TENDER SPECIFICATION

BHEL RUDRAPUR
INSTALLATION PACKAGE
FOR

Material Handling at Site Stores / Storage yard, Transportation to Site of Work, Pre-assy, Erection, Testing and Commissioning of Generator Bus duct Package.

At

NPCIL-RAPP-STPP-(2X700 MW)

TECHNOCOMMERCIAL BID
BOOK-I:

VOLUME -1A & Volume-II
Rev 04, 18-10-2017

Book-I consists of

Notice Inviting Tender,
Volume-1A: Technical Conditions of Contract.
Volume- II: Price Bid

Book-II consists of

Volume-1B: Special conditions of Contract,
Volume-1C: General conditions of Contract
Volume-1D: Forms & Procedures

BHARAT HEAVY ELECTRICALS LIMITED
(A Government of India Undertaking)
Component Fabrication Plant,
Rudrapur, Udham Singh Nagar.
Uttarakhand, 263153

ANNEXURE – 1

QUALIFYING CRITERIA

JOB	Material Handling at Site Stores / Storage yard, Transportation to Site of work, Pre assy., Erection/Installation, Testing and Commissioning of Bus duct package and accessories for NPCIL-RAPP- STPP (2X700 MW).

SL NO.	QUALIFICATION CRITERIA	Bidders claim in respect of fulfilling the QUALIFYING CRITERIA	
		Name and Description of qualifying criteria	Page no of supporting document. **Bidder must fill up this column as per applicability**
A	**Technical** Bidder must have successfully executed following works in the last seven (7) years as on latest date of bid submission (i.e. Bidder must meet A.1.1 or A.1.2 or A1.3 or A.1.4) A1.1) Executed at least one (1) contract of not less than Rs 98 Lakhs (Basic W.O. value) comprising of :- a) Electrical C&I (Including Bus duct, Transformer, Switchgear) Erection & Commissioning work in power project (Hydro / Thermal) **OR** b) High Voltage transmission line, Switchyard/Sub Station in state/national based power generation/ power distribution Company. **OR** A1.2) Executed at least two (2) contracts of each not less than Rs 61 Lakhs (Basic W.O. value) comprising of :- a) Electrical C&I (Including Bus duct, Transformer, Switchgear) Erection & Commissioning work in power project (Hydro / Thermal) **OR** b) High Voltage transmission line, Switchyard/Sub Station in	**Applicable**	

	state/national based power generation/ power distribution company **OR** A 1.3) Executed at least three (3) contracts of each not less than Rs 49 Lakhs (Basic W.O. value) comprising of :- a) Electrical C&I (Including Bus duct, Transformer, Switchgear) Erection & Commissioning work in power project (Hydro / Thermal) **OR** b) High Voltage transmission line, Switchyard/Sub Station in state/national based power generation/ power distribution company		
B-1	**Financial** **TURNOVER:** Bidders must have achieved an average annual financial turnover (Audited) of **Rs 37 Lakhs** or more over last three Financial Years (FY) i.e. 2014- 2015 , 2015-2016 & 2016-2017 or for 2013-2014, 2014-2015 & 2015-2016 if Annual Accounts for FY 2016-2017 are not audited.	**Applicable**	
B-2	NETWORTH (only in case of Companies) Net worth of the Bidder based on the latest Audited Accounts as furnished for 'B-1' above should be positive.	**Applicable**	
C	GST Registration No.	**Applicable**	
D	No Deviation Certificate	**Applicable**	
E	ESIC Registration No.	**Applicable**	
F	EPF Registration No.	**Applicable**	
G	Valid Electrical Licensee for RAPP Project	**Applicable**	
H	Solvency Certificate stating credit limit of minimum Rs 35 Lakhs.	**Applicable**	

NOTE: TENDER NOT ACCOMPANIED BY ANY ONE OR MORE OF THE PRESCRIBED ABOVE APPLICABLE DOCUMENTS ARE LIABLE TO BE REJECTED.

Rev-04
18-10-
2017

NOTICE INVITING TENDER

TECHNICAL CONDITION OF CONTRACT (TCC)

BHARAT HEAVY ELECTRICALS LIMITED, RUDRAPUR

11/3/2015

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CHAPTER-I
Volume-IA PART-I
PROJECT INFORMATION

1	Project name	RAJASTHAN ATOMIC POWER PLANT (RAPP) (2X700 MW)
2	No. of units x capacity	2X700 MW
3	Project setting up by	NPCIL
4	Location and approach	NPCIL, RAPP (2X700 MW) Super Thermal Power Plant at Village –Rawatbhata District, Chittorgarh, Rajathan. Pin:-323307.
5	Nearest railway station	65 Km From Kota Railway Station on Delhi – Mumbai branch line broad gauge section of western Central railways.
6	Nearest major town & distance from project site	KOTA (60 KM)
7	Nearest airport	Jaipur International Airport, Jaipur (300 Km)
8	Nearest highway	National Highway No. 9 A (NH-9A is connecting between Bhilwara to Modak, Rajasthan)
9	Temperature	45^{o}C (Max extreme recorded) & 12^{o}C (Min. extreme recorded), Average Temperature 32^{o}C
10	Transport	By Road, Train & By Air.
11	Project site address	NPCIL, RAPP (2X700 MW) Super Thermal Power Plant at Village –Rawatbhata District, Chittorgarh, Rajathan. Pin:-323307.

CHAPTER – II
VOLUME-IA PART – I

CONSUMABLES & FACILITIES IN THE SCOPE OF CONTRACTOR / BHEL (SCOPE MATRIX)

Sl.No.	Description Part-I	Scope to be taken care by		Remarks
		BHEL	BIDDER	
1.2.1	**ESTABLISHMENT**			
1.2.1.1	FOR CONSTRUCTION PURPOSE:			
	Open space for office	Yes		
	Open space for storage	Yes		
	a. Construction of bidder's store for keeping tool and tackle in iron Container, b. Arrangement of Furnished AC-Pota Cabin for office work at site	Yes		
	Bidder's all office equipment's, office / store/ canteen stationeries/daily needs/consumables.		Yes	
1.2.1.2	FOR LIVING PURPOSES OF THE BIDDER			
A	Open space		Yes	
B	Living accommodation		Yes	
1.2.2	**ELECTRICITY**			
1.2.2.1	Electricity For construction purposes (to be specified whether chargeable or free)		Yes	Construction power on chargeable basis.
1.2.2.2	Single point source at site		Yes	
1.2.2.3	Further distribution for the construction work to be done by bidder which include supply of electrical materials like cable and equipment for execution		Yes	
1.2.2.4	Electricity for the office, stores, canteen etc. of the bidder which include:		Yes	

1.2.2.5	Distribution from single point including supply of materials and service		Yes	
1.2.2.6	Supply, installation and connection of material of energy meter including operation and maintenance		Yes	
1.2.2.7	Duties and deposits including statutory clearances for the above.		Yes	
1.2.2.8	Living facilities for office use including charges		Yes	
1.2.2.9	Demobilization of the facilities after completion of works		Yes	
1.2.2.10	Electricity for living accommodation of the Bidder's staff, engineers, supervisors etc. on the above lines.		Yes	
1.2.3	**WATER SUPPLY**			
1.2.3.1	Making the water available at single point		Yes	
1.2.3.2	Further distribution as per the requirement of work including supply of materials and execution		Yes	
1.2.3.3	Water supply for bidder's office, stores, canteen etc		Yes	
1.2.4	**LIGHTING**			
1.2.4.1	For construction work (supply of all the necessary materials) At office storage area At the preassembly area At the construction site /area		Yes	
1.2.4.2	For construction work (Execution of the Lighting work / arrangements) At office storage area. At the preassembly area. At the construction site /area		Yes	

1.2.5	**COMMUNICATION FACILITIES for site operations of the bidder**			
1.2.5.1	Land line Telephone, Fax, Desktop Computer/Laptop with internet , scanner, email facility etc.		Yes	
1.2.6	**ERECTION FACILITIES Engineering works for construction**			
1.2.6.1	Providing the erection drawings for all the equipment's covered under this scope	Yes		
1.2.6.2	Preparation of Method Statement and Safety protocol for construction Activity		Yes	In consultation with BHEL/Customer
1.2.6.3	As-built drawings – wherever deviations observed and executed and also based on the decisions taken at site-	Yes	Yes	In consultation with BHEL/Customer
1.2.6.4	Shipping lists etc. for reference and planning the activities	Yes	Yes	In consultation with BHEL/Customer
1.2.6.5	Preparation of site erection schedules and other input requirements	Yes	Yes	In consultation with BHEL/Customer
1.2.6.6	Review of performance and revision of site erection schedules in order to achieve the end dates and other commitments	Yes	Yes	In consultation with BHEL/Customer
1.2.6.7	Weekly erection schedules based on Sl. No 1.2.6.6	Yes	Yes	In consultation with BHEL/Customer
1.2.6.8	Daily erection / work plan based on Sl. No 1.2.6.7		Yes	For daily progress report submitted by bidder to BHEL and review meeting at site
1.2.6.9	Periodic visit of the senior official of the bidder to site to review the progress so that works are completed as per		Yes	

	schedule. It is suggested this review by the senior official of the bidder should be done once in every one months.			

1.2.7. **OPEN SPACE:**
Open space for building of temporary office shed and contractor's stores shed(s) will be provided free of charges. Contractor has to make his own arrangements in labour colony.

1.2.8 ELECTRICITY**:**
1.2.8.1 Electricity for construction purpose shall be provided by L&T. on chargeable basis. L&T will provide it at One locations to BHEL. Further distribution of electricity with necessary isolator/ELCB etc. shall be arranged by the contractor at his cost.
1.2.8.2 Provision for distribution of electrical power from the one points at 415 V Voltage level to the required places with proper distribution boards, approved cables and cable laying including supply of all materials like cables, switch boards, pipes etc., observing the safety rules laid down by electrical authority of the State / BHEL / their customer with appropriate statutory requirements shall be the responsibility of the tenderer / contractor.

1.2.8.3 BHEL is not responsible for any loss or damage to the contractor’s equipment as a result of variations in voltage / frequency or interruptions in power supply.

