

**GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY
DIRECTORATE OF PURCHASE & STORES**

Separate item wise sealed tenders are invited from the reputed manufacturers/dealers/also from firms registered with DPS/DGS&D/NSIC or any other Central Government Department, BY THE REGIONAL DIRECTOR, MADRAS REGIONAL PURCHASE UNIT, DIRECTORATE OF PURCHASE AND STORES, DEPARTMENT OF ATOMIC ENERGY, VI FLOOR, SHASTRI BHAVAN, 4 HADDOWS ROAD, CHENNAI- 600 006, for the supply at Central Stores, HWP, Tuticorin/Indira Gandhi Centre for Atomic Research, Kalpakkam- 603102, as detailed below.

TENDER NO	COST OF TENDER (INCLUDING TAX)	LAST DATE FOR SALE OF TENDER SET	LAST DATE FOR RECEIPT OF TENDER (1300 HRS)	DATE OF OPENING OF TENDER (1100 HRS)	EMD (INR)	SPECIFICATION AND QUANTITY
DPS/ MRPU/ IGCAR/ ELE/ 6031/ TPT- 1035	525	15/12/ 11	05/01/ 12	PART-1 06/01/ 12 PART-II 20/02/ 12	180000	BUS DUCTS FOR 415 VOLTS AND 11 KV- to ensure site condition pl. contact on email- sbg@igcar.gov.in , yvm@igcar.gov.in , rdmrpu.tndae@nic.in , pomrpu.tndae@nic.in (Detailed specification and quantity are given in the tender document which can be purchased from Deputy Controller of Accounts, Madras Regional Accounts Unit, Department of Atomic Energy, VI Floor, Shastri Bhavan, 4 Haddows Road, Chennai 600 006 by paying the cost of the tender)

The Documents priced as above can be obtained in person from the above address between 10.00 a.m. And 1.00 p.m. on all working days on submission of a written request in the firm's letter head along with an account payee DEMAND DRAFT or Banker's cheque drawn in favour of Deputy Controller of Accounts, Madras Regional Accounts Unit (no MO, cash or postal order acceptable), payable at Chennai. Wherever the tender documents are required to be sent by Post at Vendor's risk, a written request for the same along with an Account Payee Demand Draft towards the tender fee, shall be sent to the Deputy Controller of Accounts, Madras Regional Accounts Unit at the

above address indicating the details of the tender No., Name and address of the firm on whose favor the tender documents are to be issued. It must be ensured that such request should be sent in advance to reach this Directorate at least 10 days prior to the last date for sale of tender.

The envelope should be super scribed with the wordings "Request for issue of tender document against Tender No. _____".

Alternatively prospective bidders can download the set of Technical Specifications along with the, instructions, terms and conditions, from the web link mentioned below and submit the completed format along with applicable tender fee, EMD and all applicable documents much before the due date of tender opening. However in the case of two part tenders, bidders can submit their Part-I and Part-II offers in separate covers (size: S-8) in different colors, in sealed envelopes/wrappers, by clearly and legibly super-scribing the appropriate Part Number of their offers in bold letters and the covers have to be kept in a single cover which is also to be super-scribed with TENDER REF No. & DUE DATE, and submitted accordingly.

Link for downloading Standard Tender Annexure:
<http://www.igcar.gov.in/tenders>

For all indigenous contracts FORM DPS-P 11 and for all Imported contracts FORM DPS-P.12 may be downloaded as the case may be from <http://www.dpsdae.gov.in/StdTenderForms.asp>

The tenderer shall submit along with the tender, Earnest Money Deposit (EMD) as mentioned above in the form of Demand Draft or Banker's Cheque from any Nationalized / Scheduled Banks drawn in favor of Deputy Controller of Accounts, Madras Regional Accounts Unit, Chennai. Any offer not accompanied with the EMD shall be rejected summarily as non-responsive. The EMD of the unsuccessful bidders shall be returned within 30 days of the end of the bid validity period. The same shall be forfeited if the tenderers withdraw their offer after the tender opening during the bid validity period. The Government shall not be liable for payment of any interest on EMD or any depreciation thereof.

However, those who have valid registration with DGS&D, NSIC or DPS as on the date of submission of bids are exempted from payment of EMD.

Brief information about our public tender is also available at <http://www.igcar.gov.in/tenders> and <http://tenders.gov.in/department.asp?id=256>.

For terms and conditions, instructions please visit <http://www.dpsdae.gov.in>

REGIONAL DIRECTOR, MADRAS REGIONAL PURCHASE UNIT HAS THE RIGHT TO REJECT ANY OFFER IN PART OR IN FULL WITHOUT ASSIGNING ANY REASON.

REGIONAL DIRECTOR

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TECHNICAL SPECIFICATIONS

ANNEXURE TO TENDER NO. DPS/MRPU/IGCAR/ELE/6031/TPT-1035

SECTION- B **SPECIFIC REQUIREMENTS AND SCOPE OF WORK**

Design, engineering , manufacturing, assembly, inspection, testing at vendor's works, delivery to site, installation, testing and commissioning of
(I) 11 kV,1250amps phase segregated bus ducts (partly outdoor and partly indoor)
(II) 415 V,3200amps non segregated metal clad bus ducts (fully indoor)
(III) 415 V,2000 amps non segregated metal clad bus ducts (fully indoor)
With their support structures, earthing materials, end adapter boxes inclusive of right angle bends and flexible connection in various Sub-stations at IGCAR, Kalpakkam.

For Site visit and site conditions, please contact sbg@igcar.gov.in, ycm@igcar.gov.in, apo4mrpu.tndae@nic.in

2.0 Scope of Work:

2.1(A) Scope of supply:

The scope of supply includes the following:

(I) Two different lengths of 11 kV,1250amps, TP segregated Aluminium bus ducts with Aluminium bus bars (of total length of 40 metres approximately), support structure materials, Aluminium welding materials, flexible copper links, end adapter boxes, fire barrier materials and accessories, all relevant data, drawings and instruction manuals etc.

(II) Seven different lengths of 415 volts, 3200 amps (total length of all seven bus bars 70 metres approximately) TPN non segregated Aluminium bus ducts with Aluminium bus bars, support structure materials, Aluminium welding materials, flexible copper links, end adapter boxes, fire barrier materials and accessories, all relevant data, drawings and instruction manuals etc

(III) Two different lengths of 415 Volts , 2000 amps (total length of all two bus bars 35 metres approximately) TPN non segregated Aluminium bus ducts with Aluminium bus bars support structure materials, Aluminium welding materials, flexible copper links, end adapter boxes, fire barrier materials and accessories, all relevant data, drawings and instruction manuals etc.

2.1(B) Qualification criteria :-

(1) The bus duct manufacturers who are having experience of manufacturing 11kV bus ducts and 415 Volts bus ducts only will be considered for evaluation.

(2) The manufacturer shall give a list of similar job executed in last three years for 1250amps / 11KV capacity bus ducts and 3200amps/415Volt capacity bus ducts specifying description of work,

cost of work, date of completion, address of installation, name & designation of contact person for reference.

(3)The manufacturer should submit type test certificates (Temperature rise test, Short circuit test, and air tightness tests) for 1250amps / 11KV capacity out door bus ducts and 3200amps/415Volt capacity bus ducts or equivalent rating (for short circuit test and temperature rise test) from CPRI

(4) The manufacturer should have in house capability for design, manufacture and testing at his works.

(5) The manufacturer should submit performance certificates from the customers for the bus ducts already supplied.

(6)The manufacturer should have supplied minimum 50 metres of 1250 amps, 11kV / equivalent HT bus ducts and 100 Metres of 3200amps, 415 Volt bus ducts / equivalent for the past three years.

2.1(C) Price Evaluation Criteria

i. Rates quoted must include all components required for meeting the specification and performance requirements of the item irrespective of whether they are specifically brought out in the schedule or not.

ii. Basic price quoted must be exclusive of Excise Duty, all taxes, freight but inclusive of unloading charges.

iii. Excise duty, all taxes, freight, Octroi and any other charges shall be mentioned separately.

iv. Rates quoted for supply of various items shall include the cost of hiring the crane for unloading at Site.

v. Rates shall be quoted in figures and words against each item. If any conflict between figures and words then rates mentioned in words will prevail.

vi. If any multiplication errors in the amount value, then rates mentioned in words will become the basis for comparison

vii The tenderer shall quote each metre rate as well as total length rate for the item No. 1 and 2 of price schedule 1 and item No.1 of price schedule No 2 and 3 in Section E. Payment shall be made according to the actual length of bus bars consumed at site.

viii. The Price schedules E1, E2 and E3 in Section E must be read along with the specification and scope of work (Section C1, C2, D1 and D2) for complete interpretation of this scope of work quantity wise and quality wise.

ix. Items of work described in brief are detailed under Section – C1 and C2. The scope of work will not be estimated from the brief description schedule in Section E.

x. Sum total of the prices for all the price schedules from E1 to E3 will be considered for evaluating the bid. All the prices shall be firm. The total price shall be inclusive of all taxes, duties transportation charges, transit insurance etc .The percentage of tax and duties shall be declared separately along with the basic prices.

