



ODISHA POWER TRANSMISSION CORPORATION LIMITED

TECHNICAL SPECIFICATION FOR ISOLATORS

400KV SINGLE ISOLATOR WITH 1 EARTH SWITCH

400KV SINGLE ISOLATOR WITH 2 EARTH SWITCH

220KV SINGLE ISOLATOR WITHOUT EARTH SWITCH

220KV SINGLE ISOLATOR WITH EARTH SWITCH

220 KV TANDEM ISOLATOR

132 KV DOUBLE ISOLATOR WITH EARTH SWITCH

132 KV SINGLE ISOLATOR WITH EARTH SWITCH

132 KV SINGLE ISOLATOR WITHOUT EARTH SWITCH

132 KV TANDEM ISOLATOR

33 KV DOUBLE ISOLATOR WITH EARTH SWITCH

33 KV SINGLE ISOLATOR WITHOUT EARTH SWITCH

1. TECHNICAL PARTICULARS OF 400 kV,220 kV,132 kV & 33 KV ISOLATOR

	Type:	400 kV	220 kV	132 kV	33 kV
1	Main switch	Double end break centre post rotating, gang operated			
2	Service	Outdoor			
3	Applicable standard	IS : 9921 / IEC-62271-102			
4	No. of Phases	3 phase			
5	Design Ambient temperature	50°C			
6	Type of operation	Electrically Ganged	Mechanically Ganged		
7	Rated voltage (kV)	In KV	In KV	In KV	In KV
	a) Nominal	400	220	132	33
	b) Maximum	420	245	145	36
8	Rated current (Amps)	3150	2000	1250	800
9	Short time current for 3 sec. (kA)	63	40	31.5	25
10	Rated requencey	50 HZ \pm 5%			
11	System earthing	Effectively earthed			
12	Temperature rise	As per relevant IS/IEC standards			
13	Lightening Impulse withstand voltage (kVp)				
	(a) Across Isolating distance	1425(+240)	1200	750	195
	(b) To earth	1425	1050	650	170
14	1 minute power frequency withstand voltage				
	a) Across Isolating distance	610	530	315	80
	b) To earth	520	460	275	70
15	Switching Impulse withstand voltage (kVp)				
	a) Across Isolating distance	900(+345)	-	-	-
	b) To earth	1050	-	-	-
16	Max. RIV for frequency between 0.5 MHz and 2 MHz (micro-volt)	1000 at 267kV	1000 at 156kV	500 at 92kV	-
17	Corona Extinction Voltage (kV)	320	-	-	-

	Type	400 kV	220 kV	132 kV	33 kV
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18	Operating mechanism				
	a) Isolator	Motor	Motor	Motor	Motor
	b) Earth switch	Motor	Motor	Motor	Manual
19	Auxiliary voltage				
	a) Control & Inter lock	220V DC 80% to 110%			
	b) Motor voltage	3 Phase 415V AC 50Hz			
	c) Heater, lamp & socket	Single phase 240 V 50HZ			
20	Safe duration of overload				
	150% of rated current	5 minute			
	120% of rated current	30 minute			
21	Minimum creepage distance of insulator (mm)				
22	Mounting structure	Tubular	Tubular / Lattice	Lattice	Lattice
23	Operating time	Less than 12 secs			
24	Insulator Data				
	a) Bending Strength (kgf)	800	800	800	600
	b) Height (mm)	3650	2300	1500	508
	c) Bottom PCD (mm)	300	254	184	76
	d) No. of holes & hole dia	8x18	8x18	4x18	4xM12
	e) Top PCD	127	127	127	76
	f) No. of holes & hole dia	4xM16	4xM16	4xM16	4xM12
	g) Minimum creepage distance (mm) 25mm/kV	10500	6125	3625	900
25	Bus Bar height from Plinth level (mm)	8000	5900	4600	3700
26	Phase Spacing (mm)	7000	4500	3000	1500
27	Minimum clearances (mm)				
	a) Phase to Phase	4000	2100	1300	320
	b) Phase to earth	3500	2100	1300	320
	c) Sectional clearance	6500	5000	4000	3000

