DEENDAYAL PORT AUTHORITY

ive Engineer,
Electrical Division,
Port & Customs Building,
270342
New Kandla (Kutch), Gujarat-370210.

Tel: (02836)270209

FAX: (02836) 270184 /270475

No. EL/AC/2020 **Date: 23/01/2025**

Expression of Interest (EOI)

Sub: Providing of HT cable from 66 KV substation to other dock area inside cargo jetty.

Sir,

Expression of Interests (EOI) is invited to carry out the work "Providing of HT cable from 66 KV substation to other dock area inside cargo jetty" The work is to be carried out as per the scope of work and in accordance with terms & conditions stipulated below.

The Expression of Interest (EOI) along with filled Schedule-B should reach this office of undersigned on or before 06/02/2025 at 14:00 hrs, which shall be opened on the same day. The soft copy may also have accepted of this email ID, anil.rautiya@deendayalport.gov.in.

S/d-

Executive Engineer (E)
Deendayal Port Authority

Scope of Work & Technical Specifications

The Deendayal Port Authority (earlier known as Kandla Port Authority) is one of the ISO: 9001-2008 & ISO: 14001 - 2004 certified Major Port Authority's in India, under Ministry of Shipping, Govt. of India. It is situated in the Western Coast of India on a Creek and is 90 KM away from the Gulf of Kutch connected to the Arabian Sea.

Deendayal Port Authority intend to upgrade the Down Stream, 11/0.433 KV Substations for strengthening the HT Distribution network for providing Healthy HT power. The work involves Supply, Installation, Testing & commissioning of HT SF-6 GAS insulated RMU panels at various substation i.e. 66KV Sub Station, New NDA, Old NDA 13th & 15th Berth S/S as directed by EIC.

The details of work are mentioned in Schedule-B(Section -VI) & below giving brief detail of work. Though detailed work may not be explained but the firm will complete the perfectly, precisely & accurately entire satisfaction of EIC.

Supply, Installation, Testing & commissioning at various rating gas Insulated application, Ring Main unit (RMU) as per Technical Specification.

Before dispatching the RMU panel, contractor shall take dispatch clearance from EIC; in this regard KPT official will come at factory site to inspect the Panel.

Contractor shall take prior approval regarding the drawing from EIC.

Earthing shall be carried out as per IS.

The electrical installation shall conform to all currently applicable ISI specification such as IS: 732, IS: 3043, IS: 2309, IS: 3045 etc. with up to date amendments including relevant IEC regulation and Indian Electricity rules 1956 with up to date amendment.

Before quote the rate contractor should visit the site at their own cost to get familiar with the site condition.

After successful completion of whole work in all respect, to carry out testing and commissioning of the complete work is to be carried out to the entire satisfaction of EIC.

After Completion of all work successfully, contractor shall submit the four sets project compendium in hard copy & soft copy, which shall contain, the complete single line Drawing, Schematic, All Test Report, operation & Maintenance manual of RMU Module panel etc to EIC.

1. Technical Specification for Item No. 1:

This includes supply at site of HT11KV grade, size 3CX300 Sq.mm (U/E) XLPE Insulated Aluminum conductor, armoured cable of given size which confirming to IS: 7098 (Part-II) 2011 with up to date amendments and of approved make with ISI mark. The manufacturer shall produce TYPE TEST certificate with similar size of cable, which shall not be more than 2 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 / Contractor shall produce the routine test certificate during supply of cable at site.

2. Technical Specification for Item No. 2:

This includes laying of supplied 3 core x 300 Sq.mm HT armoured aluminum Conductor XLPE Cable of 11KV Grade (excluding supply of cable) through following methods.

i) **In 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 DPT shall provide heat shrinkable straight through joint of relevant size of approved make specified in tender item no. 3 & 4 to be supplied by contractor, if the laying of cable shall be more than standard drum length. This includes all labour and material as directed by Engineer-in-Charge.

ii) **In Hard/soft Soil**: - The cable shall be laid through excavation in soft/hard soil. The trench to be excavated 0.5 Mtr. Wide 1.0 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. This includes providing & lying of half round RCC Pipe on cable lengthwise i.e. parallel to the cable and the gaps shall be filled by fresh river sand. The cable shall be covered by keeping half round heavy duty RCC NP 2 Pipe. The filling of the trench shall be done with by provided Sand cover (at least 50mm from cable surface) completely & followed by 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 DPT shall provide heat shrinkable straight through joint of relevant size of approved make specified in tender item no. 3 & 4 to be supplied by contractor, if the laying of cable shall be more than standard drum length. This includes all labour and material as directed by Engineer-in-Charge.

iii) **Road Crossing/Rail crossing:** Cable shall be laid underneath by using Horizontal Directional Drilling (HDD) {method by putting suitable diameter HDPE (suitable for cable size up to HT 3CX 300 Sq.mm {HDPE pipe having strength 10Kg/sq.cm} shall in contractor scope), the contractor shall arrange JCB Machine for excavation, water for drilling, de- watering pump, HDD equipments at their own cost.

