



**BHARAT HEAVY ELECTRICALS LIMITED  
CENTRALISED STAMPING UNIT & FABRICATION  
PLANT  
Jagdishpur**

**TENDER FOR EXECUTION OF MISCELLANEOUS CIVIL  
AND ELECTRIFICATION WORKS FOR OPERATION OF  
CSU PHASE-I INCLUDING ARCHITECTURAL WORKS AT  
JAGDISHPUR**

**Tender Enquiry No: BHE/CSU/CVL/18**

**SECTION V**

**TECHNICAL SPECIFICATION**

**PART A: SPECIFIC TECHNICAL REQUIREMENTS**

**BHARAT HEAVY ELECTRICALS LIMITED  
(A GOVERNMENT OF INDIA UNDERTAKING)  
CSU & FP  
Industrial Area  
Jagdishpur (UP) 227817**

**SECTION V****PART - A****SPECIFIC TECHNICAL REQUIREMENTS****1.0 GENERAL**

Part-A covers specific technical requirements of contract and should be read in conjunction with BOQ, Part-B and other sections of the contract. In case of any conflict between the contents of BOQ and Part-A or Part-B , BOQ will prevail over Part-A or Part-B .

**2.0 FREE ISSUE MATERIALS**

Nothing shall be supplied as free issue material by BHEL.

**3.0 DISMANTLING OF EXISTING STRUCTURES**

The contractor will have to carryout dismantling of buried/ semi buried structures, if any, encountered within the battery limit and disposal of it within plant boundary as directed by BHEL at no extra cost to BHEL.

**4.0 STATUTORY REQUIREMENTS**

Bidder shall comply with all the applicable statutory rules pertaining to Factories Act, Fire Safety Rules of Tariff Advisory Committee, Water Act for pollution control, Explosives Act, etc.

Provisions of safety, health and welfare according to Factories Act shall be complied with. These shall include provision of continuous walkway minimum 500 wide along the crane-girder level on both sides of building, comfortable approach to EOT crane cabin, railing, fire escape, locker room for workmen, pantry, toilets, rest room, etc.

Provisions for fire proof doors number of staircases, fire separation wall, lath plastering/encasing the structural members (in the fire prone areas), type of glazing etc. shall be made according to the recommendations of Tariff Advisory Committee.

Statutory clearances and norms of State Pollution Control Board shall be followed.

Bidder shall obtain approval of Civil/Architectural drawings from concerned authorities before taking up the construction work.

**5.0 LAYOUT**

Before starting the work, the Contractor shall carry out the setting out of foundation and structures and provide levels, with reference to general existing grid and bench mark. If the contractor uses the grid, , bench mark and reference pillar made by other Contractors, he shall coordinate with the Contractor and shall satisfy himself of the accuracy of the reference marks. If he is required to set out the foundation afresh, he shall do so independently with reference to the one existing grid and bench mark which has been followed by other agency at the instruction of the Engineer. In case any discrepancy be found, it shall be immediately brought to the

notice of the engineer for any rectification/modification necessary. No complaint shall be entertained at a later stage. The Contractor shall accurately set out the position for holding down bolts and inserts.

If required, in the opinion of the Engineer, he shall construct and maintain pillars for Grid, references and bench marks and maintain them till the completion of the construction. He shall also help the Engineer with instruments, materials and labours for checking the detailed lay outs and levels. The Contractor shall be solely responsible for the correctness of the layout and levels, and Engineer's approval shall not be deemed to imply any warranty in carrying out the work correctly.

## **6.0 WORKMANSHIP**

Workmanship shall be of the best possible quality and all work shall be carried out by skilled workmen except for those which normally require unskilled persons. Welding shall be done by experienced and certified welders in proper sequence using necessary jigs and fixtures. Fabrications shall be done in shops having proper equipment for accurate edge planning and milling of column shall ends, base late surfaces etc. and shaping and dimensioning of anchor bolt assembly, inserts and other misc. items. In addition to the requirement specified above, if the bye-laws of the local Govt., Municipal or other authorities require the employment of licensed or registered workmen for various traders, the contractor shall arrange to have the work done by such registered or licensed personnel. In case of manufactured materials, the Contractor shall have, with no additional cost the owner, the services of the supervisors of the manufacturers to achieve that the work is being done according to the manufacturer's specifications.

## **7.0 TEMPORARY WORK**

All scaffoldings, staging, temporary bracing and other necessary temporary work required for proper execution of the Contract shall be provided by the Contractor at his own cost and inclusive of all materials, labour, supervision and other facilities.

The layout and details of such Temporary work shall have the prior approval of the Engineer as agreed, but the Contractor shall be responsible for proper strength and safety of the same. All Temporary work shall be so constructed as not to interfere with any permanent work or with the work by other agencies. If it is necessary to remove any of the temporary work at any time to facilitate execution of the work or with the work of other agencies, such removal and re-erection, if required, shall be carried out by the Contractor at the discretion of the Engineer without any delay and any extra cost on this account shall be borne by the Contractor.

## **8.0 INTERFACE WITH STRUCTURES UNDER OTHER'S SCOPE**

a) In cases of interface e.g. structures under other's scope of supply being supported on structures under scope of this contractor, the same will be discussed and suitably addressed.

b) Modification in layout of foundation/structure during detail engineering stage may be necessary to avoid fouling with those under other's scope. Necessary changes on this account will be made without any extra cost to Owner.

c) Necessary engineering is to be done and provisions are to be kept accordingly by the Contractor to construct foundations/underground structures, etc. without disturbing/ endangering the constructions done under the scope of other contracts.

