Project Manager* during the progress of the Contract.

The *Contractor* shall provide a series of Method Statements for each work element. Each Method Statement shall cross reference to the Programme of Work and shall detail the work to be carried out, with attention being paid to the following:

- Installation Methods to be used and estimated time of completion;
- Equipment storage methods;

- Health and Safety Procedures necessary for safe execution of the work;
- Commissioning and testing procedures to be undertaken.

In preparation of the Operational Procedures, the *Contractor* shall take account of the requirements to interface with the *Project Manager*, the Office of Public Works, other *Contractors* and with the Office of Public Works Project Representatives.

The Operational Procedures for each work element will be subject to the *Project Manager's* approval. No work on the respective work elements will be permitted until the *Project Manager* has approved the Operational Procedures.

1.1.14 Progress Meeting

The *Contractor* shall be required to attend regular Progress Meetings throughout the duration of the Contract. At these meetings the *Contractor* shall be required to present the following documents:

- Updated Programme of Works;
- Updated Progress Report;
- Updated Summary of Information Outstanding.

The meetings shall normally be held once weekly at a time, date and location nominated by the *Project Manager*. The *Project Manager* reserves the right to call additional site meetings/Special Meetings whenever they are required. The *Contractor* also may request the convening of Special Meetings, which shall be held at the discretion of the *Project Manager*.

1.1.15 Sub-Contractors

The use of Sub-*contractors* for any part of the Works will be subject to the approval of the *Project Manager*. The *Contractor* shall provide the *Project Manager*, at the time of Tender, with all information necessary to allow an assessment to be made of the capability and suitability of any proposed Sub-*contractors* to undertake, to the satisfaction of the *Project Manager*, those parts of the Works for which they are proposed.

1.1.16 Standard of Workmanship and Materials

All workmanship, materials and equipment supplied under this contract shall be of the standards and types specified and to the satisfaction of the Project Manager. Workmanship, materials and equipment not specified in detail shall be of a standard and quality consistent with the other works and shall provide the performance required.

1.1.17 Pricing Document

A Pricing Document compiled on the basis of the cost of the work will be required to accompany the submission of the Tender. This pricing document must show the rates of each piece of apparatus to include the rate for Manufacture and Delivery and Installation and Commissioning. Rates shall be per sum, per unit and per unit length. The rates shall be those used by the Tenderer in arriving at his Tender Price and shall be taken into consideration during assessment of the Tender Submission. Each item shall be carried forward and totalled in accordance with the tender analysis sheet. The final grand total shall agree with the Tender Figure. The rates shall be used as a basis to evaluate Variations to the Works.

1.1.18 Variations

No variation, involving an extra to, or omission from, the Works shall be carried out unless an *Project Manager's* Instruction has been issued detailing the item and the cost.

1.1.19 Maintenance Period

The Maintenance Period shall extend for a period of 12 months commencing on the date of Take-over of the whole Works. The requirements of this Clause shall not limit the *Contractor's* obligations under the Conditions of Contract.

1.1.20 Defects Liability

During the Defects Liability Period the *Contractor* shall maintain the Works erected under this Contract, in an approved manner, and shall at its own expense make good any defect which may arise due to faulty workmanship or materials (fair wear and tear excepted).

1.1.21 *Contractor's* Offices, Stores and Messing Facilities

Site compounds and storage areas are to be provided by the *Contractor*. The *Contractor* shall be responsible for its own temporary offices, stores, messing facilities and any other accommodation or facilities, which it considers necessary for use by its site managers and all grades of staff. Prior to commencement of the works, the *Contractor*, shall submit proposals for the location and layout of its proposed offices, stores, messing and welfare facilities to the Office of Public Works for approval.

Toilet and washing facilities shall be securely connected to a foul sewer discharging to the Public Sewerage network or alternatively to a chemical treatment storage tank. If the *Contractor* proposes to discharge domestic waste waters to a chemical treatment storage tank, then the facility shall be periodically serviced by a specialist waste organisation who shall remove all chemical and wastewater off site for specialist treatment and such liquors shall be discharged to a nominated treatment works.

1.1.22 Plant and Equipment Cleaning

All apparatus, plant items and equipment shall be comprehensively cleaned and where required painted immediately prior to handover. All surplus materials, debris, and equipment belonging to the *Contractor* shall be removed off site prior to handover and the entire site left in a clean and complete condition.

1.1.23 Project Supervisor for the Construction Stage

The Works *Contractor* is required to comply with the Safety, Health and Welfare at Work Act 2005 and any subsequent Safety, Health and Welfare legislation including the requirement to have a Safety Statement.

The Works *Contractor* will also be required to comply with the Safety Health and Welfare at Work (General Application) Regulations, 2007 to 2023, particularly in relation to the appointment of the Works *Contractor* and Project Supervisor for the Construction Stage (PSCS).

2.0 Mechanical and Electrical Specification

2.1 Motor Control Centre Particular Specification

2.1.1 Scope

This part of the Specification gives the particular and or special requirements for the design, supply assembly, fixing in position, connecting, inspecting, commissioning, testing and leaving in working order, the Motor Control Centre to be provided at The Dunes Pumping Station.

2.1.2 Construction

The Motor Control Centre shall be constructed in accordance with the requirements of this Specification.

2.1.3 Low Voltage Motor Control Centre

The Motor Control Centre shall be a multi-compartment floor mounted free-standing assembly constructed to a minimum Form 4, Type 1 constructed in accordance with the Specification and comprising the following main components:

- Supply Authority incoming and metering section;
- Mains incomer switch with mobile Generator changeover facility;
- Mobile Generator connection section;
- Power monitoring section;
- Motor starter sections;
- Feeder sections;
- Surge protection devices;
- Common control section;
- Station Services Distribution Section;
- Spare sections and Cable ways.

