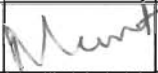
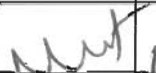




BHEL Document No. TB 379 316 002		Rev.		Prepared by	Checked by	Approved by
		00	Name	MM	MM	AS
Type of Document	Technical Specification		Sign			
Title	220kV HDB Isolators		Date	23-08-16		23/08/16
			Group	TBEM		
			W.O. No			
Customer	KARNATAKA POWER CORPORATION LIMITED					
PROJECT	220kV substation for Yelahanka CCPP (1x370 MW)					

SECTION	TITLE	PAGE
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2	Equipment Specification	12
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PROJECT : 220kV substation for Yelahanka CCPP (1x370 MW)
CUSTOMER: KARNATKA POWER CORPORATION LIMITED

Technical Specification of 220kV Isolators

TB-379-316-002

Section-1: Scope, Specific Technical Requirements & Quantities

REV.00

SECTION-1

Scope, Specific Technical Requirements and Quantities

1.1 Scope

This specification covers requirements of design, manufacture, assembly and testing at the Manufacturer's premises/ works and packing and supply of **220kV Isolators**, complete in all respects and including all fittings and accessories required for efficient and trouble-free operation.

The scope shall encompass and include all the activities listed above.

The equipment is required for following project:

PROJECT : 220kV substation for Yelahanka CCPP (1x370 MW)
CUSTOMER: KARNATKA POWER CORPORATION LIMITED
CONSULTANT: Fitchner consulting Engineers, Bangalore

The specification comprise of following sections:

Section-1: Scope, specific technical requirements & Bill of Quantities.

Section-2: Equipment specification under scope of supplies.

Section-3: General technical requirements for all equipments under the project.

Section-4: Equipment Data Sheet

In case of any conflict between various sections, order of precedence shall be in the same order as listed above.

1.2 SPECIFIC TECHNICAL REQUIREMENT

220 kV, 40 kA for 1.0 sec, mechanically group operated, horizontal upright / underhung gantry mounted isolators with one earth switch, with two earth switches as mentioned in clause no. 1.3 shall be supplied.

A.C motor drive mechanism for main blade and manual/motor operation mechanism for earth blade shall be provided.

Specific Requirements

- (a) Isolators shall be electrically interlocked with the circuit breakers in accordance with the switchyard safety interlocking scheme. Required number of auxiliary contacts shall be provided for interlocks, DCS, SCADA & panel indications.

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- (b) Isolators and earthing switches shall be provided with padlocking facility to lock them in fully open or fully closed positions. Padlocks shall be supplied with the isolators.
- (c) Isolator and earthing switch shall be mechanically interlocked such that it will not be possible to close the earthing switch when the isolator is closed and vice-versa.
- (d) Flexible tinned copper connection between rotating shaft of earth switch and frame shall have a cross-section to withstand short time withstand current.

Technical Requirements

Sl. No	Details	Unit	Requirement
			220 KV
1.0	RATING		
1.1	Application		Switchyard / Outdoor
1.2	Quantity		As per BOQ
1.3	Voltage	KV	245
1.4	Frequency	Hz	50
1.5	No. of phases		3 Phase
1.6	Rated current for site conditions	A	3000/ 1600
1.7	Short time Current		
	(a) Rating and duration	KA / sec	40 kA for 1.0 sec.
1.8	Rated peak short circuit current	KA(peak)	100
1.9	Capacity to interrupt magnetising current at p.f...	A	*
1.10	Capacity to interrupt line charging current at p.f...	A	*
2.0	Design Requirements		
2.1	Ambient temperature	°C	50°C

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Sl. No	Details	Unit	Requirement
			220 KV
2.2	Insulation level	KV(peak)	1050
2.3	Phase spacing	mm	4000
2.4	Type of break		Double break
2.5	Type of mounting		Upright/Gantry
2.6	Operating device		
	(a) For isolator		Motorised & Manual
	(b) For earth switch		Motorised & Manual
3.0	Insulator Data		
3.1	Type		Solid Core
3.2	Height of stack	mm	2600
3.3	Cantilever strength – upright	KG	800
3.4	Power frequency dry flashover voltage	kV	460/530
3.5	Power frequency wet flashover voltage	kV	*
3.6	1.2 / 50 micro sec. Impulse flashover : positive wave	kV(peak)	
3.7	1.2 / 50 micro sec. Impulse withstand voltage	kV(peak)	1050/1200
3.8	Total creepage distance	mm	31mm / kV
3.9	Visual discharge voltage for complete isolator with fittings	KV(rms)	*
3.11	RIV for complete isolator with fittings	μV	1000 micro volt at 156kV
3.12	Bottom PCD		Shall be informed during detailed engineering
3.13	Top PCD		127mm
4.0	Miscellaneous		
4.1	Auxiliary supply		220 V DC for control and interlock; 415V AC, 3 phase for motor drive

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Sl. No	Details	Unit	Requirement
			220 KV
4.2	Interlocks with circuit breakers		Bolt interlock electrically operated
5.0	Whether type tests carried out on similar isolators	Yes/ No	If yes, type test reports shall be furnished. If not, tests shall be conducted at no extra cost.
6.0	Whether all routine / tests as per latest standards will be carried out on each isolator	Yes/ No	Yes. All routine/ acceptance tests shall be conducted in presence of the corporation's representative.
5.0	Applicable standards		
5.1	Insulators		IS : 2544
5.2	Isolators		IS: 9921.

Note: * Bidder shall provide

1.3 Bill of Quantities:

S.N.	Description	Unit	Quantity
1.	220 kV, 1600A , 40 kA for 1 sec, 3-phase Horizontal double Break Isolators (main disconnecter – motor & manually operated) suitable for mechanically ganged operation, with two Earth Switch (motor & manually operated) suitable for mechanically ganged operation, excluding structure, post insulators and terminal connectors.	Nos.	7
2.	220 kV, 1600A , 40 kA for 1 sec, 3-Phase Horizontal double Break Isolators (main disconnecter – three pole motor & manually operated) suitable for mechanically ganged operation, with one Earth Switch (motor & manually operated) suitable for mechanically ganged operation, excluding structure, post insulators and terminal connectors.	Nos.	5

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Section-1: Scope, Specific Technical Requirements & Quantities

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3.	220 kV, 3000A , 40 kA for 1 sec, 3-Phase Horizontal double Break Isolators (main disconnecter – three pole motor & manually operated) suitable for mechanically ganged operation, with one Earth Switch (motor & manually operated) suitable for mechanically ganged operation, excluding structure, post insulators and terminal connectors	Nos.	2
4.	220 kV, 1600A , 40 kA for 1 sec, 3-Phase Horizontal double Break Isolators (main disconnecter – three pole motor & manually operated) suitable for mechanically ganged operation, without Earth Switch (motor & manually operated) suitable for mechanically ganged operation, excluding structure, post insulators and terminal connectors.	Nos.	10
5.	220 kV, 1600A , 40 kA for 1 sec, 3-Phase Horizontal double Break Isolators (main disconnecter – three pole motor & manually operated) suitable for mechanically ganged operation, without Earth Switch, gantry mounted, underhung as per sketch-1 (motor & manually operated) suitable for mechanically ganged operation, excluding structure, post insulators and terminal connectors.	Nos.	5
	Mandatory spares		
6.	Complete set of Gaskets (4 set each)	Lot	1
7.	Drive motor	Nos.	4
8.	Motor contactor of each type/rating	Nos.	4
9.	Fuses of each rating	Nos.	4
10.	Relays, power contactors, fuses etc., for electrical control circuit	Sets	4
	Supervision of ETC		
11.	Supervision of erection , testing and commissioning of 220kV Isolator– gantry mounted	No.	1
12.	Supervision of erection , testing and commissioning of 220kV Isolator – pedestal mounted	No.	1

Note:

1. The scope of supply includes hardware and accessories but excludes solid core insulators and structures for mounting the isolators and terminal connectors. The corona rings are included in scope of supply (if required).
2. 1 Set means for complete replacement of one Isolator (3-phase).
3. Quantity may vary at Contract stage by -30% to +30 % for overall value of contract. Final quantity will be informed during contract stage.