## 9.0 INSPECTION, TESTING AND QUALITY CONTROL FOR CIVIL WORKS

Sampling and testing for major items of civil works viz earthwork, concreting, structural steel work (including welding) etc. shall be carried out in accordance with the requirements of this specification and field quality plan (FQP).

The bidder shall submit for BHEL's approval a detailed field quality assurance programme for civil works before starting of the construction work. This shall include frequency of sampling and testing nature/type of test, method of test, setting of a testing laboratory, arrangement of testing apparatus/equipment, deployment of qualified/experienced manpower, preparation of format for record, Field Quality Plan, etc. Tests shall be done in the field and/or at a laboratory approved by the Engineer and the Bidder shall submit to the Engineer, the test results in triplicate. In addition, the bidder shall furnish the original test certificate from the manufacturer's of various materials to be used in the construction.

If any work found to be of inferior quality or sub-standard, the same shall be dismantled and shall be redone as per approved quality or relevant standard. BHEL reserve the rights to reject the work of inferior quality. All expenses on account of dismantling and rework shall be born by contractor.

**Contractor shall arrange for conducting the initial and field CBR test for the road construction as per latest IRC guidelines. The contractor's finally accepted rates shall include cost of such field tests with standard equipments and IMTEs**

## 10.0 CONSTRUCTION / ERECTION METHODOLOGY

- Construction excavation activities shall be fully mechanized from the start of the work.
- All excavation and backfilling work shall be done using excavators, loaders dumpers, dozers, poclains, excavator mounted rock breakers, rollers, sprinklers, water tankers, etc. Manual excavation can be done only on isolated place with specific approval of engineer.
- Dewatering shall be done using the combination of electrical and stand-by diesel pumps.
- For concreting, weigh batching plants, transit mixers, concrete pumps, hoists, etc. shall be used.
- All fabrication and erection activities of structural steel shall be carried out using automatic submerged arc welding machines, cutting machine, gantry cranes, crawler / wheel mounted heavy cranes and other equipments like heavy plate bending machines, shearing machines, lathe, milling machines etc. Use of derricks shall not be permitted.
- All handling of materials shall be with cranes. Heavy tailors shall be used for transportation.
- Mechanized modular units of scaffolding and shuttering shall be used.
- Grouting shall be carried out using hydraulically controlled grouting equipment.
- Roadwork shall be done using pavers, rollers and premix plant.
- All finishing items shall be installed using appropriate modern mechanical tools.

- Manual punching etc. shall not be permitted.
- Heavy duty hoist for lifting of construction materials shall be deployed.
- Compressors for cleaning of foundations and other surfaces shall be used.
- Field laboratory shall be provided with all modern equipment for survey, testing of aggregates, concrete, welding etc. For testing of steel works, ultra sonic testing machines, radiographic testing machines, dye penetration test equipment, destruction testing equipment, etc shall be deployed.
- All persons working at site shall be provided with necessary safety equipment and all safety aspects shall be duly considered for each construction/erection activity. Moreover, only the persons who are trained in the respective trade shall be employed for executing that particular work.
- Fabrication and Erection of all fabricated columns shall be done in single piece unless otherwise provided for in the approved drawings. Main columns of the power house building can have maximum of one number of the erection splice. All shop and site splice shall suitably staggered. The erection splice shall be provided with full strength splice cover plate over the butt weld. Contractor shall submit the erection scheme for the erection of all type of structures and carryout the erection work only after approval of the scheme by the owner.

**11.0 FIELD LABORATORY FACILITIES AT SITE FOR MATERIAL TESTING:**

Contractor shall provide field testing facilities at site laboratory built by the contractor as per list of apparatus at annexure-A-1.

**12.0 MAKE OF BOUGHT OUT MATERIAL:**

Contractor shall supply bought out items as per the list attached at annexure-A-2 of this section.

**ANNEXURE – “A-1”****BIDDER SHALL PROVIDE MINIMUM FOLLOWING FACILITIES IN SITE IN THE FIELD LABORATORY FOR MATERIAL TESTING****General Equipment**

| Sl.No | Description        | Sl.No | Description       |
|-------|--------------------|-------|-------------------|
| 1.    | Balances           | 10.   | Burette stand     |
| 2.    | Drier              | 11.   | Pipette           |
| 3.    | Thermometer        | 12.   | Wooden mallet     |
| 4.    | Hydrometer         | 13.   | Hair brush        |
| 5.    | Hand-scoop         | 14.   | Wire Brush        |
| 6.    | Glass beakers      | 15.   | Buckets           |
| 7.    | Measuring Cylinder | 16.   | Test Tubes        |
| 8.    | Desiccator         | 17.   | Working platforms |
| 9.    | Burette            | 18.   | Alcometer         |