2. SCOPE

This specification provides for design, manufacturer, testing at manufacturer's Works and delivery ,supervision of erection, commissioning (if required) of outdoor station type 400 kV/220kV /132kV /33kV, 3 phase triple pole double break electrically / mechanically gang operated center rotating type (Single / Double) Isolator with / without earth switches, with electrical interlock, insulators and complete in all respect with connectors, arcing horns, operating mechanism, auxiliary switches, indicating devices etc. as described hereinafter.

3. STANDARDS

Isolators covered by this specification shall conform to latest edition of IEC 62271-102 and IS: 9921 and unless specifically stated otherwise in this specification.

4. TYPE

- The Isolators shall be outdoor type with three phase suitable for electrical as well as manual operation and local/remote operation. They shall have crank and reduction gear mechanism.
- All Isolators offered shall be suitable for horizontal upright mounting on steel structures. Each pole unit of the Isolators and earth switches shall be of identical construction and mechanically linked for gang operation for Isolators upto 220kV. 400kV Isolators shall be individual pole electrical gang operated
- Each pole of the Isolator shall be provided with two sets of contacts to be operated in series and the moving contact blades shall rotate in horizontal plane.
- It should be suitable for continuous service at the system voltages specified herein. The Isolators shall be suitable to carry the rated current continuously and full short circuit current at site condition without any appreciable rise in temperature. These shall also be suitable for operation at 110% rated (normal) voltage.
- The Isolators shall be suitable for Isolating low capacitive / inductive currents of 0.7amp at 0.15 power factor. The isolators shall be so constructed that they don't open under the influence of short circuit conditions.
- The Isolators and earth switches are required to be used on electrically exposed installation and this should be taken into account while fixing the clearance between phases and between phase and earth.

5. MAIN CONTACTS

Isolator shall have heavy duty, self-aligning and high pressure line type contacts made of high conductivity, corrosion resistant, hard-drawn electrolytic copper. All copper contact points shall be silver plated to 25 micron thickness or more. Fixed contact should be of reverse loop type with adequate number of copper strips which shall be backed by powerful phosphor bronze/stainless steel springs.

The Isolator moving arm/blade shall be made out of high conductivity, corrosion resistant, hard-drawn electrolytic copper of proper length, thickness and contact/surface area for Isolators upto 220kV.

For 400kV Isolator, the moving arm shall be made out of High conductivity *aluminium* tube of outer diameter not less than 120 mm.

The dimensions of the contacts should conform to the drawing approved during type test. However the current density of the current carrying parts shall not be more than the values specified below.

Current Density in Amps/sq. mm

	<u>Tubes</u>	<u>Flats</u>
Copper	2.5	2.0
Aluminium	1.25	1.0

These fixed and moving contacts shall be able to carry the rated current continuously and the maximum fault current without any appreciable rise in temperature. The Isolator blades shall retain their form and straightness under all conditions of operation including all mechanical stress arising out of operation as well as under rated short circuit condition.

The Isolator shall be self-cleaning type so that when Isolator remains closed for long periods in a heavily polluted atmosphere, binding does not occur. No undue wear or scuffing shall be evident during the mechanical endurance tests.

Contacts and springs shall be designed so that adjustment of contact pressure shall not be necessary throughout the life of the isolator. Contact springs shall not carry any current and shall not lose their characteristics due to heating effects. Each contact or part of contacts shall be independently sprung so that full pressure is maintained on all contact at all times.

The live parts shall be designed to eliminate sharp joints, edges and other corona producing surfaces, where this is impracticable adequate corona rings made out of aluminium tubes shall be provided. Corona shields are not acceptable.

