



and / or replacement until acceptance of PG test results shall be carried out by the Contractor and (ii) All repairs and / or replacement other than maintenance works until the end of the warranty period shall also be carried out by the Contractor to fulfil the warranty obligation. Contractor shall provide minimum technical personnel as required to provide guidance to Purchaser's O & M personnel till the completion of warranty period for both units. The modalities of providing such technical personnel till completion of the Warranty Period shall be mutually discussed and agreed during the contract execution stage.

This, however, shall not dilute the Contractor's liability during the guarantee period.

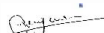
3. In the event of any emergency where, in the judgment of the Purchaser or the Consultant, delay would cause serious loss or damage, repairs, replacements or adjustments may be made by the Purchaser or the Consultant or a third party chosen by the Purchaser or the Consultant with advance notice indicating the reasonable time required to the Contractor and the cost of such work shall be paid by the Contractor, or by the Surety. In the event of such action being taken by the Purchaser or the Consultant, the Contractor shall be notified promptly and he shall assist wherever possible in making the necessary corrections. This shall not dilute the Contractor's liability under the terms and conditions of the Contract.
4. If it becomes necessary for the Contractor to replace or renew any defective portions of the plant under this clause, the provisions of this clause shall apply to the portion of the plant so replaced or renewed until the expiry of 12 months from the date of such replacement or renewal. If any defects be not remedied within a reasonable time, the Purchaser or the Consultant may proceed to do the work at the Contractor's risk and costs, but without prejudice to any other rights which the Purchaser may have against the Contractor in respect of such defects.
5. The repaired or new parts shall be furnished and erected free of cost at site by the Contractor. If any repair is carried out on his behalf at the site, the Contractor shall bear the cost of such repair.
6. The cost of any special or general overhaul rendered necessary during the guarantee period due to defects in the plant or defective work carried out by the Contractor, shall be borne by the Contractor.
7. The acceptance of the equipment by the Purchaser or the Consultant shall not in any way relieve the Contractor of his obligations under this clause.
8. In case of these defective parts which are not repairable at site but are essential for the commercial use of the equipment, the Contractor and the Purchaser or the Consultant shall mutually agree to a programme of replacement or renewal which shall minimise interruption to the maximum extent, in the operation of the equipment.
9. At the end of the guarantee period, the Contractor's liability ceases except for latent defects.

"Latent Defect" means any repeated defect or repeated adjustment in the equipment / system which was not revealed in the normal standard inspection checklist of manufacture, erection and operation, but exhibits as



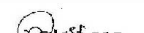
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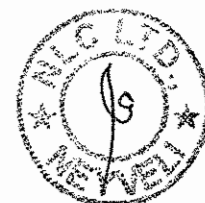
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observation or as deviation in operation parameters or as repetitive failure of certain components after Warranty Period and when variations in operating conditions are experienced and ultimately could be solved only by replacement or repair / correction of equipment or parts of equipment."

For latent defects, the liability period shall be upto 3 (three) years after the expiry of the guarantee period. In respect of goods supplied by the Sub-Contractors to the Contractor where a longer guarantee (more than 12 months) is provided by such Sub-Contractors, the Purchaser shall be entitled to the benefit of such longer guarantee.

The equipment shall be operated as per the Contractor's O&M Manual.

10. The provisions contained in Clause 10.34(1) shall not be applicable:
  - (a). If the Purchaser has not operated the equipment according to the generally approved industrial practices and in accordance with the conditions of operation specified and in accordance with operating manuals, if any.
  - (b). In case of normal wear and tear of the parts.
11. All costs on account of these warranty obligations shall be to the account of the Contractor.
12. The Contractor should furnish an Indemnity Bond in the prescribed format as per Annexure-XVI for the equipment to be taken away from Project site for repair/rectification.
13. **Defect Liability for Civil Works: Intentionally deleted**

#### 10.35 Tests on Completion

The final tests so as to demonstrate performance guarantees shall be carried out by the Contractor in the presence of Purchaser/Consultant within a reasonable period of time from the date on which the plant is provisionally taken over. Should the result of these test be not as specified, the tests shall be repeated by the Contractor within one month from the date of plant is made ready by the Contractor for retest and the Contractor shall pay to the Purchaser the expenses which the Purchaser may incur due to such retests.

#### 10.36 Access To and Possession of Site

1. Subject to clause 10.36(3) of this clause, access to and possession of the Site shall be afforded to the Contractor by the Purchaser in reasonable time to start the Contract Work as per agreed time schedule as specified in the Contract. All temporary access roads at works site and other areas allotted to the contractors in connection with contract works shall be constructed and maintained by the Contractor.
2. In the execution of the work, no person other than the Contractor, Sub-Contractor and his or their employees shall be allowed on the Site except with the written permission of the Purchaser. Facilities to inspect the works at all times shall be afforded by the Contractor to the Purchaser and his representatives and other authorised officials.
3. The access to and possession of the Site referred to in sub-clause 10.36.1 shall not be exclusive to the Contractor but only such as shall enable him to execute the works. The Contractor shall afford to the Purchaser and to other



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Contractors whose names shall have been previously communicated in writing to the Contractor by the Purchaser, reasonable facilities for the execution of the work concurrently with his own.

4. Unless otherwise provided in the Specification, the Purchaser shall allow the Contractor for carrying out the work at the Site continuously, without hindrance. While normally the Purchaser shall allow normal working hours, for completing the work within the time schedule, the Purchaser, if necessary shall also allow the Contractor for carrying out the work round-the-clock for which written approval shall be obtained by the Contractor from the Purchaser and subject to applicable labour laws in this regard.

#### **10.37 Due Dates of Payment**

Payment shall be due and payable by the Purchaser within a reasonable period which shall not normally exceed one month from the date of the receipt of each complete and correct invoice by him supported by requisite certificate issued by the purchaser/his authorised agency and proper documentation. If it is not payable the invoice shall be returned to the Contractor stating the reasons for rejection within 15 (fifteen) days from the date of receipt by the Purchaser.

#### **10.38 Deductions from Contract Price**

The Contractor shall reimburse the Purchaser all costs, charges, damage or expenses which the Purchaser may have paid or incurred, if and to the extent to which the Contractor is liable under this Contract to pay within 30 (thirty) days upon written request of the Purchaser, failing which such costs, charges, damages or expenses shall be deducted by the Purchaser from any money due or becoming due by him to the Contractor under this Contract or any other Contract failing which such amounts shall be considered as debt due from the Contractor to the Purchaser and shall be recoverable accordingly.

#### **10.39 Construction of Contract**

The schedules and terms and conditions herein contained including Annexures shall construe the entire contract and understanding between the parties and shall be binding on both the parties. All other communications which were made prior to the signature of the Contract between the parties hereto with respect to the subject matter hereof shall form the schedule of references and form part of the Contract.

#### **10.40 Rights of Purchaser to Vary Scope**

- (1). The Purchaser shall have the right, during the performance of the Contract, to change the scope and/or technical character of the Project and/or of the supplies and services stipulated in the Contract.
- (2). If any changes are required for completeness of the work as per Clause-10.7 the Contractor shall not be entitled to extra price or time.
- (3). In the event, the Purchaser requests a change as per above Clause-10.40 (1) the Contract price and time shall be adjusted upwards or downwards, as the case may be and as shall be mutually agreed. The Contractor shall not be entitled to any extension of time unless such changes adversely affect the time schedule.

