

## SECTION-III

**TECHNICAL SPECIFICATION FOR 33 KV CONTROL AND RELAY  
PANELS AGAINST TN-2127.****1.0 SCOPE :**

1.1 This specification covers design, engineering, manufacture, assembly, shop testing, inspection and testing before supply and delivery of Control and Relay Panels for 33 KV circuits to be installed at various 33/11KV sub-stations covered under Rajasthan and as detailed hereunder.

1.2 It is not the intent to specify completely herein all the details of the design and construction of equipment. However, the equipment shall conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing in continuous commercial operation upto the Bidder's guarantee, in a manner acceptable to the Purchaser, who will interpret the meanings of drawings and specifications and shall have the power to reject any work or material which, in his judgement, is not in accordance therewith. The offered equipment shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

**2.0 STANDARDS :**

The Relays, associated components and enclosures shall conform to the latest issues of standards as given below, except to the extent explicitly modified in the specification.

Indian Standard No.	Title
IS-3231	Protective Relays
IS-8686	Static protective relays
IS-1248	General requirements of indicating and integrating meters
IS-2705/1981	Current Transformers

IS-4201/1983	Application guide for current transformers
IS-2419	Dimensions of panel mounting and indicating & recording instruments
IS-3156/1981	Voltage Transformers
IS-3043/1966	Code of practice for earthing
IS-8530/1977	MDI
IS-14697-1999	Specification for AC Static Transformer operated watt hour and VAR hour meter 0.2 S and 0.5 S.
IEC-62053-22-2003	Specification for AC Static Watt hour meters, class 0.2 S & 0.5 S.
IEC-62052-11-2003	
CBIP Technical Report No.88 revised July, 1996 read with amendment issued (April,99, September,99 and also any other amendment thereafter).	Specification for AC Static Electrical Energy Meter.
IS-9224	HRC cartridge fuse
IS-3202	Climatic proofing for electrical equipment
IS-345	Code for wiring numbers
IS-6005	Code for practice for Phosphating, Iron and Steel.
IS-6875	Control switches (LV switching device for control and auxiliary circuits.)
IS-375	Marking and arrangement for switchgear Busbar main connection and auxiliary wiring.
IS-1554	PVC insulated cable upto and including 1100 V.
IS-5578	Marking & arrangements for switchgear

IS-11353	bus bars, Main connections and auxiliary wiring.
IS-2147	Degrees of protection provided by enclosures for low voltage switchgear & control gear
IS-5	Colours for ready mix paints
IS-8623	Specification for low voltage switchgear and control gear assemblies.
IS-13947	Specification for low voltage switchgear and control gear.(Covers degree of protection)

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2.1 In case equipment conforms to other International standards which ensure equivalent or better performance than that specified under clause 2.0 then the English version of such standards or the relevant extracts of the same shall be forwarded with the bid and the salient features of comparison shall be brought out separately in additional information schedule.

### **3.0 SERVICE CONDITIONS:**

#### **3.1 Climatic Conditions:**

The equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions:

i)	Location	In state of Rajasthan
ii)	Maximum ambient air temperature ( deg C) in shade	50 deg C
iii)	Minimum ambient air temperature (deg C)	-5 deg C
iv)	Average daily ambient air temperature (deg C)	45 deg C
v)	Max. yearly weighted ambient temperature (deg C)	35 deg C

vi)	Max. relative humidity	100%
vii)	Max. altitude above mean sea level (Metres)	Varies from 61 Mts. to 815 Mts
viii)	Average annual rainfall (mm)	15 cm to 100 cm
xi)	Max. wind pressure (Kg/Sq.mt)	195
x)	Isoceraunic level (days/year)	4 Months (June to Sept)
xi)	Seismic level (Horizontal Acceleration)	0.3 g

NOTE : Hot and humid tropical climate is conducive to rust and fungus growth. The climatic conditions are also prone to wide variations in ambient conditions. Smoke is also present in the atmosphere. Heavy Lightning also occurs during June to October.

### 3.2 Auxiliary Power Supply

Auxiliary electrical equipment shall be suitable for operation on the following supply system:

- |    |   |   |
|----|---|---|
| a) | AC Supply                                 | 415 V, 3 Phase 4 wire<br>50 HZ, neutral grounded<br>AC supply<br>(230 V single phase) |
| b) | D.C. Alarm, control and protective device | 110 VDC, 2 wire.  |

Each of the foregoing supplies shall be made available by the Purchaser at the terminal point for each board for operation of relays/switches and auxiliary equipment. Bidders scope include supply of interconnecting cables, terminal boxes etc. The above supply voltage may vary as below and all devices shall be suitable for continuous operation over entire range of voltages.

- i) AC supply: Voltage +/- 10% frequency +/- 5%
- ii) DC supply: -15% to +10%

#### 4.0 PRINCIPAL PARAMETERS :

4.01 The C&R panels, required at various sub stations can be broadly classified into following categories of panels :

S.No.	Particulars.	Type of panels	
		Simplex	Duplex.
1.	33 KV C&R panel for controlling (a)HV side of 2 Nos. ) of 33/11 KV ) transformers )	A	-
2.	33 KV C&R panels for controlling 2 nos. 33 KV feeder circuits.	B	-

4.02 The requirement of various sub stations will comprise of one or more of these panels. The simplex panel shall be complete in itself and provided with doors at the back, while the Duplex panels shall be with end doors which shall be provided only with transformer panels. The various panels shall generally be equipped as per Schedule-A. Statement showing CT ratio their technical particulars and instrument ranges to be provided at various sub-stations are placed at annexure I & II. Statement showing ratio of voltage transformers and capacitive voltage transformers proposed to be provided at various sub stations is placed at Annexure.III.

#### 5.0 GENERAL TECHNICAL REQUIREMENT :

5.01 This specification cover the design, engineering, manufacture, assembly, inspection and testing before supply and delivery of control and relay board duly mounted with protective relays, metering equipments etc. required for the satisfactory operation of radial and interconnected 33 KV lines, Bus couplers and 33KV side of 33/11KV Power Transformer at various 33/11KV grid sub stations included in the specification to the satisfaction of purchaser.

5.02 The intention of the specification is to provide protective relaying & metering equipments on control boards enumerated in the specification and to be complete

in every respect for the functions designated. It is required that the supplier, in accepting the contract, agrees to furnish all apparatus, appliances and material whether specifically mentioned or not but which may be

found necessary to complete or test any of the herein specified protective schemes in compliance with the requirements of the specification without any extra charges.

5.03.01 Considerations may be given to alternatives which the supplier considers advisable by reasons of his own manufacturing requirements and experience, provided descriptive literature is submitted pointing out the recommended device or arrangement as equal to, or superior to that required by the accompanying specification.

5.03.02 The each supplier/tenderer should indicate the list of recommended spares and relays which should be purchased (i.e.P.S. module, spare relays and contacts, tripping relays).

5.03.03 Each supplier/tenderer should also indicate the list of test kits and test accessories required to test their relays which should be purchased.

5.03.04 The supplier will give training at the works for the relays which are being supplied first time to protection engineers free of cost and assist them in field for commissioning of these schemes (First five) free of cost.

#### 5.04 RELAYING REQUIREMENTS :

5.04.01 The relay offered by the supplier shall comply with the requirements of latest issue of ISS:3231 & IS:8686 or relevant BSS or IEC and shall be suitable for operation in the climatic conditions specified under clause 3.1 of this specification . If complying with a specification other than BSS/ISS/IEC then an English translation of the same shall accompany the tender.

5.04.02 Each relay shall be provided with dust tight, removable covers with glass/clear plastic windows. The relay shall be so arranged that on opening the case, it shall be impossible for any dust which may have collected

in or upon the case, to fall on the relay mechanism. The operation of the relays shall be practically free from errors due to normal variation in frequency and wave form and from ambient temperature effects between (-) 5 deg. C to 50 deg.C.

5.04.03 All relay voltage current coils/elements shall be able to withstand the maximum possible thermal and mechanical stresses likely to be encountered in service, without damaging the coil/element and mechanical parts. Each relay coil/elements shall be vacuum impregnated with an insulating compound and shall be heat and moisture resistant. The continuous electrical rating of all the coils shall be 110%.

5.04.04 The volt ampere burden of the relay coils shall be low and, as per the best modern design, shall be such that the setting and calibration will not easily get out of adjustment. All contacts shall preferably be made of pure silver and shall be readily renewable and self cleaning type.

5.04.05 Time delay features which depend upon dash pots or other devices which are appreciably effected by change in temperature or humidity will not be acceptable. Permanent magnets shall be non ageing type.

5.04.06 Terminal blocks shall have bases and barriers moulded integrally with brass inserts and shall be suitable for 660 volts service, individual studs or screws with retainer type washer for terminals shall be provided for each incoming and outgoing feeders.

5.04.07 All fault detecting relays shall be equipped with operation indicators. In three phase relays with separate elements, each phase shall have separate indicator.

5.04.08 Annunciation and alarm circuits shall be operated by contacts on an auxiliary tripping relay or by a separate relay added for that purpose. All tripping shall be done by auxiliary tripping relays fed from separate D.C. source thereby providing isolation of the relaying circuits from the circuit breaker D.C. control sources. Auxiliary tripping relays for all protections included in this specification shall be hand reset type. Transformer auxiliary protection like winding temperature trip, oil temperature

trip, Buchholz trip/alarm and Oil surge trip shall be through auxiliary relays.

5.04.09 All the relays shall be provided with test blocks in panel so designed that the relays may be tested in situ. The relays should have provision of testing either through test block or test plug easily accessible by injecting the voltage/current/frequency (as applicable) from external testing instruments / source without first disconnecting / reenergizing the primary electrical circuit protected by the relays. Facilities for isolating the tripping circuit during such testing shall be also provided.

The requirement of test block shall not be applicable in case of drawout type relays which can be tested by using test plug without removing the relay from its casing.

Relay TTB shall have trip bypass arrangement.

The testing facilities provided in the relays shall be specifically stated in the bid. Necessary test plug etc. as may be required for proper testing shall be included in the contractor's scope of supply. One test plug with five panels or part thereof are to be supplied.

5.04.10 All relays shall be suitable for 5 Amps. rated C.T. secondary current and secondary voltage of 110/Root 3 volts between phase and neutral. The non-directional polarization for earth fault shall, however, be rated for 110V. The normal frequency will be 50 cycles per second.

5.04.11 All devices required for correct operation of each relay shall be provided by the supplier without extra cost.

5.04.12 For over current & earth Fault protection, only numerical relay shall be provided. In three phase protection relay, the setting for over-current element shall be 50-200% (in step of 10%) and for earth fault element from 10 to 80% (in step of 10%). The numerical relay shall have following features:-

- a. Self Diagnosis

- b. Minimum last five abnormal events recording (over current & earth fault) including fault level and phase along with date & time.
- c. On-line display of current.
- d. Communicable with open Protocol having RS-485 port.
- e. The relay should contain four shots, three phase, programmable & auto reclose control feature

5.04.13 Based on the results of comprehensive test, the tenderer shall declare the performance of the protective system in terms of the following :

- i) Fault setting.
- ii) Time of operation.
- iii) Stability limit.

#### 5.04.14

The bidder must furnish type test reports as per relevant ISS/ IEC along with bid to suit the environmental conditions of our State, in respect of the relay (of the type and design offered) which should have been type tested in NABL accredited test laboratory in respect of such tests for which the lab has been accredited (for Indian make Relays)/ CPRI/ Nationally accredited testing laboratory (for Foreign make Relays). These type test reports should not be older than three years from the date of opening of bid. Bids without Type Test reports will be treated as Non-Responsive.

#### 5.04.15 MAKE OF RELAYS

The following make of relays are acceptable to Nigam:-

- i) AREVA
- ii) ABB
- iii) EASUN REYROLLE
- iv) JVS
- v) SEL
- vi) ASHIDA
- vii) C&S
- viii) MEGAWIN
- ix) CGL
- x) STELMEC

Any other equivalent make of Relay shall be acceptable subject to prior approval of this office.

## 5.05 PROTECTION FOR 33 KV SYSTEM

### 5.05.1 INCOMER (HV side of 33/11 KV transformer)

Protection will be provided on 33 KV incomer which includes three phase non directional inverse time overcurrent relays with instantaneous attachment and one non directional inverse time earth fault relay with instantaneous attachment with stabilizing resistance.

### 5.05.2 FEEDER PROTECTION

Protection of 33 KV feeder circuits against line faults shall be met by three phase non directional inverse time over current relays and one inverse time non directional earth fault relay with instantaneous attachment.

## 5.06 FAULT/TROUBLE ALARM ANNUNCIATION SCHEME :

5.06.01 Each C/R panel shall be equipped with Annunciation scheme for indicating all the annunciations required for the trip and non trip alarms as per details given hereunder. Each annunciation shall be clearly labelled to indicate the nature of particular annunciation.

5.06.02 The following switches shall be provided with the annunciator :

i) A common push button switch near the annunciator unit which when pressed shall cancel the audible alarm by means of the alarm cancellation relay. The indication lamps incorporated in the control switch shall remain illuminated, but shall change from flashing to steady glow.

ii) A common reset push button shall be provided. By pushing this button ,annunciation shall be restored to the normal condition. The lamp incorporated in the control switch should not glow after resetting all the protection devices.

iii) A test push button switch shall be provided to illuminate all the lamps of the associated group. As long

as the test switch is held in pressed position all the lamps shall remain illuminated.

5.06.03 Necessary auxiliary relays shall be provided in the annunciator scheme to indicate each trip alarm individually .Each alarm whether trip or nontrip shall have visual as well as audible annunciation.

5.06.04 The visual annunciator alarm shall be in the form of flashing display type glow pattern. The illuminated facias with inscription on the glass transducent plastic to indicate the operation of particular protection device shall be provided. The window shall remain illuminated till the particular initiating contact is reset.

5.06.05 As regards the audible indication, the automatic trip of the circuit breaker due to the operation of protection relays shall be indicated by sounding of a hooter. All non trip alarms shall be indicated by an alarm bell/ electronic bell.

5.06.06 33 KV Feeder circuits

Following trip/Non trip alarm shall be provided on each panel controlling two 33 KV feeder circuits.

Trip

- i) Over current Feeder I trip.
- ii) Earth fault Feeder I trip.
- iii) Over current Feeder II trip.
- iv) Earth fault Feeder II trip.

Non trip

- i) Trip circuit Feeder I faulty.
- ii) Trip circuit Feeder II faulty.

5.06.07 33 KV Transformer

Following trip/Non trip alarm shall be provided on each panel controlling 2 Nos. 33 KV Transformer circuits.

Trip

- i) Over current HV trip Transformer 1.
- ii) Earth fault HV trip Transformer 1.
- iii) Over current HV trip Transformer 2.
- iv) earth fault HV trip Transformer 2.
- v) Buchholz alarm Transformer 1
- vi) Buchholz alarm Transformer 2
- vii) Buchholz trip Transformer 1
- viii) Buchholz trip Transformer 2
- ix) Oil temperature trip Transformer 1
- x) Oil temperature trip Transformer 2
- xi) Winding temperature trip Transformer 1
- xii) Winding temperature trip Transformer 2
- xiii) Oil surge relay trip Transformer 1
- xiv) Oil surge relay trip Transformer 2

#### Non trip

- i) Trip circuit faulty Transformer 1.
- ii) Trip circuit faulty Transformer 2.
- iii) Minimum oil gauge Transformer 1.
- iv) Minimum oil gauge Transformer 2.
- v) Oil temperature alarm Transformer 1.
- vi) Oil temperature alarm Transformer 2.
- vii) Winding temperature alarm Transformer 1.
- viii) Winding temperature alarm Transformer 2.
- ix) D.C. under Voltage alarm Transformer 1.
- x) D.C. under Voltage alarm Transformer 2.