6. Base :

Each single pole of the isolator shall be provided with a complete galvanized steel base provided with holes and designed for mounting on a supporting structure. The base for 400/220/132 kV shall be made out of two channels of size 200x100 / 150x75 / 150x75 or more having thickness not less than 5mm. Base channel shall be rigid in construction and capable of taking all the loads like short circuit force, terminal load, wind load and vibration caused due to seismic / operation of Isolator. Leveling screws of adequate size shall be provided on either side of the base channel under the Insulator for the alignment of Isolator. For 33kV Isolator single base channel of size 100x50 can be provided.

The rotating insulator shall be mounted on a rotating post which shall have two ball bearings of suitable size and housed inside a bearing housing made out of aluminium alloy and greased for life. The distance between the bearings shall not be less than 200/150/125/70 mm for 400/220/132/33 kV respectively.

7. ARCING HORN AND GRADING HORN

Suitable arcing horn made of GI shall be provided on the fixed and moving contacts of Isolators if required. The contacts shall be of 'make before and break after' type.

8. ELECTRICAL INTERLOCK / MECHANICAL INTERLOCK

The Isolators shall be equipped with electrical interlock for interlocking with the associated circuit breakers and earth switch. The interlocking scheme shall be approved by OPTCL.

Suitable mechanical / constructional interlock shall be provided between Isolator and earth switch which should be rigid in construction and properly mounted to ensure reliable operation.

9. AUXILIARY SWITCHES

All isolators and earth switches shall be provided with 220V DC auxiliary switches for remote position indication on the control panel and for electrical interlocking with other equipment.

The auxiliary switch shall be provided with a minimum of auxiliary contacts-12 normally open and 12 normally closed and 10 normally open and 10 normally closed for earth switch.

The auxiliary switches and auxiliary circuits shall have a continuous current carrying capacity of at least 10 Amps. Auxiliary switches shall not be used as limit switches.

Details of make, rating and type of auxiliary switch along with the type test report shall be furnished in the offer.

10. EARTH SWITCH

a) Where earth switches are specified these shall include the complete operating mechanism and auxiliary contacts. The earth switch shall be operated by a separate mechanism.

b) The earth switches shall form an integral part of the isolator and shall be mounted on the base frame of the isolator.

c) Earth switches shall be only locally operated.

d) The earth switches shall be constructionally interlocked with the isolator 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 interlocks. Suitable mechanical arrangement shall be provided for delinking electrical drive for manual operation.

e) Each earth switch shall be provided with flexible copper braids or any other improved design 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) 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.

h) The earth switch should be able to carry the same fault current as the main blades of the Isolators and shall withstand dynamic stresses.

i) 400 kV earth switches shall be of double movement type (telescopic) i.e. it has to rotate 90 degree in first movement and then lift upwards to make a contact which ensures a

reliable and jerk free operation of the earth switch. Proper locking arrangement shall be provided such that the earth switch shall be locked after lifting upwards to avoid opening during short circuit.

11. OPERATING MACHANISM

a) The bidder shall offer motor operated Isolators and earth switches except for the earth switches of 33 kV Isolator which shall be manual operated with crank and reduction gear mechanism.

b) *Control cabinet/operating mechanism box shall be made of cast aluminium / aluminum sheet of adequate thickness (minimum 3 mm) for 33 KV,132KV and stainless steel (grade-316) of minimum thickness 1.6 mm for 400 KV and 220 KV.*

c) The enclosure shall be painted / powder coated to the Shade no 631 of IS:5(for aluminium enclosure)

d) The enclosures of the operating mechanism Box shall conform to the degree of protection IP- 55

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) For 400kV Isolators, Gang / Individual switch shall be provided.

g) Provision shall be made in the control cabinet to disconnect power supply through suitable MCBs to prevent local/remote power operation.

h) All control switches shall be of MCB/rotary switch type and Toggle/piano switches shall not be accepted.

i) Motor shall be an AC motor as per IS:325. Motors rated 373 watt and above shall be used. The motor shall withstand without damage stalled torque for atleast 3 times the time lag of tripping device.