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- (4). The Contractor shall not change any work to be made pursuant to this Contract except as may become necessary to enable him to meet his technical obligations under this Contract, provided however that such changes shall be subject to prior written approval of the Purchaser.
- (5). If any changes are required for completeness of the works as per Clause 10.40(2), or the Contractor himself makes changes as per Clause 10.40 (4), the Contractor shall not be entitled to extra price or time.
- (6). The Contractor shall proceed with the changes as requested as per Clause 10.40(1) pending adjustment of Contract price and time schedule where so applicable in terms of Clause-10.40(3).
- (7). In the event that a request for changes by the Purchaser should affect the guarantees of the plant/process, a readjustment of such guarantees shall be agreed upon jointly, before the Contractor proceeds with the change.
- (8). Changes occasioned due to non-observance by the Contractor of the provisions of this Contract or arising out of detection by the Purchaser of errors in the documents or in works not in compliance with the design, specifications & drawings or with the best engineering practice, shall neither give rise to price adjustment nor extension of time. The Contractor shall take immediate steps to restore the contractual position.

#### 10.41 Waiver

1. Non-enforcement by either party of any of the provisions of this Contract shall not operate or constitute as a waiver of the provision itself or any subsequent breach thereof.
2. The validity of the Contract shall not be affected, should one or more of its stipulations be or become legally invalid and such stipulation is severable from and not fundamental to the obligations of either party to this Contract. In such a case, the parties shall negotiate in good faith to replace the invalid clause by an agreed stipulation which is in accordance with the applicable law and which shall be as close as possible to the parties original intent.

#### 10.42 Assignment

1. The Contractor shall not assign its rights and obligations under the terms of this Contract to any party other than its legal successor without the written consent of the Purchaser.
2. Should loan/financial agreement(s) require the Contractor to assign, by way of charge, any money due or to become due to it, to a bank/credit agency for the benefit of receiving payment by the Contractor under this Contract from such bank/credit agency, or if any partial assignment is necessary to be made to any insurer in terms of Insurance Policy approved by the Purchaser, the Purchaser shall not refuse consent in such cases.

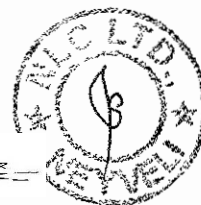
#### 10.43 Contract Amendments

1. Any amendment to the terms of this Contract (including Schedules & Annexures) shall be made in writing by both parties hereto and shall specifically state that it is an amendment to the Contract.



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2. Contractor shall not suspend the performance of this Contract during review and negotiation of any amendment to the contract except as may be directed by the Purchaser.
3. No amendment shall have any effect until the Purchaser and Contractor have agreed to the amendment in writing.

#### 10.44 Applicable Law

This Contract shall be governed by prevailing Indian Laws.

#### 10.45 Notices

- (1). All notices under this Contract shall be given in writing and shall be deemed sufficiently given when delivered either in person or by, telegram, telex, fax, e-mail or by registered mail addressed to the other party at its address set forth in the contract agreement with a copy to the nominated representative at site.
- (2). If any such notice is delivered by hand, it shall be duly acknowledged and if given by telegram, telex, fax it shall be confirmed by Registered Letter within seven days of the date of such notice. Either party shall by notice in writing inform the other party of any change of its address as stated under Clause 10.45 (1) for receiving such notices.
- (3). Date of notices under Clause-10.45 (1) shall be the date of receipt of such notice by the receiving party.

#### 10.46 Language

1. All documents, instructions, catalogues, brochures, pamphlets, design data, norms and calculations, drawings, operation, maintenance and safety manuals, reports, labels, on deliveries and any other data shall be in the English Language
2. The Contract documents and all correspondence between the Purchaser/consultants and the Contractor shall be in the English language.
3. However, all signboards required to indicate "Danger" and/or security at site and other statutory signage shall be in English and Hindi and compulsorily in the local language of Tamil. Other Indian languages shall also be considered depending upon the workforce deployed at site.

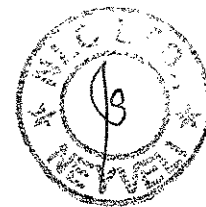
#### 10.47 Statutory and Other Regulations

1. The Contractor shall comply with all the statutory obligations of Government of India/State Government of Tamil Nadu applicable at site and the Purchaser shall not be liable for any action of the statutes applicable due to non-fulfillment of statutory obligations by the Contractor.
2. Explosives shall not be used at the site by the Contractor without the permission in writing of the Purchaser and then only in the manner and to the extent to which he has prescribed. Where explosives are used, the same shall be stored in a special magazine to be provided by and at the cost of the Contractor, who shall be liable for all damages loss or injury to any person or property and shall be responsible for complying with all statutory obligations in these respects.

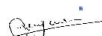


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3. The Contractor shall give all notices and pay all fees required to be given or paid under any Central or State statute, ordinance or other law or any regulation or by-law of any local or other duly constituted authority in relation to the execution of the Contract Work. The fees for obtaining statutory license in the name of Purchaser shall be paid by Purchaser.
4. The Contractor shall conform in all respects with the provisions of any statute, ordinance or laws as aforesaid and the rules, regulations or by-laws of any local or other duly constituted authority which may be applicable to the works or to any temporary works and with such rules and regulations of public bodies as aforesaid and shall keep the Purchaser indemnified against all penalties and liabilities of every kind for breach of any such statute, ordinance, law, rule, regulation or by-law.
5. All fossils, coins, articles of value of antiquity and structures and other remains or things of geological or archaeological interest discovered on the site shall as between the Purchaser and the Contractor be deemed to be the absolute property of the Purchaser and the Contractor shall take reasonable precaution to prevent its workmen or any other person from removing or damaging any such article or thing and shall immediately upon discovery thereof and before removal acquaint the Purchaser of such discovery and carry out at the expense of the Purchaser as to the disposal, removal or otherwise of the same.
6. Except where otherwise specified, the Contractor shall pay all tollage and other royalties, rent and other payments or compensation, if any, for getting stone, gravel, clay, or other materials required for the work or in connection therewith.
7. All operations necessary for the execution of the works and for the construction of any temporary works shall so far as compliance with the requirements of the Contract permits be carried on so as not to interfere unnecessarily or improperly with the public convenience or the access to use and occupation of public or private roads and footpaths or of properties whether in the possession of the Purchaser or any other person and the Contractor shall save harmless and indemnify the Purchaser in respect of all claims demands, proceedings, damages, costs, charges and expenses, whatsoever arising out of or in relation to any such matters.
8. The Contractor shall use every reasonable means to prevent any of the highways and bridges communicated with or on the routes to the site from being damaged or injured by any of his or any of his Sub-Contractor's traffic and in particular shall select routes, choose and use vehicles and restrict and distribute loads so that any such extraordinary traffic as shall inevitably arise for moving of plant and materials from and to the site shall be limited as far as reasonably possible so that no unnecessary damage or injury may be occasioned to such highways and bridges. For any damage caused by the breach hereof, the Contractor shall be solely responsible.
9. Where the nature of the work is such as to require the use by the Contractor of water borne transport, the foregoing provisions of this clause shall be construed as though "high sea" including a lock, dock, seawall or other structure related to waterway and "vehicles" including craft and shall effect accordingly.