5.06.08 It will be responsibility of the supplier to provide all the alarms and annunciation equipments required for the safe and efficient operation of the sub stations. General description of the alarms required are given but the supplier shall include other alarms that he considers necessary.

#### **5.07 SPECIFICATION OF INDICATING AND INTEGRATING INSTRUMENTS AND METERS :**

5.07.01 All indicating instruments shall be of switch board type back connected suitable for flush mounting and provided with dust and vermin proof case for tropical use and finished in black colour. All fixing screws, nuts and threaded parts shall be designed according to relevant Indian Standards. Ammeters, Voltmeters, Wattmeters, as well as power factor meters shall be square pattern and shall conform to the provisions of the latest edition of

IS:2419/1963. Energy meters shall conform to the provisions of relevant IS amended upto date.

All instruments shall have practical means of adjustment of accuracy. The limits of errors for ammeters, voltmeters, Power factor meters and watt meters shall be those permissible for class.1 instruments of switch board type given in IS:1248. The energy meters shall however conform to class.0.5S accuracy. The calibration of the instruments shall function satisfactorily when mounted on steel panels or alternatively magnetically shielded instruments shall be used.

#### 5.07.02 AMMETERS AND VOLT METERS :

All ammeters and voltmeters shall be of moving iron spring controlled type. Ammeters shall be provided in all the individual feeder panels and transformer control panels to indicate the current in all the phases. The ammeters shall be suitably scaled to indicate the current for all the ratios of current transformers. A phase selector switch with four position shall be used to measure the current in all the three phases and in the fourth position the ammeters shall be out of circuit.

The voltmeters shall be provided wherever asked for in the detailed equipment requirement. A phase selector switch with six positions shall be used to indicate the voltage between phases and between phases and earth.

#### 5.07.03 A.C. STATIC H.T. TRIVECTOR METERS :

A.C. Static H.T. Trivector Meter shall be as per specification appended at Annexure-`A'. The meters shall be located at eye level to facilitate observations of readings correctly.

Purchaser reserves the right to get energy meters separately purchased from other source, installed on the control and relay panels to be supplied by the tenderer under this contract. In that event duly blanked cutout with mounting arrangement and wiring shall be provided on the control and relay panels as per details furnished by the purchaser. The price of the control and relay panel shall be reduced corresponding to the unit price given in the tender.

#### 5.07.04 TESTING BLOCKS :

Testing terminals shall be provided for carrying out calibration tests on Energy meters, without disconnecting the connecting leads or removing the meters. The test plug shall be so arranged that when the testing respectables are fitted, the current and voltage are automatically disconnected from the source and injection from the separate source is possible.

5.07.05 Unit prices of each metering and indicating instruments shall be given in the schedule of prices. For making adjustments in the panel mountings depending upon exact system requirement.

### **5.08 SPECIFICATION OF CONTROL AND RELAY BOARD**

5.08.01 The equipment offered should conform to relevant Indian Standards or equivalent IEC standards. The references of the relevant standard specifications wherever mentioned in the text of this specification have been given accordingly. Other authoritative standards which ensure an equal or better quality than the standards specified will also be accepted.

5.08.02 The Boards shall comprise of cubicles placed side by side to form continuous boards. The duplex type shall be mounted back to back and so arranged as to have a covered corridor in between to provide access to the internal wiring. Hinged lockable access doors shall be fitted at both ends of the corridor and switch boards interior shall be automatically lit by the opening of these doors. The control boards for the same line voltages at each sub-station shall be placed side by side.

5.08.03 For the existing sub stations the tenderer shall ensure the matching of control & relay boards with the existing ones. The complete details of the existing control & relay panels shall be supplied to the successful tenderer. The following points shall be particularly coordinated

- i) The height and depth of the panel shall be perfectly matched.

- ii) Colour of panels both on exterior and interior shall be matched.
- iii) Size and appearance of instruments, control switches and indicating lamps mounted on the front of the panels shall be matched with the existing ones to the extent possible.
- iv) The size, colour and disposition of the mimic diagram shall be perfectly matched with the existing scheme.

5.08.04 For other new sub stations, access doors with concealed hinges having a swing of not less than 1050 mm on full opening of their position shall be provided at suitable locations. The equipment specified shall be manufactured in the manner set out and where not set out, to the reasonable satisfaction of the purchaser.

5.08.05 The control and relay cubicles shall be of folded type construction. The front panels, base frame and door frame shall be manufactured from CRCA sheet steel 10 SWG (3mm) thick, while the side panels, roof and doors shall be manufactured out of 14 SWG (2mm) thick CRCA sheet steel. The bottom of the cubicle frame shall be suitable for erection on flush concrete floor. Evenly spaced grout bolts projecting through the base channels forming members of the frame shall be used for securing cubicles to the floor. The dimensions of control and relay panels where no specific matching is required shall be as follows :

Height	: 2312 mm (inclusive of base channel height of 102 mm).
Width	: 750 mm or suitable to accommodate equipments
Depth	
Duplex panel.	: 610+762+610 mm (Corridor width is 762 mm).
Simplex panel.	: 610 mm

5.08.06 The front panels of all the cubicles shall be detachable and all inter connections from the control to the relay cubicles and vice versa shall be through terminal connectors. The inter connections shall preferably run underneath the top cover. In order to avoid sectionalising the leads at two points, the top cover may be provided with hinges on the part.

5.08.07 The complete switch board shall be dust and

vermin proof and shall be suitable for tropical use. All holes and extension windows in the panels shall be blanked and access doors shall be lined with compressible line at the edges. The complete boards shall incorporate all necessary meters, instruments, relays, control switches, indicating lamps, mimic buses, audible and visual alarms, horizontal and vertical wiring supports, earth bars, interior lighting system, terminal blocks, cable glands, fuses, labels, cleats, ferrules, space heaters, automatic semaphore indicators and other necessary equipment. In the relay panels, it will be the responsibility of the supplier to make provisions for the leads to be connected to the annunciator scheme for different trip and non trip alarms. The enclosure shall provide a minimum degree of protection equivalent to IP51 in accordance to IS2147.

5.08.08 All power and control cables will be connected in separate distributing trenches running immediately, underneath the control & relay panels. The cables will branch off into each cubicle through entry holes in the concrete floor opening in the bottoms of the cubicles. The tenderer shall mark the details of the cable entry holes, glands and position of grouting bolts to enable the purchaser to prepare foundations with pockets for grouting bolts while casting floor.

#### 5.08.09 PAINTING :

All unfinished surfaces of steel panels and frame work shall be sand blasted to remove rust, scale, foreign adhering matter and grease. A suitable rust resisting primer shall be applied on the interior and exterior surface of steel, which shall be followed by application of an under coat suitable to serve as base and binder for the finishing coat.

i) All sheet steel work shall be phosphated in accordance with IS:6005 code of practice for phosphating iron and steel.

ii) Oil, grease, dirt and swarf shall be thoroughly removed by emulsion cleaning.

iii) Rust and scale shall be removed by pickling with dilute acid followed by washing with running water rinsing with slightly alkaline hot water and drying.

iv) After phosphating thorough rinsing shall be carried out with clean water followed by final rinsing with dilute dichromate solution and oven drying.

v) The phosphate coating shall be sealed with application of two coats of ready mixed, stoved type zinc chromate primer. The first coat may be "flash dried" while second coat shall be stoved.

vi) After application of primer two coats of finishing synthetic enamel paint shall be applied. Each coat shall be applied followed by stoving the second coat after inspection of first coat of painting. Generally the exterior colour of paint shall be as per shade 631 of IS5, except where specific matching is required.

vii) Each of coat of primer and finished paint shall be of slightly different shade to enable inspection of painting.

viii) In case the tenderer proposes to follow any other established painting procedure like electrostatic painting, the procedure shall be submitted along with the tender for purchaser's review and approval.

#### 5.08.10 PANEL WIRING :

5.08.10.1 All wiring other than for annunciation circuits shall be of switch board type 2.5 sq.mm PVC insulated tinned copper conductor suitable for 660V service and in accordance with relevant Indian Standards. For annunciation and alarm circuits, the wiring will be done with 1.5 sq.mm PVC insulated copper conductor. Polyvinyl chloride used shall have excellent resistance against burning, moisture, oil and vermin and shall be finished with clear colour. Rubber insulated wiring shall not be acceptable.

5.08.10.2 The wiring shall be supported by plastic cleats/PVC channels. Wires shall be terminated on to the terminal blocks with annealed and tinned (not soldered) crimp tag termination, separate termination being used for each wire, and the size of termination suited to the size of wire terminated. Wiring shall in general be accommodated on the sides of the cubicles and the wires for each circuit shall be separately grouped.

5.08.10.3 Wires shall not be jointed or tied between

terminated points. At the terminal connections, washers shall be interposed between terminals and holding nuts. All holding nuts shall be secured by locking nuts. The connecting studs shall be secured by locking nuts. the connecting studs shall project at least 6 mm from the lock nuts surface.

5.08.10.4 Bus wires shall be fully insulated and run seperately. Fuses and links shall be provided to enable all circuits in a panel except lighting circuit to be isolated from the bus wire. When ever practicable all circuits in which the voltage exceeds 125 volts, shall be kept physically separated from the remaining wiring. The function of each circuit shall be marked on the associated terminal boards.

5.08.10.5 All wiring diagrams for the control and relay Boards shall be drawn as viewed from the back of the cubicles and shall be in accordance with the relevant I.S.

5.08.10.6 Wiring connected to the space heaters in the cubicle shall have porcelain beaded insulation over a safe length from the heater terminals.

5.08.10.7 All wiring inter connecting the front panels with the rear panels of the switch boards over the access shall be wired in gutters held against the ceiling of corridors by means of screws. As the front and the back panels will be detachable, the interconnection shall be made through suitable terminal connectors securely fixed on the panel.

5.08.10.8 All voltage bus wiring ,audible and non audible alarm bus wiring, A C & D C control supply,bus wiring for panel lighting and such other wiring which runs from panel to panel within the switch board shall be laid out in gutters and shall be suitably screened.

5.08.10.9 All wire shall be suitable for bending to meet the terminal studs at right angle with the studs and they shall not be skewed.Metal cases of all apparatus mounted on panels shall be separately earthed by means of flexible copper wire or strip.

5.08.10.10 The following colour scheme of the wiring shall be used :

i) A.C. three phase circuits	Colour
No. 1 Phase	Red
No. 2 Phase	Yellow
No. 3 Phase	Blue
ii) Neutral Conductor	Black
iii) Connections to earth	Green
iv) D.C. circuits	Grey

#### 5.08.11 FERRULES :

5.08.11.1 Ferrules engraved with the same numbers, letters and symbols as indicated in the connection and wiring diagrams shall be provided on the terminal ends of all wires for easy identification of circuits for inspection and maintenance.

5.08.11.2 Ferrules shall be of strong and flexible insulating material with glossy finish to prevent adhesion. They shall be engraved and clearly and durably marked and shall not be affected by dampness.

5.08.11.3 Ferrules numbering shall be in accordance with IS:375/1963. The same ferrule number shall not be used on wires in different circuits on a panel.

5.08.11.4 All points of interconnection between the wiring carried out for equipments for different suppliers, where a change of number can not be avoided, double ferrules shall be provided on each wire with appropriate numbers on the changing end. The change of numbering shall be shown on the appropriate connection wiring diagram of the equipment.

5.08.11.5 Alternatively marking of the wires may be done with legible numbers painted on the wires.

#### 5.08.12 TERMINAL BLOCKS :

5.08.12.1 Terminal block connectors built from cells of moulded dielectric and brass stud inserts shall be provided for terminating the outgoing ends of the panel wiring and the corresponding incoming tail ends of control cables. Insulating barrier shall be provided between adjacent

connections. The height of the barriers and the spacing between terminals shall be such as to give adequate protection while allowing easy access to terminals. Provision shall be made on each pillar for holding 10% extra connections. All blocks shall be shrouded by easily removable shrouds of non inflammable moulded and transparent dielectric materials.

5.08.12.2 The terminal blocks shall be suitable for 660 volts service and for connection with copper wires.

5.08.12.3 Terminal blocks shall be mounted in such a manner as to afford easy access to terminations and to enable ferrule number to be read without difficulty. Wire ends shall be so connected to the terminals that no wire terminal number gets marked due to succeeding connections. In other words ferrule numbering at the terminals should be unambiguous and fool proof. Terminal board rows shall be adequately spaced and shall not be less than 100 mm apart so as to permit convenient access to wires and terminals. Labels in the form of engraved plastic plates shall be provided on the fixed portion of terminal boards.

5.08.12.4 No live metal parts shall be exposed at the back of the terminal boards.

5.08.12.5 All studs, nuts, bolts screws etc. shall be threaded according to the latest relevant Indian or equivalent International Standards.

5.08.13 SPACE HEATERS :

Tubular/Rectangular space heaters suitable for connection to the single phase 230 volts A.C. supply complete with switches located at convenient positions shall be provided at the bottom of each cubicle to prevent condensation of moisture. The Watt loss per unit surface of heater shall be low enough to keep surface temperature well below visible heat. Each cubicle shall also be provided with a switch of appropriate rating for control for space heater.

5.08.14 MIMIC DIAGRAM.

Painted colour bands shall be used for the mimic bus. The Width of mimic diagram and its colour shall be matched with

the existing panel. The mimic shall represent a single line arrangement of the station switch Yard equipment. The colour for showing the 33 KV voltage on the mimic shall be used as green. However where specific matching is not required the color scheme for mimic shall be as under :

33 KV - Brilliant Green - Shade 221 of IS 5

11 KV - Signal Red - Shade 537 of IS 5.

The mimic diagram shall be at the eye level.

#### 5.08.15. SEMAPHORE INDICATORS

Automatic ,rotating disc type semaphore indicators for indication of 'Close'and 'open' position of circuit breakers, isolators and earth switches shall be incorporated in the mimic diagram. Other equipments such as transformers, voltage Transformers etc.shall be represented by suitable symbols.

The operating coils of the semaphore indicators shall be continuously rated and shall be operated from 110 volts D.C.The units will operate satisfactorily between the limits of 80 to 120 percent of rated D.C.voltage. The Semaphore disc shall have a 90 degree angular movement clock wise/counter clock wise to show on/off position of the equipment.

#### 5.08.16 INDICATING LAMPS.:

5.08.16.1 Indicating lamps shall be provided on the control Board to indicate the following:

- i) Visual indication of 'on' and 'off' position of each circuit breaker.
- ii) Auto trip indication for each circuit breaker.
- iii) Spring charged indication for circuit breaker.
- iv) V.T. supply indication on one part of the Panel.

5.08.16.2 Each lamp body shall be of moulded insulation and shall be able to withstand a high voltage of appropriate value. All lamps shall be suitable for 110 volts D.C.supply and shall have low wattage of consumption and shall provide a wide angle of illumination of sufficient intensity for comfortable viewing.