All sections, chambers and compartments shall be fully vermin proofed. The method of proofing shall be such that cables can be added or removed after initial installation has been completed, without detrimental effect.

Spare sections shall be provided in the motor control centre for future use. The total area given over to spare sections shall be not less than 15% of the assembly or a 600x600mm section, whichever is the greater.

All MCC sections containing electrical control systems shall be fitted with thermostatically controlled anti-condensation heaters.

2.1.4 Mains Incomer and Mobile Generator Connection

The mains incomer switch shall be a 3-position type providing Mains-Off-Assist facilities. The changeover switch shall be rated for the full operational load of the station in both power positions.

Mobile generator connection facilities shall comprise an Appliance Inlet socket which shall be fully rated for the full operational load of the Motor Control Centre.

Cable access measures shall be provided within the structure of the housing containing the Motor Control Centre and shall be designed to maintain the safety and security of the housing whether in use or not.

2.1.5 Pump Starter Sections

Design of starter sections for the two storm water pumps shall provide for the Soft Starter Drive operation of 3 phase induction motor driven pump sets. The starter sections shall be complete with the following equipment: -

- (a) Door-interlocked fuse combination unit, 3 pole and neutral link, lockable in the OFF position.
- (b) Power and control fuses, overload and plant protection circuits.
- (c) Auxiliary control relays, timers and DIN rail mounted power, control and signals marshalling terminals.
- (d) Ammeter, Hours Run counter and Run, Tripped and Auto & Available indication lamps.
- (e) Start, Stop, latch off Emergency Stop and Fault Reset pushbuttons
- (f) Panel heater and thermostat and motor heater circuits where applicable
- (g) Soft Starter Drive

Where a microprocessor and HMI device is provided as part of the MCC supply this shall be used for starter automatic control and monitoring functions.

2.1.6 Instrumentation and Control Section

This section shall house the equipment necessary to achieve the various control sequences for this station and shall be complete with the following equipment: -

- A 24 V d.c. power supply unit with suitable capacity to supply all starter section interposing control circuits and indication lamp requirements;
- An internal 230V a.c. instrumentation power distribution section;

- 1 off ultrasonic level convertor with transducer, door mounted digital display, signal isolator and LPU for wet well level detection;
- Pump duty selector function complete with circuit relays and duty indication lamps;
- Sump level probes, relays and circuit wiring for pump low level cut-out and wet well high-level alarm;
- Xylem MultiSmart Powered by Nexicon Preprogrammed Wastewater Pumping Controller.

2.1.7 Station Status Signals

Provision shall be made within the upper section of the instrumentation and control section for DIN rail mounted terminals to facilitate marshalling of station telemetry signals.

All analogue signals to or from items of plant shall be in the form of 4 – 20mA. Signals to or from the telemetry system shall be in the form of 1 – 5 volts. Signal converters shall be provided in the common control section of each panel to provide the necessary conversion where interfacing is required.

All plant electrical control systems shall incorporate a supervisory reset function designed to ensure the availability and operation of plant under automatic control by detection of abnormal power conditions caused by brownouts, power-loss and subsequent power restoration and initiating global plant reset and check signals.

The following Station status signals shall be provided: -

Description Type Qty Input/ Output

Pump Running

Description	Type	Qty	Input/Output
Pump Running	D	2	0
Pump Tripped	D	2	0
Auto and Available	D	2	0
Mains Failure	D	1	0
Wet well high-level alarm	D	1	0
Wet well level indication	A	1	0
Ultrasonic fault	D	1	0
Spare indication circuits	D	2	0
Spare indication circuits	A	1	0

D = Digital

A = Analogue

I = Input

O= Output

2.1.8 Station Services Distribution Section

Installed in this section shall be a 6-way SP&N MCB Distribution Board. MCBs on this board shall provide the following circuits: -

- 230V kiosk heater with tamperproof thermostat;
- 230V kiosk fluorescent light with door operated micro-switch;
- Site Lighting;
- Single Phase 13A, 30mA RCD protected socket outlet;
- Telemetry outstation power supply;
- Spare

The distribution board shall be pan assembly mounted and the section door shall provide a lockable cover to protect the MCBs.

2.1.9 Incoming Electricity Supply

The incoming electricity supply for the Pumping Station shall comprise a new 400 volts phase to phase supply with a frequency of 50 Hertz and standard phase rotation.

The cost of providing the new power supplies has been paid direct by the Office of Public Works to Electric Ireland.

The *Contractor* shall be responsible for undertaking all necessary co-ordination and liaison with Electric Ireland for the connection works to the new power supply. The relevant contact in Electric Ireland is to be confirmed, and all co-ordination and liaison is to be with them.

The *Contractor* shall be responsible for providing Electric Ireland with all necessary information required service to the Pumping Station. All such information shall be made available to the *Project Manager* for comment prior to submission to Electric Ireland and shall comprise details of electrical loadings, diversity, maximum demand requirements, details of starting characteristics of all motor loads, main protective device ratings and any other information required by Electric Ireland.

The *Contractor* shall provide all necessary protection and earthing requirements as dictated by the Electric Ireland supply arrangements.

2.1.10 Method of Control

Both manual and automatic control of the pumps shall be provided. Starters and common control equipment shall be housed in the Motor Control Centre.

Duty pump selector facilities shall be available through the common control section. A hand-off-auto selector switch shall be provided on each pump starter section.

It shall only be possible to start and stop the pumps by operation of their respective push buttons on the starters when the selector switch is set to Hand. With the selector switch in

the Auto position the pumps shall operate under control of the Xylem MultiSmart Powered by Nexicon Preprogrammed Wastewater Pumping Controller, which shall monitor the level of the wet well. An ultrasonic level detection system, common to both pumps, shall be provided and installed for this method of control.