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TB-379-316-002

Section-1: Scope, Specific Technical Requirements & Quantities

REV.00

1.4 TYPE TESTS:

The offered equipment should have been successfully type tested as per relevant IS/IEC and valid test reports shall be submitted. Bidder shall submit valid reports of type tests for Circuit Breakers carried out within 10 years from date of LOA i.e. 03.11.2015. If these tests have been conducted more than 10 years prior from date of LOA or test reports are not valid, the type test shall be repeated with no extra cost to BHEL/KPCL.

1.5 ERECTION COMMISSIONING AND TESTING

The offer shall be deemed to include Bidder's supervision in erection, commissioning and testing of one equipment of each type at each station. However if there persistent problems of alignment of subsequent switches, the bidder's assistance shall be deemed to be included in the offer for the subsequent erection also until full satisfaction of the Owner without any extra charge.

1.6 SPARES

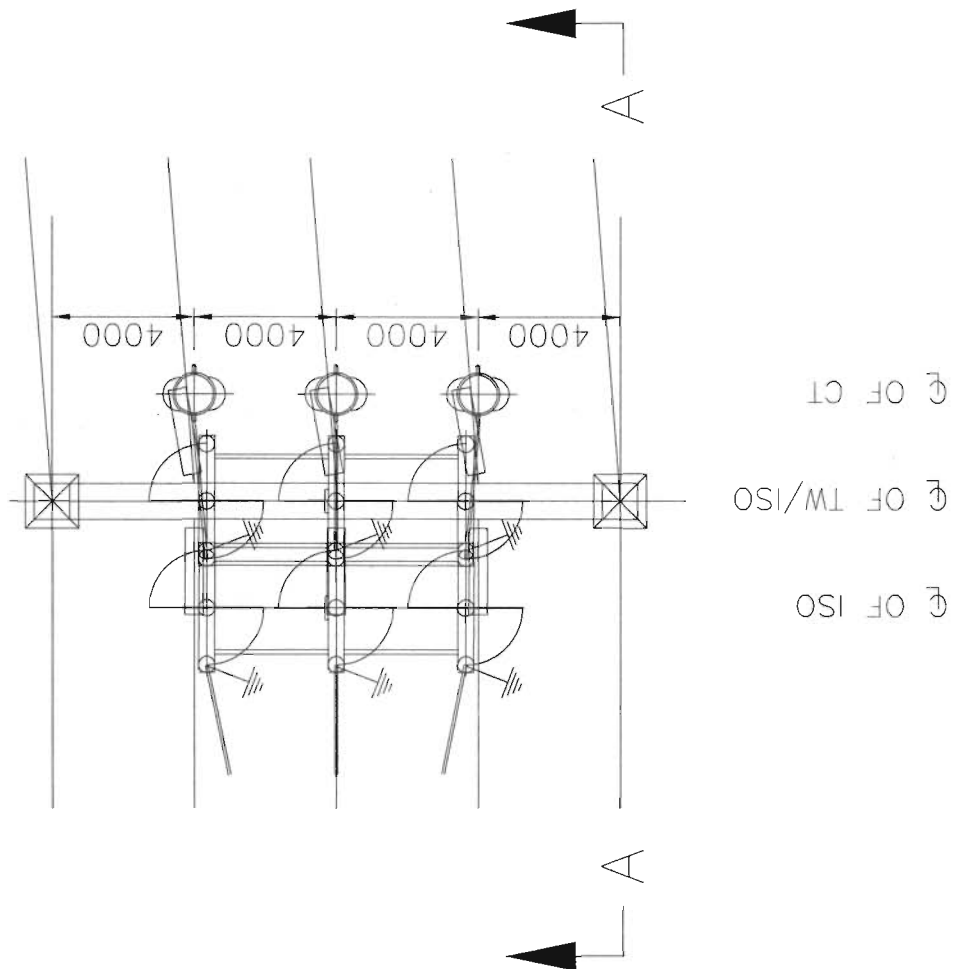
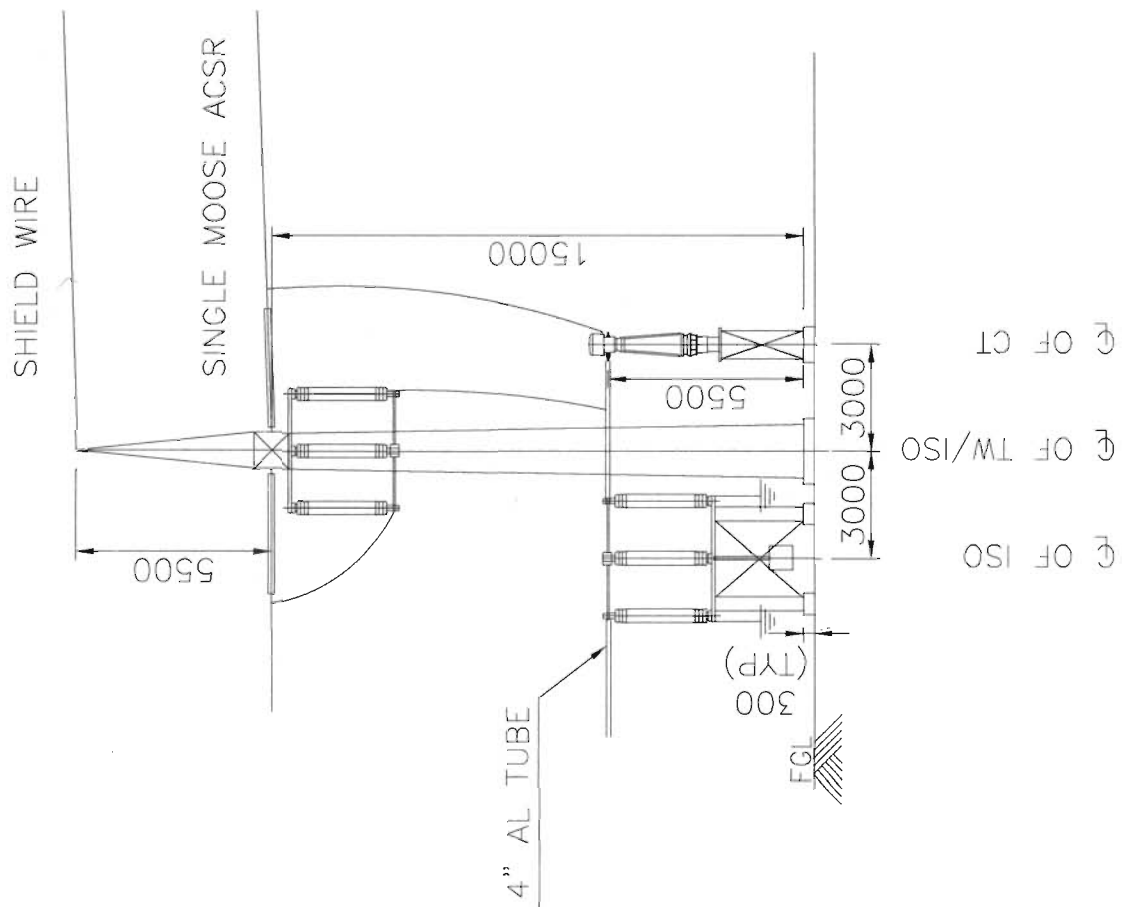
All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended for replacement. The spares shall be treated and packed for long term storage in the climatic conditions prevailing at the site. Small items shall be packed in sealed transparent plastic covers with desiccant bags as necessary.