Note:-Total cost of all the three price schedules (E1,E2 and E3) only will be considered for final evaluation.

2.2 Scope of Services

The scope includes the items of work to be furnished under this specification for the satisfactory completion of the work to meet the intent of the specification and guaranteed performance of the equipment. The scope is however not limited to the items detailed below.

- 2.2.1 Design, manufacture, testing at manufacturer's works, packing and despatch.
- 2.2.2 The contractor shall furnish all necessary supporting structures, anchoring bolts/ arrangement etc. for bus duct being supplied by him.
- 2.2.3 Transportation to site and insurance.
- 2.2.4 Receiving at site, unloading, handling, opening, inspecting reporting and submitting claims in case of damages and short supply items.
- 2.2.5 Arranging to repair and/or reordering all damaged and short supply items.
- 2.2.6 Storing at site with suitable weather protection and transportation at site.
- 2.2.7 Complete erection of all equipment.
- 2.2.8 Final check up, testing and commissioning. Energisation of the bus ducts shall be carried out only after obtaining the written approval of CEA. (Electrical inspection approval will be obtained by ESG/IGCAR and Statutory inspection charges, payable to the statutory authority for inspection of Electrical installation will be borne by IGCAR.)
- 2.2.9 Supply of necessary loose items and special tools required, if any.
- 2.2.10 Obtaining written acceptance from the Engineer-in-Charge after successful completion of testing and commissioning

3.0 Project Data

IGCAR, Kalpakkam is located 95 km away from Chennai. The site is accessible by road from Chennai via Chengalpattu, Thirukkazhukundram and also via Mamallapuram by East Coast Road. The Contractor may note the severe climatic condition existing in the region with co-incident humidity, salt laden atmosphere and high temperature conducive to rust and fungus growth.

- a. Ambient Air Temperature : 45° C.
- b. Installation location : Indoor
- c. Power supplies at the Site : i. 415V ± 10%, 3 Phase, 4 wire, 50Hz ± 3% AC solidly grounded.
ii. 240 V± 10%, 50 Hz± 3%, 1 Phase AC.

4.0 Time schedule

Total time allowed for the Supply, installation, testing and commissioning of bus ducts will be **six months** as stipulated in the Tender Notice.

The Contractor shall plan the various activities to ensure the strict adherence to the time schedule and as per the priorities to be decided by the Department.

The Contractor shall note that no work will be allowed at site on Saturdays, Sundays and all Government Holidays. However, if required by the Engineer-in-Charge, to expedite the completion of specific work, as it may arise from time to time, special permissions shall be obtained to work on such days at the discretion of Engineer-in-Charge.

5.0 Deviation :

Deviation if any, from this specification shall be clearly brought out by the Contractor in their offer.

Wherever deviations are not clearly brought out/mentioned it will be deemed that the offered will fully comply with the equipment specification, irrespective of whether the literature enclosed with the offer agrees or not.

6.0 **Quality Control, Pre-Despatch Inspection and Testing of material received at Site :**

6.1 All the Items covered by this specification to be supplied by the Contractor/manufacturer shall be offered for Pre-despatch inspection to the Engineer-in-Charge or his authorized representative. Items/Components found unsatisfactory as to workmanship or materials shall be removed by the Contractor and replaced at no extra cost with Items/Components which are satisfactory.

6.2 All the Items/Components covered by this specification to be supplied by the Contractor shall be despatched only after obtaining the written Shipping Release from the Engineer-in-Charge. Waiving off pre-despatch inspection or acceptance of the items by the quality surveyor shall not relieve the Contractor/Manufacturer from the responsibility of furnishing the items and workmanship in accordance with this specification.

6.3 **Pre-Despatch Inspection**

6.3.1 The Engineer-in-Charge or his authorised representative shall have at all reasonable times access to the Supplier's or sub-Supplier's works for the purpose of witnessing the tests and to ascertain that the items being manufactured conforms to the requirements of this specification. The Engineer-in-Charge shall be given at least 15 days advance notice prior to the commencement of testing so that the representative of the Engineer-in-Charge can plan to visit and witness the tests. All the tests indicated in this specification shall be carried out in the presence of the representative of the Engineer-in-Charge by the manufacturer and shall provide all the facilities & equipment for testing. Three copies of the Test Certificates in spiral bound volumes shall be furnished to the Engineer-in-Charge for approval prior to despatch of items from the works.

6.3.2 The supplier shall carry out the checks as per the Check List which will be provided by the Engineer-in-Charge on approval of Drawings and confirm the compliance to the Specification/Check-List prior to issue of Inspection Call to the Engineer-in-Charge.

7.0 **Packing, Delivery, Unloading and Storing**

7.1 Contractor shall prepare all the items & equipment covered by this specification for transport in such a manner as to protect it from damage in transit & ingress of water/moisture and shall be responsible for and make good at his own expense any and all damage due to improper packing. The contents shall be identified on the package. The packing shall be marked with lifting & hook-up points for unloading.

7.2 The Contractor shall make his own arrangements for the transportation and unloading at site using Crane and safe storage at Site. The Contractor shall also make his own arrangements for the Crane for unloading.

8.0 **Facilities to be provided by the Department :**

8.1 3 Phase, 415 Volts, 50 Hz Power Supply will be provided by the Department at chargeable basis. The Contractor shall however make his own arrangements for receiving and distribution of the Power Supply.

8.2 The following equipment will be provided by the Department free of cost subject to availability for carrying out pre-commissioning checks :

- a. AC / DC Hi-pot Test Kit
- b. Primary Injection Test Kit
- c. Low Resistance Measurement Test Kit
- d. 2.5 kV Insulation Tester (HV Megger)

- 8.3 The Contractor can obtain this equipment on written request from the Engineer-in-Charge for the purpose carrying out the tests for the feeders/equipment covered under this work. The contractor shall check and ensure at the time of receiving the equipment that all the above equipment are in good working condition and they shall be returned in the same good working condition without any damage and loss of components.
- 8.4 In case, if any one of the above equipment suffers from damage or loss of components the same will be procured by the Contractor and made good, failing which the Engineer-in-Charge will carry out the repair/replacement and recovery will be effected towards the cost of repair/replacement from the Contractor's Running account Bill.

Delivery and Manufacturing Schedule for all the three type of bus ducts.

The Tenderer shall fill up the following schedule according to which the work shall be carried

- a. Period required for submitting drawings for Purchaser's approval, from the date of issue of Purchase order. Weeks
- b. Period allotted to the Purchaser for approval of the submitted drawings. Weeks
- c. Period required to commence Manufacture on receipt of drawings approved by the Purchaser. Weeks
- d. Period required for completing the Manufacture of switchgear units. Weeks
- e. Period required for testing the switchgear units. Weeks
- f. Period required for the transportation of the tested units to site. Week

SECTION C (1)

9.0. TECHNICAL SPECIFICATION FOR 11KV ,1250 AMPS BUS DUCTS

- 1. Design Criteria ,Capacity and quantity of bus duct required.
- 2. Delivery and installation.
- 3. Standards.
- 4. Technical details.
- 5. Surface treatment/painting.
- 6. Earthing
- 7. Measurements.
- 8. Design data and drawings.
- 9. Tests and Test Certificates.
- 10. Deviations.

9.1 DESIGN CRITERIA, CAPACITY AND QUANTITY OF BUS DUCT REQUIRED

9.1.1 The following Bus ducts are required.

- i) Rating : 1250 A, 11 kV, TP Aluminium segregated bus duct
- ii) Quantity : 2 Nos.

9.1.2 The two bus ducts will serve as interconnection between the 20 MVA, 33 kV/11 kV outdoor transformer and 11 kV Indoor MOCB / VCB Panel. This bus ducts will be installed partially outdoor and partially indoor in a hot, humid and tropical atmosphere. Design ambient temperature of bus ducts shall be 45° C.

9.1.3 Bus duct associated equipment and wiring shall be provided with tropical finish to prevent fungus growth. All ventilation openings shall be screened and drains shall be filtered to prevent entrance of dust and insects.