**Soil testing apparatus for conducting the following tests:**

Particle size analysis and index properties of soil

Moisture-density relations of soil

Specific gravity of soil

Density of soil in place by sand replacement method

CBR initial and field testing apparatus as per IRC guidelines

**Testing Equipment for conducting the following tests on concrete samples:**

Compressive strength of concrete

Slump of concrete

Specific gravity and absorption and bulking of fine aggregates

Sieve analysis of fine aggregates and coarse aggregates

**Annexure-“A-2”****INDICATIVE LIST OF APPROVED MAKE OF BOUGHT OUT MATERIAL TO BE ARRANGED BY THE CONTRACTOR AT HIS OWN COST**

The following list may be read in conjunction with the relevant make/ makes of materials mentioned in the BOQ or elsewhere in this tender document.

| <b>S.NO.</b>                         | <b>MATERIAL NAME</b>                             | <b>MAKE</b>   |
|--------------------------------------|--|---|
| 1.                                   | GI & MS PIPES                                    | SURYA, PRAKASH, JINDAL-HISSAR, TATA   |
| 2.                                   | GI FITTINGS(MALLEABLE)                           | UNIK, KS, ZOLOTO  |
| 3                                    | CEMENT   | JP BUNIYAD, MAIHAR CEMENT , ULTRATECH , L&T OR EQUIVALENT                   |
| 4                                    | REINFORCEMENT STEEL                              | TATA-TMT, SAIL OR EQUIVALENT  |
| 5                                    | STRUCTURAL STEEL                                 | TATA, SAIL OR EQUIVALENT  |
| 6                                    | COARSE SAND                                      | BADA/KALPI /DUDHI   |
| 7                                    | LOCAL SAND                                       | GHAGHARA/ GANGA   |
| 8                                    | STONE BALLAST FOR BASE CONCRETE                  | SHANKERGARH/ DALA OR EQUIVALENT   |
| 9                                    | STONE GRIT, 20MM, 12MM, 8MM FOR RCC WORK         | JHANSI/ BHARATKROUP   |
| 10                                   | “HARDCRETE” HARDENER COMPOUND                    | SNOCEM/ PD LIGHT/M-SEAL OR EQUIVALENT                                       |
| 11                                   | PLASTIC EMULSION PAINT                           | ASIAN, BERGER, DULUX, NEROLAC, BROLAC (J&N) BRITISH, SHALIMAR OR EQUIVALENT |
| 12                                   | ACRYLIC SMOOTH EXTERIOR PAINT “TRUNP/APEX PAINT” | ASIAN, BERGER, DULUX, NEROLAC OR EQUIVALENT                                 |
| 13                                   | COMPOSITE PANEL                                  | EUROBOND, INDOBOND OR EQUIVALENT  |
| 14                                   | GLAZING / STRUCTURAL GLAZING                     | SAINT-GOBAIN, MODIFLOAT OR EQUIVALENT                                       |
| 15                                   | SUPER SYNTHETIC ENAMEL PAINT                     | LUXOL-3, ASIAN OR EQUIVALENT  |
| 16                                   | ALUMINUM SECTIONS FOR DOORS AND WINDOWS          | HINDALACO , JINDAL OR EQUIVALENT  |
| <b>SANITARY &amp; WATER SUPPLY :</b> |  |   |
| 17                                   | WHITE VITREOUS CHINA CLAY SQUATTING PAN          | PARRYWARE/HINDUSTAN/CERA/ NEYCER PARRY & JOHNSON PEDDERS.                   |
| 18                                   | - DO - URINAL                                    | PARRYWARE/HINDUSTAN/CERA/ NEYCER PARRY & JOHNSON PEDDERS.                   |
| 19                                   | - DO - SQUATTING PLATE                           | PARRYWARE/HINDUSTAN/CERA/ NEYCER PARRY & JOHNSON PEDDERS.                   |
| 20                                   | - DO - WASH BASIN                                | PARRYWARE/HINDUSTAN/CERA/ NEYCER PARRY & JOHNSON PEDDERS.                   |

| <b>S.NO.</b> | <b>MATERIAL NAME</b>   | <b>MAKE</b>  |
|--------------|--|--|
| 21           | MIRROR   | ATUL OR KIRAN OR EQUIVALENT  |
| 22           | PPR & PVC PIPES  | SUPREME, PRINCE ,RELIANCE ,PREMIER,POLYPACK OR EQUIVALENT            |
| 23           | G. I PIPES, 12.5MM, 25MM,32MM, 40MM  | 'B' CLASS TATA, JINDAL (HISSAR), Q.S.T. 'B' CLASS OR EQUIVALENT      |
| 24           | CI NAHANI TRAP   | NICCO OR EQUIVALENT  |
| 25           | FINISH PAINT & PRIMER  | BERGER, ASIAN  |
| 26           | TILES  | KAJARIA, JHONSON, RAK,SOMANY OR EQUIVALANT                           |
| 25.          | CP BRASS FITTING E.G., BIB-COCK. STOP COCK,. ANGLE COCK, TOWEL RAIL, SHOWER ETC. | L & K, JAGUAR/ ARK /MARK, PARCO, TECHNO, GEM, KINGSTON OR EQUIVALENT |
| 26           | 2500/2000/1000 LTRS/ 500 LTRS CAPACITY OVER HEAD TANKS.                          | SYNTEX, TOPCON, ELECTROPLAST, STAR, LOTUS OR EQUIVALENT              |



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**SECTION V**

**TECHNICAL SPECIFICATION**

**PART-B: SPECIFIC TECHNICAL REQUIREMENTS FOR  
ELECTRIFICATION WORKS**

**BHARAT HEAVY ELECTRICALS LIMITED  
(A GOVERNMENT OF INDIA UNDERTAKING)  
CENTRALISED STAMPING UNIT  
Industrial Area  
Jagdishpur (UP) 227817**

## **SECTION V** **SPECIFIC TECHNICAL REQUIREMENTS**

### **1.0 GENERAL**

This section covers specific technical requirements of contract and should be read in conjunction with BOQ and other sections of the contract. In case of any conflict between the contents of BOQ and technical Specifications, BOQ will prevail over technical specification.

