Specification for the Maintenance of and Associated Support for the High Voltage [33/11kV] System at Wave Hub Hayle Towans Substation

Tender Number – WHL/2016/TEN/01

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1 Project Background

1.1 Introduction

Wave Hub is the world's largest and most technologically advanced site for the testing and development of wave energy devices. It allows developers the opportunity to test arrays of wave energy devices over several years in a realistic, fully monitored marine environment.

Wave Hub is a public sector asset of national importance that is owned by the UK Government Department for Business, Innovation and Skills (BIS). On 1st January 2012, the Government transferred responsibility for operating the testing facility to Wave Hub Limited (WHL), a company limited by shares with BIS as the sole shareholder.

WHL's principle objectives are to:

- Accelerate and support the development of wave energy technology;
- Drive research and innovation to address the challenges of deploying at large-scale;
- Overcome the final hurdles to full commercialisation;
- Foster a growing marine renewables industry in Cornwall and the UK; and
- Secure the UK's position as a global leader in marine energy.

1.2 System Description

1.2.1 Infrastructure

Wave Hub comprises of a 25 km armoured subsea cable, an onshore substation and 8 sq km consented area of sea, 10 nautical miles off the north coast of Cornwall in the eastern extremes of the Atlantic Ocean.

The subsea power cable (SPC) consists of twin 300mm² 33kV power triads and two 24 core fibre optic cables, and is terminated onto two isolated busbars within the Hub chamber. The Hub sits on the seabed in approximately 50 metres of water and each busbar services two berthing areas via 300m 'tails' made up of three core 120 mm² 33 kV cable. The purpose of the Hub is to provide a watertight connection between the cable tails and the SPC. The fibre optic cables are split out from the SPC within the Hub and joined to those running to each wave energy array via the cable tails.

Each device developer will connect to the Wave Hub system by means of a subsea cable that will run from the lead device of each array to a connection point on one of the four cable tails that run from the Hub. The connections to the tails will be made above water using a dry-mate connector or cable splice. The connectors or splices provide electrical and fibre optic connection.

The SPC runs for approximately 17 km on a rocky seabed and then runs 8 km on a partially covered sand seabed until the shoreline is reached. The main cable is rock dumped for protection, stabilisation and span correction along the rock seabed section of the route, supplemented by concrete mattresses for additional stability. The cable is trenched and buried where possible along the sandy section of the route. Additional rock dump and concrete mattresses have been deployed where trenching is not possible.

Onshore, the SPC is trenched and buried across the beach area and is then jointed to a pair of 400mm^2 33kV onshore cables on the beach which pass through 2 directionally drilled 355mm polyethylene ducts under a series of sand dunes to exit into the purpose built substation which links Wave Hub to the UK's electricity grid.

The system is designed to operate at either 33kv, 11kV or with one circuit at 33kV and the other at 11kV, therefore the substation includes an 11kV/33kV transformer, shunt reactors, associated 33kV and 11kV switchgear and power factor correction equipment to ensure delivery to the grid within specification. Grid connection is made via the Western Power Distribution 132/33kV Bulk Supply Point, [BSP], at Hayle.

Control and monitoring of the wave energy convertors (WECs) will be performed remotely via a high speed broadband connection from the substation using data transmitted via fibre optic cables within the SPC. Power metering will be performed at the lead device on each WEC array and at the substation exit breaker. The WEC array meters will be provided by the WEC operators in line with the requirements of the Berthing Agreement.

Wave Hub has a 25-year lease from The Crown Estate and the consented area is subdivided into four berths, each comprising 1 km x 2 km and capable of accommodating a generating capacity nominally of 4MVA at 11kV

and 12MVA at 33kV, within the constraints of Wave Hub's Connection Agreement with WPD of 30MVA. The Wave Hub infrastructure has the potential to be upgraded to 48MVA in the future, subject to consent.

A schematic of the Wave Hub system is presented in Figure 1.1 and single line diagrams of the HV System are included at Appendices A-C.

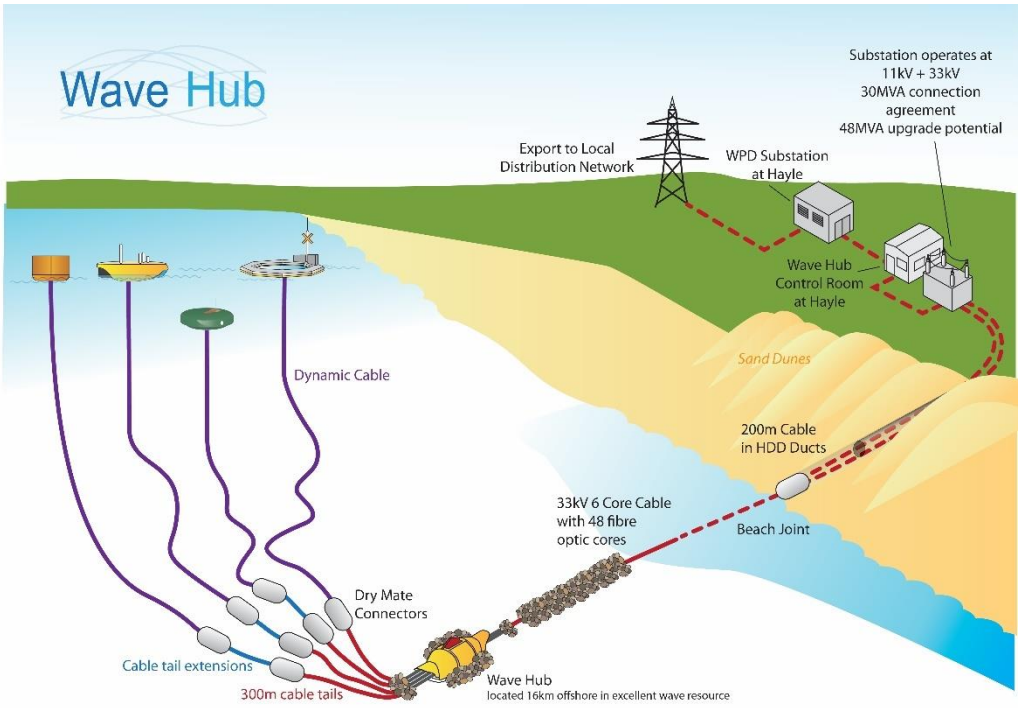

Figure 1.1

1.2.2 Wave Energy Converters -

Wave Hub will accommodate a wide range of WEC devices, with up to four WEC arrays connected to Wave Hub at any one time. The WEC operator/developer will be responsible for the provision of moorings and the installation of the WEC arrays. Details of the operational constraints that each WEC will have to satisfy are included in the WEC Connection Specification. WEC owners will also be required to comply with the Wave Hub's Operational Management System that details procedures for access to the site.

