

**MANIPUR STATE POWER DISTRIBUTION COMPANY
LIMITED
KEISAMPAT, IMPHAL**

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**TENDER SPECIFICATION**

i) No.TS-3/2/14 ii) No. TS-4/2/14 iii) No. TS-5/2/14  
iv) No. TS-6/2/14 v) No. TS-7/2/14 & vi) No. TS-8/2/14

**PROVIDING OF 11 KV DEDICATED  
LINES/FEEDERS FOR DISTRICT HEAD  
QUARTERS AND IMPORTANT TOWNS/MARKET  
PLACES ON TURN KEY BASIS**

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Imphal :- 24-7-2014

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MANIPUR STATE POWER DISTRIBUTION COMPANY LIMITED

(Regd. Office: Electricity Complex, Patta No. 1293 under 87(2), Khwai Bazar,
Keishampat, District – Imphal West, Manipur – 795001)

NOTICE INVITING TENDER

Imphal, dated the th July, 2014

No.2/3/PURCH/D-HQ/2014-ED(MSPDCL)/Pt/: Sealed Tenders in triplicate are invited by the Managing Director, Manipur State Power Distribution Company Limited(MSPDCL), a Government of Manipur enterprise from the Firms for the following works

Tender Specification No	Particulars	Estimated Cost	Cost of Tender Paper/ Package (Rs.)	Due date of receipt of completed Tender	Due date of Opening of Tender
1	2	3	4	5	6
	Providing of 11 KV Dedicated lines/Feeders for District Head Quarters(DHQ) and important towns/Market Places on turn key basis.				
TS - 3/2/14	i) Hundung Sub-Station to Ukhrul (DHQ) ii) Napetpalli Sub-Station to Lamlai Bazar iii) Litan Sub-station to Litan Bazar iv) Khuman Lampak Sub-Station to Lamlong Bazar	Rs.91.57 Lakh.	5,000/-	16/8/14 2 P.M.	19/8/14 11.30 A.M.
TS - 4/2/14	i) Karong S/S to Senapati (DHQ) ii) Kangpokpi S/S to Kangpokpi Bazar iii) Nilakuthi Sub-Station to Sekmai Bazar	Rs.127.64 Lakh.	5,000/-	16/8/14 2 P.M.	19/8/14 11.30 A.M.
TS - 5/2/14	i) Chandel S/S to Chandel (DHQ) ii) Thoubal S/S to Thoubal Bazar iii) Heikakpokpi S/S to Kakching Bazar iv) Heikakpokpi S/S to Pallel Bazar	Rs.81.86 Lakh.	5,000/-	16/8/14 2 P.M.	19/8/14 11.30 A.M.
TS - 6/2/14	i) Ningthoukhong S/S to Bishnupur (DHQ) ii) New Lamka S/S to Churachandpur(DHQ) iii) Moirang S/S to Moirang Bazar iv) Utlou S/S to Nambol Bazar v) Sangaiprou S/S to Kwakeithel Bazar	Rs.113.77 Lakh.	5,000/-	16/8/14 2 P.M.	19/8/14 11.30 A.M.
TS - 7/2/14	i) Mayang Imphal S/S to Mayang Imphal Bazar ii) Kakwa S/S to Singjamei Bazar iii) Kongba S/S to Kongba Bazar	Rs. 31.63 Lakh.	5,000/-	16/8/14 2 P.M.	19/8/14 11.30 A.M.
TS - 8/2/14	i) Tamenglong S/S to Tamenglong (DHQ) ii) Jiribam S/S to Jiribam Bazar	Rs. 44.40 Lakh.	5,000/-	16/8/14 2 P.M.	19/8/14 11.30 A.M.

Tender Papers / Bidding documents will be issued only to those Tenderers /Firms, who have fulfilled the following conditions:-

1. QUALIFYING REQUIREMENTS:-

- Consortiums of Firms are not eligible.
- Registration Certificate of the Tenderer shall invariably be furnished.

2. TECHNICAL REQUIREMENTS

- The Firm / Company should have successfully erected, tested & commissioned a) Transmission & Distribution lines of aggregate route length of at least **5kms.** of 11kV or above voltage class on Turn-key basis and b) Installation of 11 kV or higher voltage class Transformers & Electrification work of HT/LT during the last 3 (three) years and which must be in operation satisfactorily for a period of 1 (one) year as on the date of application.
- Completion certificates of those works, issued in their own name by the Officer of the Client Department, not below the rank of Executive Engineer or Equivalent, are to be furnished along with the application. The completion certificates should clearly indicate:

Contd. P/2

- i) Date of start & completion of work
 - ii) Nature of work.
 - iii) Value of work.
 - iv) Work has been completed satisfactorily
 - v) If the completion is delay- reasons for delay
- c) In addition to the above qualification & requirements, the Firm / Company should have experienced in the field of same nature of works in the North Eastern Region on Power Projects

3 COMMERCIAL & FINANCIAL REQUIREMENTS:-

- a) Minimum Average Annual Turnover (MAAT) of the Firm / Company for the last 3 (three) years shall be at least **40%** of the estimated cost of the tender or **Rs. 25.00 Lakhs**, whichever is higher.
- b) The Firm / Company shall be financially sound and must have sufficient funds to deploy in the work. A certificate from the Banker indicating various fund based / non fund based limits sanctioned to them and extent of utilization as on date shall be furnished. Such certificates should have been issued not earlier then 3 (three) months prior to the last date of receipt of request for issuing Tender Papers.
- c) The Firm / Company shall submit complete annual report together with audited statements of accounts of the Firm / Company for last 3 (three) years immediately preceding the last date of receipt of request for issuing Tender Papers.
- d) The Firm / Company shall possess required equipments, tools & tackles to carry out the work.
- e) The Firm / Company shall submit details of technical staff to work at site.
- f) The Firm / Company shall submit valid Income Tax, Service Tax, VAT/Sales Tax Registrations & PAN Card and PF, ESI code, labour license etc as applicable.
- g) The Firm / Company shall provide information on any litigation or arbitration arising out of the contracts completed or under execution or Tenders participated by it over the last 10 (ten) years. If any of the Directors / Promoters of the Firm / Company was working in another company prior to joining the present Firm / Company, litigation history of the erstwhile Firm / Company shall also be furnished. A consistent history of awards involving litigation by or against the Bidder may result in not issuing the Tender papers.

4 SUBMISSION OF DOCUMENTS

- a) The Firm / Company shall furnish documentary evidence in support of the qualifying requirement stipulated as above.
- b) The Firms / Companies, who wish to tender for the works, may submit their application for issuing Tender Papers / Bidding Documents to **the Managing Director, Manipur State Power Distribution Company Limited(MSPDCL), Keishampat, Imphal -795001** on or before the specified date.
- c) The application along with the enclosures shall be submitted in a sealed envelope, which shall be superscribed **“REQUEST FOR TENDER PAPER”**.

(3)

- d) Tender paper containing detailed Specification of the works along with Terms & Conditions will be issued from the Office of the **General Manager (PPP), MSPDCL, Keishampat, Imphal – 795 001**, Manipur to those eligible Firms / Companies only on payment of the Cost of the Tender paper (Non-refundable) shown above, in the form of Demand Draft from a Nationalized /Scheduled Bank preferably having its branch at Imphal (preferably State Bank of India), to be drawn in favour of the **Managing Director, MSPDCL** and it should be submitted to the **Managing Director, Manipur State Power Distribution Company Limited (MSPDCL), Keishampat, Imphal -795001**.

A self addressed envelope of Size (250X350 mm) with sufficient Postal Stamps duly affixed on it for sending the Tender Paper by SPEED POST or REGISTERED POST for areas not covered by the Speed Post should be accompanied with request for purchase of Tender Papers. Tender Papers can be downloaded from the website **www.manipur.gov.in** but the cost of Tender Paper should be submitted at the time of submission of completed Tender. **Completed Tenders without cost of the Tender paper shall not be accepted.** The cost of Tender Papers / Bidding Documents shall be non-refundable.

- e) A self addressed envelope, cotton linen lined, of suitable size with sufficient stamp for sending the tender papers by SPEED POST or by REGISTERED POST for the areas not covered by Speed Post should also be accompanied with the application for purchase of Tender Papers / Bidding Documents.
- f) Any delay/loss/non-receipt of the application for purchase of Tender Papers / Bidding Documents or of the Tender Papers/ Bidding Documents sold / issued or also in submission of completed Tenders due to Postal delay or any other reasons not attributable to the Department shall not be the responsibility of the Department and no time extension on these grounds shall be entertained.
- g) The Department is not bound to accept the lowest tender / bid and reserves the right to reject any or all the Tenders or to accept any Tender in full or part thereof, without assigning any reason, whatsoever. The last date of sale / issue of Tender Paper and also the last date of receipt of Tender and DUE DATE for opening Tender happens to be a holiday, the same shall be on the next working day at the same time.

Sd/-
General Manager(PPP)
MSPDCL

Copy to:-

1. The Secretary to the Hon'ble Chief Minister, Manipur, for kind information of the Hon'ble Chief Minister.
2. The Commissioner (Power), Govt. of Manipur for favour of information.
3. The Executive Director (Tech) (MSPDCL) Manipur for information please.
4. The General Manager, Electrical Circle No-I/II/III, for information please
5. The Advertisement Managers, i) Sangai Express (E), ii) The Imphal Free Press (E) iii) Naharolgi Thoudang(M) & iv) Hueiyen Lanpao(M) News Papers, Manipur. They are requested to arrange for publication of this NOTICE as a single insertion in the Daily Newspapers under intimation to this Office. The concerned Editors may be requested to submit Bills with 2(Two) copies of the Paper Cuttings in which the advertisement / NIT appeared immediately to the Managing Director, MSPDCL, Manipur.
6. The General Manager (Finance & Accounts), MSPDCL, Manipur.
7. The OSD, Department of Information Technology, Govt. of Manipur. He is requested to hoist the above NIT to the State Government website.

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DETAILS OF TENDER NOTICE

1.1:- Sealed Tenders in "Triplicate" are invited by the Managing Director, MSPDCL, a Government of Manipur enterprise for execution of the works of "Providing of 11 KV dedicated line/feeders for District Head Quarters and important towns/Market Places on turn key basis.

The Tenderer shall submit 3(three) sealed tenders in separate covers superscripted as "Earnest Money & Cost of Tender Form (Those tenderer who down loaded the Tender Paper)" in 1st Cover, 2nd as Technical Bid and the 3rd as "Price Bid".

The 3rd cover containing the "Price Bid" shall not be opened if no Earnest Money Deposit, Cost of Tender Form (Those tenderer who down loaded the Tender Paper) and Technical Bid are enclosed in the "**1st Cover & 2nd Cover**".

1.2:- Tenders will be received upto **2.00 p.m. of 16/8/2014** and opened at **11.30 a.m. of 19/8/2014** in the presence of the intending tenderers or their authorised representatives. If the dates of receipt & opening of the Tender happens to be a holiday, it will be received and opened on the next working day in the same office at the same time. ***Representative should produce authorisation letters from the respective tenderers for whom they are representing.***

1.3:- The Company reserves the right to postpone or extend the date of receipt/opening of Tenders or to withdraw the Notice without assigning any reason thereof. In such cases the Tenderers shall not be entitled to any compensation in any form from the Department.

1.4:- NAME OF WORK:-

Providing of 11 KV Dedicated lines/Feeders for District Head Quarters and important towns/Market Places on turn key basis.

1.5:- The Company shall not be responsible for Supply, Insurance, Delivery and Transportation of any of the materials/equipment for the work mentioned above. The Tenderers have to arrange for procurement & Transportation of all the equipment and materials on their own.

1.6:- The Prices for all the equipment/materials should be "**FIRM**" till the completion of the work. The Prices for Erection & Commissioning should also remain Firm till the completion schedule of the Work covered by this Tender Specification.

1.7:- The prices should be inclusive of all applicable Taxes, Duties, Freight & Insurance charges, Packing & Forwarding charges, loading & unloading charges, handling & preservation/conservation charges at site. The rates of the applicable Taxes, Duties, Freight & Insurance charges, charges for packing & forwarding, loading & unloading may also be shown separately. The applicable rates of Excise Duty & CST for each and every equipment/material in the Tender at the time of submission of the Quotation should also be furnished inevitably. If the offer is silent about the Taxes, Duties & Freight & Insurance etc., then the offered rates shall be taken as inclusive of all at the time of placement of the Order. No further clarification/modification after the opening, unless called for shall be entertained.

1.8:- No extra amount on account of Loading, unloading, reloading of materials /equipments etc. shall be paid.

1.9:- The evaluation of the Tenders shall be done on the basis of the quantities of the various materials, shown in the enclosed Annexures herewith i.e. **Annexure – I & II.**

1.10:- Tenders may be submitted by those Firms only who possesses requisite Industrial or open license to carry out the work mentioned above.

1.11:- No Tenders from the Firms who have not purchase Tender Specification or who have not been invited for the same shall be entertained.

1.12:- Up-to-date /valid Income Tax and Sales Tax clearance Certificate should invariably be accompanied with the Tender/Bid.

1.13:-Tenderers may submit the Tender in **Triplicate**, in a sealed envelope duly superscribed "**Tender Specification No., Date of Opening, Description of items**" by sending through Speed Post/ Registered Post or by hand delivery through an authorised representative. The Tenders / Offers shall be complete with necessary technical particulars and descriptive drawings. The Tender should be addressed to the Office of the **Managing Director, MSPDCL, Keishampat, Imphal – 795 001**. Any delay in submission of the Tender due to postal delay /loss of the Tender in transit /non-receipt of the tender by the Company shall not be the responsibility of the Company and No Time Extension on any one of these ground shall be allowed. Offers should be submitted strictly in sealed covers and no Telegraphic Offer/ Fax offers shall be entertained.

1.14:- Offers without Guaranteed Technical Particulars / Appropriate Technical Specification of the Equipment/material associated with these Turn - Key Jobs shall be rejected without any explanation during the course of evaluation.

1.15:-The Company reserves the right to reject any or all of the Tenders if the above conditions are not fulfilled.

1.16:-Payment Term:- (for any package of the Work)

a) Supply of materials:-

(I) 95% of the total value of materials including Taxes, Duties, Freight & Insurance etc. shall be paid on arrival of the materials at site in full and in good condition.

(ii) Remaining 5% shall be paid after one month against Bank Guarantee of Equivalent amount from a Nationalised / Schedule Bank preferably having its branch at Imphal (preferably State Bank of India the Company's Banker) having validity to cover the entire warranty period.

(b) Erection:-

(i) 95% of the erection charges shall be paid periodically against measurement sheet duly signed by an authorised representative of the Company.

(ii) Balance 5% shall be paid after one month against Bank Guarantee of equivalent amount from a Nationalised / Schedule Bank preferably having its branch at Imphal (preferably State Bank of India the Company's Banker) having validity to cover the whole warranty period.

(c) Advance money if inevitable for execution of the Complete Package of Work, will be interest bearable at the prime lending rate of State Bank of India shall be made against submission of Bank Guarantee of equivalent amount from a Nationalised / Schedule Bank preferably having its branch at Imphal (preferably State Bank of India the Company's Banker)having a validity period covering the entire completion of work and after confirmation of Bank Guarantee from the concerned Head Office of the Bank.

1.17:- EARNEST MONEY to be deposited:- @ 1% of the Estimated Cost. Each Tender shall be accompanied with earnest money in the form of Call Deposits/ Bank Guarantees from a Nationalised / Schedule Bank preferably having its branch at Imphal (preferably State Bank of India the Company's Banker) drawn in favour of the "**Managing Director, MSPDCL**".

1.18:- Each tender will have to be submitted either personally or by registered Post, in a sealed envelope addressed to the **Managing Director, MSPDCL, Keishampat, Imphal – 795 001**. All offers shall be complete with necessary technical particulars and descriptive drawings.

1.19:- Any delay / loss / non-receipt of the completed offer due to postal delay or any other reason shall not be the responsibility of the undersigned and no time extension on these grounds shall be allowed.

1.20:- Delivery of Materials.

All the materials shall be packed properly before dispatch. Packing and forwarding charges shall be borne by the contractor. The materials shall be despatched by road to the destination on freight paid basis after duly insured. The freight and insurance charges shall be borne by the contractor. The contractor shall comply with the instructions that may be given by the Department from time to time regarding safe transit of the material / plant.

1.21:- Security deposit:-

Bank Guarantee from a Nationalised / Schedule Bank preferably having its branch at Imphal (preferably State Bank of India the Company's Banker) amounting to 5% of the total value of the contract (Supply + Erection price) having validity to cover the entire warranty period of 12 months from the date of erection & commissioning or 18 months from the date of supply as stipulated in the clause No. 1.17 shall be taken as Security Deposit.