1.2.8.4 WATER:
Arranging water and further distribution of water is in the contractor’s scope.

CHAPTER – III
VOLUME-IA PART – I
MATERIAL, CONSUMABLES, T&P & MMEs TO BE DEPLOYED BY CONTRACTOR

All main items are like that IPBD & SPBD and its accessories are supplied by BHEL Rudrapur. The following minimum major Tools & Plants shall be deployed by the contractor for execution of this contract with in the quoted rate:

Sl no	Description	Capacity	Minimum quantity
1	MIG Welding Machine	--	3 Nos.
2	Arc Welding Machine	--	1 No.
3	HV Test Kit- AC Type- Spec: 100 KV, 300 m Amp.	--	1 No
4	Scaffolding Arrangement	--	As required at site
5	Chain Block Pulley	3 Ton & above	5 Nos
6	Zig Saw cutting machine	--	1 No
7	Circular Saw Cutting Machine	--	1 No
8	Ratchet Belts	--	10 Nos
9	Open Trailor for Local shifting, if required	--	1 No.
10	Hydraulic Crane	14 ton or more	1 No.
11	Mini Truck for internal transportation	--	1 no

1.3.1 EQUIPMENT FOR TESTING & COMMISSIONING:

For loading and transportation, all necessary T&P such as Trailers, Cranes, slings, strap belts, hydraulic jacks, ropes etc. are to be arranged by the contractor. All the tools & plants required for this scope of work is to be arranged by contractor. The following testing equipment / T&P shall be brought to site by contractor in sufficient number to carry out the job simultaneously in more than one area.

1) Insulation tester for insulation Register.
   a) Motorised megger - 0 - 1000 - 2000 - 5000V, 0 - 25000 M ohm & above.
   OR
   b) Hand operated megger - 0.5 KV/1.0 KV/2.5 KV, 200 - 100 M ohm
2) Torque wrench upto 100 Lb-Ft.
3) Multi-meter - Digital : voltage AC & DC - 100mv - 1000 V
   Current 10-mA - 10A Resistance - 0-20 M ohms
4) HV Test kit of 100 KV AC & 300m AMP Capacity.
5) Mili Voltage drop test Kit.
6) Dye Penetrate test kit.
7) Contact Resistance Meter (CRM) Kit.
8) Radiography shots/ test kit for radiographic testing as per FQP will be arranged by contractor.

9) CT Test kit for polarity injection ratio test.
10) Magnetic sprit level, Plumb-bob, Measurement tape and any requisite kit which is used during the erection and commissioning of Bus ducts.

1.3.2 MATERIALS / CONSUMABLES TO BE ARRANGED BY THE CONTRACTOR FOR ERECTION AND COMMISSIONING AS PART OF THE SCOPE AT FREE OF COST

i. All types of welding electrodes, filler wires-ESHAB Make, Gases and requisite tool & tackle etc.
ii. Provision for sufficient temporary scaffoldings pipes & clamp.
iii. Insulation & Danger tape.
iv. Paints required for one final coating.
v. Protocol / Calibration report sheets as per BHEL Format.
vi. Panel sealing compound material (for cable entry from bottom / top of Panel).
vii. Materials required for cable dressing (GI / Aluminium flats, PVC ties etc).
viii. PVC wire marker sleeves and Tag plates
ix. PVC cable ties
x. Copper/Aluminium Lugs of different sizes (2/2.5/4/6 sq mm) insulated/ring type.
xi. Anchor fasteners for wall mounted cable trays / JBs
xii. Fevicol SR-998 for fixing gasket.

1.3.3 Note for Contractor's Instruments, Tools & Plants:

a) For Un-loading & Loading and Internal transportation at site will require all necessary T&P such as Trailers, Cranes, Winches, welding generators, slings, jacks, wooden sleepers, rails etc., are to be arranged by the contractor.
b) If crane and trailers are under break down, the contractor immediately has to arrange alternative crane and trailers. Erection progress should not be affected due to this reason.
c) The contractor shall arrange all the above T&P, equipment and instruments as indicated except testing instruments which are proprietary in nature.
d) The contractor at his cost shall arrange all cranes and truck / tractor, trailers required for material handling purpose and also cranes required for erection. If contractor fails to arrange required equipment for erection then BHEL will arrange the necessary equipment's and the cost of hiring thereof shall be deducted in the upcoming RA bill of contractor.
e) Necessary accessories for the above shall also be provided by the contractor.
f) The above instruments / equipment will be sent for testing and calibration from time to time and maintained by contractor as required by BHEL.
g) All testing instruments shall have calibration certificate issued by recognized / accredited agencies.

h) List of such agencies and periodicity of calibration required for different instruments will be furnished by BHEL at site.
i) Contractor shall maintain calibration records as per the BHEL format and produce them whenever called for by BHEL Engineers.
j) Contractors shall arrange experienced / qualified persons for using these calibration instruments at laboratory and also at work spot.
k) Wherever frequent calibration is required, contractor shall arrange adequate number of instruments such that the work does not suffer for want of test instruments.

CHAPTER –IV
VOLUME-IA PART –I
SCOPE OF WORKS

THE SCOPE OF THE WORKS WILL COMPRISE OF BUT NOT LIMITED TO THE FOLLOWING:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

It is not the intent to specify herein all details of material. Any item related to this work, not covered by this but necessary to complete the system will be deemed to have been included in the scope of the work.

1.4.1 SITE ESTABLISEMENT

Detail scope of work

Sl no	Description of Work
1	Furnished Portable cabin equipped with all facility like printer, photostate machine, scanner, fax machine, two nos. personal computers with internet facility, other office stationeries plain paper, files, registers and box file, cupboard/almirah, two nos. office table along with office chair, potable water. These facilities are must for site office for discharging daily basis duties.
2	Canteen facility for Tea & Snacks for site staff (two times a day).
3	Void
4	*Maintaining & updating the material stock register alongwith soft copy (excel sheet).**Update excel sheet will be provided by successfully bidder end date of the every month.***
5	Security guards (Min 3 nos) to be appointed for site office for round the clock..
6	Local shifting of material at site. Material already available at L&T Storage yard area inside NPCIL premises, is to be shifted to our designated storage yard without any extra cost. The handling equipment like Crane, Trailor with operator shall be arranged by subcontractor agency. Bidders may visit NPCIL RAPP for

	accessing bus duct material available at L& T Storage yard, Stores, if any, which requires to be shifted to designated stores of BHEL, Rudrapur.
7	During the bus duct and structure erection & alignment minor cutting, welding, and modification to be carried out with the permission of BHEL representative. Aluminium Zinc rich paint to be applied on modified portion of structure after arrangement of the same to be done by successful tenderer.
8	Subcontractor is responsible for erection of bus duct, structure and other accessories which is necessary for bus duct commissioning like NGC, seal off bushing, wall frame, rubber bellow, NGR etc. as per Erection Manual, Erection Drawing. And Inspection/testing to be carried out as per approved FQP.
9	Subcontractor is responsible for attending all punch point related to bus duct erection which is raised by BHEL/Customer after commissioning of bus duct.
10	Subcontractor will be responsible for Closing the Contract with BHEL, Rudrapur and provide required Compliance timely.
11	**Bidder will be provided four wheeler vehicle Qty-1 Nos with fuel and driver facility. Model of the AC Car should be (Maruti Suzuki-Alto/Tata Indica/Mahindra Bolero) which should not have been manufactured before 2013) for daily use at NPCIL 2X700 MW for pick up and drop of BHEL Person, from their residence place to site or internal movement in plant. Maintenance, Toll charges, Parking charges, Night stay charges, Driver over time charges will be paid by bidder.**

1.4.2 MATERIAL HANDLING AND SITE STORAGE

1.4.2.1 Loading at BHEL / Customer stores and storage yard, transport to site, unloading at site / working area of equipment placement on respective foundation/location, fabrication yard, pre-assembly bay or at working area are in the scope of work. The scope includes taking materials / Equipment's from customer stores / storage yard also. Contractors Quoted / Accepted rate shall be inclusive of the same. Required cranes, tractors, trailer or trucks / slings / tools and tackles / labour including operators Fuel lubricants etc. for loading & unloading of materials will be in the scope of contractor.

1.4.2.2 The wooden pallet provided for packing itself can be retained for raised platform to protect equipment from ground damps, sinking into around and to circulate air under the stored equipment. This will also help in lifting the packing with fork-lift truck.

1.4.2.3 Due care should be taken to ensure that the equipment is not exposed to open atmosphere etc. which can affect the colour shade and also rusted. Structure material, GI Pipe, Earthing Strip etc. to be laid on the gravelled area not directly laying on ground.

1.4.2.4 All the equipment, materials and goods kept in the store room should be identified and registered in a book. Inspection report should be recorded. Any discrepancy observed should be communicated to BHEL site Engineer.

1.4.2.5 Packing material shall be retained if the cubicle to be repacked after inspection.

1.4.2.6 The contractor shall provide any fixtures, concrete blocks & wooden sleepers, which are required for temporary supporting / storage of the components at site. Wooden block is used for assembly for structure and structure & bus duct laying on it.

1.4.2.7 The contractor shall take delivery of item, materials, from the storage yard / stores / sheds of BHEL / customer which is within a radius of 5 kms. He shall also make arrangements for safe custody, watch and ward of equipment after it has been handed over to him till they are fully erected, tested and commissioned. If any theft of material takes place before commissioning, contractor will be responsible and suitable payment deductions against theft material may be initiated in upcoming invoices.

1.4.2.8 The contractor shall note that items/materials shall be transported to erection site / assembly yard etc. by the prescribed route without disturbing and causing damage to other works in the most professional manner. Items, Hardware, etc. shall be stored in appropriate manner as per BHEL's instructions.

1.4.2.9 Material will be issued by BHEL/Customer after the written request received from the contractor in specified format for erection purpose. If material not used at site then resubmit to BHEL/Customer in specified format.

1.4.2.10 The equipment’s / materials from the storage yard shall be moved in sequence to the actual site of erection / location at the appropriate time as per the direction of BHEL Engineer so as to avoid damage / loss of such equipment at site.

1.4.2.11 At the time of receiving of materials, contractor store keeper should properly verify the quantity received and inspect physically for any damages. Any damages, discrepancies (shortfall/excess) found, should be intimated to BHEL for raising MDR/SAR.

1.4.2.12 All the received materials entry to be done in the shipping list by contractor storekeeper.

1.4.2.13 Loading and Unloading of BHEL Material which is received at site within 12 hours of transporter reaching at site. Upon exceeding, standing charge will be applicable to

transporter and same amount will be liable to be deducted from your subsequent bill coming under processing. Before material receiving/signing of GR copy proper physical inspection to be carried out. If any damage is found, intimation to BHEL Representative should be given and proper remarks on GR to be made.

1.4.3 BUSDUCT ERECTION

BUSDUCTS SCOPE OF SUPPLY

IPBD and its accessories shall be supplied by BHEL Rudrapur for this project as detailed below.

a) Isolated Phase Busducts from Generator to Generator Transformer.