**The following sections of technical specification may be read for such clauses which are relevant to this tender.**

### **2.0 FREE ISSUE MATERIALS**

Nothing shall be supplied as free issue material by BHEL.

### **3.0 DISMANTLING OF EXISTING STRUCTURES**

The contractor will have to carryout dismantling of buried/ semi buried structures, if any, encountered within the battery limit and disposal of it within plant boundary as directed by BHEL at no extra cost to BHEL.

### **4.0 STATUTORY REQUIREMENTS**

Bidder shall comply with all the applicable statutory rules pertaining to Factories Act, Fire Safety Rules of Tariff Advisory Committee, Water Act for pollution control, Explosives Act, etc. Provisions of safety, health and welfare according to Factories Act shall be complied with. Statutory clearances and norms of State Pollution Control Board shall be followed. Bidder shall obtain approval of electrical drawings from concerned authorities before taking up the work.

### **5.0 WORKMANSHIP**

Workmanship shall be of the best possible quality and all work shall be carried out by skilled workmen except for those which normally require unskilled persons. Welding shall be done by experienced and certified welders in proper sequence using necessary jigs and fixtures. Fabrications shall be done in shops having proper equipment for accurate edge planning and milling of column shall ends, base late surfaces etc. and shaping and dimensioning of anchor bolt assembly, inserts and other misc. items. In addition to the requirement specified above, if the bye-laws of the local Govt., Municipal or other authorities require the employment of licensed or registered workmen for various traders, the contractor shall arrange to have the work done by such registered or licensed personnel. In case of manufactured materials, the Contractor shall have, with no additional cost to the owner, the services of the supervisors of the manufacturers to achieve that the work is being done according to the manufacturer's specifications.

### **6.0 TEMPORARY WORK**

All scaffoldings, staging, temporary bracing and other necessary temporary work required for proper execution of the Contract shall be provided by the Contractor at his own cost and inclusive of all materials, labour, supervision and other facilities.

The layout and details of such Temporary work shall have the prior approval of the Engineer as agreed, but the Contractor shall be responsible for proper strength and safety of the same. All Temporary work shall be so constructed as not to interfere with any permanent work or with the work by other agencies. If it is necessary to remove any of the temporary work at any time to facilitate execution of the work or with the work of other agencies, such removal and re-erection, if required, shall be carried out by the Contractor at the discretion of the Engineer without any delay and any extra cost on this account shall be borne by the Contractor.

#### **7.0 INTERFACE WITH STRUCTURES UNDER OTHER'S SCOPE**

a) In cases of interface e.g. structures under other's scope of supply being supported on structures under scope of this contractor, the same will be discussed and suitably addressed.

b) Modification in layout of foundation/structure during detail engineering stage may be necessary to avoid fouling with those under other's scope. Necessary changes on this account will be made without any extra cost to Owner.

c) Necessary engineering is to be done and provisions are to be kept accordingly by the Contractor to construct foundations/underground structures, etc. without disturbing/ endangering the constructions done under the scope of other contracts.

#### **8.0 INSPECTION, TESTING AND QUALITY CONTROL FOR ELECTRICAL WORKS**

Sampling and testing for major items of electrical works shall be carried out in accordance with the requirements of this specification and field quality plan (FQP). The bidder shall submit for BHEL's approval a detailed field quality assurance programme for electrical works before starting of the construction work. This shall include frequency of sampling and testing nature/type of test, method of test, setting of a testing laboratory, arrangement of testing apparatus/equipment, deployment of qualified/experienced manpower, preparation of format for record, Field Quality Plan, etc. Tests shall be done in the field and/or at a laboratory approved by the Engineer and the Bidder shall submit to the Engineer, the test results in triplicate. In addition, the bidder shall furnish the original test certificate from the manufacturer's of various materials to be used in the construction.

If any work found to be of inferior quality or sub-standard, the same shall be dismantled and shall be redone as per approved quality or relevant standard. BHEL reserve the rights to reject the work of inferior quality. All expenses on account of dismantling and rework shall be born by contractor.

**The contractor's finally accepted rates shall include cost of such field tests with standard equipments and IMTEs**

#### **9.0 CONSTRUCTION / ERECTION METHODOLOGY**

- All fabrication and erection activities of structural steel shall be carried out using automatic submerged arc welding machines, cutting machine, gantry cranes, crawler / wheel mounted heavy cranes and other equipments like heavy plate bending machines, shearing machines, lathe, milling machines etc. Use of derricks shall not be permitted.
- All handling of materials shall be with cranes. Heavy tailors shall be used for transportation.
- Mechanized modular units of scaffolding and shuttering shall be used.