1.2.3 Consents

Wave Hub has a consent under Section 36 of the Electricity Act 1989 that allows up to 120 wave energy converters and anchoring equipment to be deployed at the site with a combined capacity up to 20MW. This consent has been designed to accommodate a wide range of wave device technologies.

2. Particular Specification

2.1 Introduction

This section sets out the scope of maintenance work and additional support services that WHL are procuring.

This Specification is intended to define and outline the minimum standards, workmanship, safety and deliverables expected from the appointed Maintenance Contractor (the Contractor) for the high voltage systems installed at the Wave Hub Hayle Towans Substation.

The Contractor shall note that WHL undertakes a monthly visual inspection of the substation using the following forms.

- Wave Hub-OMS-Form-E010 – HV Circuit Breakers Monthly Inspection Report
- Wave Hub-OMS-Form-E011 – HV capacitor Bank Monthly Inspection Report
- Wave Hub-OMS-Form-E012 – HV Transformer and Shunt Reactor Monthly Inspection Report.

Copies of these inspection reports shall be provided to the Contractor prior to the maintenance being carried out. All items of concern resulting from these inspections shall be advised to the Contractor by WHL and the appropriate course of action will be discussed and agreed with the Contactor prior to implementation.

2.2 HV Maintenance Contract - Scope of Work

Wave hub requires all of its electrical plant to be maintained and be subject to regular condition assessment and maintenance in accordance with the plants manufacturing manuals and recommendations as well as industry best practice. This has been reflected in the requirements given below.

In addition to the below testing the Contractor is requested, as part of the tender return, to suggest further transformer and plant testing requirements, that in its experience, are considered beneficial to the safe operation and are in line with best industry practice. These will be considered if suitable reference can be given to CIGRE, IEC, EN BS or IEEE guidelines which have not been documented below. The Contractor is requested to provide cost estimates and frequencies for these maintenance operations, Wave Hub will then consider these for inclusion in the maintenance program if Wave Hub believes them to be cost effective and beneficial.

If the contractor finds or knows of discrepancies between the plants operational and maintenance manual and new Industry standards or requirements it is expected that the contractor will notify the client to discuss with the plant provider

The maintenance work to be undertaken as part of this Contract is as follows:

2.2.1 Transformer Routine Maintenance

The transformer is a 20MVA, 33/11kV, Dyn1, ONAN, Oil Immersed Power Transformer, as manufactured by Winder Electrical.

At Six Monthly Intervals

Type “HBP1” & “V” Silica Gel Breather: The breathers shall be inspected to ensure they are in a fully active condition with the replacement of spent desiccant if necessary. Spent desiccant shall be removed from the container and disposed of in an approved manner. The desiccant shall be replaced with the correct grade and quantity. If it is necessary to replace the complete desiccant container, the Contractor shall ensure that the self adhesive aluminium foil vapour barriers are removed from the top and the bottom of the container before installation.

Gas & Oil Operated Relay (Buchholz): Check through inspection window that the relay is full of oil. If not, and gas is present, it could be due to:

- Low oil level
- Air in relay due to de-aeration of the oil
- A minor fault in the transformer

If the presence of gas is due to other causes than low oil level, keep the relay under observation. If the amount of gas is not increasing the gas would probably be air due to de-aeration of the oil and can be released through the upper petcock. If the amount of gas is increasing, collect gas and analyse.

Oil Level: Check oil level. The transformer is filled at 15°C. The temperature of the oil must be allowed for when checking the level. If the oil is low, check for leaks at gaskets and valves.

At Twelve Monthly Intervals

As six monthly intervals plus the following:

Tank and Fittings: Visually examine the transformer tank and fittings to ensure no rust is forming, especially at welded seams. If the paintwork is damaged the surface should be thoroughly cleaned, spot primed, undercoated and glossed.

Oil & Winding Temperature Indicators: Check calibration of switches.

Gaskets: Check the compression gaskets for shrinkage and that small oil leaks have not developed. Rectify by tightening each bolt slightly, moving round the flanges until the whole joint is tight. Joints should never be tightened at one point only. If leaks persist, lower oil and renew gasket.

Oil: The oil is a pure hydrocarbon mineral oil in accordance with BS60296: 2004 Fluids for electrotechnical applications. Unused mineral insulating oils for transformers and switchgear.

Maintenance of mineral oil shall be in accordance with BS EN 60422:2006 Mineral insulating oils in electrical equipment. Supervision and guidance.

Oil Sampling: Oil contamination is often the result of sampling via a dirty valve. It is essential that the valve be cleaned and then wiped down with a non-fibrous cloth or paper followed by a wipe of similar material soaked in clean oil. The valve should then be flushed by draining off sufficient oil until the sample is representative of the oil in the bottom of the tank. Sample bottles shall be 1 litre in size and must be thoroughly cleaned and rinsed out with the first sample taken. Tests are to be carried out as soon as possible after obtaining the sample. Oil sampling and testing shall be witnessed by the Wave Hub Electrical Engineer.

Inspection of Oil Samples: A visual inspection of the oil sample can sometimes give an indication of deterioration or contamination. It should be followed by qualitative tests. The appearance of the oil should be clear, without visible contamination and not be excessively dark or unusual in colour. Cloudiness in the oil may be due to the presence of moisture or solid matter such as sludge. If the oil is dark brown or green it is indicative of the presence of acid and the rate of deterioration will be rapid. A pungent acrid odour from the oil is a sign of acids in the oil. Acids lead to the formation of sludge and corrosion and may render the oil unsuitable for treatment on site. Once sludge has formed it is very difficult to remove.