Each spare part shall be clearly marked and labeled on the outside of the packing together with the description when more than one spare part is packed in single case. A general description of the contents shall be shown on outside of the case and detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

1.7 QUALITY PLAN

The bidder shall follow BHEL/KPCL approved quality plan.

SKETCH-1



SECTION-2

1.0 ISOLATORS

1.1 GENERAL: (For 220 kV only)

The isolators and accessories shall conform in general to IEC 129 (or IS: 9921)

Isolators shall be outdoor off load type. Earth switches shall be provided on isolators wherever called for.

Complete isolator with all the necessary items for successful operation shall be supplied including but not limited to the following:

Isolator assembled with complete base frame, linkages, operating mechanism, control cabinet, interlocks etc.

The insulators are required for Horizontal double Break (HDB) for 400- & 220 kV systems. These insulators shall be supplied by BHEL

All necessary parts to provide a complete and operable isolator installation control parts and other devices whether specifically called for herein or not.

The isolator shall be designed for use in specified geographic and meteorological conditions.

The fixed contact for pantograph type isolator shall be suspended from strung bus comprising twin/single moose ACSR conductor of sub conductor spacing 250 mm.

1.2 DUTY REQUIREMENTS:

- a) Isolators and earth switches shall be capable of withstanding the dynamic and thermal effects of the maximum possible short circuit current of the systems in their closed position. They shall be constructed such that they do not open under influence of short circuit current.
- b) The earth switches, wherever provided, shall be constructionally interlocked so that the earth switches can be operated only when the isolator is open and vice versa. The constructional interlocks shall be built in construction of isolator and shall be in addition to the electrical and mechanical interlocks provided in the operating mechanism.
- c) In addition to the constructional interlock, isolator and earth switches shall have provision to prevent their electrical and manual operation unless the associated and other interlocking conditions are met. All these interlocks shall be of fail safe type. Suitable individual interlocking coil arrangements shall be provided. The interlocking coil shall be suitable for continuous operation from DC supply.
- d) The earthing switches shall be capable of discharging trapped charges of the associated lines.
- e) The isolators shall be capable of making/breaking normal currents when no significant change in voltage occurs across the terminals of each pole of isolator on account of make/break operation.

- f) The isolator shall be capable of making/breaking magnetising current of 0.7A at 0.15-power factor and capacitive current of 0.7A at 0.15-power factor at rated voltage for 400 & 220 kV.

1.3 CONSTRUCTIONAL FEATURES:

The features and constructional details of Horizontal double Break, earth switches and accessories shall be in accordance with requirements stated hereunder:

The Isolator or earthing switches when installed shall be able to bear on the terminals, the total forces (including wind loading and electro-dynamic forces on the attached conductors) related to the application and rating without impairing the reliability or current carrying capacity.

The Isolators and earthing switches including their operating mechanism shall be so constructed that they can not come out of their open or closed position by gravity, wind pressure, Vibrations reasonable shocks or accidental touching of the connecting rods or their operation mechanism.

Similar parts of the Isolators should be interchangeable.

Live parts shall be of non-rusting and non-corroding metal. Current carrying parts shall be of non-ferrous materials. Bolts, screws and pins shall be provided with lock washers, keys or equivalent locking facility and if in current carrying parts, shall be made of copper silicon alloy or equivalent.

The isolator shall be so constructed that the switch blade will not fall to the closed position if operating shaft gets disconnected.

The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces, where this is impracticable, adequate corona shields shall be provided.

The ground terminal pads with studs each suitable for connecting to the earthmat through MS flat shall be provided on each isolator.

The isolator shall be provided with high pressure current carrying contacts on the hinge and jaws ends. All contact surface shall be silver-plated. The contacts shall be maintenance free if possible.

Each pole of the isolators shall be provided with a complete galvanised steel base designed for mounting on a supporting structure to be provided by the bidder. The base shall be rigid and self-supporting. They shall also be capable of withstanding all terminal and bending stresses due to operation of the isolators.

A position indicator to show the on & off position of the isolator shall be provided on each isolator pole.

Section 2 – Equipment Specification

Counter balance springs shall be provided for balancing the isolators to prevent impact at the end of travel both on opening and closing of the isolator.

1.3.1 Contacts:

- a) The contacts shall be self-aligning and self cleaning and so designed that binding cannot occur after remaining closed for prolonged period of time in a heavily polluted atmosphere.
- b) No undue wear or scuffing shall be evident during the mechanical endurance tests. Contacts and spring shall be designed so that readjustments in contact pressure shall not be necessary throughout the life of the isolator or earthing switch. Each contact or pair of contacts shall be independently sprung so that full presence is maintained on all contacts at all time.
- c) Contact springs shall not carry any current and shall not loose their characteristics due to heating effects.

1.3.2 Base:

Each isolator shall be provided with a complete galvanised steel base with appropriate holes designed for mounting on a supporting structure.

1.3.3 Blades:

- a) All metal parts shall be of non-rusting and non-corroding material. All current carrying parts shall be made from high conductivity electrolytic copper/aluminium. Bolts, screws and pins shall be provided with lock washers. Keys or equivalent locking facilities if provided on current carrying parts shall be made of copper silicon alloy or stainless steel or equivalent. The bolts or pins used in current carrying parts shall be made of non-corroding material. All ferrous castings except current carrying parts shall be made of malleable cast iron or cast-steel. No grey iron shall be used in the manufacture of any part of the isolator.
- b) The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces, where this is impracticable adequate corona shields shall be provided. Corona shields/rings etc. shall be made up of aluminium/ aluminium alloy.
- c) Isolators and earthing switches including their operating parts shall be such that they cannot be dislodged from their open or closed positions by short circuit forces, gravity, wind pressure, vibrations, shocks or accidental touching of the connecting rods of the operating mechanism.

- d) The switch shall be designed such that no lubrication of any part is required except at very infrequent intervals i.e. after every 1000 operations or after 5 years whichever is earlier.

1.3.4 Insulator:

- a) The insulator shall conform to IS: 2544 and/or IEC-168. The porcelain of the insulator shall conform to the requirements stipulated and shall have a minimum cantilever strength of 800 kgs. for all voltages.
- b) Pressure due to the contact shall not be transferred to the insulators after the main blades are fully closed.
- c) The parameters of the insulators shall meet the requirements specified.
- d) Cap and pin type post insulators will not be considered.

The puncture voltage of hollow insulator or columns shall be greater than dry flash over voltage.

Pressure due to contact shall not be transferred to the insulators after the main blades fully closed.