The level probe system shall be designed to provide pump low level protection as well as a high-level alarm indication, operable under auto control.

The Storm pumps shall operate on a duty/assist basis. The duty storm pump shall be started using a motor soft starter and shall operate at fixed line speed once the starting sequence is complete. The duty pump shall be selected and started automatically in accordance with the pumping station control philosophy, with the assist pump available to duty as required.

Pump control shall be based on level in the pumping station as detected by the ultrasonic sensor. As the level in the pumping station rises to the nominated start level, the duty pump shall be started through the soft starter. As the level falls to the nominated stop level, the pump shall be stopped in accordance with the soft starter stopping function, where provided.

A dead band shall be introduced around the set-point level to avoid excessive pump starts and stops.

The level set-points shall be adjustable within the control system. The soft starter shall provide controlled starting and, where required, soft stopping only.

On pump start, the soft starter shall operate in accordance with a pre-set starting ramp, current limit and/or torque setting suitable for the pump duty. Once starting is complete, the soft starter shall transfer the motor to full line voltage, and the pump shall run at full speed until stopped.

The duty of the storm pumps will be rotated each time the duty pump stops. A draw down sequence shall be configured within the Xylem MultiSmart Powered by Nexicon Preprogrammed Wastewater Pumping Controller to ensure the pumping station is drained at regular intervals to prevent the accumulation of solids and stagnant liquors.

All control; protection and monitoring functions shall be configurable through the Xylem MultiSmart Powered by Nexicon Preprogrammed Wastewater Pumping Controller HMI Interface unit.

2.1.11 Ultrasonic Level Detection Equipment.

The level sensor shall be a BASEEFA approved temperature and humidity compensated ultrasonic device complete with an encapsulated pack, which shall achieve protection to IP68. The sensor shall be located over the deepest part of the pump sump and positioned such that the detection cone is not obstructed by pipe work or other obstacles, and it shall not be necessary for personnel to enter the sump to maintain them. The ultrasonic sensor

shall be supplied complete with potted and continuous cables tailored to suit the required installed length. Joints will not be permitted on these cables.

The ultrasonic controller shall be mounted within the common control section of the Motor Control Centre and shall incorporate sufficient multi-purpose relay contacts for all alarm and control functions and a 4 – 20mA output to indicate level. The controller shall be suitable for a 230V a.c. 50Hz supply and shall provide real time readouts of the levels

The level sensor and controller shall be capable of an accuracy of +/- 0.25% of the target range and a resolution of 0.1% of the program range.

A removable handheld programmer shall be provided for each unit. It shall not be possible to program the controllers without the programmer.

2.1.12 Level Detection Probes

A separate level probe system shall be designed to provide low level protection as well as a high-level alarm indication, operable under auto control for each pump. All probe generated protection and alarm circuits shall be self-resetting.

The level probes shall be installed over the deepest part of the pump sump and positioned such that the probes are not obstructed by pipe work or other obstacles, and it shall not be necessary for personnel to enter the sump to maintain them. The probes shall be of the Hawker heavy duty type manufactured in Grade 304 stainless steel. The level control relay shall be located in the common control section of the Motor Control Centre.

Under hand control the low level cut out protection shall be overridden to allow operator-controlled snoring of the pumps to clean the wet well.

2.1.13 Station Telemetry

The telemetry system shall be capable of monitoring the Power Supply, Control Panel, Pumps state (on/off), Pump availability, Pump flow, water levels in sump and from a remote float switch. The system shall also monitor the generator status (if fitted).

- The system will communicate with a base station PC based at the Office of Public Works office.
- The system shall generate sms/text msg alarms where there is a fault/trip or a value is outside a predetermined limit.
- It shall be possible to assign a priority level to each alarm.
- The system will log all events and alarms and will retain the information for a minimum of 12 months.

- The events/data log will be date and time stamped and can be viewed on site and can be downloaded to a PC on site.
- The base station PC shall be capable of requesting and receiving real time and historical information from the pump station. This data shall be presented in a format where it can be viewed in Microsoft Excel or similar.
- The SCADA software used will be licensed and upgradeable. A web server with 2 clients will also be included to allow for remote viewing.
- The remote telemetry unit will have spare configurable inputs (5 digital and 5 analogue) to allow for future expansion.
- The system will have a UPS back up so it can function in the event of a power failure
- The system will have a configurable security system so access for various levels can be set.
- The Remote telemetry unit at the pump station will have a Modbus output via RS232 port configured to present all data relating to the station
- The software system used shall also be capable of presenting tags using OPC (OLE for Process Control). The software shall operate as an OPC server to allow other systems to access information openly. This shall be available on the Control System PC through a separate Ethernet port. The *contractor* will provide a Full Tag list including description, address and variable type (i.e. integer or digital bit)
- Any alarm event shall be presented as OPC tags to be available to the OPW system.

The *Contractor* shall include for the provision of a broadband connection to the pumping station to facilitate transmission of alarm and plant status conditions to the Office of Public Works local area monitoring Office.

The Xylem MultiSmart Powered by Nexicon Preprogrammed Wastewater Pumping Controller shall be configured to supply telemetry information relating to the Power Supply, Control Panel, Pump Controllers, Pumps state (on/off), Pump availability, Pump flow, water levels in sump and generator status (if connected). The controller shall also monitor any alarms and faults and present these alarms/faults as events. The Xylem MultiSmart Powered by Nexicon Preprogrammed Wastewater Pumping Controller shall be configured to present the telemetry information in the Modbus TCP/IP protocol. The *contractor* will provide a Full Tag list including description, address and variable type (i.e. integer or digital bit).

The telemetry system, including broadband, Modbus, OPC and any remote communications interfaces, shall be provided with suitable surge protection and shall be

protected against lightning-induced transients on all incoming and outgoing signal and communication lines.