- Grouting shall be carried out using hydraulically controlled grouting equipment.
- All finishing items shall be installed using appropriate modern mechanical tools.
- Manual punching etc. shall not be permitted.
- Heavy duty hoist for lifting of construction materials shall be deployed.
- Compressors for cleaning of foundations and other surfaces shall be used.
- All persons working at site shall be provided with necessary safety equipment and all safety aspects shall be duly considered for each construction/erection activity. Moreover, only the persons who are trained in the respective trade shall be employed for executing that particular work.
- Fabrication and Erection of all fabricated columns shall be done in single piece unless otherwise provided for in the approved drawings. Main columns of the power house building can have maximum of one number of the erection splice. All shop and site splice shall suitably staggered. The erection splice shall be provided with full strength splice cover plate over the butt weld. Contractor shall submit the erection scheme for the erection of all type of structures and carryout the erection work only after approval of the scheme by the owner.

#### **11.0 FIELD LABORATORY FACILITIES AT SITE FOR MATERIAL TESTING:**

Contractor shall provide field testing facilities at site laboratory built by the contractor

#### **12.0 MAKE OF BOUGHT OUT MATERIAL:**

Contractor shall supply bought out items as per the list attached at **annexure-A-1** of this section.

#### **13.0 SPECIFIC TECHNICAL REQUIREMENT FOR ELECTRICAL WORKS FOR BUILDINGS :**

- All electrical fittings shall be concealed in walls ,floors and roofs.
- Telephone, cable wires shall be provided in each room.
- Fittings shall be of superior make.

#### **14.0 OTHER TECHNICAL REQUIREMENT FOR ELECTRICAL WORKS**

Contractor shall ensure **deployment of Qualified & Experienced Safety Engineer / Officer** at site. **It may be noted that non-compliance to this will result in penal action as may be decided by the competent authority of BHEL.**

Some of the common safety rules to be followed during working are as follows

- No outsider is allowed to enter construction area without permission.
- No body is allowed to enter at construction site without Safety Shoe.
- Never enter work area without Safety helmet & chin strap in place.
- No climbing/working allowed without proper safety belt above 2 m. height.
- Do not exceed the speed limit 25 Km/h within premises.
- No debris obstacles allowed on the roads & passages.
- All accidents/incidents to be reported to site Incharge.
- Do not walk on pipelines or false ceiling.
- Maintain good Housekeeping at work site.
- No photography/ Videography allowed without permission

- Risk factor in construction is approximately 3 times the manufacturing sector.
  - 85% of the workforce is drawn from rural background. They lack technical perspective & relevant industrial common sense. Safety awareness to be developed among these workers employed by Sub-contractors.
  - Infrastructure to be developed for carrying out jobs properly in a safe manner.
  - All Site supervisors & engineers (including subcontractor's) must be imparted structured training on construction safety before start of the job & record to be maintained.
  - Availability of qualified & trained Site Engineer at site during all working hours.
  - Site Safety training to be imparted to all workers & plan to be made to cover every worker.
  - Tools box talk (5-15 minutes) by supervisor prior to commencement of any job.
  - All accident / incidents(Near Miss) to be reported & investigated.(formats & procedure should be finalized)
  - Daily Safety Checking by Each Site Engineer along with Safety engineer.
  - Weekly co-ordination meeting of all Safety engineers with BHEL safety officer.
  - Monthly safety meeting with Site In-charges.
  - Reports: Weekly/monthly/annual SHE report format should be finalized.
  - All Safety equipment must be ISI marked & checked by Safety officer before use.
  - Tag system for erection & use of scaffoldings.
- 
- Bamboo/wooden Scaffolding material not allowed.
  - LPG cylinders not allowed for gas cutting.
  - Good House keeping. Separate waste bins to be used for flammable & non flammable material.
  - Safety awareness programs for workers by display of boards, posters, competitions, talks etc.
  - Deployment of Safety Supervisors for every 250 workers and part there of at work site.
  - Display of List of First Aid trained persons.
  - Testing certificates for lifting tools & tackle.
  - Provision & maintenance of fire extinguishers at construction site & material stores.
  - Display of emergency telephone numbers at various locations.
  - For work in confined space use 24 V lamp fitting & use tools with air motors or electric tools with max. 24 V.
  - For confined space entry Gas test must be done before & at regular intervals.
  - Checking & tag of equipment like grinding machine, welding machine, gas cutting set etc. by supervisors before use.

**Further, the contractor is required to provide proper Safety Net System wherever the hazard of fall from height is present as per instructions of BHEL Engineer at site. The safety net shall be fire resistant, duly tested and shall be of ISI mark and the nets shall be located as per site requirement to arrest or to reduce the consequences of a possible fall of persons working at different heights**

## 15. ERECTION

15.1 All works such as cleaning, checking, levelling, aligning, assembling, temporary erection for alignment, dismantling of certain equipment for checking, cleaning, surface preparation, fabrication at site, cutting, grinding, straightening, blue matching, chamfering, filing, chipping, drilling, machining, surface grinding,

shaping, fitting up etc. as may be applicable in such erection works are to be treated as incidental to erection and necessary to complete the work satisfactorily and shall be carried out by the contractor as part of the work.