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10. On completion of the work, all rubbish, kilns, vats, tanks, materials and temporary structure of any sort or kind used for the purpose or connected with the construction/erection work are to be removed by the Contractor and all pits and excavations filled up and the site handed over in a tidy and workmanlike condition and no final payment in settlement of the account for the said work shall be held to be due or shall be made to the Contractor till such site clearance shall have been effected by him and such clearance may be made by the Purchaser at the expenses of the Contractor in the event of his failure to comply with this provision within 15 (fifteen) days after receiving notice in writing from the Purchaser to that effect. If it becomes necessary for the Purchaser to have the site cleared as indicated above at the expense of the Contractor, the Purchaser shall under no circumstances be held liable for any losses or damages to such of Contractor's property as may be on such site due to such removal there from, which removal may be effected by means of public sale of such materials and property or in such a way as seems fit and most convenient to the Purchaser.
11. The Contractor must take sufficient care in moving its construction plants and equipment from one place to another so that they may not cause any damage to the property of the Purchaser, particularly to the existing structures and overhead and underground services and in the event of Contractor's failure to do so, the cost of such damages shall be borne by the Contractor.

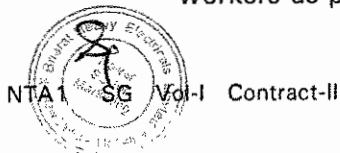
#### 10.48 Labour

##### 10.48.1 Labour rules

In respect of all labour directly or indirectly employed on the works by the Contractor, the Contractor shall comply with and implement all the provisions of the Contract Labour (Regulation and Abolition) Act 1970, or any amendment thereof, and all legislations and rules of the State and/or Central Government or other local authority formed from time to time governing the protection of health, sanitary arrangements, wages, welfare and safety of labour employed on the works and the Contractor shall be deemed to be the Principal employer for this purpose. The rules and other statutory obligations with regard to fair wages, welfare and safety measures, maintenance of register etc. shall be deemed to be part of the Contract. The Contractor shall get himself registered with the concerned statutory authorities as provided in the Act and shall be directly responsible to the authorities there under for compliance with the provisions thereof.

##### 10.48.2 Provision of Minimum Wages Act and Payment of Wages


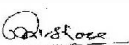
- (i). The Contractor shall comply with the provisions of the Minimum Wages Act 1948. The minimum wages Central Rules 1950, the Payment of Wages Act 1936 or any other rules made there under by the Government of Tamil Nadu in respect of all employees employed by him or his Sub-Contractor directly or indirectly for the purpose of carrying out the works. In the event of retrenchment of workers by the Contractor or Sub-Contractors employed by the Contractor during or after the completion of the work, the retrenchment compensation and other benefits shall be paid by the Contractor to the workers as per the Industrial Dispute Act.



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- (ii). If any money shall, as a result of any claim or application made under the said acts, be directed to be paid by the Purchaser, such money shall be deemed to be money payable to the Purchaser by the Contractor and/or failure by the Contractor to repay the Purchaser, any money paid by the Purchaser as aforesaid, latest within 30 days after the same shall have been demanded from the Contractor, the Purchaser shall be entitled to recover the same from any money due or accruing to the Contractor under this or any other contract with the Purchaser, failing which such amount shall be considered as debt due from the Contractor to the Purchaser.
- (iii). The Contractor shall comply with the provisions of bi-partite and tripartite agreement entered into by the Purchaser from time to time with the Labour Unions and/or the circulars issued by the Purchaser regarding payment of minimum wages and benefits applicable.

#### 10.48.3 Reporting of accidents to labour

The Contractor shall be responsible for the safety of his and his Sub-contractor(s)/Workmen and employees. All accidents at site are to be immediately reported to the required authorities. The Contractor shall be responsible for all such accidents.

#### 10.48.4 Provision of Workmen's Compensation Act

The Contractor shall be liable for in respect of any damages or compensation payable by law in respect of or in consequence of any accident or injury to any workmen or other person in the employment of the Contractor or any of his Sub-Contractors and the Contractor shall save harmless and shall indemnify and keep indemnified the Purchaser against all such damages and compensation and against all claims, demands, proceedings, costs, charges and expenses, whatsoever, in respect thereof or in relation thereto. The Contractor shall at all times indemnify and keep indemnified the Purchaser against all claims for compensation under the provisions of the Workmen's Compensation Act 1948 or any other law for the time being in force by or in respect of any workmen employed by the Contractor or his Sub-Contractors / agencies in carrying out the Contract and against all costs and expenses of penalties incurred by the Purchaser in connection therewith. In every case in which by virtue of the provisions of Section-12, Sub-Section(I) of the Workmen's Compensation Act 1923, the Purchaser is obliged to pay compensation to a workmen employed by the Contractor or his Sub-Contractor/ agencies, the amount of compensation so paid and without prejudice to the rights of the Purchaser under Section-12, Sub-Section (2) of the said Act, the Purchaser shall be at liberty to recover such amount or any part thereof from the security deposit or from the sums due or to become due to the Contractor (whether under this Contract or any other Contract) .

#### 10.48.5 Provisions of Apprentices Act

The Contractor shall comply with the provisions of the Apprentices Act 1961, and the rules and orders issued there under from time to time. If he fails to do so, his failure may be treated as breach of the Contract and the Purchaser may, in his discretion, terminate the Contract. The Contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the said Act.



#### 10.48.6 Labour Returns

The Contractor shall submit daily statements of labour employed by him/Sub-contractor(s) in the proforma prescribed by the Purchaser.

#### 10.48.7 Labour Camps

The Contractor shall, at its own expense, make adequate arrangements for housing, electricity, road, supply of drinking water and provision of latrines and urinals for its staff and labour, disposal of sewerage and sullage and for temporary creche (bal mandir) where 50 or more women are employed at a time. Drinking water and power supply shall be provided at a single point near the colony by the Purchaser (Further distribution shall be by the Contractor). However, power consumption shall be charged at the appropriate rate.

#### 10.48.8 Preservation of Peace

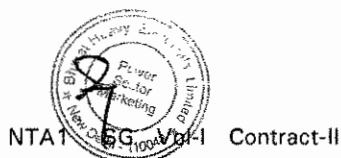
The Contractor shall take requisite precautions and use his best endeavour to prevent any riotous or unlawful behaviour by, or amongst its workmen and/or others employed on the works by him or his Sub-contractor(s) and for the preservation of peace and protection of the inhabitants and security of the property in the neighbourhood of the works/site. In the event of the Purchaser requiring the maintenance of a special police force at or in the vicinity of the site during the tenure of the Contract in consequence of the riotous or unlawful behaviour by, or amongst the Contractor's or his Sub-contractor(s)/Workmen and/or others staff employed by him/them, all expenses thereof and costs of all damages due to such riotous or unlawful behaviour shall be borne by the Contractor and if paid by the Purchaser, shall be recoverable from the Contractor from any money due or that may become due to the Contractor by the Purchaser.

#### 10.48.9 Payment of Wages

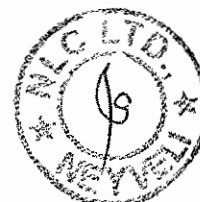
- (i). The Contractor shall make regular and prompt payment of wages to its workmen engaged in the work and in no case shall the payment be delayed more than seven days following the period for which the wages are due. The Contractor shall send a certificate to the Purchaser to this effect every month. If it is found that workers are not paid regularly, the Contract is liable to be terminated.
- (ii). The Purchaser shall have the right to enquire into and decide against any complaint alleging that the wages paid by the Contractor to any labourer for the work done by such labourer is less than the wages paid for similar work in the neighbourhood.
- (iii). As a number of Contractors may be working at the same time in the erection of different parts at the Project site, there is need for pursuance of a coordinated policy in regard to employment, wages and other conditions of work. The Contractor shall consult the Purchaser on all such matters to arrive at mutually agreed settlements.

