

KARNATAKA POWER TRANSMISSION CORPORATION LIMITED

TECHNICAL SPECIFICATION

SECTION: ISOLATORS

**TECHNICAL SPECIFICATION
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CLAUSE NO	PARTICULARS
PART-I	
1.0	SCOPE
2.0	LOCATION
3.0	SERVICE CONDITION
4.0	GOVERNING SPECIFICATION
5.0	RATING AND OTHER PARTICULARS
PART –II	
1.0	TYPE OF DISCONNECTS.
2.0	CURRENT DENSITY.
3.0	DESIGN AND CONSTRUCTION.
PART-III	
1.0	TESTS.
2.0	INSPECTION
3.0	DOCUMENTATION.
4.0	PACKING AND FORWARDING.

ISOLATORS

SECTION – i : TECHNICAL SPECIFICATION FOR 110kV / 60kV / 33kV AIR BREAK ISOLATORS

PART I

1.00 SCOPE

1.01 This specification covers design, manufacture, testing and supply of following voltage and current class of isolators.

- a) Void.
- b) Manually operated (i) 110KV, 1250 Amps, (ii) 66KV, 1250Amp and (iii) 33 KV, 800 Amps

The type of mounting and the provision of earth switch shall be as follows

- a) Upright mounting type with manually operated earth switch
- b) Upright mounting type without earth switch.
- c) Under hung mounting type without earth switch.

1.02 The isolator shall be of the manual operated type with and without earthing switches and shall complete with all parts and accessories including insulator operating rods, mounting attachments, necessary for their efficient operation.

1.03 The earthing blades shall be of the manually operated type and shall be complete with all parts and accessories including mounting attachment, operating rod, operating mechanism box etc., necessary for the efficient operation.

1.04 It is not the intent to specify completely herein. All details of the design and construction of equipments, however the equipment shall confirm in all respect to high standards of engineering mentioned in clause No. 4.0 design and workmanship and shall be capable of performing in continuous commercial operation up to the suppliers guarantee in a manner acceptable to the purchaser, who will interpret the meanings of drawing and specification and shall have the powers to reject any work or material which, in his judgment, is not in accordance therewith. The equipment offered shall be complete with all components necessary for its effective and trouble free operation along with associated equipments, interlock, protection schemes, etc. Such components shall be deemed to be within the scope of bidder's supply irrespective of whether those are

specifically mentioned, brought out in this specification and / or the commercial order or not. All similar parts particularly removable ones shall be interchangeable.

1.05 The isolator shall be suitable for Local manual control.

2.00 LOCATION

2.01 The isolators are required at sub stations specified above, where the operating conditions i.e., height of live point and phase to phase dimensions, will vary quite considerably from location to location.

3.00 SERVICE CONDITIONS:

3.01 The 110KV / 66 KV triple pole air break isolators are intended to be used primarily with associated circuit breakers for sectionalizing lines, and transformers

3.02 The earthing blades are intended to be provided on the line/Capacitor sectionalizing isolators for solidly earthing, each of the phase conductor of the line before any repair / maintenance work on the transmission line is undertaken.

3.03 ATMOSPHERIC CONDITIONS

Please refer to meteorological data Annexure - II, Volume - II.

4.0 GOVERNING SPECIFICATION:

4.01 The isolator shall unless otherwise specified, generally conform the IS : 9921 (Part I to IV) - 1985, which shall be applied in the manner altered, amended or supplemented by this specification, the latest Indian Electricity Rules wherever applicable.

4.02 Any deviation from this specification offered to improvement performance, utility and efficiency of equipment proposed by the bidder will be given due consideration, provided full particulars with justification thereof are furnished.

4.03 In the preparation of this specification, details have been taken from IEC 600 - 129 "alternating current disconnects (Isolators) and earthing switches", and IS 9921 (Part-I to IV) "Specification for alternating current disconnects (isolators) and earthing switches for voltages above 1000V".

4.04 Equipment meeting with the stipulations of equivalent IEC, ANSI, CSA, DIN standards which ensure equal or better quality than the standards listed in Clause No. 4.05, shall also be acceptable. In such case the bidder should submit along with this offer, two copies of such standards, in authentic English translation, if the language of the standard is other

than English. In case of dispute, the stipulations in English translation, submitted by the bidder shall prevail. Further, in the event of conflict between the stipulations of the standard adopted be the bidder, corresponding Indian Standard specification shall prevail.

4.05 In this specification reference has been made to the following Indian standard and other specifications.

- i) IS : 9921-85
Part-I, II, III & IV)- Specification for alternating current Disconnects (isolators) and earthing switches for voltages above 1000V.
- ii) a) IS: 2544-1973 &
b) IS : 5350-1970 - Porcelain post insulators for systems with nominal voltage greater than 1000V.
- iii) IS : 7608 - Phosphor bronze wires (for general engineering purposes)
- iv) IS : 2108-1977 - Black hard malleable iron castings
- v) IS : 1570
(Part - IQ- 1979 - Carbon steel (unalloyed steels)
- vi) IS : 2071 - General definitions, test requirements & test procedures.
(Part-I & II)-1974
- vii) IEC: 600129 - Alternating current disconnects (isolators) and earthing switches
- viii) IS : 7906 - Helical compression springs
(Part-III)-1975
- ix) IS: 5561 – 1970 - Electric power connectors
- x) IS: 996-1979 - Single phase small AC and Universal electric motors.
- xi) IS: 5358-1969 - Galvanizing of ferrous parts.
- xii) IS : 2633 - Method of testing conformity of coating of zinc coated articles.