9.2.0 **INSTALLATION:** Installation of bus ducts shall be taken up as soon as they are delivered and shall be completed in one phase. Installation of all the bus ducts shall be completed and the bus ducts shall be commissioned after site tests. Installation procedures and support arrangements shall be finalized well in advance and got approved by the Purchaser.

9.3.0 **STANDARDS:** The design, engineering & manufacture, assembly, inspection and testing at manufacturer's works, delivery at site, installation, testing and commissioning of 11 kV segregated metal clad bus ducts shall comply with all currently applicable statutes, regulations, and safety codes in the locality where the equipment shall be installed. The equipment shall also conform to the latest revisions of all applicable standards.

- i. IS 8084 : Bus Bars & Bus bar connection.
- ii. IS 375 : Marking and arrangement for switchgear bus bar.
- iii. IS 2147 : Degree of protection provided to the end bus for LV switchgear.
- iv. IS 158 : Ready mixed water and heat resistant paint for general purpose.
- v. IS 5578 : Guide for marking of insulated conductor.
- VI. IS 3043 : Code of Practice for earthing
- VII. IS 5316 : Guide for safety procedures & practices in Electrical works
- VIII. IS 2551 : Danger board.
- IX IS 1646 : Protection of fire safety for building electrical Installation.
- X IS 732 : Testing of Electrical equipment.
- XI. Indian Electricity rules.

9.4.0 TECHNICAL DETAILS

9.4.1 Design particulars :

- | | | |
|------|--|---------------------------------------|
| i | Type of bus duct | : Segregated, TP Aluminium bus duct |
| ii | Type of cooling | : Air, Natural |
| iii | Installation location | : outdoor & Indoor |
| iv | Normal Service voltage | : 3 Phase, 11 kV +/- 10%, 50 Hz, AC |
| v | Rated voltage class | : 11 KV |
| vi | Continuous current rating of bus ducts
Under site conditions | : 1250 Amps |
| vii | One minute power frequency Dry
withstand voltage | : 28 kV |
| viii | Rated short time current for one second | : 25 KA. (rms) |
| x | Maximum operating temperature of bus
bar for an ambient of 45°C | : 90°C. |
| xi | Material of bus | : Aluminium Grade 63401 WP IS
5082 |
| xii | Mill volt drop across the joints | : As per IS |
| xiii | Impulse with stand voltage | : As per IS 8084 |

9.4.2 **General requirements**

Contractors license : The tenderer shall possess EA license from the Tamil Nadu State Licensing Authority for carrying out electrical installation work. The persons deputed by the tenderer should also hold valid license issued by the licensing boards of state/locality in which work is to be carried out. In addition, the contractor shall also appoint and depute qualified and experienced electrical engineers for overall supervision of the work at site

9.4.3 **Construction requirements:**

Bus duct shall be installed as per site requirements for interconnection between 20 MVA transformers 11kV end termination box and the 11 kV Indoor CB panel.

9.4.3.1 The Bus ducts shall be supplied and installed in lengths as follows:

1. One length from the 11 kV side of the 20 MVA, 33 kV/11 kV outdoor type transformer-I to 11kV Indoor CBI. This length of the bus duct will be partly outdoor (Approx 15Mtrs) and partly indoor (Approx 5 Mtrs).
2. One length from the 11kV side of the 20 MVA, 33 kV/11kV outdoor type transformer-II to 11kV Indoor CBII. This length of the bus duct will be partly outdoor (Approx 15 Mtrs) and partly indoor (Approx 5 Mtrs).

9.4.3.2 Quantity of bus duct indicated in the schedule is approximate value. Actual length of bus duct, number of bends etc shall be decided by taking actual measurements from site. GA drawing of the bus duct offered shall be submitted with bid specifying dimensions of enclosure, clearance between phases and phase and earth, type of bus bar insulators, phase barriers and their mounting arrangements.

9.4.3.3 **It is in the scope of the supplier to visit the site and take actual measurements from the field before quoting.** Pre manufacture drawings shall be submitted along with the drawings of the bus duct support arrangements both for the outdoor and indoor bus ducts and the manufacture shall commence only after obtaining the approval of the Engineer-in-Charge. The drawing shall clearly indicate the span of support for the outdoor bus duct and the method of anchoring the same on the grounds shall be discussed and finalized during the site visit. It shall be possible to remove the support structures provided for the outdoor bus ducts at a future date if required without much difficulty and hindrances. The outdoor bus duct shall consist of a fire barrier at the point of entry to the panel room of the building.

9.4.3.4 The indoor bus ducts shall be supported from the ceiling roof with sufficient anchoring and shall be evenly supported throughout the length of the bus duct. The bus duct shall be leveled throughout. It is in the scope of the contractor to make the required scaffolding arrangements and platforms for carrying out the installation of the indoor bus ducts, as these bus ducts have to be mounted on top of the existing live 11 kV panels.

9.4.3.5 The bus duct end termination adapter box at the transformer end has to be matched with the transformer manufacturer's design and the drawing has to be studied along with the transformer drawing and the final version as approved by the Engineer in charge shall be taken for manufacturing.

9.4.3.6 The indoor portion of the transformer bus duct has to enter the 11 kV VCB panel end from the top and the end termination adapter box shall be compared and matched with the dimension and design of the 11 kV panel manufacturer and the final version approved by the Engineer in charge shall be taken up for manufacturing.

9.4.3.7 Similarly the other two lengths of bus ducts (fully indoor) shall have adapter box dimensions matched with the panel rear projection as designed by the manufacturer and the final version as approved by the Engineer-in-Charge shall be taken up for manufacturing.

9.4.3.8 The bus duct shall be made of 10 SWG Aluminium sheets. The bottom and side sheets shall be welded & top sheet shall be removable type with bolt & nuts 3 mm thick neoprene cork gasket shall be provided at bolted surfaces.

9.4.3.9 The length of the bus ducts section shall be not more than 2.5 Mtrs.

9.4.3.10 The bus ducts shall consist of :

- i. Straight runs.
- ii. Right angle bends.
- iii. End termination chambers, CT chambers, bellows, fire barriers, etc.

9.4.3.11 The bus bars shall be continuous and shall be of welded construction. All the welded joints shall be perfect without defects. The best welding method employing qualified welders shall be adopted. Welding at site, during installation shall be required. Welded joints shall pass the Milli-Volt drop test. Bus bars shall be painted with black insulated paint.

9.4.3.12 **END TERMINATION CHAMBERS:**

a. In switchboard end termination, it shall be properly formed to match with the equipment flange and shall have tinned braided copper flexible links brazed with end clamps (on both sides of copper flexible) for connecting bus duct and Switchgear bus. The bus duct shall have flexible neoprene rubber bellow to take care of minor mis-alignments and expansion/contraction due to temperature variations.

b. Transformer end termination, it shall be properly formed to match with the equipment flange and shall have tinned braided copper flexible links brazed with end clamps on both sides (Of the copper flexibles) for connecting Transformer terminal and the bus duct. The bus duct shall have flexible neoprene rubber bellow to take care of minor mis-alignments and expansion/contraction due to temperature variations. The adopter chamber shall be designed suitably to accommodate any phase cross over.

9.4.3.13 **BOLTED FLEXIBLE JOINTS:**

Flexible braided copper connections shall be provided at both transformer and switchgear end terminal connections. Bimetallic connectors shall be provided between the bus bar and the copper flexible, the joints shall be capable of 25 mm settlement of the equipment mounting pads. The joints shall be suitably designed to take care of the vibration at the terminals as well as the expansion and contraction of the bus bars. Details of braided copper flexible links shall be enclosed with the offer. Transposition of phases to match the equipment bus configuration also shall be accommodated at transformer end.

9.4.3.14 **HARDWARES:**

All bolts, nuts and lock washers used in the bus assembly shall be of high tensile stain less steel, Spring washers of "Beleville" type or equivalent shall be used. Suitable splice plates and bimetallic connectors shall be provided wherever necessary.

9.4.3.15 **SHORTING LINKS:**

Shorting jumpers, for the purpose of drying out the equipment before commissioning or for carrying out short circuit test on the equipment, rated for the main bus current shall be supplied for shorting the bus duct at a location, adjacent to the disconnecting links.

The shorting links shall have drilling dimensions matching those of the main bus disconnecting links. Suitable supporting structures and support insulators for the shorting links if any shall also be offered.

9.4.3.16 **BUS SUPPORT INSULTATORS:**

Bus bars shall be individually supported by superior quality moulded Fibre Reinforced Polyester (FRP) insulators with adequate mechanical strength and liberal creepage distances. Bus bar supports shall be arranged at close intervals. The bus duct shall withstand the fault level specified. Bus bar supports shall be non-hygroscopic.