#### 10.48.10 Sanitary arrangements

The Contractor shall comply with all local sanitary rules in force and carry out all sanitary measures and permit inspection of all sanitary arrangements at all reasonable times by the Purchaser/local bodies.



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#### 10.48.11 Infectious diseases

The Contractor shall employ such persons as are found to be free of contagious diseases and shall produce, if required by the Purchaser, certificate of fitness of all its employees working at site. The Contractor shall, if required by the Purchaser, subject all its employees to regular medical check up and produce satisfactory evidence of their being free from any contagious disease.

10.48.12 The Contractor shall remove from its labour camp such labour and their families who refuse protective inoculations and vaccination when called upon to do so by any competent authority.

#### 10.48.13 Medical Facilities at Site

The Contractor shall provide reasonable medical facilities at the site as per rules in force in relation to the strength of the Contractor's staff and workmen deployed at site.

#### 10.48.14 Use of intoxicants

The use or sale of ardent spirits or other intoxicating beverages, within the works or in any of the buildings, boarding houses, encampments or other tenements owned, occupied by or within the control of the Contractor or any of its employees or his Sub-contractor is strictly forbidden and the Contractor shall ensure strict compliance.

#### 10.48.15 Age limits of labour

The Contractor shall not employ, for the purpose of the work, any person below the age of 18 years as it is statutorily forbidden. The Purchaser reserves the right to dis-allow any labourer, whom he considers to be underage, to be employed by the Contractor. The Contractor shall submit periodical statements to the Purchaser, of labour employed by him.

#### 10.48.16 Provident Fund

- (i). The Contractor shall be solely responsible for deduction and contributions under the Employees' Provident Fund Act 1952 and Family Pension Act 1971 and the scheme made there under as amended from time to time. He shall be solely responsible for the maintenance of records for payment of contributions and submission of returns in accordance with the said act and scheme.
- (ii). In case the Contractor fails to make payments under the above act and the scheme made there under and as amended from time to time, the Purchaser reserves the right to make such payment on behalf of the Contractor on demand from the authorities under the act and recover the same from the payments due to the Contractor. Further, the Contractor shall indemnify and keep indemnified the Purchaser against any loss or damage whatsoever that may be suffered by the Purchaser as a results of any claims, damages, penalties for any failure, non- compliance on his part with the provisions of the aforesaid act and the scheme framed there under.

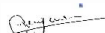
#### 10.48.17 Observance by Sub-Contractor(s)

The Contractor shall also be responsible for the observation of all the above clauses by his Sub contractor(s).



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**10.49 Care of Works**

From the commencement to the completion of work, the Contractor shall take full responsibility for the care of works and for all temporary works and in case any damage or loss shall happen to the works or to any part thereof or to any temporary works from any cause whatsoever, the Contractor shall at his own cost replace or repair and make good the same.

**10.50 Restriction of Visitors**

The Contractor shall not allow any visitors on the works except with the prior written approval of the Purchaser.

**10.51 Possession Prior to Completion**

The Purchaser shall have the right to take possession or use any completed or partially completed work. Such possession or use shall not be deemed to be an acceptance of any work done not in accordance with the Contract. However, any damage to such work solely due to such provision or use shall be to the Purchaser's account.

**10.52 Work Permit, Passport, Etc.**

The Contractor shall be responsible for arranging and obtaining at his own cost, the necessary work permits, passports, visas, police permits and expenses and for other effects of any personnel employed or engaged by him for work, which are non- residence of India.

**10.53 General**

No Director or Official or Employee of the Purchaser shall in any way be personally bound or liable for the acts or obligations of the purchaser under the contract or answerable for any default or omission in the observance or performance of any of the acts, matters or things or conditions which are herein contained.

**10.54 General Liability Provision**

The rights and obligations of the parties are finally and conclusively defined in this Contract.

**10.54.1 Limitation of Liability**

Except in case of Criminal Negligence or Wilful Misconduct,

1. The Contractor shall not be liable to the Purchaser, whether in Contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production or loss of profits or interest costs, provided that this exclusion shall not apply to any obligation of the Contractor to pay liquidated damages to the Purchaser, and,
2. The aggregate liability of the Contractor to the Purchaser, whether under the Contract, in tort or otherwise, shall not exceed the total Contract Price, provided that this limitation shall not apply to any obligation of the Contractor to indemnify the Purchaser with respect to Patent infringement.

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## 10.55 Transfer of Titles

### 10.55.1 Imported Items

Title of ownership and Property to all imported equipment, materials (including imported components to be further processed in India), drawings & documents to be delivered by the contractor in terms of the contract shall pass to the Purchaser in accordance with the 'Incoterms 2010' and transfer of ownership and property to the Purchaser shall be simultaneous at the time of delivery to the carrier, provided however, such passing of title of ownership & property to the Purchaser shall not in any way absolved, or dilute or diminish the responsibility and obligations of the Contractor under this contract including loss or damages and all risks, which shall vest with the contractor till the successful commissioning as per this contract.

### 10.55.2 Self Manufactured Indigenous Items

Ownership of equipment supplied under the supply portion of the contract shall vest with Purchaser as soon as they are despatched ex-works/place of despatch, in respect of indigenous items. However for executing the erection portion of the contract, Contractor shall take over, all such equipment from purchaser and further shall take full responsibility for safe custody, transportation to site, handling at all intermediate points and at site, storage, erection, testing and commissioning of equipment and for their exclusive use for purposes specified in this contract. Contractor's liability under the contract shall not be over till the plant in successfully commissioned and taken over by purchaser. The despatch document consigned in the name of the Purchaser, shall be endorsed by the Purchaser, in favour of the Contractor for receipt of goods and then for storage, erection testing and commissioning. Purchaser's responsibility shall be limited to endorsement of despatch documents in Contractor's favour to enable the contractor to carryout services under the erection portion of the contract.

### 10.55.3 Bought out items

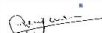
The procedure described in the above clause covers the self manufactured items of the Contractor. For bought out items directly consigned to purchaser's site, from approved sub-supplier, the consignee shall be the Purchaser. Sale in transit is acceptable to the Purchaser. However, no additional Sales tax liability shall arise to the Purchaser. The dispatches shall be made as performance relevant provisions of CST Act. However, the contractor shall ensure that no additional liability towards sales tax arises to the Purchaser.

## 10.56 Indemnity Bond

For the equipment handed over to Contractor, for performing the work under this contract, Contractor shall execute a custody cum indemnity bond in favour of Purchaser as per Annexure-XVI. The endorsement and handing over of despatch documents by purchaser to contractor shall be construed as having handed over and entrusted to the Contractor all the equipment covered in such despatch documents. The Contractor shall hold the equipment handed over to him by Purchaser, as trustee on behalf of the Purchaser without having any lien or charge against the equipment at any stage. For any loss or damage to the equipment and material till these are finally taken over by Purchaser, the contractor shall immediately replace/repair the loss or damaged equipment entirely at his cost



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irrespective of the extent and/or time of realisation of claims by him from the insurer/underwriters.

