21.0 Electrical & C&I works

Erection and Commissioning of all electrical and C&I Supplied items of ESP in the scope of supply of BHEL Units for this project like control room inserts, cables, earthing, cable trays, junction box, heating elements, interlocks, auxiliary control panel, rapper control panel, statcon panel, LT switch board, ESP switch gear, Bapcon and Accessories, opacity monitor and accessories, ash level indicators etc, is in the scope of work.

21.0.1
ESP shall have Six flue gas passes and each pass comprises of HT rectifier transformer (silicon oil filled), auxiliary control panels, electronic controller, LT main switch board and its bus duct, drives for rapping / collecting / gas damper screen, heating element for hopers / shaft and supporting insulator housing, ash level indicator and EP management (IOS) system (software based) including computer interface and associated interlock and protection.

21.0.2
HT rectifier transformer shall be erected by mechanical agencies. Scope of work covered under this contract is oil filtration of transformers (if BDV value is less than prescribed in O&M manual / FQP / commissioning check list / applicable standard) and erection and testing of various devices. Contractor shall provide silicon oil filter machine as a part of scope. Contractor has also to provide operator round-the-clock for oil filtration and other necessary testing equipments. Contractor shall utilize power supply for filter machine from the source, which is given for the construction purpose, and shall arrange required cables.

21.0.3
Panel type heaters are supplied alongwith supply cable (3 to 5 meters approxmetely) as a part of equipment. Termination of cable at JB end, after laying it through flexible GI conduit is part of job. No separate rate shall be applicable.

21.0.4
Heaters are to be tested for its resistance, IR value and current drawn measurement before mounting individually as a part of job and inclusive in the rate quoted.

21.0.5
Looping at JB, ferrulling lugs etc.is part of jobs and inclusive of rate quoted.

21.1 Installation of Cable trays/cable ducts

21.1.1
Various types of sheet metal, galvanized cable tray, i.e. Perforated, ladder type, seal metal duct, solid bottom tray, shall be provided in standard lengths along with accessories like hardware, bends, reducers, coupler plate, tray covers and tray clamps etc.

21.1.2
Installation of cable tray/cable duct shall include cutting, laying, jointing, supporting, drilling holes in the support, providing tees/reducers/bends/clamps as per tray route layout, fabrication of bends/tees/reducers from straight length, fixing of tray covers, welding of tray on support, cleaning and application of cold galvanizing paint on weld joints (supply of paint is in the scope of

contractor). Installation of tray/duct covers, wherever provided, will be done as a part of tray erection and no extra rates will be payable.

21.1.3
In case structural cable trays, bends, tees, reducers etc are required to be fabricated from structural steel and installed, unit rate applicable for ESP shall be applicable in such instance.

21.1.4
Cable trays/ducts have to be routed underground in cable trench, over head on structure, valves, floors etc. for various applications such as cable laying, copper tubes, conduits, thermocouple, temperature gauge capillary etc.

21.1.5
Installation of Copper tubes/SS tubes/copper pipes shall include cutting into required length, laying, bending, cleaning, brazing wherever required, fixing of brass fittings like compression fittings/tees/end connectors/straight connectors/bulk heads/valves etc., supporting clamping including supply of clamps and hardware, flushing and conducting leak test.

21.2 Cable laying (power / control / instrumentation shielded / unshielded cables / plug-in cables / coaxial / UTP / STP / data highway, armoured / un-armoured, single / multi-core, PVC/HR PVC/FRLS/TEFLON/XLP insulation, optical fibre)

21.2.1
Cable laying includes cutting to the required length, laying in overhead/underground cable trench/through pipes/flexible conduits, dressing/clamping in tray, drilling of holes in gland plates in panels and junction box, glanding, splicing, dressing of spliced wire inside the panel and JBs, providing PVC numerical/alphabetical / printed ferrules, termination by using crimp type copper tinned/aluminium lugs, insulated/un-insulated, termination (crimp, soldering, etc.), plug-in connections with insert type crimping, providing identification PVC/aluminium cable tags (at both the ends and at 15 m intervals throughout the route length and also at each bend), continuity checking, insulation resistance checking, high voltage test on HT cables. Contractor to arrange adequate no. of his own ferrule printing m/c.
Laying, etc of Optical fibre cables on cable trays /cable trench shall necessarily be done using flexible conduit

21.2.2
Entry to the panels and JBs may be at top, sides or bottom. All cables are required to be properly supported and clamped near to the JB/panel.

21.2.3
Wherever cable glanding is not possible, either due to the gland plate size limitations or more number of cable entries, prefab plug-in cables, etc., for such cases cables may have to be lifted inside the panel by either making cut-out in gland plate and providing rubber profile for sharp edge protection or alternatively, providing 4” or 6” PVC pipe coupling gland and these pipe coupling gland shall be supplied by contractor within the quoted rate ~~.of cable laying.~~

21.2.4

Copper tinned lugs of various types (pin, ring, fork, snap-on) upto 4 sq.mm confirming to IS 694, PVC cable ties, PVC ferrules, PVC button and tapes, cable identification tag of PVC/metallic, clamping and dressing material such as cable ties/clamps ,trefoil clamps (For single core LT power cable) with hardware, PVC sleeves etc. shall be supplied by the contractor within the quoted rates ~~for cable laying~~. The quality of material shall be got approved from BHEL engineer prior to their use on job.