5.00 RATING AND OTHER PARTICULARS

5.01 The isolators shall be designed for the following rating and other particulars.

Sl. No.	Particulars	110KV	66KV	33KV
i	Typemanually operatedmanually operated	..manually operated
		Double break,	Double	Double break,

		upright mounting/ underhung mounting with the movement of the blade in a horizontal plane suitable for outdoor installation.	break, upright mounting/ underhung mounting with the movement of the blade in a horizontal plane suitable for outdoor installation	upright mounting/ underhung mounting with the movement of the blade in a horizontal plane suitable for outdoor installation
ii	No. of poles (Phases)	Three	Three	Three
iii	Rated Voltage	123KV	72.5KV	36KV
iv	Rated normal current	2000/1250A	2000/1250A	800A
v	Rated frequency	50 Hz	50 Hz	50 Hz
vi	System neutral earthing effectively earthed...	.. effectively earthed...	.. effectively earthed...
vii	Rated short time withstand current of main switch and earth switch	40KA (rms) for 1 sec	40KA (rms) for 1 sec	25KA (rms for 1sec
viii	Rated peak withstand current	2.5 times the rated short time withstand current	2.5 times the rated short time withstand current	2.5 times the rated short time withstand current
ix	Rated 1.2/50 micro second impulse withstand voltage (peak) a) to earth b) across isolating distance	550kv 630kv	325kv 375kv	170kv 195kv
xi	Operating time of the isolator	--shall not exceed 10 seconds--	--shall not exceed 10 seconds--	--shall not exceed 10 seconds--
xiii	Temperature rise a. Copper contacts in air i. Silver faced copper ii. Bare copper b. Terminal of isolator to be connected to external conductors by bolts i. Silver faced copper	Max. Temp deg.C 105 75 105	Max. Temp deg.C 105 75 105	Max. Temp deg.C 105 75 105

	ii. Bare copper	90	90	90
	c. Metal parts acting as springs	The temperature shall not exceed a value, where the elasticity of the materials is impaired. For pure copper the temp. limit is 75deg. C	The temperature shall not exceed a value, where the elasticity of the materials is impaired. For pure copper the temp. limit is 75deg. C	The temperature shall not exceed a value, where the elasticity of the materials is impaired. For pure copper the temp. limit is 75deg. C
xiii	Safe duration of over load			
	a. 150 % of rated current	5 minutes	5 minutes	5 minutes
	b. 120% of rated current	30 minutes	30 minutes	30 minutes
xiv	Minimum creepage distance (mm)	3075	1815	840
xv	Rated mechanical terminal load			
	a. Straight load (Kgf)	51	40.76	35
	b. Across load (Kgf)	17.33	13.26	13.26
xvi	Phase to Phase spacing for installation(mm)	2000 / 2700	2000	1500
xvii	Height of center line of terminal pad above ground level (mm)	4600	4250	4000

5.02 The isolator will be called upon to close or interrupt the charging current drawn by bus bars, breakers and similar equipments. The bus selectors and by pass isolators will be used to change over the line connection from main bus bar to duplicate bus bar without the interruption of power supply, in the event of outage of line circuit breakers. Hence isolators should be capable of closing or interrupting a current of magnitude indicated in 5.01 (iv) above.

5.03 RATING AND OTHER PARTICULARS FOR EARTHINS SWITCHES:

5.03.01 The earthing blades shall be designed for the following rating and other particulars.

- i. Type Manually operated, vertically mounted, vertical air break type, suitable for outdoor installation.
- ii. Rated Voltage Associated with respective

		123KV, 72.5KV, 36 KV rated voltage isolators.
iii.	Rated frequency	50 Hz.
iv.	No. of poles(phases)	three
v.	Rated short time withstand current	a) 40KA (rms) for 1 sec for 123KV and 72.5 KV systems b) 25 KA for 1 sec for 33 KV system
vi.	Rated peak withstand current	2.5 times the rated short time withstand current.

5.03.02 Isolators provided with ear thing blades shall have a set of contacts so as to effectively earth the fixed contact of the isolator, when the ear thing blade is closed. The earth blade and its contacts shall be capable of carrying the same rated peak short circuit current and the rated short time current as applicable to the main isolator. The earth switch fixed contact shall be identical to that of main isolator fixed contact. The moving contacts shall also be made of electrolytic copper. The ear thing of the blades shall be effected by flexible copper blades, liberally rated to carry the full short circuit current specified in clause 5.01 (vii – viii)

5.03.03 The eathing blades of all poles of the isolator shall be mounted on the same shaft and shall be operated by a single and common operating handle which shall be distinct from the one for the main switch of the isolator. The blades of all poles shall fasten simultaneously into all fixed contacts.

5.04 **CLEARANCE:**

5.04.01 The clearance between live parts and ground structure shall not be less than those specified in the IS – 10118, part – III, 1982. The length of break in full open position should be such that there is absolutely, no possibility of arc over from the live parts to the de-energized parts on which any maintenance work have to be done. The speed of opening or closing the switch shall be designed to ensure that the arcing during the operation is reduced to the minimum.

Part - II
ISOLATORS
GENERAL TECHNICAL REQUIREMENTS

1.00 TYPE OF ISOLATORS :

The ISOLATORS shall be of three phase gang operated horizontal, double break type with turn and twist type moving blades and with or without gang operated vertical break earth blades as per requirements.

2.00 CURRENT DENSITY:

Current density, to be adopted, for all parts of isolator and terminal connector shall not exceed the following limits.

- | | | | | |
|----|--|-----------|---|----------------|
| a) | Hollow tube sections | – Copper | - | 2.0 A / Sq. mm |
| | | Aluminium | - | 1.25A /Sq. mm |
| b) | Other sections and terminal connectors | | | |
| | | Copper | - | 1.6 A/Sq. mm |
| | | Aluminium | - | 1.0 A/Sq. mm |

3.0 DESIGN AND CONSTRUCTION :

3.01 Qualifying Requirements : Please refer Vol – I, Section IFB

The full particulars of design, manufacture, template and quality control devices developed for manufacture of the equipments - offered in respect of the following items shall be furnished with drawings and descriptions.

- i. Contacts, material, current density etc.,
- ii. Design of contact pressure.
- iii. Contacts support and fixing arrangement on insulators
- iv. Turn and twist mechanism, clamps, locks, etc.
- v. Bearings, housing of bearing, bushes, etc.
- vi. Balancing of heights.
- vii. Coupling pipes, joints, connection adjustments.
- viii. Base plates.
- ix. Down pipe, guides joints.
- x. Brass bushes and bearings at various joints
- xi. Operating mechanism, type of gear, auxiliary switch, size and thickness of box, degree of protection. Gland plate, gland, etc.
- xii. Nuts, bolts and fasteners
- xiii. Interlocking devices

Offers without the above information or with incomplete information is **liable for rejection.**

3.02 TYPE AND CONSTRUCTION:

The design of the isolators shall be such that the switch can be changed to right or left hand control without excessive labour and with a minimum change of parts. The live parts shall be of non-rusting, non-corroding metal. Current carrying parts shall be nonferrous. Bolts, screws and pins shall be provided with lock washers, keys or other equipment locking facilities. Current carrying parts shall be made of copper alloy or equivalent material. The switch shall not require lubrication of any part, at frequent intervals.

The isolator shall be suitable for mounting in upright or under hung position (with the blades moving in horizontal plane) on steel / fabricated steel structures. The heights at which the isolators will be mounted along with phase to phase dimensions are as per clause 5.00, Part - I. Any change in dimensions, will be intimated to successful bidder. Necessary lengths of operating rod as required shall be supplied. The bidder should agree to modify the base mounting detail of under hung switches depending upon the supporting beam mounting details, if so required, by the purchaser at a later date.

3.03 OPERATING MECHANISM:

3.03.01 Void.

3.03.02 FOR MANUALLY OPERATED ISOLATOR:

- a). Manual operating mechanism, gang operated through crank & reduction gear shall be provided for main switch.
- b) Manual operating mechanism, gang operated through a lever / handle for the operating shaft shall be provided for earth switch.

3.03.03 The design of the operating mechanism shall be such that minimum energy is required for operation and one person shall be able to operate the switch without undue effort. The blades shall be in positive continuous control throughout the entire cycle of operation. Suitable reduction gear to achieve above aspects may be provided, for main switch and shall close or open with about 20 revolutions of the crank. The earth switch shall close or open by rotation of lever / handle through 90 degrees.

The operating pipes and rods shall be sufficiently rigid to maintain positive control without tension or compression & there shall also be capable of withstanding all torsional and bending stresses due to operation of the disconnecting switch. It shall not be possible, after final adjustment has been made for any part of the mechanism to be displaced at any point in the travel sufficiently to allow improper

functioning of the switch, when the switch is opened or closed at any speed. All holes, ill crank, linkages, etc., having moving pins, shall be drilled to accurate fit, so as to maintain the minimum amount of slack and lost motion. The operating mechanism and its controls shall be so designed that under no circumstances the switch blades travel is interrupted before it reaches the fully close or open position. The operating mechanism shall be suitable to hold the main switch or earth switch in closed or opened position to prevent operation by gravity, wind, short circuit, seismic acceleration, vibration, shock, accidental touching etc.

3.03.04 CONTROL CABINET:

The operating mechanism and all accessories shall be enclosed in a weather, dust and vermin proof cabinet. The control cabinet of each operating mechanism shall be made out of 12 SWG (2.64 mm thick) steel sheet. or 10mm thick aluminum in the form plate or casting. Control cabinet shall be provided with hinged doors along with padlocking arrangement. Sloping rain hood shall be provided to cover all sides. 15 mm thick neoprene or better type gasket shall be provided to ensure degree of protection at least IP 55 as per IS : 2147.

The motor operating mechanism / manually operating mechanism shall be mounted on the base supporting structures or on a separate Support-structure at a height of 300 mm from the ground level. Operating or lever for manual operation shall be at a convenient height of 1000 mm above ground level for easy operation. The unsupported length of the operating rod shall not. exceed 3 meters. Guide bearings shall be provided at suitable intervals. All brackets angles or other members mid accessories necessary for fixing the operating mechanism to switch supporting structure. and the bearing for operating rods shall be supplied. Rust proof pins and bearings of the bronze bushing, ball or roller type shall be provided. All ball and roller bearings shall be protected from weather by means of covers and grease retainers. Bearing pressures shall be kept low to ensure long life.

3.03.05 GEAR:

The disconnect may be required to operate occasionally with considerably long idle intervals. Special care shall be taken for selection of material for gear and lubrication of gears to meet these requirements. The gears shall be made of bronze or any other better material and lubricated for life with graphite or better quality non-draining or non-hardening grease. complete details of components, materials, self-lubricating arrangement, grade of lubricant, details of jigs, fixtures and devices used for quality check shall be furnished in the bid.

3.03.06 GLAND PLATE AND GLANDS:

Removable gland plate with double compression type brass type glands shall be provided with each operating mechanism for terminating of cables. Exact quantity of glands to be provided, shall be intimated to the successful bidder.

3.03.07 AUXILIARY SWITCHES:

Each disconnect switch shall be provided with EIGHT normally closed electrically separated spare contacts, in addition to the auxiliary contact required for its operation and indication mounted in a weather proof, dust tight metal housing suitable for outdoor use and with necessary cable glands. Auxiliary switch shall be provided for the grounding blades also. The auxiliary contacts, shall be made of non-ferrous metal. The contact shall be convertible type so that normally open contact May be converted to normally closed contact and vice versa. The auxiliary contact shall be rated at 10 Amps. at 240 V AC and 2 Amps. at 110V DC.

The auxiliary contact shall be adjustable type to suite the following requirements ;

- a) Signaling of "Closed position" shall not take place unless the main contacts have reached a position so that rated normal and short time current can be carried safely.
- b) Signaling of "open position" shall not. take place unless the main power contacts are at a safe isolating distance.
- c) All earthing blade assemblies shall be provided with three sets of normally open and three sets of normally closed auxiliary switches for signaling to the control room and for interlocking with any other equipment.
- d) The auxiliary switches and auxiliary circuit shall be capable of carrying a current of atleast 10 Amps continuously.
- e) Auxiliary switches shall be capable of breaking atleast 2 A in a 110V DC circuit with a time constant of not less than 20 milli seconds.
- f) Quick make and break (QMB) type auxiliary, switches shall have sharp action built in within this switch.
- a) The auxiliary switches shall be actuated by a cam or similar arrangement directly mounted on the isolator shaft without any intermediate levers, linkages, etc., to ensure foolproof operation.

NOTE:

Potential free contacts shall be provided, duly wired up to the operating mechanism housing / control cabinet for the following alarms and indications to be provided by the purchaser **both** on his control panels and **SCADA**. To cater to this requirement, sufficient number of potential free contacts shall be provided.

3.03.08 WIRING AND TERMINAL BLOCK:

All wiring inside the operating mechanism cabinet shall be done with 1100V grade PVC insulated 2.5 sq. mm stranded copper cable as per IS : 1554 Part I Latest version. All wiring shall be provided with suitable identifying PVC or other plastic ferrules at the end. All the terminal marking shall be indelible preferably engraved. Separate terminal blocks of stud type for AC or DC wiring shall be provided in the cabinet. The ends of wires shall be provided with tinned terminal spade crimped on to the wires. The wiring connected with the heaters in the panel shall be provided with porcelain beaded insulator for a short distance from the heater terminal. No joints shall be permitted in the wiring. All spare contacts of relays, push button, auxiliary switches etc., shall be wired up to the terminal blocks in the mechanism box.

The fuses provided with motor and heater circuit shall be cartridge type (HRC) with suitable fittings.

The terminal block should be located to allow easy access. Terminal blocks shall be 1100 Volts grade, clip-on type, 10 mm square or approved equivalent type and shall have 20% spare terminals. Insulating barriers shall be provided between adjacent connections.

All relays, contactors and other electrical devices mounted in the panel shall have name plates with a rating data and manufacturer's name, etc., Suitable identification label shall also be provided for control switches and fuses etc., including position indications of isolator / earth switch.

3.03.09 LOCKING / INTERLOCKING:

The operating mechanism of the isolator shall be provided with means for being locked with padlocks effectively either in the closed or in the open position.

The isolators shall be provided with a suitable electrical interlock arrangement to work in conjunction with associated circuit breakers. The arrangement shall be such as to prevent operation of the isolator either manually or on motor operation when the circuit breaker is in the closed position. The electrical inter locking shall be suitable for 110V DC supply available at site.

The operation of isolator shall be possible only by means of only one device at a time, i.e., either manually or on motor operation. Adequate means shall, however be provided to make manual operation of isolator possible in the event of failure of auxiliary DC supply to isolator operating mechanism. Under such contingencies also, the isolator operation shall be duly interlocked with the circuit breaker so that the manual operation by means of the operating handle is possible only when the circuit breaker is in the open position. The isolator mechanism

box shall consist of solenoid operating device, which shall prevent insertion of manual opening handle, when the associated circuit breaker is closed, by energizing the solenoid through the circuit breaker auxiliary circuit.

The isolator shall be suitable for provision of castles mechanical locks / interlocks for which drawings shall be supplied by the purchaser after placement of orders.

The interlock shall be provided along with each earth blade assembly such that operation of earth blade assembly is possible only when the associated isolators are locked in the open position by integral lock.

The design of the earthing blade assembly shall be such as to permit use of a pad lock, for locking the operating handle of the earthing blade assembly in the open or in the closed position.

3.04 CONSTRUCTIONAL FEATURES:

3.04.01 FIXED AND MOVING CONTACTS:

The isolator shall have heavy-duty self-aligning high pressure - contacts of modern design. The contact shall be made of high grade, high conductivity, and heat resisting material. The main contacts shall be made of hard drawn electrolytic copper and the surface shall be silver plated. Arcing contacts wherever provided shall close first and open last.

The isolators blades / arms shall be made preferably from tubular section of hard drawn electrolytic copper having suitable diameter and shell thickness, and the contact surface shall be heavily silver plated.

The surface of the contacts shall be liberally designed to withstand safely the-highest short circuit current of the system as specified in the clause 05.01 (vii) - (viii) of part - I.

The male and female contact assembly and blades shall ensure

- i) Electro dynamic withstand ability during short circuit without any risk of repulsion of contacts.
- ii) Thermal withstand ability during short circuits.
- iii) Constant contact pressure even when the live parts of the insulators stacks are subjected to tensile stresses the insulators stacks are subjected to tensile stresses due to linear expansion of connected bus - bars, flexible conductors either because of temperature variation or strong winds.
- iv) Self - wiping action during closing and opening (preferably twisting type contacts). The surface shall be wiped during closing and opening operation to remove any film, oxide coating, etc. wiping action shall not cause scouring or abrasion of surfaces.

- v) Self - wiping ensuring smooth closing of the switch. The temperature rise of the contacts and other current carrying parts shall not be more than 45 deg. C over an ambient air temperature of 45 deg. C, while carrying the rated current continuously. The temperature rise due to passage of rated short-circuit current for a period of 3 seconds shall not cause an), annealing or welding of contacts.

Fixed guides shall be provided so that proper seating of contacts will be obtained by closing even when a blade is out of alignment by 2.5 mm or less.

All movable parts which may be in the current path shall be shunted by flexible copper conductors to prevent breaking due to repeated bending.

Fabrication shall be made with suitable jig to avoid deviation during production. Details of size and shape of contact, springs, back plate, fixing arrangements, design of contact pressure, life of contacts, limit of temperature rise etc., shall be furnished along with the tender.

3.04.02 MOUNTING OF CONTACTS:

Fixed contacts shall be mounted on a block or channel welded to 10 mm thick M.S. plate with holes for fixing on insulators. Slots shall be provided for marginal adjustment of height of contacts. The contacts shall rest on a brass block and with initial tension. Suitable device shall be provided to prevent dishing. Fabrication, welding etc. shall be done in suitable jig to avoid deviation during production.

3.04.03 TURN AND TWIST MECHANISM:

Turn and twist mechanism shall be provided with adequate locking to avoid opening or loosening by wind, short circuit force etc., on moving blade. The springs shall be made out of stainless steel or phosphor bronze or any other better material to have adequate strength and resilience and shall be encased with grease to avoid exposure to rain. The clamps and plates shall be made out of at least 10 mm thick M.S. plate or flat. Fasteners with nylock nuts shall be used wherever necessary. Vulnerable parts shall be fabricated by tubular gas cutting and milling. The entire mechanism shall be fabricated in suitable jig and template to avoid deviations during production.

- 3.04.04 All live parts shall be designed to have smooth surfaces without any sharp points, edges and other corona producing surfaces so as to eliminate corona. at specified extinction voltage or at **1.1 x rated voltage**, if extinction voltage is not specified.

3.04.05 FASTENERS:

Nuts, bolts and washers of M -16 and higher size shall be hot-dip galvanized. The bolts used on tapped holes of insulators cap shall be

galvanized by centrifuge process to avoid excess deposition of zinc on threads. Nuts, bolts and washers of less than M -16 size shall be of stainless steel when used on live parts and nickel plated brass in other parts.

3.04.06 **BEARINGS**

The design and construction of the various bearings should embody all the features required to withstand the climatic conditions specified to ensure dependable and effective operation, even after long period of in action. All bearings in the current path except those specially designed as high pressure contact should be shunted by flexible copper housing having adequate cross section.

Rotating insulator shall be mounted on a housing with bearings. The housing shall be made of gravity die cast metal with smooth surfaces and suitably machined for seating the bearings. Two nos. of bearings with adequate shaft diameter and distance between the bearings shall be provided to avoid wobbling during operations. The bearings shall be of at least 75 mm internal diameter. The bearings shall be of reputed make and lubricated for life. All other friction locations shall be provided with suitable bearings or stainless or brass bushes. The bearings, bushes, joints, springs, etc., shall be so designed that no lubrication shall be required during the service. Complete details of bearings, bushes housing greasing, etc., shall be furnished with tender.

3.04.07 **BALANCING OF HEIGHT:**

Fixed insulators shall be provided with elevator base plate with four studs for balancing of height for isolator of rated voltage of 72.5 KV and above. Thickness of plate and diameter of stud shall be at least 10 mm and 25 mm, respectively. Adequate numbers of nuts, lock nuts and washers shall be provided. Taper washer shall be provided to match inclined surface of steel sections.

3.04.08 **TANDEM AND DOWN PIPE:**

The operating down pipe and tandem pipe shall be of heavy duty GI pipe of the following sizes (Bore dia) for different KV class

		110KV Isolators	66KV Isolators	33KV Isolators
a)	Bore dia of tandem pipe	40mm	32mm	32mm
b)	Bore dia of down operating pipe	50mm	50mm	50mm

Further outside diameter and thickness of pipe shall be as follows as per table - 3 of IS : 1239 (Part - 1) 1990. Mild steel tubes. - Heavy.

S1. No.	Nominal Bore in mm	outer dia Maximum (mm)	outer dia Minimum (mm)	Minimum thickness
1.	32	42.9	42	4
2.	40	48.8	47.9	4
3.	50	60.8	59.7	4.5

i. Tandem pipe:

Two Nos. of tandem pipe shall be used for phase coupling of double break isolator. Base plate of insulators for connection of tandem pipe shall be made out of one piece of at least 10 mm. thick MS plate. Bolt and shackle device shall be used to connect tandem pipe to the base plate. Wherever unavoidable, sliding clamps may be used. These clamps shall be made out of at least 10 mm thick MS plate with four(4) nos. of nuts and bolts. A grub screw shall be provided for securing connection of tandem pipes.

ii) The pipe shall be terminated into a suitable swivel or universal type joint between the insulator bottom bearing and the operating mechanism to take care of marginal angular misalignment at site. All brackets, guides, etc., shall be mounted on the base of the isolator. Arrangement of mounting any guide, bracket, mechanism and the base shall not be accepted, for upright mounting type isolator.

3.04.09 BASE :

Each pole of the isolator shall be provided with hot dip galvanized rolled steel base provided with holes for mounting bolts and designed for mounting on a steel structure. The bases shall be rigid and self supporting and shall require the guying or cross bracing between phases other than the supporting structure. The composite frame of the base shall be made of channel of following minimum sizes.

- i) 125 x 65 x 6 / 8 mm for 110KV isolators.
(twin channel)
- i) 100 x 50 x 6 / 8 mm for 66KV isolators
(twin channel)
- ii) 150 x 75 x 6 / 8 mm. For 33 KV isolators
(single channel)

Fabrication, welding etc. shall be done by suitable jig, power press, and templates to avoid deviations during production. Details and dimensions of sections, jig, templates and device used for production of the base

shall be furnished with tender. The necessary galvanized bolts and nuts for fixing the bases to the structure shall be in scope of supply.

3.05 EARTHING SWITCH:

One earthing switch per pole forming an integral part of the line disconnecting switch and manually operated shall be supplied wherever called for in the schedule of requirements. The earthing switch shall match with main switch. The earthing switch shall be designed for the rating as indicated in 5.03.01 of Part - I. A suitable flexible braided connector shall be provided on the hinge end of the earthing blade for connection to ground bus. The earthing blade shall be operated by a separate mechanism, but shall be mechanically inter locked with the disconnecting switch so that the grounding blade can be closed only when the disconnecting switch is open and vice versa. If possible similar interlock shall be provided with the bypass isolator. Alternatively electrical interlock between the grounding switch and by pass isolator shall be offered.

3.06 INSULATORS:

3.06.01 The isolator shall be provided with solid core insulators.

- a) These shall be of single unit to be used for 110KV, 66KV and 33KV systems. The dimensions and other parameters unless otherwise specified shall generally conform to IS - 5350-Part-11 & IEC60273.
- b) The cylindrical type post insulators shall be of solid core type. Insulators of similar type shall be interchangeable. The mechanical strength class for outdoor cylindrical post insulators shall be of strength class 6, corresponding mechanical strength in tension, compression and torsional shall be as per IS : 53550 Part - II. When operated at maximum system voltage, there shall be no electrical discharge. Shielding rings, if necessary shall be provided.
- c) The parameters of the insulators required shall conform to IS : 0350 - Part - II - 1973 or IEC60 273.

The dimensions, pitch circle diameter, no. of bolts, size of bolt holes, etc., shall conform to the parameters detailed in IS : 5350 Part - II 1973 or IEC 273.

In the case of 110KV, 66KV and 33KV system the cylindrical post insulator shall consist of single unit only.

- d) The insulator shall be provided with a completely galvanized steel base designed for mounting on the support. The base and mounting arrangement shall be such that the insulator shall be rigid and self supporting and no guying or cross bracing between phase shall be necessary.

- 3.06.02 The price of the isolators shall include the cost of insulators which shall be quoted separately. The porcelain used for the manufacture of the insulators shall be homogenous, free from laminations and other flaws or imperfections that might effect the mechanical or dielectric. quality and shall be thorough vitrified, tough and impervious to moisture. The glazing of the porcelain shall be uniform brown colour, with a smooth surface arranged to shade away rain water and free from blisters, burns and other similar defects. Insulators of the same rating and type shall be interchangeable.

The porcelain and metal parts shall be assembled in such a manner and with such materials that any differential thermal expansion between the metal and porcelain parts throughout the operating temperature range will not loosen the parts or electrical strength or rigidity. The assembly shall not have excessive concentration of electrical stress 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 rains or artificial means in service conditions. Further the insulators to be supplied shall be of high- quality and should not result in mismatch and misalignment of stacks during erection and operation.

Each cap shall be of a high grade cast iron or malleable steel casting or steel forging. Cap and base insulators shall be interchangeable with each other. The insulator shall conform to the requirement of the latest edition of IS : 2544, or any other equivalent standard. The bidder should furnish the characteristics of insulators.

- 3.06.03 All the ferrous metal part shall be hot dip galvanized smoothly as per IS : 3638 (as amended up to date), IS : 2623 or any other equivalent authoritative standard. The material shall be galvanized only after shop operations upon it have been completed. The metal parts be for galvanization should be thoroughly cleaned of any paint, grease, rust, scales or alkalies or any foreign deposit which are likely to come in the way of galvanization process. The metal parts coating shall withstand minimum four one minute dips in copper sulphate solution as per IEC - 168.

The insulator unit shall be assembled in a suitable jig to ensure correct positioning of the top and bottom metal fittings relative to one another. The phases of the metal fitting shall be parallel and at right angle to the axis of the insulator and corresponding holes in the top and bottom metal fittings shall be in a vertical plane containing the axis of the insulator.

It shall be sole responsibility of the supplier to carry out thorough inspection and quality, checks on the insulators at the insulator supplier works before offering the insulators for purchaser's inspection.

3.07 ACCESSORIES:

The accessories to be provided on the insulator shall include but not to be limited to the following:

3.07.01 Position Indicators :

A position indicator to show whether the isolator is in ON or OFF position.

3.07.02 Counter Balance Springs

Counter balance springs, cushions, etc., shall be provided to prevent impact at the end of travel both on opening and closing of isolator. The springs shall be made of durable and non-rusting type alloy.

3.07.03 NAME PLATE:

Isolators, earthing switches and their operating devices shall be provided with their nameplate. The nameplate 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.

a) ISOLATORS:

- Karnataka Power Transmission Corporation Limited & P.O. No.
- 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 short time current peak.
- Rated mechanical terminal load.
- Weight.

b) EARTHING SWITCH

- Karnataka Power Transmission Corporation Limited & P.O. No.
- Name of Manufacturer.
- Designation type
- Serial number
- Rated voltage
- Rated short time current.
- Rated maximum duration of short time current.
- Rated mechanical terminal load.
- Weight.

c) OPERATING DEVICE

- Karnataka Power Transmission Corporation Limited & P.O. No.
- Name of Manufacturer.
- Designation type
- Rated voltage
- Rating
- Weight.
- Reduction gear ratio
- Auxiliary, contacts quantity and rating.

3.07.04 PADLOCKING DEVICE:

The isolator and earthing switch shall be provided with padlocking device to permit locking of the isolator and earthing switch in both fully open and fully closed positions.

3.08 AUXILIARY POWER SUPPLY

3.08.01 Auxiliary electrical equipment. shall be suitable for operation Oil the following supply systems.

- | | | |
|----|--|--|
| a) | Power devices | 415V, 3 Phase, 4xvirc 50Hz neutral grounded AC system with variation of -30 to -100% |
| b) | AC control & protective devices
lighting fixture,
space heaters
Fractional.
horse power motors | 240 V single phase 2 wire 50Hz AC supply with one point grounded. |
| c) | DC alarm control & protective devices from station batteries of | 110V, 2 wire ungrounded DC supply with variation of -20 to + 10% |

3.08.02 Above supply voltage may vary as follows:

- | | | |
|----|-----------|--|
| a) | AC supply | Voltage variation : + 10% to -30%
Frequency variation: (+) or (-) 5%
Both variation may occur simultaneously Or independently, |
| b) | DC Supply | (-) 20% to (+) 10% |

Each of the foregoing supplies shall be made available at one terminal point for each isolator for operation of accessory and auxiliary equipment. Terminal point is the control cabinet of the isolator. Bidders' scope shall include distribution beyond the point of supply.

3.09 SIGNALING

3.09.01 Signaling of the close position shall not take place unless the movable contact has set in a position in which the rated normal current, the peak- withstand current and the short time withstand current can be carried safely.

- 3.09.02 Signaling of open position shall not take place unless the movable contact has reached the position such that the clearance between the contacts is at least 80% of the isolating distance.

3.10 EARTHING:

- 3.10.01 Flexible copper connections shall be provided between rotating earth blades and the frame, which shall have a cross section of at least 50 mm square and shall be tinned or suitably treated against corrosion.
- 3.10.02 The frame of each disconnect and earthing switch shall be provided with two reliable earthing terminals for connection to the purchaser's earthing conductor / flat so also clamping screw suitable for carrying specified short time current. Flexible ground connectors shall be provided for connecting operating handle. to the earthing flat. The diameter of clamping screw shall be at least 12 mm. The connecting point shall be marked with earth symbol.

3.11 TERMINAL CONNECTORS

The disconnecting switches shall be provided with high conductivity bimetallic terminal connectors and suitable for Aluminium pipes (BS 1600 schedule 40) and Drake ACSR conductors, the size of which will be indicated. to successful bidder. The connector shall be rigid in respect of ACSR conductors. The terminal connectors shall be expansion type in respect of Aluminium pipes. The terminal connector shall conform to IS : 5561 1970.

Further the terminal connectors shall be suitable for both horizontal or vertical take off.

For bimetallic type of connectors, necessary steps shall be taken by the manufacturers to ensure that there is no adverse effect on the connector and the connected equipment due to bimetallic action.

3.12 SUPPORTING STRUCTURE:

- 3.12.01 The bidder shall quote unit prices per Metric Tonne for support structure for the isolators offered. These galvanized support structures shall be fabricated as per the drawings enclosed for the respective class of isolators. The weight of the supporting structure indicated in the drawing is a provisional weight. The bidder shall quote unit price per metric tonne.
- 3.12.02 The masonry or concrete in foundations shall be arranged and constructed by the Contractor.

3.13 ASSEMBLY

The disconnect shall be fully assembled at the works of the bidder. Typical operation shall be carried out on each type of fully assembled disconnect to ascertain that all parts fit correctly and function satisfactorily.

3.14 PAINTING, GALVANIZING AND CLIMATE PROOFING:

- 3.14.01 All interiors and exteriors of enclosures, cabinets and other metal parts shall be thoroughly cleaned to remove all rust scales, corrosion, grease and other adhering foreign matter and surfaces treated by recognized phosphating (Eg. Seven tank phosphating sequence). After such preparation of surfaces two coats of zinc oxide primer shall be given by suitable stoving and air-drying, etc., before final paint.

Colour of the final paint shall be of shade No. 631 of IS-5, i.e., epoxy light grey. The final painted cubicle shall present aesthetically pleasing appearance free from any dent or uneven surface.

- 3.14.02 Paint inside the metallic housing shall be of anti-condensation type and the paint on outside surfaces shall be suitable for outdoor installation.

- 3.14.03 All ferrous parts not suitable for painting such as structural steel, pipes, rods, levers, linkages, nuts and bolts used in other than current path etc., and also supporting structures shall be hot dip galvanized. Galvanization shall be done after completion of fabrication which shall be capable to prevent corrosion in view of the severe climatic conditions.

Thickness of zinc coating shall not be less than 610 gm of zinc per sq. meter of surface. Zinc coating shall be smooth, clean and of uniform thickness and free from defect. Preparation of galvanizing and the galvanizing itself shall not adversely affect the mechanical properties of the coated material. The quality shall be established by tests per IS : 2633. Galvanizing of nuts and bolts shall be carried out by centrifugal or suitable process so that the bolts will easily fit into the tapped holes / nuts.

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

- 3.14.05 Complete details of painting, galvanizing and climate proofing of the equipments shall be furnished in the tender.

PART - III

1.00 TESTS :

1.01 Type tests :

1.01.01

Type tested Isolators shall be offered. The type test reports shall be furnished for each rating called for in the bid. The type test reports shall not be older than ten (10) years as on the last date of submission of bid.

a) For Isolators manufactured in India:

- i. Type tests on indigenous equipment for which testing facility is available in India, should have been conducted in any independent laboratories approved by Government or accredited by National accreditation body of the country like Central Power Research Institute (CPRI), Electrical Research and Development Association (ERDA), etc.
- ii. Type tests on indigenous equipment, for which testing facility is not available in India, should have been conducted in a laboratory of foreign country accredited by National accreditation body of that country.
- iii. The type tests conducted in-house by manufacturers shall also be acceptable provided the lab (manufacturer's) is accredited by National accreditation body of the country and the tests have been witnessed by a representative of NABL accredited Independent laboratory/Power utility.

b) For Isolators manufactured Abroad:

- i. Type tests on imported equipment should have been conducted in an Indian Laboratory or foreign laboratory accredited by National accreditation body of respective country.
- ii. Type tests conducted in-house by manufacturers shall also be acceptable provided the laboratory is accredited by National accreditation body of the country and the tests have been witnessed by a representative of accreditation body/Power utility.

Please refer to Clause 13 Inspection Testing and Inspection Certificate., General technical Requirements, Volume - II.

- 1.01.02 During the type test the disconnect shall be mounted on its own support structure or equivalent support structure and installed with its own operating mechanism to make the type test representative. Drawing of equivalent support structure if any and mounting arrangement made for type tests shall be furnished for purchaser's approval before conducting the type tests.

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

1.01.04 Mechanical endurance test shall be conducted On the main switch as well as earth switch on one disconnect of each type

1.01.05 LIST OF TYPE TESTS:

List of type tests to be carried out as per IS : 9921 Part - VI 1985, are as given below.

a) ISOLATORS:

- i) Visual examination of components,
- ii) Dimensional verification of parts.
- iii) Assembly, interchangeability and verification of critical dimensions.
- iv) Measurement of resistance of main circuit and earth circuit (before and after mechanical endurance test)
- v) Temperature rise test (before and after mechanical endurance test)
- vi) Mechanical endurance test.
- vii) Short time withstand current and peak withstand current tests.
- viii) One minute power frequency voltage wet withstand tests across the isolating distances and to earth.
- ix). Standard lightning impulse voltage withstand tests on auxiliary and control circuits and auxiliary switches.
- x). One minute power frequency withstand voltage test on auxiliary and control circuits and auxiliary switch.
- xi) Verification of operation during application of rated mechanical terminal loads.
- xii) Galvanization tests.
- xiii) Chemical composition of contact material, springs and fasteners and bushes.
- xiv) Physical tests on springs and fasteners and copper strip / tubes.

b) EARTHING SWITCHES:

- i). Visual examination of components.
- ii). Dimensional verification of components.
- iii). Assembly, interchangeability and verification of critical dimensions.
- iv) Measurement of resistance of earthing switch contact (before and after mechanical endurance test)
- v) Mechanical endurance test
- vi) Short time withstand current and peak withstand current tests
- vii) power frequency voltage tests on auxiliary switches at kV(rms) for one minute.
- viii) Galvanization tests

- ix) Chemical composition of contact material, springs and fasteners and bushes.
- x) Physical tests on springs and fasteners and copper strips.

- 1.01.06 Type test report for operating motor carried out as per relevant ISS or BSS shall be required to be submitted for approval.
- 1.01.07 Temperature rise and breakage capacity tests reports for auxiliary equipments i.e., closing and trip coils, auxiliary contacts, limit switch etc., shall also be required to be submitted for approval.

1.02 ACCEPTANCE AND ROUTINE TESTS:

- 1.02.01 All acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier in presence of purchaser's representative.
- 1.02.02 Mechanical operation tests (routine test) shall be conducted on the complete disconnect (man switch and earth switch) at supplier's works and a certified test report be furnished to the purchaser. Alternatively the bidder may offer to conduct this test at purchaser's sub-station in which case the purchaser shall make necessary arrangement to erect the disconnect at his sub-station site under supervision of bidders representatives for supervision shall not be borne by the purchaser.
- 1.02.03 The test report of power frequency voltage withstand test conducted on the insulator shall be furnished for purchaser's acceptance in lieu of conducting the power frequency (dry) test on main circuit (routine test).

1.02.04 LIST OF ROUTINE TESTS:

List of routine test to be carried out as per IS : 9921, Part - IV - 1985 are as given below:

- a) ISOLATORS
 - Visual examination of components.
 - Assembly, interchangeability and verification of critical dimensions.
 - One minute power frequency voltage dry withstand tests across the isolating distance and to earth.
 - Measurement of resistance of isolator contacts and between terminals of the main circuits.
 - Power frequency voltage withstand tests on auxiliary and control circuits and auxiliary switches at 2 KV (rms) for one minute.
 - Mechanical operation tests.

b) EARTHING SWITCHES

- Visual examination of components
- Assembly, interchangeability and verification of critical dimensions.
- Power frequency voltage withstand tests on auxiliary, and control circuits and auxiliary switches at 2KV (rms) for one minute.
- Mechanical operation tests.

Immediately after finalization of the programme of type / acceptance / routine testing, the supplier shall give three weeks advance intimation to the purchaser, to enable him to depute his representative for witnessing the tests.

1.04 SPECIAL TESTS

Special tests listed below shall be carried out in presence of purchaser's representative.

- 1) Test on insulators - Conforms to IS - 2544
- 2) Test on insulators - Conforms to IEC - 168
- 3) Test on terminal connectors – IS : 5561
- 4) Operation tests on operating mechanism and interlock - IS : 2623
- 5) Endurance test on Auxiliary switches.

1.05 Test certificates and documents of the following items shall be furnished at the time of routine tests.

- Chemical analysis of copper along with a copy of central excise certificate / gate pass indicating genuine source of procurement of electrolytic grade.
- Bearings
- Fasteners
- Universal/ swivel joint coupling.
- Insulators.
- Gears
- Auxiliary switch
- Interlocking devices.
- Terminal block

The purchaser may at his discretion request additional test certificates for other items as reasonably required to substantiate the quality of the same.

2.00 INSPECTION

The inspection may be carried out by the purchaser at any stage of manufacture. The successful bidder shall grant free access to the purchaser's representative at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser, shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective. The supplier shall keep the purchaser informed in advance, about the manufacturing programme so that arrangement can be made for inspection. The purchaser reserves the right to insist for witnessing the acceptance / routine testing of the bought out items.

3.00 DOCUMENTATION:

3.01 All drawings shall conform to International Standard Organization (ISO) 'A' series of drawing sheet / Indian standards specification IS : 656. All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in system international units.

3.02 LIST OF DRAWINGS AND DOCUMENTS:

The bidder shall furnish four sets of following drawings along with his offer:

- a) General outline and assembly drawings of the disconnect, operating mechanism, structure insulator and terminal connector.
- b) Sectional views and descriptive details of items such as moving blades, contacts arms, contact springs, contact support, turn and twist mechanism, bearing, housing of bearing, bushes, 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 test
- e) Name plate
- f) Schematic drawing
- g) Type test reports in case the equipment has already been type tested
- h) Test reports, literature, pamphlets of the bought out items and raw material.

3.03 The successful bidder shall, within four weeks of placement of order, submit three sets of final versions of all the above said drawings. The owner shall communicate his comments on the drawings to the supplier. The supplier shall, if necessary, modify the drawings and resubmit three copies of the modified drawings within two weeks submit 10 prints and two good quality reproducible of the approved drawings on plastic coated (film type) durable reproducible paper for owner's use.

- 3.04 Six sets of the type test reports, shall be submitted by the supplier for distribution, before commencement of supply, adequate copies of acceptance and routine test certificates, shall accompany the dispatches consignment.
- 3.05 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's risk.
- 3.06 Approval of drawings/ work by purchaser shall not relieve the supplier of his responsibility and liability for ensuring correctness and correct interpretation of the latest revision of applicable standards, rules and codes of practices.

3.07 **INSTRUCTION MANUALS**

Twenty - five copies of the erection, operation and maintenance manuals in English shall be supplied for each type of the disconnect one month prior to dispatch of the equipment. The manual shall be bound volume and shall contain all drawings and information required for erection, Operation and maintenance of the disconnect including but not limited to the following particulars.

- Marked erection prints identify the component parts of the disconnect as shipped with -assembly drawings.
- Detailed dimensions and description of all auxiliaries.
- Detailed views of the insulator stacks, metallics, operating mechanism, structure, interlocks, spare parts etc.

4.00 **PACKING AND FORWARDING:**

- 4.01 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 damage to the equipment during the transit, due to improper and inadequate packing. The easily damageable materials 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 the supplier without any extra cost.
- 4.02 Each consignment shall be accompanied by a detailed packing list containing the following information.
- a) Name of the consignee.
 - b) Details of consignment.

- c) Destination
- d) Total weight of consignment
- e) Sign showing upper / lower side of the crate.
- f) Handling and unpacking instructions.
- g) Bill of materials indicating contents of each package.
- h) One set of approved drawings and manual.

4.03 The supplier shall ensure that the purchaser before dispatch approves the packing list and bill of material.