Electric Strength: Shall be tested in accordance with BS60296: 2004.

Dissolved Gas Analysis shall be carried out in accordance with BS EN 60567:2011.

Crackle Test: This is a simple test to determine the presence of suspended moisture in the oil, and detects the presence of water above 100ppm. It consists of pouring oil into a test tube to a depth of 25%. The temperature of the oil should be between 15 & 24°C. The tube is then heated rapidly in a silent flame until the oil begins to boil. If any audible crackling occurs then water is present.

Acidity: A pungent acrid smell and discolouration of oil is a sign of the presence of acid. If detected, the tank and cover above the oil level should be checked for signs of corrosion.

Sludge: This is not frequently experienced since it is an advanced form of deterioration but is still dangerous since it effects both the insulation and the flow of oil, thus creating excessive temperatures.

Frequency of Testing: Recommended frequency of testing is given in BS EN 60422. This may be adjusted to suit the operating conditions. Dissolved Gas Analysis, electric strength and crackle test shall be carried out annually.

Recording of Test Results: A log of test results shall be prepared by the Contractor for the transformer to determine the rate of oil deterioration. A copy of the results shall be handed to the Wave Hub Electrical Engineer.

On Load Tap Changer: Inspection of the tap changer shall be undertaken on an annual basis. The motor-drive mechanism has a counter that registers every tap-changer operation. During inspection the counter reading shall be recorded. The motor and counter shall be tested by operating one step and then back, and the drag hands reset.

The oil level and the breather shall be checked.

The emergency stop shall be checked.

2.2.2 Shunt Reactor Routine Maintenance

The two shunt reactors are, VArComp X_{LHV} units as manufactured by Ultra Electronics PMES and supplied to WHL by Enspec Ltd. The two units are designed to operate at dual voltage, 33/11kV, 2.25/0.25MVar, 3phase, 50Hz, 39.4/13.1A per reactor.

At Six Monthly Intervals

Silica Gel Breathers: The breathers shall be inspected to ensure they are in a fully active condition with the replacement of spent desiccant if necessary. Spent desiccant shall be removed from the container and disposed of in an approved manner. The desiccant shall be replaced with the correct grade and quantity. If it is necessary to replace the complete desiccant container, the Contractor shall ensure that the self adhesive aluminium foil vapour barriers are removed from the top and the bottom of the container before installation.

Gas & Oil Operated Relay (Buchholz): Check through inspection window that the relay is full of oil. If not, and gas is present, it could be due to:

- Low oil level
- Air in relay due to de-aeration of the oil
- A minor fault in the transformer

If the presence of gas is due to other causes than low oil level, keep the relay under observation. If the amount of gas is not increasing the gas would probably be air due to de-aeration of the oil and can be released through the upper petcock. If the amount of gas is increasing, collect gas and analyse.

Oil Level: Check oil level. The shunt reactors were filled at 15°C. The temperature of the oil must be allowed for when checking the level. If the oil is low, check for leaks at gaskets and valves.

At Twelve Monthly Intervals

As six monthly intervals plus the following:

Tank and Fittings: Visually examine the shunt reactor tanks and fittings to ensure no rust is forming, especially at welded seams. If the paintwork is damaged the surface should be thoroughly cleaned, spot primed, undercoated and glossed.

Oil & Winding Temperature Indicators: Check calibration of switches.

Gaskets: Check the compression gaskets for shrinkage and that small oil leaks have not developed. Rectify by tightening each bolt slightly, moving round the flanges until the whole joint is tight. Joints should never be tightened at one point only. If leaks persist, lower oil and renew gasket.

Oil: The oil is a pure hydrocarbon mineral oil in accordance with BS60296: 2004 Fluids for electrotechnical applications. Unused mineral insulating oils for transformers and switchgear.

Maintenance of mineral oil shall be in accordance with BS EN 60422:2006 Mineral insulating oils in electrical equipment. Supervision and guidance.

Oil Sampling: Oil contamination is often the result of sampling via a dirty valve. It is essential that the valve be cleaned and then wiped down with a non-fibrous cloth or paper followed by a wipe of similar material soaked in clean oil. The valve should then be flushed by draining off sufficient oil until the sample is representative of the oil in the bottom of the tank. Sample bottles shall be 1 litre in size and must be thoroughly cleaned and rinsed out with the first sample taken. Tests are to be carried out as soon as possible after obtaining the sample. Oil sampling and testing shall be witnessed by the Wave Hub Electrical Engineer.

Inspection of Oil Samples: A visual inspection of the oil sample can sometimes give an indication of deterioration or contamination. It should be followed by qualitative tests. The appearance of the oil should be clear, without visible contamination and not be excessively dark or unusual in colour. Cloudiness in the oil may be due to the presence of moisture or solid matter such as sludge. If the oil is dark brown or green it is indicative of the presence of acid and the rate of deterioration will be rapid. A pungent acrid odour from the oil is a sign of acids in the oil. Acids lead to the formation of sludge and corrosion and may render the oil unsuitable for treatment on site. Once sludge has formed it is very difficult to remove.

Electric Strength: Shall be tested in accordance with BS60296: 2004.

Dissolved Gas Analysis shall be carried out in accordance with BS EN 60567:2011.

Crackle Test: This is a simple test to determine the presence of suspended moisture in the oil, and detects the presence of water above 100ppm. It consists of pouring oil into a test tube to a depth of 25%. The temperature

of the oil should be between 15 & 24°C. The tube is then heated rapidly in a silent flame until the oil begins to boil. If any audible crackling occurs then water is present.

Acidity: A pungent acrid smell and discolouration of oil is a sign of the presence of acid. If detected, the tank and cover above the oil level should be checked for signs of corrosion.

Sludge: This is not frequently experienced since it is an advanced form of deterioration but is still dangerous since it effects both the insulation and the flow of oil, thus creating excessive temperatures.

Frequency of Testing: Recommended frequency of testing is given in BS EN 60422. This may be adjusted to suit the operating conditions. Dissolved Gas Analysis, Electric strength and crackle test shall be carried out annually.