The title of ownership and property to all goods materials equipment etc. originating in India shall pass to the purchaser as per the terms and conditions of this contract after the Contractor has effected the despatch of the same to Project Site and the Contractor has prepared necessary documentation for handing over the same to Purchaser's authorised representative provided however, such passing of titles of ownership and property to the Purchaser shall not in any way absolved, dilute or diminish the responsibility and obligations of the Contractor under this Contract including loss or damage and all risks which shall vest with the Contractor till the successful commissioning as per this Contract.

**10.57 Safety**

The Contractor shall abide by the Safety Code for Contractors which is annexed as Annexure-XVII.

**10.58 General Conditions for Erection**

The Contractor shall abide by the General Conditions for Erection, which is annexed as Annexure-XX.

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



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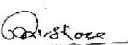


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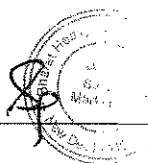
  
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**ANNEXURE – XX**  
**GENERAL CONDITIONS FOR ERECTION WORKS**  
**AND CIVIL WORKS**



  
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**ANNEXURE - XX**

**GENERAL CONDITIONS FOR ERECTION AND CIVIL WORKS**

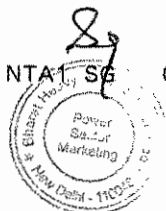
**GENERAL CONDITIONS FOR ERECTION WORKS**

**1.0 GENERAL**

- 1.1 The following shall supplement the conditions already contained in the other parts of the specifications and documents and shall govern that portion of the work of the Contract to be performed/undertaken at the project site.
- 1.2 The Contactor upon signing of the Contract shall, in addition to a Project Coordinator, nominate another responsible officer as its representative at site suitably designated for the purposes of overall responsibility and co-ordination of the Works to be performed at site. Such person shall function from the site office of the Contractor during the execution of Contract. This representative shall have full technical capability and complete administrative and financial powers to expeditiously and efficiently execute the work under the Contract.
- 1.3 The Contractor shall proceed with the work to be performed under the Contract and each and every part and detail thereof, in the best and most workman like manner by engaging qualified, diligent and efficient workers, and undertake the several parts thereof, at such time and in such order as agreed in the contract , and finish such work in strict conformity with the plans, drawings and/or specifications, and any changes, modifications or amplifications thereof made by the Purchaser/Consultant.
- 1.4 The Contractor shall not sell, assign, mortgage hypothecate or remove equipment or materials or materials which have been installed or which may be necessary for the completion of the Contract, without the written consent of the Purchaser.

**2.0 REGULATIONS OF LOCAL AUTHORITIES AND STATUES**

- 2.1 The Contractor shall ensure compliance with all statutes, laws, rules and regulations of the Central or State Government or any other authority such as the Workmen's Compensation Act 1923, Payment of Wages Act, Minimum Wages Act 1948, Employees State Insurance Act, Employees Provident Fund Act, etc. and any and all statutory modifications thereof in connection with employees engaged by him or his Sub-Contractors in performance of the work.



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- 2.2 The Contractor shall conform to the provisions of Indian Boiler Regulation, State government Factory Laws, Indian Electricity Act and rules made there under, and any other acts of legislature relating to the work and to the regulations and bye-laws of any national or local authority and of any water, lighting and other companies and/or authorities with whose systems the plant/structure is proposed to be connected and shall before making any variations from the drawings or specifications that may be necessitated by so conforming, giving to the Purchaser/Consultant written notice, specifying the variations proposed to be made and the reason for making it any apply for instructions thereof.
- 2.3 The Contractor shall arrange to give all notices required by the said Acts, Regulations or Bye-laws to be given to any Authority or to any Public Officer and pay all fees that may be properly chargeable in respect of the works and lodge the receipts with the Purchaser/Consultant, unless otherwise, specified in the specification. Obtaining all permits and licenses required there upon is the responsibility of the Contractor.
- 2.4 All registration and statutory inspection fees, in respect of the work pursuant to the Contract shall be to the account of the Contractor. However, any registration, statutory inspection fees lawfully payable under the provisions of the Indian Boiler Regulations and any other statutory laws and its amendments from time to time during erection in respect of the plant and equipment ultimately to be owned by the Purchaser shall be to the account of the Purchaser. Should any such inspection or registration need to be re-arranged due to the fault of the Contractor or its Sub-Contractor, the additional fees for such inspection and/or registration shall be borne by the Contractor.

### 3.0 CONTRACTOR'S HEALTH AND SAFETY PROGRAM

Refer Contract specification and also Annexure-XVII of this Volume for safety code.

### 4.0 PURCHASER'S LIEN ON EQUIPMENT

The Purchaser shall have lien on all equipment including those of the Contractor brought to the site for the purpose of erection, testing and commissioning of the plant. The Purchaser shall continue to hold the lien on all such equipment throughout the period of Contract. No material brought to the site shall be removed from the site by the Contractor and/or its Sub-Contractor's without the prior written approval of the Purchaser/Consultant.




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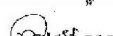
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## 5.0 INSPECTION, TESTING AND INSPECTION CERTIFICATES

- 5.1 The provisions of the clause entitled Inspection, Testing and Inspection Certificates shall also be applicable to the erection portion of the works. The Purchaser / Consultant shall have the right to re-inspect any equipment (though previously inspected and approved by him, at the Contractor's works) before and after the same are erected at Site. Inspection will be carried out as per the mutually agreed QAP for shop manufactured items. After receipt of the materials / equipments at site, in case of doubt, the Purchaser may ask for re-inspection after mutual discussion and agreement with the contractor as per the approved QAP for the materials / equipments to perform as per the contract within the contract price. If by the above inspection, the Purchaser / Consultant rejects any equipment, the Contractor shall make good for such rejections either by replacement or modifications / repairs as may be necessary, to the satisfaction of the Purchaser / Consultant. Such replacements will also include the replacements or re-execution of such of those works of other Contractor's and/or agencies, which might have got damaged or affected by the replacements or re-work done to the Contractor's work.
- 5.2 Any work, which proves faulty, shall be corrected by the Contractor without undue delay. The fact that the Purchaser / Consultant or their representatives have not pointed out faulty work or that which is not in accordance with plans and specifications, shall not relieve the Contractor from correcting such work as directed by the Purchaser / Consultant, without additional compensation.
- 5.2.1 In the event finished/completed work is 'dismantled' for the purpose of re-inspection due to damage (arising due to transportation and storage at site), in case of doubt, the Purchaser may ask for re-inspection after mutual discussion and agreement with the contractor as per the approved QAP for the materials / equipments to perform as per the contract within the contract price.
- 5.3 The Purchaser / Consultant, their representatives and employees shall, at all reasonable times, have free access to the works and/or to the workshops, factories or other places where materials are being prepared or constructed in performance of the Contract and also to any place where the materials are lying or from where they are being obtained, and the Contractor shall give every facility to the Purchaser / Consultant and his representatives for



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inspection and examination and test of the materials and workmanship even to the extent of discontinuing portions of the work temporarily, or of uncovering or taking down portions of finished work after mutual agreement.

## 6.0 ACCESS TO SITE AND WORKS ON SITE

- 6.1 Suitable access and possession of the site shall be provided to the Contractor by the Purchaser in reasonable time.
- 6.2 The Purchaser shall make ready the necessary foundations to be provided by it ready, as per the agreed schedule, for the execution of the individual phases of works.
- 6.3 In the execution of the works, no persons other than the Contractor or its duly appointed representative, Sub-Contractor and workmen shall be allowed to undertake work on the site, except by the special permission, in writing of the Purchaser / Consultant or its representative.
- 6.4 Access to the site at all times shall be accorded to the Purchaser / Consultant and other authorized officials and statutory Public Authorities. Nevertheless, the Contractor shall not object to the execution of the work by other Contractors or tradesmen whose names shall have been previously communicated in writing to the Contractor by the Purchaser / Consultant and afford them to coordinate for the execution of their several functions simultaneously with his own.

