



ODISHA HYDRO POWER CORPORATION LIMITED

RENOVATION & MODERNISATION WITH NEW TG SET OF UNIT # 1 to 6
(6x60MW) OF BALIMELA POWER HOUSE, BALIMELA, ODISHA

**INSTALLATION AND COMMISSIONING**

The Contractor will carry out at site complete erection of equipment supplied by him (including those procured from fabricated by others based on his drawings, specification and bill of quantities) as well as start-up and commissioning including performance tests of the same.

The contractor will be completely responsible for the satisfactory erection, testing, commissioning, start-up, and performance tests of the equipment notwithstanding that he may be assisted by the Owner's authorized representative.





For complete erection and commissioning the Contractor will be responsible for providing at his cost all necessary tools, tackles and instruments as required.

The installation will be carried out only by electrical contractor, holding a valid H.T. electrical license, issued by the Government of Orissa for carrying out installation work of 220 kV voltage class under the direct supervision and person holding valid certificates of competency for the same voltage classes, issued or recognized by the State Government. The Contractor will furnish with his tender the particulars of the license held by him / the electrical contractor he proposes to engage for carrying out the installation work against this specification. The Contractor will furnish to the Owner the names and particulars of certificates of competency of the supervisors and workmen to be engaged for carrying out the installation work against this specification.

The work will be executed in a workman – like manner with the best engineering practices.

The installation will have to be approved by statutory government authorities like Central Electrical Authority, Factory Inspector, Insurance officials etc. Any modification in the equipment or installation that may be demanded by them will have to be carried out by the Contractor at no extra cost to the Owner. The responsibility of obtaining clearance from the Electrical Inspectorate of Orissa for commissioning of the complete electrical equipment / system covered under this specification will lie solely with the contractor. The contractor will carry out any modification if the same is required by the statutory authority though

04.14 **ERECTION SPECIFICATION**

04.14.01 **Guidelines for design of system and engineering the layout of electrical equipment**

General

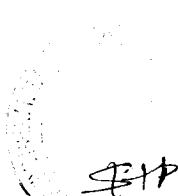
The Contractor will prepare the layout drawings taking into consideration the requirement listed below.

Electrical premises

All electrical premises will have adequate space to accommodate the electrical equipment from the point of view of operation and maintenance, and conform to IE Rules & Regulations.

The clearance between the ceiling of the electrical room and top of the tallest equipment will not be less than 1m, 2m where the equipment are to be maintained from top and additional height of lifting tackle wherever required.

Air tight door arrangement will be provided for electrical control rooms.





Cable Installation

Cables will have to be run partly along the structures and columns of the buildings, wherever it is necessary i.e. to a nearby shop cable trench /channel or surface duct will be provided. Cable channels inside turbine floor will be avoided.

Installation of cables directly buried in ground will generally conform to the requirement given in IS: 255.

If the cables are crossing the road/rail track, cables will be laid in concrete cable ducts, G.I. pipes. 25 % spare conduits/pipes/duct openings will be provided.

Cables in trenches will be laid on 8 cm of riddled sand and covered with 8 cm of riddled sand. RCC slabs will be provided for covering these trenches. The maximum trench depth will normally be 1.5 m and thickness of top cover of 75 mm. If the trench is to cross railway tracks/roads or any load bearing area the cables will be taken through suitable GI conduits/pipes/ducts.

Laying in surface ducts / on structures

Cable racks for cable trays will be fixed at a maximum interval of 1.5 m.

Cables leaving the ground/floor will be protected upto 2 m height by conduits/metallic guards.

Galvanised prefabricated ladder type cable racks and trays will be provided to lay cables in shafts/cable basements. Cables will be laid in separate racks according to the voltage/application classification. The cables will be laid from top to bottom in order of HT on top rack followed by LT cables and other cables on lower racks.

All necessary frame works and fixings for the support of cables and accessories will be supplied.

Cables will be suitably protected against heat, and mechanical damages.

Structures for cable laying

Cables will be laid on ladder type cable trays. Ladder type cable trays will be selected from sizes 200 mm, 400 mm & 600 mm and will be fabricated from 40x40x3.1 mm GI slotted angles for longitudinal members and 25x5 mm perforated flats for cross members placed at an interval of 250 mm along the length of cable tray.

Supporting vertical racks and horizontal hooks will be of 50x50x6 mm angles. Cable racks and hooks will be of welded construction.

To avoid damage during cable laying, cable structures will have no scales, abrasive or rough surfaces or cutting edges.

Transformer installation

Mineral oil filled transformer will be installed at transformer yard.



Earthing

Entire system will be earthed in accordance with the provisions of the relevant IEC recommendations/ IS code of practice IS 3043-1987 and Indian Electricity Rules, so that the values of the step and contact potentials in case of faults are kept within safe permissible limits.

Parts of all electrical equipment and machinery not intended to be alive will have two separate and distinct earth connections each to conform to the stipulation of the Indian Electricity Rules and apparatus rated 240 V and below may have single earth connections.

Earthing mat consisting of earthing electrodes and cross connecting conductor is already provided by the purchaser and Contractor has to connect equipment earthing to the grid. Existing earth pits will be renovated and rusted materials will be replaced with equivalent material and bimetal washers will be provided wherever GI strips will be connected to existing copper network.

For protective earthing separate conductor will be used for flow of earth fault current as elaborated below.

The LV side neutrals of the distribution transformers will be connected to two separate earthing electrodes. They will also be connected with the neutral bus of the corresponding switchgear and in turn switchgear neutral bus will be connected to the earthing bus of the switchgear. The protective conductor for connection from switchgear earthing bus to MCCs/DBs and further to motors will be either through fourth core of cable or armouring of cable. In case of armouring on cable, same will be double steel wire armouring. The fourth core or armour of cables and all conduits for cables will also be connected to the earthing mains. A continuous earth strip will run in each side of cable channel and in cable ducts and trenches.

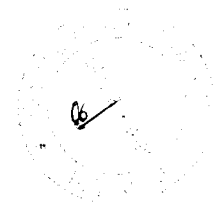
All joints in the run of the main earthing conductors will be welded or brazed type. Connection to equipment structure will be bolted type.

Conductor sizes for earth connections :

High voltage systems - 75 x 5 mm GI flat for :

- Transformers
- Earthing resistors
- Earthing leads to earth electrodes.

LT system where the voltage does not exceed 650V normally :





- 6 Sq.mm Stranded GI wire for :
- Motors and starters upto and including 2.2kW, shunt limit switches, push buttons and master controllers, Light fitting, JBs, PBs, etc.
- Instruments and miscellaneous small items protected by fuses of ratings not exceeding 15A.
- 16 Sq mm Stranded wire for :
 - Motors and starters above 3.7 kW and upto and including 15 kW.

25 x 3 mm GI flat for:

- Motors and starters above 15 kW, and upto and including 45 kW
- Control desks, cabinets, LCB, socket outlet isolators, SLDBs/DBs.

50 x 6 mm GI flat for :

- Motors and starters over 45 kW
- Switchboards, MCC, PDB, PCC MLDB.

50 x 6 mm GI flat (minimum) for :

- Main earthing ring in plant buildings
- LT transformer neutral
- LT Switchboards and other equipment protected by circuit breakers.

Sheet metal enclosed panels control desks and boxes

The base frames of all panels, desks, posts etc., will be welded to structures or to the civil inserts provided on the floor/walls. Fabrication of supports/frames, wherever required, will be done by the Contractor.

The shipping section will be placed in position before removing the protective covering to eliminate scratch/damage. The shipping section will be moved by using rollers under the shipping skids wherever lifting cranes are not available. The contractor will do the assembly at site as per manufacturer's general arrangement drawings and installation instruction. While assembling a complete board comprising several unit type cubicles, the board as a whole will be aligned. The panels will be properly levelled prior to grouting the holding down bolts or welding the panels to the inserts. All interconnection of busbars and wiring between the panels will be done as per manufacturer's instructions and drawings. Welding work on the panels will only be carried out after consultation with the purchaser. Damage to the paint due to welding will be rectified by the contractor.

Transformers





The transformer and its accessories and mountings like radiators, conservator, thermometers, silicagel breathers, Marshaling box, rollers etc., delivered at site in separate packages, will be assembled at site after cleaning by the contractor in proper sequence as per manufacturer's drawings.

Jacks will never be placed under valves or cooling tubes.

Suitable stopper will be provided both in front as well as rear of transformer to keep the transformer stationary in its position.

The oil conservator and the pipes will be erected as shown in the manufacturer's drawings. All radiator tubes will be cleaned before installation.

Before the transformer is filled/topped with oil, oil samples will be checked by the Contractor from each container. The oil will possess the dielectric strength as per relevant IS. Oil will be filled upto the mark shown.

The contractor will also test the oil from each transformer to determine its suitability for use. If required, the contractor will carry out drying and filtering operations as per IS code of practice to ensure that moisture is completely removed and the oil is free from impurities. This may be carried out by using oil filtering equipment to be provided by the Contractor having vacuum as well as heating arrangement. Only after the dielectric strength of oil and other parameters are checked and approved, the external connections will be made to the transformers.

The dial thermometers will be screwed to the thermometer pockets after removal of the blind plugs.

All necessary cabling will be connected before charging of the transformer. This will include signalling cables upto Marshaling box and from Marshaling box to meters, if not already done.

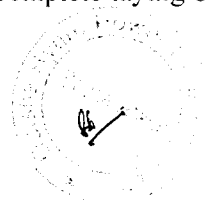
Any modifications to HT and LT terminal box to accommodate the number of cables or bus duct to be terminated will be carried out by the contractor. Naked light and flame will never be used near the transformer. Instructions given by the manufacturer's erection & commissioning manual will also be followed.

Busbar

Busbar installation will be commenced from the middle section and the buses will be fastened without tightening the bolts. The buses will lie freely on the insulators without warping and if necessary, suitable packing will be provided at the insulators.

Final tightening of the bolts will be done after the complete laying of buses. Approved means will be used for tightening of the bolts.

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Bimetallic strips/washers will be used wherever aluminium busbars or aluminium cables are terminated on copper busbars.

Limit switches

The places of installation will be seen from the engineering drawings and the switch will be secured by means of adjustable bars. Any modifications required in positioning of limit switches as per site conditions will be done by the Contractor.

Miscellaneous equipment

Cables Installations

Cable will be fixed to racks or trays or cleats as required for proper support, accessibility and neatness of installation. Cable tags will be provided at a regular interval of 30M. For cable run shorter than 30M one cable tag will be provided in the middle. These tags will be in addition to end cable tags. The cable tags will be marked with cable number, size and voltage grade. Middle tag will be indicated with destination. The end tag will be with second terminal point.

Cables will be clamped rigidly at an interval of not more than 1500 mm in horizontal, and 1000 mm in vertical & inclined run and at bends.

In the cable galleries, cable structures will be properly arranged giving sufficient clearance for movement of personnel from one part of the gallery to the other. It will also be possible to escape easily in case of fire.

Cables laid in over ground structures will be protected from the direct solar radiation. Road crossing points sufficient clearance will be provided with due consideration to road traffic. In outdoor structure cat ladder and walkable platform will be provided to facilitate cable removal/addition on the cable trays.

Perforated trays will only be used where necessary for the support of a number of small cables. Each tray will be firmly supported at suitable intervals and will carry the weight of its cables without sagging. Trays will be painted and where the surfaces or edges are cut or otherwise impaired during erection, they will be made good by coating with aluminium paint.

Small cables may be bunched together under one saddle provided that in any bunch all cables have sheaths of the same material. The number of cables will not exceed four wide and two deep.

Not more than one cable will be drawn into one conduit unless otherwise agreed. After the cable has been drawn in, the conduit will be sealed by an approved means.

All cables will be tested for proper insulation before start of laying work.





Cables will be laid in conduits, racks/trays, cable trenches, along with structures or buildings, as per cable routing drawing and cable list.

Suitable adjustment will be made in cable routes, if required at site, with a view to avoid any interference with any part of building, structures, equipment, utilities and services with the approval of the purchaser.

While laying cables, care will be taken that kinks, twists or mechanical damage do not occur to the cable.

All bends in cables will be made with due consideration to the minimum permissible bending radius of the cables.

On being pulled, the cable will not be allowed to drag drawing along the ground or over a second cable already laid. Special care will be taken while pulling through an opening where other cables have already been laid. Only approved cable pulling devices will be used.

No joints will normally be made at any intermediate point in through run of cables unless the length of the run is more than the standard drum length. In such cases where jointing is unavoidable, the same will be made inside proper bases having plastic moulds and will have moulded epoxy resin construction. Provision will be made for earthing continuity at the joint. Cable splicing and jointing will be done in accordance with the relevant IS code of practice and manufacturer's instructions. Insulation resistance of cables will be checked before cable jointing.

Adequate length of cables will be pulled inside the switch boards, control panels, control desks, etc. so as to permit neat termination.

All cables will be neatly dressed without interlocking or cross over. While laying the cable vertically, these will be clamped at suitable intervals. Horizontal runs will be rigidly secured to trays on racks/hangers in all the places where the direction of the route changes as well as at cable terminations or joints. The clamps will not be done up so tight that the insulation is damaged or deformed.

Cable markers will be provided on either side of road crossing at each turning and at 30 m intervals at straight runs for underground cables.

Where cables are required to cross roads, surface drains and water, oil, gas or other pipe lines, they will be taken through reinforced spun concrete or steel pipes.

Entry of cables from underground to the buildings or trenches will be through pipe sleeves. After laying of cables, the sleeves will be sealed with bitumin or epoxy compound with sand matting and cement plaster to make them fully water tight.



Special consideration will be given for protection of cables against chemical and mechanical damage.

All cable entry openings in the equipment will be sealed with fire proof materials. All cable openings in walls and floors will be sealed after laying of cables by water and fire proof materials.

All cables will be provided with identification tags indicating the cable number in accordance with cable lists. Tags will be fixed at both ends of the cable and at 30 m spacing for straight runs as well as on both sides wherever cables are crossing walls/floors. The tags will be of aluminium/PVC with numbers punched/painted on them and securely attached to the cables by non-corrosive wires. The shape of tags will be round, triangular and rectangular for control, medium voltage and high voltage cables respectively.

Glanding will be done for direct entry of both power and control cables into the panels by the contractor. Double compression type brass cable glands will be used.

The cables will be terminated in accordance with relevant connection diagram. Termination and clamping will be carried out in such a manner as to avoid strain on the terminals.

All power cable terminations will be by means of crimping type cable lugs. For flexible conductors, soldered termination will be adopted. In case of aluminium power cables termination on copper bus bars, suitable aluminium copper bimetallic washers will be used. Corrosion inhibiting grease will be used for aluminium cable terminations.

Suitable numbered and coloured letter interlocking type ferrules will be provided for end termination of power and control cables.

Control cable entering switch boards, control panels, control desks etc. will be neatly bunched and strapped with PVC perforated straps and suitably supported to keep it in position at the terminal blocks. All spare cores of each cable will be segregated, marked spare, neatly dressed and suitably taped at both ends.

When the cores of two or more multicore cables take a common route, cores of each cable will be separately bound and the separate bundles neatly bound together.

Individual cores of control cables will have plastic interlocked type coloured ferrules with engraved numbers at both ends of the circuit for identification.

The contractor will be responsible for correct phasing of motor power connections and will interchange connections at the motor terminals box, if necessary, after each motor is test run.

The trays will be earthed and rendered electrically continuous by welding the trays to the grounding strip at not less than two places from both sides of the tray.





Exposed conduits

Exposed conduits will be laid along walls, floors, ceilings, on steel supports etc. as per working drawings/site requirements in consultation with the supervisory personnel. The conduits will be neatly run and evenly spaced.

Fixing of conduits to the supports on wall, column, structure will not be done by welding. Exposed conduits will be adequately supported by racks, clamps, straps etc. Jointing of conduits will be done only in straight portion and not in bend portion.

The contractor will have available at site bending facilities for conduits as well as dies for threading conduits of diameters and threads corresponding to the standards. The threaded ends of conduits will be painted with anticorrosive paint. The outer ends will be smoothened free of burrs and sharp edges. Sealing will be at both ends of conduits.

Flexible metallic conduits will be used for termination of connections to motors and other electrical equipment like pressure switches etc. which need to be disconnected at periodic intervals.

All conduits will be effectively connected to the earth terminal of the equipment where it terminates.

Both ends of conduits will be suitable earthed. Earthing continuity to be maintained by means of flexible wire wherever two conduits are joined with sockets.

Approved conduit bending machines to be arranged by the contractor will be used for bending conduits in the field. The radius of any conduit bend will be as per standards for cabling. Bends will be free from cracks, crimps or other damage to the pipe or its coating.