The insulators shall be as arranged that leakage currents will pass to earth and not between terminals of the same pole or between poles.

Each rotating insulator stack shall be supported on double roller or ball bearings and shall be protected from the washer by means of covers and grease retainers. Bearing pressures shall be kept low to ensure long life and ease of operation. The insulators shall meet the following specified values:

~~(number of units per stack not more than 3 for 400 kV)~~

A	Voltage class	:	400/ 220KV
B	Cantilever strength	:	800 kg /800 Kg
C	Dry one minute power frequency withstand voltage (kV)	:	630/510 460/530
D	Wet one minute power frequency withstand voltage (kV)	:	630/400 *
E	Total creepage distance (mm)	:	31mm/kV
F	Protected leakage path not less than (at 90o)	:	50%
G	maximum visual discharge voltage	:	320 kv.(rms)/-

Technical Specification
~~400/220 kV Bellary substation~~
 Section 2 – Equipment Specification

H	maximum radio interference voltage : at 156 kV	1000
I	switching surge withstand voltage :	1050 kv.
J	impulse voltage (BIL) :	1425 /1050
K	bottom flange pitch circle dia :	shall be informed during detailed engineering
L	bottom flange no. Of drilled holes :	8 / 4
M	bottom flange dia. Of drilled holes :	18 /18mm
N	top housing pitch circle dia. :	127 /127mm
O	top housing no of tapped holes :	4 /4
P	top housing dia. Of tapped holes and : thread specification.	M16

1.4 EARTHING SWITCHES:

- a) Where earthing switches are specified these shall include the complete operating mechanism and auxiliary contacts.
- b) The earthing switches shall form an integral part of the isolator and shall be mounted on the base frame of the isolator.
- c) Earthing switches shall be only locally operated.
- d) The earthing switches shall be constructionally interlocked with the isolator so that the earthing switches can be operated only when the isolator is open and vice versa. The constructional interlocks shall be built in construction of isolator and shall be in addition to the electrical and mechanical interlocks provided in the operating mechanism.
- e) Each earth switch shall be provided with flexible copper/aluminium braids for connection to earth terminal. These braids shall have the same short time current carrying capacity as the earth blade.
- f) The plane of movement and final position of the earth blades shall be such that adequate electrical clearances are obtained from adjacent live parts in the course of its movement between ON and OFF position.
- g) The frame of each isolator and earthing switches shall be provided with two reliable earth terminals for connection to the earth mat.

Section 2 – Equipment Specification

- h) Isolator design shall be such as to permit addition of earth switches at a future date. It should be possible to interchange position of earth switch to either side.
- i) The earth switch should be able to carry the same fault current as the main blades of the isolators and shall withstand dynamic stresses.

1.5 OPERATING MECHANISM:

- a) The Bidder shall offer motor operated isolators and manually operated earth switches.
- b) Limit switches for control shall be fitted on the isolator/earth switch shaft, within the cabinet to sense the open and close positions of the isolators and earth switches.
- c) After final adjustment has been made, it shall not be possible for any part of the mechanism to be displaced at any point in the travel sufficient enough to allow improper functioning of the isolator when the isolator is opened or closed at any speed. All holes in cranks, linkage etc. having moving pins shall be drilled to accurate fit so as to maintain the minimum amount of slack and lost-motion in the entire mechanism.
- d) Control cabinet/operating mech. box shall be made of aluminium sheet of adequate thickness.
- e) A "Local/Remote" selector switch and a set of open/ close push buttons shall be provided on the control cabinet of the isolator to permit its operation through local or remote push buttons.
- f) Provision shall be made in the control cabinet to disconnect power supply to prevent local/remote power operation.
- g) Motor shall be an AC motor
- h) Suitable reduction gearing shall be provided between the motor and the drive shaft of the isolator. The mechanism shall stop rapidly when motor supplies switched off. If necessary a quick electro mechanical brake shall be fitted on the higher speed shaft to effect rapid braking.
- i) Manual operation facility should be provided with necessary interlock to disconnect motor.
- j) Gear should be of forged material suitably chosen to avoid bending/ jamming on operation after a prolonged period of non-operation. Also all gear and connected material should be so chosen surface treated to avoid rusting.

Section 2 – Equipment Specification

- k) Motor operated mechanism shall be subjected to blocked rotor test as sample test/type test at no extra cost to Purchaser.

- l) Common control box (CCB) :

A suitable free standing outdoor type common control box duly wired shall be supplied. All terminals from the individual drive (main & earth) control cabinets shall be brought to this common control box for further distribution. This CCB shall have suitable number of terminals & provision of heater and ac input supply (with provision of fixtures for lighting and 5 Amp. 3 pin socket shall also be provided). The CCB shall conform to IP55.

1.6 OTHER CONSIDERATIONS

The following aspects shall also be accounted for:

The ac motor operating mechanism shall actuate individual drive switches with controls. The operating mechanism shall be capable of providing a quick simple and effective operation. The design shall be such that a minimum of energy is required for the operation and one man shall be able to operate the isolator without undue effort.

Emergency manual operation shall be provided to enable operation of isolator in case of power failure. When the manual operation is in progress the power operation shall become inoperative. Arrangement shall be provided to pad lock the emergency handle when not in use.

Motor shall conform to IS 325. The insulated winding conductor shall be of copper and insulation shall be given fungicidal and tropical treatment as per IS 3202. Gear drive assembly shall be suitable for operating the isolator with minimum of energy. The motor enclosure shall conform to IP55. The motor shall develop a stalled torque equal to at least 2.5 times by the torque required to operate the isolator. For manual operation operating handle shall be directly coupled to gear drive having 1/33 ratio.

A weather proof control cabinet conforming to IP55 shall be provided to house the driving mechanism and other accessories. The control cabinet shall be fitted with 1100 V barrier type of terminal blocks. The terminal blocks shall be properly identified. The control wiring shall be carried out with a minimum of 2.5 mm cu. Wire of 1100V grade insulation. The auxiliary wiring with auxiliary device shall be capable of withstanding a test voltage of 2 kV for one minute.

Fail safe solenoid type inter-locking feature shall be provided.

The control shall be so arranged that the desired operation shall be completed when corresponding push button is pressed even momentarily.

The auxiliary contacts shall be actuated from the isolator shaft, so as to provide true indication of the position of isolator whether operated manually or with power driven devices.

The operating handle shall be mounted on the base supporting structure. Guide bearings shall be provided if necessary. All brackets angles or other members

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400/220 kV Bellary substation
Section 2 – Equipment Specification

necessary for attaching the operating mechanism to the isolator supporting structure shall be supplied by the bidder. Dust proof parts will be protected by grease retainers and covers. All bearings should have first filling of grease and provided with nipples for servicing.

An out of step relay for the three poles shall be provided to give remote pole discrepancy alarm in the purchasers control panel.

Limit switches should be provided to prevent over travel.

A local/remote selector switch with a set of open/close push buttons (for local operation) shall be provided on the control cabinet of the isolator. The push buttons for remote operation will be mounted on the purchases control panel.

The motor operating mechanism should be placed directly and centrally below the post insulator (in standard isolators) and should directly rotate the rod placed below the centre line of the post insulator.

400/220 kV isolators will have one operating drive for three poles which shall be gang operated.

AUXILIARY SWITCH CONTACTS

Auxiliary switches and auxiliary circuits shall be capable of carrying a current of atleast 10A continuously.