## 7.0 CONTRACTOR'S SITE OFFICE ESTABLISHMENT

- 7.1 The Contractor shall establish a Site Office at the site and keep posted an authorized representative for the purposes of the Contract. Any written order or instruction of the Purchaser / Consultant or his duly authorized representative, shall be communicated to the authorized representative for the purposes of the Purchaser / Consultant or his duly authorized Contractor at the Site Office and the same shall be deemed to have been communicated to the Contractor at his legal address.
- 7.2 The Contractor shall employ at least one competent representative whose name or names shall have previously been communicated in writing to Purchaser/Consultant by the Contractor, to supervise the erection of the plant and to carry out the work. The said representative or if more than one shall be employed, then one of such representatives shall be present at the site during working hours, and any written orders or instructions which the Purchaser/Consultant may give to the said representatives of the Contractor

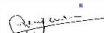


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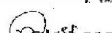
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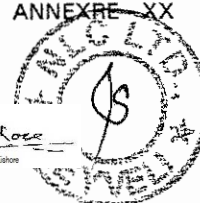
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shall be deemed to have been given to the Contractor. It is essential that the supervisory personnel shall be capable of speaking and writing in English language and preferably conversant with the local language –Tamil.

## **8.0 CO-OPERATION WITH OTHER CONTRACTORS**

8.1 The Contractor shall cooperate with all other Contractors or tradesmen of the Purchaser, who may be performing other works on behalf of the Purchaser and the workmen who may be employed by the Purchaser and doing work in the vicinity of the works under the Contract. Purchaser will be the single point of co-ordination for the same. The Contractor shall also so arrange to perform its work as to minimize, to the extent possible, interference with the work of other Contractors and its workmen. Any injury or damage that may be sustained by the employees of the other Contractors and the Purchaser due to the Contractor's work shall promptly be made good at its own cost. The Purchaser/Consultant shall determine the resolution of any difference or conflict that may arise between the Contractor and other Contractors or between the Contractor and the Workmen of the Purchaser in regard to their work.

8.2 The Purchaser/Consultant shall be notified promptly by the Contractor of any defects in the other Contractor's works that could affect the Contractor's works. The Purchaser/Consultant shall determine the corrective measures, if any, required to rectify this situation after inspection of the works and such decisions by the Purchaser/Consultant shall be binding on the Contractor. If a part of the Contractor's work depends, for proper execution, upon the work of any other Contractor, the Contractor shall inspect and promptly report in writing to the Purchaser/Consultant any defect in such work of other Contractors that render it unsuitable for proper execution of the work under the Contract. Failure to so inspect and report shall constitute an acceptance of 'Others' work as fit and proper for the reception of his work, except as to defects which may develop in the work of 'Others' after the proper execution of the work. To ensure proper execution of his sub-sequent work, the contractor shall inspect work already in place and shall at once report to the Purchaser/Consultant any discrepancy between the executed work and the drawings.

## **9.0 DISCIPLINE OF WORKMEN**

9.1 The Contractor shall adhere to the disciplinary procedure set by the Purchaser/Consultant in respect of its employees and workmen at site. The



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Purchaser/Consultant shall be at liberty to object to the presence of any representative or employee of the Contractor at the site, if in the opinion of the Purchaser/Consultant such employee has misconduct himself or be incompetent or negligent or otherwise undesirable and then the Contractor shall remove such a person object to and provide in his place a competent replacement at his own expense.

#### **10.0 CONTRACTOR'S FIELD OPERATION**

10.1 The Contractor shall keep the Purchaser/Consultant informed in advance regarding his field activity plans and schedules for carrying out each part of the works. Any review of such plan or schedule or method of work by the Purchaser/Consultant shall not relieve the Contractor of any of his responsibility towards the field activities. Such reviews shall also not be considered as an assumption of any risk or liability by the Purchaser/Consultant or any of his representatives and no claim of the Contractor will be entertained because of the failure or inefficiency of any such plan or schedule or method of work reviewed. The Contractor shall be solely responsible for the safety, adequacy and efficiency of plant and equipment and his erection methods.

10.2 The Contractor shall have the complete responsibility for the conditions of the work site including the safety of all persons employed by him or its Sub-Contractor and all the properties under his custody during the performance of the work. This requirement shall apply continuously till the completion of his 'Contract' and shall not be limited to normal working hours. The construction review by the Purchaser/Consultant is not intended to include review of Contractor's safety measures in, on or near the work-site, and their adequacy or otherwise.

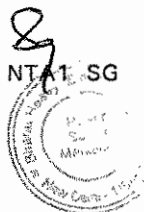
10.3 The work so far as it is carried out on the Purchaser's premises/the project site, shall be carried out at such time as the Purchaser may approve consistent with the construction schedule and so as not to interfere unnecessarily with the conduct of the Purchaser's business and the Purchaser will give the Contractor all reasonable facilities for carrying out the work.

#### **11.0 PHOTOGRAPHS AND PROGRESS REPORT**

Refer relevant clause of Schedule-10 of this Volume.

#### **12.0 MANPOWER REPORT**

12.1 The Contractor shall submit to Purchaser/Consultant on the first day of every



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month, a Manpower Report for the upcoming/next month, detailing the manpower scheduled/proposed/planned to be deployed for the month, skill-wise and area-wise.

- 12.2 The Contractor shall also submit to the Purchaser/Consultant on the first day of every month, a manpower report of the previous month detailing the number of persons planned to have been deployed to that and actually deployed, skill-wise and the areas of employment of such labour.

### 13.0 PROTECTION OF WORK

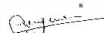
- 13.1 The Contractor shall have total responsibility for protecting his works till it is finally accepted by the Purchaser/Consultant. No claim will be entertained by the Purchaser/Consultant for any damage or loss to the Contractor's works and the Contractor shall be responsible for the complete restoration of the damaged works to its original condition to comply with the specifications and drawings. Should any such damage to the Contractor's works occur because of another party not under his supervision or control, the Contractor shall make and take-up its claim directly with the party concerned. If disagreement or conflict or dispute develops between the Contractor and the other party or parties concerned regarding the responsibility for damage to the Contractor's 'works' the same shall be resolved as per the provisions of above Clause-8 titled 'Cooperation with other Contractors'. The Contractor shall not cause any delay in the repair of such damaged 'Works' because of any delay in the resolution of such disputes. The Contractor shall proceed to repair the work immediately and no cause thereof will be assigned pending resolution of such dispute.
- 13.2 The Contractor and his Sub-Contractors shall take necessary care to see that no damage to the work which has been completed by others is caused by its own men during the course of execution of their work. The Contractor or its-sub-contractor are not responsible for protection of others work. However, Contractor shall ensure that no damage is caused by its own men during the course of execution of their work.
- 13.3 All other work completed or in progress as well as machinery and equipment that are liable to be damaged by the Contractor's work shall be protected by the Contractor and such protection shall remain and be maintained until its removal is directed by the Purchaser.
- 13.4 The Contractor shall effectively protect all the works from action of weather and from damages or defacement and shall cover finished parts where



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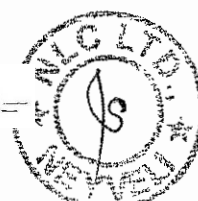
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required for their thorough protection. Face work shall be perfectly clean and free from defects.