Recording of Test Results: A log of test results shall be prepared by the Contractor for the transformer to determine the rate of oil deterioration. A copy of the results shall be handed to the Wave Hub Electrical Engineer.

2.2.3 Transformer and Shunt Reactor Re-Painting

The Contractor shall include within the Tender Price for the cost to re-paint the transformer shunt reactors once during the Contract Period.

This re-painting is generally expected to take place during the first six months of the Contract Period, however this could be altered to a point later in the Contract. Upon award of the Contract the Contractor shall undertake a visit to site to ascertain the condition of the transformer and shunt reactor to assess when re-painting will be required.

The following shall be undertaken during the repainting process:

- All existing rust is to be removed where possible and treated with a rust preventer.
- All necessary parts are to be masked to prevent painting.
- A primary coat shall be applied via a spray gun.
- Once the primary coat has dried a second top coat of paint shall be applied by means of flow painting.
- Once painting is complete all masking shall be removed and the area left clean and tidy.
- Suitable precautions must be made during re-painting to ensure that the surrounding equipment and buildings are not subject to any overspray or paint spillage.

2.2.4 Switchgear [Circuit Breakers] Routine Maintenance

The switchgear comprises of a 33kV incoming circuit breaker, a six panel 33kV switchboard, two 33kV "ring main units", [RMUs] each comprising of three 33kV CBs configured as a RMU, a four panel 11kV switchboard, and a four panel RCE switchboard, comprising of two 33kV Circuit breakers and two cable boxes.

The 33kV incoming circuit breaker is a two panel one circuit Areva T&D WSA single busbar gas insulated vacuum circuit breaker switch board.

The 33kV switch panel comprises of six Schneider CBGS-0 SF^6 insulated circuit breakers.

Each RMU comprises of three Schneider CBGS-0 SF^6 circuit breakers.

The RCE switchboard comprises of two Schneider CBGS-0 SF^6 insulated circuit breakers and two SF^6 insulated cable boxes.

The 11kV switchgear is a four panel Hawker Siddley Eclipse vacuum circuit breaker switchboard.

Maintenance of the 33kV and 11kV switchgear shall be undertaken in accordance with BS 6626:2010 maintenance of electrical switchgear and control gear for voltages above 1kV and up to and including 36kV – Code of Practice.

The switchgear shall be maintained on an annual basis, and shall include, but not be limited to, the following:

- Inspection of the general condition of the equipment, for foreign bodies, signs of tracking
- Tightness of connections
- Inspection of insulation for damage or contamination

- The interior of the switchgear shall be cleaned, any dust and debris being removed
- Check and clean earthing connections and auxiliary contacts
- Test secondary wiring with 500Vdc test set and check tightness of connections
- Check VTs and operation of disconnectors
- Check all LV and control fuses
- Check gas pressure of SF6 switchgear
- Carry out functional closing and tripping tests both manually and remotely
- Protection relays and devices
- Carry out visual inspection of protection relays and devices, clean all components and ensure free operation of moving parts, where appropriate
- Test secondary wiring
- Check terminal boxes and tightness of terminals
- Trip test circuit breakers using relay output to verify circuit
- Check original settings are re-instated to relays.

In addition to the above the Contractor shall allow within the Tender Price to carry out secondary injection tests to all protection relays, as per commissioning values, and record all results on a three yearly basis.

2.2.5 Power Factor Correction Equipment Routine Maintenance

The power factor correction [PFC] equipment consists of a 6MVA capacitor bank controlled in 3 stages by a Nokian NC-12 power factor controller.

The PFC equipment shall be maintained on an annual basis in accordance with the Manufacturer's requirements and shall include, but not be limited to, the following:

- Inspection of the general condition of the equipment, for foreign bodies, signs of tracking
- Tightness of connections
- Inspection of insulation for damage or contamination
- The interior of the equipment shall be cleaned, any dust and debris being removed
- Check and clean earthing connections and auxiliary contacts
- Check tightness of connections
- Check all LV and control fuses
- Carry out functional step opening and closing tests manually

2.2.6 Battery Charger Routine Maintenance

The battery charger is manufactured by PE Systems Ltd, and is Type WCVF/108/12/2M/105aH.

The battery charger shall be maintained on a six monthly basis in accordance with the Manufacturer's requirements and shall include, but not be limited to, the following:

- Inspection of the general condition of the equipment, for foreign bodies, signs of tracking
- Tightness of connections
- Inspection of insulation for damage or contamination
- The interior of the equipment shall be cleaned, any dust and debris being removed
- Check and clean earthing connections and auxiliary contacts
- Check tightness of connections
- Check of electrolyte level, specific gravity, connections and the function of the charger.
- Check the output voltage of the battery and the individual cells.

2.2.7 Neutral Earthing Resistor Routine Maintenance

The neutral earthing resistor is manufactured by Cressall to ANSI - IEEE 32 – 1972 Standard requirements, terminology and test procedure for Neutral Grounding Device.

The neutral earthing resistor shall be maintained on an annual basis, in accordance with the Manufacturer's requirements and shall include, but not be limited to, the following:

- Inspection of the general condition of the equipment, for foreign bodies, signs of tracking
- Tightness of connections
- Inspection of insulation for damage or contamination
- The interior of the equipment shall be cleaned, any dust and debris being removed
- Check and clean earthing connections and auxiliary contacts
- Check tightness of connections
- Check of operation of the self regulating anti condensation heater

2.2.8 Maintenance Periods

The maintenance periods for the various items of the system shall not be exceeded. However, within the duration of the Contract it may be found necessary to shorten these periods after experience to cater for operation under adverse conditions etc. The Contractor shall therefore provide within the Tender Return a Schedule of Rates for each item of equipment detailing the cost associated with each maintenance item associated with the item of equipment.

All works to the equipment shall be undertaken to the Manufacturer's requirements as detailed within the relevant Operation and Maintenance Manual.

