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| DEENDAYAL PORT AUTHORITY | | |
| An ISO 9001 : 2008 & ISO 14001 : 2004 Certified Port | | |
| **swachh-bharat-abhiyan-logo-vector-file.jpgSIPC Logo Colour** | **LOGO** | Office of Executive Engineer (Electrical),  Ground Floor, P & C Building,New Kandla, Kutch – 370210  Tel: 02836 270 342  Mob: 9825227048  Email: [xenedpt@gmail.com](mailto:xenedpt@gmail.com) |

No.: EL/AC/2786 Date:21/03/2023

**EXPRESSION OF INTEREST [EOI] for**

“Design, Supply, Erection, Testing and commissioning of 0.75 MW (1 X 750 KVA) shore based Power Supply to Ships at berth No. VII to VIII in DPA**.”**

Executive Engineer (Electrical), DPA invites Expression of Interest for the work of “Design, Supply, Erection, Testing and commissioning of 0.75 MW (1 X 750 KVA) shorebased Power Supply to Ships at Berth No. VII to VIII in DPA” from the reputed firms who have executed similar work in Government/Public Sector or other leading private organizations. The Expression of Interest (EOI) documents containing details of Scope of Work and technical specifications are enclosed herewith.

The interested firms are requested to submit budgetary quotation for the said work in format enclosed at Annexure I. The completed EOI (Expression of Interest) shall be submitted to the office of the undersigned on or before 28/03/2023.

**Executive Engineer (E)**

**Deendayal Port Authority**

**Annexure I**

**Bill ofQuantities**

**Name of Work** **:** Design, Supply, Erection, Testing and commissioning of 0.75 MW (1 X 750 KVA) shore based Power Supply to Ships at Berth No. VII to VIII or as decided by DPA.

**Bill of Quantities**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S/N** | **Description** | **Qty** | **Rate** | **Unit** | **Amount** |
| 1 | Design, Supply, Erection, Testing and commissioning of 0.75 MW (1 X 750 KVA) shore based Power Supply to Ships at berth No. VII to VIII as per Bill of Material ANNEXURE-I and scope of work & Technical Specifications. | 1 |  | Comp. Job |  |
| **Total Amount: Rs.** | | | | |  |

(In Words: Rs.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)

**(NOTE:** The rates should be inclusive of all taxes, duties, fees, cess etc. including all incidental charges; but exclusive of GST).

**Signature & Seal Executive Engineer (E)**

**of Contractor Deendayal Port Authority**

**SCOPE OF WORK**

The Scope of work envisages the pilot project of giving power supply from shore to ship at variable frequency and variable voltage, considering all safety parameters and operational aspects to meet the green energy initiative under Maritime Vision 2030.

1. **Overview**

**1.1 SFC System overview**

The PCS100 Static Frequency Converter (SFC) allows connection of 60 Hz. powered equipment to a 50 Hz. supply network and vice versa. Additionally, the PCS100 SFC can if required, convert the supply voltage to a different voltages to match with the requirement of the load.

Key technical features of the PCS100 Static Frequency Converter system consists of but not limited to the followings:

• Thoroughly proven advanced IGBT technology

• Compact design, high power density

• Modular design with expandability facility, self-contained independent rectifier and inverter modules

• No moving elements – low maintenance

• High reliability and availability

• Precise output frequency generation

• Bi-directional power flow

• Good maintainability and serviceability, excellent Mean Time to Repair (MTTR)

• Unique ‘Ride-through’ on module failure or fault, continual operation with reduced capacity

• Remote monitoring and control through Ethernet, Modbus-TCP IP protocols

* The system shall have all kind of protection like overload, earth fault etc. and shall be provided with high end SIMENS/ABB Relay for setting with Relay Coordination.

The system functions by converting the input AC power through a sine-wave rectifier to a DC link and then through an AC sine-wave inverter to produce a clean, full sine-wave output at the new frequency and voltage. For correct operation of the power electronics an isolation transformer is required as part of the SFC system. The isolation transformer can be applied to the input or output of the SFC.

The PCS100 SFC system is constructed using power electronic modules. These state-of-the-art modules operate as rectifiers to source sinusoidal current from the supply, and inverters to reproduce the AC waveforms on the output.

The primary user interface is via a door mounted touch screen Graphical Display Module (GDM). The display is intuitive and is navigated by touching on the desired menu buttons.

System monitoring is possible by connection to a PLC (via the digital and analog I/Os) or connection to a computer based SCADA package using TCP/IP Ethernet serial communications.

1. **Sub Assemblies**

A SFC System consists of the following sub-assemblies:

· Input circuit protection

· Rectifier Power Modules.

· Inverter Power Modules.

· Isolation transformer (sold separately to the SFC converter)

**2.1 Rectifiers & Inverters**

The PCS100 SFC is constructed using pairs of rectifier and inverter power modules (module pairs). The rectifier modules convert the incoming three phase AC voltage into a regulated DC voltage. The DC voltage is then supplied to the inverter modules to be re-created into AC voltage at a different frequency.

Depending on requirements, between one and sixteen replaceable PCS100 module, pairs are used. The modules are highly integrated and can behave independently. That is, if one module fails, it will automatically be withdrawn from service while the remaining modules continue to run. This provides redundancy (at reduced capacity) and very high availability for the PCS100 SFC.

