

DEENDAYAL PORT AUTHORITY

An ISO 9001:2008 & ISO 14001:2004 Certified Port

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Office of the Executive Engineer

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No.: EL/WK/2874

Date: 12/03/2025

EXPRESSION OF INTEREST

EXPRESSION OF INTEREST [EOI] for “Providing power supply for 1.6 KVA H.T 11 KV & 300 KVA LT distribution network at 7th berth oil jetty for 1MW GH Demonstration Project at DPA at Kandla”.

(This Notice is issued only to elicit Expression of Interest from the parties interested in the work and does not constitute any binding commitment from the Deendayal Port Authority to proceed with the work or invite any or all the parties in the subsequent bidding process. The Open Tenders will be issued subsequently.)

Executive Engineer (Electrical), DPA invites Expression of Interest for the work of “Providing power supply for 1.6 KVA H.T 11 KV & 300 KVA LT distribution network at 7th berth oil jetty for 1MW GH Demonstration Project at DPA at Kandla”. from the reputed firms from those who have executed similar work in Government/public sectors and 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 their expression of interest for the said work in BOQ format as enclosed at Annexure I. The completed EOI (Expression of Interest) shall be submitted to the office of the undersigned on or before 24/03/2025. A soft copy of EOI is also acceptable through e-mail Id. xenedpa@gmail.com

Yours faithfully

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Executive Engineer (Electrical)
Deendayal Port Authority.

“Schedule B”

Sr. No.	Description of Items	Qty	Rate	Unit	Amount
1	a) Supply of following type 12 KV, 630Amps , 21KA motor operated SF 6 Gas insulated IP 67 degree of protection ,IP 54 Class outdoor type with both side extensible Ring Main Unit complete along with, Motorized with battery and battery charger etc. as per tech spec no 1(a). 1) 4way RMU (1 Incomer + 3 outgoing).	1		No.	
	b) Installation, testing & Commissioning of 12KV,630Amps 21KA Outdoor mounted RMU Unit over pedestal platform as per Technical Specification No. 1(b). 1) 4way RMU (1 Incomer + 3 outgoing).	1		No	
2	Removal, Shifting, of RMU from existing location at 7 th berth oil jetty substation & Re- erection at thermal substation, Kandla with complete testing & Commissioning of RMU Unit over pedestal platform as per Technical Specification No. 2. a) 2 way RMU (1 Incomer + 1 outgoing).	1		Comp Job	
3	Supply, of 3Ph, 4 wire Tri Vector Energy Meter for HT O/g with DLMS protocol of accuracy class 0.2s, with Metering Panel as per technical Specification no 3.	1		No.	
4	Installation, testing & Commissioning of 3Ph, 4 wire Tri Vector Energy Meter for H.T O/g on the pedestal Stand as per technical Specification no 4.	1		No.	
5	Supply at site 3 core, 150 Sq. mm (U/E) HT armoured aluminum conductor XLPE cable of 11kV grade as per IS: 7098 (Part - II) 1988 & as per Tech Specification No. 5.	500		Mtr.	
6	Laying, Testing & Commissioning of 3C x 150 Sqm HT XLPE cable through following and as per Tech Speci No 6. a) laying of cable through exaction in all type of Soil as per technical specification no 6(a)	160		Mtr.	
		300		Mtr.	

	b) Laying of cable in half round RCC pipe of 6" internal dia as per technical specification no 6(b) . c) Laying of Cable through horizontal boring (16") in RCC Road /Rail/Jetty/RCC surface by providing HDPE pipe of suitable size as per technical Specification no 6(c)	40		Mtr.	
7	Supply at site following type of Heat shrink end termination kit for 3 core, 150 Sq. mm size 11kV XLPE aluminum cable as per Technical Specification No. 7. a) Outdoor type b) .Indoor type	8 2		No No	
8	Fixing of following type of Heat shrink end termination kit for 3 core, 150 Sq. mm size 11kV XLPE aluminum cable as per Technical Specification No. 8. a) Outdoor type . b) Indoor type	8 2		No No	
9	Supply at Site 1.1KV grade LT XLPE Cable steel armored aluminum conductor cable, Cross linked Polyethylene (XLPE),FRLS, insulated, PVC sheathed, armoured power cables for effectively earthed systems of approved make and manufacturer as per relevant IS and as per Tech Specification No. :-9 a) 4C x 10Sq. mm b) 4C x 35 Sq. mm c) 4C x 70 Sq. mm d) 4C x 240 Sq mm	100 300 500 500		Mtrs. Mtrs. Mtrs. Mtrs.	
10	Laying of 3.5/4.0 Core LT armoured aluminum conductor XLPE cable of 1.1KV grade of the following type as per as per technical Specification no 10. a) laying of cable through exaction in all type of Soil as per technical specification no 10a) b) Laying of cable in half round RCC pipe of 6" internal dia as per technical specie no 10(b).	600 600		Mtrs. Mtrs.	

	c) Laying of cable on Wall / Truss / Structure as per technical Specification no 10(c)	200		Mtrs	
11	Supply of 6Way 415V, L.T Distribution Panel in existing substation as per technical specification no. 11.	1		No	
12	Installation, testing and commissioning of 6way LT Distribution Panel at existing site after altering / removing the old panel at inside the substation as per technical specification no.12.	1		No	
13	This includes Design, supply of <u>0.45 KV</u> Hybrid Harmonic Filter cum Compensation bank such that >0.98 power factor can be maintained at the 0.45 kV bus for all loading conditions from 40% to 100%. for <u>1 MW green Hydrogen plant</u> at 7 th OIL jetty Kandla produced using <u>water electrolysis</u> , with all equipment and accessories as per Technical Specification No. 13	1		set	
14	Installation, testing and commissioning of <u>0.45 KV LV Power Quality Solution</u> for <u>1 MW green Hydrogen plant</u> at 7 th berth Oil jetty substation after altering / removing the 160KVA DG Set from inside the substation as per technical specification no.14.	1		set	
15	Removal, Shifting, Installation & Commissioning of DG Set AMF Panel from existing 7 th berth oil jetty Substation on the newly constructed PCC platform outside substation as per Technical Specification No. 15	1		Com Job	
TOTAL					

(In words Rupees _____ - _____ only)

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

Signature & Seal of Contractor

**Executive Engineer (E)
Deendayal Port Trust**

1.0 Scope of Work

- 1.1 Execution of Design, manufacturing, inspection & testing at manufacturer's works in accordance with agreed QAP, packaging, delivery to site; handling at site – unloading, storage, shifting from point of unloading to store, storage and from store to the installation site; cleaning, assembly, touch up painting; installation at site; inspection & testing and commissioning; and operation, along with with all accessories.
- 1.2 The work involves to provide uninterrupted 1.6KVA 11H.T & 300KVA 2 no's L.T power supply at 7th berth Oil jetty for providing power supply to 1 megawatt green hydrogen plant
- 1.3 The work involves Design, Supply, fixing & termination of 4 Way RMU panel at 7th berth oil jetty Substation and simultaneously the existing 2-way panel from 7th berth oil jetty should be removed & re-erected at thermal substation the work involves with all labour & material etc.
- 1.4 The work involves Supply, Installation & testing of H.T metering panel at 7th berth oil jetty Substation.
- 1.5 The work involves Design, Supply, fixing & termination of new 6 Way L.T distribution panel at 7th oil jetty substation with 800A Capacity.
- 1.6 This work involves Design, supply of **0.45 KV LV Power Quality Solution** for **1 MW green Hydrogen plant** at 7th berth OIL jetty Kandla produced using **water electrolysis**, with all equipment and accessories.
- 1.7 The work involves Shifting of 160KVA DG set from the existing location inside 7th oil jetty Substation and re –locate the DG set on the PCC plinth to be constructed outside Substation where the location will be given by the Engineer-in-charge.
- 1.8 All equipment and material shall be designed manufactured and tested in accordance with the latest applicable Indian Standard / IEC standard.
- 1.9 Equipment and material confirming to any other standard which ensures equal or better quality may be accepted. In such case copies of English version of the standard adopted shall be submitted.
- 1.10 The electrical installation shall meet the requirement of Indian Electricity Rules as amended upto date relevant IS code of practice and Indian electricity act for releasing / providing power to the Equipment's.
- 1.11 Chemical Earthing system (both copper & G.I) for the entire work.
- 1.12 The contractor shall submit 4 copies of drawing of the complete installation showing complete layout of H.T /L. T cables, earthing etc and same to be handed over to Engineer- in –charge.