- 15.2 Any fixtures, scaffolding materials, concrete block supports, steel structures required for temporary supporting, for pre-assembly or checking, welding, lifting and handling during pre-assembly and erection shall be arranged by contractor at his cost.
- 15.3 The following provisions cover the technical requirements for some of equipment installation. The brief idea about the work involved is indicated below however the work is to be carried out in accordance with the recommendations of the equipment manufacturer drawings, documents furnished to the contractor by BHEL or as directed by BHEL Engineer.

**16.0 LT OIL FILLED SERVICE TRANSFORMERS :**

Scope of work includes checking and preparation of foundation surface, erection of accessories and auxiliaries, carrying out minor modification wherever required; Preparation of oil and oil filling under vacuum, dry out of transformer, testing of transformer, oil and other auxiliaries, laying of cable trays upto marshalling box, cabling upto marshalling box and termination for auxiliaries, earthing of accessories to earth conductor / riser, testing of all auxiliaries, pre-commissioning and back charging of transformers.

Painting of Transformer(***Including supply of paint***), as approved by BHEL Engineer

**17.0 PANELS – POWER , CONTROL & RELAY ( LTMCCs , GRP / GCPs ,Unit Aux Control Board and Station Aux Control Board etc.)**

Erection at site / control room including chipping of floor, fabrication and fixing of base channel frame, levelling & alignment with spirit level, welding the base channel to the embedded plates / channels, grouting , fixing of anti-vibration pads, termination of inter panel connections, mounting / connections of loose instruments, inter panel bus bar connections, commissioning including loop checking, system checking, and putting necessary controls on automatics. ***Tenderer may note that fabrication / fixing / painting of base channel(Including supply of paint),/ suitable steel stool, if required, is included under the scope of this work. Contractor will be paid for fabrication / erection as per applicable rates for structural steel fabrication / erection..*** Checking of internal wiring, rectification, testing and calibration of equipment mounted inside is in the scope of contractor. The contractor may have to change / replace items found faulty without any extra cost, however materials for this shall be provided by BHEL. Mostly panels will be delivered fully wired. However wherever required termination of loose wires , bus wires is to be done. Canopy for panels will be supplied loose & shall be installed by the contractor after erection of panels. The cleaning of panels have to be done with electrical vacuum cleaner, besides conventional cleaning with brush etc. The drilling of holes in the gland plates for cable entry shall be part of panel erection. All blank holes / gaps in the gland plates / boxes etc. shall be properly sealed. The base frames shall be painted suitably. The contractor shall carry out the plugging and sealing of left out holes in the gland plates and other openings at the bottom of panels at his own cost by using fire retardant mortar or good quality sealing material as advised by BHEL . **Any minor alterations required in the bus bar arrangement, wiring in**

the panels/ cubicles shall also form part of the work. During testing, commissioning, some equipment / modules may need replacement / repairs. All such replacements / repairs and assistance during commissioning and running of the unit till handing over to the Customer are part of the scope as some of the test / commissioning will have to be done after the machine is running on various loads.

Touch-Up Painting with paint(*Including supply of paint*), as approved by BHEL Engineer .

#### 18.0 CABLE RACK AND TRAY

Cable trays shall be supplied either ladder, prefabricated, slotted or duct type. **Cost of cable tray erection as per BOQ Cum Rate Schedule shall include fabrication of supports to suit site requirement, fixing of support in position by welding as per Engineers instruction , erection and fixing of cable trays and racks by welding or by bolts and nuts. No separate payment will be released for fabrication / fixing / painting of support structure for cable trays(*Including supply of paint*),. shall be released after completion of cable tray erection / reconciliation of total material used in fabrication / erection of cable tray supports.** Jointing of trays can be carried out by bolting / welding as per direction of Engineer. Contractor shall carryout cutting of tray only by Hacksaw for obtaining proper routing from standard lengths supplied. Materials for support fabrication like flats, channels, angles etc. shall be supplied by contractor free of cost. The cutting & welding points on trays will be painted by primer & Al paint by the contractor including supply of paint within the erection price and no extra cost to BHEL. These cable trays may also be required for laying copper tubing, plica type / GI flexible conduits, local cabling and metal temp. thermocouples.

Beside above angels / channels of various sizes may have to be fabricated / erected, for use as cable trays, from structural steel to be supplied by contractor free of cost.

In many cases, trays are supplied with tray covers. These covers have to be erected after completion of bottom cable tray and lying of cables etc. The covers are to be properly secured on the bottom trays and no separate payment will be made for putting these covers. If required, GI / Al strip clamps are to be used.

#### 19.0 CABLE LAYING

**Laying, dressing & clamping ( by Nylon / PVC ties or Aluminium strips or any other method specified by BHEL Engineer ) of the cables in the cable trays / angles. The final dressing of cables on cable trays not erected by contractor shall also be done with Nylon Cord / Aluminium strip.** Cost of cable laying as per BOQ Cum Rate Schedule shall include the cost of Nylon / PVC ties & Aluminium strip required for dressing / clamping.

**The cable run number shall be provided by punching Aluminium Tag plates and tying suitably with nylon ties (at both ends and at regular intervals as advised by BHEL Engineer ) which shall be arranged by contractor at his cost.** Nylon / PVC ties & Aluminium strip required for cable tags shall have to be provided by the Contractor.