j) Suitable reduction gearing shall be provided between the motor and the drive shaft of the isolator. The mechanism shall stop immediately when motor supply is switched off.

k) Manual operation facility (with handle) should be provided with necessary interlock to disconnect motor.

l) 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. The Gears shall be lubricated for life with graphite or better quality non-drawing and non-hardening type grease.

m)The test report for blocked rotor test of motor shall be submitted

n) Only stranded copper conductor shall be used for wiring. Minimum size of the conductor for control circuit wiring shall be 2.5 sq.mm Copper.

o) The operating mechanism shall be located such that it can be directly mounted on the support structure.

- p) Suitable anti condensation heaters with the provision of thermostat shall be provided.
- q) Each operating mechanism shall be provided with 1100V grade stud type terminal block of Polyamide material. (OAT-6 for non-disconnecting type and OAT 6T for disconnecting type of Elmex) / Connectwell (Equivalent). At least 20% spare terminals shall be provided.
- r) A light fixture suitable for a 240 V CFL tube light shall be provided in each of the motor operated mechanism & shall be door operated type.
- s) A 240V, single phase, 50 Hz, 15 amp AC plug and socket shall be provided in the cabinet with ON-OFF switch for connection of hand lamps.
- t) A position indicator to show the isolator is in ON or OFF position to be provided at a suitable location.

12. OPERATION

The main Isolator and earth switches shall be individual pole electrically ganged motor operated for 400 kV and mechanically gang operated in case of 220/132/33 kV. The operating mechanism of the three poles shall be well synchronized and interlocked.

The Isolator blades shall be in positive continuous control throughout the entire cycles of operation. The operating rods and pipes shall be rigid enough to maintain positive control under most adverse conditions and to withstand all torsional and bending stresses arising from operation. Operation of the switches at any speed should not result in improper functioning, in displacement of parts / machines after final adjustment has been made. All holes in cranks, linkages etc. having moving pins shall be drilled and fitted accurately so as to prevent slackness and lost motion.

The isolator and earth switches shall be provided with "dead center mechanism" to prevent accidental opening by wind, vibration, short circuit forces or movement of the support structures.

13. DESIGN, MATERIALS AND WORKMANSHIP

- The live parts shall be designed to eliminate sharp points, edges and similar corona producing surfaces, where this is impracticable, adequate rings made out of aluminium tubes shall be provided. Corona shields are not acceptable.
- All ferrous metal parts shall be hot dip galvanized, as per IS 2629. All metal parts shall be of such materials or treated in such a way so as to avoid rust, corrosion and deterioration due to continued exposure to atmosphere and rain.
- Bolts, screws and pins shall be provided with standard locking device viz. Locknuts, spring washers, keys etc. and when used with current carrying parts, they shall be made of copper silicon or other high conductivity and wear resistant alloys.
- The switches should not need lubrication of any parts except at very long interval of five year minimum.

14. PROTECTIVE COATINGS

All ferrous parts including bolts, nuts and washers of the switches assembly shall be galvanised to withstand at least six one minute dips in copper sulphate solution of

requisite strength (Preece dip tests) except the threaded portions which should withstand four dips.

15. INSULATORS

- Support insulators for all type of isolators shall be of solid core type.
- The insulator shall be made of homogeneous and vitreous porcelain of high mechanical and dielectric strength. It shall have sufficient mechanical strength to sustain electrical and mechanical loading on account of wind load, short circuit forces etc. Glazing of the porcelains shall be of uniform dark brown colour with a smooth surface arranged to shed away rain water.
- The porcelain shall be free from laminations and other flaws or imperfections that might affect the mechanical or dielectric quality. It shall be thoroughly vitrified, tough and impervious to moisture.
- The porcelain and metal parts shall be assembled in such a manner and with such material that any thermal differential expansion between the metal and porcelain parts throughout the range of temperature specified in this specification shall not loosen the parts or create internal stresses which may affect the mechanical or electrical strength or rigidity. The assembly shall not have excessive concentration of electrical stresses in any section or across leakage surfaces. The cement used shall not give rise to chemical reaction with metal fittings.
- The insulator shall be suitable for water washing by rain or artificial means in service condition.
- Profile of the insulator shall also conform to IEC-815.
- Caps to be provided on top of the insulator shall be of high grade cast iron or malleable steel casting. It shall be machine faced and hot dip galvanized. The holes shall be suitable for bolts with threads having anti corrosive protection. The effective depth of threads shall not be less than the nominal diameter of the bolt. The cap shall be so designed that it shall be free from visible corona and shall have radio interference level within 500 micro volts.
- Casting shall be free from blow holes cracks and such other defects.