Auxiliary switches shall be capable of breaking of the circuits to be controlled i.e breaking atleast 2A in a 220 Volt D.C circuit with a time constant of not less than 20 milliseconds.

For standard Isolators minimum 15 normally open and 15 normally closed contacts. Six make before silver plated contacts suitable for CT switching.

1.7 OPERATION :

- a) Isolator shall be gang operated for 420 kV & 245 kV
- b) The design shall be such as to provide maximum reliability under all service conditions. All operating linkages carrying mechanical loads shall be designed for negligible deflection. The length of inter insulator and inter-pole operating rods shall be capable of adjustments, by means of screw thread which can be locked with a lock nut after an adjustment has been made. The isolator and earth switches shall be provided with "over centre" device in the operating mechanism to prevent accidental opening by wind, vibration, short circuit forces or movement of the support structures.
- c) Isolator and earth switch provided with a manual operating handle shall be such that one man can open or close the isolator or earth switch with ease in one movement while standing at ground level. The manual operating handle shall have provision for padlocking. The

operating handle shall be located at a height of 1000 mm from the base of isolator support structure.

- d) The isolator shall be provided with positive continuous control throughout the entire cycle of operation. The operating pipes and rods shall be sufficiently rigid to maintain positive control under the most adverse conditions and when operated in tension or compression for isolator closing. They shall also be capable of withstanding all torsional and bending stresses due to operation of the isolator. Wherever supported the operating rods shall be provided with bearings on either ends. The operating rods/pipes shall be provided with suitable universal couplings to account for any angular misalignment.
- e) All rotating parts shall be provided with grease packed roller or ball bearings in sealed housings designed to prevent the ingress of moisture, dirt or other foreign matter. Bearings pressure shall be kept low to ensure long life and ease of operation. Locking pins wherever used shall be rustproof.
- f) Signaling of closed position shall not take place unless it is certain that the movable contacts, will reach a position in which rated normal current, peak withstand current and short time withstand current can be carried safely. Signaling of open position shall not take place unless movable contacts have reached a position such that clearance between contacts is atleast 80% of the isolating distance.
- g) The position of movable contact system (main blades) of each of the isolators and earthing switches shall be indicated by a mechanical indicator at the lower end of the vertical rod of shaft for the isolators and earthing switch. The indicator shall be of metal and shall be visible from operating level.
- h) Auxiliary switches if installed on the frame of isolators & earth switches shall be suitably protected against accidental arcing from the main Contacts.
- i) The bidder shall furnish the following details alongwith quality norms, during detailed engineering stage.
- j) Details to demonstrate smooth transfer of rotary motion from motor of box to the insulator alongwith stoppers to prevent over travel.

1.8 Name Plate:

Isolators, earthing switches and their operating devices shall be provided with mounted in such a position that it shall be visible in the position of normal service and installation. It shall carry the following information :-

- A) isolators

- name of manufacturer
- designation type
- serial number
- rated voltage
- impulse withstand voltage to earth
- rated current
- rated short time current
- rated maximum duration of short time current
- rated mechanical terminal load
- weight

earthing switch

- name of manufacturer
- designation type
- serial number
- rated voltage
- impulse withstand voltage to earth
- rated current
- rated short time current
- rated maximum duration of short time current
- rated mechanical terminal load
- weight

operating device

- name of manufacturer
- designation type
- rated a.c. voltage and h.p.
- weight

1.9 TESTS :

Type test certificates for the isolators, for all the tests performed in accordance with the recommendation of the IEC-129 titled 'alternating current isolators (line connector) & earthing switches' on similar items shall be furnished for approval.

The acceptance tests in accordance with the recommendation of IEC-129 shall be furnished for purchaser's approval before dispatch of the isolators.

1.9.1 Routine tests : (IEC-129-1975) :

The isolators before transportation shall be subjected to following routine factory tests;

- A voltage tests of auxiliary circuits (clause 46)

B mechanical operating test (clause-58)

C measurement of the resistance of the main circuit (clause-47)

1.9.2 Type tests :

The following type tests shall definitely furnished :-

- | | | | |
|---|--|---|--|
| A | dielectric tests | : | clause-35 |
| B | lightning impulse voltage tests | : | clause-35.6 |
| C | switching impulse voltage tests | : | clause 35.7 |
| D | power frequency voltage tests | : | clause 35.8 |
| E | artificial pollution tests | : | clause 35.9
this can be conducted on
post insulator only with
out disconnector. |
| F | test of auxiliary and control
circuit | : | clause 35.11 |
| G | temperature rise tests | : | clause 36 |
| H | short time withstand current and
peak withstand current tests | : | clause 37 |
| I | operating and mechanical
endurance tests | : | clause 39 |
| J | tests for measuring radio
interference level | : | clause 42 |
| K | corona extinction voltage test (for 400 kV only): | | |

This test shall be conducted on a clean and new disconnector and earthing switch. The disconnect and earthing switch shall be subjected to dry power frequency voltage. The voltage shall be raised till visual corona appears on the equipment. The voltage during the test need not be raised beyond 365 kv. (rms) if the visual corona does not appear. The voltage shall be brought down to 70 kv. (rms) and raised again to visual corona inception level. Such raising and powering of the test voltage shall be done a few times. Finally, the voltage may be raised till the visual corona appears. The test voltage shall be reduced to 320 kv. (rms). Corona shall not be visible on the equipment at this voltage.

During the test, the earthed objects in the proximity of the equipment shall be kept beyond a distance of 3.5 meters. The tests on bus post insulators shall be conducted in accordance with IEC-168 (1979) and IS2544 (1973) or any latest amendment thereof.

1.9.3 Site Tests :

All routine tests including 50 operation test, except power frequency dry voltage withstand test on isolator shall be repeated on completely assembled isolator of each type at site.

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SECTION-3

1.0 PROJECT DETAILS AND GENERAL SPECIFICATIONS

1.1 NIL

1.2 PROJECT INFORMATION AND SYSTEM PARAMETERS

- a) Customer : M/s Karnataka Power Corporation Ltd, Bangalore (KPCL).
- b) Project Title : 220kV Yelahanka substaion
- c) Site location : Yelahanka, district Bangalore
- d) Nearest Railway station : Yelahanka junction, 15km from Bangalore

The following system parameters shall prevail:

Nominal system voltage	220 kV
Highest system voltage	245 kV
Frequency	50 Hz
Rated short time current	40 kA for 1 sec
Dry and wet one minute power frequency withstand voltage	460 kV
Dry and wet impulse withstand voltage positive and negative	1050 kVp
Minimum total creepage	31 mm/kV
System Earthing	Effectively Earthed

1.3 SITE CONDITIONS

- 1.3.1 Design ambient temp. : 50 deg C
- 1.3.2 Altitude : < 1000 m from mean Sea level
- 1.3.4 Pollution severity : Highly polluted
- 1.3.5 Earth quake data
- a) Seismic zone : III
- b) Seismic acceleration : As per IS: 1893 latest revision
- 1.3.6 Max. mean Wind speed : 33 m/s
- 1.3.8 Latitude : 13°06'50"N
- 1.3.9 Longitude : 77°35'54"E

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1.4 MATERIAL/WORKMANSHIP

1.4.1 General Requirement

Where the specification does not contain characteristics with reference to workmanship, equipment, materials and components of the covered Equipment it is understood that the same must be new, of highest grade of the best quality of their kind conforming to best engineering practice and suitable for the purposes for which they are intended.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety, subject to mutual agreements and shall be used throughout the design. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from purchaser.