The station telemetry system shall be fully compatible with the Office of Public Works telemetry system.

2.1.14 Power, Control and Instrumentation Cables.

The *Contractor* shall provide and install new, screened instrumentation cables and armoured power and control cables together with suitably sized galvanised steel tray work and ducts between the new panel and the various plant, control and field equipment at this station. All external power, control, instrumentation and communication cabling shall be installed with appropriate surge protection and, where required, lightning protection measures, including screening, bonding and earthing arrangements suitable for the exposure conditions of the site. The electrical installation shall be carried out in accordance with the current edition of The National Rules for Electrical Installations.

2.1.15 Pumping Station Control Kiosk

The Motor Control Centre kiosk shall be of the reinforced polyester (GRP) type. The external finish shall have a smooth sheen appearance with a gel coating containing fast colour pigmentation and shall be maintenance free.

Fire resistant laminating resins used shall have a resistant to surface spread of flame to a standard not less than that required by BS EN 13501-1, or such higher Euroclass as is required by the project fire strategy or the relevant approving body.

Large panel areas shall be provided with ribs suitably reinforced with hollow steel section. All laminated glass reinforcement shall be thoroughly impregnated with resin, free of air voids and loose fibres and totally encapsulate any steel reinforcement.

Internal mounting rails and marine ply backboards shall be provided, attached to the kiosk walls to accommodate the installation of small panels, equipment and accessories.

Doors and frames shall be of similar construction to walls; hinges shall be of non-corroding high tensile extruded alloy or stainless steel bolted to both door and frame in such a manner that the stainless-steel bolts cannot be removed from outside the kiosk.

Door locks shall be of the cylinder type. All doors shall have stays and cills shall be protected with extruded alloy capping.

Base fixing shall be by means of expansion type bolts of minimum diameter 10mm, with stainless steel nut, washer and electroplated body.

Concrete bases for kiosks shall incorporate stepped surrounds with raised floor to provide a weather-proofed seal and prevent moisture ingress to the internal floor. A suitable weatherproof sealing compound shall be applied at all interfaces between the GRP kiosk and the concrete base.

Weatherproofing shall be provided between the door and frame inherent in the GRP moulding to achieve IP55. High- and low-level fixed ventilation shall be provided to enable permanent airflow. Tensile strength shall be not less than 90 MPa. Forced ventilation shall be provided were installed plant and equipment will cause excessive heat build-up within the kiosk.

The kiosk shall incorporate a thermostatically controlled heating system to ensure a minimum background temperature of 9°C is maintained. Lighting with control switches suitable for the installed environment shall be provided for safe visual access to all maintainable plant and equipment housed within the kiosk. A 13 Amp 3 pin switched type socket outlet with a polycarbonate enclosure which shall give a sealing to IP56 when used with a standard 13A plug. The socket outlet shall have integral 30mA RCD protective device and shall be supplied with a 13A plug.

All electrical services circuits shall comply with the National Rules for Electrical Installations.

2.2 Motor Control Centre General Specification

2.2.1 Scope

This specification gives the general requirements for the design, manufacture and erection of switchgear assemblies for use indoors on LV systems in an Industrial or Commercial installation. Standard service condition is as defined in BS EN IEC 61439.

2.2.2 Deviation from the Specification.

The Tenderer shall clearly identify deviations from this Specification. Any deviations should be listed in the Tenderers covering letter.

2.2.3 Ambient Conditions.

Unless otherwise specified all equipment provided shall be capable of satisfactory operation within the temperature range - 10°C to 40 °C and relative humidity up to 80%.

2.2.4 Supply System.

Main - 400V. 3 Phase, 4 Wire. 50Hz Neutral and earth.

2.2.5 Suitability of Components.

All components shall give satisfactory operation under the continuous and transient conditions that are likely to occur for the specified duty of the plant.

Components shall be selected for operation within the ratings stated by the manufacturer for voltage, current, temperature, relative humidity, etc.

Components shall be suitable for operation under transient overvoltage conditions. Where required, surge protection devices shall be provided to protect the assembly and connected equipment from switching surges and lightning-induced overvoltage.

Components shall comply with the relevant British Standards or equivalents, and where no such standard exists the components shall be suitable in all respects for the specified duty.

Unapproved electrical components shall not be used unless specific written approval is obtained in advance from the *Project Manager*.

2.2.6 Standard Specifications.

The Switchgear Assembly shall comply with the following specifications

Factory built Assemblies	-	BS EN IEC 61439
Power Circuit Breakers	-	BS EN IEC 60947-2
Air Break Switches	-	BS EN IEC 60947-3
Fuse Combination Units	-	BS EN IEC 60947-3
HRC fuses	-	BS EN IEC 60269
MCBs	-	BS EN IEC 60947-2
MCCBs	-	BS EN IEC 60947-2
Motor Starters	-	BS EN IEC 60947-4-1
Protective Relays	-	BS EN IEC 60255-1
Current Transformers	-	BS EN IEC 61869-2
Indicating Lamps	-	BS EN 60947-5-1

Switchgear and Plant Control Assemblies shall be of the multi-cubicle type constructed from 2.0 mm thick folded sheet steel sections bolted together to form a framework complying with Form 4 type 3 and shall be suitable for floor mounting, free standing constructed as specified herein.

2.2.7 Marking and Notices.

All diagrams, charts, tables and the wording for labels and notices shall be submitted to the *Project Manager* for approval before they are installed.

Labels shall be provided in accordance with BS EN IEC 60445:2021.

Labels on the outside of equipment enclosures shall be of laminated plastic with black characters on a white background, unless otherwise indicated. Warning labels shall be black on a yellow background. Labels shall be securely fixed by non-ferrous or chrome plated screws or rivets; no adhesive shall be used for fixing.