Technical Specification

Technical Specification No. 1:

Supply of Gas insulated 4-way extensible RMU switchgear which should comply the requirement stated in the following standard & specification amended up to date.

Metal Enclosed Switchgear	IEC 62271-200/ IEC20 298/IS 12729:1988
Medium Voltage Switch	IEC 265
Alternation Current Dis-connector (Load Break Isolator & Earthing switch)	IEC 60129/ IEC 62271 - 102/ IS 9921
Specification of Alternation Current Breakers	IEC 62271- 100/IEC/60056/IS:13118:1991
Panel Design , SF-6 Circuit Breakers	IEC 62271-1/IEC 60694
Current Transformer	IEC 60044-1/IEC 60185/IS 2705:1992
HV switches	IEC 60265/IS 19920:1981
Filling of SF-6 in RMU	IEC 376
Pressure of SF6 gas	1.4 bars at 20 °C
Cable bushings	DIN 47636
Temperature class	-25 °C - +40 °C Indoor
Degree of Protection: - SF6 tank: IP 67 - Front cover: IP 2X - Cable cover:	IEC 60273/IS 13947 (P-1) IP 67 IP 2X IP 3X
Bus bars	240 mm ² Cu
Earth bar (external):	120 mm ² Cu - Bolt dimension: M10
Colour Front Cover Side & Cable Cover	RAL 7035 RAL 7035

➤ General Requirement:

The Ring Main Unit shall be installed at existing New 11/0.433 kV Substation, A.O. Building. The RMU shall be both side extensible. One Circuit Breaker for incoming cable and three Circuit breaker for outgoing feeder, shall be enclosed in the main tank using SF6 gas as insulating and vacuum as arc quenching medium or SF6 gas as both insulating and arc quenching medium. The main tank shall be

stainless steel sheet of minimum 3mm thickness

and robotically welded with a pressure relief arrangement. Incomer as well as Outgoing feeder shall be provided with Energy Meters.

The cable entry shall be from bottom and the end terminations shall be done on front side.

Inner enclosure (Main tank)

The tank shall be robotically welded stainless steel sheet of minimum 3mm thickness. The tank shall be sealed and no handling of gas should be required throughout the 25 years of service life. However, the SF6 gas pressure inside the tank shall be constantly monitored by a temperature compensating gas pressure indicator offering a simple go, no-go indication. The gas pressure indicator shall be provided with green pressure and red pressure zones. There shall be one Non - return valve to fill up the gas. The manufacturer shall give guarantee for maximum leakage rate of SF6 gas will be lower than 0.1% per Year. An absorption material such as activated alumina in the tank shall be provided to absorb the moisture from the SF6 gas to regenerate the SF6 gas following arc interruption. The degree of protection of the inner enclosure shall be IP 67.

The compact RMU Unit shall be provided with a suitable pedestal made up of M.S. Angle to mount the unit. The height of the bottom of cable box shall be minimum 310 mm to provide the turning radius for the HT cable termination.

➤ BUS BARS:

Three nos. of continuous Bus bars made up of EC grade electrolytic copper of rating current 630A shall be provided. The Short time rating current shall be 20kA for 3 seconds for 11kV. The Bus bar connections shall Anti - oxide greased.

ELECTRICAL DATA:

- 12 kV - 28kV - 1min
- Nominal voltage: 11 kV
- Rated frequency: 50 Hz
- Rated current bus bars: 630 A
- Rated current cable switch dis-connector: 630 A
- Short time withstands current:
 - Cable switch dis-connector with interface C (400-bolt) bushing: 21 kA RMS 3 Seconds
 - Vacuum circuit breaker with interface C (400-bolt) bushing: 21 kA RMS 3 Seconds
- Rated current for transformer T-off: 630 A
- Impulse withstands voltage: To earth and between phases: 95 kV
- Insulation level: - Power frequency 1 min: 28 kV. Relay & Protection Scheme:

Numerical Relay with Control Supply 24V DC, 50Hz. Phase current input Relay shall be suitable for 1A and %A CT secondary (selectable at site). Relay shall be suitable for protection core CT connection. Metering core shall be connected to measuring instruments separately. Ground current input Relay shall be suitable for residually connected CT input. The relay shall have provision for digital inputs, speed switch inputs. The Communication System of the relay shall be equipped with RS485 for

remote communication or for connection to DCS, SCADA or PLC. The relay shall be suitable for port for connection to Laptop & PC preferably of front side. Relay shall support Modbus Protocol. Relay shall be ABB REF615 / Siemens 7SR.

➤ **Front Plate:**

The front shall include a clear mimic diagram which indicates different functions. The position indicators shall give a true reflection of the position of the main contacts and shall be clearly visible to the operator. The lever operating direction shall be clearly indicated in the mimic diagram. The manufacturer's plate shall include the switchboard's main electrical characteristics.

➤ **Danger Board:**

The danger Board plate as per relevant IS shall be riveted on the front plate of the RMU in Languages viz. Gujarati, Hindi, English.

TYPE and ROUTINE TESTS:

Type tests:

The equipment offered in the tender should have been successfully type tested at NABL Laboratories in India or ERDA or equivalent international laboratories for the tests in line with the relevant standard and technical specification and manufacture to submit the valid type test certificates.

Following Type Test must have been carried out:

- Short time current withstand test and peak current withstand test.
- Lightning Impulse voltage withstand test.
- Temperature rise test.
- Short Circuit current making and breaking tests.
- Power frequency voltage withstand test (dry).
- Mechanical operation test.
- Checking of degree of protection of main tank and outer enclosure.
- Checking of partial discharge on complete unit.

➤ **ACCEPTANCE & ROUTINE TESTS:**

All acceptance and routine tests as stipulated in the respective applicable standards amended up to date for all the equipment shall be carried out by the contractor in the presence of DPA representative & TPIA without any extra cost to DPA before dispatch.

The routine tests are as follows:

- 1) Conformity with drawings and diagrams,
- 2) Measurement of closing and opening speeds,
- 3) Measurement of operating torque,
- 4) Checking of filling pressure,
- 5) Checking of gas-tightness,
- 6) Dielectric testing and main circuit resistance measurement,
- 7) Power frequency voltage,

- 8) Resistance test for the circuit,
- 9) Mechanical operation tests.

The contractor, in the presence of representative of DPA & TPIA, shall carry out all above acceptance and routine tests. The contractor shall give at least 15 days advance intimation to DPA to enable to depute representative for witnessing the tests.

The DPA reserves the right for carrying out any other tests of a reasonable nature at the works of the supplier/laboratory or at any other recognized laboratory/research institute in addition to the above mentioned type, acceptance and routine tests at the cost of the DPA to satisfy that the material complies with the intent of this specification.

➤ **DRAWINGS:**

All drawings shall conform to relevant IEC Standards Specification. All drawings shall be in ink.

The Contractor shall submit dimensional general arrangement drawings of the equipment, illustrative and descriptive literature in triplicate for various items in the RMUs, which are all essentially required for future automation.

- i) Schematic diagram of the RMU panel
- ii) Instruction manuals
- iii) Catalogues of spares recommended with drawing to indicate each items of spares
- iv) List of spares and special tools recommended by the supplier.
- v) Copies of Type Test Certificates as per latest IS/IEC.
- vi) Drawings of equipment, relays, control wiring circuit, etc.
- vii) Foundation drawings of RMU.
- viii) Dimensional drawings of each material used for item (vi).
- ix) Actual single line diagram of RMU with or without extra combinations shall be made displayed on the front portion of the RMU so as to carry out the operations easily.

The following should be supplied by contractor:

Copies in triplicate of printed volumes of operation, maintenance and erection manuals in English along with the copies of approved drawings and type test reports etc. sets of the manuals as above shall be supplied to the Engineer-in-Charge along with a soft copy of the all Technical and Drawing.

➤ **NAME PLATE:**

Each RMU and its associated equipments shall be provided with a nameplate legible and indelibly marked with at least the following information.