5.08.16.3 The 'on' and 'Off' position indication lamps shall operate at 230 V Single phase A.C. supply. Automatic change over contactor for changing the 'on' and 'off' position indication lamps from A.C. supply to D.C. supply shall be provided to keep the lamps in working condition in case of failure of AC supply. Suitable, IVT shall be added wherever there is voltage difference between AC/DC supply.

5.08.16.4 A glass of appropriate colour shall be screwed into the front of the lamps body. The design of the indication lamps shall be such as to facilitate replacement of burnt lamps. An engraved label indicating the purpose of the lamp shall be provided with each lamp. The tenderer shall quote unit prices for lamps and lenses to enable the purchaser to order certain spare quantity alongwith the main panels.

#### 5.08.17 SWITCH BOARD LIGHTING :

The switch Board interiors shall be illuminated by incandescent lamps connected to a 230 Volts single phase A.C. Supply. The illumination of interior shall be free from hand shadows and shall be planned to avoid any strain or fatigue to the wireman who may be called upon to do work. A door operated button switch shall be provided for control of lighting on both entrances of corridor of duplex C&R panels. In case of simplex panels each cubicle shall have its own interior illumination lamp operated by respective door switch.

#### 5.08.18 TRIP CIRCUIT SUPERVISION :

For continuous supervision of the trip circuits, continuous trip circuit supervision relay shall be installed. The relay shall operate self reset alarm contact for failure of trip supply and open circuit of trip coil or trip circuit wiring. The relay shall monitor the trip circuit in both close and open position of the circuit breakers.

#### 5.08.19 TITLE PLATES :

A title plate bearing the name and purpose of each panel shall be fixed on the top of each control as well as relay panel.

**5.08.20 TEST BLOCKS :**

Switch board type back connected test blocks with contacts shall be provided with links or other devices for shorting terminals of CT leads before interrupting the normal circuit for injection from an external source or for inserting testing instruments in the circuit without causing open circuit of the CT. The voltage testing studs shall preferably be housed in the narrow recesses of the block moulding insulation to prevent accidental short circuit across the studs. All test blocks for metering and the relays etc. whenever required, shall be of flush mounting pattern and the number of test blocks being provided on each control and relay panel shall be stated in the tender.

**5.08.21 SAFETY EARTHING :**

Earthing of current free metallic parts or metallic bodies of the equipments mounted on the switch boards shall be done with 2.5 sq.mm PVC insulated green coloured copper wire. The two ends of this line shall be provided with crimp tag terminations and connected to a tinned copper earth bar of 25mm x 3mm section running longitudinally at the bottom of the control Board.

The neutral point of star connected secondary winding of instrument transformers and one corner of the open delta connected LV side of voltage transformers, if used, shall be similarly earthed by tails connected with the main earth bar at the switch board earthing system. Multiple earthing of any instrument transformer circuit shall be avoided.

**5.09 CO-ORDINATION :**

5.09.01 Circuit Breaker, current transformers, voltage transformers, CVTs, isolating switches, H.T. TVM carrier equipment etc., are being purchased from other suppliers and wiring diagrams of these equipments shall be furnished by the respective suppliers. Supplier of control and relay boards shall be responsible for preparing complete wiring diagrams and cable schedules including the control circuits of various equipments and shall also undertake to mount and wire any equipment received loose from other suppliers.

5.09.02 The control and relay board shall be suitably fabricated to match and arranged to form one continuous board with the existing panels at various sub stations wherever mentioned.

5.09.03 The feeder protection schemes proposed to be provided shall be co ordinated with the existing protection at the remote end of the section. The other protection schemes, wherever asked for, shall be suitably co ordinated with the existing protection at the various sub stations. Other coordination work if required, will also be done without any extra cost by the supplier of control and relay board.

5.09.04 The supplier shall be solely responsible to propose/select the suitable carrier frequency for carrier aided protection schemes, meeting the requirement of our existing systems and arrange allocation of frequency from the wireless advisor, Govt. of India. All relays/associated equipments shall be supplied as per frequency finally approved allocated by the wireless advisor Govt. of India accordingly.

## **6.0 TESTS :**

6.1 TEST BEFORE DESPATCH : The Control & relay Panels and accessories shall be subjected at maker's works before despatch, to the following tests as per ISS.

A) ROUTINE TEST ON EACH UNIT AS PER RELEVANT STANDARD IS 8623-1977 :

- 1) Inspection of wiring & electrical operation test.
- 2) Dielectric Test.
- 3) Checking of protective measures & of electrical continuity of the protective circuit.

## **6.2 TYPE TESTS :**

The 33 KV C&R Panel offered shall be fully type tested as per relevant standards. The bidder must furnish type test reports along with bid as per the qualification requirement of the Tender Specification. However, the purchaser reserves the right to demand repetition of some or all the type tests in presence of purchaser's

representative. For this purpose, the bidder should indicate unit rates for carrying out such type tests. These test charges shall not be taken into consideration for bid evaluation.

6.2.2 A) TYPE TESTS SHALL HAVE BEEN CONDUCTED ON ONE UNIT

AS PER RELEVANT STANDARD IS 8623-1977 latest amended:

1) Verification of degree of protection IP-55 of encloser (i.e.C&R Panel) in accordance to IS-13947 Part-1.

B) TYPE TEST REPORTS IN RESPECT OF APPROVED MAKE OF RELAYS ARE NOT REQUIRED TO BE FURNISHED FOR AUXILIARY & OTHER RELAYS (EXCEPT OVER CURRENT & EARTH FAULT RELAY). THE FOLLOWING TYPE TESTS ARE REQUIRED TO BE FURNISHED IN RESPECT OF NUMERICAL OVER CURRENT & EARTH FAULT RELAYS:-

- i) Insulation Test.
- ii) High Frequency Disturbance Test.
- iii) Electrical Fast Transient Test.
- iv) Relay Characteristic, Performance & Accuracy Test.
- v) Steady State Characteristics & operating time Test.
- vi) Test for Thermal requirement.
- vii) Test for Mechanical requirement.
- viii) Test for rated burden.
- ix) Contact performance test.

C) TYPE TESTS TO BE CONDUCTED ON ONE UNIT OF ANNUNCIATOR:

- a) High Voltage Test at 2 KV A.C. r.m.s. for one minute (IS: 3231/IEC 255-4 Clause 12.3)
- b) Impulse Test 1.2/50 micro sec. 5 KV impulses (IS: 8686/IEC 255-4).
- c) Performance/ Functional Test.
- d) Temperature Rise Test.
- e) Auxiliary Supply variation Test.
- f) High Frequency Disturbance Test (IS: 8686).

6.2.3 However, the purchaser reserves the right to demand repetition of some or all the type tests in presence of purchaser's representative. For this purpose, the bidder should indicate unit rates for carrying out such type tests. These test charges shall not be taken into consideration for bid evaluation.

### 6.3 TEST ON BOUGHT OUT ITEMS

Tests are not required to be performed on bought out equipments like Relays, HT TVMs, switches etc. at the works of manufacturer except operational tests. Furnishing Test Certificate of equipments from the original equipment manufacturers shall be deemed to be satisfactory evidence. Inspection of the tests at Sub-contractors works will be arranged by the supplier whenever required.

### 6.4 ROUTINE/ACCEPTANCE TESTS :

The following tests shall be got conducted in presence of purchaser's representative.

- 1) Checking of wiring of circuits & their continuity.
- 2) One minute 2 KV insulation withstand test at 50 cycles on all equipments on the panels & wiring.
- 3) Insulation resistance of complete wiring circuit by circuit with all equipments mounted on the panel.
- 4) Checking the operation, function and calibration of protection schemes, instruments & meters
- 5) Checking of colour scheme used in wiring as per following requirement :

i)	A.C. three phase circuits	Colour
	-----	-----
	No.1 Phase	Red
	No.2 Phase	Yellow
	No.3 Phase	Blue
ii)	Neutral conductor	Black
iii)	Connections to earth	Green
iv)	D.C. Circuits	Grey

- 6) Checking of same ferrule numbers at both ends of wires.
- 7) Routine tests in accordance with relevant IS or other the international standards shall be carried out on all the instruments, relays and other devices or manufacturer's routine test reports shall be enclosed with inspection report.

#### 6.5 TOLERANCE ON TEST RESULTS :

The tests shall be conducted as per relevant ISS.

#### 6.6 TEST AT SITE :

The purchaser reserves the right to conduct all tests on Control & Relay Panels after arrival at site and the contractor shall guarantee test certificate figures under actual service conditions.

#### 7.0 INSPECTION :

All the tests (as mentioned at Clause 6.4) and Inspection shall be made at the place of manufacturer unless otherwise especially agreed upon by the bidder and purchaser at the time of purchase. The bidder shall afford the inspection officer(s) representing the purchaser all reasonable facilities without charges, to satisfy him that

the material is being furnished in accordance with this specification. The purchaser has the right to have the tests carried out at his own cost by an independent agency whenever there is a dispute regarding the quality of supply.

The Inspection may be carried out by the purchaser at any stage of manufacture/ before despatch as per relevant standard.

Inspection and acceptance of any material under the specification by the purchaser, shall not relieve the bidder of his obligation of furnishing material in accordance with the specification and shall not prevent subsequent rejection if the material is found to be defective. The Bidder shall keep the purchaser informed in advance, about manufacturing programme so that arrangements

can be made for inspection.

The purchaser reserves the right to insist for witnessing the acceptance/ routine testings of the bought out items.

The Bidder shall give 15 days advance intimation to enable the purchaser to depute his representative for witnessing the acceptance and routine tests. The inspection charges would be to the purchaser's account (Boarding , lodging and to & fro journies upto the place of inspection only).

#### **8.0 QUALITY ASSURANCE PLAN :**

8.1 The Bidder shall invariably furnish following information alongwith his offer, failing which the offer shall be liable for rejection. Information shall be separately given for individual type of equipment offered.

i) Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw material are tested, list of tests normally carried out on raw material in the presence of Supplier's representative, copies of test certificates.

ii) Information and copies of test certificates as in (i) above in respect of bought out items.

iii) List of manufacturing facilities available.

iv) Level of automation achieved and list of areas where manual processing exists.

v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

vi) Special features provided in the equipment to make it maintenance free.

vii) The bidder should have adequate facilities to carryout accurately all required tests during manufacturing and routine/acceptance tests as per relevant ISS/IEC standards at the final end routine/acceptance. The supplier will ensure that all testing/measuring instruments/apparatus are

calibrated at regular periodicity from reputed test house as per relevant standards and a certificate of testing authority is made available to purchaser's inspector at the time of inspection. Such calibration certificates, in any case shall not be older than one year on the date of such tests".

viii) List of testing instruments and apparatus alongwith their last date of calibration, available with the Bidder for testing of equipment specified and test plant limitation, if any, vis-a-vis the type, special, acceptance and routine tests testing during manufacture specified in the relevant standards. These limitations shall be very clearly brought out in "Schedule of Deviations".

8.2 The Supplier shall within 30 days of placement of order, submit the following information to the Purchaser.

i) Name of the raw material as well as bought out accessories and the names of sub-suppliers selected from those furnished alongwith the offer.

ii) Type test certificates of the raw material and bought out accessories.

iii) Quality Assurance Plan (QAP) with hold points for Purchaser's inspection. The QAP and Purchaser's hold points shall be discussed between the Purchaser and the Supplier before the QAP is finalised.

8.3 The Supplier shall submit the routine test certificates of bought out items and raw material at the time of routine testing of the fully assembled equipment.

## **9.0 DOCUMENTATION :**

### **9.01 SPARES AND OPTIONAL ITEMS :**

The supplier shall necessarily include in his tender an itemwise price list of various protection schemes, relays, meters, accessories and other optional items used in the manufacture of C&R panels offered by him to facilitate ordering of spares as well as to make suitable adjustment in prices on account of subsequent additions/deletions of any of these items. The tender without such price list is likely to be ignored.(Please also see clause 5.03.02 to

5.03.04)

#### 9.02 GUARANTEED TECHNICAL PARTICULARS :

Guaranteed technical and other particulars as asked for shall be supplied with the tender. Any tender lacking in this respect may be rejected. Particulars of guarantee shall be clearly marked.

#### 9.03 DRAWINGS :

In addition to any other drawings which the tenderer may like to enclose, to explain the merits of his proposal, the following drawings shall be enclosed with the tender in quadruplicate :

- i) Principal dimensional details of each C&R panel.
- ii) Front & rear views with instruments relays and devices positions marked AC/DC.
- iii) Elementary diagrams of all metering, protection, annunciation and other circuits.
- iv) Feeder protection scheme.

All the items of equipment included in this specification shall be provided with rating plates as per relevant standards and in addition with following particulars :

- i) Name & Address of Supplier.
- ii) Telephone No.
- iii) Fax No.
- iv) Date of Despatch.
- v) Date of Expiry of Warranty.
- vi) Name of Purchaser.
- vii) TN No.

The tenderer shall be responsible for any discrepancies/errors or omissions in the drawings and other particulars approved by the purchaser or not. 5 sets of such approved drawings would be supplied for each S/S alongwith the panel Board.

#### 9.04 ILLUSTRATED AND PRINTED LITERATURE :

Four copies of each of the descriptive and printed literature in respect of all the ammeters, voltmeters, selector

switches, watt meters, VAR meter, energy meters, power factor meter, control switches. Relays etc., proposed to be used shall be supplied alongwith the tender. A descriptive note indicating the salient points of the scheme offered shall also accompany each copy of the tender. In the event of an order, 3 sets of complete literature as well as operating/maintenance instruction manuals shall be supplied for each sub station alongwith panel board & another three sets to purchaser for other use.

#### 9.05 Test Reports :

i) Four copies of type test reports shall be furnished to the Purchaser within one month of conducting the tests. One copy will be returned duly certified by Purchaser to the Supplier within three weeks thereafter and on receipt of the same Supplier shall commence with the commercial production of the concerned material.

ii) Four copies of acceptance test reports shall be furnished to the Purchaser. One copy will be returned duly certified by the Purchaser and only thereafter shall the materials be despatched.

iii) All records of routine test reports shall be maintained by the Supplier at its works for periodic inspection by the Purchaser.

iv) All test reports for tests conducted during manufacture shall be maintained by the Supplier. These shall be produced for verification as and when requested for by the Purchaser.

#### 10.0 PACKING AND FORWARDING :

10.1 The loose equipment shall be packed in crates suitable for vertical/horizontal transport as the case may be and suitable to withstand handling during transport and outdoor storage during transit. The Supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbol. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc., shall be provided. Any material found short

inside the packing cases shall be supplied by Supplier without any extra cost.

10.2 Each consignment shall be accompanied by a detailed packing list containing the following information :

- a) Name of the consignee.
- b) Details of consignment.
- c) Destination.
- d) Total weight of consignment
- e) Sign showing upper/lower side of the crate.
- f) Handling and unpacking instructions.
- g) Bill of material indicating contents of each package.

The Supplier shall ensure that the packing and bill of material are approved by the Purchaser before despatch.

#### 11.0 QUANTITY AND DELIVERY REQUIREMENTS :

S. No.	Description of Item	Qty.	Delivery Schedule
1.	33 KV Control & Relay Panel (Transformer Type) with Non-Directional Earth Fault relay with Degree of Protection class IP 55.		Delivery to commence within 60 days maximum from the date of receipt of order and completion in Six months thereafter at equal quarterly rate.
2.	33 KV Control & Relay Panel (Feeder Type) with Degree of Protection class IP 55.		
	<b>Total</b>		

ii) The scope of supply shall include a supply of 10% extra quantity of bolts, nuts, washers, split pins, cotter pins and such other small loose items free of cost.