FRP insulators supports shall be mounted suitably to take care of short circuit forces. Minimum thickness of FRP supports shall be 10 mm.

As a consequence of current loading and variation in external temperatures in the external sections of the bus duct, condensation of moisture may take place on the surface of the insulators. Hence the insulated supports shall have a high creepage distance and a withstand voltage rating sufficient to provide specified insulation under highly humid condition.

9.4.3.17 **Wall frame assembly :**

The wall frame assembly shall be fabricated out of Aluminium angles and sheet and shall be suitable for grouting in the wall. Fire barrier insulation (reputed make) shall be placed along with wall frame assembly and shall prevent fire propagation from transformer room to switchgear room

The electrical properties of the insulator shall be in conformity with the following specifications:

- i. Rated voltage : 11 kV
- ii. One minute power frequency
Withstand voltage : 28 kV (RMS) for both Dry & Wet conditions
- iii. Minimum creep age and clearance distance : As per IS 2099
- iv. Material of insulators : FRP with insulation

9.4.3.18 **BUS DUCT SUPPORTS :**

i. Material : The supporting structure shall be fabricated from standard steel sections and shall be hot dip galvanised after fabrication. The hot dip galvanizing shall be in accordance with IS 2629 and IS 2633.

ii. Accessories and hardware :

The supporting structures shall include supporting members, angles, brackets, hangers, longitudinal beams, channels, nuts, bolts, insulating pads, insulating washers and all other hard wares which are necessary for the erection and support of the entire bus duct installation. All the accessories and hard wares of ferrous material shall be hot dip galvanised.

iii. Methods of support: The outdoor Bus ducts shall be supported from the ground and the indoor bus ducts from the ceiling.

9.4.3.19 **Markings :**

All components of the bus duct along with the supporting structures shall be distinctly marked for erection in accordance with the erection drawings to be prepared and furnished by the vendor. These marks shall be made in a manner as not to be erased in transit or to damage the galvanizing of the bus duct or the supporting structure.

9.4.3.20 **Miscellaneous :**

i. Studs, Nuts, bolts and tapped holes shall conform to the relevant standards. Only hexagonal nuts shall be used. All bolt holes shall be spot faced for nuts.

ii. Castings and forging shall conform to respective material specifications and shall be free from flaws. They shall be machined true as per good workshop practice. Welding shall be performed in accordance with relevant recognized standards.

9.4.3.21 **SPACE HEATERS :**

The bus duct shall be provided with space heaters of adequate capacity to maintain the internal temperature above the dew point to prevent moisture condensation within the bus duct. The space heaters shall be rated for 240 Volts, single phase, 50 Hz, AC supply, the space heaters shall be automatically controlled by differential thermometers. Each bus duct shall have two space heaters, one number shall be fixed inside the bus duct in transformer room and another space heater in switchgear room.

9.4.3.22 The bus ducts shall be designed to minimize the losses and the temperature rise due to induced currents. The bidder shall submit the loss calculation adopted and the details of the temperature rise calculations. Provision shall be made for expansion and contraction of the bus duct due to temperature changes and fault conditions using a neoprene rubber bellow.

9.4.3.23 A fire retardant barrier of reputed make with a fire rating of 3 hours, Insulation design shall be provided. Test Certificate shall be enclosed with the offer.

9.4.3.24 The bus bar supports shall be easily accessible for inspection and maintenance. Bus duct cover shall be openable at top. The inspection covers shall be provided with quick acting stainless steel clamps and shall have gaskets.

9.4.3.25 Bimetal washers shall be used at end jointing to ensure proper electrical contact with the equipment terminals. Spring washers shall be used to maintain adequate contact pressure.

9.4.3.26 The bus ducts shall have a rectangular Aluminium enclosure with adequate provision for supporting from ceiling EPs. The degree of protection shall be IP 55. Rain water entry shall be prevented by providing additional rain shield over the outdoor area of the bus duct as directed by Engineer in charge.

9.4.3.27 Three phase terminal enclosures shall be provided with flanged ends with drilling dimensions to suit the flanges at equipment terminals. The flanges shall be provided with gaskets, nuts, bolts etc.,

9.4.3.28 Drain plugs and Vents : Filter type drain plugs shall be installed at low points along the run of the bus duct to drain out automatically any moisture condensing within the bus enclosure. The filter elements shall be easily removable for maintenance.

9.4.3.29 **Mechanical Strength:**

The design of the bus duct enclosure shall be such that it shall withstand the internal or external pressures resulting from the following:

Normal operating conditions
Momentary short-circuit currents (peak)

The bidder shall submit the calculations adopted for the force withstanding capacity of the bus for the rated short circuit current.

9.5 **Surface treatment/painting**

9.5.1 All metal parts shall be de-greased and cleaned thoroughly before painting. 2 coats of zinc based primer and then two coats of final paint shall be applied.

9.5.2 Enclosure exterior shall be painted with RAL 7032 grey.

9.5.3 The bus duct interior may be given two coats of MATT black paint for efficient heat dissipation.

9.5.4 The bus duct supporting structures also shall be treated and painted like the bus ducts.

9.6.0 EARTHING

9.6.1 A tinned copper earth bus of 50 x 6 mm shall run all along the bus duct, externally but supported on the enclosure. All supporting structures and bus duct shall be securely connected at two points to the purchaser's station earthing bus. All necessary hard ware such as clamps, connectors etc., required for this purpose shall be furnished by the vendor.

9.6.2 Technical specifications for copper earthing conductor

i. Conductor :

The conductor shall be electrolytic grade copper shall have rectangular cross section of 50x6 mm of indicated size in the schedule. The flat shall be tinned to a minimum coating thickness of 50 mills.

ii. Applicable standards : IS 613 (latest revision)

iii. TEST CERTIFICATES :

The contractor along with supply of material shall furnish following test certificates.

- a. Purity of copper
- b. Tin coating for the conductor
- c. Conductor resistance.

9.7 MEASUREMENTS

9.7.1 The length of the bus duct shall be measured along the center line, from equipment flange at one end to the flange at the other end.

9.7.2 Termination chambers, right angle bends on extra cost basis. Extra cost (over and above the straight run cost) shall be indicated separately.

9.7.3 Scope of installation includes making of cut outs on brick wall, grouting, welding to EPs embedded, fixing with anchor bolts and all associated works for the supporting structures as also modification required if any, for the equipment bus, welding of bus bar sections, etc.

9.8.0 Design data of bus ducts and drawings

9.8.1 The bid shall contain design calculation in support of the following parameters of the bus duct design:

i. Sizing of the bus bars vis-à-vis thermal capability to withstand rated continuous current and one second short time current.

ii. Spacing of the insulators vis-à-vis mechanical strength to withstand forces due to momentary short circuit current.

iii. Heat loss and temperature rise calculations for conductor and enclosure.

9.8.2 The bid shall be complete with all heat loss calculations. All formulae and other information from which the heat losses have been derived shall be enlisted.

9.8.3 Design of the bus duct shall have been type tested at CPRI or any other government recognized institute for the following tests :

- i. Short circuit test for 25 KAmps rating
- ii. Temperature rise test for 1250 Amps rating.
- iii. Degree of ingress protection for enclosure.
- iv. High voltage and impulse tests.
- v. Milli volt drop test for joints.

Copies of type test certificates for the above indicated tests shall be furnished along with the offer.

9.8.4. The tenderer shall submit the following drawings along with offer :

i. General Arrangement and sectional drawings showing the arrangement of bus bars, supports and enclosure dimensions with the offer.

ii. Final dimensions and General Arrangement drawings, structural drawings and end termination chamber details showing transposition of conductors shall be submitted and also approval shall be obtained from the Purchaser before commencing manufacture.

9.10 TESTING AND TEST FACILITIES

9.10.1 TESTING AT MANUFACTURER'S WORKS:

The following type and routine tests shall be conducted on representative section of the bus assembly. The bus assembly tested shall include bolted connections and flexible connections. The tests shall be conducted as per standards indicated in this specification.

9.10.2 TYPE TESTS

i. Temperature rise test of bare black mat painted conductors and enclosures for one bus duct

9.10.3 ROUTINE TESTS

- i. One minute power frequency withstand voltage test.
- ii. Water tightness test.
- iii. Air tightness test
- iv. Physical inspection and checking of clearances etc. as per drawing
- v. Milli volt drop test for all joints
- vi. Insulation resistance checking

9.10.4 TESTING AT SITE :

Following pre-commissioning tests have to be conducted at site :

- i. Physical Inspection and checking of clearances etc as per drawing,
- ii. Insulation resistance value measurement.
- iii. High voltage test with 2.5 kV for one minute.
- v. Milli volt drop test for all joints.