1.4.3.1 ISOLATED PHASE BUSDUCTS

The isolated phase bus ducts is connected to the low voltage side of the generator transformer and generator. The bus consists of cylindrical conductor made of Aluminium alloy supported on post insulators. Flexible connections and expansions joints are provided at terminal and intermediate points to alleviate stresses due to expansion and to arrest vibration. All the CTs & SOB will be mounted inside the bus ducts.

Isolated phase taps connect the potential transformer, surge protection equipment and unit transformer to the main bus. Each phase of protection equipment and potential transformers shall be housed in metal clad cubicles. Delta formation is carried out externally through Delta bus duct.

A totally enclosed neutral grounding cubicle is provided to connect the Generator neutral point. The neutral grounding cubicle houses neutral grounding transformer & resistors. All the generator-isolated bus ducts are supplied with one set of Air pressurization equipment unit.

The tentative details are as under:

ISOLATED PHASE BUS DUCT

1. Rated Voltage: 24 kV
2. Phase: 3 Nos.
3. Standard Degree of protection:-IS 8084
4. Insulation Level
   a) 1 min. Hi-volt: 55 KV rms
   b) Basic Impulse: 125 KV peak
5. Shipping Data:
   Weight of the package:- Three Phase:- 900 kg/mtr (Main), 390 kg/mtr (Delta), 230 kg/mtr (Tapoff)
   Dimensions of Largest (lxbxh): 5000mm X 1800 mm X1800 mm.

6. Other details of IP Busduct:

Sl.No.	Description	Main Run	Delta Run	Tap-off Run
1	Conductor Material Temperature Rise: 55ºC	AL.ALLOY Gr 19501 WP (RANGE-1)	AL. ALLOY Gr19501WP (RANGE-1)	AL. ALLOY Gr 63401 WP (RANGE-1)
3	Enclosure Material Temperature Rise:- 40ºC	AL.ALLOY Gr 19501 WP (RANGE-1)	AL.ALLOY Gr 19501 WP (RANGE-1)	AL.ALLOY Gr 3100 WP (RANGE-1)
4	Conductor Shape	Cylindrical	Cylindrical	(2channels) Box Formation
5	Conductor Cross Section	Circular (1030O/D 15TK)	Circular (500 O/D 15 TK)	Square (2 X 203.2 X65X11.85)
6	Enclosure Phase Spacing	2200	1300	1000
7	Enclosure outside DIA	1700O/D & 1600 O/D	1070o/d,	780o/d,
8	Enclosure thickness	9 tk	6.35 tk	4.78 tk
9	Phase to Earth Clearance	230	230	230
10	Rated continuous current	26000	15000	2250
11	Bus insulator per support	3 at 90˚ apart	3 at 90˚ apart	3 at 90˚ apart

6. Grounding

a) Material and size of ground bus if provided separately: 10x65 tk G.I. Flat

b) Number of ground pads provided for 10x65 tk galvanised steel flat: As per Final layout.

c) Enclosure insulated with support structure.

The following equipment also covered in the scope of erection / commissioning of Isolated Phase Busducts:

A. Shorting Bars

Three set of shorting bar is used in each unit of IPBD shall be supplied for generator dryout.

B. SP & VT Cubicle, LA & VT cubicle

SP & VT Cubicle shall be of draw out type with VT mounted on trolleys, fabricated out of 3 mm thick steel sheet, complete with illuminating lamps, space heater, bus-bars,

mounting insulators, marshalling box, etc. The cubicle shall be self-supporting type. Each set shall comprise of the following:

i. NG Cubicle shall be fabricated out of 3 mm thick steel sheet complete with illuminating lamps, space heater, bus-bars, mounting insulators, marshalling box, etc. The cubicle shall be self-supporting type and degree of protection shall be IP54 / IP23. Each set shall house the following:
ii. Dry type epoxy cast NG transformer.
iii. NG Resistor.
iv. Voltage Transformer.
v. Lightning Arrestor.
vi. Surge Capacitor

C. Bus-duct Supporting Structure

Bus-duct supporting structure shall be fabricated from standard steel sections welded / bolted and hot dip galvanized. All structure hardware shall be HTS hot dipped / electro-galvanized. Approximate Weight of structure: **100 MT in two units.**

D. Air Pressurisation equipment

The generator bus duct will be provided with positive air pressurizing system comprising air compressors with necessary filters, driers, piping, valves, drains, pressure switches / gauges, fittings and necessary controls. A control cabinet shall be furnished with control and monitoring devices such as motor starters, indicating lights, push buttons, etc. with provision for remote alarm. Installation of pipe laying as per drg. and isolate from the IPBD.

E. Loose Item.

In IPBD Lot of accessories shall be used like that Wall frame, Seal off Bushing, Current Transformer, Rubber Bellow, Cu. Flexible, Cu. connection, Al. Connectors, etc. and other accessories which is required for commissioning of package.

~~**F. Sunshade**~~

~~Outdoor portion will be provided with sunshade. This hood should be mounted on the busduct supporting structures and all hardware and accessories shall be provided by BHEL, Rudrapur. Required amount of clearances for inspection etc shall be provided.~~

G. HOT AIR BLOWING EQUIPMENT:

The busduct package will comprise of Hot air blowing equipment suitable for the drying the moistures in the IPBD system. Hot air will be pumped inside the duct as per the specifications/capacity of the blowing equipment and will made to run for 2-3 hrs for drying up. Installation of equipment, its piping, flexible piping and sealing off the air leakages will be in the scope of contractor.

1.4.3.2 Scope of Works for Erection & Commissioning of Bus ducts

The general scope of works for Isolated Phase Bus duct is as below .Receipt from BHEL stores / yards, unloading all the bus duct materials and accessories and equipment as indicated in the BOQ and enclosed relevant drawings that forms the part of the tender specification, at the area where the bus ducts are to be erected, inspection, installation of all the materials, testing and commissioning of total bus duct items, painting and handing over. Dimensions & weights indicated in the specification / BOQ indicated for isolated phase bus ducts is only approximate. The relevant drawings are enclosed for the purpose of tendering. The contractor has to ascertain the quantum of work involved and quote the lump sum value as called for in the rate schedule.

There may be variations in the weight and dimensions. Any variation in the length of bus ducts +10% & -5% as compared to actual length indicated in the BOQ, shall not be considered for payment. However, for variations beyond +10%, payment shall be considered proportional to the length of the bus ducts. Variations in width or height or weight including support structure shall not be considered for payment.

Detailed scope of work shall as below:

a) Cleaning of Structure, Bus Ducts and other accessories before assembly and erection.

b) Instalment of structure & bus duct package (Including its accessories like, seal off bushing, current transformer, Rubber bellow, Cu. connection & flexible, al. splice plate & flexible, neutral grounding cubical, neutral grounding register, air pressurization equipment, hot air blower, CT & Space heater marshalling box, space heater conducting & its cabling, surge capacitor, voltage transformer, Lightning Arrestor, wall frame, silica gel breather assy., Earthing, SPVT Cubical) as per drg.

c) Testing of IPBD conducting as per approved FQP. Quality check of IPBD during the erection as per FQP. Sub-Contractor is responsible for prepare protocol and signed at the time of inspection.

d) Carrying out required level of cleaning inside as well as outside of the bus-duct for the purpose of conducting high voltage test before commissioning of the unit.

e) Modification if any required in the support structures due to site conditions, the same shall be carried out without any extra cost. (**Pockets will be provided during casting of foundations in which anchor bolts has to be grouted by the contractor for supporting/fixing the structures)**

f) Extension of embedment if required and erection of required supports structures as detailed in the drawing.

g) Conducting air-tightness test after erection to meet the requirement of BHEL/ Customer Standards.

h) Rectification of leakage, if any without any extra charges- For air tightness test, contractor shall arrange necessary pipe, PVC, hoses, fitting, valve, pressure regulator, rotameter etc. at their cost. Contractors shall tap the air from nearest Instruments air tapping point available at site.

i) Conducting high voltage test & CRM for IP bus ducts, short circuit test for IP bus ducts and other tests as detailed in VOLUME-IA PART- II CHAPTER-3, as per instruction of BHEL engineer after making necessary cleaning inside as well as outside of the bus duct & arranging all testing equipment required for carrying out bus duct testing. Each bus duct pieces will have to be tested for IR value and HV test at working voltage before erection.

j) Fixing of Current transformers in bus ducts including wiring from CT terminal to junction box, taking through rigid/flexible conduit pipe. GI Insulated Flexible conduit pipe arrange buy contractor at site.

k) Fixing of neutral side flexible connections to generator and position of neutral CTs after testing.

l) Assembly, erection, testing and commissioning of VT, SP & VT, NGT, NGR cubicles with its equipment such as lightning arrestors, voltage transformers, fuses, etc.

m) Erection and alignment of Tie bus ducts for unit transformer, SP & VT cubicle etc.

n) Erection and commissioning of air pressurization equipment with all the accessories.

o) Carrying out aluminium welding for bus conductor and on enclosure as detailed in the drawing using MIG / TIG machine with the Std. Aluminium filler wire (eshab Make) as per BHEL specification. Al. Welder shall be certified by BHEL/CUSTOMER Specification. Required sample test will be conduct at site before starting the welding by any welder. **Sample piece will be supplied by BHEL.**

p) Providing of MIG / TIG welding machine, Std. aluminium filler wire, Argon gas of high purity with certificate and other required consumables as per BHEL standard for efficient aluminium welding, covering supporting insulators with asbestos cloth whenever aluminium welding is carried out near the supporting insulator.

q) Making necessary modifications of makeup pieces, if required, and welding of isolated phase bus ducts along with NGT, SP & VT cubicle, UT tap-offs and delta connections.

r) Conducting 100% DPT test on all welded joints of conductor and enclosure and 10% Radiography test on conductor welded joint. Arrangement of testing kit by contractor at site.

s) Carrying out minor repair, rectification of enclosure and conductors if it has happened during transit without any extra cost.

t) Presentation of necessary log sheets, protocols, test certificate as per Field Quality Plan and getting them signed by BHEL / CUSTOMER'S/ CUSTOMER'S CONSULTANT Engineers, and submitting the same to BHEL as per the instructions of concerned BHEL Engineer.

u) If any punch point observed by BHEL/CUSTOMER after the erection. Contractor is responsible for rectify the same without any additional charges.

a) Other requirement for Erection / Commissioning of IP Bus-ducts.

(i) Aluminium welders shall appear for test as directed by the BHEL welding Engineer and only qualified welders under the GDCD Std.198 Norms shall be permitted to do the welding. Procedure of welding follows up as per approved

WPS. If contractor is unable to qualify the welder at site then BHEL Shall provide the al. welder on Risk and cost of Contractor.