The PCS100 SFC system includes a master controller that is located in one of the enclosures. The master controls all power modules and provides communication functionality to the SFC’s touch screen and external serial networks.

**2.2 Input Circuit Breakers**

Where multiple enclosures of SFC modules are needed to construct the required size converter, circuit breakers are fitted to the input of the SFC. The function of these circuit breakers is to protect the cabling inside the individual cabinet. Overload protection is performed electronically via the power electronics control. Therefore, there will be one circuit breaker fitted on the input for each full size converter cabinet.

**2.3 Isolation Transformer**

The purpose of the isolation transformer is to:

· match voltage to the utility and load’s requirement (The PCS100 voltage is nominally 480 V AC)

· transform the 3-wire inverter source into a 4-wire source and

· isolate the power module common-mode voltage from the utility & load.

An isolation transformer is required either on the input or output of the SFC converter for the above reasons.

**3. Control features**

**3.1 Power Module Redundancy Feature**

One unique feature critical to the reliability of the converted output supply is the built-in hot redundancy capability which is an intrinsic feature of the modular system design. In an unlikely event where either a single rectifier or inverter module encounters a fault and stop functioning, the master controller that oversees the rectifier/inverter module pairs will reduce the output capacity to the available remaining working rectifier/inverter module pairs.

This reduction of capacity is transparent as typically the converter is not running at full load. The load will not be shed, but it will be transferred seamlessly to the remaining module pairs in the converter.

To illustrate the function a 1000 KVA SFC has 08 pairs of rectifier/inverter modules. A rectifier module failure will result in the controller automatically transferring the load to the remaining 07 pairs of rectifier/inverters. Only the maximum output of the converter is hence reduced by 1/08 or 12.5%

The PCS100 Advanced Redundancy feature represents a further milestone of power electronics reliability and availability

Improvements:

· Reduces power output in a failure only by a small fraction of the total system power

· Enables built in n+1 configuration by adding a spare module to achieve breakthrough levels in power availability.

· Allows flexible planning of converter repair/faulty module replacement.

**3.2 Parallel load sharing**

The PCS100 SFC is extremely flexible with regard to paralleling with other voltage sources, either other generators or multiple SFC units. Parallel load sharing is achieved using frequency and voltage drop profiles programmed into the converter. This allows the converters to share power with other systems without the need for any additional communication signals. In addition, SFC converters of different power ratings can be paralleled, with each one delivering the same percentage of its rated power as required by the load.

**3.3 Power Flow Control**

Using the advanced power flow control capabilities of the SFC, provides the ability to control the powerflow from one AC grid to another. This feature is especially useful for interfacing co-gen plants to the grid, where the flow of power to & from the grid must be controlled.

**3.4 Automatic Output Synchronization**

Where two or more SFC units are paralleled together, or the SFC is connected to an AC bus with other generators, starting the SFC into the live bus is greatly simplified due to the automatic output synchronization feature. Using this feature whenever an SFC is commanded to run it will first check its output to see if there is a live bus connected (for example when changing from generator supply on board vessel to SFC supply). If the output of the SFC is live, then the SFC controller will first phase lock to this exact voltage and frequency before enabling the inverter modules. This enables a full seamless transfer from generator supply to SFC supply on the output bus. If the output bus is dead when the SFC is given a start command it will ramp up the voltage over 1 second, providing a soft energizing of the output.

**3.5 Remote Synchronization**

In addition to the automatic output synchronization feature, the PCS100 SFC also has a dedicated voltage sensing input to allow the converter to synchronize its output to any other three phase voltage reference.

This feature is particularly useful where two separate buses must be synchronized before connecting them together i.e. closing a bus tie breaker on a vessel switchboard.

**3.6 Output Short Circuit Protection**

Should a short circuit occur on the PCS100 SFC output the converter automatically provides currentlimiting to 200% of nominal current for 2 seconds. This allows discrimination with downstreamprotection. If the fault is still present after 2 seconds the SFC will trip offline to avoid damage

**3.7 Output PF Load demand**

Our SFC can supply system current in all 4 quadrants. This means that the SFC is capable of supplying at least 80% reactive current leading or lagging continuously. Depending on the quadrant it may be even higher. The test results on the SFC have shown that it is capable of delivering this magnitude of current at a worst case leading or lagging PF of 0.5.

**3.8 Ability to handle step Load**

Even though the SFC is an IGBT based converter- Inverter system, it has the ability to handle step loads up to 80% easily.

**Technical Specification**

1. **Technical Specification for Item No. 1:**

Minimum Technical Parameters of 750 KVA Static Frequency Converter are as under:

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Description** | **Parameters** |
| 1. **GENERAL** | | |
| 1 | Rating | 750 KVA |
| 2 | Make | ABB/Siemens/Schneider |
| 3 | Enclosure IP rating | IP 42 |
| 4 | Pollution degree rating | 2 |
| 5 | Operating Temperature | 0 °C to 50 °C |
| 6 | Cooling | Forced Air |
| 7 | Temperature | De-rating |
| 8 | Above 50 °C, derate | by 2% |
| 9 | load | per °C to a maximum of 60 °C |
| 10 | Humidity | < 95% non-condensing |
| 11 | Noise | 75-85 dBA typical |
| 12 | Electromagnetic Compatibility CISPR | class A |
| 13 | Enclosure Materials | Electro-galvanized  Steel |
| 14 | Colour | RAL 7035 |
| 15 | Panel Thickness – Sides & Rear Panels | 2 mm., 2 mm. |
| 16 | Enclosure Access | Hinged doors with  key lock |
| 17 | Paint | Aluminium powder coated |
| 1. **INPUT** | | |
| 1 | Type | IGBT Based |
| 2 | Voltage | 208-480 V ± 10% |
| 3 | Power System | 3-Phase TN |
| 4 | Frequency | 50 Hz. or 60 Hz. |
| 5 | Frequency Range | ± 5 Hz. |
| 6 | Max. Continuous Voltage | 110 % |
| 7 | Overload Capacity | 150 % for 30 seconds |
| 8 | Overvoltage Category | III |
| 9 | Efficiency | 95 % Typically |
| 10 | Current Harmonics | <3 % THDi (at rated load) |
| 11 | Power Factor | Unity (adjustable) |
| 1. **OUTPUT** | | |
| 1 | Capacity Rating | 750 KVA |
| 2 | Voltage | 480 V |
| 3 | Frequency | 60 Hz. |
| 4 | Voltage Harmonics | < 2.5 % THDv (linear load) |
| 5 | Overload Capability | 120 % for 10 min\* |
| 6 | 150% | for 30 s |
| 7 | Short Circuit limit | 200 % for 2 s |
| 8 | Voltage Accuracy | +/- 1 % |
| 9 | Frequency Accuracy | +/- 0.1 % |
| 1. **STANDARDS** | | |
| 1 | ISO 90001 Quality Assurance system | |
| 2 | IEC62103 / EN 50178 | |
| 3 | CE Mark | |

1. **Technical Specification for Item No. 2:**

Minimum Technical Parameters of 600 KVA Isolation Transformer are as under:

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Description** | **Parameters** |
| 1 | Rating KVA | 600 KVA |
| 2 | Make | ABB/Siemens/Schneider |
| 3 | Type of Cooling | Forced Natural Air Cooled |
| 4 | Construction | CRGO Metered core joints with four blade system |
| 5 | Phases | 3 Phase |
| 6 | Input Voltage | 480 V +/- 5 % |
| 7 | Input Frequency | 60 Hz. +/- 3 % |
| 8 | Output Voltage | 440 V +/- 5 % (IsolationTransformer) |
| 9 | Output Frequency | 60 Hz.+/- 3 % |
| 10 | Maximum output current | 850 A |
| 11 | IR Value | >200 M |
| 12 | Di-Electric Strength | 4 KV per 120 Seconds |
| 13 | Leakage Current | < 20 Amps |
| 14 | Impedance Voltage | 4-5 % |
| 15 | Regulation | 4-5 % |
| 16 | Loss per Kg | < 1.5 Watts at 1.7 Tesla |
| 17 | No Load Losses | <0.8 % |
| 18 | Load Losses | <1.2 % |
| 19 | Max. Ambient Temp | 55 deg C |
| 20 | Efficiency | >98 % |
| 21 | Linear Harmonics attenuation | 100 % |
| 22 | Duty | Continuous |
| 23 | Class of Insulation | Class “H‟ |
| 24 | Services | Outdoor Application |
| 25 | Method of Winding | Multiple parallel to reduce skin effect |
| 26 | Degree of Protection | IP-40 |
| 27 | Dimension & Weight | As per manufacturer’s design |
| 28 | Standard | IS:2026 Part-I, Part-II & Part-III & IS: 11171 |
| 29 | Material of Winding (HV/LV) Cu | Cu / Cu |
| 30 | Vector Group | Dyn11 |
| 31 | Connection (HV/LV) | Delta / Star |
| 32 | Tapping | Not Applicable |
| 33 | Type of Tap Changer | Not Applicable |
| 34 | Tapping Range / Tap Step | Not applicable |
| 35 | No of Steps | Not applicable |

1. **Technical Specification for Item No. 3:**

Minimum Technical Parameters SFC INPUT Transformer of 1200 KVA are as under:

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Description** | **Parameters** |
| 1 | Make | ABB/Siemens/Schneider |
| 2 | General Description Dry Type Transformer | Rated Frequency (in Hz.) 50 |
| 3 | Reference Standard | IS : 11171 & IS : 2026 |
| 4 | Installation | Outdoor |
| 5 | Duty | Continuous |
| 6 | Application | Converter duty |
| 7 | Altitude | Less than / equal to 1000 m |
| 8 | Rated Power (based on AN Cooling) | 1200 KVA |
| 9 | Rated No-Load Voltage Ratio (HV / LV) | 11 / 0.48 - 0.48 KV |
| 10 | Rated Frequency | 50 Hz. |
| 11 | Number of Phases | 3 |
| 12 | Material of Winding (HV / LV) | CU / CU / CU |
| 13 | Vector Group | Dd0y11 |
| 14 | Connection (HV / LV) | Delta/Delta/Star |
| 15 | Tapping | Off Load |
| 16 | Type of Tap Changer | Off Load tap links |
| 17 | Tapping Range/Tap step - | +5 % to -5 % @ 2.5 % |
| 18 | No. of Steps | +2 / -2 steps |
| 19 | For HV Variation / LV Variation | HV Variation |
| 20 | Class of Insulation Class | H / H / H |
| 21 | Method of Cooling | AN |
| 22 | Avg. Temp. Rise of Winding (HV / LV) | 115 / 115 / 115 Deg. C |
| 23 | Ambient Temp. (Max. / Mini. / Year / Day) | 55 / -5 / 32 / 40 Deg. C |
| 24 | No-Load Loss at Rated Voltage & Frequency (+15% of IS Tol) | 3.20 KW |
| 25 | Full-Load Loss at Rated Current, at 75 Deg. C &  at Principal Tap (+15% of IS Tol) and at  2000 KVA | 12.00 KW |
| 26 | Total Loss at Rated Voltage at Principal  Tapping, Rated Frequency, at 75 Deg. C & at  100% load (±10% of IS Tol.) and at 2000 KVA | 15.20 KW |
| 27 | % Impedance at Rated Current, at 75 Deg. C &  at Principal Tap (±10% of IS Tol.) and at  2000 KVA | 5.00 % |
| A. Reactance | 4.90 % |
| B. Resistance | 1.00 % |
| 28 | No-Load Current at Rated Voltage & Frequency  (as % of F.L.R.C.)(+30% IS Tol.) | 1.50 % |
| 29 | Efficiencies at 75 Deg. C at Unity Power Factor  (Reference vaule) |  |
| a) At Full Load | 98.75 % |
| b) At 3/4 of Full Load | 98.91 % |
| c) At 1/2 of Full Load | 98.98 % |
| 30 | Regulation at Full Load at 75 Deg. C |  |
|  | a) At Unity Power Factor | 1.12 % |
|  | b) At 0.8 Power Factor (Lagging) | 3.76 % |
| 31 | BIL (Insulation Level) |  |
| 32 | Full Wave Lightning Impulse Withstand Voltage (HV / LV) | 75 / - / - KV peak |
| 33 | Separate Source Power-Frequency Voltage Withstand (HV / LV) | 28 / 03 / 03 KV rms |
| 34 | Enclosure |  |
| 35 | Degree of protection of Enclosure | IP-40 |
| 36 | Termination Arrangements |  |
|  | HV | Cable box |
|  | LV | Cable box /As per requirement |
| 37 | Orientation between HV & LV | 180 Deg. |
| 38 | Weights (Approx.) |  |
| Core & Winding | 3500 Kg. or as per manufacturer |
| Enclosure & Fittings | 900 Kg. or as per manufacturer |
| Total Weight | 4400 Kg. or as per manufacturer |
| 39 | Over-all Dimensions (Approx) |  |
| Length | 2200 mm. |
| Breadth | 2350 mm. |
| Height (With base channel) | 2450 mm. |
| 40 | Fittings / Accessories  . | Rating & Diagram plate, Base Channel, Earthing terminals,  Lifting lugs & WTI Scanner with 3 PT-100 Sensors |
| 41 | List of Tests to be conducted at Manufacturer's Works | Routine Test According to IS : 11171 |
| 42 | Noise Level when measured at 1 Meter  Distance | Noise level (dB) values shall be as per NEMA TR-1 |

1. Efficiency and regulation values are calculated based on nominal values of NLL, LL & %Z
2. Weights & dimensions are subject to ±10% Tolerance
3. Terminal arrange shall be done with suitable size of support insulators & bus bars; No bushing shall be provided
4. Cable termination kits, lugs, glands etc. are in scope of Contractor.
5. Enclosure manufacturing & painting procedure shall be as per standard and as per ambient condition.
6. **Technical Specification for Item No. 4:**

This includes supply of canopy type Junction Box (Power Unit) with Plugs and socket arrangement with MCCB as backup power protection.The fixed part of the plug socket is housed in SS enclosure with IP-66 degree of protection. The SS cabinet in 3 mm. stainless steel includes cover holder with bolts. Socket at one end. Hole opening at bottom for cableentry.

Detail Specification are as under

Plug Sockets should be rated for 420 A, 1.1 KV suitable for 185 Sq. mm. copper XLPE cable and having 4 poles.

Make: ABB/SIEMENS/CAVOTEC

1) Junction Box (Power Unit) with Plugs:

* Canopy type Cabinet in 3 mm. thick Stainless Steel - 316, of approximately 813 X 1216 X 762 mm. size including cover holder with 8 Bolts. Socket at one end. Hole opening at bottom of 2 pcs. each of 75 mm.

2) Terminal block for incoming pilots

* 2 pcs. unistrut support as u-bam cabled between terminal block and pilots with 2.5 mm. 2 cable connection terminal ground, M10 bolt mounted on mounting plate
* 1 pc socket type PC5-VX04-K18523-MT1 or equivalent model 3X340A+E+3p/7.2 KV. Keyway at 12 H, Blue, with Kriklock
* 1 pc socket type PC5-VX04-K18523-6MT0 or equivalent model 3X340A+E+3p/7.2 KV. Key way at 6H, Red, with Kriklock
* Heating resistance
* Mechanical interlocking through Kriklock one on each PC5 socket or equivalent model
* FO junction Box 2X4 ch multi-mode
* 2 pcs. 4 ch FO plug with lead, pre-mounted.
* IP-66

3) PC5 plugs for above AMP power unit

* 1 pcs. PC5 SX04-K18503F0-6MT0 or equivalent model, Plug X53x360A+E+3p/7.2 KV, 185 mm.² phase cable, 95 Sq. mm. earth, with crimp terminal, straight bell, push & pull, 4 ch. FO, Red anodized and clear coated, Keying 6 o'clock
* 1 pcs.PC5 SX04-K18503F0-MT1 or equivalent model, Plug X53x360A+E+3p/7.2 KV, 185 mm.² phase cable, 95 mm.² earth, with crimp terminal, straight bell, push & pull, 4 ch. FO, blue anodized and clear coated.

**The Plug Socket should have the following Product features :**

• Maximum voltage 1.1 KV (400 V in pilot circuit), currents up to 420 A

• 4 or 5 pole insulator assembly as standard (See Multi-pin connectors data sheet for more pole)

• IP-66 (when connected or with covers closed)

• Standard ambient temperature: - 40°C to + 80°C or - 40°F to + 176°F

• Socket & connector connection with integrated cover operated by the push & pull arms (Plug available in straight or bentversion)

• Standard finishes : marine grade aluminum ISO : 3522 – Hardware in stainless steel

• Push & Pull arm material: Bronze ISO : 1338:1977

• Female contact, male pin and cable terminal material: silver plated brass

• Easy wiring with male and female insulators fully interchangeable made in PPO (Polyphenylene Oxide)

• Interchangeable pins without dismantling the connector

• All cable terminals suits for cables of Class-5, IEC : 60228

• Standard cable terminals for crimping with hexagonal crimping tool

• Cable glands: Cavotec “onion ring” gasket and strain relief covering cable outer diameters from Ø 35-72 mm. or as directed.

1. **Technical Specification for Item No. 5 :**

This includes supply of 3 Core Stranded Compacted Aluminium Conductor, Conductor Screen with Extruded Semi Conducting compound, XLPE insulated, HT, Insulation Screening with extruded semi conducting compound in combination with copper tape, cores laid up, innersheath of PVC, Galvanised steel flat strip armoured & overall PVC sheathed cable conforming to IS 7098 (Part – II) with up to date Amendments of following size.

a) 3C X 150 Sq mm (E) HT,11 KV XLPE Insulated

1. **Technical Specification for Item No. 6:**

Minimum Technical Parameters of 6 bay HT Panels are as under:

|  |  |  |  |
| --- | --- | --- | --- |
| **Sr. No.** | **Description** | **Parameters** | |
| Incomer Feeder | Outgoing Feeder |
| 1 | Type | SF6 Circuit Breaker (1 no. I/C & 3 nos. O/G) | SF6 Circuit Breaker (1 no. I/C & 3 nos. O/G) |
| 2 | Make | ABB / Siemens / Schneider | ABB / Siemens / Schneider |
| 3 | Rating | 11 KV, 800 A | 11 KV, 800 A |
| 4 | Burden | 26.3 KA for 3 Sec | 26.3 KA for 3 Sec |
| 5 | Bus bar | Copper | Copper |
| 6 | Feeder Qty. | 2 Nos. | 2 Nos.+2 Nos. spare |
| 7 | Cable Run | 1 R X 3 C | 1 R X 3 C |
| 8 | CT Ratio | 100/5-5A | 100/5-5A |
| 9 | Width of Panel | 600 mm. | 600 mm. |
| 10 | Design Ambient | 50 degree Cel. | 50 degree Cel. |
| 11 | Earthing Truck 630 A – Bus Side | 1 | 1 |
| 12 | 11 KV draw out type Floor rolling Vacuum Circuit Breaker 26.3  KA 1 sec |  |  |
| 11 KV, 800 A 26.3 KA for 1 sec CB Vind | 1 | 1 |
| 13 | 1 Ph Resin Casted Current Transformer as per tender  specifications ECS/Pragati/Jyoti make ( 26.3 KA for 1 sec) |  |  |
| 100/5-5, Core -1 : CL 0.2 S , Core -2 : CL 5P20, 5 VA | 4 | 4 |
| 14 | 1 Ph Resin Casted Potential Transformer (mounted on withdrawable trolley on back side of switchgear) : ECS/Pragati/ Jyoti make |  |  |
| As per SLD 11KV/v3/110/v3/110/v3 1/3P 25/25 VA | 3 | -- |
| MCB for PT secondary | 2 | -- |
| 15 | SWITCHES / MCB's / LAMPS: |  |  |
| Trip/Neutral/Close Switch - Switron/Kaycee make | 1 | 1 |
| Local/Remote Switch - Switron/Kaycee make | 1 | 1 |
| Indicating lamps (LED) | 1 Set | 1 Set |
| MCB for Panel AC | 1 | 1 |
| MCB for Panel DC | 1 | 1 |
| 16 | Numerical protection relays-ABB /SIEMENS make main Feeder protection relays RS 485 modbus |  |  |
| Numeric communicable relay on MODBUS (50, 51, 50 N, 51 N 86, 95)  relay type REF 615(ABB)/7SJ62(SEIMENS) | 1 | 1 |
| Static type VHXMB 27 protection | 1 | -- |
| 17 | Electromechanical / static relays |  |  |
| 86 - Master trip relay | 1 | 1 |
| 94 – Anti-pumping Relay | 1 | 1 |
| Aux relays 63TX,WTI,WTT,OTI,OTT,PRD | -- | 4 |
| 18 | INDICATING METERS (Secure/L&T/Rishab) |  |  |
| MFM accuracy Cl 0.2 S + RS 485 (Secure make Elite 440) | 1 | 1 |
| Analog Voltmeter VSS | 1 | -- |
| Analog Ammeter ASS | 1 | 1 |

1. **Technical Specification for Item No. 7:**

This includes laying of 3 C x 150 Sq.mm, 11 KV HT armored aluminium conductor XLPE Cable of 11KV Grade (excluding supply of cable) through.

* 1. **Through RCC Trench**

The cable shall be laid after opening of RCC trench by removing the RCC Covers either through manpower or earthmover & cable trench shall be cleaned properly including removal of garbage, stones, bricks & old unused cables etc from the trench line without damaging the other cables laying in the trench. After laying of the cable, cable trench shall be properly covered with removed RCC covers as per original. The contractor shall provide heat shrinkable straight through joint of relevant size of approved make if the laying of cable shall be more than standard drum length, the straight through joint shall not be considered in the quantity of Item no. This includes all labour and material as directed by Engineer-in-Charge.

* 1. **Through Hard & soft soil**

This includes laying of cable up to 3 core x 150 Sq.mm HT 11KV armored aluminum Conductor XLPE Cable of 11KV Grade (excluding supply of cable) through excavation of trench 0.6 meter wide and 1 meter deep in soft/hard soil. The cable should be placed inside heavy duty RCC Half Round Pipe of 8" inner Dia and 1 Meter length and such RCC Half Round Pipes must be placed in such a fashion so as to provide support under the cable with one half and covering over the cable with the other half.

The bed of 50mm of river sand shall be provided in the bottom of the excavated trench. The RCC Pipe shall be laid over the bed of river sand. This includes filling of gaps by fresh river sand and filling the trench upto at least 300mm height from bottom by fresh river sand. The remaining filling of the trench shall be done with the excavated stuff & should be watered and rammed properly to its original position. The excess excavated stuff shall be disposed off from the site of work and spread in low lying areas as directed by Engineer in Charge or his nominee. The contractor shall provide heat shrinkable straight through joints of relevant size of approved make if the laying of cable shall be more than standard drum length. This includes all labour and material as directed by Engineer-in-Charge. Such cable joints shall be under the scope of work of the contractor at no extra cost or obligation from DPA. Such cable joining work is completely to be done by the contractor at his own cost.

The below figure indicates the expected arrangement of laying of cables:

Ground Level

Filler of Excavated Soil

1 Mtr. River Sand

Half round pipe Top

0.3 Mtr.

Half Round Pipe Bottom

0.6 Mtr Cable

* 1. **Through HDPE pipe**

Cable shall be laid underneath by using Horizontal Directional Drilling (HDD) method by putting suitable diameter HDPE pipe (suitable for cable size up to 11kv HT 3CX 150 Sq.mm having strength 10Kg/sq.cm, shall in contractor scope), The contractor shall arranged JCB Machine for excavation, water for drilling, de- watering pump, HDD equipments of 32 Ton or above capacity along with mud pump at their own cost. The cable shall be pass through heavy duty HDPE pipe buried at nominal minimum depth 165 cm or according to construction of RCC Road/ Rail network or as per directed by EIC. For single cable individual HDPE shall be pass through a road /rail crossing, for separate cable. Separate HDPE pipe shall pass through the Tunnel / trench. Laying of HDPE pipes coupled by HDPE socket only after standard length in excavated trench/tunnel and also sealing of HDPE pipe ends by suitable cap at every manhole. Back filling & dressing of excavated trenches as per specification. This includes all labour and material as directed by Engineer-in-Charge.

1. **Technical Specification for Item No. 8:**

This includes erection, testing and commissioning of complete system including Civil work as per the site requirement. This also includes chemical earthing of 1000 Amp. rating total 10 Nos. for HT Breakers, Transformers, SFC adaptor Junction Boxes of Power Plug including supply and laying of copper strip of size 50x6 mm.

Moreover, to erect the SFC panel (Microprocessor controlled IGBT based system) the control room will need to be constructed & partitioned with a separate enclosure to protect it from dust & humidity. This will need to be taken up during the order execution stage. Construction of Control Room with any other alteration or providing of partition is in the scope of Contractor.

The location of Shore Plug & Socket will be at a mutually agreed location. In case of requirement, same is in the scope of thecontractor. However, DPA will take care of to avoid the damage after expiry of guarantee period from the date of taken over by DPA.

Commissioning of system includes energizing 11 KV breakers, its HT/LTcables, Transformers and SFC along with its power plug. This also includes pre-commissioning of system without load and post commissioning On load with plug-in power supply system with ship in the presence of DPA officials and contractor. Synchronizing system also be conducted for demonstrating with load.

1. **Technical specification 9:-**

This includes supply of heat shrinkable straight through joint kit suitable for 11 kv HT XLPE power cable jointing to HT 3 Core X 150 sq mm. The supply of cable joint kits as per approved

make.

1. **Technical Specification 10 :-**

This includes fixing of heat shrinkable Straight through joint suitable for 11 kv HT 3 Core X 150 sq mm XLPE cable. This including fixing of all required materials. The joint shall be made in such a way that joined section can be reeled without sagging and also joint shall be electrically and mechanically permanent. The work includes all labour, tools tackles, joint kit of approved make and as directed by Engineer-in-Charge

1. **Technical specification 11:-**

This include supply of following type end termination HT XLPE indoor kit as per approved make list.

1. HT 3C x 150 Sq.mm cable
2. **Technical Specification 12:-**

This include making/fixing of following type end termination HT XLPE indoor kit as per approved make list.

1. HT 3C x 150 Sq.mm cable
2. **Technical Specification 13:-**

This includes supply at site 1.1 kV grade, 3 core Copper conductor x 185 sqmm, XLPE insulated armoured cable confirming to IS: 7098 (Part-I) 1985 with up to date amendments and of approved make with ISI mark. The cable shall have marking/embossing at the interval of every meter showing its progressive length. During the cable inspection, the manufacturer shall show the relevant ROUTINE TESTS to inspecting authority or otherwise the manufacturer shall produce the routine test certificate during supply of cable at site.

1. **Technical Specification 14:-**

This includes laying of supplied cable of size 3 core, 185 Sq mm LT armoured Copper Conductor XLPE Cable of 1.1KV Grade .

* 1. **Through RCC Trench**

The cable shall be laid after opening of RCC trench by removing the RCC Covers either through manpower or earthmover & cable trench shall be cleaned properly including removal of garbage, stones, bricks & old unused cables etc from the trench line without damaging the other cables laying in the trench. After laying of the cable, cable trench shall be properly covered with removed RCC covers as per original. The contractor shall provide heat shrinkable straight through joint of relevant size of approved make if the laying of cable shall be more than standard drum length, the straight through joint shall not be considered in the quantity of Item no. This includes all labour and material as directed by Engineer-in-Charge.

* 1. **Through Hard & soft soil**

This includes laying of cable up to 3 core x 185 Sq.mm LT armored aluminum Conductor XLPE Cable of Grade (excluding supply of cable) through excavation of trench 0.6 meter wide and 1 meter deep in soft/hard soil. The cable should be placed inside heavy duty RCC Half Round Pipe of 8" inner Dia and 1 Meter length and such RCC Half Round Pipes must be placed in such a fashion so as to provide support under the cable with one half and covering over the cable with the other half.

The bed of 50mm of river sand shall be provided in the bottom of the excavated trench. The RCC Pipe shall be laid over the bed of river sand. This includes filling of gaps by fresh river sand and filling the trench upto at least 300mm height from bottom by fresh river sand. The remaining filling of the trench shall be done with the excavated stuff & should be watered and rammed properly to its original position. The excess excavated stuff shall be disposed off from the site of work and spread in low lying areas as directed by Engineer in Charge or his nominee. The contractor shall provide heat shrinkable straight through joints of relevant size of approved make if the laying of cable shall be more than standard drum length. This includes all labour and material as directed by Engineer-in-Charge. Such cable joints shall be under the scope of work of the contractor at no extra cost or obligation from DPA. Such cable joining work is completely to be done by the contractor at his own cost.

The below figure indicates the expected arrangement of laying of cables:

Ground Level

Filler of Excavated Soil

1 Mtr. River Sand

Half round pipe Top

0.3 Mtr.

Half Round Pipe Bottom

0.6 Mtr Cable

* 1. **Through HDPE pipe**

Cable shall be laid underneath by using Horizontal Directional Drilling (HDD) method by putting suitable diameter HDPE pipe (suitable for cable size up to LT 3CX 185 Sq.mm having strength 10Kg/sq.cm, shall in contractor scope), The contractor shall arranged JCB Machine for excavation, water for drilling, de- watering pump, HDD equipments of 32 Ton or above capacity along with mud pump at their own cost. The cable shall be pass through heavy duty HDPE pipe buried at nominal minimum depth 165 cm or according to construction of RCC Road/ Rail network or as per directed by EIC. For single cable individual HDPE shall be pass through a road /rail crossing, for separate cable. Separate HDPE pipe shall pass through the Tunnel / trench. Laying of HDPE pipes coupled by HDPE socket only after standard length in excavated trench/tunnel and also sealing of HDPE pipe ends by suitable cap at every manhole. Back filling & dressing of excavated trenches as per specification. This includes all labour and material as directed by Engineer-in-Charge.

**Annexure- I**

|  |  |  |  |
| --- | --- | --- | --- |
| **S/N** | **Description** | **Qty** | **Unit** |
| 1 | Supply of 750 KVA Static Frequency Converter PCS100-03- 06E/F-LH 750 kVA as per the Technical Specification No. 1 | 1 | No. |
| 2 | Supply of Outdoor Isolation Transformer 600 KVA, 3 Ph, 60 Hz., Input 480 V, Output 440 V, Air Cooled as per Technical Specification No. 2 | 1 | No. |
| 3 | Supply of SFC Input Transformer 1200 KVA, 3Ph, 50Hz, Input 11 KV, Output 480 V, 3 winding, Air cooled Ddd0y as per Technical Specification No. 3. | 1 | No. |
| 4 | Supply of Junction Box with Plug as per Technical Specification No. 4.  It will comprise of following components  - Stainless Steel box  - 4 sockets suitable for 400 Amps., 185 Sq. mm.  - 4 plugs suitable for above sockets  - 400Amps – MCCB – 4 Nos. | 1 | No. |
| 5 | Supply of 3 core,11 KV grade, HT Copper conductor XLPE armoured Cable of size 150 Sq. mm. in as per Technical Specification No. 5 and termination of same | 1500 | Mtr. |
| 6 | Supply of 6 Bay HT Panel with Switchgear of 11 KV, 26.3 KA, Lean Gear ZN1, 800 A, for total 6 as per Technical Specification No. 6 | 1 | Set |
| 7 | Laying of 3 core, 11 KV grade, HT Copper conductor XLPE armoured Cable of size 150 Sq. mm. in as per Technical Specification No. 7 and termination of same   1. Through RCC trench 2. Through Hard/Soft soil 3. Through HDPE | 800  400  300 | Mtr. |
| 8 | Erection and Commissioning of the above installations including Civil works and as per Technical Specification No. 8. | 1 | No. |
| 9. | Supply of heat shrinkable straight through joint kit suitable for 11 kv HT XLPE power cable jointing to HT 3 Core X 150 sq mm as per technical specification 9 | 6 | No. |
| 10. | Fixing of heat shrinkable straight through joint kit suitable for 11 KV HT XLPE power cable jointing to HT 3 Core X 150 sq mm as per technical specification 10 | 6 | No. |
| 11 | Supply of following type end termination 11KV HT XLPE indoor kit as per technical specification 11 | 6 | No. |
| 12 | Fixing of following type end termination 11 KV HT XLPE indoor kit as per technical specification 12 | 6 | No. |
| 13 | Supply of 4 core, 1.1 KV grade, LT Copper conductor XLPE armoured Cable of size 185 Sq. mm. in as per Technical Specification No. 13 and termination of same | 500 | mtr |
| 14 | Laying of 4 core, 1.1 kv grade, HT Copper conductor XLPE armoured Cable of size 185 Sq. mm. in as per Technical Specification No. 7 and termination of same   1. Through RCC trench 2. Through Hard/Soft soil 3. Through HDPE | 200  200  100 | mtr |

**NOTE:-**

1. Scope of civil works including covered housing for placing the equipments near the jetty area for the shore supply systems. The Contractor shall design the foundation for the equipments, housing for equipments to prevent the equipments from weather conditions, anti-rusting roofing with steel structures, providing Epoxy painting etc. The housing/room shall withstand the weather conditions such as wind speed @180 KM/Hour etc. and same to be designed accordingly to the location. Design for the civil works shall be get approved by EIC or TPIA (if appointed).
2. It is contractor’s responsibility to make good the areas/locations etc. to the original/ standard condition after the work has been carried out in connection with project work proposed at their own cost and risk.
3. The diagrams, specifications, standards, documents etc. given, are for reference only and the Design, Engineering, Installation and Commissioning has to done as per the requirements and recommendations of EIC by the successful bidder. Preparation of drawings, SL diagrams, earthing layout etc. shall be done as per rule/codes and approval from CEA will be obtained by DPA. However, arrangement for inspection, compliance of observations etc. is in the scope of the contractor.
4. The work has to be carried out in phases as approved by Employer from time to time so that the total project work can progress smoothly with least obstruction to the operations and also works of other Contractors/agencies.
5. It will be deemed that the contractor has priced the respective items on the basis of the approved makes. List of approved makes applicable for the contract is placed at respective volumes of technical specification or as per approved make list of DPA.

A) Where makes have not been indicated in the approved make list, such items shall be of ISI marked/reputed brands/UL certified. Reputed brand implies a brand which is supported by nationwide sales & service distributors/dealers/network/centers, having approval from any Govt. Body/Organisation and all such items shall be got approved from Engineer-In-Charge.

1. Wherever “equivalent” mentioned against makes, suitable evidence shall be produced and get the prior approval of such makes from the Engineer-In-Charge.
2. The work will be under turnkey project with EPC in nature. The minimum requirements are given only which are indicative but not limited to the same.
3. All labour, skilled or unskilled shall be arranged by the contractor. Settling any dispute with the labour will be contractor's responsibility.
4. All plants, equipments and consumables required for the whole work, shall be arranged by the contractor at his own cost.
5. The work shall be arranged by the contractor without causing any damage to Port’s property/any other equipment/installations/structures. Any damage caused by the contractor while execution, shall be compensated/made good at contractor’s risk and cost to the satisfaction of the Engineer-in-Charge of the work, failing which department will do the rectification work and the cost incurred will be recovered from any sum due to him from the Port.
6. The contractor shall take all care and precautionary measures for avoiding damage or accidents to the work from ship or other water crafts movements or other operations in the area. The department will not entertain any claim from the contractor whatsoever, towards compensation for any such damage or accident occurring during the execution of the contract.
7. It may not be possible to give the cite clearance to execute work continuously. The permission will be given to avoid hindrance of port operation.

**Signature & Seal Executive Engineer (E)**

**of Contractor Deendayal Port Authority**