#### 12.0 HT TVMs :

12.1 Following makes of HT TVMs are acceptable to JVVNL:

- i) Secure

- ii) L&T
- iii) ABB/Elster
- iv) Schlumberger
- v) Genus Infra

12.2 In case bidders want to provide HT TVMs other than above make then as a qualification requirement the bidder must have supplied upto atleast 80% of total quantity of respective HT TVMs (similar type and model) as worked out on the basis of quantities of panels indicated in schedule of requirement (Annexure-B) of this specification in any one year during last 5 years (i.e. continuous period of 12 months) as on date of bid opening. Atleast 20% of the total quantity of respective HT TVMs (similar type and model) as worked out on the basis of quantities panels indicated in schedule of requirement (Annexure-B) of this specification must have been in successful commercial operation for last 2 years as on the date of bid opening.

The successful bidder(s) has to furnish 1 No. sample of HT TVM to be provided in the 33 KV C&R Panel to the MM wing within 30 days from the date of receipt of detailed Purchase Order for getting it tested in MT Lab before commencement of supplies. The supplies will be commenced only after approval of sample of HT TVM. If approval of sample of HT TVM is not conveyed by the Nigam within 15 days of receipt of sample, then commencement period will be extended correspondingly.

12.3 The technical suitability of relays/schemes may also be examined by Protection Wing & acceptability will be judged appropriately.

### **13.0 MAKE AND TYPE OF BOUGHT OUT ITEMS :**

13.1 The following make of bought out items will be acceptable to department :

S.No.	Name of Item	Make
1.	Indicating Instrument (Analog type)	AE/IMP/MECO
2.	Indicating Instrument	AE/IMP/MECO

(Digital type)

- |     |   |   |
|-----|---|---|
| 3.  | Control Switch for Circuit Breaker/Trip Transfer. | ALSTOM/RECOM/SWITRON/<br>KAYCEE                           |
| 4.  | Selector Switch for Voltmeter/Ammeter             | SWITRON/KAYCEE/RECOM                                      |
| 5.  | Semaphore Indicator                               | ALSTOM/<br>DAV IND. (Deepl)/ER                            |
| 6.  | Indicating Lamp                                   | ALSTOM/TEKNIC/<br>VAISHNO/<br>DAV Ind. (Deepl)            |
| 7.  | Annunciator                                       | MINILEC/YESHMUN/<br>INSTALRAM/PROTON/<br>JVS/PRADEEP/ALAN |
| 8.  | Push Button                                       | TEKNIC/VAISHNO/ESSEN<br>DAV Ind. (Deepl)                  |
| 9.  | A.C. Hooter/Bell                                  | TARGET/INDUSTRIAL<br>HOOTER/ALAN/JVS                      |
| 10. | D.C. Hooter                                       | TARGET/INDUSTRIAL<br>HOOTER/ALAN/JVS                      |
| 11. | Heater  | SOFIA/ELTER/AIREX<br>KAYCEE                               |
| 12. | Link Type test terminal block for testing of TVM  | IMP/CAPITAL/<br>DAV Ind. (Deepl)                          |
| 13. | CFL Tube  | PHILIPS/CROMPTON/BAJAJ                                    |
| 14. | 2 Pin/3 Pin socket with Switch (5/15A)            | ISI MARK  |

Other makes shall also acceptable if it is of "ISI MARK" or type tested for which tenderers shall furnish attested photostat copies of ISI Certificate/type test report not older than 5 years for the respective make offered alongwith tender.

13.2 Make / type of each relay, indicating instruments, integrating instruments, control switches, selector switches, indicating lamps, semaphore indicators, annunciator scheme, bell, hooter etc. shall be clearly and invariably indicated in the GTP (Guaranteed Technical Particulars), bill of material and unit price list. Only specific make accessories shall be indicated. The word "EQUIVALENT/REPUTED MAKE" will not be given for consideration.

#### **14.0 GUARANTEE PERIOD OF CONTROL AND RELAY PANELS :**

The guarantee period of each control & relay panels along with all accessories shall be for the period of 5 years from the date of receipt of panel along with all accessories.

The supplier shall attend the complaint within 15 days from the date of receipt of complaint. The date of receipt of complaint shall be treated as the date of FAX/ 3 days from the date of despatch of complaint by the field officer/ stores/ Purchaser. If the supplier fails to attend the complaint within 15 days from the date of receipt of complaint intimated by the field officer/ purchaser then penalty @ Rs.500/- (Rs. Five Hundred only) per day will be leviable and in case the equipment is not attended upto 30 days from the date of receipt of complaint, then penalty @ Rs.1,000/- per day will be leviable from 31<sup>st</sup> day from the date of receipt of complaint, till such time 33 KV C&R Panels is rectified by the firm. Further to this, in case of emergency, 33 KV C&R Panel can be get rectified by the field officer at the risk & cost of the supplier firm. The rectification of 33 KV C&R Panel means satisfactory performance report duly signed by the field officer (AEn/JEn) i.e. incharge of 33/11 KV Sub-Station.

#### **15.0 TERMS OF PAYMENT:-**

As per provision of clause No. 1.42.2 (c) of GCC, 5% payment against supply of each lot shall be retained by the Sr.A.O.(CPC) in order to ensure that PV claims are furnished by the supplier timely, which shall be released on finalization of PV claim by the purchaser.

##### **A) FOR NEW SUPPLIERS:**

95% (Eighty Five percent) payment of each consignment shall be made along with taxes & duties by the Sr. Accounts Officer (CPC), Jaipur Discom, Jaipur subject to furnishing of SBG & PBG in terms of relevant clause of GCC. In absence of furnishing of Security Bank Guarantee & Performance Bank Guarantee, 83% payment of the cost of each consignment along with 100% taxes, duties and freight and insurance charges shall be made on production of receipted challan duly verified by the consignee. **No payment shall be released without furnishing of complete type test reports.**

**B) For old & established suppliers:-**

80% (Eighty Percent) Payment of each consignment with taxes & duties shall be payable on supply of equipment in absence of type tests and 15% payment will be released after successful type test reports. In case of failure of any of the type test reports, the 15% payment shall be forfeited for the used material and remaining unused material will be lifted back by the supplier. In absence of furnishing of Security Bank Guarantee & Performance Bank Guarantee, 68% payment of the cost of each consignment along with 100% taxes, duties and freight and insurance charges shall be made on production of receipted challan duly verified by the consignee.

16.0 FURNISHING OF PROTO TYPE SAMPLE

One Proto Type 33 KV Transformer/Feeder Type C&R Panel conforming to various requirements of technical specification along with subsequent modifications made, has to be supplied by the successful bidder within two months of placement of detailed purchase order for our inspection & approval. The offer for inspection of subsequent material shall be entertained only after approval of proto type C&R Panel and he will have to complete the entire ordered quantity within six months of approval of proto type C&R Panel at equal quarterly rate. Prior to supply of prototype C&R Panel, the detailed drawings, Bill of Material & protection scheme shall be got approved.

DETAILS OF EQUIPMENTS

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SCHEDULE-A

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1. 33KV CONTROL AND RELAY PANELS FOR CONTROLLING  
TWO CIRCUIT BREAKERS FOR HV SIDE OF 33 KV  
TRANSFORMER : TYPE-A
- 

Equipment for each circuit shall occupy space on front of panel on either side of vertical centre as under :

For Transformer 1

-----

- |       |  |
|-------|--|
| One   | Section of painted and overlaid mimic diagram for one main and one auxiliary bus arrangement with symbol.  |
| Three | Semaphore indicators for automatic position indication of Isolators.   |
| One   | Semaphore indicator for automatic position indication of circuit breaker.  |
| One   | Three position control switch for the circuit breaker with pistol grip handle.   |
| Four  | Indicating lamps for the following :<br>i) Circuit breaker `ON'                      Red.<br>ii) Circuit breaker `OFF'                     Green.<br>iii) Circuit breaker `Auto-Trip.            White.<br>iv) Circuit breaker                           Amber.<br>spring charged. |
| One   | Flush switch board mounting, 144 mm square pattern, moving iron AC Ammeter of Class.1 accuracy, suitable for 5 Amps. CT secondary current suitably scaled.   |
| One   | Ammeter phase selector switch to indicate phase currents in all the three phases and off position.   |
| One   | 3 phase, 4 wire, Static KWH meter of class 0.5S accuracy.  |
| One   | Three phase IDMTL non directional over current relay with instantaneous attachment.  |

- One IDMTL non-directional earth fault relay with instantaneous attachment with stabilising resistance.
- One High speed trip relay.
- One. Continuous supervision relay for trip circuit healthy check both in closed and open position of circuit breaker.
- One Test terminal block 3 phase 4 wire.
- Five Auxiliary relay for transformer trouble.

FOR TRANSFORMER 2 :

-----  
 Equipments for Transformer 2 shall be identical to Transformer 1 with following additions :-

- Three Indicating lamps for the following :
  - i) VT supply indication (3 nos.) Red,Amber,Blue
- One Flush switch-board mounting, 144mm square pattern, moving iron AC voltmeter of class.1 accuracy suitable for 110V phase to phase VT secondary, suitably scaled.
- One Voltmeter phase selector switch to indicate phase to phase and phase to ground voltages of all the three phases.

FOLLOWING EQUIPMENTS SHALL ALSO BE PROVIDED ON THE C/R PANEL IN COMMON FOR BOTH CIRCUITS.

- One 24 way Annunciation windows complete with Annunciator relays for indicating 8 trip/non-trip alarms individually.
- One Set of 3 control Push buttons for 'Accept' Reset and 'lamp Test ' of above annunciation scheme.
- One Bell for Non trip alarm
- One Hooter for trip alarm
- One D.C. under voltage relay.

- One Space heater with switch.
- One 230V A.C. flourcent tube with door switch.
- One 3 Pin Socket with switch 15Amp. rating.
- One 2 Pin Socket with switch 5 Amp. rating.

2. 33KV CONTROL RELAY PANEL FOR CONTROLLING TWO FEEDER  
CIRCUIT BREAKERS.  
TYPE-B

-----

The C/R Panel shall accomodate equipments for two feeders. Each Circuit shall occupy space on front of panel on either side of vertical centre.

EACH OF THE TWO CIRCUITS SHALL HAVE FOLLOWING EQUIPMENTS:

- One -Section of painted and overlaid mimic diagram for one main + one auxiliary Bus arrangement with symbols.
- Four Semaphore indicators for automatic position indication of isolators and earth switch.
- One Semaphore indicator for automatic position indication of circuit breaker.
- One Three position control switch for the circuit breaker with pistol grip handle.
- Four Indicating Lamps for the following :-
  - i) Circuit Breaker `ON' - Red
  - ii) Circuit Breaker `OFF' - Green
  - iii) Circuit Breaker `Auto-trip'-White.
  - iv) Circuit Breaker  
Spring charged -Amber.
- One Flush switch Board mounting 144mm square pattern moving iron A.C.Ammeter of Class-1 accuracy suitable for 5 Amps CT secondary suitably scaled.

- One Ammeter phase selector switch to indicate phase currents in all the three phases and off position.
- One 3 Phase, 4 wire, Static KWH meter of class 0.5S accuracy.
- One Triple pole IDMTL non directional combined over current and earth fault relay with instantaneous attachment.
- One High speed trip relay.
- One Continuous supervision relay for trip circuit healthy Check both in closed & open position of circuit breaker.
- One Test terminal block 3 phase 4 wire.

FOLLOWING EQUIPMENTS SHALL ALSO BE PROVIDED ON THE C/R PANEL IN COMMON FOR BOTH CIRCUITS :

-----

- One 8 way Annunciation windows complete with Annunciation relays for indicating 8 trip/non trip alarm individually.
- One Set of 3 control push buttons for 'Accept' reset and Lamp 'Test' on above annunciation scheme.
- One 230V A.C. incandescent bulb with door switch.
- One Bell for Non trip alarm
- One Hooter for trip alarm
- One Space heater with switch.
- One 3 Pin Socket with switch 15 Amp rating.
- One 2 Pin Socket with switch 5 Amp rating.

## ANNEXURE-I

33 KV CURRENT TRANSFORMER  
FOR HV SIDE OF 33 KV TRANSFORMER  
(RATIO : 240-120-60/5-5A)

NO OF CORES	CORE NO.	APPLICATION	RATED BURDEN	CLASS OF ACCURACY	MAXIMUM INSTRU- MENT SECURITY FACTOR.	MIN. ACCU- RACY LIMIT FACTOR
2	1.	BACKUP PROTECTION	40 VA	5P	-	15
	2.	METERING	30A	0.5S	5	-

33 KV CURRENT TRANSFORMER  
FOR 33 KV FEEDER  
(RATIO : 300-150/5-5A)

NO OF CORES	CORE NO.	APPLICATION	RATED BURDEN	CLASS OF ACCURACY	MAXIMUM INSTRU- MENT SECURITY FACTOR.	MIN. ACCU- RACY LIMIT FACTOR
2	1.	BACKUP PROTECTION	40 VA	5P	-	15
	2.	METERING	30A	0.5S.	5	-

## ANNEXURE-II

INSTRUMENT RANGES 33 KV  
-----

		: 33 KV SIDE :		: 33 KV SIDE :	
S. NO.	INSTRUMENT	: FEEDER PANEL :	:	TRANSFORMER :	:
		:	:	PANEL :	:
1	AMMETER	: 0-300 A	:	0-240 A	:
		:	:		:
2	VOLTMETER	: -	:	0-40 KV	:
		:	:		:

## ANNEXURE . III

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TECHNICAL PARTICULARS OF VOLTAGE TRANSFORMERS  
PROPOSED TO BE UTILISED AT VARIOUS SUB-STATIONS.