If the contractor finds or knows of discrepancies between the plants operational and maintenance manual and new Industry standards or requirements it is expected that the contractor will notify the client to discuss with the plant provider

The Contractor shall prepare a maintenance programme for the equipment detailed within this Specification based upon the maintenance periods indicated. A copy of this programme shall be included within the Tender Return.

Within the Tender Price the Contractor shall allow a visit to the site within fourteen days of being awarded the Contract to familiarise themselves with the system and to undertake an inspection of the system and to provide a report to the Engineer of any defects noted during the inspection.

2.2.9 Off Site Support

The Contract shall include for Off Site Support to the Wave Hub Engineer. This is to take the form of telephone or e-mail support as required during office hours, 08:00 to 18:00.

2.3 Additional HV System Support Duties

2.3.1 Call Outs

The Contractor shall have the facility to provide a 24hr 365 day / year emergency cover to Wave Hub on a call out basis.

The Contractor shall indicate within the Tender Return how their call out system shall operate, i.e. point of contact, telephone support, time to attend site etc.

The Contractor shall indicate within the Tender Return the costs associated with the provision of the call out service.

2.3.2 Operational Support

WHL shall require, from time to time, assistance with the operation of the HV System. This is generally envisaged to be, but not limited to, during the deployment of a WEC and could involve testing of cables and equipment, testing of protection settings, proving dead and assistance with switching etc.

Unlike a call out this work will be planned in advance and be carried out to a programme. The Contractor shall indicate within the Tender Return the costs associated with the provision of the Operational Support Service on this basis.

2.4 General Duties

Whilst undertaking any maintenance work the Contractor is to control all activities on the Wave Hub System required for maintenance of the system. All activities shall be undertaken by persons authorised by the Contractor in writing, in strict accordance with the Contractor's Operational Safety Rules and Procedures and WHL's OMS Documents.

The Contractor shall provide a copy of their Operational Safety Rules and Procedures with the Tender Return.

Should there be a conflict between the Wave Hub OMS and the Contractor's Operational Safety Rules and Procedures these shall be brought to the attention of the Wave Hub Duty Authorised Person for clarification.

The Contractor shall note that during the periods allocated for maintenance of the system any WEC Device Developer with equipment connected to the system will be instructed by Wave Hub to isolate and disconnect their device at the offshore device circuit breaker [Offshore Point of Connection].

The WEC Device Developer shall issue a written notification to Wave Hub that their device is disconnected and isolated [Certificate of Isolation and Earthing CIE].

Once disconnected the device offshore circuit breaker cannot be closed without an enable signal from the Wave Hub SCADA System. The subsea cable can be proved dead by applying a circuit earth at the incoming circuit breakers from the Hub and closing the circuit breakers via the SCADA System.

When the WHL Duty Authorised Person has received the notifications that all of the connected devices are disconnected and isolated, cable earths shall be applied to the sea bound cables at their respective circuit breakers.

The incoming 33kV circuit breaker of the Wave Hub System shall then be disconnected, isolated and earthed, which will render the Substation equipment dead.

The manual/auto/off switch for the SCADA system shall be put into the off position and the operating key placed in the substation key cabinet, so that the system cannot be operated remotely.

The relevant safety locks and notices shall be applied to the circuit breakers and a Permit to Work [PTW] issued to the Contractor for the relevant work.

It shall be noted that WHL employ a system of safety locks whereby every operating switch etc. has its own unique numbered safety lock. The Contractor may use this safety locking system whilst undertaking the works under their control and must use this system when undertaking works under WHL control.

Once the PTW has been issued the system is effectively 'handed over' to the Contractor to carry out their works, and during this period the Contractor shall work under their own Operational Safety Rules and Procedures.

Once the work is completed the PTW shall be signed off and cancelled, as described within the OMS, and the system handed back to the WHL Duty Authorised Person.

2.5 Personnel

The following personnel shall be provided by the Contractor for the implementation of this contract:

2.6.1 Contract Manager

The duties of the Contract Manager are described below:

- Shall be in a senior position within the Contractor's Company, and shall be the first point of contact between WHL and the Contractor.
- Shall be in such a position so as to be able to make all commercial decisions on behalf of the Contractor in relation to the Contract.
- Shall be responsible for the overall implementation and administration of the Contract.

- Shall have sufficient qualifications and experience to undertake the role of Senior Authorised Person in respect of the type of installation installed at Wave Hub, as described within the Energy Networks Association, [ENA], Model Distribution Safety Rules, [MDSR] and supplemented by Wave Hub's Electrical Safety Guidance [HV] Document, Wave Hub-OMS-ESP-02 .
- Should have experience of the renewable energy industry.

Details of the proposed Contract Manager, including a CV and details of relevant experience, shall be provided with the Contactor's Tender Return.

2.6.2 Designated Site Engineer

The duties of the Designated Site Engineer are described below:

- Shall be a senior engineer within the Contractor's Company, and shall be responsible for the site operations required for the Maintenance Contract.
- Shall be responsible for all works undertaken as part of this Contract.
- Shall have sufficient qualifications and experience to undertake the role of Senior Authorised Person in respect of the type of installation installed at Wave Hub, as described within the Energy Networks Association, [ENA], Model Distribution Safety Rules, [MDSR] and supplemented by Wave Hub's Electrical Safety Guidance [HV] Document, Wave Hub-OMS-ESP-02 .
- Should have experience of the renewable energy industry.

Details of the proposed Designated Site Engineer, including a CV and details of relevant experience, shall be provided with the Contactor's Tender Return.

2.6.3 Electrical Engineering Technicians

The Contractor shall provide sufficient Electrical Engineering Technicians to undertake the works described within this Specification.

The Electrical Engineering Technicians shall:

- Be under the control of the Designated Site Engineer.
- Be sufficiently skilled and experienced to undertake the tasks required.
- Have sufficient qualifications and experience to undertake the roles of Authorised Person or Competent Person in respect of the type of installation installed at Wave Hub, as described within the Energy Networks Association, [ENA], Model Distribution Safety Rules, [MDSR] and supplemented by Wave Hub's Electrical Safety Guidance [HV] Document, Wave Hub-OMS-ESP-02 .

Details of the Electrical Engineering Technicians required for the Contract shall be provided with the Tender Return.