16. Name plate :

Isolator, earth switches and their operating devices shall be provided with name plate. The name plate shall be weather proof and corrosion proof. It shall be mounted in such a position that it shall be visible in the position of normal service and installation. It shall carry the following information's duly engraved or punched on it. Name plate shall be bilingual i.e. in English & Oriya

A. Isolator Base

Name : OPTCL
Name of manufacturer –
Type Designation –
Manufacturers serial No. –
Rated voltage –
Rated normal current –
Rated short time current (rms) and duration –
Rated short time peak current (KAP)
Weight

B. Earthing Switch

Name : OPTCL
Name of manufacturer –
Type Designation –
Manufacturers serial No. –
Rated voltage –
Rated normal current –
Rated short time current (rms) and duration
Rated short time peak current (KAP)
Weight

C. Operating Device

Name – OPTCL
Name of manufacturer –
Type Designation –
Reduction gear ratio –
AC motor
i) Rated auxiliary voltage
ii) Starting current
iii) Designation of AC motor as per I.S 4722/325
iv) Starting torque at 80% of supply voltage
v) Over travel in degrees after cutting off supply
Total operating time in seconds
i) Close operation – Electrical
ii) Open operation – electrical
Open operation – manual

All components shall be given adequate treatment of climate proofing as per IS:3202 so as to withstand corrosive and severe service conditions.

All metal parts not suitable for painting such as structural steel, pipes, rods ,levers, linkages, nuts and bolts used in other than current path etc. shall be hot dip galvanized as per IS -2629

Complete details of painting, galvanizing and climate proofing of the equipment shall be furnished in the offer.

17. TESTS

Type Tests

Isolators offered, shall be fully type tested as per the relevant standards. The Bidder shall furnish one set of the following valid type test reports for their different type of offered Isolators along with the offer. The Purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative. For this purpose the Bidder may quote unit rates for carrying out each type test and this will be taken during bid price evaluation, if required.

The following type test reports shall be submitted for evaluation purpose. In the absence of any one of the following, the bid is liable to reject.

- a) Short time withstand & peak withstand current test for Isolator & Earth Switch.
- b) Power frequency (Dry & Wet), Lightning Impulse dry withstand Test
- c) Radio interference voltage (RIV) test

- d) Mechanical endurance Test & Terminal load test
- e) Degree of Protection test (IP-55)
- f) Corona Test (For 400kV Only)
- g) Temperature rise test
- h) Blocked rotor test

During type tests the isolator shall be mounted on its own support structure or equivalent support structure and installed with its own operating mechanism to make the type tests representative. Drawing of equivalent support structure and mounting arrangements shall be furnished for Purchaser's approval before conducting the type tests.

The type tests shall be conducted on the isolator along with approved insulators and terminal connectors.

Mechanical endurance test shall be conducted on the main switch as well as earth switch of one isolator of each voltage class for M0 class (1000 operations) for Isolators upto 220kV. 400kV Isolators shall be tested for extended mechanical endurance test, M2 class (10000 operations) as per IEC 62271-102 which shall be tested at any NABL accredited independent laboratory like CPRI/ERDA.