1.22 :- Guarantee Clause:-

The contractor shall guarantee and be entirely responsible for the execution of the contract in accordance with the specification and schedule. They should further guarantee and be responsible for the quality and workmanship of all materials and completed works, correctness of the designs, drawings and their accuracy, conformity of all works to the approved drawings and designs, correct delivery of materials, their erection within the guaranteed completion period and performance within the warranty period of 12 months from the date of commissioning. The Department reserves the right to make changes in the designs which may be necessary to make the materials and works conform to the specification without any extra charge by the contractor.

1.23:- PENALTY:-

In case of failure to execute/ complete the work within the stipulated period, penalty @ 1/2 % per week subject to a maximum of 10% of the total value of (i) materials/equipment delivered late/ remained undelivered (ii) works remained non completed / pending/ completed late including commissioning shall be imposed. However, in case of delay by 3 (Three) months or more, the Order may be cancelled and the Security Deposit will be forfeited without any prejudice to any other action that may be taken up under law. The imposition of Penalty is, however, subjected to Force Majeure Conditions.

1.24:- For delay in supply/execution of the work within the contractual delivery/ execution schedule, the proportionate amount of advance money (if interest free) lying non-adjusted with the Contractor shall attract interest @ 12% per annum. The interest so applicable & to be borne by the contractor in such case shall be compounded annually.

1.25:- Wastage of materials:- The contractor shall not be paid for any wastage of material in excess of the allowable limit to be decided by the department during the course of execution of the work. The wastage shall be handed over to the Department and the amount for any wastage beyond the allowable limit shall be deducted from the bill for payment.

1.26:- Force Majeure Condition:- The Force Majeure condition shall be such acts of God, acts of public enemy, Fire, Flood, Epidemic, Strike, freight embargo, Earthquake, Labour unrest, Wars, Lockout, Civil commotion, Cyclone, Government regulation etc. If the progress or delivery is delayed due to the above happenings during the delivery period/execution period, the Extension of Time will be allowed for the time lost , provided notice of such happening issued by a competent authority is given within 30 (Thirty) days from the date of happening.

1.27:- Safety of staff & Labour:- The contractor shall make all the necessary arrangements for the safety of staff and labour. The department will not in any way be responsible for any accident minor, major or fatal to any person at the site of the works. Any damage/ accident during the erection shall be contractor's sole responsibility. The necessary insurance charges if any shall also be borne by the contractor.

1.28:-Hanging Over:- The contractor shall hand over the complete package of work after completion of supply , erection, testing and commissioning. However, the Department reserves the right to take over the work in parts if the situation arises.

1.29:- The Tender Papers are not transferable and the successful Tenderer should in no way opt for awarding any one the contract Package to a sub-contractor after the work is awarded to them. In such case, the Department is at liberty to cancel the work awarded in favour of them.

1.30:- All disputes relating to this NIT/ Work shall be tried/ settled within the legal jurisdiction of Imphal only.

Sd/-
General Manager (PPP)
MSPDCL

Part (A) :-

TECHNICAL PARTICULAR Providing of 11 KV Dedicated lines/Feeders for District Head Quarters and important towns/Market Places on turn key basis.

2.1 SCOPE OF WORK:- The scope of work covers

Survey, design, construction of 11 KV line with ACSR Rabbit on Steel Tubular Pole 9 m. long, inspection at manufacturers works before dispatch, testing, supply, transportation to site (inclusive of transit insurance charges), receipt, storage, preservation & conservation, handling at site erection.

2.2:-The Company shall not be responsible for supply and delivery of any equipment/ material required for installation and commissioning of the work. The contractor shall make his own arrangement for obtaining the services of any specialist Engineer required for installation, testing and commissioning of the major equipment.

2.3. 1: Details of the Scope of Works:

The Scope of Work will consist of the following:-

(i) Design, fabrication, Supply, Assembly, Arrangement for inspection at the manufacturer's works before dispatch and testing, transportation of materials to site, receipt and storage, preservation, handling at site, erection testing and commissioning of all the equipment and materials. Civil works such as Pole Muffing, Fixing of Insulators, Stringing of 11 KV line etc. which are included in the Scope of Work.

(ii) Arrangement for Tools & Plants (Special if any) necessary for erection and commissioning of the Poles and Equipments and also for completion of the work including the Civil Works.

(iii) The Tenderer shall make their own arrangement to obtain the services of any specialist Engineer required for installation, testing and commissioning of the Street Lighting, if required.

(iv) The Tenderer shall make their own arrangement to procure any material/materials required for erection of the poles and construction of the (i) 11 KV lines, ii) Pole Muffing, etc. The Second Party will not issue and shall not be responsible for procurement of any of the items.

(v) The Tenderer shall also bear the charges of Power and Water consumed for execution of the work.

(vi) The Tenderer will supply the materials and equipments from the manufacturers listed below. Further, the Company will have the right to change the Vendors/Manufacturers in case of non-availability / delay in delivery of unforeseen circumstances with approval of the Department.

2.4:- QUANTITIES-;

2.4.1:- The Qty. of equipment and materials are shown in the **Annexure-I & II**.

2.4.2:-The Company reserves the right to vary the Quantity of each item in the order at the rates given in the Price Schedules.

2.4.3:- Any extra consumable items like Bolts & Nuts, cable accessories and connectors, materials required for Earthing of the Equipment etc., required for erection of the poles, installation and commissioning luminaries, which are not specifically mentioned in the order, shall be supplied by the First Party at their cost. Any additional Supplies / Deliveries / Erections beyond the Annexures to the Order may be treated as extra at free of cost.

2.4.4:- If any extra work is to be carried out which is/are not covered in the Order, it may be decided at a mutually agreed rate and approval of the Second Party prior to the execution of such work should be obtained.

2.4.5:- Evaluation of the Tenders shall be based on the quantities indicated in Annexure-I &II or on the quantities assessed by the Tenderer whichever is the more. However, payment shall be made on the basis of actual quantities used with the allowable wastage to be decided later on by the two Parties.

2.5:- GUARANTEED AND OTHER TECHNICAL PARTICULARS:

2.5.1:-The offers shall preferably be based on single makes. The Technical particulars of the material/equipment with offered make shall be furnished in the schedule of Guaranteed and other Technical particulars. In case alternative make are offered, the Tenderer shall furnish the Technical particulars of each make separately in the schedule.

2.5.2:- In the event of the alternative makes being offered by the Tenderer, the right to choose any equipment/material of particular make shall rest with the Company.

2.6:- SYSTEM PARTICULARS:

2.6.1:- The particulars of the system in which the equipment covered under this Specification shall be used, are given below:-

Sl.No.	Particulars	L. T. System
1.	Rated system voltage	415/240 V
2.	System frequency	50 Hz
3.	No. of phases	Three
4.	System Earthing	Effectively earthed

2.7:- AUXILIARY SUPPLY :

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

- | | |
|-----------------------------|---|
| a) Three phase A.C. Supply | 415 Volts, 3-phase, 4 wire, 50Hz grounded A.C. System. |
| b) Single phase A.C. Supply | 240 Volts, single phase, 2 Wire, 50 Hz A.C. supply with one point grounded. |

The above power supply are subject to the variations given below :-

A.C. supply	Voltage variation-20% to + 10% frequency variation +/- 3%
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2.7.2:- Each of the foregoing supplies will be made available by the Company at one terminal point for all equipment for operation of the accessories and auxiliary equipment. Tenderer's scope shall include distribution beyond the points of supply including supply of interconnecting cables, terminal blocks etc.

2.8:- GEOGRAPHICAL CONDITIONS :-

The work shall be executed mostly in the District Head Quarters/Important Towns/Market Places of Manipur, which is situated in the North Eastern Border of the Country.

2.8.1:- SAND AND BOULDER :

Sand and boulder for construction of foundations are available in Manipur from the following places which are situated at a distance from Imphal shown against each.

SAND :

- a) Khoirom - 45 Kms. from Imphal.
- b) Sekmai - 20 Kms. from Imphal.

BOULDER :-

- a) Kanglatongbi - 22 Kms from Imphal
- b) Sekmai - 20 Kms. from Imphal.

2.8.2 :- CLIMATIC CONDITIONS AND ISOCHRONAL CONDITIONS

The climatic conditions of the work site under which the equipment and materials are required to operate satisfactorily are given below :-

I)	Maximum temperature of air	40 Degree C
II)	Minimum temperature of air	-2 DegreeC
III)	Every day Temperature.	26 Degree C
IV)	Wind Pressure.	
	a) for conductor to ground wire on full projected area.	45 Kg. F/Sq.m
	b) for Tower on 1.5 times the projected area of the wind face	195 Kg.F/Sq.m
V)	Maximum humidity	87%
VI)	Minimum humidity	33%
VII)	Average number of thunderstorm per annum	50
VIII)	Height above mean sea level	900 metre
IX)	Average rainfall per annum	1800 mm.
X)	Snow incidence	Nil
XI)	Rain Months.	May to September
XII)	Working season	October to April
XIII)	Terrain	Plain
XIV)	Seismic Co-efficient	
	a) Horizontal	0.1
	b) Vertical	0.05 g

2.9:- LOCATION AND TRANSPORTATION LIMITATIONS :

2.9.1:- The Site where the erection of 11 KV for District Head Quarters/Important Towns/Market Places in Manipur.

2.9.2:- The National Highway No.39, which links Imphal with Dimapur has got maximum axle load bearing capacity up to 15MT and the covered bridge at Dhansari River near Dimapur on the way to Imphal has high restriction up to 17 ft. 6 inch.

2.9.3:- Any additional information if required, may be obtained from the concerned transport authorities.

2.10:- **DEVIATIONS** : Deviations, if any, from the Tender Specification shall be separately listed for all equipment separately as per **Schedule - A** failing which it shall be assumed that the provisions of the Specification are complied with by the Tenderer.

2.11:- DRAWINGS MANUALS AND CATALOGUES :

2.11.1:- In addition to any other drawings which the Tenderer may like to supply, four sets of the following drawing/manuals must be submitted with the tender.

2.11.2:- Within 30 days of the receipt of order, the successful Tenderer shall furnish the time schedule for submission of all the relevant drawings/manuals in triplicate for approval of the Purchaser in the prescribed **Schedule B.**

2.11.3:- The Purchaser/Consignee/ executing authority will review the drawings and return one copy to the Contractor within 30 Calendar days after their receipt. Each drawing returned by the Purchaser will be (a) appropriately stamped (b) Generally approved and (c) Marked up with points in case of no further resubmission of drawings shall be required for Purchaser's approval. In case of the Contractor shall correct the original drawings in the light of the comments made by the Purchaser, it should be resubmitted in the same manner as stated above within two weeks after receipt of the marked up prints.

2.11.4:- If the Contractor desires to re-submit a revision or change for approval, such re-submission will be in three prints. The Contractor shall also supply prints of each approved resubmission within 30 days of receiving the approved re-submission.

2.11.5:-The Contractor shall supply to the Purchaser within 30 days of receiving the approved drawings, seven complete sets of final drawings for each equipment, one of which shall be suitable for reproduction.

2.11.6:- Any shop work done prior to the approval of the drawing shall be at the Contractor's risk. The Contractor shall make all such changes in the design as are considered necessary to make the equipment conform to the provisions and content of this Specification, without any additional cost to the Purchaser.

2.11.7:- Each drawing shall be identified by a drawing number and each subsequent re-submission/revision or addition to the drawing shall be identified by a revision number. All drawings shall be thoroughly checked for accuracy and completeness and signed by a responsible Officer of the Contractor.

2.11.8:-Checking and approval of the drawings by the Purchaser is for the benefit of the Purchaser and shall not relieve the Contractor of full responsibility for ensuring correct interpretation of design drawings and Specification or for completeness and accuracy of drawing and relevant Specifications.

2.11.9:-All deviations, concessions, omissions, changes etc. occurring throughout the manufacturing assembly and testing phases shall be reported to the Purchaser and incorporated only after the Purchaser's approval.

2.11.10:-All drawings shall be in English language and dimensions in metric system.

2.12. COMPLETENESS OF EQUIPMENT:

All fittings and accessories for equipment/materials which may not have been specifically mentioned under various equipment heads, but which are usually necessary for completion of the equipment and the total package of work shall be deemed to have been included in the Specification and shall be supplied by the successful Tenderer without any extra cost. Alternative designs and other types of equipment may also be considered so long as the requirements as specified under various equipment /material heads are met and in that case too, the Tenderer shall ensure that all fittings and accessories required to complete the equipment and the work in all respects are included in the tender. No claim for any extra cost will be entertained at a later stage.

2.13:- SPARE PARTS

The Tenderer shall furnish in a schedule, an item wise list and quantity of the recommended spare parts separately for each equipment covered in this Specification for five years operation in the prescribed **Schedule C**. The Purchaser shall decide the actual quantity of spares to be ordered on the basis of the information, furnished by the Tenderer. The cost of spares wherever specifically indicated shall be taken into consideration for the purpose of evaluation of bids.

2.14:-DESIRED MAKES OF EQUIPMENTS & MATERIALS.

A list of desired makes of important equipment and materials are enclosed with **Annexure-III** enclosed with the Tender Paper.

2.15:- ERECTION AND MAINTENANCE MANUALS & TOOLS

2.15.1:- MANUALS:- Three copies of operation, maintenance and erection manuals for each equipment shall be supplied by the successful Tenderer prior to dispatch of the equipment. The manuals shall be in English Language and shall be of bound volumes. The manuals shall contain all the drawings and information required for erection, operation and maintenance of the equipment covered in this Specification. The manuals shall include amongst other the following particulars:

- i) Marked erection prints identifying the component parts of the equipment as detached with an assembly drawing.
- ii) Detailed dimensions, assembly and description of all equipment, their accessories etc.
- iii) List of spare parts.

2.15.2:- TOOLS :- The Tenderer shall furnish a list of special Tools, accessories and equipment required for installation, testing and maintenance of the equipment covered in this Specification together with their prices in the **Schedule - D**.

2.16:- INSPECTION AND TESTS :

2.16.1:- Equipment / Materials offered shall be submitted for inspection of an authorised representative of the Purchaser. Inspection may be made at any stage of manufacture at the option of the Purchaser and the equipment if found unsatisfactory due to material used or poor workmanship shall be liable to be rejected. The contractor shall guarantee free access to the places of manufacture to the Purchaser's representatives at all times, when the work is in progress.

2.16.2:- Inspection and acceptance of any equipment/materials by the Purchaser or his authorised representatives shall not relieve the Contractor of his obligation of furnishing equipment/materials in accordance with the Specification and shall not prevent subsequent rejection, if such equipment /material is later found to be defective.

2.17.3:- No equipment or materials should be despatched until the test reports are duly approved by the Purchaser or his representative or inspection waiver instruction is given in writing by the Purchaser.

2.18.4:- The Purchaser reserved the right of having at his own expense any other tests of reasonable nature carried out at site or at manufacturer's works or at any other place in addition to the aforesaid type and routine tests to satisfy himself that the equipment comply with the Specification.

2.19.5:- Three copies of test reports shall be supplied for approval of the Purchaser. The reports shall indicate clearly the governing standards and the standard values obtained from such test, to facilitate checking of the test reports. Three bound copies of the test reports shall be submitted after approval of test report along with the equipment.

2.20:- INTERCHANGEABILITY:

Similar parts of any equipment shall be interchangeable.

2.21:- WORK SCHEDULE:

i) Supply of materials:- Supply and delivery of all materials/equipments should be completed within **4(Four) months** from the date of receipt of the Confirmed order or the date of receipt of the Advance money (if applicable) whichever is earlier.

(ii) Erection and Commissioning:- Erection, Installation, Testing and Commissioning of materials/equipments should be completed **within 6 (Six) months**

2.22:- COMPLETION OF WORK:-

The Tenderer should give the completion period clearly with their Tender. They should also furnish CPM network / PERT Chart showing the details of work at different stages. The program shall identify key phases in various areas of the work like design, manufacture, testing, transport and estimated period of erection, testing and commissioning etc. for each of the equipment, indicating restrains and interphase activities to be arranged by the Purchaser.

2.23: - PERFORMANCE :

2.23.1 Only the Tenderers who have successfully completed and commissioned the works similar to the above work or equivalent / of higher rating than that stipulated in this Specification and which have been in satisfactory operation are eligible.