Test report of pre-commissioning tests also shall be prepared and submitted to the department before commissioning the bus duct.

9.10.5 TEST REPORTS FOR COMPONENTS

Manufacturer's type and routine test certificates shall be submitted for tests conducted as per relevant standards for the following components.

- i. Insulators
- iii. Flexible joints.
- iv. Bus bars
- v. Enclosure material.
- vi. Galvanizing of support structures.

9.10.6 GUARANTEE

Bidder shall offer guarantee for satisfactory operation of the bus duct for a period of TWELVE months from the date of commissioning and taking over by the department.

9.11. Deviations

The Tenderer shall furnish along with the offer details regarding deviations proposed from the specifications. The equipment offered shall comply with the specification in to except for the deviations approved by the Purchaser.

SECTION C (2)

I. SPECIFICATION FOR 415 VOLT, 3200A AND 2000A BUS DUCTS:-

Scope of this specification relates to design, manufacture, installation, testing and commissioning of LT bus ducts, at various substations at IGCAR, Kalpakkam, Tamil Nadu as detailed in the schedule of quantities and subsequent sections of this technical specifications.

II. STANDARDS FOR FOLLOWING WORKS (common to all the listed below works)

- i. IS 3043 : Code of Practice for earthing
- ii. IS 5316 : Guide for safety procedures & practices in Electrical works
- iii. IS 2551 : Danger board.
- iv. IS 1646 : Protection of fire safety for building electrical Installation.
- v. IS 5133 : Boxes for Electrical installation steel and cast iron.
- vi. IS 732 : Testing of Electrical equipment.
- vii. Indian Electricity rules.

III. General Requirements :

i. Contractors license : The tenderer shall possess **EA license** from the **Tamil Nadu State Licensing Authority** for carrying out electrical installation work. The persons deputed by the tenderer should also hold valid license issued by the licensing boards of state/locality in which work is to be carried out. In addition, the contractor shall also appoint and depute qualified and experienced electrical engineers for overall supervision of the work at site.

ii. Workmanship: Good workmanship and neat finished appearance are basic requirements of installation work. To ensure good workmanship of all works, the contractor shall deploy only qualified and well-experienced staff. Names and particulars of all such staffs shall be furnished to the department before initiation of work.

iii. Structural hardware :

All nuts, bolts and washers shall be of stainless steel and adequate sized to meet requirement.

iv. Site coordination :

The tenderer shall co-ordinate with other contractors working at site for installation of transformers, bus ducts, cables etc., and shall make no damage and interference to their works.

v. Completion and Guarantee :

After completion, testing and commissioning of entire electrical works, the contractor shall hand over the installation to the department along with a completion certificate and guarantee for 12 months for successful operation. Any defect/failure in installation during this defect liability period shall be replaced repaired at free of cost by the contractor.

IV. TECHNICAL SPECIFICATION

- 1. Scope.**
- 2. Capacity and quantity of bus duct required.**
- 3. Delivery and installation.**

4. **Standards.**
5. **Technical details.**
6. **Surface treatment/painting.**
7. **Earthing**
8. **Measurements.**
9. **Design data and drawings.**
10. **Tests and Test Certificates.**
11. **Deviations.**

1.0 SCOPE: This scope of work includes the design, engineering & manufacture, assembly, inspection and testing at vendor's works, delivery to site, installation, testing and commissioning of 415 V non segregated metal clad bus ducts.

2.0 CAPACITY AND QUANTITY OF BUS DUCT REQUIRED

2.1 The following Bus ducts are required.

Sl.No	Rating	Qty
1)	3200Amps	7
2)	2000 Amps	2

3.0 INSTALLATION: Installation of bus ducts shall be taken up as soon as they are delivered and shall be completed in one phase. Installation of all the bus ducts shall be completed and the bus ducts commissioned after site tests within 6 months from the date of Purchase order.

Installation procedures and support arrangements shall be finalized well in advance and got approved by the Purchaser.

4.0 STANDARDS: The design, engineering & manufacture, assembly, inspection and testing at vendor's works, delivery to site, installation, testing and commissioning of 415 V non segregated metal clad bus ducts shall comply with all currently applicable statutes, regulations, and safety codes in the locality where the equipment shall be installed. The equipment shall also conform to the latest revisions of all applicable standards.

- i. IS 8623 : Bus Bars & Bus bar connection.
- ii. IS 375 : Marking and arrangement for switchgear bus bar.
- iii. IS 2147 : Degree of protection provided to the end bus for LV switchgear.
- iv. IS 158 : Ready mixed water and heat resistant paint for general purpose.
- v. IS 5578 : Guide for marking of insulated conductor.

5.0 TECHNICAL DETAILS

5.1 Design particulars: (Common for 3200A and 2000A)

i	Type of bus duct	Non segregated, Metal Enclosed, TPN
ii	Type of cooling	Air, Natural
iii	Installation location	Indoor
iv	Normal Service voltage	3 Phase, 415 V +/- 10%, 50 Hz, AC
v	Rated voltage class	1.1 KV
vi	Continuous current rating of bus ducts Under site conditions	3200 Amps & 2000 Amps

vii	Three minute power frequency Dry withstand voltage	2.5 kV
viii	Rated short time current for one second	50 KA (RMS)
ix	Rated peak short time current	105 KA peak.
x	Maximum operating temperature of bus bar for an ambient of 45 ⁰ C.	90 ⁰ C.
Xi	Material of bus	Aluminium Grade 63401 WP IS 5082
Xii	Mill volt drop across the joints	As per IS
xiii	Impulse with stand voltage	As per IS

5.2 Construction requirements: Bus duct shall be installed as per site requirements for interconnection between transformer and Power Control Centre (PCC). Quantity of bus duct indicated in the schedule is approximate value. Actual length of bus duct, number of bends etc shall be decided by taking actual measurements from site. GA drawing of the bus duct offered shall be submitted with bid specifying dimensions of enclosure, clearance between phases and phase and earth etc.,

5.2.1 The bus duct shall be made of 10 SWG Aluminium sheets. The bottom and side sheets shall be welded & top sheet shall be removable type with bolt & nuts 3 mm thick neoprene cork gasket shall be provided at bolted surfaces .

5.2.2 The length of the bus ducts section shall be not more than 2.5 Mtrs.

5.2.3 The bus ducts shall consist of :

- i. Straight runs.
- ii. Right angle bends.
- iii. End termination chambers, CT chambers, bellows, fire barriers, etc.

5.2.4 The bus bars shall be continuous and shall be of welded construction. All the welded joints shall be perfect without defects. The best welding method employing qualified welders shall be adopted. Welding at site, during installation shall be required. Welded joints shall pass the mill volt drop test. **Bus bars shall be painted with black insulated paint.**

5.2.5 END TERMINATION CHAMBERS:

a. In switchboard end termination, it shall be properly formed to match with the equipment flange and shall have **tinned braided copper flexible links brazed with end clamps (on both sides of copper flexible)** for connecting bus duct and Switchgear bus.. **No cross over shall be permitted.** The bus duct shall have flexible neoprene rubber bellow to take care of minor mis-alignments and expansion/contraction due to temperature variations.

b. Transformer end termination, it shall be properly formed to match with the equipment flange and shall have **tinned braided copper flexible links brazed with end clamps on both sides(Of the copper flexibles)** for connecting Transformer terminal and the bus duct. The bus duct shall have flexible neoprene rubber bellow to take care of minor mis-alignments and expansion/contraction due to temperature variations.

c Phase cross over (if any) shall be accommodated in one of the bus duct end termination.

5.2.6 BOLTED FLEXIBLE JOINTS : Flexible braided copper connections shall be provided at both transformer and switchgear end terminal connections. Bimetallic connectors shall be provided between the bus bar and the copper flexible, the joints shall be capable of 25 mm settlement of the equipment mounting pads. The joints shall be suitably designed to take care of the vibration at the terminals as well as the expansion and contraction of the bus bars. Details of braided copper flexible links shall be enclosed with the offer. Transposition of phases to match the equipment bus configuration also shall be accommodated at transformer end.

5.2.7 HARDWARES: All bolts, nuts and lock washers used in the bus assembly shall be of high tensile

stain less steel, Spring washers of “Beleville” type or equivalent shall be used. Suitable splice plates and bimetallic connectors shall be provided wherever necessary.

5.2.8 SHORTING LINKS: Shorting jumpers, for the purpose of drying out the equipment before commissioning or for carrying out short circuit test on the equipment, rated for the main bus current shall be supplied for shorting the bus duct at a location, adjacent to the disconnecting links.