(ii) For MIG / TIG welding only high purity argon gas shall be used. If the contractor is unable to arrange the required high purity Argon gas, the same shall be arranged by BHEL on chargeable basis. The cost of gas shall be recovered from the running bills as per BHEL norms.

(iii) Aluminium filler wire / rod shall be procured in consultation with BHEL Engineer.

(iv) Connecting the bus duct with other equipment erected by other agencies is in the scope of bus duct erection.

(v) During erection of bus duct, there is always a likelihood of minor mismatches, increase or decrease in length etc. as below:

(a) Minor mismatch of support structures due to shifting of holes.
(b) Minor mismatch of Aluminium support legs.
(c) Mismatch of flange holes.

To the extent when these are not due to wrong supply or wrong drawing these will be done at no extra cost by the contractor.

1.4.4 TESTING AND COMMISSIONING

1.4.4.1 **SCOPE OF PRE-COMMISSIONING / COMMISSIONING AND POST COMMISSIONING WORKS:**

Testing of bus duct will be carried out as per approved FQP. In FQP Clearly mention the testing stage, equipment, percentage of inspection some of following important test must be carried during the erection and commissioning of bus duct.

a) Insulation resistance test of each bus duct, SPVT, before erection and recorded.
b) Each CT Polarity injection ratio test before erection.
c) 10% Radiography test is applicable on welded joints in IPBD conductor during the erection.
d) Insulation resistance of bus duct in full route.
e) High Voltage test of bus duct in full route.
f) Milli voltage drop test in bus duct in full route.
g) CRM Testing Kit.

Above testing at what stage Ref: Approved FQP/Consult BHEL Engineer.

1.4.4.2 Scope of pre-commissioning / commissioning starts with the commissioning of various equipment erected by the contractor and making them available to commission various materials / systems and main power plant.

1.4.4.3 The contractor shall co-ordinate with BHEL and other contractor's during the main plant commissioning to ensure successful commissioning of total plant.

1.4.4.4 The pre-commissioning activities of the main power plant will start with energizing of start-up power supply system's followed by trial run of various drives prior to light up of boiler. Commissioning operations shall continue till trial operation of the unit. The contractor shall simultaneously start checking bus duct erected by him to match with the various milestone activities /commissioning programme of the project. All these works need specialised testing engineers, supervisors including electricians in each area to coordinate with BHEL Engineers and other agencies round the clock to match with commissioning schedule of unit. Contractor shall earmark separate manpower for various commissioning activities. The manpower shall not be disturbed or diverted for erection work.

1.4.4.5 The mobilization of testing team shall be planned in time and shall be undertaken round the clock. Contractor shall discuss on day to day / weekly / monthly basis the requirement of testing manpower, consumables, tools and tackles with BHEL engineer and arrange for the same. If at any time the requisite manpower, consumables, T & P are not arranged then BHEL shall make alternate arrangements and the cost will be recovered from contractor.

1.4.4.6 Prior to commissioning and after commissioning, protocols have to be made with BHEL / Customer. The formats will be given by BHEL and have to be printed by the contractor in adequate numbers. It shall be specifically noted that above personnel of the contractor may have to work round the clock along with BHEL commissioning engineers which may involve over time payment which forms part of Contractors Scope.

1.4.4.7 Any rework / rectification / modification is required to be done because of contractor's faulty erection, which is noticed during commissioning at any stage, the same has to be rectified by the contractor at his cost. During commissioning, any improvement rework / rectification / modification due to design improvement / requirement is involved, the same shall be carried out promptly and expeditiously. Claims if any, for such works from the contractor shall be governed by clauses covered elsewhere.

1.4.4.8 Minimum requirement of Man Power for testing/checking works shall be as follows: (Requirement given below is per unit):

FOR BUSDUCT PORTION:

	Bus Duct
Engineer	---
Supervisor	1
Technician	2

The above testing / checking group shall be identified at the Pre commissioning time. The above commissioning group shall have the knowledge of various systems referred in the tender and possess adequate experience in testing. The above manpower for commissioning is only tentative and if any additional manpower required as per site requirement, the same shall be arranged by the contractor. If the contractor fails to deploy the above Engineer / Supervisor / Technician at appropriate time of commissioning, no payment shall be made against commissioning activities as per terms of payment.

1.4.4.9 All testing activities shall be carried out as per relevant standard, code of practice, manufacturer's instructions and BHEL norms. The contractor shall follow the checklist of BHEL prior to taking up testing & commissioning activities and the activities shall be carried out in accordance with the checklist. All the above will be witnessed by BHEL engineer and the reports signed jointly.

1.4.4.10 All the tests at various stages shall be repeated till all the equipment satisfy the requirement of BHEL / Customer. Any rectifications required shall have to be done / redone by the contractor at his cost.

1.4.4.11 It shall be the responsibility of the contractor to provide various categories of workers in sufficient numbers along with Supervisors during pre-commissioning, commissioning and post commissioning of equipment and attending any problem in the equipment erected by the contractor till handing over. The contractor will provide necessary consumables, T&Ps, IMTEs etc., and any other assistance required during this period. Association of BHEL’s / Client's staff during above period will not absolve contractor from above responsibilities.

1.4.4.12 The contractor shall carryout any other test as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor

1.4.4.13 Contractor provides necessary commissioning assistance from pre-commissioning state onwards and up to continuous operation of the unit & handing over to customer. The category of personnel to be as per site requirement and to meet the various pre-commissioning and commissioning programmes made to achieve the schedule agreed with customer.

1.4.4.14 The contractor shall carryout any other test not listed in the tender as desired by BHEL Engineer on erected equipment covered under the scope of this contract during testing, pre-commissioning, commissioning, and operation, to demonstrate the completion of any part or whole work performed by the contractor.

1.4.5 PAINTING

1.4.5.1 The quoted rate / price shall be inclusive of supply and application of final one coat painting of the erected bus ducts as per the colour shade of bus duct. Paint, thinner, tools & tackles for application is in the scope of contractor.

1.4.5.2 Normally Paint shall be applied by spray painting as per the instruction of BHEL Engineer. Spray painting gun and compressed air arrangement has to be made by the contractor himself within the Quoted rates. BHEL will help get the service air, if provided by customer at site.

1.4.5.3 All damaged/rectified/modified galvanized surfaces i.e. GI Structures shall be applied with final coat of cold galvanizing paint (Zinc rich Aluminium Paint) in order to protect the surfaces from getting rusted.

1.4.5.4 The scope of painting includes application of colour bands, lettering the names of the systems, equipment's, danger / warning signs and other data as required by BHEL within the quoted rate.

1.4.5.6 All surfaces shall be thoroughly cleaned, free from scales, dirt and other foreign matter. Final one coat shall be applied in an even & uniform film free from lumps, streaks, runs, sags and uncoated spots.

1.4.5.7 The actual colour to be applied shall be approved by the BHEL/customer before starting of actual painting work.

1.4.5.8 Finish paint shall be of reputed paint supplier. Contractor has to procure paints and the paints should be as per the BHEL/customer painting specification.

a) Carrying out one coat final painting as per the standard colour codes recommended by BHEL including supply of paints, thinner and other consumables etc. As required as part of erection. Name of the equipment shall be painted boldly as per the instruction of site engineer. Any danger boards required to be displayed shall be arranged by the contractor.

CHAPTER-V
VOLUME-IA PART – I
TIME SCHEDULE

1.5.1 TIME SCHEDULE

1.5.1.1 The entire work of erection, testing and commissioning of bus duct of 2x700 MW including application of one coat final painting, as detailed in the Tender Specification shall be completed within 31 months from the commencement date of contract.

1.5.1.2 During the total period of contract, the contractor has to carry-out the activities in a phased manner as required by BHEL and the program of milestone events.

1.5.1.3 The erection work shall be commenced as per note in commencement of contract period. The decision of BHEL in this regard shall be final and binding of the contractor. The scope of work under this contract is deemed to be completed only when so certified by the site Engineer.

1.5.2 COMMENCEMENT OF CONTRACT PERIOD

The date of commencement of contract period shall be as per the Milestones dates mentioned in 1.5.3. In case of discrepancy the decision of BHEL engineer is final.

1.5.3 MOBILISATION FOR ERECTION, TESTING, ASSISTANCE FOR COMMISSIOING ETC.,

The activities for erection, testing etc. shall be started as per directions of Construction manager of BHEL. The contractor has to augment his resources in such a manner that following major milestones of erection & commission are achieved on specified schedules:

DESCRIPTION	**MILESTONES (2x800 MW)**	
	UNIT-1	UNIT-2
Mobilization at Site	1) For Erection of IPBD in Unit-1: Within one week after receipt of intimation from BHEL, Rudrapur.	
Commencement Date	As per Mobilisation of site, point no.2 above	Within Sixteen (16) Months from mobilisation in Unit-1
Completion Date	Within Sixteen (16) Months from mobilisation date Or Material received at site for Unit-1, whichever is later.	Within Nine (9) Months from mobilisation date / Commencement date of Unit-2 Or Material received at site for Unit-2, whichever is later.
Contract Closing of bidder With BHEL Rudrapur		Within six (6) months from the date of completion of Unit-2.

1.5.4 In order to meet above schedule in general, and any other intermediate targets set, to meet customer / project schedule requirements, contractor shall arrange & augment all necessary resources from time to time on the instructions of BHEL.

1.5.5 **In case any requirement is there to compress the schedule of activities to achieve project completion, then the additional expenses if any incurred will be discussed mutually and settled. BHEL decision in this regard is final and the issue is not open to arbitration.**

1.5.6 CONTRACT PERIOD

The contract period for completion of entire work under scope shall be **31 (Thirty One) months** from the "COMMENCEMENT OF CONTRACT PERIOD" as specified earlier.

1.5.7. WARRANTY PERIOD:

1) The Contractor shall be liable to replace /rectify any parts that may fail or show signs of defects in the work done by the contractor under this contract, or from any act or omission of the contractors for a period of 30 Months from the date of taking over certificate (TOC) of works to the satisfaction of the Purchaser.

2) Any part or components of the goods or services forming the unit having defects which is warrantable by BHEL/contractor and corrected by the contractor either by the way of repair or replacement (of BHEL supplied part/component) shall further be warranted by contractor for a period of 06 months from the date of such correction is effected and accepted by owner/owner's representative. Replacement of parts/component in BHEL scope of supply found defective shall be provided at site by BHEL free of cost for replacement in the unit by contractor during the warranty period.

CHAPTER-VI
VOLUME-IA PART – I
TERMS OF PAYMENT

1.6.1 **Terms of payment:**

The progressive payment **against running bills** for erection, testing and commissioning of bus duct package will be released as per scheme mentioned below.