Characters for labels fixed on the means of isolation at the origin of each installation shall be at least 10mm high and 1.5mm wide. On all other labels characters shall be at least 6mm high and 0.5mm wide.

2.2.8 Rubber Safety Mats.

Rubber Safety mats shall comply with BS EN IEC 61111. Mats shall be at least as long as the assembly in front of which they are placed and shall be 1m wide. One mat shall be provided for each panel installed.

2.2.9 Drawings, Schematics, Diagrams and Maintenance Manuals.

Drawings and Documentation shall be provided as follows:

- (a) WITH TENDER - 3 copies of each drawing showing proposed overall dimensions and layout.
- (b) AFTER ORDER - 3 copies of each Drawing showing overall Dimensions, layout and foundation plans and cabling areas, together with Schematics and Diagrams for approval before commencing manufacture.
- (c) AFTER MANUFACTURE - 2 Copies of final drawings and schematic diagrams together with 2 copies of maintenance instructions.

2.2.10 Inspection and Tests.

- (a) GENERAL - Equipment shall be inspected and tested with all necessary facilities being provided for witnessing final tests at Works.
- (b) AT WORKS - Inspection and tests to ensure equipment is operating functionally correctly.

Tests shall include:

- (i) Checking with compliance to drawings;
 - (ii) Insulation - 2500V for 10 seconds;
 - (iii) Functional tests on all devices.
- (c) AT SITE -Final Testing and Commissioning shall be required on site.

2.2.11 Class of Equipment

Equipment shall comply with the form of construction stated within the particular specification.

2.2.12 Enclosure Protection

Equipment shall comply with the ingress protection of IP54

2.2.13 Fault Ratings.

The rated short time withstand current of the panel shall be 50kA for 1 second circuit protective devices shall be co-ordinated to ensure that a fault on any outgoing circuit does not operate the protective device on the incoming circuit.

ASTA Certificate shall be provided covering complete busbar assemblies (main and secondary), ACBs, HRC Fuse Switches and similar devices.

2.2.14 Construction.

Busbars shall be manufactured from HDHC Copper and housed in separate compartments. Secondary busbars are considered a part of the main busbar system. Busbars with bolted joints to be tin plated and busbars within plug-in joints to be silver plated.

Phase busbars shall be fully rated throughout the length of the switchgear assembly with the neutral busbar also fully rated. Connections shall be HDHC Copper, tin plated for bolted joints and plug In

Cubicle structures shall be manufactured from 2.0mm sheet steel formed or folded to give an inherently rigid design.

Provision shall be made for the installation of surge protection devices and their associated earthing and bonding connections within the switchgear assembly.

Modular Design Fuse switches, MCCBs, Motor starters and similar devices shall be designed on a common modular dimension and shall be dimensionally interchangeable.

Segregation shall be provided between devices, and it shall be possible to reposition this in modular type cubicles.

Panel doors shall be fitted with neoprene gaskets. Cabling sections shall have drilled, removable gland plates which shall be effectively bonded to the main earthing bar.

All individual steel components shall be anti-rust primed before assembly and finished in light grey 10-A-07 stove enamel to BS 4800. Screws, nuts, bolts, etc used for fixing equipment and panel sections shall be cadmium plated.

2.2.15 Cabling.

Gland plates shall be steel for multi-core cables and brass for single-core cables.

The Switchgear Assembly shall be suitable for top, front and bottom access cabling. Incoming and outgoing circuits shall be as shown on the drawings.

2.2.16 Earthing.

The main structure together with devices shall be provided with earthing continuity in the form of copper bonding tape or cable connected to the earth busbar.

Earthing Busbar - A copper HDHC Earth Busbar shall run the length of the switchgear assembly. The size of busbars shall be in accordance with The National Rules for Electrical Installations.

2.2.17 Small Wiring

Small wiring within the switchgear assembly shall be PVC flexible cable to BS 6321 bunched and cleated or run in PVC wiring duct. Jumper cables shall be provided to all hinged panel sections.

The size of the wiring within the panel shall be as follows:

- (a) Switchgear - to be a minimum 2.5 sq. mm stranded;
- (b) Control Circuits - to be a minimum 1.5 sq.mm stranded.

All wiring shall be provided with crimped terminations unless agreed otherwise with the *Project Manager*.

2.2.18 Labelling.

Circuits - All devices shall be provided with engraved plastic circuit labels.

Wiring - All covers, doors and complete sections shall be provided suitable labelling to comply with Health and Safety.

Main - A main label shall be provided in accordance with BS EN IEC 60445:2021 which gives details of voltage rating, current rating, class of equipment, fault rating, serial number and C.E Marking.

2.2.19 HRC Fuse Switches.

For general distribution AC 22 category and for Motor Control Duty AC 23 category. ASTA certified for 50kA rating and shall provide the following:

Silver faced contacts;

Manual spring closing mechanism;

Single Pole or Triple Pole with switched neutrals on the single pole units and bolted neutrals on the triple pole units.

2.2.20 Miniature Circuit Breakers

General - SP, DP or TP MCBs shall be 9kA current limiting type with thermal/magnetic protection as Type 2 or Type 3.

2.2.21 Moulded Case Circuit Breakers

General - Shall be SP, DP or TP 4P with a 50kA rating and fitted with thermal./magnetic protection.

2.2.22 Instrumentation & Metering

Power Instrumentation shall be provided with metering facilities to enable the power factor, phase currents, voltage and kVA/kW to be displayed. Where an HMI is provided as part of the MCC supply then this may be used as a means of displaying power information.

Metering shall be provided and arranged to match instrumentation and provided on instrument panels adjacent to the circuit to which it applies.

2.3 Motor Soft Starter Drive Specification

2.3.1 Scope

This part of the Specification gives the particular and or special requirements for the design, supply assembly, fixing in position, connecting, inspecting, commissioning, testing and leaving in working order, the motor soft starter drive units to be provided at The Dunes Pumping Station.

The work carried out shall comply with this Specification, the General Specification and the details given on the drawings.

2.3.2 General Requirements

The type and make of motor soft starter used in the installation shall be approved by the *Project Manager*.

Electronic “soft starters” shall be located within the starter section compartment of the motor which they control, mounted on the back plate of the section and complete with all required heat sinks and forced ventilation. Each soft starter shall have a dedicated door mounted programmer/controller unit, mounted on the door of the motor starter section complete with manufacturer’s door mounting kit, connection cable between programmer/controller and soft start.

Soft starters shall be supplied with bypass converter modules etc. to allow the soft start protection and metering features to operate with a bypass contactor configuration, as this will be the normal mode of operation when not stopping or starting. The soft starters shall be provided with the appropriate built in starting and stopping method for the application e.g. pump motor soft starters shall be capable of pump control starting and shall also be capable of current limit starting. All soft starts shall also provide suitable motor stopping e.g. pump motor soft starters shall be capable of pump control stopping. All motor stopping/starting modes shall be provided integral to the soft start and not as “bolt on” type units. The soft start shall contain a PLC which shall control the starting and stopping by analysing the motor variables and accordingly generating control commands to ensure that the motor is smoothly controlled at all times.

All soft starts shall be rated for 10% more than the motor rated power and shall all be from the same manufacturer and all from the same range/type of units to ensure consistency.

All soft starters shall provide for the following mode of operation:

- load current (selectable). Current limit starting - This mode shall limit the maximum starting current to 50 to 500% of full
- Soft Starting - This mode shall limit the current starting and reduce the motor stress (this can be considered the default mode of starting for any non-specific application).

- Soft Stopping - This mode shall limit the mechanical stress of the motor stopping.

Soft starters may be provided with the following specific mode of operation, depending on the application. Pump Control Operation - This mode of operation shall be utilised to reduce surges in pumping systems during starting and stopping of a pump motor. This shall be achieved by smoothly accelerating and decelerating the motor at a selectable rate. The motor starting time shall be adjustable from 2 to 30 seconds and the stopping time from 2 to 120 seconds.

Pump control shall be fully analogue in nature, and no digital ramping shall be permitted. The voltage against time curve for pump control shall be a smooth curve that is fully analogue in nature.

Each soft starter shall have the following motor protection functions built in. It shall not be permitted to “bolt on” motor protection functions externally to the soft start; all functions must be integral to the unit.

- Overload protection
- Underload protection
- Phase rebalance imbalance
- Jam protection
- Stall protection
- Under voltage
- Over voltage

Each soft starter shall provide multiple auxiliary relay output contacts (rated at 230 volts, 5 A minimum). A minimum of three such auxiliary contacts shall be provided and all auxiliary contacts shall be programmable.

The programmer/controller unit shall have a 2-line LCD text display which shall aid programming/set up and shall also be capable of indicating faults and metering information including the following:-

- Each three phase current
- Each three phase voltage
- Power in kW
- Power usage in kWh
- Motor thermal capacity usage
- Power factor

The nature of the fault shall be provided as a text message as well as a fault code. The programmer/controller unit shall provide ‘*Project Manager*’ (password protected) access, to prevent unauthorised changing of settings within the unit.

2.4 Storm Water Pumps, Station Pipework and Valves.

2.4.1 Scope

This part of the Specification gives the particular and or special requirements for the design, supply assembly, fixing in position, connecting, inspecting, commissioning, testing and leaving in working order, the pumps, station pipe work and valves for The Dunes Pumping Station.

The work carried out shall comply with this Specification, the General Specification and the details given on the drawings.

2.4.2 Storm Water Pump Installation - General

The main work elements to be provided under this section shall include two new storm water pumps, station pipe work, valves, stainless steel lifting chains, wash water standpipe, portable lifting davit and sockets.

The pumps shall be fully submersible with guiderail and low-level coupling facilities to permit removal for maintenance or repair and replacement without disturbing the fixed pipe work installation.

Operation of the storm pumps shall be on a duty/assist basis with starting, stopping and pump sequence control under the command and supervision of a Xylem MultiSmart Powered by Nexicon Preprogrammed Wastewater Pumping Controller. The controller shall initiate pump start and stop commands, and the soft starter shall provide controlled motor starting and, where specified, soft stopping only. The pumps shall operate at fixed line speed once started, and no variable speed control shall be provided. All field installed electrical, control and instrumentation equipment associated with the pumps, level detection, alarms and telemetry shall be provided with suitable surge protection and, where necessary, lightning protection measures appropriate to the installation environment.

Description	Parameter
Number of Pumps:	2
Pump Type:	Submersible Grundfos SL1.80.80.40.4.51D Sewage Pumps
Pump capacity (each):	39.9 litres/second
Total Pump Head:	5.5 metres
Hydraulic Efficiency:	58%
Operational Mode:	Duty / Assist
Protection:	Winding over-temperature device and leakage detection.
Diameter of Station Pipe Work:	80mm Ductile Iron with taper to 150mm
Diameter of Pumping Main:	150mm pipework with taper to 250mm Ductile Iron Pumping main
Primary Control:	Ultrasonic Level Controller, High Level
Secondary Control:	Alarm and Low-Level Pump Cut out.

2.4.3 Submersible Pump Units

The pump casing shall be manufactured from grey cast iron complying with BS EN 1561:2023, to a grade and mechanical properties appropriate to the duty. The rotor shaft shall be manufactured from stainless steel supported in lubricated maintenance free ball bearings.

Shaft sealing between the motor and the hydraulic section shall be by means of silicon carbide mechanical seals. A moisture sensor shall be provided in the oil chamber to monitor the condition of the shaft seal and provide an alarm indication on the starter section on detection of moisture ingress.