- 13.5 The work shall be carried out onto completion without damage to any work and property adjacent to the area of his work, to whomsoever it may belong, without interference with the operation of their existing machines or equipment.
- 13.6 The Contractor shall provide the necessary temporary roadways, footways, guards as may be rendered necessary by reason of his work, for the protection and accommodation of foot passengers of other traffic of the Purchaser or occupier of adjacent property and of public. The Contractor shall at the times provide sufficient temporary barriers, notice boards and lights to protect and warn the public and post necessary watchman to guard the site and equipment. He shall take all precautions necessary and shall be responsible for the safety of the work to be performed by him. The Contractor shall also observe and display Safety First signs and shall have proper safety and fire protection equipment.
- 13.7 Adequate lighting at and near all the storage, handling, fabrication, pre-assembly and erection sites for properly carrying out the work and for safety and security shall be provided by the Contractor. The Contractor's work area shall be adequately lighted during night time too. The Contractor should also engage adequate electricians/wiremen, helpers, etc., to carry out and maintain these lighting facilities. If the Contractor fails to provide all the above listed facilities, the Purchaser may provide such facilities as it may deem necessary and charge the cost thereof to the Contractor. In any case the Contractor shall be liable for any damages and consequences arising out of its neglect in this regard.

#### 14.0 EMPLOYMENT OF LABOUR

- 14.1 The Contractor/Sub-Contractors will be expected to employ on the work skilled employees with experience of his particular work. No person below the age of eighteen years shall be employed.
- 14.2 The Contractor shall furnish details of the qualifications and experience of his senior supervisors and Consultants assigned to the work, including their experience in supervising erection and commissioning of plant and equipment of comparable capacity.
- 14.3 All travelling expenses including provisions of all necessary transport to and from site, loading allowances and other payments to the Contractor's

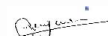


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- employees shall be the sole responsibility of the Contractor.
- 14.4 The hours of work on the site shall be decided by the Purchaser and the Contractor shall adhere to it. Working hours for each employee will normally be 8 (eight) hours per day.
- 14.5 The Contractor's employees shall wear suitable identification badges while on work at site clearly indicating his name, designation, Employer etc, among other essential details.
- 14.6 The Contractor shall ensure that it pays its personnel/workmen regular wages, overtime and other compensations. The attendance register and the wage register shall be submitted to the Purchaser for verification at regular intervals. The Contractor shall also furnish the Purchaser at fortnightly intervals a certificate that he has paid all the dues to his workmen. In case such payment is not made regularly by the Contractor, the Purchaser will be in his right to make such payments and deduct the same from the Contractor's progress payments.
- 14.7 In case the Purchaser becomes liable to pay any wages or dues to the labour or to any Government agency under any of the provisions of the Minimum Wages Act, Workmen's Compensation Act or any other law due to act of omission of the Contractor, the Purchaser may make such payments and shall recover the same from the Contractor's bills.
- 14.8 None of the Contractor's superintendents, supervisors, Consultants or labour may be withdrawn from the work without due notice being given to the Purchaser/Consultant. Further, no such withdrawal shall be made if, in the opinion of the Purchaser/Consultant, it will jeopardize the required pace of progress and/or the successful completion of the work.
- 14.9 In connection with the performance of work under this Contract, the Contractor shall not discriminate on the basis of race, religion, colour or national origin. It is also expected that the Contractor in his selection of personnel will give due regard to their ability to co-operate with the Purchaser/Consultant. Suggestions and recommendations made by the Purchaser/Consultant relating to the work and coordination thereof are to be carefully and courteously considered.

## 15.0 FACILITIES TO BE PROVIDED BY THE PURCHASER

### 15.1 Space


Refer Schedule-2 of this Volume.





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
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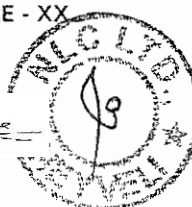
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## 15.2 Electricity

Refer Schedule-2 of this Volume.

## 15.3 Water

Refer Schedule-2 of this Volume.

## 15.4 Construction Tools and Equipment

Refer Schedule-2 of this Volume.

## 16.0 FACILITIES TO BE PROVIDED BY THE CONTRACTOR

### 16.1 Tools, Tackles and Scaffoldings

16.1.1 The Contractor shall provide at its own cost & expense, all the construction equipment, false work, erection tools, machine tools, power tools, tackles, hoists, cranes, derricks, cables, slings, skids, scaffolding work benches, tools for rigging, cribbing and blocking, welding machines preheating and stress relieving equipment, X-ray and all associated protective equipment, instruments, appliances, materials, and supplies required for unloading, transporting, storing, erection, testing and commissioning that may be required to accomplish the work under the Contract unless otherwise specifically provided for. Adequacy of such tools will be subject to final determination of the Purchaser/Consultant. He shall submit a list of all such materials to the Purchaser / Consultant before the commencement of pre-assembly at site. These tools and tackles shall not be removed from the site without the written permission of the Purchaser/ Consultant.

16.1.2 The Contractor shall also furnish all necessary expandable devices like anchors, grinding and abrasive wheels, raw plugs, hacksaw blades, taps, dies, drills, reamers, chisels, files, carborandum stones, oil stones, wire brushes, necessary scaffolding, ladders, wooden planks, timbers, sleepers and consumable material like welding electrodes, oxygen, acetylene, argon, lubricating oils, greases, cleaning fluids, cylinder oil, graphite powder and flakes, fasteners, gaskets, temporary supports, stainless steel shims of various thickness as required, cotton waste, cheese cloth and all other miscellaneous supplies of every kind required for carrying out the work under the 'Contract'.

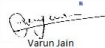
16.1.3 The Contractor shall provide all reasonable facilities including tools, personnel, etc. and ensure coordination with the Purchaser / Consultant and the SUB-Contractor's erection supervisors to enable them to carry out all supervision, measurements, checks, etc. in a satisfactory manner.



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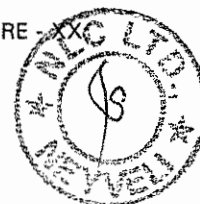
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16.1.4 The Contractor shall not dispose of, transport or withdraw any tools, tackles, equipment and material provided by him for the 'Contract' without taking prior written approval from the Purchaser/Consultant, and the Purchaser/Consultant at all times shall have right to refuse permission for disposal, transport or withdrawal of tools, tackles, equipment and material if, in his opinion, the same will adversely affect the efficient and expeditious completion of the 'Project'.

#### 16.2 Communication

The Contractor will make its own arrangement for all his communication needs such as telephone, email etc. at its Site Office. The Purchaser will assist or facilitate the Contractor in obtaining the above facilities, if requested.

#### 16.3 First-Aid

The Contractor shall provide necessary first-aid facilities for all its employees, representatives and workmen at the site.

#### 16.4 Cleanliness

16.4.1 The Contractor shall be responsible for proper house-keeping the entire area allotted to him, clean and free from rubbish, debris etc. during the period of 'Contract'. The Contractor shall employ sufficient number of special personnel to thoroughly clean his work area at least once in a day. All rubbish and scrap material shall be identified, stacked or disposed in a place to be identified by the Purchaser / Consultant. Materials and stores shall be so arranged to permit easy cleaning and upkeep. In areas where equipment might drip oil and cause damage to the floor surface, a suitable protective cover of a flame resistant, oil-proof sheet shall be provided to protect the floor from such damage.