PAYMENT TERMS FOR E&C OF BUS DUCT AT NPCIL-RAPP- STPP (2X700 MW).

DESCRIPTION OF PAYMENT					
RA Bill No	**Detail**		**Unit-1**	**Unit-2**	**Total**
SPBD		**ROW No.**	→		
1	Deployment of Manpower, tools and tackles and Security Guard at site upto contract closure.	A	10% (Limited to 0.5% per month)		10%
2	Arrangement of four wheeler vehicle for BHEL Staff for pick and drop from residence place to site & internal movement for office work up to contract closure.	B	14% (Limited to 0.5% per month)		14%
3	IPBD Structure Erection -Complete	C	3%	3%	6%
4	Erection & Fitment of Bus duct	D	11%	11%	22%
5	Welding of Conductor & Enclosure along with its Testing (DP/RT).	E	10%	10%	20%
6	Termination of Bus duct & Conducting Testing as per FQP.	F	5%	5%	10%
7	Punch Point Closure.	G	3%	3%	6%
8	Commissioning /Charging	H	3%	3%	6%
Sub-Total					**96%**
9	Closure of Contract.	I	3%	3%	6%
				GROSS TOTAL	**100%**

NOTES TO TERMS OF PAYMENT:-

1) Percentage of payment to contractor will be considered on the total basic work order value excluding GST.

2) Invoices can be raised on pro-rata / monthly basis against each line items of IPBD during erection, testing & commissioning work. The work completed should

correspond to the percentage of payment claimed in invoices as against total quantum of work. Reference documents for determining total quantum of work will be contract documents, length/weight relevant drawings, dispatch documents. FQP, protocols, punch points list by BHEL, handing over/commissioning certificates by customer etc. In case of discrepancy, the decision of BHEL engineer will be treated as final.

3) Payment will be made within 30 days from the submission of Invoices along with filled WAM & MB at BHEL, Rudrapur.

4) Invoices raised have to be certified by site representative of BHEL, Rudrapur for work verification.

5) Security Deposit shall be deposited before the start of work as per the applicable clause in Vol-IC (GCC), Clause No: 1.10.

6) Contractor will be required to submit following details as and when desired by BHEL as part of documentation to be submitted with invoice to end customer:
Valid PF Challan, ESI Challan, Valid Certified Wages Record, Labour licensee Copy, Periodicity WC Policy-One Time, Indemnity Bond- One time, Pervious Invoice Service Tax Challans, Certificate from Contractor (***Labour payment distribution***), Detail planning for erection activity for Next Month, Certificate regarding compliance to Labour Act for maintaining records required as per the law, Certificate for compliance to safety norms and other statutory papers, if required. Failure to do so will result in hold of payment of contractor.

7) In case of no punch points, corresponding payments will be released upon certification by BHEL site representative.

8) Statuary requirement for payment of four wheeler vehicle must be obtain by bidder and submitted in BHEL along with first bill only. e.g RC Book copy, driver license, comprehensive motor insurance policy etc.

CHAPTER – VII
VOLUME-IA PART – I
BILL OF QUANTITY (BOQ)

Sl No.	Description	UNIT-2X700 MW.
1	**IPBD(Busduct with all relevant accessories)**	2 Set
1A	**24 KV IP BUSDUCT**	Length
	Isolated Phase Bus Duct Product Details: a) Voltage: 24 KV, Air natural Cooled b) Current Rating: Main Run-25000 Amps, Delta Run-15000 Amps, Tap Off Run-2000/1250 Amp c) Weight: Main: 300 Kg/mtr, Delta: 390 Kg/mtr, TapOff-230 kg/mtr d) Standard Section Length: 4-5 Mtr e) Degree of Protection: IP-54. f) Finish Paint: Exterior: RAL 631, Interior: Matt Black g) D.C Resistance 20˚C:- 0.762 µΩ\m, 1.512µΩ\m , 4.2 µΩ\m. h) Shape: & Dimesion: Main: Circular 1030 o/d 15 tk, Delta: Circular 500 o/d 15 tk, Tap-Off: Rectangular 2 X203X65X11.84. i) Method of jointing adjacent sections: Continuous Welding. j) Disconnecting/Shorting links: Material: Al Alloy, Current- 25000 Amps, k) Bolted flexible joint for connection at equipment end: Copper flexible. l) Rubber Bellows m) Seal-Off-Bushings n) Current Transformers o) Lightning Arrestor. p) Surge Capacitor. q) Voltage Transformer Cubicles. r) Neutral Earthing Cubicle Equipment s) Earthing Transformer	a) MAIN RUN (INDOOR, DIA 1700)- 314 mtrs, b) MAIN RUN (OUTDOOR, DIA 1600)- 444 mtrs, c) DELTA RUN (DIA 1070)- 324 mtrs, d) TAP-OFF RUN (DIA 780)- 214 mtrs.

	t) Earthing Resistor u) Support Structures (Galvanised) for busduct and accessories: Approx 100 MT v) Pressurisation Equipment. w) Hot Air Blowing Equipment. x) Neutral Grounding Transformer ~~y) Sunshade on IPBD~~	

NOTE TO BOQ: The quantity indicated in the BOQ is approximate only and is liable for variation.

CHAPTER –VIII
VOLUME-IA PART –I
GENERAL

THE SCOPE OF THE WORK WILL COMPRISE OF BUT NOT LIMITED TO THE FOLLOWING:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

1.9.1 In addition to the clause 2.8 of General Conditions of Contract (Volume- 1C of Book-II) the contractor shall comply with the following.

1.9.1.1 The Contractor should Register their Establishment under BOCW Act 1996 read with rules 1998 by submitting Form I (Application for Registration of Establishment) and Form IV (Notice Of Commencement / Completion of Building other Construction Work) to the respective Labour Authorities i.e.

a) Assistant Labour Commissioner (Central) in respect of the project premises which is under the purview of Central Govt.– NTPC,NTPL,NPCIL etc
b) Inspector of Factories in respect of the project premises which is under the purview of State Govt.

1.9.1.2 The Contractor should comply with the provisions of BOCW Welfare Cess Act 1996 in respect of the work awarded to them by BHEL

1.9.1.3 The contractor should ensure compliance regarding Registration of Building Workers as Beneficiaries, Hours of work, welfare measures and other conditions of service with particular reference to Safety and Health measures like Safety Officers, safety committee, issue of Personal protective equipment's, canteen, rest room, drinking water, Toilets, ambulance, first aid centre etc.

1.9.1.4 The contractor irrespective of their nature of work and manpower (Civil, Mechanical, Electrical works etc.) should register their establishment under BOCW Act 1996 and comply with BOCW Welfare Cess Act 1996.

1.9.2 Identification of equipment at storage yard, technical assistance for checking and making the shortage/damage reports, taking delivery at storage yard and pre-assembly of equipment wherever required, erecting the equipment, aligning, fastening, supporting, cleaning, checking and carrying out statutory tests as required, trial operation, pre commissioning, commissioning and post commissioning activities up to the time of

completion of commissioning activities and commercial operation of the unit and handing over to customer or till completion contract period whichever is earlier, along with the supply of all consumables, tools and tackles and testing instruments.

1.9.3 Scope of work covered under this specification requires quality workmanship, engineering and construction management. The contractor shall ensure timely completion of work. The contractor shall have adequate tools, measuring instruments, calibrating equipment etc. in his possession. He shall also have adequate trained, qualified and experienced engineers, supervisory staff and skilled personnel. The manpower deployment identified by contractor shall match with above scope of works.

1.9.4 The contractor shall have valid **ELECTRICAL CONTRACTOR LICENSE, Workmen Compensation Policy** as required to carry out the scope / job mentioned in the Bill of Quantity (BOQ).

1.9.5 All the necessary certificates and licenses required to carry out this scope of work are to be arranged by the contractor then and there at no extra cost.

1.9.6 It is not the intent to specify herein all details of material. Any item related this work not covered by this but necessary to complete the system will be deemed to have been included in the scope of the work.

1.9.7 The work shall be executed under the usual conditions without affecting power Plant construction and in conjunction with other operations and contracting agencies at site. The contractor and his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

1.9.8 All the work shall be carried out as per instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor.

1.9.9 Contractor shall erect all items / materials etc. as per sequence prescribed by BHEL at site. BHEL engineer depending upon the availability of materials / work fronts etc. will decide the sequence of erection / commissioning methodology. No claims for extra payment from the contractor will be entertained on the grounds of deviation from the methods of erection / commissioning adopted in erection/commissioning of similar job or for any reasons whatsoever.

1.9.10 After completing all the works, contractor shall hand over all remaining extra materials with proper identification tags in a packed condition to BHEL/Customer stores. In case of any use over actual design requirements, BHEL reserves the right to recover

the cost of material used in excess or misused. Decision of BHEL engineer in this regard will be final and binding on the contractor.

1.9.11 Contractor shall retain all T&P / Testing instrument / Material handling equipment's etc. at site as per advice of BHEL engineer and same shall be taken out from site only after getting the clearances from engineer in charge.

1.9.12 The contractor at his cost shall arrange necessary security measures for adequate protection of his machinery, equipment, tools, materials etc. BHEL shall not be responsible for any loss or damage to the contractor's construction equipment and materials. The contractor may consult the Engineer-in-Charge on the arrangements made for general site security for protection of his machinery equipment tools etc.

1.9.13 The Contractor may have to execute work in such a place and condition where Other agencies also will be under such circumstances. However completion time for erection agreed will be subject to the condition that contractor's work is not hampered by the agencies.

1.9.14 wherever erection sequences are furnished by BHEL, the contractor shall follow the same sequence.

1.9.15 If required by BHEL, the contractor shall change the sequence of his operation so that work on priority sectors can be completed within the projects schedule. The contractor shall afford maximum assistance to BHEL in this connection without causing delay to agreed completion date.

1.9.16 Any wrong erection shall be removed and re-erected promptly to comply with the design requirements to the satisfaction of Site Engineer.

1.9.17 Contractor has to work in close co-ordination with other erection agency at site. BHEL engineer will co-ordinate area clearance. In a project of such magnitude, it is possible that the area clearance may be less / more at a particular given time. Activities and erection program have to be planned in such a way that the milestones are achieved as per schedule/ plans. Contractor shall arrange & augment the resources accordingly.

1.9.18 The contractor must obtain the signature and permission of the security personnel of the customer for bringing any of their materials inside the sit premises. Without the Entry Gate Pass these materials will not be allowed to be taken outside.

1.9.19 Contractor shall remove all scrap materials periodically generated from his working area in and around power station and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and

remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect. All the package materials, including special transporting frames, etc. shall be returned to the BHEL stores / customer's stores by the contractor.