The pump impeller shall be manufactured from grey cast iron complying with BS EN 1561:2023, to a grade suitable for the duty, and shall incorporate auxiliary pump-out vanes on the back shroud.

The motor shall be a three phase, 400V, 50Hz squirrel cage unit and shall incorporate an open jacket cooling system with continuous medium circulation.

Temperature sensors shall be provided in the motor windings to switch off the motor in the event of overheating and provide an alarm indication on the starter section. Pump motors

shall also incorporate moisture ingress sensors which shall also switch off the motor and give an alarm indication on the starter section.

After manufacture and testing each pump shall be primer undercoated and given a final coat of chlorinated rubber gloss paint.

2.4.4 Pipework and Fittings.

The *Contractor* shall include for all necessary pipe work and support brackets between the pumps and the rising main. All (liquid carrying) station pipe work, fittings and joints supplied and installed in this contract shall be ductile iron complying with BSEN 598: 2007 + A1:2009. Flanges for pipe and pipeline fittings shall comply with BS EN 1092-1: 2018 + A1 and BS EN 1092-2: 2023 for 16 Bar nominal rating.

Flanged gaskets shall be Type WA rings, manufactured from material conforming to the provisions of BS EN 681-1:1996.

All necessary supports, saddles, fixing bolts and foundation bolts shall be supplied to support the pipe work in an approved manner. No point of passage of pipes through floors or walls shall be used as a point of support except with the approval of the *Project Manager*. Flanges either side of the wet well/valve chamber shall be a minimum of 200mm from the wall.

Gate valves shall be double flanged cast iron to BS EN 1092-1:2018 & BS EN 1092-2: 2023 and shall be clockwise closing with non-rising spindles.

Non-return valve bodies shall be double flanged cast iron (PN16) and shall incorporate a removable hatch cover and a counter balanced gate lever arm brought out through a sealed gland.

Each pump discharge pipe shall be tapped for a pressure gauge connection point and fitted with an isolation valve and plug. Pressure gauges shall be of the Bourdon tube or diaphragm seal type complying with BS EN 837-1 and BS EN 837-3.

2.4.5 Pump Design Data.

The friction losses shall be assessed at the "duty point and be based on the "Tables for the Hydraulics Design of Pipes" published by the Department of Environment, Hydraulic Research Station, Wallingford. The *Contractor* shall make his own assessment of the friction losses in the pump fittings and delivery pipe work.

Characteristic and system curves for the pumps shall be supplied with the Tender to a reasonably large scale, which shall show the capacity of the pump at the duty point and with the sump at maximum and minimum levels.

When tested throughout their complete working range at the Manufacturers Works, the pumps shall give results which conform to the curves submitted with the Tender.

2.4.6 Portable Lifting Davit

The portable lifting davit shall be of the two-piece alloy type and shall be capable of lifting a minimum of 500 kg SWL or such greater load as required. The spigot shall be 63.5 mm diameter. The spigot shall be complete with an internal bearing for ease of turning under full load. The davit shall have the capability for varying both height and reach. The radius shall be adjustable by repositioning the pin up or down the continuous channel attached to the tensioning webbing strap.

All 65mm diameter davit sockets have been installed by the OPW and have plug in stoppers to prevent the ingress of water when not in use. Socket and stoppers are constructed in galvanised steel and shall be cast flush. *Contractor* to confirm on site the size, installation and specification of the davit sockets prior to works commencing on site.

The radius adjustment shall be variable between 800-1300mm. The assembled weight of the lifting davit shall not exceed 20 kg. All lifting equipment supplied, including all davit sockets, shall be load tested and affixed with individual permanent identity plates (note that for sockets the identity plate shall be mounted adjacent to the socket). The identity plates shall be stamped with SWL, date of manufacture, date of test and identifying fixed plant serial number. All requisite test certificates shall be included in the Final O&M Manuals.

Lifting equipment shall be sized and constructed such that the lifting device (chain block etc.) is directly above the lifting point of the item of plant to be lifted. Additionally, after the item of plant is lifted, the lifting equipment provided shall ensure that it can be moved elsewhere for maintenance purposes, if necessary off the site. All chains, hooks, sheaves etc. utilised for lifting purposes shall be stainless steel grade 316.

3.0 Testing and Commissioning

3.1 Requirements for testing and commissioning

3.1.1 Scope

This part of the specification gives the particular and or special requirements for the Testing and Commissioning of all mechanical, electrical, instrumentation and control systems installed under this contract.

3.1.2 General Requirements

Tests shall be carried out to demonstrate under quasi conditions that the plant meets the mechanical, electrical, instrumentation and control requirements of the Contract Specification.

Potable water shall be used for pumping Installation tests All water and other consumables required for the tests shall be provided by the *Contractor*.

3.1.3 Off Site Testing

The *Project Manager* shall be afforded the opportunity to witness any off-site testing of plant components and materials proposed to be provided under the Contract. The *Contractor* shall give the *Project Manager* a minimum of 10 working days written notice of the commencement of any off-site tests.

The *Contractor* shall provide the *Project Manager* with documentation from their component or material manufacturers and suppliers indicating the detailed material and construction specifications for items proposed to be supplied sufficient to validate conformity to the Contract Specification.

Tests to the witnessed by the *Project Manager* off-site may include but shall not be limited to the following:

- Tests on factory built electrical control panels and other assemblies to demonstrate all control functions and instrumentation;
- Inspection of significant plant items at or near completion of their manufacture;
- Performance simulation of control software;
- Tests on acoustic performance of plant items and their associated enclosures.

3.1.4 Electrical Testing

All parts of the electrical installation shall be fully tested and certified in accordance with the requirements of the National Rules for Electrical Installations.