2.23.2 :- The Tenderer shall offer equipment/materials of only those manufacturers whose equipment/materials of similar rating as covered under this Specification or of higher rating have been in satisfactory operation for at least three years. The Tenderer shall furnish documentary evidence of the above with the tender. Tenders lacking in this regard are liable to be rejected.

2.23.3:- The Tenderer shall submit in the prescribed **Schedule - E**, details of 11 KV lines, 11/0.4 KV Sub- Station, installation and commissioning of 11KV VCB, C-R Panel on turn key basis, which are in satisfactory operation along with certificates of trouble free operation from the customers.

2.23.4:- Notwithstanding anything stated above, the Purchaser reserved the right to assess Tenderer's capability and capacity to perform the contract should the circumstances were at, such assessment in the overall interest of the Purchaser.

NOTE :- The Tenderers should furnish the rates of Applicable Taxes and Duties against each Equipment & Material at the time of submission of the Offer for taking up the Turn Key work stated above.

General Manager (PPP)
MSPDCL

SPECIFICATION OF HOT DIP GALVANISED STEEL TUBULAR POLES FOR OVERHEAD LINES

1. SCOPE

- 1.1 This part covers the general requirement for Hot dip galvanized Steel Tubular poles with base plate of circular cross section for overhead power lines.

These general requirement apply to Hot dip galvanized Steel Tubular poles made of steels of minimum tensile strength 410 Mpa (Normal duty) and 540 Mpa (Heavy duty).

2 TERMINOLOGY

- 2.0 For the purpose of this standard, the following definitions shall apply.
- 2.1 Breaking Load – The theoretical load which would produce at ground level a stress equal to the tensile strength in the material. This is only of theoretical interest. In reality, the elastic limit of the materials would be exceeded and considerable deformation would occur before this theoretical load could be applied.
- 2.2 Load for Permanent Set – The maximum load which may be applied without producing at the gripping and a permanent set higher than specified. The permanent set measured at the point of application of this load shall not exceed 13mm.
- 2.3 Load for Temporary Deflection – The maximum load which may be applied without producing at the point of application of this load a temporary deflection exceeding 157.5mm.
- 2.4 Crippling Load – The load which is just sufficient to cause crippling of the pole.
- 2.5 Point of Application of Load – For the purpose of definitions from 2.1 to 2.3, the load should be applied at right angles to the axis of the poles at a point 30cm below the top for poles of length up to and including 9m and at a point 60cm below the top for poles longer than 9m. The pole should also be considered planted to specified depth.

Lot – A collection of the poles of one designation manufactured by the same process under similar conditions of production and offered for inspection at a time.

Lot size – Number of poles in a lot.

3. TYPES

- 3.1 Tubular steel poles shall be of the following two types :
- a) Stepped and
 - b) Swaged

4. SUPPLY OF MATERIAL

- 4.1 The general requirements relating to the supply of the material shall be laid down in IS : 1387 – 1967.

5 MANUFACTURE

- 5.1 The tubes making poles shall conform to grade Yst 240 or Yst 310 of IS: 1161-1979 as appropriate, except that manual metal arc welding process may also be used to make the tubes and the cold bend test need not be carried out.
- 5.1.1 For mechanical test the tubes shall be sampled in accordance with IS: 4711-1974 depending on the number of tubes in the lot to be inspected.
- 5.2 Stepped poles – Stepped poles shall be made from one length of tube, seamless or welded, the diameter being reduced in parallel steps by passing the tubes through series of dies. Where welded tubes are used they shall have one longitudinal weld seam only.
- 5.3 Swaged Poles – Swaged poles shall be made of seamless or welded tubes of suitable length swaged and joined together. No circumferential joints shall be permitted in the individual tube lengths of the poles. If welded tubes are used they shall have one longitudinal weld seam only; and the longitudinal welds shall be staggered at each swaged joint.
- 5.3.1 Swaging may be done by any mechanical process. The upper edge of each joint shall be chamfered off at an angle of about 45°. The upper edge need not be chamfered if a circumferential weld is to be deposited in accordance with 5.3.2.
- 5.3.2 Unless swaging is done by special process such as rotary or longitudinal die swaging process circumferential weld shall be deposited at the upper end of the joint at a slope of approx. 45°. This circumferential weld shall be deposited only after the poles are subjected and conforms to all the test requirements specified in this standard.
- 5.4 Joints in Swaged Poles – The lengths of joints on swaged poles shall be as follow:

Outside diameter of smaller tube in Joint	Length of joint (mm)
76.1	200
88.9	230
114.2	300
139.7	350
165.1	400
193.7	450

6. CHEMICAL COMPOSITION

- 6.1 The material when analysed in accordance with IS:228 (part-II) – 1972 and IS:228 (Part IX) – 1975 shall not show sulphur and phosphorus contents of more than 0.060 percent each.

7. FREEDOM FROM DEFECTS

- 7.1 Poles shall be well finished, clean and free from harmful surface defects. Ends of the pole shall be cut square. Poles shall be straight, smooth and cylindrical.

8. TOLERANCES

- 8.1 Outside diameter – The poles shall be as nearly circular as possible and their outside diameter shall not vary from the appropriate value, except at the joint or step, by more than + 1.0 percent.

8.2 Thickness

8.2.1 In the case of welded tubes, its thickness shall not fall below the thickness specified by more than 10 percent.

8.2.2 In the case of seamless tubes, the following tolerances on thickness shall apply

- a) Where the ratio of the thickness to the outside diameter is more than 3 percent, - 12.5 percent of the specified thickness; and
- b) Where the ratio of the thickness to the outside diameter is equal to or less than 3 percent; - 15 percent of the specified thickness.

8.3 Length – the tolerance on the length shall be as follow :

On the length of any section - +40mm

On the overall length of poles - +25mm

8.4 Weight – The mean weight for bulk supplies shall be not more than 5 percent below the calculated value. The weight of any single pole shall not fall below the calculated weight by more than 7.5 percent.

8.5 Straightness- The finished pole shall not be out of straightness by more than 1/600 or its length.

9. WORKMANSHIP

9.1 When the tubes are made by manual metal welding, the welder employed shall be qualified.

9.2 The welded joins shall be of good quality free from scale, surface defects, cracks etc.

10. PROTECTION AGAINST CORROSION

10.1 Unless otherwise specified, the poles shall hot dip galvanised conforming to relevant IS specifications.

11. EARTHING ARRANGEMENTS

11.1 If earthing arrangements are required by the purchaser, a through hole of 14mm diameter shall be provided in each pole at a height of 300mm above the planting depth.

12. MARKING

12.1 Unless otherwise specified the poles shall be marked with designation, manufacturer's identification and the year of manufacture.

12.2 The poles may also be marked with the ISI Certification Mark.

TECHNICAL SPECIFICATION FOR HOT DIP GALVANISED CROSS ARMS, BRACING SETS, CLAMPS

1.0 SCOPE

The scope covers manufacturing including hot dip galvanised, transport to site, insurance, storage, erection and commissioning of different types of Cross Arms, Bracing sets suitable for 11 kV lines.

A. Horizontal Type Cross-Arms and Bracing Set for 11 KV

- It shall comprise of M. S. Channel 75 x 40 x 6 mm, 1.05 mt long for 11 kV Single Pole, M. S. Channel 75 x 40 x 6 mm, 2.20 mt long for 11 kV Double Pole, M. S. Angle 50x50x6 mm (2x2.2 mt long + 2x2.5 mt long) for bracing to be provided on Steel Tubular Poles for 90⁰ cut points.
- The rolling and cutting tolerance for steel products conforming to IS-226 shall be those specified in IS-1852-1973 or its latest version.
- The clamp shall be manufactured and hot dip galvanised with MS flat 50 x 6 mm suitable for Steel Tubular poles.
- The Cross-Arm should not have any welded joints.

TECHNICAL SPECIFICATION OF STAY SET

1. SCOPE:

This specification provides for manufacturing, testing, dispatch, supply and delivery of Stay Rod for 11KV & L. T. line. One set of stay set consists of following items.

a) Stay Rod	1 no
b) Anchor plate	1 no
c) M. S. Bow	1 no
d) Thimbles	2 nos
e) Suitable hexagonal M.S. Check nut (Ordinary)	1 no
f) Suitable hexagonal M.S. Ratchet nut	1 no
g) M.S. Spring washer	1 no

11KV DETAILS:

2. Stay Rod:

This shall be made out of 28/35 tons quality steel M.S. Rod of 16 mm diameter. It shall be 1900mm long with forged squire head at one end. The other end shall be threaded to a length of 300 mm. The forged squire head shall be 32x32x16 mm size.

3. Anchor Plate:

This shall be made out of 28/35 tons quality steel with 18x18 mm hole in the centre. The size shall be 150x150x6 mm with a 18 mm square hole in the centre so that 16 mm dia rod shall passed through it conveniently.

4. Thimbles & Nuts:

There shall be two nos of the galvanised iron thimbles one hexagonal 13 mm thick ratchet nut and one M.S. hexagonal 13 mm thick ordinary nut. The nuts and screw shall be as per relevant IS. The thimble shall be suitable for taking 7/10 & 7/12 SWG G.I.Wire. There shall be one no. 18 mm dia spring washer of suitable thickness.

5. Ratchet Section:

The ratchet nut & ratchet face of the cross head of the body shall be formed to sure proper & good ratchet action.

6. Galvanisation:

All the component of the stay set shall have smooth and continuous hot-dip galvanisation in such a way that the zinc coating shall not crack or flake nor it should be removed by rubbing with bare fingers. The galvanisation must be done as per relevant IS. The threading should be done before galvanisation. Nuts should smoothly be tightened over the galvanisation.

7. Breaking Load:

The breaking load of the stay set shall as per standards.

8. Gross Weight:

The gross weight of each stay set should be 5.5 kgs

9. Submission of Test Certificate:

The tenderer shall have to submit a test certificate issued any govt. recognised institute/ testing laboratory in respect of galvanisation test carried out as per IS:2633-1972 and least test of the stay set.

10. Tolerance:

The permissible tolerance as per IS:1852-73 for different component of the stay set are given below:

Name of Component:

Rounds & Squire bars		Tolerance
a)	For the dimension up to and including 25 mm	±0.5 mm
b)	Tolerance in weight for the size over 10 mm to 16 mm	± 5 % (for Bow rod)

Plates:

a)	For the thickness	+12.05 % — -5%
b)	Tolerance in weight	+5 % — -3%

Nuts

Fabrication tolerance will be allowed as under:

i.	Rod(In length)	±0.5%
ii.	Bow rod	±1%
iii.	Stay Plate	±1%
iv.	Forged Components	±1% in length and +0.5 mm in thickness
v.	Threading	±1%
vi.	Tolerance in Gross Weight	±4%

L. T. DETAILS:

1. Stay Rod:

This shall be made out of 28/35 tons quality steel M.S. Rod of 12 mm diameter. It shall be 1900mm long with forged squire head at one end. The other end shall be threaded to a length of 300 mm. The forged squire head shall be 32x32x16 mm size.

2. Anchor Plate:

This shall be made out of 28/35 tons quality steel with 18x18 mm hole in the centre. The size shall be 150x150x6 mm with a 18 mm square hole in the centre so that 16 mm dia rod shall passed through it conveniently.

3. Thimbles & Nuts:

There shall be two nos of the galvanised iron thimbles one hexagonal 13 mm thick ratchet nut and one M.S. hexagonal 13 mm thick ordinary nut. The nuts and screw shall be as per relevant IS. The thimble shall be suitable for taking 7/10 & 7/12 SWG G.I.Wire. There shall be one no. 18 mm dia spring washer of suitable thickness.

4. Ratchet Section:

The ratchet nut & ratchet face of the cross head of the body shall be formed to sure proper & good ratchet action.

5. Galvanisation:

All the component of the stay set shall have smooth and continuous hot-dip galvanisation in such a way that the zinc coating shall not crack or flake nor it should be removed by rubbing with bare fingers. The galvanisation must be done as per relevant IS. The threading should be done before galvanisation. Nuts should smoothly be tightened over the galvanisation.

6. Breaking Load:

The breaking load of the stay set shall as per standards.

7. Gross Weight:

The gross weight of each stay set should be 5.5 kgs

8. Submission of Test Certificate:

The tenderer shall have to submit a test certificate issued any govt. recognised institute/ testing laboratory in respect of galvanisation test carried out as per IS:2633-1972 and leasd test of the stay set.

9. Tolerance:

The permissible tolerance as per IS;1852-73 for different component of the stay set are given below:

Name of Component:

Rounds & Squire bars		Tolerance
c)	For the dimension up to and including 25 mm	±0.5 mm
d)	Tolerance in weight for the size over 10 mm to 16 mm	± 5 % (for Bow rod)

Plates:

c)	For the thickness	+12.05 % — -5%
d)	Tolerance in weight	+5 % — -3%

Nuts

Fabrication tolerance will be allowed as under:

i.	Rod(In length)	±0.5%	
ii.	Bow rod	±1%	
iii.	Stay Plate		±1%
iv	Forged Components	±1% in length and +0.5 mm in thickness	
V	Threading	±1%	
Vi	Tolerance in Gross Weight	±4%	

TECHNICAL SPECIFICATION OF INSULATORS

1.0 TECHNICAL DESCRIPTION

1.1 General Requirements

- 1.1.1 All insulators for 11KV shall conform to Type B of latest version of IS : 731.
For 415/240V lines, the insulators shall comply with latest version of IS : 1445.
Guy strain insulators shall conform to designations A and C as per IS : 5300.
- 1.1.2 Pin insulator shall consist of a single piece of porcelain, intended to be mounted rigidly on a supporting structure by a pin, which passes up inside the insulator. The pin type insulator shall have a top groove and shall be threaded to take mild steel pins. The profile of threads shall be as per IS: 1445.
- 1.1.3 The strain insulators shall be of Ball and Socket type or Tongue or Clevis type, as specified. The string insulators shall only be of Ball and Socket type.
- 1.1.5 For 415/240V lines, Shackle insulators shall also be used. It shall consist of a single piece of porcelain intended to be mounted vertically or horizontally, between and in contact with the two ends of a 'U' strap or a pair of straps with its axis vertical and intended to secure a line conductor in tension.
- 1.1.6 Following type of guy strain insulators shall be used on guy wires of overhead lines of different voltage levels:

<i>Power Line Voltage</i>	Designation of Insulators(as per IS :5300)
415/240V	A
11kV	C
33kV	C (2 insulators to be used in series)

2.0 MATERIALS

2.1 Porcelain

The porcelain used in the manufacture of shells shall be sound, free from defects thoroughly vitrified and smoothly glazed.

2.2 Glaze

The finished porcelain shall be glazed in brown colour. The glaze shall cover all exposed parts of the insulator and shall have a good lusture, smooth surface and good performance under the extreme weather conditions of a tropical climate. It shall not crack or chip by ageing under the normal service conditions. The glaze shall have the same co-efficient of expansion as of the porcelain body throughout the working temperature range.

2.3 Cement

Cement used in the manufacture of the insulator shall not cause fracture by expansion or loosening by contraction. The cement shall not give rise to chemical reaction with metal fittings and its thickness shall be as small and uniform as possible. Proper care shall be taken to correctly centre and locate individual parts during cementing.

3.0 CREEPAGE DISTANCE

Highest System Voltage	Normal & moderately polluted atmosphere	<i>Heavily polluted atmosphere</i>	
		Pin Insulator	Strain Insulator
kV	mm	mm	mm
12	230	320	400
36	580	840	

Note :

1. In 33kV lines, for insulator used in an approx. vertical position, the creepage distance as given in col 2 shall apply. For insulators used in an approx. horizontal position, the creepage distance as given in col 2 shall apply, but the value at col 3 may be reduced as much as 20%.
2. In 11kV lines, higher value of creepage distance has been specified for strain insulators as these are normally used in horizontal position.

4.0 DISC INSULATORS

4.1 Pin and Cap

- 4.1.1 Pins and Caps shall be made of drop forged steel and malleable cast iron/ spheroidal graphite iron/drop forged steel respectively, duly hot dip galvanised and shall not be made by jointing, welding, shrink fitting or any other process from more than one piece of material.
- 4.1.2 Pin and Cap shall be designed to transmit the mechanical stresses to the shell by compression and develop uniform mechanical strength in the insulator. The cap shall be circular with the inner and outer surfaces concentric, of such design that it will not yield or distort under load conditions.
- 4.1.3 The pin ball shall move freely in the cap socket but without danger of accidental uncoupling during erection or in position. The design of the disc should be such that stresses due to expansion or contraction in any part of the insulator shall not lead to deterioration.