1.9.20 The contractor shall ensure that his premises are always kept clean and tidy to the extent possible. Any untidiness noted on the part of the contractor shall be brought to the attention of the contractor's site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineering- Charge.

1.9.21 The contractor is strictly prohibited from using BHEL's regular components like angles, channels, beams, plates, pipe / tubes, and handrails etc. for any temporary supporting or scaffolding works. Contractor shall arrange himself all such materials. In case of such misuse of BHEL materials, a sum as determined by BHEL engineer will be recovered from the contractor's bill. The decision of BHEL engineer is final and binding on the contractor.

1.9.22 The contractor will be responsible for the safe custody and proper accounting of all materials in connection with the work. If the contractor has drawn materials in excess of design requirements, recoveries will be affected for such excess drawls at the rate prescribed by manufacturing units.

1.9.23 No member of the already erected structure / platform, pipes, grills, platform, other component and auxiliaries should be cut without specific approval of BHEL engineer.

1.9.24 Contractors shall ensure that all their Staff / Employees are exposed to periodical training programme conducted by qualified agencies/ personnel on ISO 9001 – 2008 Standards.

1.9.25 For other agencies, such as civil, transformer, piping, insulation etc., to commence their work from / on the equipment's coming under this scope, Contractor has to clear the front, expeditiously and promptly as instructed by BHEL Engineer. Some time it may be required to re-schedule the activities to enable other agencies to commence/continue the work so as to keep the overall project schedule.

1.9.26 The terminal points decided by BHEL are final and binding on the contractor for deciding the scope of work and effecting the payment for the work done up to the terminals.

1.9.27 Crane operators deployed by the contractor shall be tested by BHEL and have valid Driving Licensee before he is allowed to operate the cranes.

1.9.28 For the purpose of planning, contractor shall furnish the estimated requirement of power (month wise) for execution of work in terms of maximum KW demand.

1.9.29 On Completion of work, all the temporary buildings, structures, pipe lines, scaffolding, cable etc. shall be dismantled and levelled and debris shall be removed as per instruction of BHEL by the contractor at his cost. In the event of his failure to do so, the expenditure towards clearance of the same will be recovered from the contractor. The decision of BHEL Engineer in this regard is final.

1.9.30 Prior to erection of any components internal inspection to be done for any foreign materials and damages and they are to be attended as per directions of BHEL engineer.

1.9.31 All the equipments /material to be taken inside the plant building shall be cleaned thoroughly before taking them inside and erect.

1.9.32 It is the responsibility of the contractor to do the alignment of bus duct with our structure if any minor modification like that of structure cutting and welding done by contractor free of cost basis. If necessary, repeatedly to satisfy BHEL Engineer / Customer Engineers with all the necessary tools and tackles manpower etc. without any extra cost. The alignment will be completed only when jointly certified so, by the BHEL Engineer & Customer. Also the contractor should ensure that the alignment is not disturbed afterwards .

1.9.33 The scope of specification covers the installation, testing and commissioning of the erected equipment/ instrument along with accessories as detailed in Bill of Quantity.

1.9.34 **SITE INSPECTION**

The owner / employer or his authorized agents may inspect various stages of work during the currency of the contract awarded to him. The contractor shall make necessary arrangements for such inspection and carry out the rectification pointed out by the owner / employer without any extra cost to the owner / employer. No cost what so ever such duplication of inspection of work be entertained.

BHEL / Customer will have full power and authority to inspect the works at any time, either on the site or at the contractor's premises. The contractor shall arrange every facility and assistance to carry out such inspection. On no account will the contractor be allowed to proceed with work of any type unless such work has been inspected and entries are made in the site inspection register by customer / BHEL.

Wherever the performance of work by the contractor is not satisfactory in respect of workmanship, deployment of sufficient labour or equipment, delay in execution of work or any other matter, **BHEL shall have the right to engage labour at normal ruling rates and get the work executed through other agency and debit the cost to the contractor and the contractor shall have no right to claim compensation thereof.** In such a case, BHEL shall have the right to utilize the materials and tools brought by the contractors for the same work.

1.9.35 **MANPOWER REQUIREMENT**

1.9.35.1 Manpower requirement for Erection and Commissioning shall as follows:

a. There shall be a Resident manager as Site In Charge at site, under whom there shall be sufficient area engineers who shall take care of the erection activities.

b. One Safety Engineer, One Quality Engineer & One Planning Engineer deployed at site which have a minimum qualification of Engineering Degree or Diploma in Engineering with minimum 02 years of experience.

c. Supervisor should have a minimum qualification of Diploma in Engineering or any graduate with minimum 2 years of experience in Thermal Power Station.

d. Contractor should have one Qualified Store Keeper who have responsible for daily basis stock of material in store yard and properly stacking of material , Receipt of Bhel material ,Issue of Bhel material for erection work and entry in material inward and outward register.

e. Three no. of Al. welder should be deployed at site for execution. All the welders have to be certified by BHEL/Customer and then inducted into the mainstream. Al. Welder should be qualified under the GDCD Std. 198 Norms and Test sample prepared accordingly WPS. Arrangements towards the sample testing (DP/Radiography) will be carried out by contractor.

1.9.35.2 Each engineer shall be provided with minimum one supervisor and adequate number of Technicians / electricians and other erection staff and T&P etc.

1.9.35.3 The Site in charge shall be provided with PCs and good communication facilities like telephone, fax, email etc. at the cost and expense of the contractor. Lack of communication facilities will not be an excuse for extension of completion date.

1.9.35.4 All instructions from BHEL / Customer will be directed to the contractor through the Site in-charge and he shall be responsible for all the contractor's activities at site. The contractor shall name his authorized representative prior to or immediately on commencement of operations at site.

1.9.35.5 The Site In charge shall be present at site during all normal working hours and his contact address after normal working hours shall be made available to BHEL so that if any emergency arises, the presence of the contractor's site Representative at site can be called for.

1.9.35.6 The contractor shall not change the site Representative without the consent of BHEL. Should BHEL require the replacement of the contractor's site Representative for justifiable reasons (including inadequate progress of work) the contractor shall ensure that replacement is made as soon as possible and work is not allowed suffering delay on this account.

1.9.35.7 The contractor shall provide to the satisfaction of BHEL sufficient and qualified staff for the execution of works. If and whenever any of the contractor's staff is found guilty of any misconduct or be incompetent or insufficiently qualified in the performance of his duties the contractor shall remove them from site as directed by Site Engineer.

1.9.35.8 The contractor shall ensure that all his supervisor's staff and workmen conduct themselves in a proper manner. They shall all be persons who are familiar with and skilled at the jobs allocated to them. Any misconduct / inefficiency noted on the part of the contractor's personnel shall be brought to the attention of the contractor's site representative who shall immediately take such action as necessary including the removal of such misconducting / inefficient persons, if so required by the Engineer-in-Charge.
1.9.35.9 The contractor shall ensure that replacement for such persons removed from site is provided immediately and the work is not allowed to suffer delay on that account.

1.9.36 **DOCUMENTATION**

1.9.36.1 The following information shall be furnished by the bidder within two weeks of award of contract for purchaser's approval

a) Bar chart covering planned activities at site.
b) Detailed organization chart.
c) Details of T&P available with contractors with documents proofs.

1.9.36.2 The following information shall be furnished by the bidder after testing and inspection: Test certificates of various tests conducted at site. All inspection and test certificates shall be signed by customer's representative also, wherever called for as per field quality plan.

1.9.36.3 As built drawings:
After successful completion, testing and commissioning of installation work, Purchaser's drawings / documents shall be updated in line with the actual work carried out and as built drawings / documents shall be submitted by the contractor as agreed for the project.

1.9.37 **VOLUME-IA PART- II CHAPTER-3 of this booklet contains general guidelines for Installation, Testing and Commissioning of supply items of bus duct package.**

CHAPTER –IX
VOLUME-IA PART –I
FOUNDATIONS AND GROUTING

THE SCOPE OF THE WORKS WILL COMPRISE OF BUT NOT LIMITED TO THE FOLLOWING:

(All the works mentioned hereunder shall be carried out within the accepted rate Unless otherwise specified.)

1.10.1 Foundation for the equipments (Bus duct Structure, Beam etc) to be erected shall be provided by BHEL / clients of BHEL. The dimension of the foundation and anchor bolt pits shall be checked by the contractor for their correctness as per drawings. Further, top elevation of foundations shall be checked with respect to bench mark etc. All adjustments of foundations surfaces, enlarging the pockets in foundations etc. as may be required for the erection of equipment's plants shall be carried out by the contractor.

1.10.2 Foundation Pit will be provided by BHEL/L&T Ltd. Foundation bolt, supplied by BHEL, has to be grouted in foundation pit by the contractor. Civil material required for grouting will be arranged by contractor.

1.10.3 Cleaning of foundation surfaces, pocket holes and anchor bolt pits etc., dewatering, making them free of oil, grease, sand and other foreign materials by soda wash, water wash, compressed air or any other approved methods etc., form/shuttering work are within the scope this work.

1.10.4 It shall be contractor's responsibility to check the various equipment foundations for their correctness with respect to level, orientation, dimensions etc., and ascertained dimensions shall be measured and submitted to BHEL for approval before erection. Also minor chipping, dressing of foundations up to 30 mm for obtaining proper face for packer plates/shims, and may be required for the erection of the equipment/plants will have to be carried out by the contractor without extra cost.

1.10.5 The surface of foundations shall be dressed to bring the surface of the foundations to the required level and smoothness prior to placement of equipment's.

1.10.6 Foundation pockets are to be cleaned thoroughly before placing the columns/equipment. Verticality of foundation bolts to be checked along with correctness of the threads and freeness of the nuts movement. If required cleaning of the threads to be done with proper dies.

CHAPTER – X
VOLUME-IA PART – I
PROGRESS OF WORK

The scope of the work will comprise of but not limited to the following:

(All the works mentioned hereunder shall be carried out within the accepted rate unless otherwise specified.)

1.11.0 Refer forms F -14 to F-18 of volume I D (Forms & Procedure) of volume –ID of Book-II. Plan and review will be done as per the formats.

1.11.1 The progress reports shall indicate the progress achieved against plan, Indicating reasons for delays, if any. The report shall also give remedial actions which the contractor intends to make good the slippage or lost time so that further works can proceed as per the original plan the slippages do not accumulate and affect the overall programme.

1.11.2 It is the responsibility of the contractor to provide all relevant information on a regular basis regarding erection progress, labour availability, equipment deployment, testing, etc. with all necessary documents.