All signal retransmission installations and control installations shall be fully tested for functionality. The *contractor* shall test and verify all surge protection devices, including correct installation, bonding, earthing and indication of serviceable status where applicable. Lightning protection and equipotential bonding arrangements, where provided, shall also be inspected and tested for continuity and conformity with the design intent.

Full test and commissioning certificates shall be completed, signed by an authorised person and the original returned to the *Project Manager*. Copies shall be retained by the *Contractor* for inclusion in the Operation and Maintenance Manuals.

The *Contractor* shall undertake tests on completion in presence of the *Project Manager*. All systems shall have been fully and successfully tested by the *Contractor* prior to the Tests on Completion and records of these tests shall be available to the *Project Manager* during the Tests on Completion. In the event of it being necessary to repeat the tests on completion as a result of defects in the installation then the costs incurred by the re-tests, including those pertaining to the *Project Manager* shall be borne in full by the Mechanical and Electrical *Contractor*. All commissioning tests shall be undertaken in the presence of the *Project Manager*.

3.1.5 Inspection and Testing of Factory Build Assemblies

Inspection and Testing of all Factory Built Assemblies shall be carried out in accordance with the relevant British/European Standard. The Motor Control Centre provided under this Contract shall have the relevant Inspection Report Forms and Certificates completed before it leaves the factory. The *Project Manager* shall be given the opportunity to inspect the MCC assembly prior to it leaving the manufacturers works. In the event of it being necessary to repeat the inspection tests as a result of unsatisfactory or incomplete work or MCC construction incomplete then the costs incurred by the re-inspection, including those pertaining to the *Project Manager* shall be borne in full by the *Contractor*.

The MCC shall be issued with certificates stating that it complies with the European Union (Low Voltage Electrical Equipment) Regulations SI No. 345 of 2016 and Electromagnetic Compatibility Regulations – Council of European Communities Low Voltage Directive 2014/35/EU and Council of European Communities EMC Directive 2014/30/EU.

3.1.6 Inspection and Testing of Pump Sets

All pumps shall be tested at the Manufacturers Works in accordance with the relevant British/ European Standards.

The *Contractor* shall provide a pump efficiency as tested to BS 5316: Part 2: Class B with no negative tolerance for each pump type provided.

3.1.7 Hydraulic Tests

All sections of the pipe work which will subsequently be inaccessible, e.g. in ducts, chases, underground, etc., shall be tested, in sections, during erection and the whole installation on completion. These tests shall be maintained for a period of two hours without loss in the presence of the *Project Manager* or his representative.

Test pressure shall be as follows, or twice the working pressure, whichever is the higher:

Station Pipe work - 10 bar gauge.

Pumping Main - 10 bar gauge.

Any leaks or defects which become apparent shall be repaired and a further test applied and the procedure repeated until the system is perfectly sound.

3.1.8 Pre-commissioning and Commissioning Tests

These tests shall include simulation of abnormal situations, as well as the normal, including electrical power failure and alarm conditions.

The tests shall include but not be limited to:

- Safety Tests
- Operation of mechanical plant.
- Operation of instrumentation, control and automation equipment.
- Instrument calibration tests.
- Pump performance and efficiencies.
- Electrical services tests
- Plant Cleanliness.
- Plant lubrication.

The *Contractor* shall carry out pre-commissioning tests to ensure that all plant, equipment, control and instrumentation systems are complete, operable and function in both hand and automatic control prior to being witnessed by the *Project Manager*.

All tests shall be repeated as full commissioning tests and shall be witnessed by the *Project Manager*. Any deficiencies identified during the tests on individual items of plant or composite assemblies or plant systems shall immediately be made good by the *Contractor*. The tests shall be repeated on items that require intervention by the *Contractor* and these repeated tests shall be to the satisfaction of the *Project Manager* and the Contract Specification.

The *Contractor* shall prepare Fixed Plant Data Sheets in an approved format listing all fixed equipment, including Manufacturer, model, size/range for use by the *Project Manager*

during the commissioning tests and for inclusion in the Operation and Maintenance Manuals.

3.1.9 Site Testing

In addition to the individual tests as laid down in the Specifications for each item of plant and equipment, the *Contractor* shall participate in an overall site test to demonstrate the satisfactory operation of the Pumping Station as an entity.

The site tests shall demonstrate the satisfactory functional operation of all items of plant under automatic, manual, local and remote-control including protection systems and signal retransmissions to the MCC Microprocessor and to the Office of Public Works remote monitoring office.

The pumping installation shall be tested for cavitation, vibration, noise, excess heat and installation problems.

Each pump set shall be tested for overall efficiency, using portable equipment if necessary. The *Contractor* shall include for all necessary pipe work tapings, and fittings for the attachment of test gauges and instruments.

All test readings and results shall be recorded and the position of duty points on pump curves noted. All test information shall be documented in an approved manner and handed over as part of the relevant Operation and Maintenance Manual documentation.

3.1.10 Taking Over Tests

The Mechanical and Electrical *Contractor* shall not commence the Taking Over Tests at any part of the Pumping Station until the commissioning of that part of the works has been completed to the satisfaction of the *Project Manager*.

Following satisfactory completion of the testing and commissioning phase, the installation shall undergo a continuous proving period during which time the plant and control systems shall operate under automatic control. Failure of any item of plant or equipment during this period shall necessitate a repeat of the proving period.

3.1.11 Taking Over Certificate

The *Contractor* shall be responsible for the management, maintenance and operation of the Pumping Station until a Taking-over Certificate is issued. The Taking-over Certificate shall only be issued after the installation has operated satisfactorily and without failure for the specified operational period.

Failure to provide approved operation and maintenance manuals and training by the end of the continuous proving period shall cause the period to be extended by the number of days necessary to produce the relevant documentation and obtain approvals.