4.2 Security clip

- 4.2.1 Security clip for use with ball and socket coupling shall be of R-shaped hump type which shall provide positive locking of the coupling as per IS: 2486-(Part-III)/ IEC:372. The legs of the security clips shall be spread after installation to prevent complete withdrawal from the socket. The locking device should be resilient, corrosion resistant and of suitable mechanical strength. There shall be no risk of the locking device being displaced accidentally or being rotated when in position- under no circumstances shall locking device allow separation of insulator units or fittings.
- 4.2.2 Security clips shall be made of good quality stainless steel or phosphor bronze as per IS:1385-1968. 2.5% extra Security clip shall be provided.

4.3 Ball and Socket Designation

The dimensions of the balls and sockets shall be of 16 mm designation in accordance with the standard dimensions stated in IS:2486 - (Part - II).

5.0 INTERCHANGEABILITY

The disc insulators inclusive of fittings shall be of standard design suitable for use with the hardware fittings of any make conforming to relevant Indian/International Standards.

6.0 MAINTENANCE

- 6.1 The insulators offered shall be suitable for employment of hot line maintenance techniques so that the usual hot line operations can be carried out with ease, speed and safety.

7.0 WORKMANSHIP

- 7.1 All the material shall be of the latest design and conform to the best modern practices adopted in the distribution voltage field. Contractors shall offer only such insulators as are guaranteed by him to be satisfactory and suitable for specified voltage level lines and will give continued good service.
- 7.2 The design, manufacturing process and material control at various stages shall be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish and elimination of sharp edges and corners.
- 7.3 The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.
- 7.4 In disc insulators, metal caps shall be free from cracks, seams, shrinks, air holes, burrs and rough edges. All surfaces of the metal parts shall be perfectly smooth with no projecting points or irregularities. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.
- 7.5 All ferrous parts shall be hot dip galvanised to give a minimum average coating of Zinc equivalent to 600 gm/sq.m. and shall be in accordance with the requirement of IS:2629-1985 and shall satisfy the tests mentioned in IS:2633 1986. The zinc used for galvanising shall be of Grade Zn 99.95 as per IS:209-1979. The zinc coating shall be uniform, adherent, smooth, reasonably bright, continuous and free from imperfections such as flux, ash, rust stains, bulky white deposits and blisters. The galvanised metal parts shall be guaranteed to withstand at least six successive dips each lasting for one (1) minute duration under the standard preece test.
- 7.6 Before ball fittings are galvanised, all die flashing on the shank surface of the ball shall be carefully removed without reducing the dimensions below the design requirements.
- 7.7 In disc insulators, the design of the insulators shall be such that the shell shall not engage directly with hard metal. The design shall also be such that when units are coupled together there is no contact between the shell of one unit and metal of the next adjacent unit. The design of the shell ribs shall be such that the security clip of the insulator can be engaged and disengaged easily with hot stick without damaging the shell ribs.
- 7.8 Insulator units after assembly shall be concentric and co-axial within limits as permitted by the relevant Indian Standards.
- ## **8.0 EQUIPMENT MARKING**
- 8.1 Each insulator shall be legibly and indelibly marked with the trade mark of the manufacturer and year of manufacture. The guaranteed combined mechanical and electrical strength shall be indicated in kilo Newton followed by the word 'kN' to facilitate easy identification and to ensure proper use.
- 8.2 The marking shall be on porcelain, and shall be printed, not impressed and shall be applied before firing.

9.0 Bid Drawings

- 9.1 The Bidder shall furnish full description and illustration of the material offered.
- 9.2 The Bidder shall furnish along with the bid the outline drawing (6 copies) of each insulator unit including a cross sectional view of the insulator shell. The drawing shall include but not limited to the following information :
- (a) Dimensions with manufacturing tolerances
 - (b) Minimum Creepage distance with positive tolerance
 - (c) Protected creepage distance
 - (d) Eccentricity of the disc
 - (i) Axial run out
 - (ii) Radial run out
 - (e) Unit mechanical and electrical characteristics
 - (f) Size and weight of Pin Ball Shank / ball and socket parts
 - (g) Weight of unit insulator disc
 - (h) Materials
 - (i) Identification mark
 - (j) Manufacturer's catalogue number
- 9.3 After placement of award, the Contractor shall submit fully dimensioned insulator drawings containing all the details as given in Clause No. 1.12.2 above, in four (4) copies to Owner for approval. After getting approval from Owner and successful completion of all the type tests, the Contractor shall submit 20 more copies of the same drawing to the Owner for further distribution and field use at Owner's end.

10.0 TESTS AND STANDARDS

10.1 Tests

- The following type, acceptance, routine tests and tests during manufacture shall be carried out on the insulator individually and along with hardware fittings. For the purpose of this clause:
- 10.1.1 Type tests shall mean those tests which are to be carried out to prove the design process of manufacture and general conformity of the material to this specification. These tests shall be carried out on samples prior to commencement of commercial production against the specification. The Bidder shall indicate this schedule for carrying out these tests in the activity schedule.
- 10.1.2 Acceptance tests shall mean those tests which are to be carried out on samples taken from each lot offered for pre-despatch inspection for the purpose of acceptance of that lot.
- 10.1.3 Routine tests shall mean those tests, which are to be carried out on each insulator/hardware fitting to check requirements which are likely to vary during production.
- 10.1.4 Tests during manufacture shall mean those tests which are to be carried out during the process of manufacture and end inspection by the Supplier to ensure the desired quality of the end product to be supplied by him.
- 10.1.5 The norms and procedure of sampling for these tests will be as per the Quality Assurance Programme to be mutually agreed to by the Supplier and Owner.

- 10.1.6 The standards and norms to which these tests will be carried out are listed against them. Where a particular test is a specific requirement of this specification, the norms and procedure of these shall be as specified in Annexure-A of this Section or as mutually agreed to between the Supplier and the Owner in the Quality Assurance Programme.
- 10.1.7 For all types and acceptance tests, the acceptance values shall be the values guaranteed by the Bidder in the Guaranteed Technical Particulars of this proposal or the acceptance value specified in this specification whichever is more stringent for that particular test.
- 10.1.8 For all type and acceptance tests, the Bidder shall guarantee only minimum values in the Guaranteed Technical Particulars. Bidder shall be required to achieve the same or higher values, as guaranteed, during testing for all type and acceptance tests.

10.2 Type Tests

The following type tests shall be conducted on a suitable number of individual insulator unit, components, materials or complete strings:

- (a) Verification of dimensions
- (b) Thermal mechanical performance test
- (c) Power frequency voltage withstand and flashover test
 - (i) dry
 - (ii) wet
- (d) Impulse voltage withstand and flashover test (dry)
- (e) Visible Discharge test (dry)
- (f) RIV test (dry)
- (g) Mechanical failing Load Test (for pin insulator only)
- (h) 24 hr mechanical strength test (for strain / string insulator only)

10.3 Acceptance Tests

- (a) Visual examination
- (b) Verification of dimensions
- (c) Temperature cycle test
- (d) Galvanising test
- (e) Mechanical performance test
- (f) Test on locking device for ball and socket coupling
- (g) Eccentricity test
- (h) Metallurgical Test
 - (i) Grain size)
 - (ii) Inclusion rating) For Metal fittings only (iii)
 - Chemical analysis) (in Black condition)
 - (iv) Microstructure)
- (i) Mechanical Failing Load test (for Pin Insulator only)
- (j) Electro-mechanical strength test (for Strain Insulator only)
- (k) Porosity test
- (l) Puncture test (for Strain Insulator only)

10.4 Routine Tests

- (a) Visual Inspection
- (b) Mechanical routine test (for Strain Insulator only)
- (c) Electrical routine test (for strain insulator only)

10.5 Tests During Manufacture

On all components as applicable

- (a) Chemical analysis of zinc used for galvanising) Annexure – A
)
- (b) Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.)
)
)
)
- (c) Chemical analysis hardness tests and magnetic particle inspection for forgings) Annexure – A
)
)
)
- (d) Hydraulic Internal Pressure tests on disc insulator shells)
)

10.6 Test Voltages

10.6.1 The test voltages of insulators shall be as under :

Highest System Voltage	Visible Discharge Test	Wet Power Frequency withstand Test	Power Frequency puncture withstand test		Impulse voltage withstand Test
			Pin insulator	Strain / string Insulators	
kV (rms)	kV (rms)	kV (rms)	kV (rms)	kV (rms)	kV (rms)
415/240V (for pin & Shackle type)		10	60		
12	9	35	105	1.3 time the actual dry flash over voltage of the insulator	75
36	27	75	180	1.3 times the actual dry flash over voltage of the insulator	170

10.6.2 For guy strain insulators, test voltages shall be:

Designation of Insulator	Dry one min power freq withstand voltage	Wet one min power frequency withstand voltage
	KV (rms)	KV (rms)
A	18	8
C	27	13

10.6.3 The withstand and flashover voltages are referred to the 'Reference Atmospheric Conditions' as per Indian Standards.

10.7 Failing Load

10.7.1 Mechanical Failing Load (For Pin Insulators only)

The insulators shall be suitable for a minimum failing load of 10KN (for 33kV), 5 KN (for 11kV) and 3.5KN (for LT) applied in transverse direction.

Shackle insulators shall be suitable for a minimum failing load of 11.5KN for type 1 insulator and 16.0KN for type 2 insulator.

Guy strain insulator type A shall be suitable for a minimum failing load of 44KN whereas, type C shall be suitable for a minimum failing load of 88KN.

10.7.2 Electro-Mechanical Failing Load (For Strain Insulators/ String Insulator Units)

The insulators shall be suitable for a minimum failing load of 45 KN (for 11kV lines) applied axially.

10.8 Testing Expenses

10.8.1 Testing charges for the type test specified shall be included in the bid price and no separate payment shall be made for the same.

10.8 Additional Tests

10.8.1 The Owner reserves the right of having at his own expense any other test(s) of reasonable nature carried out at Contractor's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the Specifications.

10.8.2 The Owner also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Contractor's premises or at any other test centre. In case of evidence of non compliance, it shall be binding on the part of the Contractor to prove the compliance of the items to the technical specifications by repeat tests or correction of deficiencies, or replacement of defective items, all without any extra cost to the Owner.

10.9 Co-ordination for testing

The Contractor shall have to co-ordinate testing of insulators with hardware fittings to be supplied by other Contractor and shall have to also guarantee overall satisfactory performance of the insulators with the hardware fittings.

10.10 Guarantee

The Contractor of insulators shall guarantee overall satisfactory performance of the insulators with the hardware fittings.

10.11 Test Reports

- 10.11.1 Copies of type test reports shall be furnished in at least six (6) copies along with one original. One copy shall be returned duly certified by the Owner only after which the commercial production of the concerned material shall start.
- 10.11.2 Copies of acceptance test reports shall be furnished in at least six (6) copies. One copy shall be returned duly certified by the Owner, only after which the material shall be despatched.
- 10.11.3 Record of routine test reports shall be maintained by the Contractor at his works for periodic inspection by the Owner's representative.
- 10.11.4 Test certificates of test during manufacture shall be maintained by the Contractor. These shall be produced for verification as and when desired by the Owner.

10.12 Inspection

- 10.12.1 The Owner's representative shall at all times be entitled to have access to the works and all places of manufacture, where insulator, and its component parts shall be manufactured and the representatives shall have full facilities for unrestricted inspection of the Contractor's and sub-Contractor's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.
- 10.12.2 The material for final inspection shall be offered by the Contractor only under packed condition as detailed in the specification. The Owner shall select samples at random from the packed lot for carrying out acceptance tests. Insulators shall normally be offered for inspection in lots not exceeding 5000 nos. The lot should be homogeneous and should contain insulators manufactured in the span of not more than 3-4 consecutive weeks.
- 10.12.3 The Contractor shall keep the Owner informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.
- 10.12.4 No material shall be despatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived off by the Owner in writing. In the latter case also the material shall be despatched only after satisfactory testing for all tests specified herein have been completed.
- 10.12.5 The acceptance of any quantity of material shall be no way relieve the Contractor of his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection, if such material are later found to be defective.

10.13 Packing and Marking

- 10.13.1 All insulators shall be packed in strong seasoned wooden crates. The gross weight of the crates alongwith the material shall not normally exceed 200 Kg to avoid handling problem. For marine transportation, crates shall be palletted.
- 10.13.2 The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
- 10.13.3 Suitable cushioning, protective padding, or dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.
- 10.13.4 All packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly despatched on account of faulty packing and faulty or illegible markings. Each wooden case/crate shall have all the markings stenciled on it in indelible ink.

1.0 Hydraulic Internal Pressure Test on Shells (if applicable)

The test shall be carried out on 100% shells before assembly. The details regarding test will be as discussed and mutually agreed to by the Contractor and Owner in Quality Assurance Programme.

2.0 Thermal Mechanical Performance Test (if applicable)

Thermal Mechanical Performance Test shall be performed in accordance with IEC-383-1-1993 Clause 20 with the following modifications :

- (1) The applied mechanical load during this test shall be 70% of the rated electromechanical or mechanical value.
- (2) The acceptance criteria shall be
 - (a) X greater than or equal to $R + 3S$.

Where

X Mean value of the individual mechanical failing load.

R Rated electro-mechanical / mechanical failing load.

S Standard deviation.

(b) The minimum sample size shall be taken as 20 for disc insulator units.

(c) The individual electromechanical failing load shall be at least equal to the rated value. Also puncture shall not occur before the ultimate fracture.

3.0 Electromechanical/Mechanical Failing Load Test.

This test shall be performed in accordance with clause 18 and 19 of IEC 383 with the following acceptance

- (i) X greater than or equal to $R + 3S$

Where

X Mean value of the electro-mechanical/mechanical/ failing load.

R Rated electro-mechanical / mechanical failing load.

S Standard deviation.

(ii) The minimum sample size shall be taken as 20 for disc insulators units. However, for larger lot size, IEC 591 shall be applicable.

(iii) The individual electro-mechanical/mechanical failing load shall be at least equal to the rated value. Also electrical puncture shall not occur before the ultimate fracture.

4.0 Chemical Analysis of Zinc used for Galvanizing

Samples taken from the zinc ingot shall be chemically analysed as per IS:209-1979. The purity of zinc shall not be less than 99.95%.

5.0 Tests for Forgings

The chemical analysis hardness tests and magnetic particle inspection for forgings, will be as per the internationally recognised procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Contractor and Owner in Quality Assurance Programme.

6.0 Tests on Castings

The chemical analysis, mechanical and metallographic tests and magnetic, particle inspection for castings will be as per the internationally recognised procedures for these tests. The samplings will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Contractor and Owner in Quality Assurance Programme.

**HARD DRAWN STRANDED ALUMINIUM AND STEEL CORED
ALUMINIUM CONDUCTORS FOR OVERHEAD POWER LINES****FOREWORD**

A Conference on Standardisation of Specifications and Construction Practices in Rural Electrification was held on 4th and 5th January, 1971 in New Delhi. Besides the Rural Electrification Corporation, representatives of various State Electricity Boards, the Indian Standards Institution (BIS), Central Water & Power Commission (CEA), Central Board of Irrigation and Power and many other organisations participated in the discussions. Based on the consensus arrived at the Conference, REC Specification No. 1/1971 covering 7/2.21 mm (25 mm² aluminium area) and 7/3.10mm (50mm² aluminium area) AAC for use on LT lines and 7/2.59 mm (30mm² aluminium area) and 7/3.35mm (50mm² aluminium area) ACSR for use on 11 KV and LT lines was issued.

Subsequently, the Specification was revised to incorporate an additional size of ACSR viz 7/2.11mm (20mm² aluminium area) for use on 11 KV and LT lines and then again to incorporate three more sizes of ACSR viz. 7/3.35mm (50mm² aluminium area), 7/4.09mm (80mm² aluminium area) and 6/4.72mm + 7/1.57 mm (100mm² aluminium area) for use on 33 KV lines.

Consequent upon the revision of IS:398 in 1976, it was considered necessary to bring the above mentioned REC Specification in line with the revised Indian Standards Specification.

Accordingly, the required modifications were discussed by the Technical Committee on Standardisation in its meeting held in April, 1978. The Committee also considered certain suggestions made by the Conductor and Cable Manufacturers' Association of India (CACMAI) for modifications in the standard lengths, short lengths, gross weight etc.

This revised Specification is issued on the basis of the decisions taken by the Technical Committee, which were subsequently ratified by the Eighth Conference on Standardisation, Research & Training in Rural Electrification held in February, 1979.