Acceptance and Routine Test :

All acceptance and routine test as stipulated in the relevant standards shall be carried out by the supplier in presence of Purchaser's representative.

Mechanical operation test (routine test) shall be conducted on isolator (main switch and earth switch) at the supplier's works as well as purchaser's substation site.

Immediately after completion of the routine test, the supplier shall give 20 days' advance intimation along with routine test certificates, valid calibration reports from Govt. approved test laboratories for the equipments, instruments to be used during testing for scrutiny by the purchaser to enable him to depute his representative for witnessing the tests.

If there will be any discrepancies in the routine test certificates and calibration reports furnished by the manufacturer, then after settlement of the discrepancies only, purchaser's representative will be deputed for witnessing the tests.

Special tests proposed to be conducted (if decided to conduct) as type test on isolators, are given at Annexure. These special type test charges shall be quoted along with all other type tests as per relevant IEC standard and these charges shall be included in the total bid price.

Test certificates of various raw materials and bought out items including but not limited to the following shall be furnished at the time of routine tests.

- a) Chemical analysis of copper alongwith a copy of excise certificate indicating genuine source of procurement of electrolytic grade copper.
- b) Aluminium extrusions
- c) Aluminium ingots & castings
- d) Fasteners
- e) Insulators
- f) Motor
- g) Gears
- h) Auxiliary switch

- i) Limit switch
- j) Overload / single phase preventer
- k) Interlocking devices
- l) Terminal block

18. INSPECTION

- i) The Purchaser shall have access at all times to the works and all other places of manufacture, where the Isolators, earth switches and associated equipment are being manufactured and the supplier shall provide all facilities for unrestricted inspection of the works of raw materials manufacture of all the accessories and for conducting necessary tests as detailed herein.
- ii) The supplier shall keep the purchaser informed in advance of the time of starting of the progress of manufacture of equipment in its various stages so that arrangements could be made for inspection.
- iii) No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.
- iv) The acceptance of any quantity of the equipment shall in no way relieve the supplier of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection if such equipment are later found to be defective.

19. QUALITY ASSURANCE PLAN

The Bidder shall invariably furnish following information along with his offer, failing which his offer shall be liable for rejection.

- (i) Names of sub suppliers for raw materials, list of standards according to which the raw materials are tested, list of tests normally carried out on raw materials in presence of Supplier's representative, copies of test certificate
- (ii) Information and copies of test certificates as in (I) and (ii) above in respect of bought out accessories.
- (iii) List of manufacturing facilities available
- (iv) Level of automation achieved and list of areas where manual processing still 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) List of testing equipments with calibration certificates from Govt. approved test house available with supplier for final testing equipment and test plant limitation if any, vis-à-vis the type, special acceptance and routine test specified in the relevant standards. These limitations shall be very clearly brought out in the specified test requirements.

The supplier shall within 30 days of placement of order, submit following information to the purchaser.

- i) List of raw material as well as bought out accessories and the names of sub-suppliers selected from the lists furnished along with offer.
- ii) Type test certificates of the raw material and both bought out accessories.
- iii) Quality Assurance Plan (QAP) with hold points for purchaser's inspection.

20. DOCUMENTATION

All drawings shall conform to relevant international standards organisation (ISO). All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in S.I. Units.

The Bidder shall furnish four sets of following drawings / documents along with his offer.

- a) General outline and assembly drawings of the dis-connector operating mechanism, structure, insulator and terminal connector.
- b) Sectional views and descriptive details of items such as moving blades, contacts, arms contact pressure, contact support bearing housing of bearings, balancing of heights, phase coupling pipes, base plate, operating shaft, guides, swivel joint operating mechanism and its components etc.
- c) Loading diagram
- d) Drawings with structure for the purpose of type tests.
- e) Name plate.
- f) Schematic drawing.
- g) Type test reports.
- h) Test reports, literature, pamphlets of the bought out items and raw material.