The shorting links shall have drilling dimensions matching those of the main bus disconnecting links. Suitable supporting structures and support insulators for the shorting links if any shall also be offered.

5.2.9 BUS SUPPORT INSULTATORS: Bus bars shall be individually supported by superior quality moulded Fibre Reinforced Polyester (FRP) insulators with adequate mechanical strength and liberal creepage distances. Bus bar supports shall be arranged at close intervals. The bus duct shall withstand the fault level specified. Bus bar supports shall be non-hygroscopic.

FRP insulators supports shall be mounted suitably to take care of short circuit forces. Minimum thickness of FRP supports shall be 10 mm.

As a consequence of current loading and variation in external temperatures in the external sections of the bus duct, condensation of moisture may take place on the surface of the insulators. Hence the insulated supports shall have a high creepage distance and a withstand voltage rating sufficient to provide specified insulation under highly humid condition.

5.2.10 Wall frame assembly : The wall frame assembly shall be fabricated out of Aluminium angles and sheet and shall be suitable for grouting in the wall. Fire barrier with insulation (reputed make) shall be placed along with wall frame assembly and shall prevent fire propagation from transformer room to switchgear room

The electrical properties of the insulator shall be in conformity with the following specifications:

- i. Rated voltage** : 1.1 kV
- ii. Three minute power frequency Withstand voltage** : 2.5 kV (RMS) for both Dry & Wet conditions
- iii. Minimum creepage distance** : As per IS 2099
- iv. Material of insulators** : FRP with insulation

5.2.11 Phase Clearances : The minimum phase to phase and phase to earth clearances of bus bars within the enclosure shall be as follows :

- Phase to Phase** : 25.4 mm
- Phase to Earth clearance** : 19.4 mm

5.2.12 BUS DUCT SUPPORTS :

i. Material : The supporting structure shall be fabricated from standard steel sections and shall be hot dip galvanised after fabrication. The hot dip galvanizing shall be in accordance with IS 2629 and IS 2633.

ii. Accessories and hardware :

The supporting structures shall include supporting members, brackets, hangers, longitudinal beams, channels, nuts, bolts, insulating pads, insulating washers and all other hard wares which are necessary for the erection and support of the entire bus duct installation. All the accessories and hard wares of ferrous material shall be hot dip galvanised.

iii. Methods of support Bus ducts shall be supported from the EPs provided on the ceiling.

5.2.13 Markings :

All components of the bus duct along with the supporting structures shall be distinctly marked for erection in accordance with the erection drawings to be prepared and furnished by the vendor. These

marks shall be made in a manner as not to be erased in transit or to damage the galvanizing of the bus duct or the supporting structure.

5.2.14 Miscellaneous :

- i. Studs, Nuts, bolts and tapped holes shall conform to the relevant standards. Only hexagonal nuts shall be used. All bolt holes shall be spot faced for nuts.
- ii. Castings and forging shall conform to respective material specifications and shall be free from flaws. They shall be machined true as per good workshop practice. Welding shall be performed in accordance with relevant recognized standards.

5.2.15 SPACE HEATERS :

The bus duct shall be provided with space heaters of adequate capacity to maintain the internal temperature above the dew point to prevent moisture condensation within the bus duct. The space heaters shall be rated for 240 Volts, single phase, 50 Hz, AC supply, the space heaters shall be automatically controlled by differential thermometers. Each bus duct shall have two space heaters, one shall be fixed inside the bus duct in transformer room and another space heater in switchgear room.

5.2.16 The bus ducts shall be designed to minimize the losses and the temperature rise due to induced currents. Provision shall be made for expansion and contraction of the bus duct due to temperature changes and fault conditions using a neoprene rubber bellow.

5.2.17 A fire retardant barrier with a fire rating of 3 hours, similar to the one of M/s. Lloyd Insulation design shall be provided. Test Certificate shall be enclosed with the offer.

5.2.18 The bus bar supports shall be easily accessible for inspection and maintenance. Cover shall be openable at top. The inspection covers shall be provided with quick acting stainless steel clamps and shall have gaskets.

5.2.19 Bimetal washers shall be used at end jointing to ensure proper electrical contact with the equipment terminals. Spring washers shall be used to maintain adequate **contact pressure**.

5.2.20 The bus ducts shall have a rectangular Aluminium enclosure with adequate provision for supporting from ceiling E.Ps. The degree of protection shall be IP 55.

5.2.21 Three phase terminal enclosures shall be provided with flanged ends with drilling dimensions to suit the flanges at equipment terminals. The flanges shall be provided with gaskets, nuts, bolts etc.,

5.2.22 Drain plugs and Vents : Filter type drain plugs shall be installed at low points along the run of the bus duct to drain out automatically any moisture condensing within the bus enclosure. The filter elements shall be easily removable for maintenance.

5.2.23 Mechanical Strength:

The design of the bus duct enclosure shall be such that it shall withstand the internal or external pressures resulting from the following:

- a. Normal operating conditions
- b. Momentary short-circuit currents (peak)

6.0 Surface treatment/painting

6.1 All metal parts shall be de-greased and cleaned thoroughly before painting. 2 coats of zinc based primer and then two coats of final paint shall be applied.

6.2 Enclosure exterior shall be painted with RAL 7032 grey.

6.3 The bus duct interior may be given two coats of **MATT black paint** for efficient heat dissipation.

6.4 The bus duct supporting structures also shall be treated and painted like the bus ducts.

7.0 EARTHING

7.1 A tinned copper earth bus of 50 x 6 mm shall run all along the bus duct, externally but supported on the enclosure. All supporting structures and bus duct shall be securely connected at two points to the purchaser's station earthing bus. All necessary hard ware such as clamps, connectors etc., required for this purpose shall be furnished by the vendor.

7.2 Technical specifications for copper earthing conductor

i. Conductor :

The conductor shall be electrolytic grade copper shall have rectangular cross section of 50x6 mm of indicated size in the schedule. The flat shall be tinned to a minimum coating thickness of 50 mills.

ii. Applicable standards : IS 613 (latest revision)

iii. Test certificates:

The contractor along with supply of material shall furnish following test certificates.

- a. Purity of copper
- b. Tin coating for the conductor
- c. Conductor resistance.

8.0 MEASUREMENTS

8.1 The length of the bus duct shall be measured along the centre line, from equipment flange at one end to the flange at the other end.

8.2 Termination chambers, right angle bends on extra cost basis. Extra cost (over and above the straight run cost) shall be indicated separately.

8.3 Scope of installation includes making of cut outs on brick wall, grouting, welding to EPs embedded, fixing with anchor bolts and all associated works for the supporting structures as also modification required if any, for the equipment bus, welding of bus bar sections, etc.

9.0 Design data of bus ducts

9.1 The bid shall contain design calculation in support of the following parameters of the bus duct design :

- i. Sizing of the bus bars vis-à-vis thermal capability to withstand rated continuous current and one second short time current.
- ii. Spacing of the insulators vis-à-vis mechanical strength to withstand forces due to momentary short circuit current.
- iii. Heat loss and temperature rise calculations for conductor and enclosure.

9.2 The bid shall be complete with all heat loss calculations. All formulae and other information from which the heat losses have been derived shall be enlisted.

9.3 Design of the bus duct shall have been type tested at CPRI or any other government recognized institute for the following tests:

- i. Short circuit test for 50kA for 1 Sec.
- ii. Temperature rise test for 3200 Amps rating.
- iii. Degree of ingress protection for enclosure.
- iv. High voltage and impulse tests.
- v. Milli volt drop test for joints.

Copies of type test certificates for the above indicated tests shall be furnished along with the offer.

10. Drawings :

The tenderer shall submit the following drawings along with offer.

- i. General Arrangement and sectional drawings showing the arrangement of bus bars, supports and enclosure dimensions with the offer.
- ii. Final dimensions and General Arrangement drawings, structural drawings and end termination chamber details showing transposition of conductors and also approval shall be obtained from the Purchaser before commencing manufacture.

11 TESTING AND TEST FACILITIES

11.1 TESTING AT MANUFACTURER'S WORKS :

The following type and routine tests shall be conducted on representative section of the bus assembly. The bus assembly tested shall include bolted connections and flexible connections. The tests shall be conducted as per standards indicated in this specification.