Subsequently, BIS has introduced Amendment No. 2 to IS:398 Part-I 1976 (for AAC) and amendment No. 4 to IS:398 part-II (for ACSR conductors), reducing the maximum resistivity from 0.02845 ohm.mm²/m to 0.028264 ohm.mm²/m, thus reducing the maximum permissible resistance of all conductors at 20°C. This revision incorporates the amended values of maximum resistance at 20°C accordingly.

1. SCOPE

This Specification covers the details of the conductors for use on 33 KV, 11 KV and LT overhead lines in rural electric distribution systems. The sizes of conductors standardised for lines of different voltages are indicated below :

33KV Lines

- i) ACSR 7/3.35mm (50mm² aluminium area)
- ii) ACSR 7/4.09 mm (80mm² aluminium area)
- iii) ACSR 6/4.72 mm + 7/1.57 mm (100mm² aluminium area)

11 KV Lines

- i) ACSR 7/2.11 mm (20mm² aluminium area)
- ii) ACSR 7/2.59 mm (30mm² aluminium area)
- iii) ACSR 7/3.35 mm (50mm² aluminium area)

LT Lines

- i) ACSR 7/2.11 mm (20mm² aluminium area)
- ii) ACSR 7/2.59 mm (30mm² aluminium area)
- iii) ACSR 7/3.35 mm (50mm² aluminium area)
- iv) AAC 7/2.21 mm (25mm² aluminium area)
- v) AAC 7/3.10 mm (50mm² aluminium area)

2. APPLICABLE STANDARDS

Except when they do not comply with the specific requirements in this specification, the conductors shall comply with the Indian Standard Specification IS:398 (Pt.I)-1976 and IS:398 (Pt.II)-1976 or the latest version thereof.

3. SIZES

The sizes and properties of Stranded Aluminium and Steel cored Aluminium Conductors shall be as under:

TABLE – I

STANDARD ALUMINIUM STRANDED CONDUCTORS

Nominal Aluminium Area	Stranding and Wire Diameter	Sectional Area	Approx. Overall Diameter	Approx. Mass	Calculated Resistance at 20° C Max.	Approx. Calculated Breaking load
1	2	3	4	5	6	7
mm.sq.	mm	mm.sq.	mm	Kg./Km	Ohm./Km	KN
25	7/2.21	26.85	6.63	74	1.086	4.52
50	7/3.10	52.83	9.30	145	0.5525	8.25

TABLE – II

STRANDED STEEL CORED ALUMINIUM CONDUCTORS

Nominal Aluminium Area	Stranding & Wire Diameter		Sectional Area of Aluminium	Total Sectional Area	Approx. Overall Diameter	Approx. Mass	Calculated Resistance at 20°C Max.	Approx. Calculated Breaking Load
	AL.	Steel						
1	2	3	4	5	6	7	8	9
mm.sq	Mm	mm	mm.sq.	Mm.sq.	mm	Kg./Km.	Ohm./Km	KN
20	6/2.11	1/ 2.11	20.98	24.48	6.33	85	1.394	7.61
30	6/2.59	1/ 2.59	31.61	36.88	7.77	128	0.9289	11.12
50	6/3.35	1/ 3.35	52.88	61.70	10.05	214	0.5524	18.25
80	6/4.09	1/ 4.09	78.83	91.97	12.27	319	0.3712	26.91
100	6/4.72	7/ 1.57	105.00	118.50	14.15	394	0.2792	32.41

4. ALUMINIUM WIRES

THE PROPERTIES OF ALUMINIUM WIRES TO BE USED IN THE CONSTRUCTION OF THE STRANDED CONDUCTORS SHALL BE AS UNDER

TABLE – III
SOLID ALUMINIUM WIRES USED IN THE CONSTRUCTION OF STRANDED ACSR CONDUCTORS

Diameter			Cross Sectional Area of Nominal Diameter Wire	Mass	Resistance At 20° C	Breaking Load Min.	
Nominal	Min.	Max.				Before Stranding	After Stranding
1	2	3	4	5	6	7	8
mm	mm	mm	mm.sq.	Kg./Km	Ohm./Km.	KN	KN
2.11	2.09	2.13	3.497	9.45	8.237	0.63	0.60
2.21	2.19	2.23	3.836	10.37	7.503	0.68	0.65
2.59	2.56	2.62	5.269	14.24	5.490	0.89	0.85
3.10	3.07	3.13	7.548	20.40	3.818	1.24	1.18
3.35	3.32	3.38	8.814	23.82	3.265	1.43	1.36
4.09	4.05	4.13	13.140	35.51	2.194	2.08	1.98
4.72	4.67	4.77	17.500	47.30	1.650	2.78	2.64

5. STEEL WIRES

THE PROPERTIES OF STEEL WIRES TO BE USED IN THE CONSTRUCTION OF THE STRANDED ACSR CONDUCTORS SHALL BE AS UNDER

TABLE – IV
SOLID STEEL WIRES USED IN THE CONSTRUCTION OF STRANDED ACSR CONDUCTORS

Diameter			Cross Sectional Area of Nominal Diameter Wire	Mass	Breaking Load Min.	
Nominal	Min.	Max.			Before Stranding	After Stranding
1	2	3	4	5	6	7
mm	mm	mm	mm.sq.	Kg./Km	KN	KN
1.57	1.54	1.60	1.936	15.10	2.70	2.57
2.11	2.07	2.15	3.497	27.27	4.60	4.37
2.59	2.54	2.64	5.269	41.09	6.92	6.57
3.35	3.28	3.42	8.814	68.75	11.58	11.00
4.09	4.01	4.17	13.140	102.48	17.27	16.41

6. FREEDOM FROM DEFECTS

The wires shall be smooth and free from all imperfections, such as spills & splits.

7. JOINTS IN WIRES & CONDUCTORS

7.1 All aluminium conductors : No joints shall be permitted in any wire.

7.2 Aluminium Conductor Steel Reinforced :

Aluminium Wires: No two joints shall occur in the aluminium wires closer together than 15 metres.

Steel Wires : No joints shall be permitted in steel wires used for ACSR of Sizes 20mm² aluminium area (7/2.11mm), 30mm² aluminium area (7/2.59mm), 50mm² aluminium area (7/3.35mm) and 80mm² aluminium area (7/4.09 mm). In the case of ACSR of 100mm² aluminium area (6/4.72mm + 7/1.57 mm) having seven galvanised steel wires, joints, in individual wires shall be permitted but no two such joints shall be less than 15 metres apart in the complete steel core.

8. STRANDING

8.1 The wires used in construction of a stranded conductor shall, before stranding satisfy all the requirements of this standard for solid wires.

8.2 Lay Ratio :

(i) The lay ratio for aluminium wires in case of AAC shall be within limits given below:

No. of wires in conductors	Lay Ratio	
7	Min.	Max.
	10	14

(ii) The lay ratio for aluminium and steel wire in case of ACSR shall be within limits given below :

No. of wires		Ratio Aluminium wire dia to steel wire dia	Lay ratio for Steel wire (6 wire layer)		Lay Ratio for Aluminium wire	
Al.	Steel		Min.	Max.	Min.	Max.
6	1	1.000	-	-	10	14
6	7	3.000	13	28	10	14

9. TESTS

The samples of individual wires for the tests shall normally be taken before stranding. The manufacturer shall carry out test on samples taken out at least from 10% of aluminium wire spools and 10% of steel wire coils. However, when desired by the purchaser, the test sample may be taken from the stranded wires.

a) The wires used for all aluminium conductors shall comply with the following tests as per IS:398(Pt.I)-1976.

- Breaking load test
- Wrapping test
- Resistance test

b) The wires used for aluminium conductors, steel reinforced shall comply with the following tests as per IS:398 (Pt.II)-1976

- i) Breaking load test
- ii) Ductility test
- iii) Wrapping test
- iv) Resistance test
- v) Galvanising test

10. PACKING & MARKING

The conductors shall be wound in reels or drums conforming to IS:1778-1980 'Specification for Reels and Drums for bare wire' or the latest version thereof.

10.1 Packing

10.1.1 The gross mass for various conductors shall not exceed by more than 10% of the values given in the following table :

Conductor Size	Gross Mass
AAC	
25mm ² Al. area (7/2.21 mm)	500 Kg.
50mm ² Al. area (7/3.10 mm)	500 Kg.
ACSR	
20mm ² Al. area (7/2.11 mm)	1000 Kg.
30mm ² Al. area (7/2.59 mm)	1000 Kg.
50mm ² Al. area (7/3.35 mm)	1500 Kg.
80mm ² Al. area (7/4.09 mm)	1500 Kg.
100mm ² Al. area (6/4.72mm + 7/1.57mm)	2000 Kg.

10.1.2 The normal length of various conductors shall be as given in the following table :

Conductor Size	Normal conductor length
AAC	
25mm ² Al. area (7/2.21mm)	1.0 Km.
50mm ² Al. area (7/3.10mm)	1.0 Km.
ACSR	
20mm ² Al. area (7/2.11 mm)	2.0 Km.
30mm ² Al. area (7/2.59 mm)	2.0 Km.
50mm ² Al. area (7/3.35 mm)	2.0 Km.
80mm ² Al. area (7/4.09 mm)	1.5 Km.
100mm ² Al. area (6/4.72mm + 7/1.57mm)	2.0 Km.

10.1.3 Longer lengths shall be acceptable.

10.1.4 Short lengths, not less than 50% of the standard lengths, shall be acceptable to the maximum extent of 10% of the quantity ordered.

10.2 Marking : The following information shall be marked on each package :

- a) Manufacturers' name

- b) Trade mark, if any
- c) Drum or identification number
- d) Size of conductor
- e) Number and lengths of conductor
- f) Gross mass of the package
- g) Net mass of conductor
- h) I.S.I certification mark, if any

11. INSPECTION

All tests and inspection shall be made at the place of manufacture unless otherwise especially agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities without charge, to satisfy him that the material is being furnished in accordance with this Specification.

TECHNICAL SPECIFICATION FOR HARDWARE FITTINGS FOR 11kV and LT OVER-HEAD POWER LINES

1.0 TECHNICAL DESCRIPTION OF HARDWARE FITTINGS

1.1 Pins for Insulators

1.1.1 General Requirements

The pins shall be of single piece obtained preferably by the process of forging. They shall not be made by joining, welding, shrink fitting or any other process using more than one piece of material. The pins shall be of good finish, free from flaws and other defects. The finish of the collar shall be such that a sharp angle between the collar and the shank is avoided. All ferrous pins, nuts and washers, except those made of stainless steel, shall be galvanized. The threads of nuts and tapped holes, when cut after galvanizing shall be well oiled or greased.

1.1.2 Dimensions

For 11KV lines, pins shall be of small steel head type S 165 P as per IS:2486 (Part-II) having stalk length of 165mm and shank length of 150mm with minimum failing load of 5KN.

For 415/240 V lines, pins shall have a stalk length of 135mm and shank length of 125mm with minimum failing load of 2 KN.

1.1.3 Tests

Insulator pins shall comply with the following test requirements as per IS:2486 (Part-I)-1993 or latest version thereof:

Type Tests

- a) Checking of threads on heads
- b) Galvanising test
- c) Visual examination test
- d) Mechanical test

1.1.3.2 Acceptance Tests

- a) Checking of threads on heads
- b) Galvanising test
- c) Mechanical test

1.1.3.3 Routine Test

Visual examination test

1.2 Helically Formed Pin Insulator ties

1.2.1 Helically formed insulator ties shall be suitable for specified conductor size.

1.2.2 Helically formed ties used for holding the conductor on the pin insulator shall be made of aluminium alloy or aluminized steel or aluminium-clad steel wires and shall conform to the requirement of IS: 12048-1987.

1.2.3 The ties shall be suitable for pin insulator dimensions and conductor sizes to be specified by the owner.

1.2.4 Elastomer pad for insulator shall be used with the ties to avoid abrasion of the conductor coming into direct contact with the insulator.

1.2.5 Tests

The ties shall be subjected to the tests specified in IS: 12048-1987

1.3 Fittings for Strain Insulators with Helically formed conductor Dead-End Grips

1.3.1 Fittings for Strain Insulators of Tongue & Clevis Type

1.3.1.1 The fittings shall consist of the following components:

- a) Cross arm strap conforming to IS: 2486 (Part-II)-1989
- b) Aluminium alloy die cast thimble-clevis for attaching to the tongue of strain insulator on one end and for accommodating the loop of the helically formed dead-end fitting at the other end in its smooth internal contour. The thimble shall be suitable for all sizes of conductors ranging from 7/2.11mm to 7/3.35mm ACSR. The thimble clevis shall be attached to the insulator by a steel cutter pin used with a non-ferrous split pin of brass or stainless steel. The thimble shall have clevis dimensions as per IS:2486 (Part-II)-1989
- c) Helically formed dead-end grip having a pre-fabricated loop to fit into the grooved contour of the thimble on one end for application over the conductor at the other end. The formed fitting shall conform to the requirement of IS: 12048-1987.

1.3.1.2 Nominal dimensions of the T&C type insulator fittings are shown in Drawing No. ST&D/LINE/HW/03.

1.3.2 Fittings for Strain Insulators of Ball & Socket Type

1.3.2.1 The fittings shall consist of the following components:

- a) Cross arm strap conforming to IS:2486 (Part-II)-1989
- b) Forged steel ball eye for attaching the socket end of the strain insulator to the cross arm strap. Forgings shall be made of steel as per IS:2004-1978
- c) Aluminium alloy thimble-socket made out of permanent mould cast, high strength aluminium alloy for attaching to the strain insulator on one end and for accommodating the loop of the helically formed dead-end fittings at the other end in its smooth internal contour. The thimble-socket shall be attached to the strain insulator with the help of locking pin as per the dimensions given in IS:2486 (Part-II)-1989 and
- d) Helically dimensions dead-end grip as per clause 1.3.1.1 (c) above.

1.3.3 Tests

The helically formed fittings for strain insulators shall be subjected to tests as per IS: 12048-1987. The other hardware fittings shall be tested as per IS:2486 (Part-I).

1.4 Fittings for Strain Insulators with Conventional Dead-end Clamps (Alternative to Fittings covered in Clause 1.3)

1.4.1 Fittings for strain insulators with conventional dead-end clamps for use with tongue & clevis or ball & socket type insulators shall consist of the following components:

- a) Cross arms strap conforming to IS:2486 (Part-II)-1989

1.4.1.2 Dead-end clamp made of aluminium alloy to suit ACSR conductors from 7/2.11mm to 7/3.35mm. The ultimate strength of the clamp shall not be less than 3000 Kg.

1.4.2 Tests

The fittings shall be subjected to type, routine and acceptance tests in accordance with the stipulations of IS: 2486 (Part-I).

1.5 Shackle Insulator Fittings for 415/240V lines

1.5.1 General Requirements

- 1.5.1.1 All parts shall be of good finish and free from flaws and other defects. The edges on the outside of fittings, such as holes etc. shall be rounded.
- 1.5.1.2 All ferrous fittings and the parts other than those of stainless steel shall be galvanized. Small fittings like spring washers, nuts etc. may be electro-plated with zinc.
- 1.5.2 For angle and dead-end locations, strap type fittings shall be supplied.
- 1.5.3 Strap type fittings shall consist of the following :
 - (a) A pair of MS strap
 - (b) 2 Nos. MS bolts with hexagonal head and nuts
 - (c) 2 Nos. spring washers
 - (d) Helically formed conductor dead-end fittings made of aluminium alloy or aluminium-clad steel conforming to the requirements of REC Spec No. 25/1983.
- 1.5.4 'U' Clamp fittings shall be supplied for tangent locations or for service lines, where load is small.
- 1.5.5 'U' clamp fittings shall consist of :
 - (a) MS 'U' clamp
 - (b) 1 No. MS bolt and nut
 - (c) 1 No. spring washer
 - (d) Helically formed distribution side tie made of aluminium alloy or aluminium-clad steel conforming to the requirements of REC Spec No. 25/1983.

1.5.6 Tests

The fittings shall be subjected to type, routine and acceptance tests in accordance with the stipulations of IS: 7935.

1.6 String Insulator Fittings

- 1.6.1 The hardware fittings shall be suitable for ball and socket type insulator. Each hardware fitting shall be supplied complete in all respects.
- 1.6.2 The common snail type strain clamp shall be suitable for specified ACSR conductor.
- 1.6.3 The tension hardware with 3 or 4 bolts strain hardware shall have a minimum failing load, not less than 95% of strength of respective conductor.
- 1.6.4 The bolted type strain clamps shall be –
 - a) Common for Racoon and Wolf – 3 bolted type**
- 1.6.5 Suspension hardware fittings shall be –
 - a) Envelope type clamp and hardware for Wolf /Racoon.**
- 1.6.6 The envelop type suspension hardware suitable for Wolf /Racoon shall have minimum failing load of 30 KN.**
- 1.6.7 The suspension clamp shall have slip strength not exceeding 20% of conductor rated strength. The conductor shall not slip at loads less than 12.5% of rated strength of conductor.