2.6 Contract Schedule

Within the Tender Proposal the Contractor shall indicate the period of time required for maintenance of the system. These time periods will be used by WHL to advise the WEC Developers of the shutdowns of the system that will be required for maintenance of the system.

2.7 Notification of Operational Restrictions

The Contractor shall be a subscriber to the Energy Networks Association [ENA] and National Equipment Defects Reporting System [NEDeRS] and shall advise the WHL Electrical Engineer in writing of any Dangerous Equipment Notices [DIN], Suspension of Operational Practice [SOP] and National Equipment Defect Reports [NEDeR] that are issued in respect of the types of equipment installed at Wave Hub, including any appropriate actions that may be required.

The Contractor shall also have a system in place to monitor the industry for any Operational Restrictions that are advised in respect of the types of equipment installed at Wave Hub. The Contractor shall advise the WHL

Electrical Engineer immediately in writing of the Operational Restriction, including any appropriate actions that may be required.

Upon receipt of a NEDeRS Report or an Operational Restriction relevant the Wave Hub Equipment, the WHL Electrical Engineer will confirm receipt of this advice and in turn advise the Contractor of the action taken in respect of the NEDeRS Report or Operational Restriction.

The cost of any remedial work that is required as a result of the issue of a NEDeRS Report or an Operational Restriction is outside the Terms of this Contract and will be subject to a separate instruction.

3. Service Level Agreement

The Contractor shall be aware that the following items may result in termination of the Contract:

- Non-compliance with the Wave Hub OMS.
- Failure to attend a call out within specified time.
- Failure to comply with the requirements of this Specification.

In the event of the occurrence of any of the above, WHL shall immediately advise the Contractor's Contract Manager, in writing, who shall arrange for the necessary remedial actions to take place without delay.

Any costs associated with these remedial actions shall be borne by the Contractor.

4. Instructions to Tenderers

4.1 Introduction

Failure to comply with any of these instructions may lead to tenders being rejected.

4.2 Clarifications

If there is any query regarding the meaning of the Tender Document the Tenderer shall set out such queries in writing, by e-mail, for clarification and address them to Rob McConnell, Wave Hub Electrical Engineer at rob.mcconnell@wavehub.co.uk

Requests for clarification shall be submitted in writing, by e-mail, in sufficient time to allow a response and at least two working days before the final date for submission of Tenders.

4.2.1 Tender Amendment

During the tender period WHL may issue Tender Amendments to clarify, modify or add to the Tender Document. A copy of each Tender Amendment will be issued via the Contracts Finder Portal and the Wave Hub Website. No addition or alteration shall be made to the Tender Document unless it is the subject of a Tender Amendment.

4.2.2 Conditions for Tendering

WHL does not bind itself to accept the lowest or any Tender nor shall WHL be liable for any expenses incurred by the Tenderer in preparation of the Tender. Tender qualifications are to be avoided by prior clarification of requirements or interpretation with the WHL. A qualified Tender may be rejected.

4.2.3 Information to be Returned with Tender

The following information is to be returned in the order specified in a single folder containing the relevant files in pdf format.

- Project Organisation setting out the proposed team along with details of any sub contractors to be appointed.
- Experience of the company in maintenance of high voltage systems with a particular emphasis on renewable energy systems, in particular offshore wave and wind energy.
- List of key personnel that you are proposing to deliver the maintenance along with CVs for key staff. The CVs should show how the proposed individuals have the necessary skills and expertise to meet the requirements of this specification.

- A detailed method statement setting out as a minimum your approach to managing this appointment.
- A maintenance programme for the equipment detailed within this Specification based upon the maintenance periods indicated.
- Details of the operation of the call out system as proposed by the Contractor.
- A schedule of staff resources (with hours/days by activity) required to complete the work described to tally with the lump sum submitted as part of the tender.
- The Contractor's Operational Safety Rules and Procedures for High Voltage Systems.
- The completed QHSE Tender Questionnaire, see Appendix F.
- The completed Form of Tender, Appendix G. The Contractor shall note that this document is to be returned both in pdf and Exel formats as per the files provided with the Tender Invitation.

Tenders should be returned by e-mail to:

tenders@wavehub.co.uk with the subject line Tender Number WH/TEN/2016/01, by 12.00 hrs on the 11th March 2016. Tenders should not bear any identification of the sender.

Tenders received after the time stated for return will not be considered.

5. Evaluation

5.1 Evaluation Criteria

Submissions will be assessed based upon the most economically advantageous tender. There will be a quality/price split of 70/30. The following assessment criteria will be applied to the submissions:

Quality – 40 points

Project organisation	5
Company experience	10
Detailed maintenance proposal	25

Team composition/roles – 30 points

Contract Manager.	10
Designated Site Engineer.	15
Maintenance Engineers.	5

Price – 30 points

Commercial Offer (Price)	30

This is the Tendered rates from the Form of Tender. 30 Points will be awarded for the lowest price for the delivery of the Maintenance Contract. The number of points will be awarded such that the lowest Tenderer for the project receives 30 points, others will receive points based on their percentage above the lowest tender, eg:

Lowest tender rate - £1m, 1/1 x 10 = 30

Next lowest tender rate - £1.2m, 1/1.2 x 10 = 25.00

5.2 Award of Contract

If and when it is decided to award a contract, a written notification will be sent to each of the Tenderers advising of our decision.

Appendix A - Single Line Diagram, Onshore

Appendix B – Single line Diagram, Offshore

Appendix C – Single Line Diagram, Protection Scheme

Appendix D – Standard Specification Clauses

Definitions

In applying the Specification the following words shall have the following meanings assigned to them unless there is something in the subject matter of context inconsistent with such construction.

"CLIENT" shall mean the Person, Persons, Company, Authority and their Representatives who have instructed that the works shall be carried out.

"ENGINEER" shall mean the person representing Wave Hub Limited.

"CLIENT REPRESENTATIVE" shall mean the person appointed to supervise the works.

"CONTRACT" shall mean the Contract made between the Client and the Contractor.