Whenever possible, all similar part of the Works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall be interchangeable with, and shall be made of the same materials and workmanship as the corresponding parts of the Equipment supplied under the Specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.

All materials and equipment shall be installed in strict accordance with the manufacturer's recommendation(s). Only first-class work in accordance with the best modern practices will be accepted. Installation shall be construed as being the erection of equipment at its permanent location. This, unless otherwise specified, shall include unpacking, cleaning and lifting into position, grouting, leveling, aligning, coupling of or bolting down to previously installed equipment bases/foundations, performing the alignment check and final adjustment prior to initial operation, testing and commissioning in accordance with the manufacturer's tolerances /instructions and the Specification. All factory assembled rotating machinery shall be checked for alignment and adjustments made as necessary to re-establish the manufacture's limits. Suitable guards shall be provided for the protection of personal on all exposed rotating and / or moving machine parts and shall be designed for easy installation and removal for maintenance purpose. The spare equipment(s) shall be installed at designated locations and tested for healthiness.

The Contractor shall apply oil and grease of the proper specification to suit the machinery, as is necessary for the installation of the equipment. Lubricants used for installation purposes shall be drained out and the system flushed through where necessary for applying the lubricant required for operation. The Contractor shall apply all operational lubricants to the equipment installed by him.

All oil, grease and other consumables used in the Works/ Equipment shall be purchased in India unless the Contractor has any special requirement for the specific application of a type of oil or grease not available in India. If such is the case, he shall declare in the proposal where such oil or grease is available. He shall help purchaser in establishing equivalent Indian make and Indian Contractor. The same shall be applicable to other consumables too.

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1.4.2 Provisions For Exposure to Hot and Humid climate

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity, heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipments located in non-air conditioned areas shall also be of same type.

1.5 COLOUR SCHEME AND CODES FOR PIPE SERVICE

The contractor shall propose a color scheme for those equipment/Items for which the colour scheme has not been specified in the specification for the approval of purchaser. The decision of purchaser shall be final. The scheme shall include:

Finishing colour of Indoor equipment

Finishing colour of Outdoor equipment.

Finish colour of all cubicles.

Finishing colour of various auxiliary system equipment including piping

Finishing colour of various building items.

All steel structures, plates etc. shall be painted with non-corrosive paint on a suitable primer. It may be noted that normally all electrical equipment in switchyard are painted with shade 631 of IS-5. All The indoor cubicles shall be of same colour scheme and for other miscellaneous items, colour scheme will be approved by the purchaser.

1.6 PAINTING

- a) All sheet steel work shall be phosphated in accordance with the following procedure and in accordance with IS:6005 "Code of practice for Phosphating Iron and Steel".
- b) Oil, grease, dirt and swerve shall be thoroughly removed from emulsion by cleaning.
- c) 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.
- d) After phosphating, thorough rinsing shall be carried out with clean water followed by final rinsing with dilute bichromate solution and over drying.
- e) The phosphate coating shall be sealed by the application of two coats of ready mixed, stoving type zinc chromate primer. The first coat may be "Flash dried" while the second coat shall be stoved.
- f) After application of the primer, two coats of finishing epoxy paint shall be applied, each coat followed by stoving. The panel shall have colour conforming to shade 631 of IS-5 for outside and inside of the panel with black colour for base frame.

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- g) Each coat of primer and finishing paint shall be of a slightly different shade to enable inspection of the painting.
- h) Finished painted appearance of panel shall present an asthetically pleasing appearance free from dents and uneven surface.
- i) A small quantity of finishing paint shall be supplied for minor touching up required at site after the installation of the panels.

1.7 PROTECTION

- a) All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device. All ends of all valves, pipings and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage.
- b) All equipment accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects and corrosion.
- c) The parts which are likely to get rusted, due to exposure to weather should also be properly treated and protected in a suitable manner.
- b) Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

1.8 FUNGISTATIC VARNISH

Besides the space heaters, special moisture and fungus resistant varnish shall be applied on the parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interface with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application to the varnish.

1.9 SURFACE FINISH

All interiors and exteriors of tanks, control cubicles and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, greases or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible, shall be painted with not less than two coats of heat resistant, oil insoluble, insulating paints.

All metal surfaces exposed to atmosphere shall be given two primer coats of zinc chromate and two coats of epoxy paint with epoxy base thinner. All metal parts not accessible for painting shall be made of corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped or other wise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather within the limit specified. The paint shall not scale off or wrinkle or be removed by abrasion due to normal handling.

1.10 GALVANIZING

All ferrous parts including all sizes of nuts, bolts, Plain and spring washers, support channels,

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structures, shall be hot dip galvanised conforming to latest version of IS:2629 or any other equivalent authoritative standard. However, hardware less than M12 size shall be electro-galvanized. Minimum weight of zinc coating shall be 610 gm/sq.mm and minimum thickness of coating shall be 85 microns for all items thicker than 6mm. For items lower than 6 mm thickness, requirement of coating shall be as per relevant ASTM.

1.11 AUXILIARY POWER SUPPLY

1.11.1 A.C power supply for auxiliaries will be available at 240 V, 50 C/s 1-phase, 2 wire and 415V, 50 C/s, 3-phase, 4 wire, neutral solidly earthed with variation in frequency of +/-5% and variation in voltage +/-10%

1.11.2 D.C. power supply at 220 V, 2-wire ungrounded will be available 187 V to 242 V.

1.12 INSPECTION AND TESTING

All tests and inspection of the equipment specified shall be performed to the extent and in the manner as stipulated in the relevant standards and in this specification. All type tests/routine tests/acceptance tests as specified shall be conducted in the presence of purchaser. Wherever equipment similar to the one being offered has already been type tested within 5 years from the date of opening the bid. Type tests done in an independent government laboratory or in the presence of representative of State Electricity Board or other reputed public undertakings, the type test reports of the same shall be submitted for scrutiny /approval. If these are found suitable and technically acceptable, conducting of type tests shall be waived off. Otherwise the subcontractor will have to carry out the type tests without any extra cost and without any delivery implications.

1.13 PACKAGING

Aluminium Tube shall be partially packed with Hessians cloths. Similar items shall be grouped and tied with steel wires/strip for convenient handling during transits.

Markings

The following details are to be clearly indicated in the material forwarding documents:

- a) Name and address of the consignee.
- b) Purchase order number.
- c) Name of supplier/s.
- d) Description of equipment / material.
- e) Tare weight.
- f) Gross weight.

All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. On request of the purchaser, the Contractor shall also submit packing details/associated drawing for

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any equipment material under his scope of supply, to facilitate the purchaser to repack any equipment/ material at a later date, in case the need arises, while packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage wagons and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor. Purchaser takes no responsibility of the availability of the wagons.

1.14 HANDLING, STORING AND INSTALLATION

In accordance with the specific installation instructions as shown on manufacturer's drawings or as directed by the purchaser or his representative, the Contractor shall unload, store, erect, install, wire, test and place into commercial use all the equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square and properly aligned and oriented. Commercial use of switchyard equipment means completion of all site tests specified and energisation at rated voltage.