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		DETAILS OF VTs.	
S.NO.	PARTICULARS	33 KV	
1	Type	: Outdoor	:
2	Rated primary voltage.	: $33KV/\sqrt{3}$	:
3	No. of secondary winding.	: Two	:
4	Winding.I	: 110/_/3 V	:
	Winding.II	: 110/_/3 V	:
5	Rated burden :	:	:
	Winding.I	: 100 VA	:
	Winding.II	: 100 VA	:
6	Accuracy class.	:	:
	Winding.I	: 0.5, 3 p	:
	Winding.II	: 3 p	:
7	Maximum ratio error with rated burden & 5% normal primary voltage.	:Within limits specified by IS:3156 for accuracy class indicated.	:
8	Maximum phase angle error with rated burden & 5% normal primary voltage.	:Within limits specified by IS:3156 for accuracy class indicated.	:
9	Oil	:Transformer oil conforming to IS:335.	:
10	Temperature rise of 1.2 times rated voltage with rated burden.	:Within limits specified by IS:3156.	:
11	Rated voltage factor and time.	:1.2 continuous. :1.5 for 30 seconds.	:
12	Temperature for 11 above.	:Within limits specified by IS:3156.	:

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## DETAILS OF EQUIPMENTS

## SCHEDULE-A

1. 33KV CONTROL AND RELAY PANELS FOR CONTROLLING TWO CIRCUIT BREAKERS FOR HV SIDE OF 33 KV TRANSFORMER : TYPE-A
- 
- Equipment for each circuit shall occupy space on front of panel on either side of vertical centre as under :
- For Transformer 1
- 
- |       |  |        |                      |      |     |                       |        |      |                             |        |     |                                 |        |
|-------|--|--------|----------------------|------|-----|-----------------------|--------|------|-----------------------------|--------|-----|---------------------------------|--------|
| One   | Section of painted and overlaid mimic diagram for one main and one auxiliary bus arrangement with symbol.  |        |                      |      |     |                       |        |      |                             |        |     |                                 |        |
| Three | Semaphore indicators for automatic position indication of Isolators.   |        |                      |      |     |                       |        |      |                             |        |     |                                 |        |
| One   | Semaphore indicator for automatic position indication of circuit breaker.  |        |                      |      |     |                       |        |      |                             |        |     |                                 |        |
| One   | Three position control switch for the circuit breaker with pistol grip handle.   |        |                      |      |     |                       |        |      |                             |        |     |                                 |        |
| Four  | Indicating lamps for the following : <table border="0" style="margin-left: 20px;"> <tr> <td>i)</td> <td>Circuit breaker `ON'</td> <td>Red.</td> </tr> <tr> <td>ii)</td> <td>Circuit breaker `OFF'</td> <td>Green.</td> </tr> <tr> <td>iii)</td> <td>Circuit breaker `Auto-Trip.</td> <td>White.</td> </tr> <tr> <td>iv)</td> <td>Circuit breaker spring charged.</td> <td>Amber.</td> </tr> </table> | i)     | Circuit breaker `ON' | Red. | ii) | Circuit breaker `OFF' | Green. | iii) | Circuit breaker `Auto-Trip. | White. | iv) | Circuit breaker spring charged. | Amber. |
| i)    | Circuit breaker `ON'   | Red.   |                      |      |     |                       |        |      |                             |        |     |                                 |        |
| ii)   | Circuit breaker `OFF'  | Green. |                      |      |     |                       |        |      |                             |        |     |                                 |        |
| iii)  | Circuit breaker `Auto-Trip.  | White. |                      |      |     |                       |        |      |                             |        |     |                                 |        |
| iv)   | Circuit breaker spring charged.  | Amber. |                      |      |     |                       |        |      |                             |        |     |                                 |        |
| One   | Flush switch board mounting, 144 mm square pattern, moving iron AC Ammeter of Class.1 accuracy, suitable for 5 Amps. CT secondary current suitably scaled.   |        |                      |      |     |                       |        |      |                             |        |     |                                 |        |
| One   | Ammeter phase selector switch to indicate phase currents in all the three phases and off position.   |        |                      |      |     |                       |        |      |                             |        |     |                                 |        |
| One   | 3 phase, 4 wire, Static KWH meter of class 1.0 accuracy.   |        |                      |      |     |                       |        |      |                             |        |     |                                 |        |
| One.  | 3 phase, 4 Wire power factor meter (Size 96 x 96 sq mm).   |        |                      |      |     |                       |        |      |                             |        |     |                                 |        |
| One   | Two phase IDMTL non directional over current relay with instantaneous attachment.  |        |                      |      |     |                       |        |      |                             |        |     |                                 |        |
| One   | IDMTL Non-directional earth fault relay with instantaneous attachment with stabilising resistance.   |        |                      |      |     |                       |        |      |                             |        |     |                                 |        |
| One   | High speed trip relay.   |        |                      |      |     |                       |        |      |                             |        |     |                                 |        |

- One. Continuous supervision relay for trip circuit healthy check both in closed and open position of circuit breaker.
- One Test terminal block 3 phase 4 wire.
- One Flush switch-board mounting, 96 mm square, 3 phase, unbalanced load MW meter, class 1 accuracy.
- Five Auxiliary relay for transformer trouble.

FOR TRANSFORMER 2 :

-----

Equipments for Transformer 2 shall be identical to Transformer 1 with following additions :-

- Three Indicating lamps for the following :
  - i) VT supply indication (3 nos.) Red,Amber,Blue
- One Flush switch-board mounting, 144mm square pattern, moving iron AC voltmeter of class.1 accuracy suitable for 110V phase to phase VT secondary, suitably scaled.
- One Voltmeter phase selector switch to indicate phase to phase and phase to ground voltages of all the three phases.

FOLLOWING EQUIPMENTS SHALL ALSO BE PROVIDED ON THE C/R PANEL IN COMMON FOR BOTH CIRCUITS.

- One 24 way Annunciation windows complete with Annunciator relays for indicating 8 trip/non-trip alarms individually.
- One Set of 3 control Push buttons for 'Accept' Reset and 'lamp Test ' of above annunciation scheme.
- One Bell for Non trip alarm
- One Hooter for trip alarm
- One D.C. under voltage relay.
- One Space heater with switch.
- One 230V A.C. flourcent tube with door switch.
- One 3 Pin Socket with switch 15Amp. rating.
- One 2 Pin Socket with switch 5 Amp. rating.

2. 33KV CONTROL RELAY PANEL FOR CONTROLLING ONE/TWO  
FEEDER CIRCUIT BREAKERS.  
TYPE-B

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The C/R Panel shall accommodate equipments for one/two feeders. Each Circuit shall occupy space on front of panel on either side of vertical centre.

EACH OF THE ONE/TWO CIRCUITS SHALL HAVE FOLLOWING EQUIPMENTS :

For One Feeder :

- One -Section of painted and overlaid mimic diagram for one main + one auxiliary Bus arrangement with symbols.
- Two Semaphore indicators for automatic position indication of isolators and earth switch.
- One Semaphore indicator for automatic position indication of circuit breaker.
- One Three position control switch for the circuit breaker with pistol grip handle.
- Four Indicating Lamps for the following :-
  - i) Circuit Breaker `ON' - Red
  - ii) Circuit Breaker `OFF' - Green
  - iii) Circuit Breaker `Auto-trip'-White.
  - iv) Circuit Breaker Spring charged -Amber.
- One Flush switch Board mounting 144mm square pattern moving iron A.C.Ammeter of Class-1 accuracy suitable for 5 Amps CT secondary suitably scaled.
- One Ammeter phase selector switch to indicate phase currents in all the three phases and off position.
- One 3 Phase, 4 wire, Static H.T. TVM of class 0.5 s accuracy.
- One Triple pole IDMT non directional combined over current and earth fault relay.
- One High speed trip relay.
- One Continuous supervision relay for trip circuit healthy Check both in closed & open position of circuit breaker.
- One Test terminal block 3 phase 4 wire.

- One Flush switchboard mounting, 96 mm square, three phase, unbalanced load MW meter, class 1 accuracy.
- One 8 way Annunciation windows complete with Annunciation relays for indicating 8 trip/non trip alarm individually.
- One Set of 3 control push buttons for 'Accept' reset and Lamp 'Test' on above annunciation scheme.
- One 230V A.C. incandescent bulb with door switch.
- One Bell for Non trip alarm
- One Hooter for trip alarm
- One Space heater with switch.
- One 3 Pin Socket with switch 15 Amp rating.
- One 2 Pin Socket with switch 5 Amp rating.

For Two Feeder :

- One -Section of painted and overlaid mimic diagram for one main + one auxiliary Bus arrangement with symbols.
- Four Semaphore indicators for automatic position indication of isolators and earth switch.
- One Semaphore indicator for automatic position indication of circuit breaker.
- One Three position control switch for the circuit breaker with pistol grip handle.
- Four Indicating Lamps for the following :-
  - i) Circuit Breaker 'ON' - Red
  - ii) Circuit Breaker 'OFF' - Green
  - iii) Circuit Breaker 'Auto-trip'-White.
  - iv) Circuit Breaker Spring charged -Amber.
- One Flush switch Board mounting 144mm square pattern moving iron A.C.Ammeter of Class-1 accuracy suitable for 5 Amps CT secondary suitably scaled.
- One Ammeter phase selector switch to indicate phase currents in all the three phases and off position.
- One 3 Phase, 4 wire, Static H.T. TVM of class 0.5 s accuracy.

- One Triple pole IDMT non directional combined over current and earth fault relay.
- One High speed trip relay.
- One Continuous supervision relay for trip circuit healthy Check both in closed & open position of circuit breaker.
- One Test terminal block 3 phase 4 wire.
- One Flush switchboard mounting, 96 mm square, three phase, unbalanced load MW meter, class 1 accuracy.
- One 8 way Annunciation windows complete with Annunciation relays for indicating 8 trip/non trip alarm individually.
- One Set of 3 control push buttons for 'Accept' reset and Lamp 'Test' on above annunciation scheme.
- One 230V A.C. incandescent bulb with door switch.
- One Bell for Non trip alarm
- One Hooter for trip alarm
- One Space heater with switch.
- One 3 Pin Socket with switch 15 Amp rating.
- One 2 Pin Socket with switch 5 Amp rating.



### **SECTION-III (PART-B)**

#### **TECHNICAL SPECIFICATION & SCHEDULE OF REQUIREMENT FOR SUPPLY OF 3 PHASE, 4 WIRE A.C.STATIC HT TRIVECTOR METER OF ACCURACY CLASS 0.5S**

##### **3.01 (A) SCOPE:**

i) This specification covers the design, engineering, manufacture, assembly, inspection, testing at manufacturers works before despatch, supply and delivery at site/FOR destination any where in vicinity of Class 0.5S accuracy static HT Tri-vector Meters for energy account & tariff purpose along with software and interface cable as per requirement given in this specification. The meter should be 3-phase 4-wire type suitable for connection to a 3 phase 4 wires as well as 3-phase 3-wire system. The meter should be capable to record and display KWh, KVArh, KVAh and 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 of zero (lagging) through unity up to zero (leading) as per requirement given in this specification.

(ii) It is not the intent to specify completely herein all the details of the design and construction of material. The material shall, however, conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing for continuous commercial operation in a manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which in his judgment is not in accordance therewith. The offered HT TVM shall be complete with all accessories, software and components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of Bidder's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

(iii) The meter shall be ISI mark & bidder shall furnish the details of ISI license at the time of bid or or within 60 days from the date of opening of bid.

##### **3.02 STANDARDS APPLICABLE:**

Unless otherwise specified elsewhere in this specification, the performance and testing of the meters shall conform to the following Indian/International Standards and all related Indian/International standards to be read with up to date and latest amendments/revisions thereof:

S. No.	Standard No.	Title
1.	IS 14697-1999 (With latest amendments)	: Specifications for AC Static Transformer Operated Watt-hour and VAR-Hour Meters, class 0.2S & 0.5S.
2.	CBIP technical report No. 88 of July 1996 read with amendments issued (April 1999, September 1999) and latest amendment(s) issued thereafter.	: Specification for AC Static Electrical Energy Meters. With latest amendments.
3.	IEC 62053-22-2003 IEC 62052-11-2003	: AC Static Watt-hour Meters for Active Energy, class 0.2S & 0.5S
4.	CBIP Technical Report No.111 Revised July 1996	: Specification for Common Meter Reading Instrument.
5.	IS: 9000	: Basic Environmental Testing Procedures for Electronic & Electrical items.

Meters matching with requirements of other national or international standards, which ensure equal or better performance than the standards mentioned above, shall also be considered. When the equipment offered by the tenderer conforms to standards other than those specified above, salient points of difference between standards adopted and the standards specified in this specification shall be clearly brought out in the relevant schedule and copy of such standards along with their English translation shall invariably be furnished along with the offer.

### 3.03 CLIMATIC CONDITIONS:

The meters to be supplied against this specification should be capable of performing and maintaining required accuracy under extreme hot, cold, tropical and dusty climate and solar radiation typically existing in the state of Rajasthan (India). The meter shall be required to operate satisfactorily and continuously under the following tropical climate conditions: -

a) Maximum ambient air temperature	: 50° C
b) Maximum ambient air temperature in shade	: 45° C
c) Maximum temperature attainable by the meter exposed to Sun.	: 60° C
d) Minimum ambient temperature in shade	: (-) 5° C
e) Average daily ambient air temperature	: 40° C
f) Maximum relative humidity.	: 95%.
g) No. of months of tropical monsoon condition	: 4 Months.
h) Maximum attitude above mean sea level	: 1000 Meters.
i) Average rain fall.	: 10-100 cms.
j) Maximum wind pressure	: 200Kg/ Sq. meter.
k) Isoceran level (days/ year)	: 40
l) Seismic level ( Horizontal Accn.)	: 0.30 g.
m) Permitted noise level	: 45 db.

### 3.04 SUPPLY SYSTEM:

Rated Voltage (Vref) (Through PT)	3 x 63.5 V - Phase to Neutral (3 phase 4 wire system) 3 x 110 V - Phase to Phase Meter shall be programmed for PT ratio 11KV/110V (Ph.to Ph.)
Rated current (Ib) (Connected through CT)	3 x -/5 Amps

Multiplying factor to arrive at actual primary values wherever applicable shall be calculated from the CT and PT ratio of the installed CTs and PTs.

### **3.05 POWER FACTOR RANGE:**

The meter shall be suitable for full power factor range from zero (lagging) through unity to zero (leading). The meter should work as an active energy import and export and reactive (lag and lead) energy meter.

### **3.06 POWER SUPPLY VARIATION:**

The supply system shall be 3x110V Phase to Phase, 3 phase 4 wires. The extreme power supply variations for which an operating meter should withstand without damage and without degradation of its meteorological characteristics when it is subsequently operated under its normal operating conditions shall be as follows: -

Specified operating range - 0.8 to 1.15 V ref.

Limit range of operation - 0.7 to 1.20 V ref.

Frequency - 50 Hz. +/- 5%

However, the bidder can offer meter, which can withstand higher variations. The limit of power supply variations should be as per IS: 14697-1999.

### **3.07 ACCURACY:**

Class of accuracy of the meter shall be 0.5S. The accuracy should not drift with time.

### **3.08 POWER CONSUMPTION:**

**(i) Voltage circuit:** The active and apparent power consumption in each voltage circuit including the power supply of meter at reference voltage, reference temperature and reference frequency shall not exceed 1.0 Watt per phase and 8 VA per phase respectively.

**(ii) Current circuit:** The apparent power taken by each current circuit at basic current, reference frequency and reference temperature shall not exceed 1 VA per phase.

### **3.09 STARTING CURRENT:**

The meter should start registering the energy at 0.1% Ib and unity power factor.

### **3.10 MAXIMUM CURRENT:**

The rated maximum current of the meter shall be 200% Ib.

### **3.11 GENERAL AND CONSTRUCTIONAL REQUIREMENTS:**

i) Meters shall be designed and constructed in such a way so as to avoid causing any danger during use and under normal conditions. However, the following should be ensured: -

- a) Personnel safety against electric shock
- b) Personnel safety against effects of excessive temperature.
- c) Protection against spread of fire.
- d) Protection against penetration of solid objects, dust and water.
- e) Protection against fraud.
- f) Protection against Pilferage.

ii) All the materials and electronic power components used in the manufacture of the meter shall be of highest quality and reputed make to ensure higher reliability, longer life and sustained accuracy.

iii) (a) The manufacturer should use application specific integrated circuit (ASIC) for metering functions.

(b) The meter should not have any form of mechanical adjustment such as trim-pots, potentiometer etc. for calibration. The meter shall be factory calibrated and no adjustment of calibration shall be possible at site by any means.