11.2 TYPE TESTS

- i. Temperature rise test of bare black mat painted conductors and enclosures.**

11.3 ROUTINE TESTS

- i. One minute power frequency withstand voltage test.**
- ii. Water tightness test.**
- iii. Air tightness test**
- iv. Physical inspection and checking of clearances etc. as per drawing**
- iv. Milli volt drop test for all joints**
- v. Insulation resistance checking**

11.4 TESTING AT SITE :

Following pre-commissioning tests have to be conducted at site :

- i. Physical Inspection and checking of clearances etc as per drawing,**
- ii. Insulation resistance value measurement.**
- iii. High voltage test with 2.5 kV for one minute.**
- iv. Milli volt drop test for all joints.**

Test report of pre-commissioning tests also shall be prepared and submitted to the department before commissioning the bus duct.

11.5 TEST REPORTS FOR COMPONENTS

Manufacturer's type and routine test certificates shall be submitted for tests conducted as per relevant standards for the following components.

- i. Insulators
- iii. Flexible joints.
- iv. Bus bars
- v. Enclosure material.
- vi. Galvanizing of support structures.

12. GUARANTEE

Bidder shall offer guarantee for satisfactory operation of the bus duct for a period of TWELVE months from the date of commissioning and taking over by the department.

13. Deviations

The Tenderer shall furnish along with the offer details regarding deviations proposed by the supplier from this specification. The equipment offered shall comply with this specification except for the deviations approved by the Purchaser.

All materials required for completion of the above work is in the scope of this contract.

TERMS AND CONDITIONS FOR ERECTION, TESTING AND COMMISSIONING

- i. The site is ready for installation and commissioning. Power supply shall be provided to the contractor, at a point preferred by him and as approved by the Engineer-in-charge. **The contractor shall make suitable arrangement for receiving and distribution of power by making use of an ISOLATOR WITH HRC FUSES and also keeping ELCB in the distribution circuit as a safety measure, as approved by the Engineer-in-charge. Electricity shall be provided on Chargeable basis.**
- iii. **The Contractor shall arrange cranes and truck for loading, shifting of the equipment, materials and shall unload the equipment directly at the place of work site. All the materials for installation and commissioning is in the scope of contract.**
- iv. Even though the project is in protected area, provision of necessary watch and ward shall be the responsibility of the Contractor
- v. Normal working days are from Monday to Friday between 0900 hrs to 1700 hrs. However working beyond these hours and on holidays is possible with a special permission on case to case basis.
- vi. All necessary gate passes/work permits shall be issued to Contractor for men and material for carrying out uninterrupted work. In case of any delay in testing and commissioning activities for reasons not attributable to the vendor, necessary delivery extensions for extended stay shall be accorded.
- vii. The insurance for material and manpower shall be in the scope of the Contractor
- viii. During installation, testing, commissioning period accommodation and transport shall be arranged by the Contractor for their man power.
- ix. After completion of erection, testing and commissioning as per specifications, the system shall be ready for energisation. The equipment is deemed to have been commissioned once the electric supply is established at

the outgoing terminals.

- x. **Electrical inspection approval will be obtained by ESG/IGCAR and Statutory inspection charges, payable to the statutory authority for inspection of Electrical installation will be borne by IGCAR**

Note ;

The section D format filled with technical details by the manufacturer shall be submitted along with the offer. The offers without technical specification shall not be considered.

All the material shall be procured only from the reputed manufacturers and a copy of the Purchase order placed by the tenderer shall be produced. Purchase through dealer is not permitted.

Pre despatch inspection shall be carried out for all materials at manufacturer's premises.

Tenderers are advised to get acquainted with the site conditions before quoting.

- 1.2.12 Short Circuit Test Certificate or Report no. :
- 1.2.13 Type and material of inter phase barriers :
- Thickness of the inter phase barriers :
- 1.2.14 Interior dimensions of the bus duct :
- 1.2.15 Thickness of enclosure material
- a) Bottom :
- b) Cover :
- c) Side :
- 1.2.16 Max. pressure to which enclosure is designed :
- 1.2.17 Mechanical (momentary) withstand rating of the bus duct (peak) :
- 1.2.18 Weights (Kg) of
- a) Transformer Bus duct cubicle :
- b) Other two Bus duct cubicles :
- 1.2.19 Impact loading for support structure design, to include dead load plus impact value of operating at max. current rating in terms of equivalent dead load :
- 2.0 Bus Bars**
- 2.1 Type of main bus bar :
- 2.2 Material of main bus bar :
- 2.3 Dimensions of the bus bar :
- 2.4 Cross section of the bus bar :
- 2.5 Maximum continuous current rating :
- 2.6 Minimum clearances provided (in air)
- a) Between phases :
- b) Between phases and earth :
- c) Center to Center distance between phases :
- 3.4 Details of bus bar segregation :
- 3.6 Momentary rating (peak) :
- 3.7 Thermal rating (RMS)
- a) 1 Second :

b) 3 Seconds	:
3.8 Temperature rise of the bus bars over the specified ambient for CMR	:
3.10 One minute power frequency withstand Voltage	:
3.11 Impulse withstand 1.2/50 micro second wave	:
4.0 Bus bar support Insulators	
4.1 Type	:
4.2 Material	:
4.3 Voltage class of the insulator	:
4.4 Dimensional details	:
4.5 Weight of one insulator	:
4.6 Insulation class of the insulator	:
4.7 Bus insulation	
a) Material and process	:
b) Thickness in mm	:
c) Voltage grade	:
d) Test Voltage	:
5.0 No. of 90 Bends	:
5.1 Dimensional details of the bends	:
5.2 Drawing of the bends	:
6.0 Welding	
6.1 Type of welding	:
6.2 Material of weld	:
6.3 Properties of the Aluminium used for welding	:
6.4 No. of Aluminium TP straight jointing welds	:
6.5 Dimensional details of the welds	:
7.0 Flexible copper links	
7.1 Material of links	:
7.2 Purity of copper	:
7.3 Dimensional details of the flexible links	:
7.4 Cross section of the copper links	:
7.5 Ampacity of the copper links	:

8.0	Breather	
8.1	Type of breather	:
8.2	Container material	:
8.3	Dimensional details	:
8.4	Drawing of the breather	:
9.0	Adapter Boxes	
9.1	Dimensional details of the adapter box at transformer end	:
9.2	Dimensional details of the adapter box at panel end	:
9.3	Drawings of the adapter boxes	:
10.0	Gasket material and details	
11.0	Wall frame assembly details	
11.1	Fire barrier material	:
11.2	Dimensional details of fire barrier	
12.0	Support Structures	
a)	Material	:
b)	Type of support	:
c)	Dimensions of the span of support for the outdoor duct	:
d)	Dimensions of the span of support for the indoor duct	:
13.0	Material for the ground bus	:
13.1	Dimensional details of the ground bus	:
13.2	Cross section of ground bus	:
13.3	Whether joints tinned or not	
13.0	Space Heater Details	
a)	Voltage	:
b)	Rating	:
c)	Numbers	:
d)	Type of control	:
e)	Whether thermostat control provided	:
14.0	Disconnects	
14.1	Primary disconnects	
a)	Type	:

- b) Contact material :
 - c) Whether self aligning or not :
- 14.2 Secondary disconnects
- a) Type :
 - b) Contact material :
 - c) Whether self aligning or not :

15.0 Terminal blocks

- a) Type :
- b) Current rating :

16.0 Sizes of small wiring

- a) Power circuits :
- b) Control circuits :
- c) C.T. circuits :

17.0 List of deviations

The Contractor shall state all the deviations from tender specification in his offer, if any. The offer shall be deemed to be in conformity with tender specification unless deviation from tender specification are clearly mentioned in this section.

18.0 Proof of ability

The Supplier/Contractor shall furnish a list of clients with contact person's name and address where similar 11 kV segregated Aluminium bus ducts has been supplied & installed by him, conforming to the specifications in this tender document and operating under similar conditions.