**While laying cables, existing cable tray covers and false flooring may require to be removed and re-fixed. The same has to be done at no extra cost to BHEL**

## **20.0 CABLE TERMINATION**

- a) **Termination Of HT Cables Only Shall Be Measured And Paid Separately As Per Quoted / Accepted Rate Of Respective Item Of BOQ CUM Rate Schedule.**
- b) **For Cables Other Than HT Cables , The Cost Of Cable Laying As Per BOQ Cum Rate Schedule Shall Also Include The Cost Of Termination With Suitable Crimping Type Lugs Including Supply Of Ferrules ( for cross / direct ferruling as per BHEL instructions). Drilling of holes in gland plates of HT / LT switchgear, transformer, control panels, JBs etc as per requirement shall also be part of cabling at no extra cost to BHEL.**
- c) The contractor shall carryout insulation testing, simulation testing etc. as per the instructions of Engineer at site.
- d) Screen of signal cables shall run in insulated sleeve (to be arranged by contractor at no extra cost) and shall be terminated as per the instructions of the BHEL Engineer.

## **21. JUNCTION BOX, PUSH BUTTONS ETC**

Includes supply ,fabrication / fixing / painting of stands for junction boxes / push buttons / frame mounted panels etc will be included in quoted / accepted price of respective item. **Tenderer may note that fabrication / fixing / painting of stands for junction boxes / local push buttons / indication boxes etc. will be included in quoted / accepted price of respective item. No separate payment will be released for fabrication / erection of these stands.**

## **22 RIGID PIPE/CONDUITS**

Cutting / threading of standard lengths of conduits, laying on fabricated supports or on floor, using screwed fittings, clamping, sealing of open ends. Approved Good quality sealant shall be used to make the joint water proof.

## **23 PLICA FLEXIBLE CONDUIT**

Laying of conduits in cable trays, end connection with instrument / J.B. / panel, using suitable connectors / unions etc. . Suitable thread / Plica sealant shall be used to make the conduit system water proof. Aluminum painting, clamping and tagging in tray / angle forms part of erection job

## **24 EARTHING**

Earthing work mainly involves laying and tack welding of conductors on columns / beams at every one meter interval and bolted connections with equipment at least at two points. Low hydrogen content electrodes shall be used for welding. All the galvanized items shall be given surface treatment (by thoroughly cleaning with sand paper and / or cotton cloth to make the surface clean, smooth & free from any type of spots) at the welded joints & the places where galvanizing has been damaged. Welded joints shall be applied with two coats of cold zinc paint whereas portions with damaged galvanizing shall be applied with single coat.

- Any cutting of masonry work, which is necessary shall be done by the contractor at his own cost and shall be made good to match the original work. The Contractor shall obtain prior approval before cutting any masonry / concrete work.
- Conduits shall be thoroughly cleaned before pulling in the cable.
- Pipes sent in standard length shall be cut to suit the site conditions and the layouts. Tubes or pipes wherever deemed to be convenient will be sent in running lengths with sufficient bends. Bends upto 80 mm Nb will have to be fabricated at site.
- In case of Transformers if any leakage / sweating is observed from field assembled / shop assembled gasket joints, valves, welded joints the same shall be attended by the contractor including draining of oil, refilling of oil & centrifuging if required at no extra cost to BHEL till handing over period. Sealing compound and any other consumable, if needed, shall be arranged by the contractor with in the quoted rates.
- Calibration log-sheets / history cards of all the instruments, panels, drives, relay testing etc. under the scope shall be recorded and submitted on BHEL approved formats. Proper logging will form a part of calibration / erection activity for the purpose of monthly running bills payments.
- The contractor shall use only SHEARING machine or HACKSAW for cutting angles, flats, channels and trays. No gas cutting is permitted. Drill machine shall be used for drilling holes.
- The contractor should note that after execution of work they will hand over marked up drawings "as erected" drawings to BHEL Engineer at site for preparation of firm "as built" drawings. "As erected" drawings will bear the signature of BHEL Engineer and contractor.
- The contractor shall paint the name / put tag numbers on all the equipment / instruments / cables etc. erected by him. Materials for tagging shall be supplied by the contractor. Contractor at his cost shall also arrange the adhesive etc.
- Contractor shall fabricate and erect stands / supports for Junction boxes, push button stations, fixing of push button and plugging of holes in JB's. This is considered inclusive in the item erection.
- DRIP SHIELDS shall be fabricated for all field mounted panels / instruments / instrument racks / JB Racks / control cabinets etc. The fabrication forms part of erection work.
- The motors and motorized valves actuators and solenoid valves will be erected and commissioned by other agency. However, if required electrical commissioning, of motorized valves may have to be carried out, wherever required, against this contract, payment of which shall be made as per applicable item of the Rate schedule.