(c) The electronic components shall be mounted on the printed circuit board using latest Surface Mount Technology (SMT). The PCB material should be made of glass epoxy FR-4 grade conforming to relevant standards or better grade.

iv) All insulating materials used in the construction of meters shall be non-hygroscopic, non-ageing and of tested quality. All parts that are likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating.

v) The meter shall have an operation indication device such as a blinking LED. The operation indicator shall be visible from the front window.

vi) The meter shall have test out put device in the form of calibrating LED accessible from the front and capable of being monitored conveniently with suitable testing equipment.

vii) The meter shall conform to the degree of protection IP 51 of IS: 12063/IEC: 60529 for protection against ingress of dust, moisture and vermin.

viii) The meter shall be immune to tampering through application of external magnetic field (A.C. electro-magnet or D.C. magnet) as per the value specified in CBIP technical report 88 (with latest amendments). However the meter alone should comply up to 0.27 Tesla Magnetic field with a permanent magnet.

ix) The meter should continue to function even if any spurious signals are injected on the neutral of the meter such as D.C signals through diodes etc. and /or High Frequency Signals.

x) The meter shall be supplied with a transparent extended terminal-block cover (ETBC).

xi) The meter shall have two push buttons, one for forward scrolling and other for reverse scrolling of different parameters available in push button mode.

**xii) Meter Base And Cover:**

(a) The meter -base, meter cover; terminal block and ETBC shall be made of unbreakable, high grade, flame retardant polycarbonate with thickness more than 2.0 mm, and of good dielectric and mechanical strength. The material of meter base & terminal block shall be glass reinforced.

(b) Meter cover and extended terminal block cover (ETBC) should be injection moulded in UV stabilized polycarbonate in natural colour. The ETBC shall be kept fully transparent and the meter cover except the window portion shall be semi-transparent / non-transparent/corrugated. The moulded meter case and terminal cover(s) should not change in colour, shape, size, and dimensions, when subjected to 200 hours on UV ageing test. It should withstand 650 deg. C glow wire test and heat deflection test as per ISO 75.

(c) The manufacturer shall emboss on the base/cover(s), the name of the material they have used in an abbreviated form e.g. PCFR 10 GF (to denote that they have used polycarbonate flame retardant 10 % glass filled polycarbonate)

(d) The window portion shall be of transparent, unbreakable, silicon coated, scratch resistant surface UV stabilized polycarbonate material for easily reading all the displayed values/parameters, nameplate details and calibrating LED. It should not fade in course of time and become opaque causing inconvenience in reading. The window portion shall be ultrasonically welded with the meter cover such that it cannot be removed undamaged without breaking the cover.

(e) The meter cover shall be ultrasonically welded with the meter base. The sample meter to be sent along with bid may not be ultrasonically welded with the meter base, as at the time of sample testing it has to be opened to ascertain conformity of meter as per specification. However, before commencement of supply, sample has to be got approved with ultrasonically welded meter by the successful bidder.

**xiii) Terminal Block:**

(a) The detachable terminal block shall be moulded type made of non-hygroscopic, flame retardant material having good dielectric and mechanical strength. The moulded terminal block shall be made from best quality phenol formaldehyde or 10-20% glass filled polycarbonate material or any

equivalent/better material conforming to FH-1 of IS 11731 (Part-I) having adequate insulating properties and mechanical strength with brass inserts for connecting terminals.

The terminal block should satisfy all the conditions specified in IEC-62052 & IS-14697 and shall be made from best quality phenol formaldehyde or 10-20% glass filled polycarbonate material or any equivalent/better material. The glass filled polycarbonate should fulfill the requirement of following tests

- (i) The flame retardant rating of VO as per UL94 testing.
- (ii) The glow wire temperature of 960 deg. C as per IS-11000 (part-2/Sec-1) or IEC 695-2-1.
- (iii) Heat deflection temperature (HDT) test of 135 deg. C.
- (iv) Ball pressure test at 125 deg. C.

(b) The terminal block, the ETBC and the meter case shall ensure reasonable safety against the spread of fire and shall not be ignited by the thermic overload of live parts in contact with them

c) The current circuit conductors of a meter shall be connected to its current terminals inside the meter terminal block adopting procedure prescribed either B-1 or B-2 of the recommended methods under Clause 6.4-Annexure-B of IS 14697. Any other method which meets this requirement in a better manner/way shall also be considered. The bidder should elaborate the arrangement adopted.

(d) The meter terminal block shall have tin-plated brass terminals.

The terminals shall have suitable construction with barriers and transparent cover to provide firm and safe connections of incoming and out going leads. The terminal screws shall have flat bottom so as not to pierce in the external conductors. The terminals shall be of suitable rating to carry continuously  $I_{max}$  current and made of electroplated (or tinned) brass and shall be of replaceable type. Any other provision which meets this requirement in a better manner/ way shall also be considered. The bidder should elaborate the procedure adopted.

(e) (i) The manner of fixing the external conductors to the terminal block shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. Screw connections transmitting contact force and screw fixings, which may be tightened and loosened several times during the life of the meter, shall screw into the body of brass terminal.

All parts of each terminal shall be such that the risk of corrosion is minimized. Two screws shall be provided in each current terminal for effectively clamping the external leads or thimbles. Each clamping screw shall engage a minimum of three threads in the terminal. The ends of screws shall not pierce and cut the conductors used. Electrical connection shall be so designed that contact pressure shall not be transmitted through insulating materials. If the manner of fixing of terminals is through thimbles /lugs/reducer type terminals. The supplier shall supply a set of the same along with each meter.

(ii) The internal diameter of the terminal hole shall be minimum 4.0mm. The holes in the insulation material of the terminal block, which form an extension of the terminal holes, shall be of sufficient size to accommodate the insulation of the conductors also. The clearance and creepage distance shall not be less than the values specified in clause 6.6 of IS 14697:1999.

Further, the supporting webs between two terminals of the terminal block should be sufficiently high to ensure that dust does not bridge the two neighboring terminals or a flash over does not take place.

f) The fixing screw(s) used on the ETBC for fixing and sealing of extended terminal cover shall be held captive on the terminal cover.

g) To facilitate sealing, a raised support arrangement with minimum 2 mm hole nearby sealing screws, which shall constitute an integral part of the terminal cover or a slot type arrangement underneath/alongside the sealing screw shall be provided.

xiv) The termination of current circuit wires inside the meter (i.e. CT primary conductor) on the terminal block shall be through lugs and washers of proper size. The loop length of the primary current circuit should be kept minimum. Alternatively the CT primary conductor may be flattened to form a 'lug' like shape for proper termination on terminal block without using lug or any other better arrangement may also be provided.

xv) The meter shall have minimum three fixing holes, one at the top and other two inside the terminal block. The top hole shall be key-hole type on the back of the meter base so that the hanging-screw is not accessible after fixing of the meter and it shall not be possible to remove the meter from the hanging-screw without removing the terminal cover and screw(s) from the terminal block. Any alternate better arrangement shall also be considered for acceptance.

The lower fixing holes shall be provided under the extended terminal cover. A set of fixing screws shall be supplied with each meter.

xvi) Extended terminal block cover shall be provided to ensure that the internal parts are not accessible for tampering etc. without breaking the seals. The ETBC shall be extended by about 30 mm $\pm$  5 mm below the terminal block. A firm connection shall be established with in the meter case to energies the voltage circuit.

Arrangement for display, optical port, auxiliary supply source, push buttons for manual mode, meter nameplate and display sequence should be made in such a manner that it is accommodated in size of 170mm(W) x 140 mm (H) from opposite side of ETBC. This is required for facilitating of fixing of the HT Tri-vector meter in HT pane box.

### **3.12 MANUFACTURING ACTIVITIES:**

i) The meter should employ latest technology such as Application Specific Integration Circuit (ASIC) to ensure reliable performance. The mounting of component on the PCB (Printed Circuit Board) must be SMT (Surface Mounted Technology) type by deploying the automatic SMT pick and place machine and reflow soldering process. The electronic component used in the meter shall be of high quality such that the meter shall remain in the accuracy class for at least up to 10 years. Further, the Bidder should own or have assured access (through hire, lease or subcontract) of above facilities.

ii) Quality should be ensured at the following stages:

a) At PCB manufacturing stage, each board shall be subjected to computerised bare board testing.

- b) At insertion stage, all components should under go computerised testing for conforming to design parameters and orientation.
- c) Complete assembled and soldered PCB should under go functional testing using Automatic Test Equipments (Testing Jig)
- d) Prior to final testing and calibration, all electronic components of the meter shall be subjected to accelerated ageing test to eliminate infant mortality.
- iii) The calibration of meters shall be done in house.
- iv) The bidders should submit the list of all major components used in meter along with the offer.
- v) A detailed list of bought-out items, which are used in the manufacture of the meter, should be furnished indicating the name of firms from whom these items are procured. The bidder shall also give the details of quality assurance procedures followed by him in respect of the bought-out items.

### **3.13 SEALING ARRANGEMENT OF THE METER:**

Atleast two sealing screws shall be provided for proper fixing of meter cover so that access to the working parts shall not be possible without breaking the seals. One screw provided on left side shall be used by manufacturer to provide his own sealing with high quality double anchor polycarbonate seal bearing laser etched monogram of JVVNL/AVVNL/JdVVNL along with meter serial number and other provided on right side by purchaser, which should be left unsealed. Provision shall also be kept for one no. seal on terminal cover. All the sealing screws shall be captive type so that they cannot be detached when they are in open condition. The holes in the head of sealing screw shall be of min. 2mm dia. The sealing screws for meter base and cover shall be unidirectional and slotless (2 No.) .Two No. tamper indicative paper seal(s) on either side of the meter case shall be provided by the manufacturer. For this, at least two (2) Nos. seals on meter body and provision for, one (1) no. seal on meter terminal cover and one (1) no. seal on communication port shall be provided.

For the above sealing arrangement for the purchaser, the manufacturer shall provide at least one seal on the meter body at the factory after calibration and testing. Provision for all the seals should be provided on front side only. Rear side sealing arrangement will not be accepted. The Suppliers in their offer should explain the sealing arrangement.

### **3.14 MARKING OF METER:**

The meter terminal marking and mounting arrangement should be as per Indian installation practices. The marking on every meter shall be in accordance with IS 14697-1999/ IEC 62052-11-2003.

Every meter shall have nameplate beneath the meter cover such that the nameplate cannot be accessed without opening the meter cover and without breaking the seals of the meter cover and the nameplate shall be marked indelibly. The nameplate marking should not fade or otherwise be adversely affected by UV exposure with lapse of time. The basic markings on the meter nameplate shall be as follows:

- i. Manufacturer's name or trademark and place of manufacturer.
- ii. Type & Designation.
- iii. Number of phases and wires for which the meter is suitable.
- iv. Serial number.
- v. Month & year of manufacture.
- vi. Reference voltage / PT ratio, frequency and temperature.
- vii. Basic current and rated maximum current in Amp.
- viii. Principal unit(s) of measurement.
- ix. Meter constant (Impulse/Kwh, KVARh, KVAh).
- x. Class index of meter.
- xi. "Property of JVVNL/AVVNL/JDVVNL".
- xii. JVVNL/AVVNL/JDVVNL Purchase Order Number & Date.
- xiii. Guarantee Period.
- xiv. Sign of Insulation.
- xv. Bar coding of serial number, month and year of manufacture.

### **3.15 CONNECTION DIAGRAM & TERMINAL MARKINGS:**

The connection diagram of the meter shall be clearly shown for 3 phase 4 wire system as well as 3 phase 3 wire system, on inside portion of the terminal cover and shall be of permanent nature. The meter terminals shall also be marked and this marking should appear in the above diagram.

### **3.16 SOFTWARES AND INTERFACE BETWEEN METER & CMRI:**

Adequate number of licensed copies of the following software shall be made available and shall be installed in CMRI and Base Computer System (BCS) by the Supplier without extra cost. The Supplier shall impart necessary training regarding installation and use of the above softwares. The exact quantity of each type of software to be so supplied shall be intimated to the Supplier prior to/at the time of ordering subject to maximum 30 Nos./sets.

- i) Software for reading, down loading meter data, as well as configuration change activity in meter such as time setting, reactive energy for apparent energy calculations reprogramming, MD integration period change and TOD reprogramming (changing TOD time-zones, subject to maximum 8 time zones, and/ or, change of any one or more TOD time-zone timings in the meter), normally resident in the Common Meter Reading Instrument (CMRI); Software suitable for MS Window XP or higher version. *The software shall be installed in and be compatible to all makes of the CMRIs (Analogic/Sands/any other make) and PC/Laptop as well as supplied separately in the form of floppies/CDs.*

ii) Configuration change activity (programming) should be enabled at BCS under multilevel password protected security system for specified/selected meter(s) identified by the meter serial number(s). Configuration change activity can only be possible after written consent of SE(M&P), JVVNL/AVVNL/JDVVNL, Jaipur and a password available with SE(M&P) Jaipur is to be entered first for enabling any configuration change activity. Without entering the password provided by SE(M&P) Jaipur, configuration change activity shall not at all possible. Such configuration change in the meter shall be immediately preceded automatically by meter-data reading such that entire meter data prior to change is downloaded from the meter before the change is effected in the meter. Details of minimum 10 such change/s (event/s) made in the meter shall be logged in the meter memory, each with date and time-stamp, and shall be capable of downloading through CMRI and shall be available for viewing at the BCS end. The logging shall be roll-over type on first-in, first-out basis.

iii) Windows based Base Computer Software (BCS) for receiving data from CMRI and downloading instructions from base computer to CMRI. This BCS should have, amongst other requirements and features and facilities described later in this specification, the facility to convert meter reading data into user definable ASCII file format so that it may be possible for the user to integrate the same with the user's billing data and process the selected data in desired manner. The necessary training, if required, and documentation for this purpose shall also be provided free of charge. **The bidder shall obtain billing format from the purchaser before commencement of supply.**

iv) The BCS should be user friendly. The data transfer should be reliable and fraud proof. The BCS should give all details pertaining to billing and load survey data.

The meter condition details should also be transferred into the BCS including abnormal/anomalies of voltage current conditions or tamper conditions which can occur due to mistake in connections or intentionally done for the purpose of tamper.

v) Necessary software for loading application programme via CMRI serial port. *The time taken for downloading the complete meter data should not be more than **Five** minutes.*

vi) Any other special application software of the manufacturer for the meter.

Any future up gradation made by the supplier in any of the above softwares shall also be provided free of cost.

**(a) Platform:**

The BCS should be executable on MS WINDOWS 95/98/2000/XP or higher operating system. The BCS shall be suitable to run on IBM PC or compatible hardware platform.

**(b) Meter Data Display:**

i) The BCS should show electrical conditions existing at the time of reading the meter in tabular forms as well as in graphical format (Phasor diagram).

ii) All the information about energy, maximum demand and their respective TOD register readings, billing register readings and billing history readings should be shown in a manner which user can understand quickly, preferably in tabular format.

iii) All the load survey data should be available in numerical as well as graphical format. It should also be possible to view this data in daily, weekly and monthly formats. The load survey graph should show values where the cursor/pointer is placed for the selected or all parameters.

iv) All the information about tamper events should be accompanied with date and time stamping along with the 'snap-shots' (details) of the respective electrical conditions. This information should be displayed in the sequence in which it happened, in cumulative format as well as in summary format. The cumulative format should segregate a particular tamper

information and summary report shall show count of tamper occurrence and the duration for which meter has remained under tamper condition.

v) The BCS should be capable of preparing *all available makes of CMRIs* to read the meter information or for Configuration Change activity in the meter after entering the password provided by SE(M&P) Jaipur such as time-setting, Reactive Energy for Apparent Energy calculation re-programming, MD integration period change and TOD re-programming (changing TOD time-zones, subject to max. 8 time-zones, and/or, change of any one or more TOD time-zone timings in the meter).

**(c) Support Display:**

There should be "user friendly" approach for viewing meter data for the reading collected now or for the reading collected in the past. All information about a particular consumer should be segregated and available at one place so that locating any consumer's past data is easy. It should be possible to locate/retrieve data on the basis of one of the following particulars:

- i) Consumer ID/Number.
- ii) Meter Sr. No.
- iii) Date of meter reading.
- iv) Location.

**(d) The Data Transfer:**

It should be possible to transfer the data to and from CMRI through serial interface/port. *The data transfer shall be in the desired format, which suits to billing software of the Nigam.*

**(e) Configurability:**

It should be possible to have selective printing out of all the available data of the meter. Print out should not include anything and everything available with the BCS. The software should support "Print Wizard" or similar utility whereby user can decide what to print out. The user of the software need not revert back to the supplier of the software for modifying the software just to print what he desires.

It is very important that the BCS shall have the feature to export available data to ASCII or spreadsheet format for integrating with the JVVNL/AVVNL/JDVVNL billing system and it may be amended as desired by Nigam from time to time.

"Export billing Wizard" should be provided and a drop down should be available to select from various options for exporting the data or similar utility should be available whereby user can select file format (for ASCII or for spreadsheet), what data to export, the field width selection (whether 8 characters or 10 characters, to include decimal point or not, number of digits after decimal point etc.)

**(f) Security:**

The BCS shall have multi level password for data protection and security. The first level shall allow the user to enter the system. The different software features shall be protected by different passwords. The configuration of passwords shall be user definable. The software installed on one PC shall not be copiable on to another PC.

**(g) Help:**

Exhaustive on-line Help should be available with the software so that user can use all the features of the software by just reading the Help contents.

**3.17 SALIENT FEATURES:**

The meter shall have the following additional salient features:

- i)** It should be possible to check the healthiness of phase voltages by displaying all the voltages on the meter display.
- ii)** The meter display shall have phase indicators to indicate the status of phase voltages, which shall keep coming with every display.
- iii)** The meter should work accurately irrespective of phase sequence of the mains supply.
- iv)** It should be possible to check the correctness of connections of CT and PT to the meter with proper polarity. This shall be made available on CMRI by displaying phasor diagram. For this purpose, a suitable software for field diagnosis of meter connections with the help of meter and CMRI should be supplied as per Annex G15 of IS 14697/ 1999.

v) The meter should remain powered up and functional even when either of any two phases or any one-phase alongwith neutral is available to the meter.

vi) The meter should continue to record accurately as per prevailing electrical conditions even if the neutral of potential supply gets disconnected.

vii) The meter shall be provided with adequate magnetic shielding so that any external magnetic field (AC Electro Magnet or DC Magnet as per the values specified in CBIP Technical Report No.88, with latest amendments) applied on the meter shall not affect proper functioning and recording of energy as per error limits prescribed by CBIP. However the meter alone should comply up to 0.27 Tesla D.C magnetic field. On application of 0.27 Tesla DC magnet at anywhere on meter body, the meter shall record energy at  $I_{max}$ , rated voltage and unity power factor as per CBIP / IS, in case of Magnetic Interference beyond 0.27 Tesla and the event of Magnetic Interference and restoration shall be available with date & time stampings along with other snap shots.

viii) Meter shall have Scroll Lock facility to display any one desired parameter continuously from display parameters, which will keep on displaying till the lock is released.

ix) The meter should continue to function even if any spurious signals are injected on the neutral of the meter, such as D.C signals through diodes etc.

x) The meter reading count should increase by one digit every time the meter is read successfully through CMRI or computer or any other device and be available at BCS end as well as on meter display. The count shall not increase through CMRI operations as instantaneous parameters view and other similar CMRI operations, which do not download any data from meter memory.

xi) Data Alteration Count: Meter should be capable to display the data alteration count This count should increase by one digit whenever there is any programme or meter data change in the meter *through CMRI or computer or any other device and be available at BCS end as well as on meter display*. This count should not increment on any data read-only communication.

xii) The meter shall be capable of detecting condition of power-off if mains supply is not present. It shall record such occurrence and restoration of power failures as separate events in the meter memory with date and time stamp. Snapshot of electrical parameters is not necessary during this condition.

xiii) The meter shall have provision to be read in the absence of power through an external /internal source as per provision of Annex G14 of IS 14697/1999 such that it should not be possible to damage the internal circuitry of the meter by applying any voltage on /through the device /port provided for powering up the meter in the absence of power supply. The bidder should explain the method adopted by them for this purpose in their offer.

Minimum 20 such events (either off or on) shall be logged in meter memory and be available for downloading through a CMRI for viewing at the BCS end. These events shall be logged in a separate compartment on roll-over, first-in, first-out basis. Electrical values snap shots shall not be required for the logging of Power -off / Power - on events.

- xiv)** The manufacturer shall provide drivers for interoperability of meters so that meters of different makes can be read by a common software for reading and data conversion. The meter manufacturer shall provide application programme interface (APIs) for exporting data in common format so that third party software which is using data for further processing will have uniform way of handling the data irrespective of the manufacturers from which meter is bought.

The manufacturer API shall have the following features:-

- a) All APIs will be executable exes.
- b) All APIs are controlled by CFW. No API will handle screen or keyboard request directly.
- c) All messages will either be passed on via configuration file or via the command structure described.
- d) APIs will transfer the messages via MII protocol. Longer message to API will be passed on via configuration file.
- e) APIs should pass on meaningful message in case particular command is not handled by it.
- f) Error reported can be meter specific or API specific. API should give clarity about it.
- g) Success of the work is to be declared only if last step of the operation is done such as file generated for a given commands is stored at the indicated (or predefined) location.
- h) APIs may drop some of the tags due to unavailability of information from the meter.
- i) No APIs will work standalone. CFW will have to pass on license key information for this.
- j) API will give acknowledgement of any command within 3 seconds.

e.g. The naming conventions of different meter manufacturers are as below:-

<b>API function</b>	<b>SML</b>	<b>L&amp;T</b>	<b>C.G.S.</b>	<b>Elster</b>	<b>TTL Ltd.</b>
MRD	SMLMRD	LNTMRD	CGSMRD	ELSMRD	TTLMRD
MRI	SMLMRI	LNTMRI	CGSMRI	ELSMRI	TTLMRI
CFC	SMLCFC	LNTCFC	CGSCFC	ELSCFC	TTLCFC
CHK	SMLCHK	LNTCHK	CGSCHK	ELCHK	TTLCHK

The parameter code list is enclosed at Annexure `A`.

xv) **The meter should be compatible to GSM technology for remote metering.**

### **3.18 DISPLAY OF MEASURED VALUES:**

The measured value(s) shall be displayed on seven segments, seven digits Liquid Crystal Display (LCD) display unit/register; having minimum character height of 8 mm. LCD to be of 'STN' (super tested kneumatics) type construction suitable for temperature 70 Deg.C continuously.

The data should not be lost in the event of power failure and should be stored in non-volatile memory. The non-volatile memory should retain data for a period of not less than 10 years under un-powered condition i.e. the non-volatile memory shall have a storage life (without use) of ten (10) years. Battery backup memory will not be considered as NVM.

It should be possible to easily identify the single or multiple displayed parameters through symbols/legend on the meter display itself or through display annunciator alongwith a separate legend plate fixed on the front face of the meter cover. The different legends for display parameters are available at Annexure `A`

The register shall be able to record and display starting from zero, for a minimum of 1500 hours, the energy corresponding to rated maximum current at reference voltage and unity power factor. The register should not roll over in between this duration.

### **3.19 METER SERIAL NUMBER:**

In addition to providing serial number of the meter on the display plate, the meter serial number shall also be programmed into meter memory for identification through CMRI/meter reading print out.

### **3.20 DISPLAY SEQUENCE:**

“The meter shall display the required parameters in two different modes i.e. Auto Display Mode and Push Button Mode in the sequence as detailed hereunder without leaving any specified parameter or adding any additional parameter”

#### **A) Auto Display Mode:**

The following parameters hereinafter referred to as "Billing Parameters" (B.P) shall be displayed in an auto-cyclic mode, in the following sequence: -

- a) Cumulative Active energy import reading (KWh) of predefined date & time for billing purpose (BP import KWh).
- b) Cumulative Active energy exports reading (KWh) of predefined date & time for billing purpose (BP exports KWh).
- c) Cumulative Apparent energy reading (KVAh) of predefined date & time for billing purpose (BP KVAh).

- d) Maximum demand (KVA) up to predefined date & time for billing purpose (BP KVA).
- e) Average power factor of the consumption month up to predefined date and time for billing purpose (BP AVG PF).  
(Note: the average power factor displayed for billing purpose should match the average power factor worked out through KWH/KVAh)
- f) “Cumulative tamper count reading of predefined date & time for the last two consumption months (BP TC)”
- g) “Cumulative power-On hours reading of predefined date & time of the last two consumption months (BP POH)”

The first parameter shall be on meter display for 5-10 seconds and thereafter, each parameter shall be on meter display for 10 seconds subject to 10 % tolerance and the time between two auto-display cycles shall be maximum 120 seconds.

### **B) Push Button Mode:**

The following parameters strictly in the sequence given below, shall be displayed on pressing the push button(s). *The billing parameters as shown at (a) to (e) in the auto-display mode shall also be displayed in the push-button mode at the start.*

- a) LCD segment check.
- b) Real time.
- c) Date - dd, mm,yy.
- d) Meter serial number.
- e) Rising demand with elapsed time.
- f) Cumulative Meter Reading Count in accordance with Cl 3.17 (ix)
- g) Cumulative Power-On hours.
- h) Cumulative MD reset count.
- i) Cumulative Data Alteration Count as per Clause 3.17 (xi)
- j) Cumulative Active energy import (kWh).
- k) Cumulative Active energy export (kWh).
- l) Cumulative Reactive energy lag (kVArh lag).
- m) Cumulative Reactive energy lead (kVArh lead).
- n) Cumulative Apparent energy (kVAh).
- o) High Resolution energies registers: -

(Min. 4 digit after decimal)

- i. KWh - xx.xxxx
- ii. KVArh lag - xx.xxxx
- iii. KVArh lead - xx.xxxx
- iv. KVAh - xx.xxxx

**Note:** If energy readings up to 4 decimals or more digits are provided on the main registers, then high-resolution energy registers as given at sequence (o) above will not be required separately.

- o) Instantaneous power factor with sign for lag/lead.
- p) Cumulative maximum demand (KVA).
- q) Instantaneous phase voltage.
  - i) R phase voltage.
  - ii) Y phase voltage.
  - iii) B phase voltage.
- r) Instantaneous line currents (Amps.)
  - i) R phase line current.
  - ii) Y phase line current.
  - iii) B phase line current.
- s) Frequency.
- t) Phase sequence of voltages (Alternatively, this may be provided at CMRI/ BCS end.
- u) Instantaneous load in
  - i) KW
  - ii) KVA
- v) Maximum demand in KVA since last reset.
- w) Tamper data:
  - i) Present status of tamper
    - a)-Missing potential with phase identification.
    - b)-Neutral disturbance
    - c)-Current circuit polarity reversal with phase identification.
    - d)-Current unbalance.
    - e)-Current circuit short (bypass) & current circuit (failure) open (applicable when meter is connected in 3 phase 4 wire mode only).
    - f) Magnetic influence.
  - ii) Date and time of last tamper occurrence with tamper identification.
  - iii) Date & time of last tamper restoration with tamper identification.
  - iv) Cumulative tamper count of all types of tampers & all phases.

Detailed phase-wise tamper information of missing potential and current circuit polarity reversal tamper should, however, be logged in the meter memory and be capable of downloading through the CMRI and be available for viewing at the BCS end.

x) TOD Maximum Demand (KVA) Registers

006:00- 09:00 Hrs  
 09:00 - 18:00 Hrs  
 18:00 - 22:00 Hrs  
 22:00 - 06:00 Hrs

y) TOD Active Energy (Cumulative KWh) Registers

006:00- 09:00 Hrs  
 09:00 - 18:00 Hrs  
 18:00 - 22:00 Hrs  
 22:00 - 06:00 Hrs

**Note:** 1. Apparent Energy should be based on reactive Lag + Lead.

$$\text{i.e. Apparent Energy} = \sqrt{[\text{Active Import Energy}]^2 + [\text{Reactive Energy (Lag +Lead)}]^2}$$

2. Apparent energy calculation should be configurable for reactive energy so that either Lag + Lead or Lag only can be selected as required. This selection shall be possible at BCS end and communicated to the meter through CMRI/computer.

3. The TOD wise bill point active energy, apparent energy and maximum demand though not provided on meter display, should be logged in the meter memory and be capable of downloading to the BCS through the CMRI and be available for viewing at the BCS end.

4. Bill point shall be 00.00 Hrs of the first day of every calendar month (or say 24.00 Hrs on the last day of the month for each calendar month) .In case the meter is not in powered up condition at the predefined date and time, the specified operation should be done at the instant of first powering up of the meter, thereafter.

### 3.21 OUT PUT DEVICE:

The meter shall have a test output accessible from the front and be capable of being monitored with suitable testing equipment. The operation indicator, if fitted, must be visible from the front. Test output device shall be provided in the form of one common LED for kWh, kVArh and optionally kVAh with the provision of selecting the parameter being tested. Alternatively, test output device in the form of separate LEDs for kWh, kVArh and optionally kVAh is also acceptable.

The relation between test output and the indication on display shall comply with the marking on the name plate (imp per kWh/kVArh/kVAh).

The bidder shall state the necessary number of pulse count(s) to ensure measurement accuracy of at least 1/10<sup>th</sup> of class of the meter at the different test points.

The resolution of the test output pulse(s) should be sufficient to enable conduction of the starting current in less than 10 minutes and accuracy test at the lowest load with desired accuracy within 5 minutes.

### 3.22 COMMUNICATION PORT:

The meters shall have a galvanically isolated optical communication port as per only IEC 1107 so that it can be easily connected to a handheld common meter reading instrument for data transfer or subsequently hooked to a remote metering device such as modem etc.

The interference between meter and CMRI shall consist of meter optical sensor terminating into a 9 pin D type male connector along with a flexible, shielded cable of 500 mm. + 10 mm. length. It shall be the responsibility of the meter manufacturer to provide such cables without extra cost along with meters to use CMRI for reading the meter. The exact quantity of this cable to be so

supplied shall be intimated to the supplier at the time of placing order subject to *maximum 2% of ordered quantity of meters*. The bidder shall also quote separately the unit price for such cable for future requirement.

### **3.23 AUXILIARY POWER:**

The auxiliary power shall be drawn from all the three phases and the meter should be able to remain powered up with availability of any two phases or any one phase and neutral.

Alternative power packs one percent of ordered quantity for taking reading during power down conditions shall be supplied free of cost.