1.6.8 Designation

1.6.8.1 Ball and Socket Designation

The dimensions of the ball and socket shall be 16 mm designation wherever 70kN disc insulator are used. The designation should be in accordance with the standard dimensions stated in IS: 2486-(Part-II)/IEC:120. The dimensions shall be checked by the appropriate gauge after galvanising only.

1.6.9 Security Clips and Split Pins

1.6.9.1 Security clips for use with ball and socket coupling shall be R-shaped, hump type which provides positive locking of the coupling as per IS: 2486-(Part-III) / IEC : 372. The legs of the security clips shall be spread after assembly in the works to prevent complete withdrawal from the socket. The locking device should be resilient, corrosion resistant and of suitable mechanical strength. There shall be no risk of the locking device being displaced accidentally or being rotated when in position.

1.6.9.2 Split pins shall be used with bolts & nuts.

1.6.10 Suspension Assembly

1.6.10.1 The suspension clamp shall be designed to have maximum mobility in any direction and minimum moment of inertia so as to have minimum stress on the conductor in the case of oscillation of the same.

1.6.10.2 The suspension assembly shall be designed, manufactured and finished to give it a suitable shape, so as to avoid any possibility of hammering between suspension assembly and conductor due to vibration. The suspension assembly shall be smooth without any cuts, grooves, abrasions, projections, ridges or excrescence which might damage the conductor.

1.6.10.3 The suspension assembly/clamp shall be designed so that it shall minimise the static & dynamic stress developed in the conductor under various loading conditions as well as during wind induced conductor vibrations. It shall also withstand power arcs.

1.6.11 Envelope Type Suspension Clamp

1.6.11.1 The seat of the envelope type suspension clamp shall be smoothly rounded & suitably curved at the ends. The lip edges shall have rounded bead. There shall be at least two U-bolts for tightening of clamp body and keeper pieces together. Hexagonal bolts and nuts with split-pins shall be used for attachment of the clamp.

1.6.12 Fasteners: Bolts, Nuts and Washers

1.6.12.1 All bolts and nuts shall conform to IS: 6639. All bolts and nuts shall be galvanised as per IS-1367 - (Part 13)/IS-2629. All bolts and nuts shall have hexagonal heads, the heads being forged out of solid truly concentric, and square with the shank, which must be perfectly straight.

1.6.12.2 Bolts up to M16 and having length up to 10 times the diameter of the bolt should be manufactured by cold forging and thread rolling process to obtain good and reliable mechanical properties and effective dimensional control. The shear strength of bolt for 5.6 grade should be 310 MPa minimum as per IS: 12427. Bolts should be provided with washer face in accordance with IS: 1363 Part-1 to ensure proper bearing.

1.6.12.3 Nuts should be double chamfered as per the requirement of IS: 1363 Part-III, 1984. It should be ensured by the manufacturer that nuts should not be over tapped beyond 0.4 mm oversize on effective diameter for size up to M16.

1.6.12.4 Fully threaded bolts shall not be used. The length of the bolt shall be such that the threaded portion shall not extend into the place of contact of the component parts.

- 1.6.12.5 All bolts shall be threaded to take the full depth of the nuts and threaded enough to permit the firm gripping of the component parts but no further. It shall be ensured that the threaded portion of the bolt protrudes not less than 3 mm and not more than 8 mm when fully tightened. All nuts shall fit and tight to the point where shank of the bolt connects to the head.
- 1.6.12.6 Flat washers and spring washers shall be provided wherever necessary and shall be of positive lock type. Spring washers shall be electro-galvanised. The thickness of washers shall conform to IS: 2016.
- 1.6.12.7 The Bidder shall furnish bolt schedules giving thickness of components connected. the nut and the washer and the length of shank and the threaded portion of bolts and size of holes and any other special details of this nature.
- 1.6.12.8 To obviate bending stress in bolt, it shall not connect aggregate thickness more than three time its diameter.
- 1.6.12.9 Bolts at the joints shall be so staggered that nuts may be tightened with spanners without fouling.
- 1.6.12.10 To ensure effective in-process Quality control it is essential that the manufacturer should have all the testing facilities for tests like weight of zinc coating, shear strength, other testing facilities etc, in-house. The manufacturer should also have proper Quality Assurance system which should be in line with the requirement of this specification and IS-14000 services Quality System standard.
- 1.6.12.11 Fasteners of grade higher than 8.8 are not to be used.

1.6.13 Tests

1.6.13.1 Type Tests

- (a) Visual Examination
- (b) Verification of dimensions
- (c) Slip strength test
- (d) Heating cycle test
- (e) Mechanical strength test
- (f) Electrical Resistance test

1.6.13.2 Acceptance Tests

- (a) Visual Examination
- (b) Verification of dimensions
- (c) Galvanising/Electroplating test
- (d) Mechanical strength test of each component
- (e) Mechanical Strength test of welded joint
- (f) Chemical analysis, hardness tests, grain size, inclusion rating & magnetic particle inspection for forgings/castings
- (g) Clamp Slip strength Vs Torque test for suspension clamp

1.6.13.3 Routine Tests

- (a) Visual examination
- (b) Proof Load Test

1.6.13.4 Tests During Manufacture

On all components as applicable

- | | | | | | |
|-----|--|---|----|-----|------------|
| (a) | Chemical analysis of Zinc used for galvanising |) | | | |
| | |) | | | |
| | |) | | | |
| (b) | Chemical analysis mechanical metallographic test and magnetic particle inspection for malleable castings |) | As | per | Annexure-A |
| | |) | | | |
| | |) | | | |
| (c) | Chemical analysis, hardness tests and magnetic particle inspection for forgings |) | | | |
| | |) | | | |

1.7 Materials

The Bidder shall indicate the material proposed to be used for each and every component of hardware fittings stating clearly the class, grade or alloy designation of the material, manufacturing process & heat treatment details and the reference standards.

1.8 Interchangeability

The hardware fittings shall be of standard design, so that these hardware are interchangeable with each other and suitable for use with insulators of any make conforming to relevant Indian/International Standard.

1.9 Workmanship

- 1.9.1 All the equipment shall be of the latest design and conform to the best modern practices adopted in the distribution voltage field. The Bidder shall offer only such equipment as guaranteed by him to be satisfactory and suitable for 33kV / 11kV / 415V / 240V lines, as applicable and will give continued good performance.
- 1.9.2 The design, manufacturing process and quality control of all the materials shall be such as to give the specified mechanical rating, highest mobility, elimination of sharp edges and corners, best resistance to corrosion and a good finish.
- 1.9.3 All ferrous parts including fasteners shall be hot dip galvanised, after all machining has been completed. Nuts may, however, be tapped (threaded) after galvanising and the threads oiled. Spring washers shall be electro galvanised. The bolt threads shall be undercut to take care of the increase in diameter due to galvanising. Galvanising shall be done in accordance with IS: 2629-1985 / IS:1367 (Part 13) and shall satisfy the tests mentioned in IS:2633-1986. Fasteners shall withstand four dips while spring washers shall withstand three dips of one minute duration in the standard Preece test. Other galvanised materials shall have a minimum average coating of zinc equivalent to 600/gm/sq.m., shall be guaranteed to withstand at least six successive dips each lasting one (1) minute under the standard preece test for galvanising.
- 1.9.4 Before ball fittings are galvanized, all die flashing on the shank and on the bearing surface of the ball shall be carefully removed without reducing the dimensions below the design requirements.
- 1.9.5 The zinc coating shall be perfectly adherent of uniform thickness, smooth, reasonably bright continuous and free from imperfections such as flux, ash rust, stains, bulky white deposits and blisters. The zinc used for galvanising shall be grade Zn 99.95 as per IS: 209.
- 1.9.6 Pin balls shall be checked with the applicable "GO" gauges in at least two directions one of which shall be across the line of die flashing, and the other 90° to this line. "NO GO" gauges shall not pass in any direction.

- 1.9.7 Socket ends, before galvanising, shall be of uniform contour. The bearing surface of socket ends shall be uniform about the entire circumference without depressions or high spots. The internal contours of socket ends shall be concentric with the axis of the fittings as per IS:2486/IEC : 120.

The axis of the bearing surfaces of socket ends shall be coaxial with the axis of the fittings. There shall be no noticeable tilting of the bearing surfaces with the axis of the fittings.

- 1.9.8 In case of casting, the same shall be free from all internal defects like shrinkage, inclusion, blow holes, cracks etc. Pressure die casting shall not be used for casting of components with thickness more than 5 mm.
- 1.9.9 All current carrying parts shall be so designed and manufactured that contact resistance is reduced to minimum.
- 1.9.10 No equipment shall have sharp ends or edges, abrasions or projections and cause any damage to the conductor in any way during erection or during continuous operation which would produce high electrical and mechanical stresses in normal working. The design of adjacent metal parts and mating surfaces shall be such as to prevent corrosion of the contact surface and to maintain good electrical contact under service conditions.
- 1.9.11 All the holes shall be cylindrical, clean cut and perpendicular to the plane of the material. The periphery of the holes shall be free from burrs.
- 1.9.12 All fasteners shall have suitable corona free locking arrangement to guard against vibration loosening.
- 1.9.13 Welding of aluminium shall be by inert gas shielded tungsten arc or inert gas shielded metal arc process. Welds shall be clean, sound, smooth, uniform without overlaps, properly fused and completely sealed. There shall be no cracks, voids incomplete penetration, incomplete fusion, under-cutting or inclusions. Porosity shall be minimised so that mechanical properties of the aluminium alloys are not affected. All welds shall be properly finished as per good engineering practices.

1.10 Bid Drawings

- 1.10.1 The Bidder shall furnish full description and illustrations of materials offered.
- 1.10.2 Fully dimensioned drawings of the complete hardware fittings showing clearly the arrangements shall be furnished in five (5) copies along with the bid. Weight, material and fabrication details of all the components should be included in the drawings.
- 1.10.3 All drawings shall be identified by a drawing number and contract number. All drawings shall be neatly arranged. All drafting & lettering shall be legible. The minimum size of lettering shall be 3 mm. All dimensions & dimensional tolerances shall be mentioned in mm.

The drawings shall include:

- (i) Dimensions and dimensional tolerance.
- (ii) Material, fabrication details including any weld details & any specified finishes & coatings. Regarding material designation & reference of standards are to be indicated
- (iii) Catalogue No.
- (iv) Marking
- (v) Weight of assembly
- (vi) Installation instructions
- (vii) Design installation torque for the bolt or cap screw.

- (viii) Withstand torque that may be applied to the bolt or cap screw without failure of component parts.
- (ix) The compression die number with recommended compression pressure.
- (x) All other relevant terminal details.

1.10.4 After placement of award, the Contractor shall submit fully dimensioned drawing including all the components in four (4) copies to the Owner for approval. After getting approval from the Owner and successful completion of all the type tests, the Contractor shall submit thirty (30) more copies of the same drawings to the Owner for further distribution and field use at Owner's end.

2.0 ACCESSORIES FOR CONDUCTOR

2.1 General

2.1.1 This portion (under clause 2.) details the technical particulars of the accessories for Conductor.

2.1.2 2.5% extra fasteners, filler plugs and retaining rods shall be provided.

2.2 Mid Span Compression Joint

2.2.1 Mid Span Compression Joint shall be used for joining two lengths of conductor. The joint shall have a resistivity less than 75% of the resistivity of equivalent length of conductor. The joint shall not permit slipping off, damage to or failure of the complete conductor or any part thereof at a load less than 95% of the ultimate tensile strength of the conductor.

2.2.2 In ACSR conductors, the joint shall be made of steel and aluminium sleeves for jointing the steel core and aluminium wires respectively. The steel sleeve should not crack or fail during compression. The Brinell Hardness of steel sleeve shall not exceed 200. The steel sleeve shall be hot dip galvanised. The aluminium sleeve shall have aluminium of purity not less than 99.5%. Tapered aluminium filler plugs shall also be provided on the line of demarcation between compression and non compression zone.

2.3 Repair Sleeve

Repair Sleeve of compression type shall be used to repair conductor with not more than two strands broken in the outer layer. The sleeve shall be manufactured from 99.5% pure aluminium and shall have a smooth surface. The repair sleeve shall comprise of two pieces with a provision of seat for sliding of the keeper piece. The edges of the seat as well as the keeper piece shall be so rounded that the conductor strands are not damaged during installation.

2.4 Material and Workmanship

2.4.1 All the equipment shall be of the latest proven design and conform to the best modern practices adopted in the power line field. The Bidder shall offer only such equipment as guaranteed by him to be satisfactory and suitable for 11/33 kV transmission line application and will give continued good performance.

2.4.2 The design, manufacturing process and quality control of all the materials shall be such as to achieve requisite factor of safety for maximum working load, highest mobility, elimination of sharp edges and corners, best resistance to corrosion and a good finish.

2.4.3 All ferrous parts shall be hot dip galvanised, after all machining has been completed. Nuts may, however, be tapped (threaded) after galvanising and the threads oiled. Spring washers shall be electro galvanized as per grade 4 of IS-1573-1970. The bolt threads shall be undercut to take care of increase in diameter due to galvanising. Galvanising shall be done in accordance with IS:2629-1985 / IS-1367 (Part-13) and satisfy the tests mentioned in IS-2633-1986.

Fasteners shall withstand four dips while spring washers shall withstand three dips. Other galvanised materials shall have a minimum over range coating of Zinc equivalent to 600 gm/sq.m and shall be guaranteed to withstand at least six dips each lasting one minute under the standard Preece test for galvanising unless otherwise specified.

- 2.4.4 The zinc coating shall be perfectly adherent, of uniform thickness, smooth, reasonably bright, continuous and free from imperfections such as flux, ash, rust stains, bulky white deposits and blisters. The zinc used for galvanising shall be of grade Zn.99.95 as per IS: 209.
- 2.4.5 In case of castings, the same shall be free from all internal defects like shrinkage, inclusion, blow holes, cracks etc.
- 2.4.6 All current carrying parts shall be so designed and manufactured that contact resistance is reduced to minimum and localised heating phenomenon is averted.
- 2.4.7 No equipment shall have sharp ends or edges, abrasions or projections and shall not cause any damage to the conductor in any way during erection or during continuous operation which would produce high electrical and mechanical stresses in normal working. The design of adjacent metal parts and mating surfaces shall be such as to prevent corrosion of the contact surface and to maintain good electrical contact under all service conditions.
- 2.4.8 Particular care shall be taken during manufacture and subsequent handling to ensure smooth surface free from abrasion or cuts.
- 2.4.9 The fasteners shall conform to the requirements of IS: 6639-1972. All fasteners and clamps shall have corona free locking arrangement to guard against vibration loosening.

2.5 Compression Markings

Die compression areas shall be clearly marked on each equipment designed for continuous die compressions and shall bear the words 'COMPRESS FIRST' suitably inscribed on each equipment where the compression begins. If the equipment is designed for intermittent die compressions, it shall bear the identification marks 'COMPRESSION ZONE' and 'NON-COMPRESSION ZONE' distinctly with arrow marks showing the direction of compression and knurling marks showing the end of the zones. The letters, number and other markings on finished equipment shall be distinct and legible.

2.6 Bid Drawings

- 2.6.1 The Bidder shall furnish detailed dimensioned drawings of the equipments and all component parts. Each drawing shall be identified by a drawing number and Contract number. All drawings shall be neatly arranged. All drafting and lettering shall be legible. The minimum size of lettering shall be 3 mm. All dimensions and dimensional tolerances shall be mentioned in mm.
- 2.6.2 The drawings shall include
 - (i) Dimensions and dimensional tolerances
 - (ii) Material fabrication details including any weld details and any specified finishes and coatings. Regarding material, designations and reference of standards are to be indicated.
 - (iii) Catalogue No
 - (iv) Marking
 - (v) Weight of assembly
 - (vi) Installation instructions

- (vii) Design installation torque for the bolt or cap screw
- (viii) Withstand torque that may be applied to the bolt or cap screw without failure of component parts
- (ix) The compression die number with recommended compression pressure.
- (x) All other relevant technical details

2.6.3 The above drawings shall be submitted in five copies with all the details as stated above along with the bid document. After the placement of award, the Contractor shall again submit the drawings in four copies to the Owner for approval. After Owner's approval and successful completion of all type tests, 20 (twenty) more sets of drawings shall be submitted to Owner for further distribution and field use at Owner's end.