## **16.0 TESTING, PRE-COMMISSIONING, COMMISSIONING AND POST-COMMISSIONING.**

- 16.1 Site testing shall be required for all equipment installed by the contractor to ensure proper installation, setting, connection and functioning in accordance with drawings, specifications and manufacturer's recommendations.
- 16.2 Commissioning protocols are to be prepared as advised by BHEL Engineer for getting approved by customer/ Consultant.
- 16.3 Testing, and pre-commissioning checks shall be as per relevant codes / practices and BHEL drawings / specifications/ approved commissioning Protocols and same shall include, but not be limited to the following :

**( I.) TRANSFORMERS**

- (a) Insulation resistance and earth resistance checks.
- (b) Oil testing like BDV of oil of each drum before pouring, after processing and in the course of dry out, moisture content tests as and when required. Provision should be made for preparation of oil in a separate tank before filling in the main transformer tank.
- (c) Checking of Buchholz Relay, oil level indicator PRV, calibration of OTI, WTI etc.
- (d) Winding resistance, vector group, turns ratio test on different taps, magnetising current, core balance check etc.
- (d) After installation the contractor will get oil samples tested at an accredited test lab as per relevant IS as advised by BHEL Engineer and submit the test results, in case the test results are found unsatisfactory the tests will be got repeated by the contractor after reprocessing of oil & submitted to BHEL for approval/acceptance.
- (e) Turns ratio, polarity, insulation resistance and winding resistance checks on all CT's.

**(II.) CONTROL & PROTECTION PANELS**

- (a) Checking of complete wiring and insulation resistance.
- (b) IR test and loop checking of all field wiring in the panel.
- (c) Checking of all protection, metering and indicating schemes.
- (d) Calibration of all indicating and measuring instruments, relays, timers.
- (e) Checking of all auxiliary schemes e.g. space heating, illumination.
- (f) Checking of operation of all relays, switches and other indicators.
- (g) Commissioning of total scheme including relevant internal equipment.
- (h) Carrying out suitable modifications as per system requirement.
- (i) Carrying out primary injection, secondary injection, stability checks etc.

- 16.4 In case any defect is noticed during tests, trial runs and commissioning such as loose components, undue noise or vibration, strain on connected equipment etc. the contractor shall immediately attend to these defects and take necessary corrective measures. If any readjustment and realignment are necessary, the same shall be done as per Engineer's instructions including repair, rectification and replacement work by the contractor at his cost. The parts to be replaced shall be provided by BHEL.
- 16.5 During this period, though the BHEL's staff / Consultant appointed by BHEL will also be associated in the work, the contractor's responsibility will be to arrange for the complete requirement of supervision, labour, consumable, T&P and IMTEs required till such time the commissioned units are taken over by the BHEL's customer.
- 16.6 During commissioning activities and for carrying out various tests, special instruments etc, have to be temporarily erected and commissioned to suit the commissioning activities. Contractor will provide the necessary equipment. Contractor has to carry out the erection, calibration, dismantling of the same. After completion of activities the temporary systems have to be removed and to be taken back at no extra cost to BHEL.
- 16.7 During erection of various equipment, prior to commissioning and after commissioning, protocols have to be made with BHEL's customer. The proforma

and formats as approved have to be printed by the contractor in adequate numbers. The pre-commissioning activities will start with various trials, commissioning operations shall continue till units are handed over to customer. Simultaneous commissioning activities will be progress in various areas, checking of equipment erected, making ready for trial runs, all these works need specialised gangs including electricians / instrument technicians in each area to render assistance to BHEL commissioning staff. Contractor shall earmark separate manpower for various commissioning activities. The manpower shall not be disturbed or diverted.

- 16.8 It shall be the responsibility of the contractor to provide workmen of various categories in sufficient numbers along with Engineers/ Supervisors including necessary consumables, T&P etc. during pre-commissioning, commissioning and post commissioning period for commissioning of equipment and attending any problem in equipment erected by the contractor till handing over. The rates quoted shall include all these contingencies also.
- 16.9 It shall be specifically noted that the above employees of the contractor may have to work round the clock alongwith BHEL commissioning Engineer and hence overtime payment by the contractor to his employees may be involved. The contractor's accepted rates shall be inclusive of all these factors also.
- 16.10 In case, any rework is required because of contractor's faulty erection which is noticed during commissioning , the same has to be rectified by the contractor at his cost. If any equipment / part is required to be inspected during commissioning, the contractor will dismantle / open up the equipment / part and reassemble/redo the work without any extra claim.
- 16.11 During commissioning, opening and closing of valves, attending to leakage, changing of gaskets, modifications in wiring, realigning of equipment, re-calibration of instrument, attending to leakage, minor adjustments of erected equipment may arise. The accepted rates shall include all such works.

## 17.00 FINISH PAINTING

- 17.1 All equipment within the scope of these specifications shall be received duly painted. The type of painting to be carried out is specified. For panels , during storage and handling the same may get peeled off / damaged / deteriorate. All such surfaces are to be thoroughly cleaned and to be touch up painted with suitable approved primer / finish paint matching with shop paint / approved final colour. **Besides above two coats of approved primer paint and at least two coats of approved finish paint to get the desired dry film thickness, is to be applied on various loose equipment and all steel structures fabricated and erected at site.** All paints, tools and other consumables including scaffolding materials required for painting shall be arranged and provided by contractor within the quoted rates. Paint and other materials so purchased shall be ISI marked and painting should be as per colour scheme and quality approved / specified by Engineer. Valid Test certificate for the paint so supplied shall be made available before use of the same on work. The contractor shall provide legend on equipment in size specified by Engineer. Letter writing shall be done in Hindi / English or in both language. The printer have to under go test and only qualified painters will be allowed to work.
- 17.2 Certain equipment shall require spray painting (touch up). The contractor shall make arrangements of the required equipment for spray painting of such equipment **Including supply of paint**, at his own cost. Spray painting at the job site shall be permitted only at times and locations approved by the owner / Engineer.