1.11.3 During the course of erection, if the progress is found unsatisfactory, or if the target dates fixed from time to time for every milestone are to be advanced, or in the opinion of BHEL, if it is found that the skilled workmen like fitters, operators, technicians employed are not sufficient BHEL will induct required additional workmen to improve the progress and recover all charges incurred on this account including all expenses together with BHEL overheads from contractor's bills.

1.11.4 Contractor is required to draw mutually agreed monthly erection programs in consultation with BHEL well in advance. Contractor shall ensure achievement of agreed program and shall also timely arrange additional resources considered necessary at no extra cost to BHEL.

1.11.5 Progress review meetings will be held at site during which actual progress during the week vis-a-vis scheduled program shall be discussed for actions to be taken for achieving targets. Contractor shall also present the program for subsequent week. The contractor shall constantly update / revise his work program to meet the overall requirement. All quality problems shall also be discussed during above review meetings. Necessary preventive and corrective action shall be discussed and decided upon in such review meetings and shall be implemented by the contractor in time bound manner so as to eliminate the cause of nonconformities.

1.11.6 The contractor shall maintain a record in the format as prescribed by BHEL of all operations carried out on each weld and maintain a record indicating the number of welds, the names of welders who welded the same, date and time of start and completion, preheat temperature, radiographic results (RT), DP Result of each joint, rejection if any, percentage of rejection etc. and submit copies of the same to the BHEL Engineer as required.

1.11.7 The contractor shall submit daily, weekly and monthly progress reports, manpower reports, materials reports, consumables (gases / electrodes / ferules / lugs) report, cranes availability report and other reports as per Performa considered necessary by the Engineer as per the BHEL formats.

1.11.8 The contractor shall submit weekly / fortnightly / monthly statement report regarding consumption of all consumables for cost analysis purposes.

1.11.9 The manpower reports shall clearly indicate the manpower deployed, category wise specifying also the activities in which they are engaged.

1.11.10 The monthly report shall be submitted at the end of every month as a booklet and shall contain the following details:-

a) Colour Progress photographs.

b) Erection progress in terms of tonnage, percentage of work completion, welding joints, DP tests, stress relieving, etc., completed as relevant to the respective work areas against planned.

c) Site Organization chart of engineers & supervisors as on the last day of the month with further mobilization plan

d) Category- wise man hours engaged during the previous month under the categories of fitters, welders, riggers, khalasis, grinder-men, gas-cutters, electricians, crane operations, store keepers, helpers, security etc.

e) Consumables report giving consumption of all types of gases and electrodes during the previous month.

f) Availability report of cranes

g) Safety implementation report in the format

h) Pending material and any other inputs required from BHEL for activities planned during the subsequent month.

VOLUME-IA PART – II
CHAPTER 2
DRAWINGS

Attached Separately.

1. **IPBD**

A. Layout drawing for IP Bus duct.
B. Foundation layout drawing for IP Bus duct.
C. Approved FQP.

VOLUME-IA PART- II
CHAPTER -3
TECHNICAL REQUIREMENTS AND GUIDELINES FOR INSTALLATION, TESTING, COMMISSIONING OF SUPPLY ITEMS OF BUSDUCT PACKAGE.

3.1 INSTALLATION, TESTING & COMMISSIONING IN GENERAL:

The stages of completion of various works shall be as follows:

Equipment shall be considered to be completely erected when the following activities have been completed:

a) Moving of all equipment to the respective foundations.
b) Fixing of anchor bolts or tack welding as required.
c) Levelling and alignment of equipment.
d) Assembling of all accessories such as relays, CTs, PTs, meters, instruments etc. as described in the job specification.
e) Sub-assemblies of bus ducts(SP &IP) and erection of the same.
f) Conduit laying, termination with continuity check.
~~g) Installation of sunshade for outdoor portion of IPBD.~~
h) Applying of final coat of paint on bus-duct.

All the equipment shall be tested at site to know their condition and to prove suitability for required performance. The site tests and acceptance tests to be performed by contractor are detailed below. The contractor shall be responsible for satisfactorily working of complete integrated system and guaranteed performance.

3.2 Site Tests and Checks

3.2.1 General

All the equipment shall be tested at site to know their condition and to prove suitability for required performance.

The test indicated in following pages shall be conducted after installation. All tools, accessories and required instruments shall have to be arranged by contractor. Any other test which is considered necessary by the manufacturer of the equipment, contractor or mentioned in commissioning manual has to be conducted at site.

In addition to tests on individual equipment some tests / checks are to be conducted / observed from overall system point of view. Such checks are highlighted under miscellaneous tests but these shall not be limited to as indicated and shall be finalized with consultation of client before charging of the system.

The contractor shall be responsible for satisfactory working of complete integrated system and guaranteed performance.

3.2.2 Bus ducts – Isolated phase bus ducts

3.2.2.1 ERECTION OF STRUCTURE IP.

Foundations for column erection are the start point of erection wherein we have to be careful & precise while erecting of structures. Any deviation in the structure erection will escalate to misalignment & consequent rework in bus duct at height. It also affects the quality and aesthetics of erected bus duct. Following steps needs to be followed from initial level of erection:

3.2.2.1.1 OUTDOOR PORTION:-

a) Handing over of foundation bolt set to customer by proper format. Format will be given by BHEL.
b) Ask for load test certificate for foundation pocket from customer. It is to ensure load carrying capacity of foundation pockets.
c) Joint protocol to be signed between civil contractor of customer and BHEL sub contracting agency/representative for measuring the level of foundation bolt & physical condition of foundation bolt after civil work in proper format. Appropriate drawings may be referred. Format will be given by BHEL.
d) Check nut fixed on foundation bolt and set zero reference level as given by customer.
e) Cleaning of foundation bolt threads may be done with wire brush, if required.
f) Required structure as per the drawing from the received material may be taken out with the help of requisite equipment and clean it before erection by wire brush/cloth. Must ensure that hole in column base plate is as per drawing.
g) Assemble vertical members by nut bolt with jointing plate at ground and check for straintness with magnetic spirit level. Afterwards, erect on foundation pockets by the help of requisite crane.
h) Check verticality of structure by the magnetic sprit level/ plum bob method after erection. If verticality is proper, then install foundation nut, plain washer & spring washer as per drawing and proper tightness may be ensured as per recommended standard.
i) Earthing of structure will be done after the bus duct & accessory erection. Touch paint on earthing joint may be done with Alumium Zinc rich paint after welding.
j) Ensure that no gap is found between the horizontal and vertical member of structure joint after bolting. If found, rectify it with required welding at the location and apply touch up paint.
k) Cutting and welding on structures for alignment of structures can be done after taking necessary permissions from Customers and BHEL. Cold galvanising paint (zinc rich paint) should be applied at the welded/modified/rectified portions.

3.2.2.1.2 INDOOR PORTION:-

a) Structure identified and segregated from the received lot and shifts it inside the switchgear room & near generator bushing location for ipbd erection by the help of tested chain block. Use tested sling for shifting purpose.
b) Structure may be modified/bolted/welded for required length as per drawing for erection purpose.
c) Gas cutting permission for cutting and making holes at required location in structures may be taken from customer/BHEL.
d) Touch up paint on cutting and welding portion by Zinc rich Al. paint.
e) Earthing of structure will be done after the bus duct & accessory erection.

3.2.2.1.3 NGR STRUCTURE ERECTION:-

a) Check for embedded plate on wall and match with our ref. Drg.
b) Either EP plate or anchor fastener bolts as the case may be as per drg. May be ensured before civil work is completed. After fixing EP bolts/anchor fastener bolt may be grouted.
c) Structure may be modified if found necessary.
d) NGR must be mounted on epoxy based insulator for proper insulation of our structure.

3.2.2.2. ERECTION OF IPBD:-

During the IPBD erection, care regarding the welding work at joints must be taken and visually inspection of insulator for cracks to be done. In IPBD all joint is AL.welded and is high rating current carrying path.

REMOVING PACKING OF BUSDUCT:-

Packing of bus duct is removed and visually checked for all dimensions of bus duct, conductor, backing plate & insulator support & BOM nos. Packing on silver plating on palms should not be removed at this stage.

i. SHIFTING OF BUSDUCT FROM STORE TO PROJECT SITE

Identify the bus duct which is needed for erection at project site. Issue it from stores after proper entries. Lift the bus duct by requisite crane and load on trailer, if required by the help of strap belt and provide wooden support for proper stacking on it. Bus duct is tightened on trailer if required by the help of ratchet belt to avoid scratch/damage, toppling on the enclosure of bus duct.

ii. UNLOADING OF BUSDUCT AT PROJECT SITE

Busduct is unloaded by requisite crane and proper care should be taken during unloading. Guide rope must be fixed at the end of busduct for avoiding any wobbling at site. Busduct to be unloaded at paved/proper levelled area and proper stacking with the support of wooden strip to be carried out.

iii. SHIFTING AND READYNESS OF IPBD INSIDE AREA.

a) Inside busduct identified by ref drg and taken out from the stacked/stored material and lifted by tested chain block and tight with strap belt & shifted near the generator.
b) Proper cleaning of aluminium conductor and epoxy insulators by the help of cotton cloth.
c) Visually inspect the condition of black paint on IPBD conductor and inside portion of IPBD enclosure. If paint has peeled off then touch up paint will be require on peel off area.

iv. ASSEMBLY & ERECTION OF BUSDUCT IN TG HALL.

a) Measurement of embedded plates size inside the TG Hall and check as per ref. Drg.
b) Bolting on support leg with our structures. Both leg pins to be inserted in IPBD support channel ring clamp. If insulations provided then arrangement of insulation as per our ref drg. May be carried out. Size of bolts installed must be same.
c) Positioning of busduct to be done by the help of chain block and match the conductor overlapping on backing tube with adjacent duct. Tight with ratchet belt and tag weld the joints. All joints and dimensions to be checked as per our ref drg.
d) Proper cleaning of jointing area by wire brush and removal of black paints & burr. To be done. 5 mm to 12 mm gap is to be created on backing tube and adjacent conductor for further welding.
   Welding conditions for MIG process:

Filler wire:	1.6mm dia (NG21 with 5% silicon)
Angle:	10° to 15° forehand
Cleaning:	decrease and scratch brush
Setting:	250A to 320A, 28 to 30 volts (dependent on thick)
Process:	4 off 25mm long equispaced tack welds
Gas supply:	50 cu. Ft/hr argon – 10-12 lits/min.argon
Shield:	5/8" dia
Purity:	99.98%

e) Root welding on IPBD conductor by certified welder has to pass DP Test/Radiography test, if mentioned in FQP.
f) After root welding cleaning by wire brush and perform dye penetration test on it.
   i. Apply cleaner on welded portion.
   ii. Spray penetration on welded portion.
   iii. Spray developer on welded portion. Leave 15 min for developing time. If pin spots found then grinding has to be done on this portion and it is to be rewelded. Again DP test to be conducted on this joint.
   iv. Finally cleaner is used to clean the layers and ready for final welding.
g) After final welding on this joint, again dye penetration test is to be carried out. If joint passes the test then proper cleaning by wire brush and black matt paint to be applied on this joint.