"CONTRACTOR" shall mean the Person, Firm or Company whose quotation for Specialist Engineering Works forming the subject of this Specification has been accepted and who has entered into a Contract with the Client and shall include his or their successors, heirs, executors and administrators.

"SPECIFICATION" shall mean the Specification on which the Tender is based.

"MATERIALS" shall mean all plant, materials and equipment for incorporation in the works.

"WORKS" shall mean and include all materials to be used and work to be done by the Contractor under the Contract and shall include supplying, fixing, testing, regulating and commissioning of the installations described in the Specification.

"SUPERVISING OFFICER" shall mean the person appointed by the Client who is responsible for the administering of the Contract.

"SITE" shall mean the actual place or places to which the materials shall be delivered to where work shall be done by the Contractor, together with so much of the area surrounding the said place, or places, as the Contractor shall actually use in connection with the Works as otherwise than merely for the purpose of access to the said place or places.

"WRITING" shall mean any manuscript, typewritten or printed statement under seal or hand as the case may be.

"SHALL" shall mean mandatory.

"SHOULD" shall mean optional.

"WILL" shall mean informative.

"DATE OF TENDER" shall mean the date nominated in the enquiry document for the return of tenders.

"BRITISH STANDARD SPECIFICATION" The term "BSS" or "BS" shall mean British Standard Specification, current edition.

"OTHER DEFINITIONS" OR "EXPRESSIONS" shall have the meanings respective assigned to them in the Contract Terms and Conditions. Work importing persons include Firms and Corporations.

Words importing the singular only also include the plural and vice versa where the context requires.

The terms "APPROVED" and "DIRECTED" herein shall mean approved and directed in writing by the Client or the Client's appointed representative.

"OMS" shall mean the Operational Management System of Wave Hub Limited.

Tender Drawings

The drawings provided as part of the enquiry documentation shall be treated as confidential documents and must not be loaned or copied to any other party without the express permission of the Engineer.

The drawings provided (together with this Specification) are intended to provide sufficient information to enable tenders to provide estimates for the required work and provide the basis for working drawings, if required. Not all items or matters referred to in the Specification are indicated on the drawings and similarly not all items detailed on the drawings are described in the Specification.

Unless previously advised by the Engineer the tender drawings are not intended for use as working drawings.

The Contractor to Inform Himself Fully

The Contractor shall be deemed to have examined the site, the Specification, drawings and any other documents which form part of the Contract or describe the works.

In the case of an existing installation the Contractor shall be responsible for visiting site to carry out a pre-tender survey to ascertain the conditions under which the work is to be carried out, means of access, requirement for scaffolding, building structure and obtaining full particulars of any part or parts of the existing installation and make full allowance in his Tender for all such like factors.

No allowance shall be made for ignorance due to the Contractors neglect in this respect.

Conflict

Any contradiction between the Specification and drawings must be brought to the attention of the Engineer during the tender period when a ruling will be given.

A discrepancy between the Specification and drawings will not be accepted as a basis for additional payment after receipt of tenders.

If the details given in the Specification conflict in any way with manufacturers installation instructions or the requirements of British Standards or Codes of Practice, then the relevant section of the Specification will not be adhered to. Any such conflicts shall immediately be brought to the attention of the Engineer.

Dimensions

The Contractor shall take his own dimensions of the buildings or structures for the purpose of installing any plant and materials to be supplied to fixing under the contract and shall be responsible for the accuracy of such dimensions. These dimensions shall be used in preference to any supplied the Engineer.

Dimensions written on drawings shall in all instances, be taken in preference to those measured on a drawing to a given scale.

Any such discrepancies shall be notified to the Engineer before action is taken.

Connection to Equipment

The Contractor shall be responsible for the satisfactory reconnection of any existing plant or equipment which he disconnects during the course of the work.

Supervision

The Contractor must, during the period of the works, engage a suitably qualified person on site to supervise the work, whose identity shall not be changed without the written agreement of the Engineer.

The suitably qualified person must be capable of taking decisions and receiving instructions which are binding on the Contractor.

Specialist Trades Attendance on Equipment

The Contractor shall arrange and make all payment for specialist tradesmen to visit the site, adjust and put into working order all items of specialist plant and equipment, as detailed in the Specification.

Noise and Vibration

The work is to be undertaken in the vicinity occupied buildings, the Contractor shall arrange this work so that the minimum noise and inconvenience is caused to the occupants of the buildings.

Fire Hazard

The Contractor shall be responsible for ensuring that proper precautions are taken to protect the building and its contents where naked flame is used in the course of the work, commissioning or testing.

He shall ensure that fire extinguishers, fire blankets or other devices required by the local Fire Officer are available in areas where such hazards exist.

Standard of Installation

A suitably high standard of installation shall be maintained to comply with the requirements of this Specification and those of the relevant bodies as published in the latest editions of their standard requirements and/or regulations.

For example:-

i) British Standards issued by the British Standards Institute
ii) Building Regulations
iii) Requirement of the Health and Safety Executive and CDM Regulations
iv) Regulations under the Electricity Acts issued by the Department of Energy
v) Requirement of the Local Fire Officer and/or Building Control Officer
vi) Current IEE Wiring Regulations for Electrical Installations and current amendments
vii) Requirements of the Local Electricity Distribution network Operator
viii) CIBSE Recommendations

Any installation or parts thereof installed by the Contractor deemed by the Engineer to be untidy, installed incorrectly, not in accordance with the above will be removed and correctly installed to the satisfaction of the Engineers at the Contractors cost.

Materials

All the required materials and equipment shall be new unless otherwise stated in this Specification. Where detail or descriptions are given, these are for guidance only, and the Contractor shall ensure that full allowance is made for all associated materials and equipment to provide a fully complete and operational installation.

The Contractor must prepare his Tender based upon the material specified but may offer alternative materials to those specified by listing them on a supplementary sheet to his Tender.

Any alternative material offered shall not form part of the Tender offer but will be considered provided there is a benefit to be gained either in cost, quality or delivery.

If alternative materials to those which are specified are accepted, any time spent by the Engineer in changing the installation to accommodate the alternative materials will be paid for by the Contractor.