The supplier shall within 2 weeks of placement of order submit four sets of final versions of all the above said drawings for Purchaser's approval. The purchaser shall communicate his comments / approval on the drawings to the supplier. The supplier shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for Purchaser's approval within two weeks from the date of comments. After receipt of approval the supplier shall within three weeks submit 5 prints and soft copies in two CD of the approved drawings for purchaser's use.

Six sets of the type test reports, duly approved by the Purchaser shall be submitted by the supplier for distribution, before commencement of supply Adequate copies of acceptance and routine test certificates, duly approved by the Purchaser shall accompany the despatched consignment.

The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the supplier risk.

21. INSTRUCTION MANUALS :

Five copies of the erection, operation and maintenance manuals in English be supplied for each type of Isolator one month prior to despatch of the equipment. The manual shall be bound volumes and shall contain all drawings and information required for erection, operation and maintenance of the Isolator including but not limited to the following particulars.

- (a) Marked erection prints identifying the component parts of the Isolator as shipped with assembly drawings.
- (b) Detailed dimensions and description of all auxiliaries.
- (c) Detailed views of the insulator stacks, metallics, operating mechanism, structure, interlocks, spare parts etc.

22. PACKING AND FORWARDING.

The 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 symbols. 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.

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) Handling and unpacking instructions.
- (f) Bill of material indicating contents of each package.

The supplier shall ensure that the bill of material is approved by the purchaser before dispatch.

23. SUPERVISION OF ERECTION TESTING & COMMISSIONING (ET&C)

Purchaser proposes to utilize the services of the supplier for supervision of testing and commissioning of the equipment being supplied by him, if it is required. For this purpose, the supplier should make available the services of trained personnel (Engineers) who shall correct in the field, any errors or omissions in order to make the equipment and material properly perform in accordance with the intent of this specification.

The Engineer shall also instruct the plant operators in the operation and maintenance of the commissioned equipment. The supplier shall be responsible for any damage to the equipment on commissioning the same, if such damage results for the faulty or improper ET&C.

Purchaser shall provide adequate number of skilled / semi skilled workers as well as general tools and equipment and cranes required for equipment erection, at his own expenses. Apart from the above, the Purchaser shall not be responsible for providing any other facilities to the supplier. Special tools if required for erection and commissioning shall be arranged by the supplier at his cost and on commissioning these shall be supplied to the purchaser free of cost for future use.

24. QUATITITY AND DELIVERY REQUIREMENTS :

The scope of supply shall include a supply of 2.5% extra quantity of galvanised bolts, nuts, washers, split pins, cotter pins and such other small loose items free of cost.

ANNEXURE
(Isolators)

LIST OF SPECIAL TESTS TO BE CARRIED OUT (IF DECIDED BY THE PURCHASER)

Sl. No.	Name of the Test	Standard to which it conforms.
1.	Test for visible Corona and Radio interference voltage (RIV) on Isolators and terminal connector	NEMA Pub No. 107-1964 ISRI Pub No. 1-1972
2.	Tests on insulators	IS-2544 IEC. 168

3.	Tests on terminal connectors	IS:5561
4.	Tests on galvanised components	IS:2633
5.	Stalled torque test on motor operating mechanism	At 110% of supply voltage

LIST OF MANDATORY SPARES

Sl. No	Item	Quantity
1.	Copper contact fingers for male and female contact per Isolator	2sets each for each Type of Isolators (400/220/132/33KV)
2.	Relay, power contactors, MCBs, Rotary switches for electrical control circuit per Isolator (Indicate the nos of relay, power contactors, MCBs, Rotary switches used in the electrical circuit of each type of isolators)	2sets for each Type of Isolators
3.	Support insulator stack for one pole of the isolator	2 stacks for each type of Isolators
4.	Terminal pad	2 Nos. for each type of isolators
5.	Limit switch and Auxiliary switch per Isolator (Indicate the nos of each switch used in each type of isolators)	2sets for each type of Isolators
6.	Terminal connectors per Isolator	2 sets for each type of isolators.