h) Again cleaning of conductor and insulator before closing the enclosure by makeup pieces.
i) Clean the edges with grinder of the makeup pieces and enclosure and fitting by the help of ratchet belt and tag welding/final welding on it. After welding on makeup piece grinder is used for remove burr and apply touch up paint on the joints.

v. SHIFTING AND READYNESS OF IPBD OUTSIDE AREA.

a) Outside bus duct identified by ref drg and taken out from the stacked material by requisite crane.
b) Proper cleaning of aluminium conductor and epoxy insulator by the help of cloth.
c) Visually inspect the condition of black paint on IPBD conductor and inside portion of IPBD enclosure. If paint has peeled off then touch up paint has to be applied on peeled off area.

vi. ASSEMBLY & ERECTION OF BUSDUCT IN TRANSFORMER YARD.

a) Positioning of bus duct by the help of requisite crane and match the conductor overlapping on backing tube with adjacent duct and tight with ratchet belt and tag welded on this joint. All sub-assembly to be prepared at ground floor.
b) Proper cleaning of jointing area by wire brush and remove all black paint & burr. 5 mm to 12 mm gap to be created on backing tube and adjacent conductor.
c) Root welding on IPBD conductor by certified welder has to pass DP Test/Radiography test, if mentioned in FQP.
d) After root welding cleaning by wire brush and perform dye penetration test on it.
    i. Apply cleaner on welded portion.
    ii. Spray penetration on welded portion.
    iii. Spray developer on welded portion. Leave 15 min for developing time. If pin spots found then grinding has to be done on this portion and it is to be rewelded. Again DP test to be conducted on this joint.
    iv. Finally cleaner is used to clean the layers and ready for final welding.

e) After final welding on this joint, again dye penetration test is to be carried out. If joint passes the test then proper cleaning by wire brush and black matt paint to be applied on this joint.
f) Again cleaning of conductor and insulator before closing the enclosure by makeup pieces.
g) Clean the edges with grinder of the makeup pieces and enclosure and fitting by the help of ratchet belt and tag welding/final welding on it. After welding on makeup piece grinder is used for remove burr and apply touch up paint on the joints before erection of assembled set of IPBD by the help of requisite crane.
h) Assembled IPBD needs to be erected on structure with IPBD support leg matching with our IPBD cross structure and proper bolting of AL.leg and insert both leg pin in the AL.support channel ring. If insulation is provided then

arrangement of insulation has to be carried out as per our ref drg. Size of bolts must be same.

vii. IPBD RUBBER BELLOW ERECTION.

Rubber bellow is provided in IPBD route for maintanance and adjustment of minor misalignment during erection horizontally & vertically.

a) Removing packing of rubber bellow.
b) Visual inspection of rubber bellow for cracks.
c) Location and erection of rubber bellows as per ref. Drg.
d) Rubber bellow is erected with adjacent duct by means of bolted joint.
e) Rubber bellow joint is covered by rain hood if required as per drg.

viii. EARTHING OF ISOLATED PHASE BUSDUCT.

Leakage current in IPBD is grounded by earthing arrangement. In IPBD, shunt plates is used for shorting all three phase of IPBD. Shunt arrangement will be provide as per layout drg. Earthing arrangement for the same shall be made. Size of recommended earthing strip is 10 x65 mm/as per TDS.

a) Remove paint on shunt plate where jointing has to take place by the help of grinder.
b) Create required hole in earthling strip by magnetic drilled m/c and gas cutting set for bolting arrangement.
c) Must ensure that overlap portion of earthing strip is (3 x65 mm (wide))195 mm and proper bolted.

ix. ERECTION OF CURRENT TRANSFORMER.

Current transformer is used in IPBD for metering purpose of the equipment.

a) Remove the packing of current transformer carefully and visually check for any damages. Take out the Brass and SS spacers from inside the packing.
b) Polarity ratio test to be conducted on CT before erection.
c) After testing current transformer, install in bus duct at ground level with brass/ss spacers and fixed with hardware's and nylon washers.
d) Assembled bus duct with current transformer to be erected by requisite crane.

x. ERECTION OF CURRENT TRANSFOREMR MARSHALLING BOX.

Supply is provided in current transformer by means of CT marshalling box.

a) Remove the packing of current transformers marshalling box and visually inspect the condition of marshalling box. Match with our ref. Drg.
b) Termination at CT stud with lug and wire be laying of cable tray and tied with plastic strips.
c) CT marshalling box fitted as per drg. by the help of anchor fasteners and 1.8 mtr from the ground level.
d) Wire is terminated in the marshalling box by fitting proper cu.lug.

e) Identification and marking inside the ct marshalling box for wires may be correctly done.

xi. ERECTION OF IPBD WALL FRAME.

Erection of wall frame in IPBD at the TG hall wall in the route to be carried out as per ref drg. Rubber gasket is providing between the IPBD enclosure and inner surface of wall frame.

xii. ERECTION OF SEAL OFF BUSHING.

Seal off bushing is used for sealing the ducts compartment wherever required in the route of bus duct. This may be near adopter chamber, terminating ducts on GT's, UT's & ST's in IPBD to protect the ducts.

a) Remove the packing of seal off bushing and visually inspect the condition of seal off bushing and match with our ref. Drg. And rating.
b) Proper care should be taken during the erection in IPBD flange.
c) Neoprene cork gasket may be inserted between surface of AL. flange of IPBD and surface of seal off bushing.
d) Nylon washer is fixed on the surface of seal off bushing and proper nut bolt fixed.
e) Must ensure that air does not passes from the seal off bushing. If any air leakage detected, then arrest by the help of sealant.

xiii. ALIMUNIUM TERMINATIONS/DISCONNECTING LINKS IN IPBD.

In IPBD high rating current flows, so that following step should be considered during the jointing of aluminium /cu. Plates at terminals.

a) In IPBD terminating palms silver plating is done on respective palms. Packing of palm assembly to be removed before erection.
b) Aluminium plate is cleaned by soft cloth to remove the oxide layer on the surface.
c) Densol compound to be applied on aluminium plates for preventing any oxidation to re-occur.
d) Nut bolt arrangement is used for fitting this splice plate on IPBD palm and check with recommended torque tightness**.**

xiv. ERECTION OF IPBD AL/COPPER FLEXIBLE JOINT IN IPBD:-

Cu.flexibles are used inside the rubber bellow for terminations at bus duct end with other connecting equipment's.

a) Remove the packing of cu.braided flexible and visually inspect and check as per required drg./rating.
b) Bimetallic strip is used at this location. Ensure that cu.surface of bimetallic strip is towards cu. surface of cu.flexibles and AL. surface of bimetallic strip is towards with AL. Conductor surface of busduct.
c) Torque tightness check as per recommended torque settings.

xv. ERECTION OF NEUTRAL GROUNDING CUBICLE.

Neutral grounding cubicle is provided for at the neutral side of generator bushing to ground the current.

a) Remove the packing of neutral grounding cubical and check all accessories in this packing list.
b) Shift the cubicle at desired location as per our layout drg.
c) Installed all accessories in NGC as per our ref. Drg.
d) Earthing of NGC body to be done at the end.

xvi. ERECTION OF AIR PRESSURIZATION/HOT AIR BLOWER.

This system is used for maintain the pressure/dry up inside the busduct above the atmospheric pressure/for moistures and attend sufficient temperature.

a) Remove the packing of air pressurization and hot air blower system and physically check the entire accessory as mention in dispatch document.
b) Shift the system at desired location and installed all piping scheme as per our layout drg/scheme.
c) Respective vendor of this system is will be called for commissioning after proper installation of all accessories.
d) Hand over the system after successfully commissioning.

xvii. ERECTION OF SHORTING BAR

During the short circuit test at site all three phase of IPBD will be shorted by the help of shorting bar.

a) Shifting short circuit arrangement at desired installation location by the requisite mechanism.
b) Erect shorting bar with the help of chain block pulley and prepare the structure as per ref. Drg/Scheme.
c) Install insulator on the structure.
d) Install all aluminium splice plates with shorting links and get inspected by the inspection authority with recommended torque tightness.
e) After inspection all aluminium splice plates to be dismantled and handed over to customer in proper format.

3.2.2.3 **Power Frequency High Voltage Test**

Preparation:

Following equipment must be disconnected from bus bars removing the bolted link and grounded suitably prior to conducting this test:

a. Generator terminals
b. Unit auxiliary transformer terminals
c. Generator transformer terminals
d. Neutral grounding transformer HV terminal

e. Lightening arresters
f. Capacitors
g. Potential transformer.

It is important to ensure that secondary of all the current transformers mounted on bus bars are shorted and grounded properly before conducting this test.

Ensure that all insulators seal-off bushings are cleaned free from any dust, grease and moisture etc. before test.

During the test, ensure the following

a. The generator rotor is kept stationary.
b. H.V. Circuit breakers on system side are kept in the open position.

Test Voltage:

The test voltage shall be alternating current on any frequency between 25 hertz to 100 Hz and approximately of sine-wave form.

The r.m.s. value shall be as given in table-1 below:

For A.C. voltage duration of test shall be one minute.

The test with D.C. at a voltage not in excess of the values given in below table , Column-3 for the corresponding rated voltage may be substituted for the AC test prescribed. For D.C. voltage duration of test shall be fifteen minutes.

Rated Highest System Voltage(KV) -Upto & Including	Test Voltage (A.C.)-KV	Test Voltage (D.C.)-KV
3.6	16.8	16.8
7.2	21.6	21.6
12	28	28
24	44	44
36	60	60

3.2.2.5 IR Value Checks:

Before the application of high voltage, check the insulation of each bus conductors by applying 5 KV from IR Testing machine. A value of 100 mega ohms expected under normal conditions. However, mainly during season this value may fall down considerably and drying up by hot air may be necessary before the test. Minimum acceptable value is around 20 mega ohms. After the application of high voltage the insulation value is checked gain.

Note:

The test specified above for all the electrical equipment are not exhaustive. Any other pre-commissioning and field tests not included in the above list but necessary as per relevant standards, Electricity rules, code of practice and instructed by the manufacturer of the equipment shall also have to be carried if deemed necessary & shall be carried out as per requirement free of cost . The contractor shall take the

full responsibility of testing, commissioning, trial run and successful operation of the equipment under overall guidance of BHEL engineer.