- Name of manufacturer
- Type
- Serial number
- Voltage Current
- Frequency
- Symmetrical breaking capacity
- Making capacity
- Short time current and its duration
- Purchase Order number and date

- Month and Year of supply

TRAINING:

The contractor shall provide training to Operational Staff and Engineers of DPA. In case of training at manufacturer's works is required, necessary expenses towards boarding, lodging & traveling for the deputed Engineers of DPA shall be borne by DPA.

➤ PERFORMANCE GUARANTEE:

All equipment supplied against this specification shall be guaranteed for a period 12 months from the date of commissioning. However, any engineering error, omission, wrong provision, etc. which do not have any effect on the time period, shall be attended to as and when observed/pointed out without any financial implication on DPA.

The contractor shall supply at site 11 kV, 630 Amp, Indoor Compact Switchgear (Gas Insulated), Extensible on One Side, Motor Driven Spring Charging having 4 nos. Circuit Breaker Modules mentioned as under:

Module No. 1 as 11 kV Incomer along with PT, Module 2 & 3 as Circuit Breaker Module suitable for Distribution Transformer and Module No. 4 as spare 11 kV outgoing feeder suitable for Distribution Transformer.

The Circuit breaker modules shall be supplied with three position isolator/earthing switch, bus bars, interlocking, earth bar and stored spring energy mechanism.

Qty. for each module	Details of Module No. 1
1	Stored energy mech. For manual and Motor Driven Spring Charged operation
1	PT for incomer for metering purpose 11 kV/110 V, Class 0.5
1	Multifunction Energy Meter with RS485
1	Circuit breaker 12 kV, 630 A
1	Control voltage, trip coil 24 V DC
1	Protection system: Relay must be Numeric type with following features: a) Self-Powered OC+EF Protection Relay b) Control voltage, 24 V DC c) Interference RS-485, RS232 port d) Equivalent to CAG 37 for Instantaneous Over Current e) Equivalent to CTUM 15 for short Circuit protection, Inst. Earth fault f) Instantaneous definite time & inverse type protection of over current.
1	Set of three ring core metering & protection CTs: CTs of 300-200/1-1A, 5P10, 2.5VA for protection and 300-200/1-1A CL 0.5, 2.5VA for metering (considering the cable size 3Cx 300 sq. mm HT XLPE cable)

1	Breaker ON(red)/OFF(green)/TRIP(amber) LED Indication
1	Capacitive voltage indication fixed type
1	Suitable Power Pack for Auxiliary DC Power supply for Relays

Qty. for each module	Details of Module No. 2, 3 & 4
1	Stored energy mech. for manual and Motor Driven Spring Charged operation
1	Multifunction Energy Meter with RS485
1	Circuit breaker 12 kV, 630 A
1	Control voltage, trip coil 24 V DC
1	Self-Powered OC+EF Protection Relay
1	Set of three ring core metering & protection CTs: CTs of 150-100/1-1A, 5P10, 2.5VA for protection and 150-100/1-1A CL 0.5, 2.5VA for metering (considering the cable size 3Cx 150 sq. mm HT XLPE cable)
1	Set of Transformer Protection Annunciation Scheme comprising of: 1 no. Master Trip Relay (24VDC) 6 no. Aux. Relays (24VDC) 1 no. 8-Window Annunciator & Hotter Suitable for providing facility for Buchholz/OTI/WTI Alarm/Trip Indication,
1	Breaker ON(red)/OFF(green)/TRIP(amber) LED Indication
1	Capacitive voltage indication fixed type
1	Suitable Power Pack for Auxiliary DC Power supply for Electro-Mechanical Aux Relays and Master Trip Relays

In addition to above following material to be supplied by Contractor for each panel.

Qty.	Material to be supplied by Contractor with each panel
3	Set of Terminal Protector boots for covering cable-termination.
1	Manometer installed on RMU for Gas Pressure indication.
2	Operating handle

Note: The contractor shall provide 5 Years warranty against the low pressure of pre-filled SF6.gas in the RMU from the date of commissioning of RMU.

The work also includes installations, testing and commissioning of supplied RMU panel at exiting 7th berth 11/0.433 kV Substation, Kandla.

All the RMU Panel application shall be erected by using suitable size of M.S. channel (to be supplied & erected by contractor, as per each module approved foundation drawing) foundation bolts including grouting of the bolts of each Module RMU panel. The RMU panel shall be connected with two separate and distinct earthing system. After installation of RMU panel, necessary test and trial shall be carried out for proper functioning of safety, devices, relay etc. and before charging RMU Panel, all the tests required under relevant ISS and IEC – Rules 1956 shall be carried out and the result shall be in conformity with specifications and copies of test results shall be furnished to Engineer-in-Charge. The work includes supply & fixing of required length of insulated Rubber Mat having withstand capacity up to 22 kV, the Rubber Mat shall be laid in such a way, near the panel for operation of RMU.

The complete work shall be carried out as directed by Engineer in Charge. The work includes required labour & material for installations, testing and commissioning of RMU as directed by Engineer in Charge.

Technical Specification No. 2:

The work involves removal & shifting of 2way RMU from the existing location and re assemble the same at thermal substation along with testing and commissioning at thermal Substation, Kandla. This includes end terminations of Incoming and outgoing cables in all respect with cable glands, lugs for incoming & outgoing cables. During transportation or while removing utmost care should be taken proper tools & tackles should be used for loading & transportation.

The RMU Panel shall be erected by using suitable size of M.S. channel (to be supplied & erected by contractor, as per each module approved foundation drawing) foundation bolts including grouting of the bolts of each Module RMU panel. The RMU panel shall be connected with two separate and distinct earthing system. After installation of RMU panel, necessary test and trial shall be carried out for proper functioning of safety, devices, relay etc. and before charging RMU Panel, all the tests required under relevant ISS and IEC – Rules 1956 shall be carried out and the result shall be in conformity with specifications and copies of test results shall be furnished to Engineer-in-Charge. The work includes supply & fixing of required length of insulated Rubber Mat having withstand capacity up to 22 kV, the Rubber Mat shall be laid in such a way, near the panel for operation of RMU.

The complete work shall be carried out as directed by Engineer in Charge. The work includes required labour & material for installations, testing and commissioning of RMU as directed by Engineer in Charge.

TECHNICAL SPECIFICATIONS FOR ITEM NO.3.

This includes supply, of 3Ph, 4 wire Tri Vector Energy Meter for HT O/g with DLMS protocol of accuracy class 0.2s, with Metering Panel. The meter should be capable to record & LED Display KWH, KVARh, KVAh & maximum demand in KVA for 3 phase 4 wire as well as 3 phase, 3 wire AC balanced / unbalanced loads for a power factor range ZERO (Lagging) through unity up to ZERO (Leading) as per requirement given in specification.

Application: - In 7th oil jetty Substation at 1 no. for Outgoing Panel for 1 mega watt GH2 plant

Sr. No	Items	Requirement
01	Type	AMR compatible static, Tri Vector for 3phase, 4/3 phase 3 wires for tariff metering purpose.
02	CT	100-150/50-5 class 0.2s
03	PT	11KV/110 v Class 0.2s
04	Ammeter	Digital type with selector switch
05	Voltmeter	Digital type with selector switch
06	Frequency	50Hz(+/-)5%
07	Accuracy Class	0.2s as per IS 14697/CBIP-88
08	Secondary Voltage	For CT/PT operated HT Meters –suitable for operation from 110V Ph-Ph or 63.5V ph-N.
09	Current	CT operated I b1A,5A. I Max.....200% of Ib. Whole Current Ib.....20Amps. Imax.....up to 600% of Ib.
10	Power factor	0.0lag-unity -0.0 lead
11	Power Consumption	The active and apparent power in each circuit .
12	Measured value	4 quadrant measurement of KWH, KVARh, KVAh
13	Parameter Shown in LED Display	1 , 3ph-ph to neutral Vg. 2 , 3ph-ph to ph Vg. 3 , 3ph-current. 4 , 3ph KVA, KW, KVAR & PF Frequency. 5 , Total voltage, Current, Frequency, KVAh, KWH, KVARh, PF& Average PF till last MD reset. 6 , TOD KWH, KWH, KVARh (Lag & Lead) for 4 Zones. 7 , rising demand.

		<p>8, prediction Demand KVA.</p> <p>9, Max Demand with Date & Time.</p> <p>10. TOD max Demand & date in 4 zones.</p> <p>11. Cumulative MD & MD reset counts.</p>
13	Tamper Recording	<p>Should be lag the following Tamperers with date & Time of occurrence & restoration.</p> <ul style="list-style-type: none"> - Missing Potential. - Missing I. - I&V unbalance. - Current Reversal. <p>Snapshot of V, I, PF, Energy at time of Tamper.</p> <p>Flag for phase sequence, I reversal, V.</p>
14	Display	<p>LCD with Backlight, 8 Digits, 7 Segment Display.</p> <ol style="list-style-type: none"> 1. Auto Scroll Display. 2. 3 Display Modes. 3. Up-Dn keys scroll.
15	Maximum Demand	<p>Up to 3 MD register can be programmed integration period programmable from 1 to 60 minute.</p> <p>Reset: auto/manual/through.</p>
16	communication	<p>Optical port as per IEC 1107.</p> <ul style="list-style-type: none"> -RS 232 port (optimal) - RS 485 using MODBUS protocol (optimal).
16	Data security	<p>Data storage in non volatile memory 2 levels of password :-</p> <p>For Data reading.</p> <p>For programming.</p>
17	Design	<p>Meter shall be designed with application specific integrated circuit (ASIC) or micro controller ; shall have no moving part; electronics component shall be assembled on printed circuit board using surface mounting technology; factor calibration using high accuracy (0.2s class) software based test bench.</p>

Specification for Metering Panel.

Sr. No	Description	Specification
01	MOC	CRC with bolted Structurer
02	Thickness	2.5mm for door 2.0mm rest of the Structure. 1.0mm for explosion vent.
03	Main Bus Bar	1X50X10 AL bus Bar.
04	Earth Bus bar	25X6 Al. Bus Bar
05	Sleeves	Colour Coded PVC sleeves
06	Paint	RL 7032 Powder Coated after seven tank Process –Epoxy
07	Power cable Entry	Bottom
08	Control Cable entry	Bottom
09	Wiring For CT , PT Circuit For Control Circuit	2.5 Sq.mm Stranded cu wire 1.5 Sq.mm Stranded cu wire
10	Installation	Indoor Type Floor Mounted free standing.
11	Over All Dimension	600X900X1800mm
12	Min Clear Draw Out Space	1.2Mtr.
13	Weight	200 Kg approx.
14	Testing offered	Polarity & CT /PT primary injection.

4. TECHNICAL SPECIFICATIONS FOR ITEM NO. 04

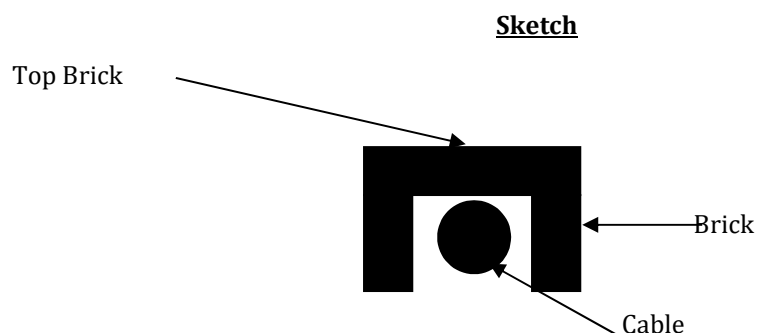
This includes installation Metering Panel at the S/s wiring includes necessary wiring connection & earth linking, the works also include CT, PT shall be Tested in ERDA Lab and Meter should Test in PGVCL authority Lab, in this regard contractor shall be submitted the Test Report of CT, PT , HT Tariff Meter Works comprise with all material, licensing ,labour tolls & tackles as directed by EIC.

5. TECHNICAL SPECIFICATIONS FOR ITEM NO. 05.

This includes supply at site 11KV grade, 3 core 150 Sq mm 11KV Aluminum conductor, HT XLPE insulated armoured cable confirming to IS: 7098 (Part-II) 2011 with up to date amendments and of approved make with ISI mark. Cables is to be supplied in single length and cable with joint shall not be accepted. The manufacturer shall produce TYPE TEST certificate with similar size of cable, which shall not be more than 3 years old. 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. This includes all the labour, taxes loading,unloading at site as directed by Engineer-in-Charge, but excluding GST.

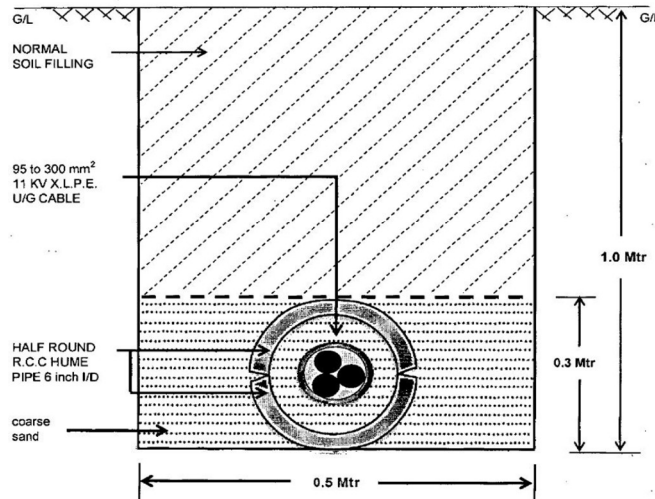
6. TECHNICAL SPECIFICATIONS FOR ITEM NO. 06.

- (a) The item includes laying of single length cable of size 3 Core, 150 Sq. mm XLPE Insulated aluminum conductor XLPE insulated armoured cable of 11kv grade through excavation in hard/soft soil. The trench to be excavated of 300 mm width & 1.5 meter depth. The bed of 50mm of river sand shall be provided in the bottom of the excavated trench. The cable shall be laid over the bed of river sand. The cable shall be protected as per Sketch shown below by providing and laying bricks both the sides lengthwise parallel to the cable & the gaps shall be filled with river sand. The cable shall be covered by keeping two bricks over the side bricks shown in the sketch. The 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 spreaded in low laying area as directed. The item includes required material and labour as directed by Engineer in charge.



- (b) The item includes laying of single length cable of size 3 Core, 150 Sq. mm XLPE Insulated aluminum conductor XLPE insulated armoured cable of 11kv grade in the existing NP2 Pipe Trench. The cable shall be passed through the existing NP2 pipe after opening & removing RCC trench manhole cover. After laying of the cable, the manhole shall be properly covered with existing removed RCC covers as per its original position. At every approximately 30m length of NP2 Pipe, a suitable size of manhole exists. The item includes required material and labour as directed by Engineer in charge.

**DRAWING FOR LAYING OF ONE NO 11 KV 95 TO 300 mm² X.L.P.E.
UNDE GROUND CABLE**



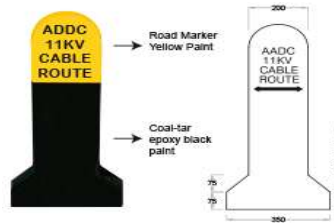
(c) Laing through HDD:-

Cable shall be laid underneath by using {16" Boar Diameter} Horizontal Directional Drilling (HDD) method by putting suitable diameter HDPE (suitable for cable size up to HT 3CX 400 Sq.mm} HDPE pipe having strength 10Kg/sq.cm} shall in contractor scope), the contractor shall arranged JCB Machine for excavation, water for drilling, de- watering pump, HDD equipment's 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. Lying 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 rate includes all labour and all material as directed by Engineer-in-Charge.

CABLE ROUTE AND JOINT MARKERS

1. Permanent means of indicating the positions of joints on site should be provided. During the course of permanent reinstatement cable and joint markers, should be laid directly above the route of the cable and the position of the joint respectively.
2. Wherever it is not possible to place the marker directly over the cable route or joint the marker should be suitably placed near the cable route or joint on which the distance of the cable route or joint at right angles to and parallel to the marker should be clearly indicated.
3. The below fig shows different samples of route marker as per the site requirement & position of fixing the markers will be decided of the Engineer-In-charge.
4. The letters to be written on the route marker will be decided while execution by the Engineer-in-charge. The diagram shown below is just for knowledge to have an idea while execution of laying of cable.

5. Route marker should be visible and the pedestal should be buried underneath the ground atleast 1mt depth by providing CC foundation.



7. TECHNICAL SPECIFICATIONS FOR ITEM NO. 7.

- (a) This include supply at site outdoor type heat shrink end termination kit for 3 core, 150 Sq. mm HT armored aluminum conductor XLPE Cable of 11 kV grade as per the approved make list.
- (b) This include supply at site indoor type heat shrink end termination kit for 3 core, 150 Sq. mm HT armored aluminum conductor XLPE Cable of 11 kV grade as per the approved make list.

8. TECHNICAL SPECIFICATIONS FOR ITEM NO. 8.

This include fixing of following type heat shrink end termination kit of 3 Core, 95 Sq. mm size of HT armored aluminum conductor XLPE Cable of 11 kV grade. The joint shall make in such a way that joined section can be reeled without sagging and the joint shall be electrically and mechanically permanent. This includes all required material, tools & tackles and labour as directed by Engineer in charge.

- a) Outdoor type end termination,
- b) Indoor type end termination.

9. TECHNICAL SPECIFICATIONS FOR ITEM NO. 9.

This item includes supply at site 1.1 kV grade, following size of aluminium conductor XLPE insulated armoured cable confirming to IS: 7098 (Part-I) 1985 with up to date amendments, having ISI mark and of approved make. The cable shall have marking/embossing at the interval of every meter showing its progressive length. The size of LT armoured XLPE aluminium conductor cable are:

- a) 4 Core, 10 Sq.mm,
- b) 4 Core, 35 Sq.mm,
- c) 4 Core, 70 Sq.mm,
- d) 4 Core, 240 Sq.mm,

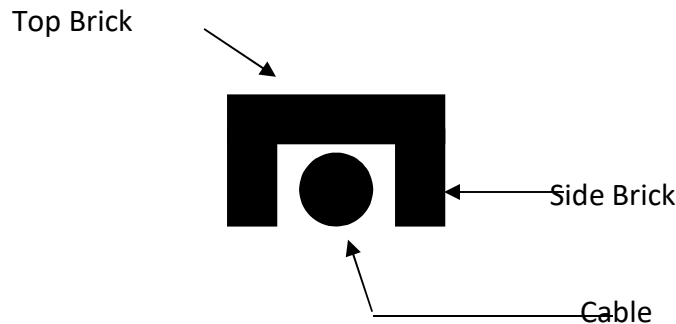
The contractor shall submit type test certificate at the time of supply of Cable at site. The type test certificate shall not be more than 3 years old. The rate shall be inclusive of all taxes (excluding GST), packing, forwarding, insurance, transportation, and unloading at site of work.

10. TECHNICAL SPECIFICATIONS FOR ITEM NO. 10.

This includes laying of single length cables up to 3 ½ / 4.0 core x 150 Sq.mm LT armoured aluminum Conductor XLPE Cable of 1.1KV Grade (excluding supply of cable)

- a) Through excavation in soft/hard soil. The trench to be excavated 0.3 mtr. wide 0.6 mtr. deep. The bed of 50mm of river sand shall be provided in the bottom of the excavated trench. The cable shall be laid over the bed of river sand. The cable shall be protected as per Sketch shown below by providing and laying bricks both the sides lengthwise parallel to the cable & the gaps shall be filled with river sand. The cable shall be covered by keeping two bricks over the side bricks shown in the sketch. The 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 spreaded in low laying area as directed.

Sketch



- b) Excavation of trench 0.5Mtr. Wide and 1 Mtr. Deep for laying of LT underground cable of size upto 150Sq.mm XLPE.(The cable should be laid on bed of sand and to cover cable with half round RCC pipe 6" internal dia and length of one meter along with each at the bottom and top of the cable as shown in figure below.) The entire trench thereafter should be refilled with earth dully rammed up to ground level As per drawing below.
- f) Laying of L.T cable on existing wall/cement /M.S structure.

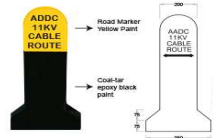
This includes laying of supplied single length cable up to 3 ½ / 4.0 core x 150 Sq.mm LT armoured aluminum Conductor XLPE Cable of 1.1KV Grade (excluding supply of cable) on existing wall/cement structure. The G.I. Saddle set with base & Clamps shall be provided of suitable size (with respect to cable outer diameter) made from G.I. flat 25 x 3 mm with G.I. Nut bolts/heavy duty screws for clamping. The base shall be fixed rigidly on wall/cement/ steel structure through cemented wooden gutties or welding if on structure at 0.50 mtr. Intervals & the cable shall be laid on 3mm thick G.I. saddle base on wall/cement structure and clamped rigidly by G.I. screwing/bolting of clamps. The work includes with all materials and labour as directed by Engineer-in-charge.

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. This includes all labour and material as directed by Engineer-in-Charge.

CABLE ROUTE AND JOINT MARKERS

1. Permanent means of indicating the positions of joints on site should be provided. During the course of permanent reinstatement cable and joint markers, should be laid directly above the route of the cable and the position of the joint respectively.
2. Wherever it is not possible to place the marker directly over the cable route or joint the marker should be suitably placed near the cable route or joint on which the distance of the cable route or joint at right angles to and parallel to the marker should be clearly indicated.

3. The below fig shows different samples of route marker as per the site requirement & position of fixing the markers will be decided of the Engineer-In-charge.
4. The letters to be written on the route marker will be decided while execution by the Engineer-in-charge. The diagram shown below is just for knowledge to have an idea while execution of laying of cable.
5. Route marker should be visible and the pedestal should be buried underneath the ground at least 1mt depth by providing CC foundation.



11. TECHNICAL SPECIFICATIONS FOR ITEM NO. 11.

This item includes design, manufacture, testing & supply at site 16 Way, 2000 Amp, LT Power Distribution Panel suitable for 415V, 3 Phase 4 Wire, 50Hz AC supply system including Switchgears and internal wiring complete in all respect. The LT panel shall be extensible on one side.

The Panel shall be dust and vermin proof, free standing, compartmentalized made from 14 SWG, indoor type, and fabricated from CRCA sheet on robust angle iron frame painted with two coats of Zinc rich primer paint and two coats of colour pigmented epoxy paint shade no. 631 of IS: 5. Before painting the panel, the surface treatment shall be carried out by 7 tank process including degreasing etc.

LT distribution panel shall have Bus-bars which shall be made of high conductivity aluminum alloy of E91E grade, Bus bar joints shall be complete with high tensile steel bolt and washers and nuts bus bar of 2000 Amp rating for three Phases and Half the size of Neutral including and PVC sleeving. All the bus bar shall be supported on hylem /epoxy insulator. The Bakelite sheet of 12 mm (Minimum) thickness shall be provided in side enclosure of panel and wherever it is found necessary under relevant IS specification and IER 1956.

The panel shall be provided with metallic engraved/Radium film labels on front for identification of Incoming & Outgoing feeders.

The neoprene gaskets shall be provided on the periphery of the doors of all feeders.

The sleeved electrolytic copper bus-bars with epoxy insulators with Bakelite support and separators shall be provided with colour code.

All power cables shall enter the switchboard from the bottom on the back of the panel. Sufficient space shall be provided for ease of connection and termination of cables.

Any other electrical component for which details not mentioned but required for operational point of view is to be also considered.

The panel shall be complete in all respect with cable glands, lugs for incoming & outgoing cables along with 2 nos. of earthing terminals.

The panel shall be comprised with following accessories:

1) Main Incomer (1 No.)

The Main Incomer Feeder shall be provided with 1 no. 800 Amp, 50 kA, 415 Volt, Triple Pole – MDO (Draw out type) ACB (Air Circuit Breaker) with Microprocessor released over current, Short circuit and Earth fault relay with Shunt Trip & under Voltage Coil.

The Digital Multi-Function Energy Meter (accuracy class 0.5) with LCD display shall be provided with parameters like kWh, MD, Voltage of each phase, Line current for each Phase, PF of each Phase, P.F average, Instantaneous kW, Frequency & Date & Time. The Energy Meter shall have RS485/RS232/Ethernet communication port for output.