The cable shall be pass through heavy duty HDPE pipe buried at nominal minimum depth 2500 mm or according to construction of RCC Road/ Rail network or as per directed by EIC. For single cable individual HDPE Pipe shall be pass through a road /rail crossing, for separate cable; separate HDPE pipe shall pass through the Tunnel / trench. The 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, however for preparation of pit area for Man hole (suitable LxWx H) & their heavy duty pre cast cover including all necessary CIVIL works shall be in scope of Contractor. Back filling & dressing of excavated trenches as per specification. This includes all labour and material as directed by Engineer-in-Charge.

3. Technical Specification for Item No. 3:

This includes supply at site of HT11KV grade, size 3CX150 Sq.mm (U/E) XLPE Insulated Aluminum conductor, armoured cable of given size which confirming to IS: 7098 (Part-II) 2011 with up to date amendments and of approved make with ISI mark. The manufacturer shall produce TYPE TEST certificate with similar size of cable, which shall not be more than 2 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 / Contractor shall produce the routine test certificate during supply of cable at site.

4. Technical Specification for Item No. 4:

This includes laying of supplied 3 core x 150 Sq.mm HT armoured aluminum Conductor XLPE Cable of 11KV Grade (excluding supply of cable) through following methods.

i) **In 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 DPT shall provide heat shrinkable straight through joint of relevant size of approved make specified in tender item no. 3 & 4 to be supplied by contractor, if the laying of cable shall be more than standard drum length. This includes all labour and material as directed by Engineer-in-Charge.

ii) **In Hard/soft Soil**: - The cable shall be laid through excavation in soft/hard soil. The trench to be excavated 0.5 Mtr. Wide 1.0 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. This includes providing & lying of half round RCC Pipe on cable lengthwise i.e. parallel to the cable and the gaps shall be filled by fresh river sand. The cable shall be covered by keeping half round heavy duty RCC NP 2 Pipe. The filling of the trench shall be done with by provided Sand cover (at least 50mm from cable surface) completely & followed by 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 DPT shall provide heat shrinkable straight through joint of relevant size of approved make specified in tender item no. 3 & 4 to be supplied by contractor, if the laying of cable shall be more than standard drum length. This includes all labour and material as directed by Engineer-in-Charge.

(iii). Road Crossing/Rail crossing: Cable shall be laid underneath by using Horizontal Directional Drilling (HDD) { by putting suitable diameter HDPE (suitable for cable size up to HT 3CX 300 Sq.mm {HDPE pipe having strength 10Kg/sq.cm} shall in contractor scope), the contractor shall arrange JCB Machine for excavation, water for drilling, de-watering pump, HDD equipments at their own cost.

The cable shall be pass through heavy duty HDPE pipe buried at nominal minimum depth 2500 mm or according to construction of RCC Road/ Rail network or as per directed by EIC. For single cable individual HDPE Pipe shall be pass through a road /rail crossing, for separate cable; separate HDPE pipe shall pass through the Tunnel / trench. The 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, however for preparation of pit area for Man hole (suitable LxWx H) & their heavy duty pre cast cover including all necessary CIVIL works shall be in scope of Contractor. Back filling & dressing of excavated trenches as per specification. This includes all labour and material as directed by Engineer-in-Charge.

5. Technical Specification for Item No. 5:

This includes providing of heat shrinkable straight through joint kit suitable for HT XLPE power cable jointing kit to various size. The supply of cable joint kits as per approved make like 3M/Raychem/ASCON/YAMUNA DENSON.

6. Technical Specification for Item No. 6:

This includes fixing of heat shrinkable straight through joint suitable for jointing kit to various size.. This including fixing of all required materials and by validated person work will be carried out. The joint shall be made in such a way that the 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.

7. Technical Specification for Item No. 7:

This includes supply of following type End termination HT XLPE jointing kit to various size. as per approved make like 3M/Raychem/ASCON/YAMUNA DENSON. Any Major activity and query about work related to be discussed with Engineer-in-Charge and finalized as per his directions.

8. Technical Specification for Item No. 8:

This include making/fixing of following type End termination HT XLPE indoor kit HT. This including fixing of all required materials. The joint shall be made in such a way that the joint shall be electrically and mechanically permanent. The work by validated person will be carried out includes all labour, tools tackles, joint kit of approved make and as directed by Engineer-in-Charge.

9. Technical Specification for Item No. 9:

Deendayal Port Authority intend to upgrade the Down Stream, 11/0.433 KV Substations for strengthening the HT Distribution network for providing Healthy HT power. The work involves Supply, Installation, Testing & commissioning of HT SF-6 GAS insulated RMU panels at various substation as directed by EIC.
The broad details of each item & Technical Specification of the work are shown in the Schedule "B" attached herewith.

The Gas insulated RMU switchgear shall comply with 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 mm2 Cu
Earth bar (external):	120 mm2 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 11/0.433 kV Substation inside Cargo Jetty area. The RMU shall be extensible. 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 2mm 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 2mm 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.
- Lightening 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 equipment 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 6 nos. Circuit Breaker Modules mentioned as under:
Module No. 1 & 2 as 11 kV Incomer along with PT, Module No. 3, 4 as Circuit Breaker Module suitable for Distribution Transformer and Module No. 5 ,6 as spare 11 kV outgoing feeder.
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 & 2
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. 3, 4,5,6**
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 300 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 shall 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 rate shall be inclusive of all taxes (excluding GST), packing, forwarding, insurance, transportation, and unloading at site of work.