2.7 Tests

2.7.1 Type Tests

2.7.1.1 Mid Span Compression Joint for Conductor

- (a) Chemical analysis of materials (as per Annexure – A)
- (b) Electrical resistance test
- (c) Heating cycle test
- (d) Slip strength test

2.7.1.2 Repair Sleeve for Conductor

- (a) Chemical analysis of materials

2.7.1.3 Flexible Copper Bond

- (a) Slip Strength Test (as per Annexure – A)

2.7.2 Acceptance Tests

2.7.2.1 Mid Span Compression Joint for Conductor and Earth wire

- (a) Visual examination and dimensional verification
- (b) Galvanising test
- (c) Hardness test

2.7.2.2 Repair Sleeve for Conductor

- (a) Visual examination and dimensional verification

2.7.2.3 Flexible Copper Bond

- (a) Visual examination and dimensional verification
- (b) Slip strength test

2.7.3 Routine Tests

- (a) Visual examination and dimensional verification

2.7.4 Tests During Manufacture

On all components as applicable

- (a) Chemical analysis of Zinc used for galvanising)
- (b) Chemical analysis mechanical metallo-graphic test and magnetic particle inspection for malleable castings) As per Annexure-A
- (c) Chemical analysis, hardness tests and magnetic particle inspection for forgings)

3.0 TESTS AND STANDARDS

3.1 Testing Expenses

- 3.1.1 The entire cost of testing for type, acceptance and routine tests and tests during manufacture specified herein shall be treated as included in the quoted Ex-works Price.
- 3.1.2 The Owner reserves the right of having at his own expense any other test(s) of reasonable nature carried out at Contractor's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the specifications.
- 3.1.3 The Owner also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Contractor's premises or at any other test centre. In case of evidence of non compliance, it shall be binding on the part of Contractor to prove the compliance of the items to the technical specifications by repeat tests, or correction of deficiencies, or replacement of defective items, all without any extra cost to the Owner.

3.2 Test Reports

- 3.2.1 Copies of type test reports shall be furnished in at least six copies along with one original. One copy shall be returned duly certified by the Owner, only after which the commercial production of the concerned material shall start.
- 3.2.2 Copies of acceptance test report shall be furnished in at least six copies. One copy shall be returned, duly certified by the Owner, only after which the materials will be dispatched.
- 3.2.3 Record of routine test report shall be maintained by the Contractor at his works for periodic inspection by the Owner's representative.
- 3.2.4 Test certificates of tests during manufacture shall be maintained by the Contractor. These shall be produced for verification as and when desired by the Owner.

3.3 Inspection

- 3.3.1 The Owner's representative shall at all times be entitled to have access to the works and all places of manufacture, where the material and / or its component parts shall be manufactured and the representatives shall have full facilities for unrestricted inspection of the Contractor's, sub-Contractor's works raw materials, manufacturer's of all the material and for conducting necessary tests as detailed herein.
- 3.3.2 The material for final inspection shall be offered by the Contractor only under packed condition as detailed in clause 4.11 of this part of the Specification. The engineer shall select samples at random from the packed lot for carrying out acceptance tests.
- 3.3.3 The Contractor shall keep the Owner informed in advance of the time of starting and of the progress of manufacture of material in its various stages so that arrangements could be made for inspection.
- 3.3.4 Material shall not be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived off by the Owner in writing. In the latter case also the material shall be dispatched only after all tests specified herein have been satisfactorily completed.
- 3.3.5 The acceptance of any quantity of material shall in no way relieve the Contractor of his responsibility for meeting all the requirements of the Specification, and shall not prevent subsequent rejection, if such material is later found to be defective.

3.4 Packing and Marking

- 3.4.1 All material shall be packed in strong and weather resistant wooden cases/crates. The gross weight of the packing shall not normally exceed 50 Kg to avoid handling problems.
- 3.4.2 The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
- 3.4.3 Suitable cushioning, protective padding, dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.
- 3.4.4 Bolts, nuts, washers, cotter pins, security clips and split pins etc. shall be packed duly installed and assembled with the respective parts and suitable measures shall be used to prevent their loss.
- 3.4.5 Each component part shall be legibly and indelibly marked with trade mark of the manufacturer and year of manufacture.
- 3.4.6 All the packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty packing and faulty or illegible markings. Each wooden case/crate shall have all the markings stenciled on it in indelible ink.

3.5 Standards

- 3.5.1 The Hardware fittings, conductor and earth wire accessories shall conform to the following Indian/International Standards which shall mean latest revisions, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification.
- 3.5.2 In the event of the supply of hardware fittings; conductor and earth wire accessories conforming to standards other than specified, the Bidder shall confirm in his bid that these standards are equivalent to those specified. In case of award, salient features of comparison between the Standards proposed by the Contractor and those specified in this document will be provided by the Contractor to establish their equivalence.

Sl. No.	Indian Standard	Title	International Standards
1.	IS : 209-1992		Specification for Zinc BS:3436-1986
2.	IS 1573-1991		Electroplated Coating of Zinc on iron and steel
3.	IS : 2121-1981		Specification for Conductor and Earth-wire Accessories for Overhead Power lines Part-I Mid-span Joints and Repair Sleeves for Conductors
4.	IS:2486		Specification for Insulator Fittings for Overhead power Lines with Nominal Voltage greater than 1000 V Part-I.1993 General Requirements and Tests
5.	IS:2629-1990		Recommended Practice for Hot Dip Galvanising of Iron and Steel
6.	IS:2633-1990		Method of Testing Uniformity of Coating on Zinc Coated Articles

1.0 TESTS ON HARDWARE FITTINGS**1.1 Galvanising / Electroplating Test**

The test shall be carried out as per Clause no. 5.9 of IS: 2486-(Part-1) - 1972 except that both uniformity of zinc coating and standard preece test shall be carried out and the results obtained shall satisfy the requirements of this specification.

1.2 Mechanical Strength Test of Each Component

Each component shall be subjected to a load equal to the specified minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. The load shall be held for five minutes and then removed. The component shall then again be loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified UTS and held for one minute. No fracture should occur. The applied load shall then be increased until the failing load is reached and the value recorded.

1.3 Mechanical Strength Test of Welded Joint

The welded portion of the component shall be subjected to a Load of 2000kgs for one minute. Thereafter, it shall be subjected to die-penetration/ ultrasonic test. There shall not be any crack at the welded portion.

1.4 Clamp Slip Strength Vs Torque Test for Suspension Clamp

The suspension assembly shall be vertically suspended by means of a flexible attachment. A suitable length of Conductor shall be fixed in the clamp. The clamp slip strength at various tightening torques shall be obtained by gradually applying the load at one end of the conductor. The Clamp slip strength vs. torque curve shall be drawn. The clamp slip strength at the recommended tightening torque shall be more than 12.5% but less than 20% of conductor rated strength.

2.0 TESTS ON CONDUCTOR AND EARTHWIRE ACCESSORIES**2.1 Mid Span Compression Joint for Conductor and Earth-wire****(a) Slip Strength Test**

The fitting compressed on conductor/earth wire shall not be less than one meter in length. The test shall be carried out as per IS:2121 (Part-II)- clause 6.4 except that the load shall be steadily increased to 95% of minimum ultimate tensile strength of conductor/earth wire and retained for one minute at this load. There shall be no movement of the conductor/ earth wire relative to the fittings and no failure of the fittings during this one minute period.

(b) Hardness Test

The Brinnel hardness at various points on the steel sleeve of conductor core and of the earthwire compression joint and tension clamp shall be measured.

2.2 Flexible Copper Bond**Slip Strength Test**

On applying a load of 3 kN between the two ends, stranded flexible copper cable shall not come out of the connecting lugs and none of its strands shall be damaged. After the test, the lugs shall be cut open to ascertain that the gripping of cable has not been affected.

2.3 Chemical Analysis Test

Chemical analysis of the material used for manufacture of items shall be conducted to check the conformity of the same with Technical Specification and approved drawing.

3.0 TESTS ON ALL COMPONENTS (AS APPLICABLE)

3.1 Chemical Analysis of Zinc used for Galvanizing

Samples taken from the zinc ingot shall be chemically analysed as per IS-209. The purity of zinc shall not be less than 99.95%.

3.2 Tests for Forgings

The chemical analysis hardness tests and magnetic particle inspection for forgings will be as per the internationally recognised procedures for these tests. The, sampling will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Contractor and Owner in Quality Assurance Programme.

3.3 Tests on Castings

The chemical analysis, mechanical and metallographic tests and magnetic particle inspection for castings will be as per the internationally recognised procedures for these tests. The samplings will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Contractor and Owner in Quality Assurance Programme.

-(51)-
**TECHNICAL SPECIFICATION FOR STRANDED
AND SOLID GI WIRE**

A) STRANDED GI WIRE:

1. **Scope:** This specification provides for manufacture, test dispatch supply and delivery of Galvanized stranded steel wire.
2. **Standards:** The G.I. (Stay) Wires shall comply with the following Indian Standards with their latest amendments unless otherwise modified in this specification or any other international standards which ensured equal or higher quality materials.

Stranded Wire

IS : 2141	1979
IS : 4826	1979
IS : 6594	1974

and the relevant standards indicated therein with latest amendment.

Hot dip galvanized with heavy coating for stranded wire shall confirm to IS: 4826-1979 with latest amendment.

MATERIALS

1.01 Materials –

- a) Stranded G.I. (Stay) wires 7/10 SWG equivalent to 7/3.15 mm for 33kV
- b) Stranded G.I. (Stay) wires 7/12 SWG equivalent to 7/2.5 mm for 11kV
- c) Stranded G.I. (Stay) wires 7/14 SWG equivalent to 7/2.0 mm for LT

- 1.1 The wire shall be drawn from steel made by the open hearth basic oxygen or Electric Furnace process and of such quality that when drawn to the size of wire specified and coated with zinc, the finished strand and the individual wires shall be of uniform quality and have the properties and characteristics as specified in this specification. The wires shall not contain sulphur and phosphorus exceeding 0.060% each.
- 1.2 The wire shall be coated with zinc of grade Zn 98 of IS: 209-1966 with latest amendment.
- 1.3 The wires shall be circular and shall be free from scale, irregularities, imperfection, split surface flaws, rough jagged and imperfect edges. The zinc coating shall be smooth, even and bright.
- 1.4 Joints shall be permitted in the individual wires during stranding but these stranding joints shall be less than 15 meters a part in the finished strands.

2.0 CONSTRUCTION

- 2.1 The wires shall be of grade 4 having minimum Tensile strength of (700 N/mm²).
- 2.2 The construction details shall be as specified in table 'A' below. The galvanized stay strand shall be of 7 (seven) wire and wires shall be so stranded together that when an evenly distributed pull is applied at the ends of the completed reach strand will take an equal share of the pull.
- 2.3 Minimum Breaking load
The minimum breaking load of the wire before and after stranded shall be as per IS : 2141/1979 with latest amendment.

No. of wires	SWG of Wire	Diameter (mm)	Minimum breaking load (KN/mm ²) of single wire before stranding	Length of lay	Strands minimum breaking load (KN)
7	10	3.15	5.46	12 to 18 times the strand dia.	36.26
7	12	2.5	3.44	-Do-	-
7	14	2.0	2.20	-Do-	14.62

TOLERANCE:

The tolerance of $\pm 2.5\%$ of on the diameter of wires with a mm² .025 mm before stranding shall be permitted.

2.4 The minimum elongation shall be as per IS : 2141-1979 with latest amendments.

3.0 SAMPLING CRITERIA :-

Sampling criteria and the tests shall be in accordance with IS: 2141-1979.

4.0 TESTS

4.1 Test on wires before manufacture.

- i) Ductility test in accordance with IS : 2141 with latest amendment.
- ii) Measurement of diameter.

4.2 Test on completed strand.

- i) Tensile and Elongation test as per IS : 2141 with latest amendment.
- ii) Chemical analysis of sample from each lot.
- iii) Coating test.

The uniformity of zinc coating shall be tested by method specified in IS: 2633-1964 with latest amendments. The wire shall withstand the number of dips as specified in IS: 4826-1968 or latest version indicated below in table 'B'.

TABLE 'B' Hard		HEAVY COATED WIRE	
Nominal diameter of galvanized wire (mm)/SWG	Wt. Of coating wire g/m ²	No. of dips	
		1 Min.	½ Min.
3.15/10	250	3	-
2.5/12			
2.0/14	210	2	

WEIGHT OF COIL

1. The wires shall be supplied in 70-100 Kg. Coils.

2. Marking

Each coil should be provided with a label fixed firmly on the inner part of the coil bearing the following information.

- a) Manufacturer's name or trade marks
- b) Lot number and coil numbers
- c) Size

- d) Constructions
- e) Tensile designation
- f) Lay
- g) Coating
- h) Length
- i) Mass
- j) Contract No.
- k) ISI Certification mark
- l) Identification mark if any.

The above shall be legibly stamped upon a metallic tape securely attached to the coil.

3. Packing

Each coil shall be wrapped in hessian and packed in a manner acceptable to the purchaser.

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SOLID GI WIRE

1. **Scope:** This specification provides for manufacture, test dispatch supply and delivery of solid GI wire.
2. **Standards:** The G.I. (Stay) Wires shall comply with the following Indian Standards with their latest amendments unless otherwise modified in this specification or any other international standards which ensured equal or higher quality materials.

Stranded Wire

IS : 280 1979

IS : 7887 1979

and the relevant standards indicated therein with latest amendment.

Hot dip galvanized with heavy coating for stranded wire shall confirm to IS: 4826-1979 with latest amendment.

MATERIALS

1.0 Materials –

Supply of solid steel G.I. (Stay) wires 8 SWG.

- 1.1 The wire shall be drawn from the wire rods conforming IS: 7887-1975
- 1.2 The requirement for chemical composition for the wires shall confirm to those given in IS:7887-1975
- 1.5 The wires shall be circular and shall be free from scale, irregularities, imperfection, split surface flaws, rough jagged and imperfect edges. The zinc coating shall be smooth, even and bright.
- 1.6 Tolerance in diameter:
The tolerance in nominal dia at any section of wire shall not exceed $\pm 2.5\%$. Further the maximum difference between the dia at any two section of wire shall not exceed 2.8%.

1.7 Tensile tests for GI wire

- i. The tensile strength of the wire of hard grade when tested in accordance with IS:1521-1972 shall be 550-900 Mpa
- ii. The solid wire shall be subjected to wrapping test in accordance with IS:1755-1961. The wire shall withstand without breaking or splitting being wrapped eight times round its own diameter and subsequently straightend
- iii. The galvanized coating of steel wire shall confirm to the requirement given IS:4826-1968.
- iv. All the test and sampling criterion shall be in accordance with IS:280-1978
The wire should be galvanized after drawing without annealing. Weight of coating and number of dips

TABLE 'B' Hard		HEAVY COATED WIRE	
Nominal diameter of galvanized wire (mm)/SWG	Wt. Of coating wire g/m ²	No. of dips	
		1 Min.	½ Min.
4/8	275	3	-

WEIGHT OF COIL

1. The wires shall be supplied in 50-75 Kg. Coils.
2. Marking

Each coil should be provided with a label fixed firmly on the inner part of the coil bearing the following information.

- a) Manufacturer's name or trade marks
- b) Lot number and coil numbers
- c) Size
- d) Constructions
- e) Tensile designation
- f) Lay
- g) Coating
- h) Length
- i) Mass
- j) Contract No.
- k) ISI Certification mark
- l) Identification marks if any.

The above shall be legibly stamped upon a metallic tape securely attached to the coil.

3. Packing

Each coil shall be wrapped in hessian and packed in a manner acceptable to the purchaser.

1.0 GENERAL TECHNICAL REQUIREMENTS

1.1 Type of A B Switch

The A B Switch shall be outdoor type suitable for horizontal mounting on the support structure. The A B switch shall be 3-phase 3-pin type gang operated and of rotating type with one post insulators per stack and single throw, double break characteristic. It would be complete with arcing horns, down pipe and operating mechanism.

1.2 Current Density

Current density to be adopted for all the parts of A B Switch and terminal connector shall not exceed the following limits:

- a. Hollow tube section –Copper- 2.0 A/sqmm
- b. Flat section – Copper 1.6 A/sqmm
- c. Terminal connectors –Alum. 1.0 A/sqmm

1.3 Post Insulators

- i) The Post insulator shall be with solid core insulators. Polycone insulators shall not be acceptable. The post insulator should conform to IS: 2544 latest issue. Each stack two such insulators placed one over other with original cementing.
- ii) The insulator shall be provided with a completely galvanised steel base design for mounting on the support. The base and mounting arrangement of the insulator shall be such that the insulator shall be rigid and self-supporting and no guying or cross bracing between phases shall be necessary.
- iii) Insulator shall be made of homogeneous and vitreous porcelain of high mechanical & dielectric strength. It shall have sufficient mechanical strength to sustain electrical and mechanical loading on account of wind load, short circuit stresses etc. Glazing of the porcelain shall be uniform brown or dark brown colour with a smooth surface arranged to shed away rain water. Porcelain and metal parts shall be assembled in such a way that any thermal differential expansion between the metal and porcelain through the range of temperature specified in this specification shall not loosen the parts or create undue internal stresses which may affect the mechanical or electrical strength or rigidity.
- iv) Cap of the insulator shall be of high grade malleable steel casting. It shall be machine faced and hot dip galvanised as per IS 3638, IS 2623. The cap shall have four number of tapped holes spaced on a pitch circle of diameter of 76 mm. To accommodate the terminal clamps of Busbar.
- v) 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.

1.4 Operating Mechanism

- i) Manual operating mechanism gang operated through hand-operated lever shall be provided for A B switch.
- ii) The operating mechanism shall provide quick, simple and effective operation. The design shall be such that one person shall be able to operate the A B Switch without undue efforts. A B Switch operating mechanism should be such that it should not operate by gravity, wind, short circuit, seismic acceleration, vibration, shock, accidental touching.

- iii) It shall make it possible to effect a smooth and fully controlled movement of the three blades simultaneously throughout the entire cycle of operation. Adjustment step shall be provided at either end and of the mechanism to stop the handle in the "ON" and "OFF" position. Pad locking arrangement for the handle in the "ON" and "OFF" position should be clearly indicated on the stand.

1.5 Control Cabinet

- i) The control cabinet of each operating mechanism shall be made out of 12 SWG (2.64 mm thick) sheet steel. Control cabinet shall be provided with hinged door along with padlocking arrangement. 15mm thick neoprene or better type of gaskets shall be provided to ensure degree of protection at least IP55 as per IS 13947.

1.6 Gland Plates and Glands

A removable gland plate with double compression type brass cable glands shall be provided with each operating mechanism for terminating all cables.

1.7 Auxiliary Switch

- i) Main switch operating mechanism shall be equipped with reliable auxiliary switch with 4 NO & 4 NC contacts exclusively for owner's interlocking and protection scheme.
- ii) The auxiliary switch and auxiliary shall be capable of carrying of 10 Amp current continuously.
- iii) Quick make and break (QMB) type auxiliary switch shall have snap action built in within the switch.
- iv) Auxiliary switches shall be actuated by a cam or similar arrangement directly mounted on the A B Switch shaft without any intermediate levers, linkages etc to ensure fool proof operation.

1.8 Terminal and Wiring

A B switch operating mechanism shall be provided with 1100 volt grade stud type terminal. Auxiliary switch shall be wired upto the terminal block. There shall be at least 20% extra terminals. All wiring shall be carried out with 1100 V grade PVC insulated 2.5 sq. mm copper conductor maximum conductor temperature shall be as per IS: 3961.

1.9 Accessories

- i. Position indicator
- ii. Name plate (Complete details of the parameter)
- iii. Padlocking device
- iv. Status of the A B Switch shall not show as closed till its contacts are not closed properly.
- v. Status of the A B Switch shall not show as opened till its contacts are not opened at least 80% of the isolating distance.

1.10 Earthing

- i. Flexible copper braid connections shall be provided between rotating earth blades and the frame which shall have a cross section of at least 50 sqmm and shall be tinned or suitably treated against corrosion.
- ii. The frame of each A B Switch shall be provided with two reliable earthing terminals for connecting to earth mat. The connection shall be such that it can carry specified short circuit current.

1.11 Design and Construction

- i. Contractor shall have to give full details of design, manufacturing, quality control etc of the equipment offered in respect of the following items.
1. Contacts material, current density etc.
 2. Contact support and fixing arrangement on insulator.
 3. Bearings, housing of bearings, bushes etc.
 4. Base plates
 5. Down pipe, guides joints
 6. Operating mechanism, aux switch, size and thickness of box, degree of protection, gland plate, gland etc.
 7. Nuts, bolt and fasteners
 8. Inter locking devices.

Offers without the above information or with incomplete information may be rejected.

- ii. 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 1.1x Rated voltage if extinction voltage is not specified.

1.12 Fasteners

Nuts, bolts and washers of 5/8" and higher size shall be hot dip galvanised. The bolts used on tapped holes of insulator cap shall be galvanised by centrifuge process to avoid excess deposition of zinc on threads. Nuts, bolts and washers of less than 5/8" size shall be non-magnetic stainless steel.

1.13 Contacts

Contacts shall be made out of hard drawn rolled/extruded electrolytic grade copper. The contact assembly should be so robustly designed that while carrying the rated continuous current the temperature rise does not increase beyond 65°C over and average ambient temperature of 40°C and peak ambient temperature of 50°C. Arcing contacts wherever provided shall close first and open last. The contacts shall be silver plated (10 to 15 microns).

1.14 Terminal Pad

It shall be made out of electrolytic copper heavily silver plated (15 microns). The terminal pads shall be suitable for connection to 40x40 mm terminal connector.

1.15 Mounting of Contacts

Fixed contacts shall be mounted on 6 mm thick 100x50 mm M.S. Galvanised 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.

1.16 Moving Blades

Contact surface of moving blades shall be heavily silver plated to 15 microns thick. The surface shall be wiped during closing and opening operations to remove any oxide deposition on the contacts. The blades would be made of single length of rolled/extruded electrolyte grade copper of adequate size matching with the current carrying capacity. The blade shall be supported shall be steel angle on MS angle striping of adequate dimensions (40x40x6 mm).

1.17 Fixed Contact Assembly

The fixed contact element shall be made of rolled/extruded electrolyte grade copper flat and reverse loop type. The contact assembly shall be so robustly designed that while carrying the rated continuous current the temperature rise does not increase beyond 65°C over and average ambient temperature of 40°C. The fixed contact assembly shall be spring-loaded and of high pressure and self aligned type, head guide shall be provided so that proper rating of contact elements and detailed even when the blade is out of alignment by ¼ inch. It should be of robust design. The fixed contact assembly shall be designed in such that the passage of short circuit current for a period one second shall not cause any annealing of the contact. The various part should be finished to ensure inter-changeability of similar component.

1.18 Bearings

Rotating insulator shall be mounted on a housing with bearings. Two numbers of bearings with at least 50 mm ID and 80 mm distance between the bearings shall be provided. The bearings shall be of reputed make and lubricated for lifetime. Other parts like bushes, joints springs etc shall be so designed that no lubrication shall be required during the service.

1.19 Down Pipe

The down pipes of A B Switch shall be of at 1.25% I.P.S. G.I. pipe and its length would be such that when the blades of the switch are at height of 20 ft, the operating handle is 3.5 ft from the ground level. Suitable guides shall be provided for intermediate positions of the down pipe.

1.20 Base

Each base of A B Switch shall be provided with a rigid base fabricated from steel sections. The base shall be suitable for mounting on support structures. Fabrication, welding etc shall be done by suitable jig, templates and devices used for production of the base shall be furnished with the contractor.

- i. Supporting Structures / Arcing Horns / Phase Coupling Bar The contractor shall quote unit prices for support structure for the A B Switch offered. These support structures shall be fabricated out of galvanized steel sections conforming to IS 1239.
- ii. The support structure shall be suitable for mounting operating mechanism and guides. It shall be designed to withstand short circuit forces, wind pressure, seismic forces etc. along with the operating forces, vibrations, shocks etc. at actual site conditions with adequate factor of safety.
- iii. The arcing horn shall be of 8 mm galvanised steel rod. One end of each arcing horn shall be soundly welded to a 25x6 mm steel flat which in turn shall be fitted to the switch using 5/16 inch dia galvanised bolts and nuts. Arcing horn shall be fitted against one another.
- iv. The phase coupling bar: The bar required for coupling the rotation of all the three phase would on 1 inc I.P.S. steel pipe in 9 ft length. The fixing arrangement for the phase coupling bar to the cranks and the rotating insulator stacks shall be such as to permit a smooth movement of coupling bar on operation of the switches without and bending/looseness.

1.21 Terminals & Connectors

- i. Terminal: The terminal shall be made of rolled/extruded electrolytic grade copper flat having a cross section area equal to that of the blade. It shall be so constructed that an intimate contact with the contact element is ensured and provision is made to bolt with two numbers of 3/8 inch dia galvanised bolts and nuts, a cast aluminium connector suitable to take conductors up to the size of ACSR 150 mm² using number 3/8 inch dia bolts and nuts. The terminal shall be silver coated.

- ii. Connectors: The cast aluminium connectors shall be smooth and supplied for the each end of each phase of the switch. The design of the connector shall be such that at no place its cross sectional area is less than the twice the cross sectional area of the copper blade. All the bolts should be galvanised.

1.22 Assembly

- i. The dis-connector shall be fully assembled at the works of the contractor and all operations of the fully assembled disconnector shall be checked at the manufacturer's works.

1.23 Painting , Galvanizing and Climate Proofing

- i. All interiors and exteriors of enclosures, cabinets and other metal parts shall be thoroughly cleaned to remove all rust, scales, corrosion, grease and other foreign materials. After cleaning two coats of zinc oxide primer shall be given by suitable stoving and air drying etc. Colour of the final paint shall be epoxy light gray.
- ii. Paint inside the metallic housing shall be of anti-condensation type and the paint on outer surfaces shall be suitable for out door condition.
- iii. Galvanisation shall be done after completion of the fabrication and should be capable of preventing corrosion in view of severe climatic conditions.
- iv. All ferrous part of the switch shall be hot dip galvanised as IS: 2629-1969 (as amended up to date). The steel pipe used shall be galvanised in accordance with IS: 4786-1968 (as amended up to date)

1.24 Tests

Type Tests: The A B Switch shall be type tested as per IS:1818-1972 (as amended up to date) for the following, for which the bidder shall submit the type test report along with the bid.

- i. Impulse voltage dry test
- ii. Temperature rise test of the main contact.
- iii. Measurement of resistance of main contact in closure position.
- iv. Test to prove the capability of carrying the rated full load current continuously and short circuit for some second.
- v. Mechanical endurance tests.

Routine Tests & Acceptance Test:

- i. All acceptance and routine tests as stipulated in the relevant standards shall be carried out by the supplier/contractor in presence of owner representative.
- ii. Mechanical operation test (Routine test) shall be conducted on the complete A B switch.
- iii. Immediately after finalization of the Programme of type/acceptance/routine testing, the supplier/contractor shall give three weeks advance intimation to the owner, to enable him to depute his representative for witnessing the tests.

1.25 Inspection

- i. The owner may carry out the inspection at any stage of manufacture. The contractor shall grant free access to owner's representative at a reasonable time when the work is in progress.

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- ii. The owner reserves the right to insist for witnessing the acceptance / routine testing of the bought out times.
- iii. Inspection and acceptance of any equipment under this specification by the owner, shall not relieve the supplier/contractor of his obligation of supplying equipments in accordance with the specification.

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List of the relevant standards:

- a. Indian Standards: 1818, 9921, 2544, 13947, 4691, 325, 4722, 2629, 4759, 2633, 1573, 3033, 2016, 3961, 5561, 1554, 5578, 11353, 9920
- b. IEC: 129, 168,
- c. Indian Electricity Rules 1956

Only the latest versions of all these standards shall be followed.

Technical Parameters:

S. No.	Parameter	Unit	Requirements
1	Rated Freq.	Hz.	50
2	System Neutral Earthing		Effectively earthed
3	No. of phase(poles)	No.	3
4	Temp. rise	Deg. C	As per standards IS/IEC
5	Safe duration of overload	Minutes	
	a) 150 % of rated current		
	b) 120 % of rated current		
6	Rated voltage	KV rms	12
7	Type of A B Switch (AB)		DBCR
8	Rated normal current	Amps.	400
9	Rated short time withstand current of MS for 3 second	KA rms	25
10	Rated short circuit make current	KA peak	63
11	Derating factor		unity
12	Basic Insulation Level		
	1) Lightening Impulse withstand voltage	KV peak	
	a) Pole to earth & between poles		75
	b) Across isolating distance		85
	2) Rated power freq. withstand voltage	KV rms	
	a) Pole to earth & between poles		28
	b) Across isolating distance		32
13	Min. creepage distance	mm	300
14	Special Requirements: a) A B Switch be required to make or break the line charging current when no significant change in voltage occurs across the isolating distance on account of make or break b) The A B Switch required is not with "Turn and twist mechanism" . It must be rotating type.		

Material Details:

S.No.	Description	Material	Size
1	Base Channel	MS Galvanized	75x 40 x 6 mm
2	Base Support Channel	MS Galvanized	75x 40 x 6 mm
3	Base for 4 th bearing	MS Galvanized	75 x 50 x 6 mm
4	Tandem pipe	GI Pipe	25 NB, class 'B' 3200 mm long
5	Down Pipe	GI Pipe	50 NB, Class 'B' 1900 mm long
6	Earthing Terminal		M16, Bolts with Nut
7	Support structure	MS Galvanised pipe	114 mm OD x 12 SWG

Note: The dimensions/data shown above against material details are for reference of the bidder and indicative only.

LIST OF SPECIFIC STANDARDS:

S. No.	Name of Test	Relevant Standard
1	Test on Insulator	IS 2544, IEC 168
2	Test on terminal connectors	IS 5561
3	Test on Galvanized components	IS 2623
4	Operation tests on operating mechanism & interlocks	IEC 129/IS 9921
5	Mechanical Endurance tests on auxiliary switches	

TO BE FILLED IN & SIGNED BY THE TENDERER.

SCHEDULE OF DEVIATIONS
(Clause 2.13)

We / I have carefully gone through the Technical Specification and the General condition of the contract and we / I have satisfied ourselves/myself and hereby confirm that our/ my offer strictly conform to the requirements of the Technical Specification and General conditions of the contract except for the deviation which are given below:-

Sl. No	Descriptions	Stipulations in Specifications	Deviations offered	Remarks
1.	General Conditions.			
2.	Technical			

Dated.
Place

Signature.
Name:-
Status:-

Whether authorised / attorney of
of the tendering company.

Name of the Tendering Company:-

SCHEDULE -- B

(To be filled in and signed by the TENDERER.)

SCHEDULE OF SUBMISSION OF DRAWINGS:
(Clause 2.14.2)

The Tenderer shall furnish the list of drawings which shall be furnished by him in the schedule as follows:

Sl. No.	Name of the Drawings.	When to be submitted (to be given in days after receipt of the order)

Dated.
Place

Signature.
Name:-
Status:-

Whether authorised / attorney of
of the tendering company.

Name of the Tendering Company:-

SCHEDULE --- C

(To be filled in and signed by the Tenderer)

SCHEDULE OF SPARE PARTS.
(Clause 2.16)

The Tenderer shall furnish below a list of required spare parts which are recommended for normal operation in next Five Years and cost thereof.

Sl. No.	Description of Spare Parts.	Qty. recommended.	Unit prices F.O.R. District Hd. Qtr. & ADC Hd. Qtr. site.	Application.

Dated.
Place

Signature.
Name:-
Status:-

Whether authorised / attorney of
of the tendering company.

Name of the Tendering Company:-

SCHEDULE --- D

(To be filled in and signed by the Tenderer)

SCHEDULE OF ERECTION AND MAINTENANCE TOOLS
(Clause 2.18.2)

The Tenderer shall furnish below a list of special tools, accessories and equipment required for installation, testing and maintenance of the equipment covered in this Specification together with their prices:

Sl. NO.	Description of Tools.	Quantity.	Unit prices F.O.R. District Hd. Qtr. & ADC Hd. Qtr. site.	Application.

Dated.
Place

Signature.
Name:-
Status:-

Whether authorised / attorney of
of the tendering company.

Name of the Tendering Company:-

SCHEDULE -- E

(To be filled in and signed by the Tenderer)

PERFORMANCE SCHEDULE
(Clause 2.24.3)

The Tenderer shall furnish here a list of similar works executed on Turn - Key basis which are presently in service.

Sl.No.	Size & brief description of installation.	Name of Purchaser	Value	Date since when the Sub-Station is in service.	Remarks.

Dated.
Place

Signature.
Name:-
Status:-

Whether authorised / attorney
of the tendering company.