SECTION – D2

Format for submission of TECHNICAL DATA accompanying the Tender

3200A, 415 Volt and 2000A, 415 Volt non Segregated Aluminium Bus Duct with Aluminium Bus bars rated for 415volt ,

	(1) 3200A Bus duct	(2)2000A Bus duct
Make of the bus duct manufacturer :		
1. Nominal rated voltage		
2. Continuous current rating		
3. Generated maximum temperature rise.		
4. Heat loss at full load		
5. Rated short circuit current		
6. Insulation level		
7. Minimum clearances in air.		
i. Phase to phase and neutral.		
ii. Phase/neutral to ground (body).		
8. Minimum Creepage distance to ground		
9. Manufacturer of material		
i. Conductor material		
ii. Sheet metal		
10. Number of bus per phase.		
i. Phase bus		
ii. Neutral bus		
11. Method of jointing bus bars		
i. Welding procedure.		
ii. Electrode used.		
12. End termination chamber		
12.1 Size of flexible link.		
12.2 Tinned copper braided Copper flexibles		
12.3 No. of links per phase		

12.4 No. of links per neutral		
12.5 Method of joining the braids at end.		
13. Spacing of supports.		
14. MATERIAL DETAILS		
a. Aluminium composition		
b. Bus bars Mechanical properties.		
c. Bus bar enclosure		
d. Bus bar enclosure supports		
e. Bus bar insulated supports		
f. Expansion bellows		
g. Bus bar bolts		
h. Gaskets		
i. Paint		
j. Earth bus		
15. MATERIAL GRADE & SIZE		
a. Bus (R , Y , B Phase)		
b. Neutral Bus		
c. Earth bus		
d. Bus bar enclosure (Thickness in mm)		
e. Bellows (Thickness)		
f. Bus bar bolts & Enclosure Bolts		
g. Gaskets (Thickness)		
h. Heaters		
i. Thermostat		

j. MCB		
k. Silica gel (Breathers)		
16. Bus bar arrangements.(Interleaved)		
17. Bus bar sequence		
18. Bus bar joints details: Aluminium welding at site		
19. Fire barrier with insulation: (Between Switchgear room & Transformer bay)		
20. Degree of protection		
21. Whether short circuit tests were Conducted in 3200 Amps bus bars at CPRI/ERDA . If conducted type test certificates shall be enclosed)		
22. Whether Temperature rise tests were Conducted in 3200 Amps bus bars (If conducted, type Test certificates shall be enclosed).		
23. Fabrication facilities		
24. Painting facilities(Powder coating)		
25. Pre-despatch inspection tests at factory premises:		
i. Temperature rise tests.		
ii. IR Value (Before & after HV)		
iii. Power frequency HV tests		
iv. Milli-volt drop tests on bolted joints		
26. Tests at site after installation		
i. IR value		
ii. HV tests		
iii. Dye Penetration tests on welded joints		
iv. Milli-volt drop tests on welded joints		
27. Drawings and Test Certificates enclosed with the offer.		
I. General Arrangement Drg. No.		
ii. Sectional drawing No.		
iii. Type Test Certificate No.		
28. Manufacturing and delivery schedule		
I. Preparation of final drawings		
ii. Time to Purchaser for approval		
iii. Manufacture		

iv. Testing at Works		
v. Installation at Site		
vi. Commissioning		
29. Proof of ability		
29.1 Details regarding similar equipment		
I. supplied		
ii. Client's name and full address.		
iii. Ratings, specification and quantity.		
iv. Total value		
v. Performance report, if any.		
29.2 Equipment and facilities available		
I. at Works.		
ii. Sheet metal work.		
iii. Fabrication and welding.		
iv. Painting and surface treatment.		
v. Testing.		
30. Deviations		
The equipment offered will comply with the tender specifications completely but for the following deviations		

SECTION -E (Format for Part-II submission)

Tender Evaluation Criteria

- i. This Price schedules 1, 2 and 3 in section E must be read along with the specification and scope of work (Section C1, C2, D1 and D2) for complete interpretation of this scope of work quantity wise and quality wise.
- ii. Items of work described in brief below are detailed under Section - C. The scope of work will not be estimated from the brief description schedule in Section E.
- iii. Rates quoted must include all components required for meeting the specification and performance requirements of the item irrespective of whether they are specifically brought out in the schedule or not.
- iv. Basic price quoted must be exclusive of Excise Duty, all taxes, freight but inclusive of unloading charges.
- v. Excise duty, all taxes, freight. Octroi and any other charges shall be mentioned separately.
- v. Rates quoted for supply of various items shall include the cost of hiring the crane for unloading at Site.
- vi. Rates shall be quoted in figures and words against each item. If any conflict between figures and words then rates mentioned in words will prevail.
- vii. If any multiplication errors in the amount value, then rates mentioned in words will become the basis for comparison
- viii. The tenderer shall quote each metre rate as well as total length rate for item No. 1 and 2 of schedule E1 and item No.1 of schedule No. E 2 and E3 in Section E. Payment shall be made according to the actual length of bus bars consumed at site.
- ix. Sum total of the prices for all the price schedules from E1 to E3 will be considered for evaluating the bid. All the prices shall be firm and inclusive of all taxes , duties transportation charges, transit insurance etc .The percentage of tax and duties shall be declared separately along with the basic prices.

Note:-Total cost of all the three price schedules only will be considered for final evaluation

PRICE SCHEDULE-E1
1250 amps, 11KV, Bus ducts - at two different places (From out door Transformers to 11kV incomer panels)

Item. No	Item Description	Qty	Unit	Basic Price Excl. of Tax	Taxes and Duties	Total Price in Rs
(A)	Supply of items					
1	Straight run of Bus duct – Indoor 1250A, 11kV	10	Mtr			
2	Straight run of Bus duct - Outdoor 1250A, 11KV	30	Mtr			
3	90° bend	4	Nos.			
4	Adaptor box at Transformer end	2	Nos.			
5	Adaptor box at Panel end	2	Nos.			
6	Braided Cu. Flexible Termination at Transformer end	2	TP SET			
7	Braided Copper Flexible Termination at Panel end	2	TP SET			
8	Wall Frame Assembly with Fire Barrier	2	Set			
9	Space Heater with Thermostat for 1 set of bus duct	2	Set			

10	Junction Box for Space Heater wiring	2	Nos.			
11	Breather	2	Nos.			
12	GI Support Structures	1000	Kg			
13	Aluminium Flexible Expansion Joint	2	TPSET			
14	Rubber Bellow	4	Nos.			
15	Welding of Bus bar for 1set of bus duct	2	TP SET			
16	Temperature rise test for 1 set of bus duct	1	set			
(B)	Erection , Testing and Commissioning at site					
17	Erecting, testing and commissioning charges of Bus duct	2	Set			
						Total

PRICE SCHEDULE-E 2
3200Amps, 415 Volts Bus ducts at seven different places (From indoor Transformers to PCC)

Item. No	Item Description	Qty	Unit	Basic Price Excl. of Tax	Taxes and Duties	Total Price in Rs
(A)	Supply of items					
1	Straight run of Bus duct - Indoor	70	Mtr			
2	90° bend	20	Nos.			
3	Adaptor box at Transformer end	7	Nos.			
4	Adaptor box at Panel end	7	Nos.			
5	Braided Copper Flexible Termination at Transformer end	7	TPN SET			
6	Braided Copper Flexible Termination at Panel end	7	TPN SET			
7	Wall Frame Assembly with Fire Barrier	7	Set			
8	Space Heater with Thermostat for 1set of bus duct	7	Set			
9	Junction Box for Space Heater wiring	7	Nos.			

PRICE SCHEDULE-E3
2000Amps, 415 volt Bus ducts at two different places (From indoor transformers to PCC)

Item. No	Item Description	Qty	Unit	Basic Price Excl. of Tax	Taxes and Duties	Total Price in Rs
(A)	Supply of items					
1	Straight run of Bus duct - Indoor	35	Mtr			
2	90° bend	7	Nos.			
3	Adaptor box at Transformer end	2	Nos.			
4	Adaptor box at Panel end	2	Nos.			
5	Braided Copper Flexible Termination at Transformer end	2	TPN SET			
6	Braided Copper Flexible Termination at Panel end	2	TPN SET			
7	Wall Frame Assembly with Fire Barrier	2	Set			
8	Space Heater with Thermostat for 1 set of bus duct	2	Set			
9	Junction Box for Space Heater wiring	2	Nos.			

10	Breather	2	Nos.			
11	G.I. Support Structures	1000	Kg			
12	Aluminium Flexible Expansion Joint	3	TPN SET			
13	Rubber Bellow	4	Nos.			
14	Welding of Bus bar for 1set of bus duct	2	TPN Set			
(B)	Erecting , Testing and Commissioning at site					
15	Erection, testing and commissioning charges of Bus duct	2	Set			
						Total

Grand total
Price Schedule 1 + 2 + 3 =

Delivery and Manufacturing Schedule for all the three type of bus ducts.

The Tenderer shall fill up the following schedule according to which the work shall be carried

- a. Period required for submitting drawings for Purchaser's approval, from the date of issue of Purchase order. Weeks
- b. Period allotted to the Purchaser for approval of the submitted drawings. Weeks
- c. Period required to commence Manufacture on receipt of drawings approved by the Purchaser. Weeks
- d. Period required for completing the Manufacture of switchgear units. Weeks
- e. Period required for testing the switchgear units. Weeks
- f. Period required for the transportation of the tested units to site. Weeks