Contractor may engage manufacturer's Engineers to supervise the unloading, transportation to site, storing, testing and commissioning of the various equipment being procured by them separately. Contractor shall unload, transport, store, erect, test and commission the equipment as per instructions of the manufacturer's supervisory Engineer(s) and shall extend full cooperation to them.

In case of any doubt/misunderstanding as to the correct interpretation of manufacturer's drawings or instructions, necessary clarifications shall be obtained from the purchaser.

Contractor shall be held responsible for any damage to the equipment consequent to not following manufacturer's drawings/instructions correctly.

Where assemblies are supplied in more than one section, contractor shall make all necessary mechanical and electrical connections between sections including the connection between buses. Contractor shall also do necessary adjustments/alignments necessary for proper operation of circuit breakers, isolators and their operating mechanisms. All components shall be protected against damage during unloading, transportation, storage, installation, testing and commissioning. Any equipment damaged due to negligence or carelessness or otherwise shall be replaced by the contractor at his own expenses.

Contractor shall be responsible for examining all the shipment immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's information only. The Contractor shall submit to the purchaser every week a report detailing all the receipts during the weeks. However, the Contractor shall be solely responsible for any shortages or damages in transit, handling and/or in storage and erection of the equipment at Site. Any demurrage, pilferage and other such charges claimed by the transporters, railways etc. shall be to the Contractor' account.

The Contractor shall be fully responsible, for the equipment/material until the same is handed over to the purchaser in an operating condition after commissioning. Contractor shall be responsible for the maintenance to the equipment/material while in storage as well as after erection until taken over by Purchaser, as well as protection of the same against theft, element of such nature,

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corrosion, damages etc.

The Contractor shall be responsible for making suitable indoor storage facilities, to store all equipment which requires indoor storage.

The words erection and installation used in the specification are synonymous. Exposed live parts shall be placed high enough above ground to meet the requirements of electrical and other statutory safety codes.

The minimum phase to earth, phase to phase and section clearance along-with other technical parameters for the various switchyard voltage levels to be maintained shall be strictly as per the approved drawings.

The design and workmanship shall be in accordance with the best engineering practices to ensure satisfactory performance throughout the service life. If at any stage during the execution of the Contract, it is observed that the erected equipment(s) do not meet the above minimum clearances, the Contractor shall immediately proceed to correct the discrepancy at his risks and costs.

1.15 TOOLS AND TACKLES

The Contractor shall supply with the equipment one complete set of all special tools and tackles for the erection, assembly, dis-assembly and maintenance of the equipment. However, these tools and tackles shall be separately, packed and brought on to Site.

1.16 EQUIPMENT BASES

A cast iron or welded steel base-plate shall be provided for all rotating equipment, which is to be installed on a concrete base unless otherwise agreed to by the Purchaser. Each base-plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units shall have a raised lip all around, and shall have threaded drain connections.

1.17 QUALITY

BHEL quality plan to be followed subject to TBEM / customer's approval.

1.18 DOCUMENTATION

1.18.1 Drawings

All drawings shall be prepared in AutoCad and ultimate documentation would include drawings/documents on CDs. All dimensions and data shall be in SI metric units.

All items of the equipment should be clearly identified by proper part nos. in the contract drawings. Such parts, which are to be dispatched to site from works in dispatchable units and are reassembled at site, should be marked by proper identification marks at works and indicated in the drawings and quantified. The shipping list should be sent along with the general arrangement drawings for engineer's approval. All the items of the shipping list should be identified in the drawing.

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The drawing submitted by the supplier shall be reviewed by the purchaser as far as practicable within two weeks of receipt of drawings and shall be modified by the sub-contractor if any modifications and/or corrections are required by the purchaser. The sub-contractor shall incorporate such modifications and / or corrections and submit the final drawings for approval. Any delay arising out of failure of the subcontractor to rectify the drawings shall not alter the contract completion date.

Further work by the subcontractor shall be in strict accordance with these drawings and no deviation shall be allowed without the written approval of the purchaser.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at supplier's risk.

Approval of drawing or work by the purchaser/consultant shall not relieve the subcontractor of any of his responsibilities and liabilities under the contract.

In case of any modifications that may be necessary during erection or commissioning of the equipment, the subcontractor shall carry out modifications in the original drawing & submit 'As Built drawings' and required no. of prints thereof.

1.18.2 Instruction manuals

The supplier shall submit to the purchaser, draft instruction manuals for approval within 30 days of placement of order. The final instruction manuals complete in all respects shall be submitted 60 days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipment furnished, the erection procedures, testing, operation & maintenance procedures of the equipment.

If after the commissioning and initial operation of the plant, the instruction manuals require any modification/ addition / changes, the same shall be incorporated and the up- dated final instruction manuals shall be submitted as required.

1.18.3 Title Block & Drawing/ Document numbering scheme

Title block for drawing / document should be followed as per ANNEXURE-1

1.18.4 DOCUMENTATION SCHEDULE AT CONTRACT STAGE

A.	<u>For approval</u>	<u>No of Copies</u>
	Copies of all drawings with project details, dimension, shipping weights, No. of cases & dimensions, fixing details, tolerance etc.	3
	Copies of type test reports.	3
	Copies of works quality plan & field quality plan.	3
	Copies of installation operation & maintenance manual.	3

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	Copies of drawings on floppies/CDs	-
B.	<u>After approval and for information / distribution</u>	
	Copies of all drawings	12
	Copies of installation, operation & maintenance manual including Routine test reports	12
	Sets of RTF of drawings	-
	CDs of Drgs.	-
C.	<u>As Built Drawings</u>	
	Hard copies of Drawings	7
	CDs	4

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CONSULTANT: FICHTNER Consulting Engineers (India) Pvt. Ltd., Bengaluru

Technical Specification of 220kV Isolator

TB-379-316-002

Section-4: Guaranteed Technical Particulars

ISOLATORS / GROUNDING SWITCHES		245kV (specified value)	Bidder's offer
1.	Name and address of the Manufacturer		
2.	Manufacturer's type designation	Double Break	
3.	Standard applicable	IS : 9921 (1985)/IEC - 129	
4.	Rated Voltage Ur (KV)	245	
5.	Rated Current Under site conditions at 50° C ambient (Amps)	1600A, 3000A	
6.	Rated frequency (Hz)	50	
7.	Number of poles	3	
8.	Whether all 3 poles are ganged mechanically	Mechanically ganged	
9.	Pole to pole spacing (mm)	4000	
10.	Rated short time current of isolator for 1(one) second (kA) and dynamic current (kAp)	40 kA/ 100 kAp	
11.	Opening time of isolator and earth switch (s)	12	
12.	Closing time of isolator and earth switch (s)	12	
13.	Rated Mechanical Terminal Load (kg)	50	
14.	Dielectric withstand capacity of completely assembled isolator/ earth switch	As per item 15 below	
15.	One minute dry power freq.withstand test voltage		
	i) against ground (kV rms)	460	
	ii) Across isolating distance (kV rms.)	530	
16.	1.2/50 micro's impulse withstand test voltage		
	i). Against ground (kVp)	1050	
	ii. Across isolating distance (kVp)	1200	

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CONSULTANT: FICHTNER Consulting Engineers (India) Pvt. Ltd., Bengaluru

Technical Specification of 220kV Isolator

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Section-4: Guaranteed Technical Particulars