The design responsibility for the change will be rested with the Contractor who will be required to confirm to the Engineer via the Main Contractor, that he (the Contractor) indemnifies the Engineer for any time spent and costs incurred by the Engineer as a direct result of changing from the materials originally specified.

The Contractor must ensure that all specified materials are correctly applied and installed strictly in accordance with the manufacturer's advice and requirements. Any conflict between information given in the Specification and that given by the manufacturer must be brought to the attention of the Engineer before tenders are submitted.

Any costs incurred by the Contractor through not installing materials in accordance with the manufacturers requirements will not be reimbursed through the Contract.

Ordering of Materials

The Contractor should obtain the specified materials from any available source.

Should the Contractor fail to order materials immediately and as a result specified materials become unavailable, suitable alternative materials shall be detailed by the Contractor for approval by the Engineer and any additional cost shall be borne by the Contractor.

Protection of the Installation, Equipment and Materials

The Contractor shall ensure adequate, safe and suitable storage for all materials and equipment provided by, and installed by him.

All materials and equipment shall be adequately stored under cover to prevent damage to the materials.

All materials or equipment stored in an unsuitable method will be rejected by the Engineer and replaced at no cost to the Client.

The Contractor shall ensure that the condition of all materials and equipment is maintained during the course of the Contract and that no damage, corrosion, soiling or deterioration of any kind affects the materials or equipment.

Existing Materials

The Contractor shall not, under any circumstances, re-use existing materials unless permitted in writing by the Engineer or unless specifically stated in the Specification.

Where existing materials are to be re-used the Contractor shall take full responsibility for the condition, safe-keeping and satisfactory re-use of such materials.

Schedule of Rates

A schedule of rates for the project shall be provided with the Tender Submission.

Where the Engineer requests quantities to be included, the schedule shall clearly show the following:

Item

Quantity

Rate/Quantity

Total Cost

The following provides an illustration of what is required:

Item	**Quantity**	**Rate**	**Total**
Insulating Oil	100 Litres	£30/litre	£300.00

The rates given shall be inclusive of all on-costs.

The total of the schedule prices shall equal the contract price.

The prices given shall be the installed cost to the Client and shall be used for costing variations to the Contract and the evaluation of work for interim payments, if required.

When used for costing variations of a like basis it is deemed that the schedule price given includes for all costs associated with contract administration overheads and profit and that no additional charges will be levied.

Variations

General additions or omissions of work shall only be carried out on receipt of written. No order for such alterations, additions or omissions will be issued until an estimate of cost has been submitted by the Contractor unless specifically instructed in writing by the Engineer.

Interim Claims for Payment Conflict

Interim claims for payment shall include a statement indicating:-

(a) Value of work complete for each defined price section of work in the Summary of Tender.

(b) Priced schedule of unfixed materials on site.

(c) Value of work complete against each agreed variation.

(d) Value of unfixed materials on site for each agreed variation.

Materials stored off site will not normally be paid for unless specific agreement is reached between the Contractor and Client in accordance with the Contract.

Performance Tests

The Contractor shall satisfy the Engineer by means of suitable test procedures during the undertaking of and final test on completion that the whole of his work is carried out in accordance with all rules and regulations applicable to the work, and shall provide at his own expense all testing, apparatus, etc., and shall provide all labour required. The accuracy of the tests must be to the satisfaction of the Engineer whose decision will be final.

Commissioning and Completion

The Contractor shall ensure that the whole of the works are complete, tested and commissioned before the final inspection is carried out by the Engineer.

The Contractor shall clear away all rubbish and surplus materials and ensure that the whole installation is in a clean, sound and satisfactory working order.

When the Contractor is confident that the works are complete, he shall inform the Client whereupon an inspection will be carried out by the Engineer and a list of outstanding and/or remedial works prepared. The Contractor shall attend to all items noted immediately in order that the installation is completed to the Engineer's satisfaction for handover.

The Contractor shall provide attendance to all commissioning carried out by Specialist Contractors and shall be responsible for the satisfactory completion of such works. The Contractor shall also provide attendance during the commissioning of any other site works where he has had a contractual involvement.

The Engineer will not certify completion until all works under the Contract have been completed, tested and demonstrated to his complete satisfaction.

The Contractor shall advise when all listed items have been attended to such that a confirmatory re-examination may be carried out by the Engineer.

If such advice is not received, re-examination will be carried out to suit the Contract requirements, before handover. If the re-examination determines that the Contractor has not successfully cleared the list of items, all costs incurred by the Engineer in subsequent inspections will be the responsibility of the Contractor and be debited from the Contract Sum.

Final Inspection and Handover

Upon completion of all outstanding works and/or remedial works the Contractor shall notify the Client that all works are ready for handover. A final inspection will then be carried out at an agreed date to suit all parties. The inspection will be carried out by the Engineer or his representative and a responsible representative of the Contractor shall be present. If the work has been completed to the satisfaction of the Engineer or his representative, a Hand Over Certificate will be issued.

The Construction (Design & Management) Regulations 2015

The Contractor shall, before submitting a Tender, be fully aware of the requirements of the above Regulations.

The Contractor shall include in his Tender for fully complying with all requirements of the current UK Health and Safety Legislation, Regulations and Codes of Practice, including the 2015 CDM Regulations and any transitional provision of the regulations and subsequent amendments.

The Contractor shall include for all liaison and co-ordination required by the the CDM Regulations and for the production of all Method Statements, Health and Safety Plans, details, documents, information, etc., such that the Health & Safety Plans as required under the CDM Regulations can be produced and the requirements of the Regulations can be met.

The Contractor shall include for the continual update of documents, etc. as necessary, and for the provision of all record drawings, plans, maintenance procedures, O & M Manuals, details and locations of all materials used during the maintenance works, etc., as required by the Health and Safety Executive and any other documents that may be required such that the system Health and Safety Manual can be updated and handed to the Client in order that the Client has final documentation to satisfy the CDM Regulations and to enable the Client to operate and maintain the “Works” in accordance with HSE Legislation.

Appendix E – QHSE Tender Questionnaire

Appendix F – Wave Hub Electrical Safety Guidance for HV Systems

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Appendix G – Form of Tender