21.2.5
All care should be taken to avoid abrasion, tension, twisting, kinking, stretching of cables during installation.

21.2.6
Cable shielding – all signal cables are supplied with bare shielded copper wire/with braided wire shield. Generally shield wire is kept isolated at instrument/field device end and continuity is maintained through JBs and grounded at panel end only. While terminating the shield wire either in panel or JBs, PVC sleeves are to be used to avoid two-point earthing.

21.2.7
Wherever cables run through ducts, conduits, valves, etc., they shall be sealed using fire/weather proof compound. In addition to this, cable entry in panels, MCCs, instruments, electrical actuators etc., are also required to be sealed. The required material for doing so shall be included by contractor in the cabling scope.

21.2.8
Many of the cable trays and cables have to be laid in cable trenches. For this purpose, the cover of the trenches have to be opened for working in site and whenever the cables are to be laid in existing cable tray, all safety precautions have to be observed.
After completing the work, the trenches have to be cleaned and covers put back into position. Contractor shall also carry out de-watering from the trenches if required and arrange pumps etc., at his cost.

21.2.9
Looping wire at terminal block of panels and electrical actuator as shown in the inter-connection diagrams or as required is to be done by contractor at no extra cost.

21.2.10
Contractor shall carefully plan the cutting schedule of each cable drum in consultation with site engineer such that wastage are minimized.

21.2.10.1
The erection contractor shall make every effort to minimize wastage during erection work. In any case, the wastage shall not exceed the following limits;

Sl No.	Item	% Wastage on issued Qty
1.	Fabrication steel	2
2.	Each size of power cables	1
3.	Each size of control/Inst cables	2
4.	Impulse pipe/tubes/GI pipes/copper tube	1

If the actual wastage be more than the specified figure, then equivalent price of the excess portion will be deducted from the contractor's bill.

21.3 Junction Boxes :
Different type of junction boxes are to be erected by the contractor like junction boxes below 48 ways and above 48 ways. The junction boxes are to be located at the locations jointly decided at site during erection. The junction boxes are to be erected on the frames fabricated at site. Fabrications of frames are also in the scope of work.

21.4 Installation of panels

21.4.1
Electrical control panels, electronic control panels, etc., are normally supplied in suit of either one/two/three or loose shipping sections with integral base frame or loose supplied. These panels may have to be installed as stand alone or in groups consisting of number of panels in each row, depending upon the plant layout and foundation arrangement.

21.4.2
Installation of panel shall include fixing of base frame, fabrication of base frame if required, levelling, alignment, fixing of anti-vibration pads, removal of side covers, fixing of cubicle interconnection hardware, bus bar jointing, wiring interconnection, welding and grouting of panels and base frames, mounting of panel canopy wherever supplied as part of panel, drilling of gland plates and sealing of panel cable entries. In certain case where canopies are not supplied but have to be fabricated out of MS sheets provided by BHEL, payment will be done accepted unit rates of ESP. Where the base frame is not supplied as part of panel supply, the contractor shall fabricate the base frame from structural items at site. Payment for such fabrication will be effected on measured quantity at the rate applicable for ESP.

21.4.3
Panels have to be shifted to their locations through floor openings, temporary openings like floor grills, door etc. which shall be part of work and no claim whatsoever will be entertained with regard to non-availability of opening as per shortest route etc. Panel have to be erected at different locations and elevation in ESP control room etc.

21.4.4
Panel and instruments once erected in position should be properly protected using necessary care to prevent ingress of dust/moisture. This will have to be periodically cleaned and surroundings have to be kept tidy.

21.4.5

Wherever the panels to be mounted on cable trenches, channel supports have to be provided across the cable trench over which the base frame of panel shall be mounted. For such work, structural steel fabrication, installation rates shall be applicable.

21.4.6
Normally the panels shall be supplied with instruments, relays, meters, electronic modules ,push button,contector etc. mounted and pre-wired. However, if these are supplied loose / separately for safety in transit, contractor shall mount/wire such devices as part of the panel installation work and no separate rates shall be applicable for this. \

21.4.7
No separate payment shall be made for replacement of any devices like electronic modules, relays, conductors, terminal block, push buttons etc. which are found defective during pre-commissioning / post-commissioning of any equipment / item.

21.4.8
For the panels erected by other agencies, commissioning/calibration work and trouble shooting has to be carried out by the contractor as part of testing and commissioning work.

21.4.9
Minor civil works like drilling, chipping, punching holes and opening in concrete floors, slabs and brick walls, grouting, related to Rack, support installation, minor civil works required for installation of control panels, Junction boxes etc., shall be included in the erection cost of such items. Also all miscellaneous civil works like chipping away and making good as necessary in floor slab/wall for cabling / earthing etc., as required are included in the scope for which no separate payment is applicable. The scope also includes supply of grouting material, if any.

21.4.10
Supplier's instruction manuals, packing slips, door keys etc. received along with the panels should be promptly handed over to BHEL's engineer on opening of the panels.

21.4.11
Regular cleaning of the panels as per the instruction of BHEL engineer till handing over of the set to customer is to be carried out by the contractor within the quoted rate.

21.4.12
Interposing Relays (24 / 48 Volt DC) along with mounting base shall be supplied separately for mounting in the various feeders of 11KV / 6.6 KV HT switchgear boards and 415 Volt MCC Board for uni-directional / bi-directional drives, solenoid valves. 2 Nos. interposing relay are required to be mounted in each feeder. Internal wiring for these relay shall be pre-wired in the feeders, wires to be terminated on relay terminals. Approximately quantity is 1700 Nos. Contractor shall mount the same and terminate the wire as part of panel installation work and no extra payment shall be made for this work.