ISOLATORS / GROUNDING SWITCHES		245kV (specified value)	Bidder's offer
17	250/2500 micro sec switching surge withstand test voltage dry and wet		
	i). Against ground (kVp)	Not Applicable	
	ii. Across isolating distance (kVp)	Not Applicable	
18	Corona extinction voltage (kV rms)	156	
19	Radio interference level at 1.1 Ur/ root 3 (in micro volts) at 1 MHz	Less than 1000mV @156kV rms	
20	Operating Mechanism		
	i) For Main Blades	Motor operated	
	ii). For Earth Switches	Motor operated	
21	Controls		
	i) Rated DC control voltage	220V	
	ii). Limits of voltage	+ or - 10%	
22	Constructional Features	SUPPLIER SPECIFIC	
	i) Main Contacts		
	a) Type of contacts		
	b) Contact Area (sq cm)		
	c) Material of contact		
	d) Contact pressure (kg/sq cm)		
	e) Max current density under normal current carrying capacity.		
	f) Thickness of silver plating		
23	Compliance to technical specification w.r.t		
	i) MoM Box	Yes	
	ii) Support Insulator	Yes	
	iii) Terminal connector	Yes	
24	a) Confirm whether similar equipment are type tested as per IEC/IS and are in successful operation for at least 2 (two) years (furnish type test reports)	The offered equipment is type tested and the Type test reports shall be furnished at contract stage.	
25	Overall General Arrangement drawing of isolators is to be enclosed	SUPPLIER SPECIFIC	

(INFORMATION TO BE FURNISHED WITH OFFER)

BIDDERS ARE INSTRUCTED TO

WRITE 'YES' UNDER CLOUMN '2', IF THE INFORMATION / SCHEDULE IS FURNISHED / ENCLOSED WITH THE OFFER, OR
 WRITE 'NO' UNDER CLOUMN '2', IF THE INFORMATION / SCHEDULE IS NOT FURNISHED / ENCLOSED WITH THE OFFER, OR
 WRITE 'NOT APPLICABLE (NA)' UNDER CLOUMN '2', IF THE INFORMATION / QUERY / SCHEDULE IS NOT RELEVANT TO THEM, AND

RETURN THIS CHECKLIST AS THE PART OF THE OFFER DULY SIGNED BY THEM.

S.N.	ISOLATORS / GROUNDING SWITCHES	220kV Isolators	
		Specified Requirement	Confirmation Yes/No
1.	Rated Voltage (KV)	245	
2.	Type of Isolator	Outdoor, HDB	
3.	Standard applicable for isolators and earthing switches	IEC:62271-102 (2001-12), IEC-129, IS:9921- 1985	
4.	Rated Current Under site conditions (A) at 50° C ambient-	1600/ 3000	
5.	Rated short time withstands Current of Isolator and Earth switch for 3 sec.	40kA	
6.	Rated dynamic short circuit withstand Current of Isolator and Earth switch	100kAp	
7.	Rated frequency (Hz)	50	
8.	Number of poles	Three	
9.	Phase to phase spacing (mm)	4000	
10.	Whether all 3 poles are ganged	Mechanically	
11.	Opening time of isolator and earth switch (Sec.)	Less than 12	
12.	Closing time of isolator (Sec.)	Less than 12	
13.	Temperature rise over 50° C ambient temperature corresponding to maximum continuous current (°C)	As per table V of IEC-694	
14.	Seismic Acceleration	0.3 g	

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Technical Specification of 220kV Isolators

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Section-5: Check List

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ISOLATORS / GROUNDING SWITCHES		220kV Isolators	
S.N.		Specified Requirement	Confirmation Yes/No
15.	Dielectric withstand capacity of completely assembled isolator/isolator and earth switch		
15.1	One minute dry power freq. Withstand test voltage(KV rms)		
	i. against ground (KV rms)	460	
	ii. Across isolating distance (KV rms.)	530	
15.2	1.2/50 micro's impulse withstand test voltage		
	i. Against ground (KVP)	±1050	
	ii. Across isolating distance (KVP) -	1200	
15.3	250/2500 micro sec. switching surge withstand test voltage (dry & wet)		
	i. Against ground (KVP) -	-	
	ii. Across isolating distance (KVP)	-	
16.	Corona extinction voltage (KV rms) –	156	
17.	Radio interference level at 1.1 Ur/√3 (in micro volts at 1.0 MHz)-	Less than 1000μV	
18.	Total creepage distance to ground (mm) (if 31 mm/kV)	7595	
19.	Operating Mechanism for Isolator	Motor	
20.	Operating Mechanism for Earth Switches	Manually	
21.	Whether constructional Mechanical interlock between Isolator & Earth switch provided	YES	
22.	Whether interlock between Isolator & Earth switch provided	Mechanical/ Electrical/ Both	
23.	Arrangement provided to prevent electrical or manual operation unless interlock conditions are satisfied	YES	

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Technical Specification of 220kV Isolators

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Section-5: Check List

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ISOLATORS / GROUNDING SWITCHES		220kV Isolators	
S.N.		Specified Requirement	Confirmation Yes/No
24.	Rated Mechanical Terminal Load (kg)	50	
25.	Whether interlock coil is continuously rated	YES	
26.	Rated DC control voltage and variation allowed	220V	
27.	Material of contacts	copper	
29.	Number of auxiliary contacts on isolator/pole for Owner's use	12 NO + 12 NC +2 MBB	
30.	Number of auxiliary contacts on earth switch/pole for Owner's use	10NO + 10 NC	
31.	Rating of Auxiliary contacts	10 A at 220V DC	
32.	Rated DC breaking current of Auxiliary contacts with 20 ms time constant (A)	2 A	
33.	Material of Current carrying parts	Aluminium/ Copper	
34.	Height from mounting plane to top of terminal stud	5500 mm	
35.	Height of gantry for gantry mounted isolators. (length of operating rod provided suitably)	15000mm	
36.	All valid Type test reports(as per IEC 129) not older than 5 years, available	Yes, available	
CONTROL CABINETS			
37.	Application	Outdoor	
38.	Material of control cabinet sheet	Aluminium sheet	
39.	Thickness of sheet (mm) Aluminium Sheet steel (Hot rolled) Sheet steel (Cold rolled)	12 SWG	
40.	Degree of protection provided	IP55	
41.	Standard applicable for control cabinet	IS-5093/IS-8623, IEC-439	
42.	Whether Hot Dip Galvanised	YES/No	

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Technical Specification of 220kV Isolators
Section-5: Check List

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REV.00

S.N.	ISOLATORS / GROUNDING SWITCHES	220kV Isolators	
		Specified Requirement	Confirmation Yes/No
43.	Colour shade of finish paint of outside of control cabinet as per IS : 5		
44.	Colour shade of finish paint of inside of control cabinet as per IS : 5		
45.	Size of Conductor used in Control Wiring of control cabinet	4 & 2.5 sq.mm	
46.	20 % Spare Terminal Blocks provided in control cabinet	YES	
47.	Confirm to follow the BHEL/Customer MQP	Confirmed	
48.	Following accessories not limited to this is included or not:		
A	Hardware for Structure to Base Plate	YES	
B	Hardware for Base Plate to Bottom of Post Insulator	NO	
C	Hardware for Top BPI to Male/Female Member	YES	
D	Hardware for Structure to MOM Box	YES	
E	Hardware for Structure to Earth Switch MOM	YES	
F	Terminal Connectors	NO	

Date:
Place:
Phone:
Fax:
E-mail:
Mobile:
Website: