



SUPPLY CHAIN MANAGEMENT

THIRUVANANTHAPURAM

SPECIFICATION

220KV AND 110KV BUS AND LINE ISOLATORS WITH STRUCTURE

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Technical Specification and Evaluation Committee for Transmission Material



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Doc. #: **SCM-SPEC/XT/220kV&110kV Bus & Line Isolators**

Rev.#: 0

Effective Date **31/05/2021**

(i) Document Approval & Control Status

	Compiled by	Verified by	Approved by
Name	Smt.Santhini.G.P	Smt.Sajithakumari.T.S	Sri. Sanal Kumar.K
Position	Assistant Executive Engineer (Supply Chain Management)	Executive Engineer (Supply Chain Management)	Chief Engineer (Supply Chain Management)
Date	01/05/2021	14/05/2021	31/05/2021
Signature	Sd/-	Sd/-	Sd/-

(ii) Amendments and History

Sec. #	Rev. #	Date	History of Change



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1. PURPOSE:

Purpose of this document is to document updates & history, upkeep and publish the specifications related to **220kV & 110kV Bus and Line Isolators with Structure** in a professional manner

2. SCOPE:

The Scope of this document is to inform and alert all relevant stakeholders including KSEBL, Public, KSERC etc regarding the current specifications and historical changes adopted in specifications of **220kV & 110kV Bus and Line Isolators with Structure** used in field by KSEBL

3. RESPONSIBILITY:

The Executive Engineer (T), Office of Chief Engineer, Supply Chain Management shall compile and take necessary steps to publish the specification in KSEBL website and shall inform relevant stakeholders regarding updates and revisions

4. PROCEDURE FOR REVISION:

Modifications if any, in the technical specification will be incorporated as **Revisions**. Any changes in values, minor corrections in pages, incorporation of small details etc. will be considered as Minor Modification. **The Revisions due to minor modifications will be assigned as Rev. No.0.1, 0.2 etc.**

A complete updation of the technical specification will be considered as Major modification. **The Revisions due to major modifications will be assigned as Rev. No.1.0, 2.0 etc.**

All the details of regarding the revisions (both minor and major) will be incorporated in **“(ii)-Amendments and history”** above.

The concerned officers, in consultation with the Technical Committee will review and suggest changes required and the revision suggestion will be approved by **Chief Engineer (SCM)**. Those who notice any discrepancy or have any suggestion regarding revision, may bring the matter to the attention of Chief Engineer (SCM) in writing or through e-mail id:**cescm@kseb.in**



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TECHNICAL SPECIFICATION

220KV AND 110KV BUS AND LINE ISOLATORS WITH STRUCTURE

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TECHNICAL SPECIFICATION FOR 220KV 2000A ISOLATORS

1) Scope:-

This specification provides for design, manufacture, testing at manufacturers works and delivery of outdoor station type 220kV (local manual operation and remote electrical) of 2000A isolators With/Without earthing blades and complete in all respects with solid core insulators, metallic connectors, arcing horns, arcing contacts, operating mechanisms, interlocks auxiliary switches, indicating devices, fixing details etc as described herein. The remote operation shall be by means of motor operated mechanism.

Unloading of the equipment will be supplier's responsibility. The power and control cables for the interlocking and remote position indication of the isolators and earth switches are not covered by this specification.

2) Climatic Conditions:-

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

Maximum temperature under hot sun	: 50 ⁰ C
Maximum temperature of air in shade	: 40 ⁰ C
Minimum temperature of air in shade	:15 ⁰ C
Maximum relative humidity ☐	:100
Average number of thunderstorm days Per annum	: 50%
Average number of dust days per annum	: 5
Average number of rainy days per annum	: 90
Average annual rainfall	: 3000
Number of months during which tropical Monsoon conditions prevail	: 5
Maximum wind pressure	: 100 kg/sq. metre
Attitude above M.S.L not exceeding	: 1000 m

3) Particulars of the System:-

The isolators to be procured under this specification are intended to be used on 3 phase, A.C 50 cycles, effectively grounded system. The nominal system voltage is 220KV. The rated short time withstand current shall be 40KA for 220KV. For position indication of line isolators and bus isolators on the indoor control panel and for electrical interlocking of isolators with

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circuit breakers and other associated equipments, auxiliary supply will be available at 110 Volts D.C from the station battery.

4) Standards:-

The isolators and earth switches shall comply in all respects with IS.9921 or IEC publication No.129. Equipment meeting any other authoritative standard which ensures an equal or better quality than the standard mentioned above will also be accepted.

5) Type and Rating:-

All the 220KV isolators are to be **Double** break isolators with/without earthing switches will have rotating blade feature and pressure relieving contacts. All isolators with/without earth switches shall operate through 90° from their fully closed position to fully open positions so that the break is distinct and clearly visible from the ground level. The 220KV isolators shall be of **Double** break as detailed below:

220kV Isolators are Double Break Type having three posts per phase, Triple pole single throw outdoor type rotating centre post, silver plated contacts, with horizontally operating blade and insulator posts arranged vertically. The isolators shall be gang operated with single operating mechanism. Motor control is required for isolator and earth switch suitable for local and remote operation.

The equipment offered shall be designed for a normal current rating of 2000A 220KV and suitable for continuous service at the system voltage specified herein. The isolators are not required to operate under load but they must be called upon to handle magnetization currents of the power transformers and capacitive currents of bushings, bus bars, connections, very short length of cables and currents of voltage transformers and dividers. The isolators and earthing switches are required to be used in electrically exposed installations and this should be taken into account while fixing the clearance between phase and earth.

The rated insulation strength of the equipment shall not be lower than the levels specified below:

Standard declared voltage kV(rms)	Rated voltage of the isolator kV (rms)	Standard impulse with - stand voltage positive polarity kV (Peak)		One minute power frequency withstand voltage kV (rms)	
		Across the isolating distance	To earth and between poles	Across the isolating distance	To earth and between poles
220	245	1210	1050	530	460

6) **Temperature Rise:-**

view of the severe climatic conditions at site, the reference ambient temperature is to be taken as 50°C. The temperature rise for the various parts shall be adjusted accordingly as specified in IS.9921 and I.E.C publication No.129.

7) **Isolator Insulation:-**

- 1) Insulation to ground, insulation between open contacts and the insulation between phase of the completely assembled isolators switch shall be capable of with standing the dielectric test voltage specified in clause 1.5 above. Insulation between open contacts of a pole shall at least be 15% more than the insulation between the live parts of a pole to ground so that any flash over occurs when switch is open, it shall be to the ground.
- 2) The solid core post insulators shall have an ultimate bending strength of 6KN and shall conform to IS.2544 or other internationally recognized standards. The insulators selected shall be for use at normally polluted atmosphere creepage distance of 25mm/KV min. and shall be specifically suited to meet the particular requirements of ultimate torsional strength and cantilever loads which they will be called upon to resist during service the rated voltages.
- 3) The porcelain shall be homogeneous and free from all cavities and flaws. Design of the insulators shall ensure ample insulation, mechanical strength and rigidity for satisfactory operation under site conditions. The design shall also ensure that the losses caused by capacitive currents or conduction through dielectric are minimum and that the leakage due to moist and dirty insulator surface is least.
- 4) All metal caps and supports shall be cemented to the porcelains where as the blades and contact blocks shall be bolted on the metal parts of insulator thus making the replacement of damaged insulator easy.

8) **Main Contacts:-**

All isolators with/without earth switches shall have heavy duty, self aligning and high pressure line type fixed contacts of modern design and made of hard drawn electrolytic copper. The various parts should be accordingly finished to ensure interchangeability of similar components. The switchblades forming the moving contacts shall be made from tubular section of hard drawn electrolytic copper having suitable diameter and thickness. These contacts shall be liberally dimensioned so as to withstand safely the highest short-circuit currents and over voltages that may be encountered during service. The surfaces of the contact shall be rendered smooth and silver-plated. In

nut-shell the male and female contact assemblies shall be of substantial construction, and design of their assemblies shall ensure.

- 1) Electrodynamics withstand ability during short circuits without any risk of repulsion of contacts.
- 2) Thermal withstand ability during short circuits.
- 3) Constant contact pressure even when the live parts of the insulator stacks are subject to tensile stresses due to linear expansion of connected bus bar or flexible conductors either because of temperature, variation of strong winds.
- 4) Wiping action during closing and opening.
- 5) Self alignment assuring closing of the switch without minute adjustments.

The earthing switches shall each be provided with suitable type of fixed contacts below the fixed contact assemblies of the main switch on the incoming supply side and of moving contacts. These contacts too shall be fabricated out of hard drawn electrolytic copper and dimensioned to withstand the currents on the line. The moving contacts for triple pole isolators shall be gang operated.

9) **Arcing Horn and Arcing Contacts:-**

Adjustable arcing horns which are required for the purpose of arc reduction are to be provided. Adjustable arcing horns which are required for the purpose of insulation co-ordination are also to be provided if required. The details thereof should be given in the tender. The tenderer shall supply the graph showing impulse and power frequency spark over voltage for various gap settings of the arcing horns.

10) **Connectors:-**

Each isolator shall be provided with appropriate number of bimetallic clamping type of connectors suitable for ACSR double moose with 250mm spacing in between. The maximum length of the jumper that may be safely connected or any special instructions considered necessary to avoid undue loads on the post insulators should be stated. The connectors shall be of heavy-duty type with zinc passivated bolts, nut and washers 12mm dia or above and adequate contact area shall be provided with the fixing end of the isolators.

11) **Operating Mechanism:-**

All isolators and earthing switches shall have separate local manual and remote electrical operation. They should be provided with ON AND OFF indicators and padlocking arrangements for locking in both the end positions to avoid un-intentional operation.

The isolators with/without earth switches inclusive of their operating mechanism, should be such that they cannot come out of their open or closed positions by gravity, wind pressure, vibrations, shock etc. Isolators and earth switches should be capable of resisting in closed position, the dynamic and thermal effect of maximum possible short circuit currents specified. The operating mechanism should be of robust construction, easy to operate by a person and conveniently located for local operation in the switchyard.

12) **Earth Switches:-**

Earth switches shall consist of three links per isolator, which will normally rest against the frame when the connected isolator is in closed position. Each Earth switch shall be mechanically interlocked with the connected isolating switch so that is possible to close and open the Earth Switch only when the connected isolating switch is in the open and close positions respectively. Each earthing switch shall be designed to withstand electro-dynamic stress due to currents as per IEC recommendations. Isolator with earth switches shall be provide independent control (local manual and remote electrical) for each Eath Switch.

13) **Manual Operating Mechanism:-**

The manual operating mechanism shall be of robust construction, conveniently located for operation and easily operable by a single person. The length of the operating rod will be such that the height of the manual-operating handle above ground is from 1000 mm to 1300mm. The operating rod of earthing switch shall have insulated handle so that the electrostatic voltage on the handle from bus bar may not cause shock to the operator. The isolators shall be so constructed that the switchblades will not fall to the closed position if the operating shaft gets disconnected.

14) **Auxiliary Switches:-**

All isolators and earthing switches shall be provided with 110Volts DC auxiliary switches for their remote position indication on the control board and for electrical interlocking with other equipment. Twelve pairs of normally open and twelve pairs of normally closed contact each for the main and earthing switches shall be provided. All contacts should be brought out on terminals. Provision shall be kept for adding more auxiliary switch contacts at a later date. Separate auxiliary switches shall be provided for isolating/earth switches. The auxiliary switches shall be of robust construction and housed in weatherproof and dust tight covers mounted on the respective operating mechanism. Auxiliary Box, auxiliary contacts, terminals, electrical interlocking mechanism etc are the components of isolator which give

frequent trouble. Durability, quality and workmanship of the above materials shall be ensured in the construction of isolators and this shall be subject to stringent quality check before supply. It shall be possible to change normally closed contact into normally open contacts and vice versa at site.

15) Interlocks: -

For the purpose of making the operation of the isolator dependent upon the position of the associated circuit breaker or other equipment as may be required at site, suitable electrical interlocks should be provided on each isolator. The interlocks should be of robust design and contained in a weather proof and dust tight housing. Besides the electrical interlocks, the earthing switches shall be provided with mechanically operated interlock also. Alignment of every component shall be of perfect design and construction.

16) Bearing:-

The design and construction of the various bearings shall embody all the features required to withstand climatic conditions specified, so as to ensure dependable and effective operation even after long period in action of these isolators and switches. All bearings in the current path, except those specially designed as high-pressure contacts, should be shunted with flexible copper conductors of adequate cross section. Bearing housings should be weather proof. Facilities should be provided for lubrication of the bearing. All bearing shall be filed with first filling of grease and provided with nipples for servicing.

17) Supporting Structures:-

The isolators with/with out earth switches shall be suitable for being mounted on galvanized steel supporting structures preferably on Tubular column in upright support position.

The minimum clearance in air for the isolators shall be as follows.

220kV

- a) Between phases (centre to centre) 4500 mm
- b) Between live parts & earth (Min) 2080 mm

The height of structure above ground level shall not be less than 2.8 meter for 220kV isolators. The line terminal of the equipment shall be approximately 5.5 M for 220kV above ground level. The supporting structure must meet ASTM standard and relevant IS/IEC.

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18) **Design Materials and Workmanship: -**

The supplier shall assume full responsibility for co-ordination and adequate design. All materials used in the construction of the equipment shall be of the appropriate class, well finished and of approved design and make. All similar parts should be accurately finished and interchangeable.

All ferrous parts shall be heavily hot dip galvanized. Bolts, nuts, pins and washers, etc used on the isolators shall also be galvanized. Special attention shall be paid to give tropical treatment to all the equipments, as they will be subjected during service to extremely severe exposure to atmospheric moisture and to long period of high ambient temperature. All current carrying parts shall be non-ferrous metal or alloys and shall be designed to limit sharp point edges and similar sharp faces.

19) **Cable Boxes:-**

Cable boxes including cable glands for terminating multicore cables and power cables shall be provided wherever required. The supply includes necessary connecting materials for mounting of cables boxes on the isolating structures. Mounting of cable boxes shall be in accessible position, clear from the floor level to make the jointing work easy. The size of power cable will be 300 sq.mm and that of the control cable 2.5mm². Provisions for 3 nos. each 12 core, 7 core and 2 core cable entry shall be provided. Unused cable glands shall have blanking plates.

20) **The Motor Operating Mechanism:-**

The motor mechanism shall be connected to the torsional control of disconnection through a suitable coupling assembly. Suitable means to avoid over travel shall be provided. Motor shall develop a stalled torque to develop at least 2.5 times the torque required to operate the isolator and conform IS:325. Hot dip galvanized control cubicle shall be provided to house the driving mechanism and other accessories. The operating device shall be able to closing and opening the isolator at any value of the supply voltage between 80% and 110% of rated voltage. The Local / remote Switch and set of open/close push button shall be provided on the control cabinet of the disconnect to permit local and remote operation. Fail-safe solenoid type inter-locking feature shall be provided. The heating element and other auxiliary equipment may be operated from single phase, 50 c/s, 250 VAC supply. All shafts couplings etc shall be galvanized. This which shall also be provided with single phase 240V AC 15A socket with independent 15A MCB.

- 20.1) The motor operating mechanism shall actuate 3 pole group operated switches or individual drive switches with suitable controls. The operating mechanism shall be connected to the torsional control of disconnecter through a suitable coupling assembly.
- 20.2) Emergency manual operation shall be possible.
- 20.3) All equipments for satisfactory remote operation of the isolating switches, such as control switches ON/OFF indicating lights etc. which are to be mounted on the control board inside the control room shall be detailed but shall not be included in the scope of supply.
- 20.4) All shafts, coupling etc shall be galvanised. Flexible copper connectors of at least 50 Sq.mm. Cross section shall be provided between the rotating shafts and the frame work.

21) **Drawing and Literature:-**

The following drawings shall be furnished.

- 1) The drawing showing the outline dimensions of the isolating and Earth switches.
- 2) Drawing showing the details of main contact
- 3) Drawing showing the mechanical interlocks between Earth and Isolating switches
- 4) Drawing showing the electrical connections of the control circuit.
- 5) Drawing showing equipment of electrical interlock
- 6) A graph showing impulse and frequency spark over value for various gap settings of arcing horns.
- 7) Motor Operated Mechanism.
- 8) Name Plate details.

22) **Type Tests:-**

All the Isolators, earthing switch along with **Insulators and Structure** offered shall be fully tested for following type tests, at ERDA/ CPRI or Govt. NABL accredited laboratory. The Bidder shall furnish the type test reports for the Isolators of the type and Design offered by him along with the offer.

Following Type test reports shall be submitted.

- i) Lightning Impulse Voltage withstand test
- ii) Power Frequency Voltage withstand test on main circuit.
- iii) Power Frequency Voltage withstand test on auxiliary circuit
- iv) Temperature rise test on main isolator
- v) Short Time Current & peak withstand current test on isolator and earthing switch.

- vi) Short Circuit making performance test of earthing switch
- vii) Operating and mechanical endurance test on isolator and earthing switch
- viii) STC test on terminal connector
- ix) Degree of protection test on cubicle
- x) Mech& Elect Endurance test on Auxiliary switch
- xi) Dielectric tests on insulating sleeve provided on operating handle.
- xii) Tests on insulator:-
 - 1) Dielectric Test
 - 2) Mechanical load tests
 - 3) Galvanizing test
 - 4) Visual Inspection and Dimension Test

However the purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative.

Routine / Acceptance tests:- For isolator/earthing switch to be supplied with structure, all the acceptance tests shall be performed on offered structure only. For isolator/earthing switch to be supplied without structure, all the acceptance tests shall be performed on dummy structure. All the acceptance tests shall be as per relevant standard and shall be furnished. Also, all routine tests/ acceptance tests shall be performed by the successful bidder in the presence of purchaser's representative.

Following Routine / Acceptance tests on isolators and isolators-cum-earthing switches along with insulators as per relevant standard and shall be furnished.

- i) Power frequency voltage dry withstand test on main circuit with offered insulators
- ii) Voltage tests on control and auxiliary circuits.
- iii) Measurement of resistance of main circuit.
- iv) Mechanical operation test on isolator and earthing switch (50 operating cycles at rated auxiliary supply or hand operated & 10 operating cycles each at maximum and minimum auxiliary supply) on selected one sample out of every offered lot.
- v) Temperature rise test at rated current on one selected sample out of every offered lot.
- vi) List of additional tests on insulator
 - Bending load test in four direction of 50% min bending load guaranteed on all insulators as routine test.
 - Bending load test in four directions at 100% of min bending load guaranteed as special test on sample of insulator selected from each lot.
 - Tensional test on sample of insulator selected from each lot.

23) **Marking:-**

- a) Isolators and their operating device shall be provided with the nameplates in accordance with the Table 1 of IS.9921 /1985 (Part 5). The name plates shall be weather proof and corrosion proof.
- b) The name plate should be fitted in a position where it can be visible in normal service and installation.
- c) The isolators may also be marked with the ISI Certification mark, if any.

24) **Inspection:-**

All routine tests and inspection shall be made at the place of manufacturer unless otherwise especially agreed upon by the manufacturer and purchaser at the time of purchase.

- 24.1. Inspection may be carried out by the purchaser at any stage of manufacture. The supplier shall grant free access to the purchaser's representative at a reasonable time when the work is in progress. Inspection and acceptance of any material under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing materials in accordance with the specification and shall not prevent subsequent rejection, if the material is found to be defective.
- 24.2. 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 advance intimation. The supplier shall give 20 days enable the purchaser to depute his representative for witnessing the acceptance and routine tests.
- 24.3. The purchaser has the right to have the tests carried out at the supplier's cost by an independent agency wherever there is a dispute regarding the quality of supply.

Sd/-

CHIEF ENGINEER (SCM)

TECHNICAL SPECIFICATION FOR 110KV BUS AND LINE ISOLATORS

1) **Scope:-**

This specification provides for design, manufacture, testing at manufacturers works and delivery of outdoor station double break type 110kV line with earth switch, bus isolator and structure for both (local, manual operating mechanism) isolators complete in all respects with solid core insulators, metallic connectors, arcing horns, arcing contacts, operating mechanisms, interlocks auxiliary switches, indicating devices, fixing details etc as described herein.

Unloading of the equipment will be supplier's responsibility. The power and control cables for the interlocking and remote position indication of the isolators and earth switches are not covered by this specification.

2) **Climatic Conditions:-**

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

Maximum temperature under hot sun	: 50 ⁰ C
Maximum temperature of air in shade	: 40 ⁰ C
Minimum temperature of air in shade	: 15 ⁰ C
Maximum relative humidity	: 100%
Average number of thunderstorm days Per annum	: 50%
Average number of dust days per annum	: 5
Average number of rainy days per annum	: 90
Average annual rainfall	: 3000
Number of months during which tropical Monsoon conditions prevail	: 5
Maximum wind pressure	: 100kg/sq. metre
Attitude above M.S.L not exceeding	: 1000 m

3) **Particulars of the System:-**

The isolators to be procured under this specifications are intended to be used on 3 phase, A.C 50 cycles, effectively grounded system. The nominal system voltage is 110 kV. The rated short time withstand current shall be 31.5 kA for 110kV isolators. For position indication of line isolators and bus isolators on the indoor control panel and for electrical interlocking of isolators with circuit breakers and other associated equipments, auxiliary supply will be available at 110 Volts D.C from the station battery.

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4) **Standards:-**

The isolators and earth switches shall comply in all respects with IS.9921 or IEC publication No.129. Equipment meeting any other authoritative standard which ensures an equal or better quality than the standard mentioned above will also be accepted.

5) **Type and Rating:-**

All isolators shall operate through 90° from their fully closed position to fully open positions so that the break is distinct and clearly visible from the ground level.

110kV isolators shall be double break as detailed below.

Double break type having three posts per phase, triple pole, single throw outdoor type rotating centre post, silver plated contacts, with horizontally operating blade and insulator posts arranged vertically. The isolators shall be gang operated with single operating mechanism as indicated in the schedule of requirement. The operating mechanism of 110kV Isolators is manual.

The equipment offered by the supplier shall be designed for a normal current rating of 1200A & 800A for 110kV and suitable for continuous service at the system voltage specified herein. The isolators are not required to operate under load but they must be called upon to handle magnetization currents of the power transformers and capacitive currents of bushings, bus bars, connections, very short length of cables and currents of voltage transformers and dividers. The isolators are required to be used in electrically exposed installations and this should be taken into account while fixing the clearance between phase and earth.

The rated insulation strength of the equipment shall not be lower than the levels specified below:

Standard declared voltage kV(rms)	Rated voltage of the isolator kV (rms)	Standard impulse with - stand voltage positive polarity kV (Peak)		One minute power frequency withstand voltage kV (rms)	
		Across the isolating distance	To earth and between poles	Across the isolating distance	To earth and between poles
110	123	630	550	310	230

6) **Temperature Rise:-**

In view of the severe climatic conditions at site, the reference ambient temperature is to be taken as 50⁰C. The temperature rise for the various parts shall be adjusted accordingly as specified in IS.9921 and I.E.C publication No. 129.

7) **Isolator Insulation:-**

i) Insulation to ground, insulation between open contacts and the insulation between phase of the completely assembled isolators switch shall be capable of with standing the dielectric test voltage specified in clause 1.5 above. Insulation between open contacts of a pole shall at least be 15% more than the insulation between the live parts of a pole to ground so that any flash over occurs when switch is open, it shall be to the ground.

ii) The solid core post insulators shall have an ultimate bending strength of 6KN and shall conform to IS.2544 or other internationally recognised standards. The insulators selected shall be for use at normally polluted atmosphere creepage distance of 25mm/KV min. and shall be specifically suited to meet the particular requirements of ultimate torsional strength and cantilever loads which they will be called upon to resist during service the rated voltages.

iii) The porcelain shall be homogenous and free from all cavities and flaws. Design of the insulators shall ensure ample insulation, mechanical strength and rigidity for satisfactory operation under site conditions. The design shall also ensure that the losses caused by capacitive currents or conduction through dielectric are minimum and that the leakage due to moist and dirty insulator surface is least.

iv) **All metal caps and supports shall be cemented to the porcelains where as the blades and contact blocks shall be bolted on the metal parts of insulator thus making the replacement of damaged insulator easy.**

8) **Main Contacts:-**

All isolators shall have heavy duty; self aligning and high pressure line type fixed contacts of modern design and made of hard drawn electrolytic copper. The various parts should be accordingly finished to ensure interchangeability of similar components. The switchblades forming the moving contacts shall be made from tubular section of hard drawn electrolytic copper having suitable diameter and thickness. These contacts shall be liberally dimensioned so as to withstand safely the highest short-circuit currents and over voltages that

may be encountered during service. The surfaces of the contact shall be rendered smooth and silver-plated. In nut-shell the male and female contact assemblies shall be of substantial construction, and design of their assemblies shall ensure.

- i) Electrodynamic withstand ability during short circuits 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 insulator stacks are subject to tensile stresses due to linear expansion of connected bus bar or flexible conductors either because of temperature, variation of strong winds.
- iv) Wiping action during closing and opening.
- v) Self-alignment assuring closing of the switch without minute adjustments.

The earthing switches shall each be provided with suitable type of fixed contacts below the fixed contact assemblies of the main switch on the incoming supply side and of moving contacts. These contacts too shall be fabricated out of hard drawn electrolytic copper and dimensioned to withstand the currents on the line. The moving contacts for triple pole isolators shall be gang operated.

9) **Operating Mechanism:-**

All isolators shall have separate local manual operation. They should be provided with ON AND OFF indicators and padlocking arrangements for locking in both the end positions to avoid un-intentional operation.

The isolators operating mechanism should be such that they cannot come out of their open or closed positions by gravity, wind pressure, vibrations, shock etc. Isolators should be capable of resisting in closed position, the dynamic and thermal effect of maximum possible short circuit currents specified. The operating mechanism should be of robust construction, easy to operate by a person and conveniently located for local operation in the switchyard.

10) **Manual Operating Mechanism:-**

The manual operating mechanism shall be of robust construction, conveniently located for operation and easily operable by a single person. The length of the operating rod will be such that the height of the manual-operating handle above ground is from 1000 mm to 1300mm. The operating rod shall have insulated handle so that the electrostatic voltage on the handle from bus bar may not cause shock to the operator. The isolators shall be so constructed

that the switchblades will not fall to the closed position if the operating shaft gets disconnected. Local operation of the isolator in electrical mode is also required.

11) **Arcing Horn and Arcing Contacts:-**

Arcing horns which are required for the purpose of arc reduction are to be provided. Arcing horns which are required for the purpose of insulation co-ordination are also to be provided if required.

12) **Connectors:-**

Each isolator shall be provided with appropriate number of bimetallic clamping type of connectors suitable for ACSR double KUNDAH with 250mm spacing in between. The maximum length of the jumper that may be safely connected or any special instructions considered necessary to avoid undue loads on the post insulators should be stated by the bidders in their offers. The connectors shall be of heavy-duty type with zinc passivated bolts, nut and washers 12mm dia or above and adequate contact area shall be provided with the fixing end of the isolators.

13) **Earth Switches:-**

Earth switches shall consist of three links per isolator, which will normally rest against the frame when the connected isolator is in closed position. Each Earth switch shall be mechanically interlocked with the connected isolating switch so that is possible to close and open the Earth Switch only when the connected isolating switch is in the open and close positions and vice versa. Each earthing switch shall be designed to withstand electro-dynamic stress due to currents upto 50KA (peak) as per IEC recommendations.

14) **Auxiliary Switches:-**

All isolators shall be provided with 110 Volts DC auxiliary switches for their remote position indication on the control board and for electrical interlocking with other equipment. Eight pairs of normally open and eight pairs of normally closed contact each for the main and earthing switches shall be provided. All contacts should be brought out on terminals. Provision shall be kept for adding more auxiliary switch contacts at a later date. The auxiliary switches shall be of robust construction and housed in weatherproof and dust tight covers mounted on the respective operating mechanism. Auxiliary Box, auxiliary contacts, terminals, electrical interlocking mechanism etc are the components of isolator which give frequent trouble. Durability, quality and workmanship of the above materials shall be ensured in the construction

of isolators and this shall be subject to stringent quality check before supply. It shall be possible to change normally closed contact into normally open contracts and vice versa at site.

15) **Interlocks:-**

For the purpose of making the operation of the isolator dependent upon the position of the associated circuit breaker or other equipment as may be required at site, suitable electrical interlocks should be provided on each isolator. The interlocks should be of robust design and contained in a weather proof and dust tight housing. Besides the electrical interlock, the earthing switches shall be provided with mechanically operated interlock also. Alignment of every component shall be of perfect design and construction.

16) **Bearing:-**

The design and construction of the various bearings shall embody all the features required to withstand climatic conditions specified, so as to ensure dependable and effective operation even after long period in action of these isolators and switches. All bearings in the current path, except those specially designed as high-pressure contacts, should be shunted with flexible copper conductors of adequate cross section. Bearing housings should be weather proof. Facilities should be provided for lubrication of the bearing. All bearing shall be filed with first filling of grease and provided with nipples for servicing.

17) **Design Materials and Workmanship:-**

The successful Supplier shall assume full responsibility for co-ordination and adequate design. All materials used in the construction of the equipment shall be of the appropriate class, well finished and of approved design and make. All similar parts should be accurately finished and interchangeable.

All ferrous parts shall be heavily hot dip galvanized. Bolts, nuts, pins and washers, etc used on the isolators shall also be galvanized. Special attention shall be paid to give tropical treatment to all the equipments as they will be subjected during service to extremely severe exposure to atmospheric moisture and to long period of high ambient temperature. All current carrying parts shall be non-ferrous metal or alloys and shall be designed to limit sharp point edges and similar sharp faces.

18) **Supporting Structures:-**

The isolators with/without earth switches shall be suitable for being mounted on galvanized steel supporting structures preferably on Tubular column in upright support position. (Minimum 163 mm dia and base plate 400x400x12mm) with suitable base channel and earthing pad etc. with ASTM Standard. Galvanizing confirming to Cl.No.9.11 of IS 2544 and Cl.No.5.7 of IEC 168).

The minimum clearance in air for the 110kV isolators shall be as follows.

- | | |
|--------------------------------------|---------|
| a) Between phases (centre to centre) | 2250 mm |
| b) Between live parts & earth (Min) | 1050 mm |

The height of structure above ground level shall not be less than 2.8 meter . The line terminal of the equipment shall be approximately 4.5 M for 110kV above ground level.

19) **Cable Boxes:-**

Cable boxes including cable glands for terminating multicore cables and power cables shall be provided wherever required. The supply includes necessary connecting materials for mounting of cable boxes on the isolating structures. Mounting of cable boxes shall be in accessible position, clear from the floor level to make the jointing work easy. The size of control cable will be 2.5mm². Provisions for 3 nos. each 12 core, 7 core and 2 core cable entry shall be provided. Unused cable glands shall have blanking plates. Boxes shall be made of corrosion free material with suitably painted in seven tank process / powder coated or with fully galvanized ASTM Standard with degree of protection above IP55.

20) **The Motor Operating Mechanism:-**

All shafts, coupling etc shall be galvanized. Flexible copper connectors of at least 50 Sq.mm cross section shall be provided between the rotating shafts and the framework.

21) **Drawing and literature:-**

The following drawings shall be furnished.

- i) The drawing showing the outline dimensions of the isolator.
- ii) Drawing showing the details of main contact
- iii) Drawing showing the electrical connections of the control circuit.
- iv) Drawing showing equipment of electrical interlock
- v) A graph showing impulse and frequency spark over value for various gap settings of arcing horns.

- vi) All structural drawings showing galvanizing thickness.
- vii) Motor Operated Mechanism.
- viii) Name Plate details.

22) **Type Tests:-**

All the Isolators, earthing switch along with **Insulators and Structure** offered shall be fully tested for following type tests, at ERDA/ CPRI or Govt. NABL accredited laboratory. The Bidder shall furnish the type test reports for the Isolators of the type and Design offered by him along with the offer.

Following Type test reports shall be submitted.

- i) Lightning Impulse Voltage withstand test
- ii) Power Frequency Voltage withstand test on main circuit.
- iii) Power Frequency Voltage withstand test on auxiliary circuit
- iv) Temperature rise test on main isolator
- v) Short Time Current & peak withstand current test on isolator and earthing switch.
- vi) Short Circuit making performance test of earthing switch
- vii) Operating and mechanical endurance test on isolator and earthing switch
- viii) STC test on terminal connector
- ix) Degree of protection test on cubicle
- x) Mech& Elect Endurance test on Auxiliary switch
- xi) Dielectric tests on insulating sleeve provided on operating handle.
- xii) Tests on insulator:-
 - 1) Dielectric Test
 - 2) Mechanical load tests
 - 3) Galvanizing test
 - 4) Visual Inspection and Dimension Test

However the purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative.

Routine / Acceptance tests:- For isolator/earthing switch to be supplied with structure, all the acceptance tests shall be performed on offered structure only. For isolator/earthing switch to be

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supplied without structure, all the acceptance tests shall be performed on dummy structure. All the acceptance tests shall be performed in presence of purchaser's representative.

Following Routine / Acceptance tests shall be carried out on isolators and isolators-cum-earthing switches along with insulators shall be furnished at the time of bid.

- i) Power frequency voltage dry withstand test on main circuit with offered insulators
- ii) Voltage tests on control and auxiliary circuits.
- iii) Measurement of resistance of main circuit.
- iv) Mechanical operation test on isolator and earthing switch (50 operating cycles at rated auxiliary supply or hand operated & 10 operating cycles each at maximum and minimum auxiliary supply) on selected one sample out of every offered lot.
- v) Temperature rise test at rated current on one selected sample out of every offered lot.
- vi) List of additional tests on insulator
 - Bending load test in four direction of 50% min bending load guaranteed on all insulators as routine test
 - Bending load test in four directions at 100 % of min bending load guaranteed as special test on sample of insulator selected from each lot.
 - Tensional test on sample of insulator selected from each lot.

23) **Marking:-**

- a) Isolators and their operating device shall be provided with the nameplates in accordance with the Table 1 of IS.9921 /1985 (Part 5). The name plates shall be weather proof and corrosion proof.
- b) The name plate should be fitted in a position where it can be visible in normal service and installation.
- c) The isolators may also be marked with the ISI Certification mark, if any.

24) **Inspection:-**

All routine tests and inspection shall be made at the place of manufacturer unless otherwise especially agreed upon by the manufacturer and purchaser at the time of purchase.

- 1.24.1. Inspection shall be carried out by the purchaser at any stage of manufacture. The supplier shall grant free access to the purchaser's representative at a reasonable time when the work is in progress. Inspection and acceptance of any material under this specification by the



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purchaser shall not relieve the supplier of his obligation of furnishing materials in accordance with the specification and shall not prevent subsequent rejection, if the material 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 advance intimation. The supplier shall give 20 days enable the purchaser to depute his representative for witnessing the acceptance and routine tests.

- 1.24.2. The purchaser has the right to have the tests carried out at the supplier's cost by an independent agency wherever there is a dispute regarding the quality of supply.

Sd/-
Chief Engineer (SCM)

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Sl.No	Description	Board's requirements	Bidder Offer
1	Type, make and country of origin.		
2	Maximum permissible continuous service voltage (KV)	245 kv	
	Details of operating mechanism.	Main Switch – Motor operated Earth Switch – Manual operated and local manual & remove	
4	Clearance in air (Minimum)		
	i) Between Phases (mm)	4500	
	ii) Between parts and earth(mm)	2300	

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	iii) Distance between centers of outer stacks of insulators (mm)	2700	
5	Power frequency withstand test voltage for completely assembled switches.		
	a) Against ground.		
	i) Dry KV (rms):	460	
	ii) Wet KV (rms):	460	
	b) Across open contacts:		
	i) Dry KV (rms)	530	
	ii) Wet KV (rms)	530	
	c) Between Phases:		
	i) Dry KV (rms)	530	
	ii) Wet KV (rms)	530	
6	Impulse withstands test voltage of completely assembled switch without arcing horns with 1.2/50 micro second impulse		

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	voltage.		
	a) Against ground KV (Peak)	1050	
	b) Across the open ends of the same phase KV (Peak)	1210	
	c) Between phases KV (Peak)	1210	
7	100% impulse flashover voltage of completely assembled switch with arcing horns with 1.2/50 micro second impulse wave against ground (KV Peak)		
8	Particulars of the main contacts i.e. fixed contacts (Main Switch, earthing switch)and moving contact (Main switch and Earthing Switch)		
	a) Type		
	b) Material (give full dimensions of the fixed and moving contacts)	Hard drawn Electrolytic Copper	
	c) Surface treatment and thickness of surface coating.	Silver plating minimum 15 microns	

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	d) Contact area.		
	e) Contact pressure.		
9	Current density at the minimum cross section of switch blade Amp./ Sq.mm.		
10	Continuous current rating Amp.	2000 A	
11	Short time current rating:		
	i) For 1 second KA (rms)	40 kA	
	ii) For 2 seconds KA (rms)	40 kA	
12	Rated peak short circuit current KA(Peak)	100 kA	
13	Rated peak short circuit current of earthing blade KA(Peak)	100 kA	
14	Momentary current KA.	40 kA	
15	Temperature rise corresponding to:		
	a) Maximum continuous current rating and 50°C ambient temperature (°C)		

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	b) Short time current rating		
	i) For One second (°C)		
	ii) For Three second (°C)		
16	Type test report for thermal limiting current (Whether copy is enclosed)		
17	Maximum transformer magnetizing breaking current which can be safely interrupted by the switch		
18	Maximum current that can be safely interrupted by the switch.		
19	Maximum current that can be safely interrupted between equipotential bus bar.		
20	Number of operations which the switch can withstand without deterioration of contacts.	>1000	
21	Number of times the switches can be operated without any need for inspection	>1000	
22	Auxiliary switches:		

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	a) Number of normally open and normally closed contacts.	12 NO + 12 NC	
	b) Rated voltage	110V DC	
	c) Rated current	10A	
	d) Test voltage.	2kV	
23	Phase to phase distance (mm)	4500 mm	
24	Type of mounting	Horizontal	
25	Number of break per phase	Double Break	
26	Power required by DC inter locking coil at 110 Volts and its make (W)		
27	Safety factor taken into account while designing the isolator.		
28	Connectors provided and the type and material used.	Bimetallic clamping type suitable for ACSR Double Moose	
29	Adjustable gap type arcing horns provided and the material used.		

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30	Arcing contacts provided & give type and materials used.		
31	Separate operating mechanism provided for operation of main blade and earthing blade.		
32	Location and type of bearing		
33	Particulars of insulators.		
	i) Make		
	ii) Type		
	iii) Size Height (mm)	2300	
	iv)(a) Ultimate bending strength:	6kN	
	(b) Compression strength	270 kN	
	(c) Tensile strength	110 kN	
	(d) Torsional strength	4.5 kN	
	v) Weight (Kg.)		

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vi)	Number of units per stack.	2	
vii)	Diameter of shed (mm)		
viii)	Height of stack (mm)		
ix)	Minimum nominal creepage distance (mm)	6125 mm	
x)	Dry arcing distance(mm)		
xi)	1 minute dry withstand voltage KV (rms)		
xii)	30 secs. Wet withstand voltage KV (rms)		
xiii)	Power frequency flashover voltage (KV rms)		
	a) DRY		
	b) WET		
xiv)	Impulse flashover voltage KV (Peak)		
xv)	Impulse withstand voltage KV (Peak)		

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xvi)	Hissing voltage (at which audible discharge can be detected (KV)		
xvii)	Puncture voltage KV		
xviii)	Visible Discharge voltage.		
34	Weight of one three pole-isolating switch without earthing blade (kg.)		
35	Weight of one three pole-isolating switch with earthing blade (kg.)		
36	Type of interlocking between isolating switch and earthing switch.	Electrical & Mechanical	
37	Torque required to open the switch (kg.)		
38	Drawing for reference		
	a) Without earthing blades.		
	b) With earthing blades.		
39	Remote operating mechanism		
i)	Type of remote operating mechanism.	Motor Operating Mechanism	
ii)	Motor.		

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	a) Rating (Voltage, Current, HP)		
	b) Duty		
	iii) Power of normal operation required for.		
	a) Interlocking coils		
	b) Heating elements.		
	iv) Type of stop for limit position offered.		
	v) Operating time.		
	vi) Details of arrangement for emergency local / manual operation provided.		
	vii) Weight of operating mechanism.		
40	Test voltage of coil		
41	Closing Time.	Less than 12 sec.	
42	Tolerance permissible in the DC operating voltage.		
43	Opening time of isolating switch.	Less than 12 sec.	



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44	Weight of operating mechanism		
45	Type of interlocks provided	Mechanical & Electrical interlocking	
46	Actual Dimension of isolator		
47	Dimensions of base in mm		
48	Dimensions of largest package for despatch.		

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Sl.No	Description	Board's requirements	Bidder Offer
1)	Type, make and country of origin.	Double Break	
2)	Maximum permissible continuous service voltage (KV)	123 kV	
3)	Details of operating mechanism.	Manual Operating Mechanism	
4)	Clearance in air (Minimum)		
i)	Between Phases (mm)	2250 mm	
ii)	Between parts and earth(mm)	1050 mm	
iii)	Distance between centers of outer stacks of insulators (mm)	1800 mm	

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5)	Power frequency withstand test voltage for completely assembled switches.	230kV	
a)	Against ground.		
	i) Dry KV (rms):	230kV	
	ii) Wet KV (rms):	230kV	
b)	Across open contacts:		
	i) Dry KV (rms)	310kV	
	ii) Wet KV (rms)	310kV	
c)	Between Phases:		
	i) Dry KV (rms)	230kV	
	ii) Wet KV (rms)	230kV	
6)	Impulse withstands test voltage of completely assembled switch without arcing horns with 1.2/50 micro second impulse voltage.		
a)	Against ground KV (Peak)	550	
b)	Across the open ends of the same phase KV (Peak)	630	
c)	Between phases KV (Peak)	550	

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7)	100% impulse flashover voltage of completely assembled switch with arcing horns with 1.2/50 micro second impulse wave against ground (KV Peak)		
8)	Particulars of the main contacts i.e. fixed contacts and moving contact	Main Switch (1200A)	Main Switch (1200A)
a)	Type		
	i) Fixed Contact		
	ii) Moving Contact		
b)	Material (give full dimensions of the fixed and moving contacts)	Hard drawn Electrolytic Copper	
	i) Fixed Contacts		

	ii) Moving Contacts		
c)	Surface treatment and thickness of surface coating.	Silver plated minimum 15 microns	
d)	Contact area.		
e)	Contact pressure.		
9)	Current density at the minimum cross section of switch blade Amp./Sq.mm.		
10)	Continuous current rating Amp.	1200 A	
11)	Short time current rating:		
i)	For 1 second KA (rms)	31.5 kA rms for 1 Sec.	
ii)	For 2 seconds KA (rms)		
12)	Rated peak short circuit current KA(Peak)		
13)	Momentary current KA.		
14)	Temperature rise corresponding to:		

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a)	Maximum continuous current rating and 50°C ambient temperature (°C)		
b)	Short time current rating		
i)	For One second (°C)		
ii)	For Three second (°C)		
15	Maximum transformer magnetizing breaking current which can be safely interrupted by the switch		
16	Maximum current that can be safely interrupted by the switch.		
17	Maximum current that can be safely interrupted between equipotential bus bar.	1200 A	
18	Number of operations which the switch can withstand without deterioration of contacts.	>1000	
19	Number of times the switches can be operated without any need for inspection	>1000	
20	Auxiliary switches:		
a)	Number of normally open and normally closed contacts.	8 NO + 8 NC	

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b)	Rated voltage	110 V DC	
c)	Rated current	10 A	
d)	Test voltage.	2kV for 1 Minute	
21	Phase to phase distance (mm)	2250 mm	
22	Type of mounting	Horizontal	
23	Number of break per phase	2	
24	Power required by DC interlocking coil at 110 Volts and its make (W)		
25	Safety factor taken into account while designing the isolator.		
26	Whether connectors provided and if so, indicate the type and material used.	Bimetallic clamping type suitable for ACSR Double Kundah Conductor	
27	Whether adjustable gap type arcing horns provided and if so, the material used.		
28	Whether arcing contacts provided & if so, give type and materials used.		

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29	Whether separate operating mechanism provided for operation of main blade and earthing blade.		
30	Location and type of bearing		
31	Particulars of insulators.		
	i) Make		
	ii) Type	Solid Core Post Insulator	
	iii) Size Height (mm)	1220 mm	
	iv) (a) Ultimate bending strength:	6 kN	
	(b) Compression strength	120 kN	
	(c) Tensile strength	60 kN	
	(d) Torsional strength	4 kNm	
	v) Weight (Kg.)		
	vi) Number of units per stack.	One	
	vii) Diameter of shed (mm)		
	viii) Height of stack (mm)	1220 mm	
	ix) Minimum nominal creepage distance (mm)	3075 mm	
	x) Dry arcing distance(mm)	1100 mm	
	xi) 1 minute dry withstand voltage KV (rms)	250 kV	

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xii)	30 secs. Wet withstand voltage KV (rms)	230 kV	
xiii)	Power frequency flashover voltage (KV rms)		
	a) DRY		
	b) WET		
xiv)	Impulse flashover voltage KV (Peak)		
xv)	Impulse withstand voltage KV (Peak)		
xvi)	Hissing voltage (at which audible discharge can be detected (KV)		
xvii)	Puncture voltage KV		
xviii)	Visible Discharge voltage.		
32	Weight of one three pole-isolating switch without earthing blade (kg.)		
33	Type of interlocking between isolating switch and earthing switch.		
34	Test voltage of coil	2kV for 1 Min.	
35	Closing Time.	Less than 12 sec.	



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36	Tolerance permissible in the DC operating voltage.		
37	Opening time of isolating switch.	Less than 12 sec.	
38	Type of interlocks provided	Mechanical & Electrical	
39	Actual Dimension of isolator		
40	Dimensions of base in mm		

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Sl.No	Description	Board's requirements	Bidder Offer
1)	Type, make and country of origin.	Double Break	
2)	Maximum permissible continuous service voltage (KV)	123 kV	
3)	Details of operating mechanism.	Manual Operating Mechanism	
4)	Clearance in air (Minimum)		
i)	Between Phases (mm)	2250 mm	
ii)	Between parts and earth(mm)	1100 mm	
iii)	Distance between centers of outer stacks of insulators (mm)	1800 mm	
5)	Power frequency withstand test voltage for completely assembled switches.		

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a)	Against ground.		
	i) Dry KV (rms):	230kV	
	ii) Wet KV (rms):	230kV	
b)	Across open contacts:		
	i) Dry KV (rms)	310kV	
	ii) Wet KV (rms)	310kV	
c)	Between Phases:		
	i) Dry KV (rms)	230kV	
	ii) Wet KV (rms)	230kV	
6)	Impulse withstands test voltage of completely assembled switch without arcing horns with 1.2/50 micro second impulse voltage.		
a)	Against ground KV (Peak)	550	
b)	Across the open ends of the same phase KV (Peak)	630	
c)	Between phases KV (Peak)	550	

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7)	100% impulse flashover voltage of completely assembled switch with arcing horns with 1.2/50 micro second impulse wave against ground (KV Peak)				
8)	Particulars of the main contacts i.e. fixed contacts (Main Switch, earthing switch) and moving contact (Main switch and Earthing Switch)	Main Switch	Earth Switch	Main Switch	Earth Switch
a)	Type				
b)	Material (give full dimensions of the fixed and moving contacts)	HDEC	HDEC		
	i) Fixed Contacts				
	ii) Moving Contacts				
c)	Surface treatment and thickness of surface coating.	Silver plating min.15 microns	Silver plating min.15 microns		
d)	Contact area.				

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e)	Contact pressure.				
9)	Current density at the minimum cross section of switch blade Amp./Sq.mm.				
10)	Continuous current rating Amp.	800A			
11)	Short time current rating:				
i)	For 1 second KA (rms)	31.5 kA			
ii)	For 2 seconds KA (rms)	31.5 kA			
12	Rated peak short circuit current KA(Peak)	78.75kA			
13	Momentary current KA.	31.5kA			
14	Temperature rise corresponding to:				
a)	Maximum continuous current rating and 50°C ambient temperature (°C)				
b)	Short time current rating				
i)	For One second (°C)				

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ii)	For Three second (^o C)		
15	Maximum transformer magnetizing breaking current which can be safely interrupted by the switch		
16	Maximum current that can be safely interrupted by the switch.		
17	Maximum current that can be safely interrupted between equipotential bus bar.	800 A	
18	Number of operations which the switch can withstand without deterioration of contacts.	>1000	
19	Number of times the switches can be operated without any need for inspection	>1000	
20	Auxiliary switches:		
a)	Number of normally open and normally closed contacts.	8 NO + 8 NC	
b)	Rated voltage	110 V DC	
c)	Rated current	10 A	

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d)	Test voltage.	2kV for 1 Minute	
21	Phase to phase distance (mm)	2250 mm	
22	Type of mounting	Horizontal	
23	Number of break per phase	Double Break	
24	Power required by DC inter locking coil at 110 Volts and its make (W)		
25	Safety factor taken into account while designing the isolator.		
26	Whether connectors provided and if so, indicate the type and material used.	Bimetallic clamping type suitable for ACSR Double Kundah Conductor	
27	Whether adjustable gap type arcing horns provided and if so, the material used.		
28	Whether arcing contacts provided & if so, give type and materials used.		
29	Whether separate operating mechanism provided for operation of main blade and earthing blade.		
30	Location and type of bearing		

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31	Particulars of insulators.		
i)	Make		
ii)	Type		
iii)	Size Height (mm)	1220 mm	
iv)	(a) Ultimate bending strength:	6 kN	
	(b) Compression strength	120 kN	
	(c) Tensile strength	60 kN	
	(d) Torsional strength		
v)	Weight (Kg.)		
vi)	Number of units per stack.		
vii)	Diameter of shed (mm)		
viii)	Height of stack (mm)	1220	
ix)	Minimum nominal creepage distance (mm)	3075	

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x)	Dry arcing distance(mm)		
xi)	1 minute dry withstand voltage KV (rms)	230	
xii)	30 secs. Wet withstand voltage KV (rms)	230	
xiii)	Power frequency flashover voltage (KV rms)		
	a) DRY		
	b) WET		
xiv)	Impulse flashover voltage KV (Peak)		
xv)	Impulse withstand voltage KV (Peak)	550	
xvi)	Hissing voltage (at which audible discharge can be detected (KV)		
xvii)	Puncture voltage KV		
xviii)	Visible Discharge voltage.		
32	Weight of one three pole-isolating switch without earthing blade (kg.)		

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33	Type of interlocking between isolating switch and earthing switch.		
34	Test voltage of coil		
35	Closing Time.		
36	Tolerance permissible in the DC operating voltage.	2kV for 1 Min.	
37	Opening time of isolating switch.	Less than 12 sec.	
38	Type of interlocks provided		
39	Actual Dimension of isolator	Less than 12 sec.	
40	Dimensions of base in mm	Mechanical & Electrical	

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SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR SUPPORTING STRUCTURES

Sl.No.	Particulars	Guaranteed Values	
		220kv	110kv
1)	Mounting details		
2)	Over all dimensions		
3)	Weight of Supporting Structure		
4)	Thickness of Galvanizing of Supporting Structure		
5)	Additional information, if any.		