### **3.24 (A) MAXIMUM DEMAND (MD) REGISTRATION:**

The meter shall continuously monitor and calculate the average demand in KVA during the integration period set and the maximum, out of these, shall be stored along with date and time when it occurred in the meter memory. The maximum registered value shall also be made available on meter-display.

The maximum demand will be computed from the main apparent energy register.

The rising demand under the current integration period should be displayed alongwith the elapsed time.

The integration period shall be set as 30 minutes, on real time basis starting from 00.00 H

The principle of maximum demand calculation used by the Bidder should be explained in the offer.

### **3.24 (B) Maximum Demand Registration and MD resets :**

Meter shall continuously monitor and calculate the average maximum demand of each demand interval time of 30 minutes (with a sliding window of 15 minutes) on real time basis and maximum of these in a calendar month shall be stored. The maximum demand shall automatically reset at 24.00 hrs. of the last date of each calendar month for which minimum 30 years calendar shall be programmed by the manufacturer. The cumulative kWh should also be recorded at 24.00 hrs. on the last date of each calendar month for previous 6 months.

### **3.25 MAXIMUM DEMAND RESET:**

The auto reset facility of MD at pre-defined date & time shall be provided. The meter shall log on in the meter memory, average value of voltage & current for 30 minutes integration period, the maximum demand reset count, which should increment by one digit every time the MD is reset.

### **3.26 LOAD SURVEY CAPABILITY & BILLING POINT REQUIREMENTS:**

**The meter shall be capable of recording half an hour KW and KVA demand, or, kWh and KVAh energy & P.F. of 30 (thirty) minutes integration period for at least last 180 (one hundred eighty) days. It shall be possible to select either demand or energy at the BCS end.**

**(The integration period shall be configurable for 15/30/60 minutes from the BCS using a MRI transaction in the meter).**

The load survey data should be available in the form of bar charts as well as in spreadsheets. The BCS shall have the facility to give complete load survey data both in numeric and graphic form with option for either of them.

The figures of 24 hours kWh import and kVAh should also be made available under each date in the load survey and it should be possible to represent this at BCS end.

The predefined date and time for registering the billing parameters of kWh, kVAh, PF and kVA MD as well as Tamper Count and Power-On hours readings shall be 00.00 hours of the first day of each calendar (billing) month. All billing parameters shall be transferred to billing registers and shall be displayed on auto cyclic display mode referred to as "BILLING PARAMETERS".

In case the meter is not in powered-up condition at the predefined date and time, the specified operations should be done at the instant of the first powering-up of the meter thereafter.

The above billing data, TOD registers data, load survey data, tamper information and instantaneous parameters data shall all be retrievable through the meter's communication port through a common meter reading instrument (CMRI) and shall be transferred (downloaded) to a PC with Windows based software to get complete details in numerical and/or graphic form. The necessary base computer software (BCS) for this purpose shall be provided by the supplier with complete details.

Further, apart from instantaneous parameters like voltage, current, PF, and reading of billing parameters, energy registers, TOD registers etc., the following additional parameters should be available at the BCS end: -

- a) Meter Reading Count.
- b) MD reset count.
- c) Billing Parameters for last 12 months.
- d) Billing Point (BP) Cumulative Power-On/Power-Off Hours for the last 12 months.
- e) Data Alteration count.

### **3.27 TIME-OF-DAY (TOD) TARIFF/DEMAND:**

The meter should be capable of registering the time-of-day energy and maximum demand. The defined time-zones shall be as follows:-

006:00- 09:00 Hrs  
09:00 - 18:00 Hrs  
18:00 - 22:00 Hrs  
22:00 - 06:00 Hrs

The display registers for energy and demand for the above-defined four time zones as well as 00:00 to 24:00 Hrs zone shall be provided on meter display. Further the meter should have in-

built capacity to define up to four more time zones through operation of CMRI thus making a total of 8 time zones. The change of the TOD time-period(s) or defining additional TOD zones should be possible through CMRI with special authenticated command from the BCS so that only authorized person(s) can make such changes. The main control of this system along with proper security password/code should be available on one or more computers located at the authorized location(s) as per the directions to be given by the Purchaser.

### **3.28 HARMONICS MEASUREMENTS:**

The accuracy of the meter shall not be affected by harmonics circulating in the system of magnitudes within permissible limits stipulated in relevant ISS/ IEC/ CBIP Standards and CEA Regulations-2004. The meter shall indicate and record the total resultant quantities of fundamental frequency and harmonics or alternatively the meter shall record fundamental frequency quantities and harmonics related quantities (such as KWh, KVAh and KVARh) separately.

“The meter shall comply with the provisions of IS: 14697/1999 and shall be capable of measuring 50 Hz energy and total energy. In this case, meter shall indicate mechanism of 50Hz energy measurement, sampling rate, accuracy of current measurement under the presence of harmonics. Alternatively meter shall comply with IEC 62053-22:2003 and shall be capable of measuring total energy consisting of fundamental energy and harmonics energy. In this case percentage distortion due to harmonics should be available in the graphics.

The fundamental and total energy shall be logged in the meter memory and be capable of downloading to the BCS through the CMRI and be available for viewing at the BCS end.

### **3.29 SELF DIAGNOSTIC FEATURE:**

The meter shall be capable of performing complete self-diagnostic check to monitor the circuits for any malfunctioning to ensure integrity of data memory location all the time. The meter shall have indications for unsatisfactory / nonfunctioning / malfunctioning of the following as per the requirement under Annex G 19 of IS 14697. :

- (a) Time and date.
- (b) Real Time Clock (RTC) battery.
- (c) All display segments.
- (d) Non-volatile memory.

The details of unsatisfactory/non-functioning /malfunctioning of time and date should additionally be recorded in the meter memory and available for viewing at BCS end either directly or through comparison with CMRI date and time.

The details of self-diagnostic capability feature should be furnished by the bidder.

### 3.30 TAMPER AND FRAUD PROTECTION:

The meter shall atleast be immune to tampers elaborated in IS: 14697(Annexure G-10). The meter should have features to detect the occurrence and restoration of, at least, the following common ways of tamper and fraud:

**a) Missing Potential:** The meter shall be capable of detecting and recording phasewise occurrences and restoration events of missing potential (one phase or two phases) as on meter terminals which can happen due to intentional / accidental disconnection of potential links (leads) with date and time, along with the total number of such events for all phases. Absence of one or more phase voltage from mains side should not be recorded as missing potential.

**b) Neutral Disturbance:** The meter shall be capable of detecting occurrences and restoration of injection of spurious signals on the neutral of the meter, such as DC signals through diodes etc., which affect the meter functionality and energy recording.

**c) Current Reversal:** The meter shall be capable of detecting and recording phase wise occurrences and restoration of current reversal of one or more phases

**d) CT Short (Bypass) & Current Circuit Open (Failure):** The meter shall be capable of detecting and recording occurrences and restoration of shorting (bypassing) and opening (failure) of any one or two phases of current circuit when the meter is connected to a 3 phase 4 wire system or 3 phase 3 wire system. The No-load condition should not be recorded as tamper.

**e) Current Unbalance:** The meter shall be capable of detecting and recording occurrences and restoration of current unbalance as a tamper event only

The threshold values for voltage, current and power factor etc. for the purpose of logging occurrence and restoration of various type of tamper shall be as per Annexure `B`

#### **f) Magnetic Influences:**

The meter should record the presence of abnormal external magnetic fields alongwith date and time.

Snapshots (numerical values) of voltage, current, power factor and energy (kWh) readings as well as the date and time of logging of the occurrence and restoration of all tamper events, subject to meter-memory space as described herein under, should be logged in the meter-memory and available for retrieving through the meter's optical port via CMRI and downloading to the BCS.

**g) The accuracy of the meter should not be affected with the application of abnormal voltage/ frequency generating device such as spark discharger of approximately 35 KV. The meter shall be tested by feeding the output of such device(s) to meter in any of the following manner for 10 minutes:-**

- i) On phase or neutral terminals.**
- ii) On any connecting wires of the meters.**
- iii) Voltage discharge with 0 to 10mm spark gap.**

- iv) **Spark on meter body.**
- v) **At any place in load circuit.**

**The accuracy of the meter shall be checked before & after the application of above device(s) with site conditions.**

**The abnormal voltage/frequency devices are available at Nigam's MT labs and the bidders may check their samples with one of the device before submission of the same to the purchaser. The device with which the respective bidder will check his sample meters will be sealed in the Nigam's MT lab under sign. of his representative and concerned XEN/AEn of MT lab and the same device will be used during sample testing against this offer and final inspection of meters in case of placement of order.**

h) **Cover Open Tamper** – If the meter cover is opened, the meter shall log this as tamper and shall display “Open” with date and time of such opening and should not restore in any condition (in power on as well as power off condition) in blinking display on the LCD alongwith other display parameters, so that it is immediately noticed by the meter reader and same shall be downloaded in CMRI.

### **3.31 TAMPER LOGIC:**

A properly designed meter tamper logic should be provided. The tamper logic should be capable of discriminating the system abnormalities from source side and load side and it should not log/record tamper due to source side abnormalities.

There shall be three separate compartments for logging of different types of tampers as follows:

#### Compartment No.1:

(i) 40% of total tamper memory space shall be allocated for the following current related tampers:

- CT polarity & current circuit reversal.
- Current circuit short (By pass)
- Current circuit open (Failure)
- Current unbalance

#### Compartment No.2:

(ii) 30% of total tamper memory space shall be allocated for potential related tampers including missing potential.

#### Compartment No.3:

(iii) 30% of total tamper memory space shall be allocated for Neutral disturbance and magnetic influence related tampers.

Minimum hundred (100) events (occurrence & restoration as one event) of all types of tamper with date and time shall be available in the meter memory on first-in, first-out basis (one event means occurrence & restoration). It shall be possible to retrieve the tamper data along-with alongwith date and time of logging through the meter's optical port with the help of a CMRI and download the same to the BCS where it shall be available for viewing. All this information shall be available in simple and easily understandable format. It should not be possible to reset the tamper data through CMRI or BCS software.

The logging of various tampers in each compartment should be as under:

The first tamper event of each compartment should always remain in the memory and should not get overwrite. Once one or more compartments have become full, the last tamper event pertaining to the same compartment will be entered and the earliest (second one) tamper event should disappear. Thus, in this manner each succeeding tamper event will replace the earliest recorded event (second one), compartment wise. Events of one compartment/category should overwrite the events of their own compartment/category only.

The bidder should furnish the details as to how the tamper logic is able to detect and protect the meter against the abovementioned tamper and fraud with sketches and phasor diagrams wherever necessary. If a bidder has any better proposal for tamper logic, the same may be submitted alongwith the offer for purchaser's consideration. Bids without such details shall be considered as non-responsive. Additional features, if any, in their meter may also be clearly indicated for purchaser's consideration.

Tamper count should increase as per occurrence (not restoration) of tamper events. The total number of tamper counts should also be provided on the meter-display as well as at the BCS end.

### **3.32 TAMPER PERSISTENCE TIME:**

The persistence time for logging/ registration of an occurrence of a tamper should be 5 minutes +/- 10 seconds. The persistence time for logging of restoration of tamper should not be more than 120 seconds.

### **3.33 ACCURACY REQUIREMENT:**

The accuracy of parameters measured by meters shall be tested in accordance with the relevant standards described in clause 3.02 of this specification. For apparent energy, accuracy testing shall be done in accordance with the provisions of Annexure G-7 of IS: 14697-1999. Time accuracy of the meter should be as per Annexure G-18 of IS: 14697-1999.

### **3.34 ELECTRICAL REQUIREMENT:**

The electrical requirement of the meter shall be as specified in the relevant Standards described in clause 3.02 of this specification.

### **3.35 ELECTROMAGNETIC COMPATIBILITY AND INTERFERENCE:**

The meter shall meet EMI/EMC requirement as specified in the relevant Standards described in clause 3.02 of this specification and shall also be protected against radiated interferences from either magnetic or radio frequency sources.

### **3.36 MECHANICAL REQUIREMENT:**

The meter shall be capable of meeting the mechanical requirement as specified in the relevant standards described in clause 3.02 of this specification.

### **3.37 CLIMATIC INFLUENCE REQUIREMENT:**

The meter shall meet the requirement of dry heat / cold / damp heat / cold / damp heat cyclic test as per the relevant standards described in clause 3.02 of this specification.

### **3.38 MINIMUM TESTING FACILITIES:**

The tenderer should have the necessary testing facility for carrying out the following tests: -

- i. AC voltage test.
- ii. Insulation resistance test.
- iii. Test of limits of errors.
- iv. Test of meter constant.
- v. Test of starting condition.
- vi. Test of no load condition.
- vii. Repeatability of error test.
- viii. Test for power consumption
- ix. Vibration test.
- x. Tamper conditions-as per purchaser specification.
- xi. Shock test.

#### **Notes: -**

- a) Manufacturer should possess fully computerized Meter Test Bench system for carrying out the relevant routine/acceptance tests as well facility to generate Test Reports for each and every meter tested.
- b) Manufacturer should have duly calibrated Electronic Reference Standard (ERS) meter of class 0.05 accuracy or better. Where testing facilities do not exist at the Supplier's Works for Shock and Vibration Testing as per the relevant standards, these two tests may be carried out in accordance with the provisions of IS: 13010 with latest amendments.

### **3.39 TESTS:**

The test reports/certificate/records for all type tests specified having been successfully performed on the type of the meter offered shall be submitted with the tender. The bidder shall clearly bring out the deviations from this specification clause whether on account of tests or

manufacturing process or features incorporated in the meter. The tender lacking with above information and without supporting test reports for meter meeting the requirement of tests laid in this specification are likely to be rejected.

a)- Type tests :

The Energy meter offered shall be fully type tested at any of the test laboratories mentioned below by the bidder as per relevant standards but test reports shall not be more than two years old from the date of opening of bid. The bidder shall furnish two sets of type test reports along with the bid.

<u>S.No</u>	<u>Name of Testing Laboratory.</u>
1.	N.P.L; New Delhi.
2.	<i>E.R.T. L (N) New Delhi.</i>
3.	<i>E.R.T .L (W) Mumbai.</i>
4.	<i>E.R.T .L (E) Kolkata.</i>
5.	<i>E.R.T .L (S) Thiruaanandapuram.</i>
6.	C.P.R.I Bangalore/Bhopal.
7.	<i>ERDA, Vadodara.</i>

b)- Acceptance tests :

The Supplier in the presence of the Purchaser's representative shall carry out all acceptance tests as stipulated in the relevant standards. The following additional tests shall also be carried out on meters from each lot offered for inspection as per the relevant standards on selected samples:

- Shock test.
- Vibration test.
- Magnetic Induction of External Origin, and
- Verification of tamper and fraud detection features and threshold values as per specifications and subsequent agreement between the Supplier and Purchaser.

**Note:** Where testing facilities do not exist at the Supplier's works for shock and vibration testing as per the relevant standards, these two tests may be carried out in accordance with the provisions of IS: 3010 with latest amendments.

c)- Routine test :

All routine tests as stipulated in the relevant standards shall be carried out and routine test certificates/reports shall be submitted to the Purchaser for approval and also placed inside individual meter packing.

**3.40 FIELD/LABORATORY TESTING OF METER:**

The supplier should furnish detailed write up for the procedure to be adopted for error testing of the meters in the laboratory and at site/field.