The LED Indication lamps 6 nos. for R, Y, B, ON, OFF and trip indication shall be provided.

The 3 Nos. CTs having ratio of 800/5 Amps, class 1 tape wound, shall be provided for metering on each feeder and 4 nos. control fuses / neutral links are to be provided with incomer & the control wiring shall be done with copper wire.

2) DG Set Incomer (1 No.)

The AMF DG Set Incomer Feeder shall be provided with 1 no. 800 Amp, 50 kA, 415 Volt, Triple Pole – MDO (Draw out type) ACB (Air Circuit Breaker) with Microprocessor released over current, Short circuit and Earth fault relay with Shunt Trip & under Voltage Coil.

The Digital Multi-Function Energy Meter (accuracy class 0.5) with LCD display shall be provided with parameters like kWh, MD, Voltage of each phase, Line current for each Phase, PF of each Phase, P.F average, Instantaneous kW, Frequency & Date & Time. The Energy Meter shall have RS485/RS232/Ethernet communication port for output.

The LED Indication lamps 6 nos. for R, Y, B, ON, OFF and trip indication shall be provided.

The 3 Nos. CTs having ratio of 800/5 Amps, class 1 tape wound, shall be provided for metering on each feeder and 4 nos. control fuses / neutral links are to be provided with incomer & the control wiring shall be done with copper wire.

3) OUTGOING FEEDERS (10 Nos.):

The Outgoing Feeders shall be provided with

- (1) 2 no. 400 Amp, 35 kA, 415 Volt, Triple Pole – MDO (Draw out type) ACB (Air Circuit Breaker) with Microprocessor released over current, Short circuit and Earth fault relay with Shunt Trip & under Voltage Coil. The LED Indication lamps 6 nos. for R, Y, B, ON, OFF and trip indication shall be provided.
- (2) 1 Nos. TPN MCCB, 400 Amp, 415 Volt, 36 kA breaking capacity with Microprocessor based for each feeder.
- (3) 2 no 250A, FP, MCCB, Thermal Magnetic , Ics=100% Icu , Breaking Capacity =50KA
- (4) 6 no 100A, MCCB,FP,125A, Thermal Magnetic , Ics=100% Icu , Breaking Capacity =50KA.
- (5) 3 no 63A, FP, MCCB, Thermal Magnetic , Ics=100% Icu , Breaking Capacity =25KA

Each feeder shall have Digital Multi-Function Energy Meter, Accuracy Class 0.5 for measurement of

energy consumption of the feeder with RS485/RS232/Ethernet communication port for output. The LED Indication lamp 1 no. for ON indication shall be provided on each feeder. The control wiring & power wiring shall be done with copper wire properly and the power wiring shall be brought up to the Power terminal block of suitable ampere capacity.

The LT Panel shall be tested as per the relevant IS standard. Before Manufacturing the LT Panel, the relevant test certificate in support of LT distribution panel manufacturing, along with design & drawing shall be submitted to DPA for approval and also all Electrical accessories shall be used as per approved Make List of DPA.

The rates shall be inclusive of all the taxes (excluding GST), insurance, transportation, unloading at site as directed by Engineer in charge.

12. TECHNICAL SPECIFICATIONS FOR ITEM NO. 12.

This item includes installation, testing and commissioning of supplied 16 way LT Power Distribution Panel in new Substation of 7th berth oil jetty Sub-station. The work includes end termination, connection of cables laid between Transformer's LT side and the LT Power distribution panel including earth connection. This includes necessary mounting hardware for bolting/welding down the base frame to the foundation. All alignment, leveling, grouting, anchoring adjustments shall be carried out in accordance with manufacturer's instruction or as directed by Engineer in charge. The work includes termination of the laid Cables along with providing suitable size of lugs, glands and necessary earth linking connection. All connections in Distribution Panel shall be completed, checked and adjusted to ensure safety and satisfactory operation of the equipment. After installation of the Distribution Panel testing and commissioning shall be done as directed. The work includes all material, labour, tools & tackles as directed by Engineer in charge.

13. TECHNICAL SPECIFICATIONS FOR ITEM NO. 13.

This includes supply of 0.45 KV LV Power Quality Solution for 1 MW green Hydrogen plant at 7th berth OIL jetty Kandla produced using water electrolysis, with all equipment and accessories the specification is intended to cover the minimum requirement for complete system design, engineering, manufacturing, material, testing at manufacturer's works, painting, packing for transportation, forwarding, Supervision of Testing and Commissioning at site, site painting (if any), performance guarantee test of LV Power Quality Solution, with all equipment and accessories.

Site Information

- Project Title : 1 MW Green Hydrogen Generation Unit
- Location : Kandla
- State/ Country : Gujarat, INDIA
- Nearest town/ city : Gandhidham
- Nearest airport : Gandhidham
- Rainy Season : June to September
- Annual rainfall (Min/Avg/Max) : 15.50/467.5/1393 mm
- Seismic Zone : V (Five).

Ambient conditions:

Parameters	Units	
Ambient temperature During Summer (Min / Max)	°C	21.68 / 48.44
Ambient temperature During Monsoon (Min / Max)	°C	29.32/ 33.38
Ambient temperature During Winter (Min / Max)	°C	21.68 / 31.24
Relative humidity During Summer (Min / Max)		30.59 % / 76.32%
Relative humidity During Monsoon (Min / Max)		66.85 % / 84.57%
Relative humidity During Winter (Min / Max)		49.02 % / 59.69%
Atmospheric pressure	Kg/cm2(a)	1.026
Design Ambient Temperature	°C	50

Code and Standards

All equipment, systems and services covered under this specification shall comply with all currently applicable statutes, regulations, and safety codes in the locality where the equipment will be installed. The equipment and systems shall also confirm to the latest applicable standards.

All standards and codes referenced in the codes and standards listed below, or listed in the relevant design criteria, are considered implicit in this document. Where applicable, all codes and standards must incorporate all amendments.

IS: 5	Colours for ready mixed paints and enamels.
IS: 1248	Direct acting indicating analogue electrical measuring instruments and their accessories
IS: 2071	High Voltage Test Technique
IS: 2705	Current transformers
IS: 2099	Bushings for alternating voltages above 1000V
IS: 2544	Porcelain post insulators for systems with nominal voltage greater than 1000V
IS:3618	Phosphate treatment of iron and steel for protection against corrosion.
IS:5082	Wrought Aluminum and Aluminum alloy bars, rods, tubes and sections for electrical purposes.
IS: 5553	Reactors
IS: 5578	Guide for marking of insulated conductors
IS: 8084	Interconnecting bus bars for AC voltage above 1kV up to and 36kV .
IS: 9402	HV fuses for the external protection of shunt power capacitors
IS: 10601	Dimensions of terminals of high voltage switchgear and Control-gear
IS: 11353	Guide for uniform system of marking and identification of Conductors & apparatus terminals
IS: 12672	Internal fuses and internal overpressure dis-connectors for shunt capacitors
IS: 13925	Shunt capacitors for AC power systems having a rated voltage above 1000/660V IEC 60282-1
IS/IEC 60470	High voltage fuses -Current Limiting fuses
IEC 60871	High Voltage Switchgear Alternating Current Contactors and contactor-based motor starters
60076	Shunt capacitors for AC power systems having rated voltage above 1000V. IEC
IEEE-519	Power Transformers
IS/IEC 62271	Recommended Practice and Requirements for harmonic Control in electric power Systems
(Part 1, 102, 103,	High Voltage Switchgear and Control gear

105, 109, 200, 201)

IEC 62271 High Voltage Switchgear and Control-gear

IS IEC: 60529 Degrees of protection provided by enclosures (IP Code). IS:13925(Part-1)
Capacitor IEC 60871-1,

IS:5553 Series Reactor

IEC 60931-3 Internal fuse

Scope of Work:-

The package in general includes but not limited to design engineering, manufacturing, handling, cleaning, inspection & testing at manufacturers work ,coating ,shop painting and related approvals of statutory bodies as applicable, packing and delivering at site, supervision of erection and commissioning ,supervision of performance guarantee testing at site and site services as specified elsewhere for LV Power Quality Solution and providing the service as delineated in the document and in accordance with applicable codes and standards . The work shall include all necessary and/or usually supplied equipment and appurtenances for the safe, efficient, and reliable operation of LV Power Quality Solution within the scope of this specification whether such items are specifically referred to in this specification and in accordance with applicable codes and standards. LV Power Quality Solution shall confirm to high standard of engineering design and workmanship and be capable of performing in continuous commercial operation up to Bidder's guarantee in a manner acceptable to PURCHASER/OWNER. Bidder/contractor shall supply the Power Quality Solution as a hybrid of Active and Passive compensation and filtering. The passive component shall provide maximum kVAR compensation and the active component shall be designed to cater to the variable kVAR requirements, according to different plant loading conditions, such that there is no overcompensation of kVAR causing leading power factor occurs. The share of passive and active compensation in the Power Quality Solution package should be optimised with respect to efficiency, total footprint as well as initial CAPEX.

Any items though not specified but which are required to make reliable trouble-free operation shall also be taken to be included in the scope of supply.

The scope of supply of shall cover the following:

Sr.No.	Description of Equipment	Quantity (Nos.)
1	<p>Bidder to design 0.45 kV Hybrid Harmonic Filter cum Compensation bank such that >0.98 power factor can be maintained at the 0.45 kV bus for all loading conditions from 40% to 100%.</p> <p>Please note that our requirement is to install harmonic filters and compensation banks on the 0.45 kV bus to improve power factor and mitigate harmonics in compliance to IEEE-519 limits.</p> <p>Here, also attached are the harmonic spectrums and harmonic limits along with system data for reference.</p> <p>Type: Indoor Type</p>	1

All fittings and accessories required for the completeness of the equipment, whether specifically mentioned or not, but considered essential for satisfactory performance, shall be included in the scope of supply.

Terminal Points

The following is a list of terminal points:

- (a) The Power terminals for Panels.
- (b) One no. (1) of 240V/415V AC auxiliary power supply shall be provided by Purchaser. Further distribution within Panel as per manufacturer's standard type tested design shall be by Bidder.
- (c) Panel Control and CT/PT terminals (for connection to equipment not under the scope of supply of this specification) shall be provided by Bidder. All external connections shall be through terminal block. Terminal blocks shall be grouped according to Power supplies, annunciation, functioning etc. Spare terminals shall be wired up to terminal block.

Information/ Documents/ Data to be furnished with the bid

Bidder shall submit the following drawings / data / information along with offer. Several blank documents in excel format have been attached. Bidder to fill up the excel sheets and submit along with offer:

Sr No	Document
1.	Technical datasheet
2.	General Arrangement drawing along with different views and cable termination details
3.	Single line Diagram & Bill of Material
4.	QAP and Inspection & Test Plan
5.	Past Project References
6.	Type Test Certificates not Older than 5 Years
7.	Commissioning & start-up spares list

Technical Description

- (a) 0.45 kV LV Power quality solution shall be supplied with indoor equipment e.g., reactor, Capacitor etc.
- (b) 0.45 kV LV Power quality solution shall be located indoor in ventilated substation area.
- (c) LV Power quality solution shall provide maximum net KVAR at rated nominal voltage. The insulation system shall be designed to withstand continuous over voltage of 110%.
- (d) It is supplier's responsibility to ensure that effect of harmonics shall be taken in consideration while designing the complete system. Supplier shall comply with relevant standards, as applicable.