This item includes installation, testing and commissioning of supplied RMU panel at exiting 11/0.433 kV various Substation at inside Cargo Jetty area. The scope of works include RMU relay Co-Ordinate & Set the relay data with existing system. Necessary secondary injection and testing of GIS relay is in the contractor scope.

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 scope includes required multiple core screened / control cable & its laying in 150 mm wide perforated tray (supply & erection 600 mtr) is in the scope of contractor.

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.

10. Technical Specification for Item No. 10:

Supply of 11 module compact GIS panel as site heaving following Technical Specification: -

For 11 KV GIS Breaker panel the scheme configuration as under

1) **2 No. I/C + 1 no. Bus Coupler**

2) **8 O /G, 11 KV**

Technical Data:

14.1 System particulars:

a. Rated voltage … 12 Kv
b. Rated frequency … 50 Hz ± 3 %
c. Rated Short – duration power frequency with stand voltage: 28KV[1])
d. Rated lighting impulse with stand voltage : 75KV[1])
e. Rated peak with stand current : 65.75KA
f. Rated Short circuit making current : 65.75 kA
g. Partition class: PM
h. Normal feeder current: 1250A
i. Internal Arc classification: IAC A FLR 26.3kA 1s
j. Rated short-time withstand current 3s: 26.3kA
k. Rated short circuit breaking current: 26.3kA
l. Relative Humidity … 90 %
m. Maximum ambient Temp. … 45 %

Standards:

Metal Enclosed switchgear:	IEC 62271-200
General Purpose switches:	IEC 60265- 1
Dis-connector and Earthing switches:	IEC 62271- 102
Switch Fuse Combination:	IEC 62271-105
Circuit Breakers:	IEC 62271-100
Common clauses:	IEC 60694
Pressure of SF6 Gas	1.4 bar at 20 °C
Cable bushing:	DIN 47636
Temperature class:	-25 °C - +40 °C **Indoor**

Degree of Protection

- SF6 Tank: … IP 67
- Fuse canisters: … IP 67
- Front Cover: … IP 4X
- Cable Cover: … IP 4X

Bus bars to be designed for 1250Amps.

Earth bar (external) 120 mm² Cu – Bolt dimension: M10

The item includes 8 module Fixed-mounted 12KV Gas insulted medium voltage Switchgear, three position isolator/ earthing switch, bus bars, interlocking, earth bar and stored spring energy mechanism (A. mech.)

1	Switchgear Panel	➢ The Gas insulated Metal clad switchgear shall be complete with all the accessories for efficient and trouble free operation. The equipment offered shall be safe, reliable and compact to install. The workmanship shall be high order. The circuit breaker switches and protective device etc shall be latest design so as to ensure rapid and efficient interruption of fault current low arc energy, small arching time and freedom from fire shall be fully arc proof, free standing, floor mounted, fully compartmentalized, metal, enclosed construction complying requirements of IEC 62271-200. Each circuit shall have a separate vertical panel with required compartments for circuit breaker, cable termination main bus-bars and auxiliary control devices. ➢ Switchgear shall have an Internal Rac classification of IAC –A – FLR 26 KA, 1 sec. (as per EI guidelines all switchgears shall be at least 1.2 meters away from well) The switchgear construction shall be such that the operating personnel are not endangered by breaker operation and internal explosions, and the front of the panels shall be specially designed to withstand these. Gas Pressure relief device/ Explosion Vent/ Pressure relief duct shall be compartment, so that in case of a fault in a compartment, the gages produced are safely vented out, thereby minimizing the possibility of it's spreading to other compartments and panels. The pressure relief device/Explosion vent/pressure relief duct shall not however reduce the degree of protection of panels under normal working conditions. ➢ The switchgear shall be cooled by natural air flow. The switch board shall have the facility for extension of additional breakers (to existing set up) for future expansion shall be provided.

		➢ The manufacture shall give guarantee for maximum leakage rate of SF6 gas will be lower than 0.1 % per year. In case of GAS leakage the GIS should have the capability to withstand die-electric strength at 1 bar pressure. Separate gas monitoring sensors should be available for all the gas filled chambers. ➢ The minimum operating SF6 gas pressure shall be 1.4 Bar at 20°C Alarm shall be generated if the SF6 gas pressure drops to 85% of the minimum operating pressure and if it further drops below 80% the circuit breaker shall trip & go into lockout mode. ➢ Thermostatically controlled space heater with common MCB shall be provided for various compartments.
2	GIS SWITCHGEAR WITH BUS BAR IN SF6 GAS:	➢ The SF6 gas insulated metal enclosed switchgear shall be construction from corrosion- resistant stainless steel sheet of min 2 mm thickness, filled with SF6 accommodating the primary switching devices (Busbar and Three position dis-connector cum earthing switch) and all live parts. This panel complying ingress protection min IP 67. ➢ The GIS switchgear shall be provided with silicon coated busbars. ➢ The switchgear enclosure complying ingress protection IP4X ➢ Paint shade of indoor switchgear shall be 694 as per IS: 5 (Dove grey)
3	Bus Bar	➢ Busbar shall be of made of electrolytic high grade copper of adequate size and bus bar size calculation / supporting type test report shall be submitted for approval (current density of copper shall not exceeded more than 1.6 Amp/sq.mm). They shall be adequately supported on insulator to withstand electrical and mechanical stresses due to specified short circuit currents. ➢ All piping for SF6 gas shall be made of copper & their fittings shall be made of non-magnetic stainless steel. ➢ The temperature of the busbars and all other equipment, when carrying the rated current continuously shall be limited 60deg C above ambient temperature 45deg C as per the relevant Standards.
4	GIS Circuit Breaker	➢ GIS Circuit Breaker can be used for system voltage 11KV. ➢ 11 KV GIS breaker shall comprise of three single pole interrupting unites or 3-pole interrupting unit, operated through a common shaft by a sturdy operating mechanism.

		➢ Closing spring charging shall only be acceptable. Anti-pumping features shall be provided for each breaker. An arrangement of two breakers in parallel to meet a specified current rating shall not be acceptable. (No parallel interrupter) ➢ Circuit breaker shall be provided with two trip coils. ➢ Suitable indicators shall be provided on the front of panel to indicate OPEN/CLOSED conditions of the circuit breaker, and CHARGED/ DISCHARGED conditions of the closing spring, SF6 gas density monitor for all gas compartments. ➢ For 11 KV feeder: Tripping time; 30-40 ms (including Relay Time) closing Time 40-50 ms. ➢ Manual /Auto Spring Charging shall be provided in all feeders. ➢ The circuit breakers has to control at least 10,000 Make-Break cycles without maintenance. The mechanical life and operating cycles of the vacuum interrupter shall confirm relevant IS/IEC amended up to date. ➢ The circuit breaker shall be provided with motor operated spring charged closing. Spring charging motor shall be suitable for 240V, 50 Hz, single phase AC. Suitable rating starter shall be provided for motor protection. Spring release coil for closing shall be suitable for 24 V DC. ➢ Tripping of the circuit breakers shall be through "Shunt trip" coils rated for 30V DC auxiliary supply. It shall be possible to trip the breaker manually in case of necessity.
4	Dis-connector & Earth Switch	➢ Switch panel shall be provided with three (3) position disconnecting –cum-earthing switch of required rating. ➢ The earthing position for all 3 phase must be visible via a mechanical position indicator (MIMIC) directly connected to the drive shaft on panel front fascia. The mechanical operation of isolator / 3 position dis-connector switch must be possible with door closed for operator safely.
5	Control & Interlock	➢ Switchgear having mechanically & Electrically interlock as per scheme configuration. ➢ Necessary mechanical & electrical interlock shall be provided between CB, Isolator & Earth switches for safe operation.
6	SCADA compatibility	➢ Panel shall have SCADA compatibility

7	Numerical protection Realy	➢ Indoor switchgear panels shall have communicable numerical protection relays (IEDs) complying with IEC-61850 on all feeders which shall be networked on Ethernet to communicate with substation SAS/SCADA system on EIC- 61850. Relay shall have redundant RJ45 ports complying to PRP redundancy of IEC 61850. These IEDs shall also be used for control & monitoring the switchgear from SAS. In addition to status of devices) CBs/Isolator /Earth Switches) and equipment alarms, metering data shall also be made available to SAS/SCADA station from protection IEDs. Directional numerical relays shall have provision of both current (CT) and Voltage (PT) inputs as required for protection & measurement purpose using protection cores. ➢ All Numerical relays shall have feature for electrical measurement of current. ➢ Numerical relays as per IEC including report for IEC 61850 protocols from accredited lab. ➢ All numerical relays shall be rated for control supply voltage 24 Volt DC and shall be capable of satisfactory continuous operation between 80-110% of the rated voltage. Making and carrying and breaking current rating of their contacts shall be adequate for the circuit in which they are used. Heavy duty binary output contacts od IEDs to be used for breaker close and trip commands shall be so rated as to be used directly used in the closing and tripping circuits of breaker without the need of any interposing / master trip relays.
8	Numerical Protection I/C feeder	➢ The relay shall have instantaneous as well as time delayed three over current (50) and one earth fault (50N) protection elements. With standard inverse characteristics (1.3 and 3 Sec) IDMT. ➢ The over current element should have the minimum setting adjustable between 20-200% of CT secondary rated current with increment / decrement by 1 % and High set setting 100-2000%. ➢ The earth fault element of relay shall be suitable for detection of earth fault currents in the range of 5% to 80% of the CT rated current (IDMT) and high set 100-1000%. ➢ For transformers of rating Min. 6.3 to 10 MVA & 12.5 MVA, definite time delayed stand by earth fault protection shall be provided having a pick up setting range of 10% to 40% with a timer delay of 0sec to 3 sec. in step of 0.01s. ➢ Trip circuit supervision shall be provided to monitor the circuit breaker trip circuit both in pre-trip and post-trip conditions.

09	Numerical protection for O/g Feeders	➢ Self-powered, Earth Fault, O/C, instantaneous earth fault.
10	2 Nos. I/C feeder + 1 Nos Bus Coupler shall equipped with instrument i.e. CT, for metering & protection, PT, for Differential protection PS class CT (for incomer feeder Only).	**CT Ratio 300-150 /5.5** ➢ Accuracy Class =0.2 ➢ CT shall be designed considering the 25 KA for 3 sec ➢ CT shall be metering & protection core both. ➢ Rated burden 15 VA. ➢ Insulation Class E. ➢ 5P20 ➢ The CTs shall be resin /epoxy cast. Correct polarity shall be invariably marked on each primary and secondary terminal. ➢ All current transformers for GIS shall be ring type (Tape wound /resin cast.) ➢ Confirming to IEC: 60044-1. ➢ No of secondary core : 2 ➢ PS Class CT for Differential Scheme equipped in I/C:- 600-300/1-1, Burden 15VA, PT Ratio 11KV√3 / 110 V AC. ➢ P.T. shall be epoxy/resign cast. Contact tips of primary/secondary contacts shall be silver plated. Correct polarity shall be distinctly marked on primary and secondary terminal. ➢ 3 phase primary input 11 KV. ➢ Output 110 Volt. ➢ Core 2. ➢ Rated Burden 15 VA.
11	8 O/G Feeder	➢ CT=> 300-150/5.5 ➢ Accuracy Class => 0.2 ➢ Metering & Protection Core. ➢ The CTs shall be resin/epoxy cast. Correct polarity shall be invariably marked on each primary and secondary terminal. ➢ Burden 20VA. ➢ 5P20
General requirement of 11 module Gas insulated switchgear as under		
Qty. (In nos.)	Requirement	
11	Set of Terminal Protector boots for covering cable-termination.	
3	Manometer installed on for Gas Pressure indication	
3	Operating handle	
11	Each feeder shall have power pack unit for Auxiliary 24 volt DC Power supply for Electro Mechanical Aux Relays and Master Trip Relays.	
11	Ammeter, Voltmeter for 2 I/c +1 BC + 8 O/G	
11	Multifunction Meter for 2 I/c +1 BC + 9 O/G	
11	Breaker ON(red)/OFF(green)/TRIP(amber) LED Indication for each.	
11	Local/remote selector switch for each feeder.	

11	Auto/Manual selector switch for each feeder.
	croprocessor based latest version numerical relay for 2 Nos. I/C feeder + 1 Bus coupler for over Current, Earth Fault, Instantaneous Earth, with trip Ckt. Supervision relay
Make of GIS	EMENS/ABB/Schneider/GE

11. Technical Specification No.11:

This including **erection, testing** and commissioning of 11 ways of 11KV Gas insulated switchgear at Exiting 66/11 KV sub-station. All the GIB's shall be erected on fabricated "C" Channel platform of suitable size of M.S. Channel having height of 1.0 meter & the platform shall be ground with suitable Anchor fasteners. Surrounding the MS platform. the brick masonry with fine plaster may be provided (if required). Each panel shall be connected with 2 separate and distinct Earthing. After installation of GIB panel, necessary test and trail are to be carried out for proper functioning of safety, devices, relay panel etc. and before charging GIB's all the test required under relevant ISS and IEC- Rules 1956 shall be carried out and the result shall be in conformity with specification and copies of test result shall be furnished to EIC. If required any civil alteration & modification on existing substation platform / pedestal area during erection of GIS breakers, necessary CIVIL works is in the scope of Contractor. The scope includes required multiple core screened / control cable & its laying in 150 mm wide perforated tray (supply & erection 600 mtr) is in the scope of contractor.

The scope of works include GIS relay Co-Ordinate & Set the relay data with existing system. Necessary secondary injection and testing of GIS relay is in the scope contractor. The complete work shall be carried out as directed by E.I.C. The works includes all special tools, tackle man & material required for installation & commissioning of GIB and shall be done as by E.I.C.

12. Technical Specification No.12:

This includes preparation of earth station with chemical treated back filled compound 80 mm dia Pipe In Pipe GI Type 3 Mtr Depth, Maintenance free including all accessories & Masonry work Enclosure with cover plate.

A cement concrete (ratio 1:4:8) chamber of at least 30 Cm. x 30 Cm. shall be provided just below the surface of ground over the funnel for watering and having RCC/CI cover of suitable size as directed. This also includes removal of extra-excavated earth from the site. The work shall be carried out to entire satisfaction of Engineer-in-charge. This work includes all labour and material as directed by Engineer-in-Charge. The works also include earthing value marking & painting on earth strips & earthing station by suitable paints (Green Color on Strips) and also mentioned the earth value on earth pits.

13. Technical Specification No.13:

This includes supply, Laying & connecting, Hot Dip G.I. strip of size 50 X 6 mm. Coating having minimum 80 Micron galvanized coating on Strip earthing system, connected to two separate and distinct main earth as directed and shall be clamped suitably on wall /floor or buried in the ground/pucca trench as directed. The pieces of GI strips shall be connected using GI nut bolts rigidly and the GI strip shall be laid either on RCC with proper clamping or in the ground minimum 300 mm. below the ground level as the case may & as directed & shall be buried properly or as directed by EIC.

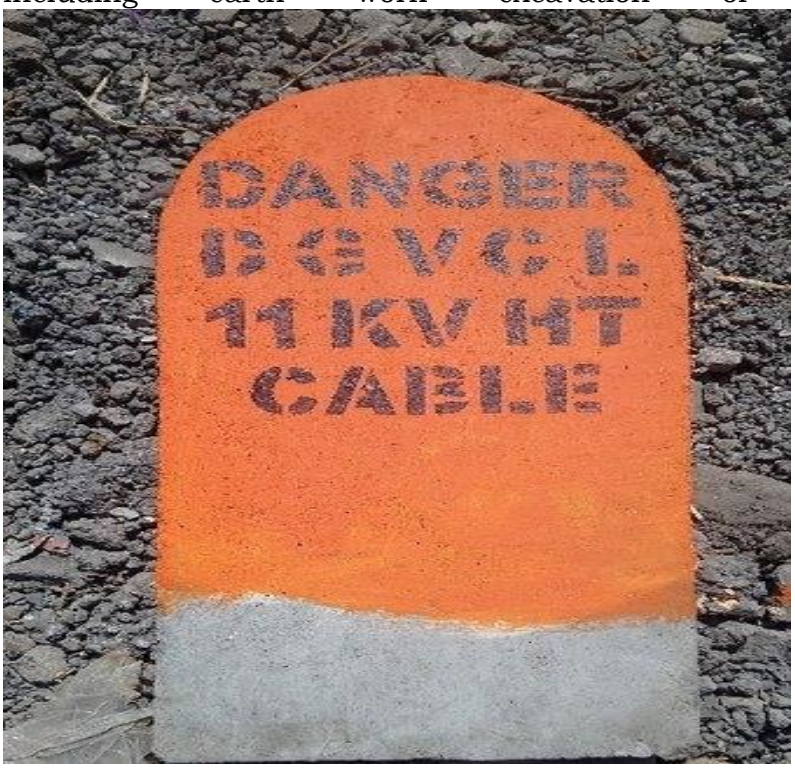
14. Technical Specification No.14 :

RCC CABLE ROUTE MARKERS

1.0 Manufacturing and supplying of RCC cable route markers slab of size 0.70 Mtr. height, 0.24 Mtr. width and 0.075 Mtr. depth, using reinforced M20 concrete with letters “HT 11 KV UG Cable” with an arrow (→) letter showing distance and depth at which cable is buried engraved in concrete on a smooth and clean finished surface with painting of 2 coats of apex over coat of primer with yellow shade and the letters with contrast red shade. For reference of Route Marker given in figure below.

2.0 Fixing the RCC cable route markers of size 0.70 Mtr. height, 0.24 Mtr. width and 0.075 Mtr. depth with PCC (1:3:6) using 20mm down size jelly

3.0 including earth work excavation of 0.30 Mtr. Depth.



HT Cable Route Marker Sample Fig.

CABLE ROUTE MARKERS/CABLE JOINT MARKERS

Permanent means of indicating the position of joints and cable route shall be fabricated, supplied and erected. Route Marker shall be provided at every 200 meter and at the turning points. In addition, markers, if required shall be provided per the field requirement. If the route passes through open fields, markers should be conspicuously visible and above ground surface and particularly along the Road beams except on road & pavements where they may interfere in the movement of traffic or pedestrians. The markers should incorporate the relevant information. The name of the owner, voltage shall be marked on the route marker. The markers shall be of RCC. The design shall be such that it cannot be pulled out. Tile type marker shall be used along the pavement. The RCC markers shall be cut into proper size, covered with cement plaster with engraving of the information required. Any Major activity and query about work related to be intimated to Engineer-in-Charge and finalized as per his directions.

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Schedule – B (BOQ)

Sub: - Providing of HT cable from proposed GIS 66 KV substation to other dock.

Sr. No.	Description	Unit	Qty	Rate	Amount
1	Supply at site 3 Core x 300 Sq.mm. 11/11KV HT armoured aluminium conductor XLPE cable of 11KV grade of the following type & size as per IS: 7098 (Part - II) 2011 & as per Technical Specification No. 1.	Mtr	3100		
2	Laying, Testing & Commissioning of 3CX300 Sq.mm HT XLPE cable through following and as per Technical Specification No.2 Cable Trench Hard & Soft Soil Lying of HT Cable through Horizontal Direction Drilling underneath RCC Road /Rail Crossing/RCC/Road crossing with HDPE Heavy Duty Pipe HDPE Pipe 150mm Dia size to accommodate supplied.	 Mtr Mtr Mtr.	 2600 500 500		
3	Supply at site 3 Core x 150 Sq.mm. 11/11KV HT armoured aluminium conductor XLPE cable of 11KV grade of the following type & size as per IS: 7098 (Part - II) 2011 & as per Technical Specification No. 3.	Mtr	2600		

4	Laying, Testing & Commissioning of 3CX150 Sq.mm HT XLPE cable through following and as per Technical Specification No.4				
i)	Cable Trench	Mtr	2000		
ii)	Hard & Soft Soil	Mtr	300		
iii)	Lying of HT Cable through Horizontal Direction Drilling underneath RCC Road /Rail Crossing/RCC/Road crossing with HDPE Heavy Duty Pipe HDPE Pipe 150mm Dia size to accommodate supplied.	Mtr.	300		
5	Supply of Heat shrink straight through Joint kit for 11KV, H.T XLPE cable as per Technical Specification No. 05 a) 3C x 300 Sq.mm b) 3C x 150 Sq.mm	 No. No.	 7 8		
6	Fixing the Heat Shrink Straight through Joint kit for 11KV H.T XLPE cable as per Technical Specification No.06 a) 3C x 300 Sq.mm b) 3C x 150 Sq.mm	 No. No.	 7 8		
7	Supply of Heat shrink long sleeve & boat, suitable for RMU End termination kit (Indoor Type) for 11KV 3C x 150 Sq.mm H.T XLPE cable as per Technical Specification No. 07	No.	15		
8	Fixing of Heat shrink long sleeve & boat, suitable for RMU End termination kit (Indoor Type) for 11KV 3C x 150 Sq.mm H.T XLPE cable as per Technical Specification No. 08	No.	15		

9	Supply, Installation, Testing & commissioning at 11KV/0.433KV Outdoor type of gas Insulated, Ring Main unit (RMU) with fixing in floor HT Rubber Mat Describe as below a) 6 Way, 11KV/0.433KV RMU Outdoor type, as per Technical Specification No.09	No.	3		
10	Supply, of 11KV GIS panel -11 Module for indoor application 2 nos. I/C + 1B/C + 8 O/G as per technical specification No.10	No.	1		
11	Installation, Testing & Commissioning of supplied 11 KV GIS panel as per Technical Specification No.11	No.	1		
12	Preparation earthing station, chemical treated back filled compound earthing system with Pipe-In-Pipe 80 mm Dia Hot dip GI type 3 Mtr Depth, Maintenance free as per Technical Specification No.12	No	12		
13	**Hot Dip G. I. Strip for Earthing** Supply, laying, fixing including termination / connection of following type and size of GI earth strips 50 X 6 mm GI earth strips and as per technical specification no.13	Mtr.	250		
14	Supply and Installation of Pre cast RCC Cable Route Marker install every 50 Mtr. and turning point of Cable Trench end/HDD area/Excavated cable route along with Masonry work with complete work and as per Technical Specification no.14	No.	140		

(In Words:
Rs._____
_____)

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

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Approved Make List for Electrical Items		
Sr. No.	Description	Recommended Makes
1	HV VCB	SIEMENS / CROMPTON GREAVES/ABB/Schneider
1(a)	HV Gas Insulated Breakers	SIEMENS /Schneider/ABB
2	POWER TRANSFORMERS	VOLTAMP/CROMPTON GREAVES /BHARAT BIJLEE/ BHEL/ SIEMENS/ABB/ Schneider/T&R
3	DISTRIBUTION TRANSFORMERS	EMCO/KIRLOSKAR/PATSON/VOLTAMP/ABB/ Schneider/T&R
4	RESIN CAST TRANSFORMERS	
	A) RESIN CAST IMPREGNATED	VOLTAMP / KIRLOSKAR / EMCO
	B) DRY CAST	VOLTAMP/KIRLOSKAR/EMCO
5	HT XLPE CABLES	POLYCAB/TORRENT/RPG ASIAN/ NICCO/GLOSTER/ UNISTAR/ UNIVERSAL
6	LT XLPE CABLES	POLYCAB/TORRENT/RPG ASIAN/ NICCO/ RALLISON/PRIMECAB/ HAVELLS/ UNIVERSAL/ UNISTAR/AVOCAB
7	LT ACB	SIEMENS/L&T/SCHNEIDER/C&S
8	PROTECTION RELAYS	AREVA/L&T/SIEMENS/ABB/C&S
9	LT PANEL	CPRI APPROVED

10	CHANGE OVER SWITCH	SIEMENS/L&T/ABB/C&S/SCHNIDER/ LEGRAND / INDOASIAN
11	SFU FOR MAIN LT DISTRIBUTION PANELS	SIEMENS/L&T/ABB/C&S
12	SFU FOR DISTRIBUTION PANELS & FEEDER PILLERS	SIEMENS/L&T/ABB/C&S/ SCHNEIDER/ LEGRAND/ INDOASIAN/HAVELLS
13	MCCB FOR MAIN LT DISTRIBUTION PANELS	SIEMENS/L&T/ABB
14	MCCB FOR DISTRIBUTION PANELS AND FEEDER PILLERS	SIEMENS/L&T/ABB/C&S/ SCHNIDER/ LEGRAND/ INDOASIAN/HAVELLS
15	MCB/ELCB/RCCB/ RCCBO FOR MAIN LT DISTRIBUTION PANELS	SIEMENS/HAGER L&T/ABB
16	MCB FOR DISTRIBUTION PANELS AND FEEDER PILLERS	SIEMENS/L&T/ABB/C&S/ SCHNEIDER/ LEGRAND/ INDOASIAN/ HAVELLS/ STANDARD
17	MCB DISTRIBUTION BOARD	STANDARD / HENSEL/LEGRAND / INDOASIAN / HAVELLS
18	MULTI FUNCTION DIGITAL METER FOR MAIN LT DISTRIBUTION PANELS/DIGITAL KWH METERS	L&T/ENERCON/SECURE/L&G/ RISHABH
19	ANALOG VOLT/AMPARE METER FOR DISTRIBUTION PANELS AND FEEDER PILLERS	RISHABH/AE/ENERCON/L&T
20	SLECTOR SWITCH FOR VOLTMETER/AMPARE METER	L&T/SIEMENS/C&S
21	POWER CONTACTOR & OVER LOAD RELAYS	L&T/SIEMENS/ABB
22	QUARTZ TIME CLOCK SWITCH	L&T/INDOASIAN/SIEMENS
23	PVC WIRE WITH COPPER CONDUCTOR	RR KABEL/KEI/POLYCAB/MILEX/GUJCAB/ STANDARD/ FINOLEX/ANCHOR
24	FLUSH TYPE SWITCHES, SOCKETS, HOLDERS AND CEILING ROSES & ELECTRONIC REGULATORS	ANCHOR/MK/NORTHWEST/VINAY/PANAMA/ HAVELLS
25	DOOR BELLS/CALL BELLS	ANCHOR/LEGEND/MK/NORTHWEST
26	MODULAR SWITCHES, SOCKETS, PLATES & BOXES	ANCHOR / MK / NORTHWEST / LEGRAND /HAVELLS/INDOASIANSIEMENS
27	PVC CONDUIT/OVAL CONDUIT & CASSING CAPPING AND ACCESSORIES	PRECISION/VULCAN/FINOLEX/ GARWARE/RESTOPLAST/SWASTIK/BPI
28	GLS LAMPS & FLUORESCENT LAMPS	PHILIPS / BAJAJ / WIPRO / CROMPTON GREAVES / OSRAM / SURYA ROSHNI /GE

29	HPSV, HPMV & METAL HELIDE LAMPS	PHILIPS / BAJAJ / WIPRO / CROMPTON GREAVES / OSRAM / SURYA ROSHNI /GE
30	IGNITORS FOR HPSV, METAL HELIDE LAMPS	PHILIPS / BAJAJ / WIPRO / CROMPTON GREAVES / OSRAM / SURYA ROSHNI /GE
31	LUMINARIES	PHILIPS/BAJAJ/WIPRO/CROMPTON GREAVES / OSRAM / SURYA ROSHNI /GE
31a	LED Luminaries	Philips /Bajaj/Wipro/CG/Surya/Pyrotech/Syska/Nessa having surge Protection ≥10KV for fittings & internal Surge rotection for Driver of≥4KV, LED Chip only OSRAM/CREE/Philips Lumileds/Citizen/Nicia with LM-79,80 CERTIFICATION
32	CEILING FANS	BAJAJ/ORIENT/USHA/CROMPTON GREAVES / ALMONARD/GEC
33	WALL MOUNTING FANS	BAJAJ/ORIENT/USHA/CROMPTON GREAVES / ALMONARD/GEC
34	EXHUAST FANS	BAJAJ/ORIENT/USHA/CROMPTON GREAVES / ALMONARD/GEC
35	HEAVY DUTY INDUSTRIAL WALL MOUNTING FANS	BAJAJ/ORIENT/USHA/CROMPTON GREAVES / ALMONARD/GEC
36	WATER COOLER	VOLTAS/SHRIRAM USHA/BLUE STAR
37	AIR CONDITIONERS	VOLTAS/CARRIER/BLUESTAR/USHA/ HITACHI/LG/ SAMSUNG/ONIDA
38	REFRIGERATORS	VOLTAS/CARRIER/BLUESTAR/USHA/ HITACHI/LG/ SAMSUNG/WHIRLPOOL
39	VOLTAGE STABILIZER	VEELINE / CAPRI
40	INVERTERS	SUKAM / MICROTEK
41	D.G. SETS A) ENGINE B) ALTERNATOR	 CUMMINS/GREAVES/KIRLOSKAR/ CATERPILLAR/ ASHOK LEYLAND/VOLVO STAMFORD/CROMPTON GREAVES /JYOTI/ KIRLOSKAR ELECTRIC
42	ELECTRIC MOTOR	ALSTOM/CROMPTON GREAVES /SIEMENS/ KIRLOSKAR/ABB
43	WATER PUMPS	SWASTIK / KSB

44	WATER GEYSER	BAJAJ/USHA / CROMPTON GREAVES / SPHEREHOT / RACOLD
45	HT/LT Heat Shrinkable Joint Kit	3M/Raychem/Yamuna Denson /Compaq
46	LUGS & CABLE GLANDS	DOWELLS / JAINSON / BRACO

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