1.0 Attachments

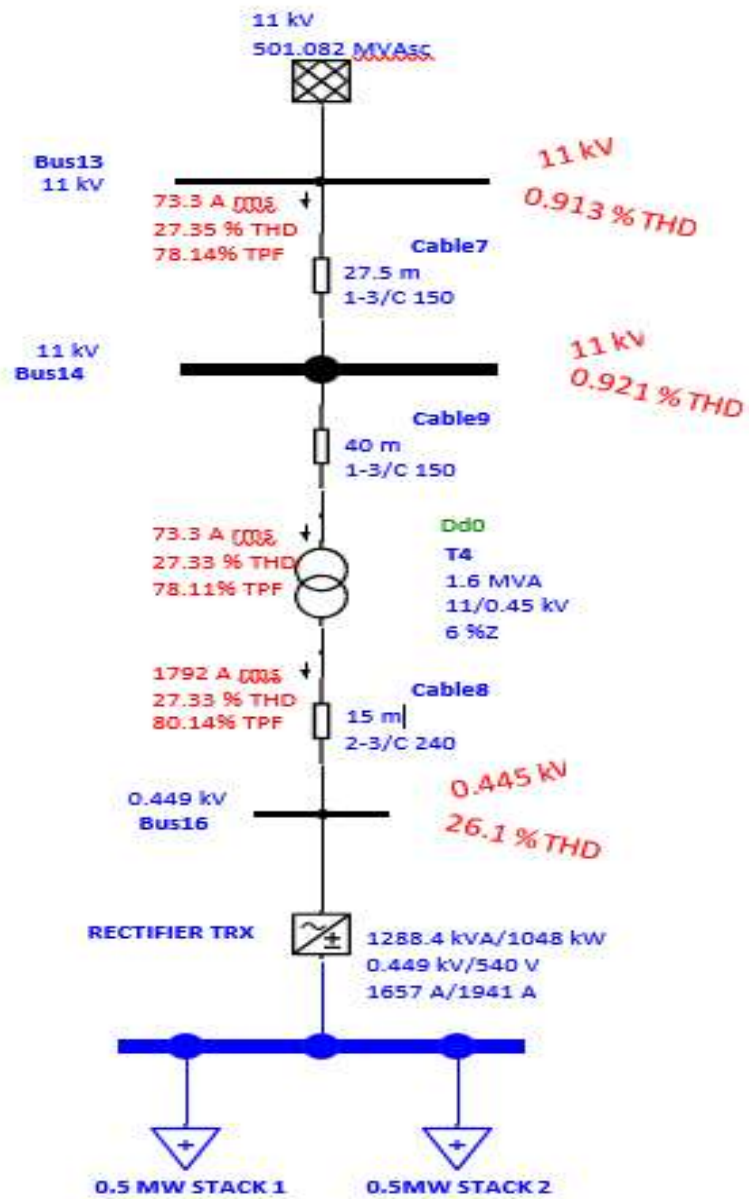
Annexure-1. SLD

Annexure-2 . Harmonic Spectrum

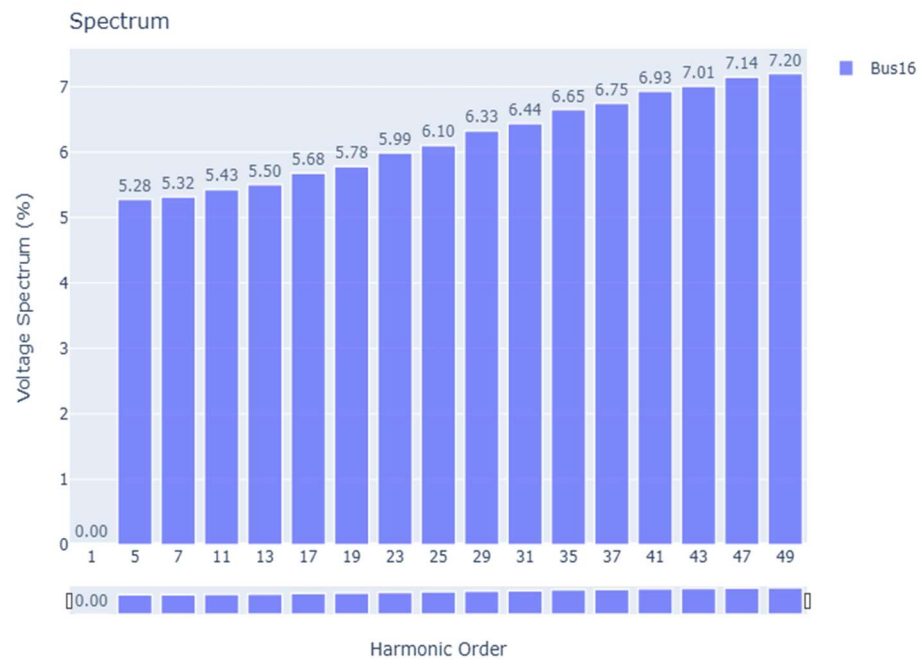
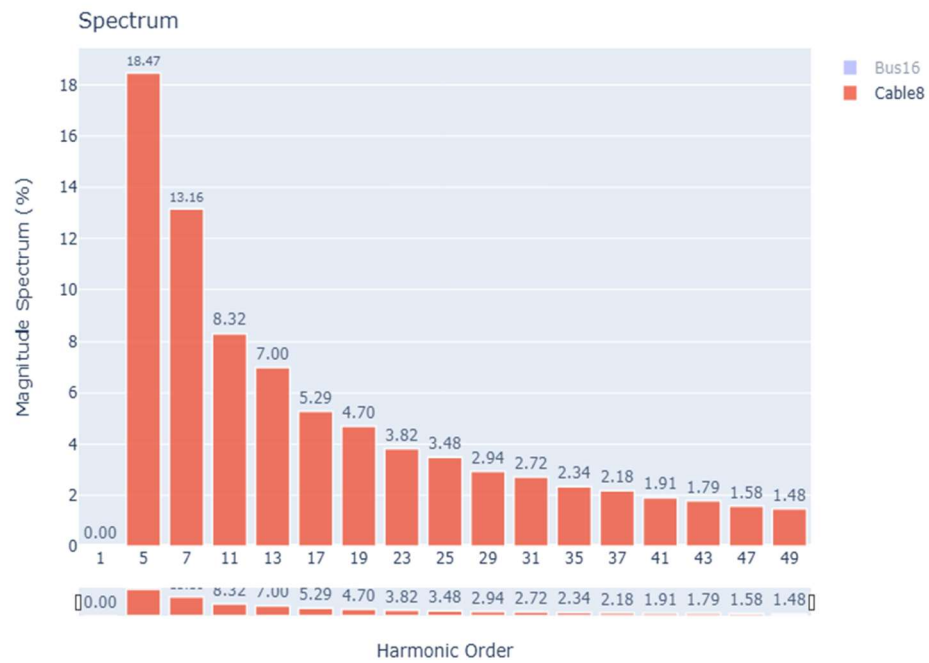
Annexure-3. Impedance Plots

Annexure-4. Rectifier Loading
Characteristics Annexure-5bb Harmonic
Limits.

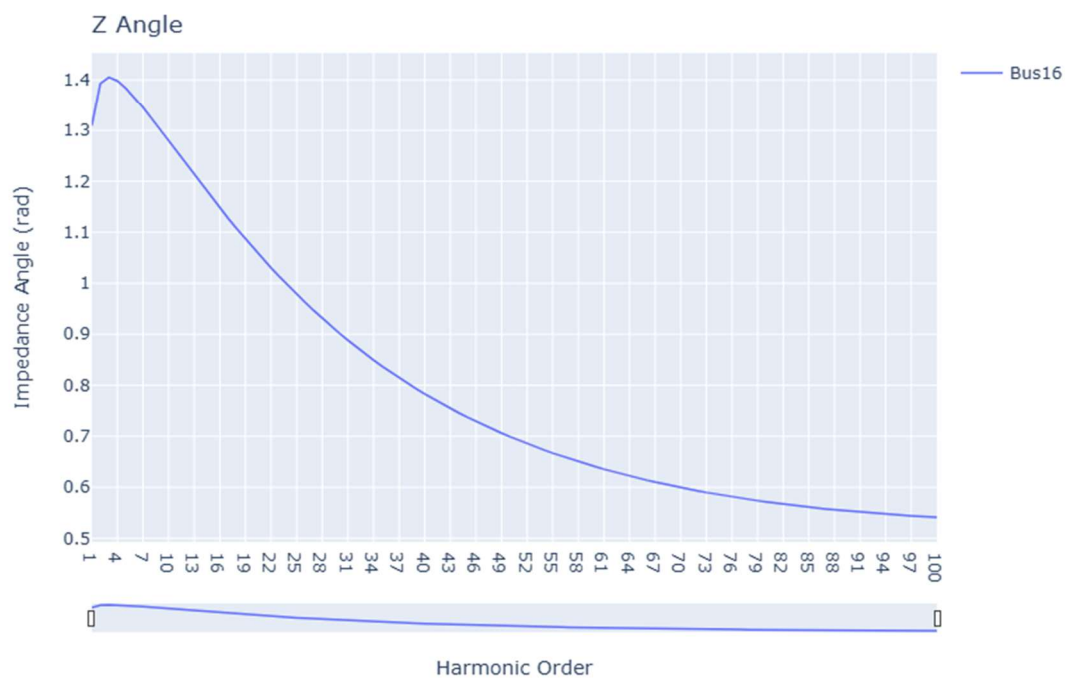
ANNEXURE-1 SLD



Annexure-2 . Harmonic Spectrum



Annexure-3. Impedance Plots



Annexure-4. Rectifier Loading Characteristics

RECTIFIER LOADING CHARACTERISTICS

	BOL	EOL
Amp load	Power Factor	Power Factor
900	0.6	0.73
1125	0.61	0.74
1350	0.62	0.75
1575	0.63	0.77
1800	0.64	0.78
2025	0.66	0.8
2250	0.67	0.81
2300	0.67	0.83

Annexure-5 Harmonic Limits.

System

Bus voltage V at PCC	I_{sc}	I_L (100% loading)
11kV	26.3 kA	73.3 A

Voltage distortion limits

Bus voltage V at PCC	Individual harmonic (%) $h \leq 50$	Total Harmonic distortion (%)
11kV	3.0	5.0

Bus voltage V at PCC	Individual harmonic (%) $h \leq 50$	Total Harmonic distortion (%)
11kV	3.0	5.0

Current distortion limits

Maximum harmonic current distortion in percent of I_L						
I_{sc}/I_L	$2 \leq h < 11$	$11 \leq h < 17$	$17 \leq h < 23$	$23 \leq h < 35$	$1 \leq h < 50$	TDD
<20	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	93.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

14. TECHNICAL SPECIFICATIONS FOR ITEM NO. 14

This includes installations, testing and commissioning of supplied 0.45KV LV Power Quality Solution panel at exiting 7th berth 11/0.433 kV Substation, Kandla. the 0.45KV LV Power Quality Solution panel shall be erected by using suitable size of M.S. channel (to be supplied & erected by

bidder/contractor, as per required approved foundation drawing) foundation bolts including grouting of the bolts of LV panel. The RMU panel shall be connected with two separate and distinct earthing system. After installation of L.V panel, necessary test and trial shall be carried out for proper functioning of safety, devices, relay etc. and before charging L.V Panel, all the tests required under relevant ISS and IEC – Rules 1956 shall be carried out and the result shall be in conformity with specifications and copies of test results shall be furnished to Engineer-in-Charge. The work includes supply & fixing of required length of insulated Rubber Mat having withstand capacity up to 22 kV, the Rubber Mat shall be laid in such a way, near the panel for operation of L.V panel.

The Works comprise with all material such as connecting L.t cable, control cables, labour tools & tackles as directed by EIC.

15. TECHNICAL SPECIFICATIONS FOR ITEM NO. 15

This item includes removal, shifting, installation and commissioning of 160kVA DG Set from substation Room to outside S/.s on the PCC plinth.

This item includes preparation of PCC Foundation which should be of ratio of 4:2:1. The length and breadth of the foundation shall be 300 mm more from the respective length and breadth of the Power Generator. The height of the foundation shall be 500 mm, i.e., 200 mm below and 300 mm above the ground level.

The work includes necessary mounting hardware for bolting/welding down the base frame to the foundation. All alignment, leveling, grouting, anchoring adjustments shall be carried out in accordance with best workmanship & best industrial practice to the satisfaction of Engineer in Charge. The work includes termination of the laid Cables along with providing suitable size of lugs, glands and necessary earth linking connection. All connections in AMF Panel shall be completed, checked and adjusted to ensure safety and satisfactory operation of the equipment. After installation of the AMF Panel, testing and commissioning shall be done as directed. The work includes all material, labour, tools & tackles as directed by Engineer in Charge.

**Signature & Seal
of Contractor**

s/d-
**Executive Engineer (E)
Deendayal Port Authority**