16.4.2 Similarly, the offices of the Contractor shall be kept clean and neat to the satisfaction of the Purchaser/Consultant. Proper sanitary arrangements shall be provided by the Contractor in the work areas and offices of the Contractor.

#### 17.0 LINES AND GRADES

17.1 All the works shall be performed to the lines, grades and elevations indicated on the drawings. The Contractor shall be responsible to locate and layout the works. Basic horizontal and vertical control points will be established and marked by the Purchaser / Consultant at site at suitable points. These points shall be used as datum for the 'Works' under the Contract. The Contractor



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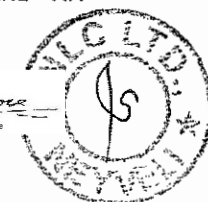
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shall inform the Purchaser / Consultant well in advance of the times and places at which he wishes to do work in the area allotted to him, so that suitable datum points may be established and checked by the Purchaser / Consultant to enable the Contractor to proceed with its works. Any work done without being properly located may be removed and/or dismantled by the purchaser/Consultant at Contractor's expense.

17.2 Where the Purchaser/Consultant had already established the base lines and bench marks adjacent to the various sections of work, the same must be carefully preserved by the contractor, and in case of their unnecessary destruction by him or any of his employees, these will be re-established by the Purchaser/Consultant at the Contractor's expense.

17.3 The Contractor shall be responsible for the accuracy of all dimensions within the various sections of the work according to the figures of dimensions in the drawings.

**18.0 FIRE PROTECTION – NOT APPLICABLE**

**19.0 SECURITY**

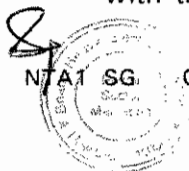
Refer Schedule-2 of this Volume.

**20.0 CONTRACTOR'S AREA LIMITS**

The Purchaser/Consultant will clearly demarcate the boundary limits of access roads, parking, spaces, storage and construction areas and the Contractor shall not tress-pass areas not so marked out for him. The Contractor shall be responsible to ensure that none of its personnel move out of the areas marked out for its operations. In case of such a need for the Contractor's personnel to work out of the areas marked out for him, the same shall be done only with the written permission of the Purchaser/Consultant.

**21.0 CONTRACTOR'S COOPERATION WITH THE PURCHASER**

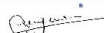
21.1 In cases where the performance of the erection work by the Contractor affects the operation of the system facilities of the Purchaser/Consultant such erection work of the Contractor shall be planned to be performed only in the manner stipulated by the Purchaser/Consultant and the same shall be acceptable at all times to the Purchaser/Consultant. The Purchaser/Consultant may impose such restrictions on the facilities provided to the Contractor such as electricity, water etc. as he may think fit in the interest of the Purchaser and the Contractor shall strictly adhere to such restrictions and co-operate with the Purchaser/Consultant. It will be the responsibility of the Contractor



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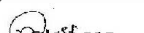
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to provide all necessary temporary instrumentation and other measuring devices required during start-up and operation of the equipment systems, which are erected by him. The Contractor shall also be responsible for flushing and initial filling of all the oil and lubricants required for the equipment furnished and erected by him, so as to make such equipment ready for operation. The Contractor shall be responsible for supplying such flushing oil and other lubricants unless otherwise specified elsewhere in these documents.

This clause comes into effect only in the case of interferences between the Contractor and Purchaser's other Contractors. In such a case, the Purchaser / Consultant will discuss with all the parties concerned to reach consensus in the overall interest of the Project.

21.2 The Contractor at all times shall work in coordination with the Purchaser's Consultants and offer them all reasonable facilities to become familiar with the erection, operation and maintenance of the equipment.

21.3 In respect of observations of local rules, administrative orders, working hours and the like, the Contractor and his personnel shall cooperate with the Purchaser.

## 22.0 COMMISSIONING

The 'Commissioning' of the equipment supplied and erected by the Contractor shall be the responsibility of the Contractor as detailed in Tender specification. The Contractor shall provide in addition, test instruments, calibrating devices etc. and the labour required for the successful performance of these tests. If it is anticipated that the above tests may prolong for a long time, the Contractor's workmen required for the above tests shall always be present at site during such tests.

## 23.0 MATERIAL HANDLING AND STORAGE

23.1 All the equipment furnished under the Contract and arriving at site shall be promptly received, unloaded and transported and stored in the storage spaces by the Contractor.

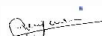
23.2 The Contractor shall be responsible for examining all the shipment and notify the Purchaser/Consultant immediately of any damage, shortage, discrepancy etc. for the purpose of Purchaser's / Consultant's information only. The Contractor shall submit to the Purchaser / Consultant every week a report detailing all the receipts during the week. However, the Contractor shall be



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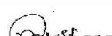
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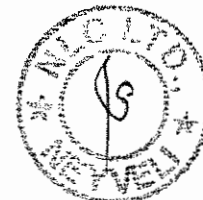
  
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- solely responsible for any shortages or damage in transit, handling and/or in storage and erection of the equipment at the site (Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor).
- 23.3 The Contractor shall maintain an accurate and exhaustive record detailing out the list of all equipment received by him for the purpose of erection and keep such record open for the inspection of the Purchaser/Consultant at any time.
- 23.4 All equipment shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings etc shall be used for unloading and/or handling of the equipment without the specific written permission of the Purchaser/Consultant. The equipment stored shall be properly protected to prevent damage either to the equipment or to the floor where they are stored. The equipment from the store shall be moved to the actual location at the appropriate time so as to avoid damage for such equipment at site.
- 23.5 All electrical panels, control gears, motors and such other devices, shall be properly dried by heating before they are installed and energized. Motor bearings, slip rings, commutators and other exposed parts shall be protected against moisture ingress and corrosion during storage and periodically inspected. Heavy rotating parts in assembled condition shall be periodically rotated to prevent corrosion due to prolonged storage and shall also be periodically inspected.
- 23.6 All electrical equipment such as motors, generators etc. shall be tested for insulation resistance at least once in three months from the date of receipt till the date of commissioning and a record of such measured insulation values shall be maintained by the Contractor. Such records shall be open for inspection by the Purchaser/Consultant.
- 23.7 The Contractor shall ensure that all the packing materials, and protection devices used for the various equipment during transit and storage are removed before the equipment are installed.
- 23.8 The consumables and other supplies likely to deteriorate due to storage must be thoroughly protected and stored in a suitable manner to prevent damage or deterioration in quality by storage.
- 23.9 All the materials stored in the open or dusty locations must be covered with suitable weatherproof and flameproof and flame proof covering material wherever applicable.





- 23.10 If the materials belonging to the Contractor are stored in areas other than those earmarked for him, the Purchaser/Consultant will have the right to get it moved to the area earmarked for the Contractor at the Contractor's cost.
- 23.11 The Contractor shall be responsible for making suitable indoor storage facilities to store all equipment which require indoor storage. Normally all the electrical equipment, such as motors, control gears, generators, exciters and consumables like welding electrodes, lubricants, etc. shall be stored in the closed storage space. The Purchaser/Consultant in addition, may direct the Contractor to move certain other materials which in his opinion will require indoor storage, to indoor storage areas which the Contractor shall strictly comply with.
- 23.12 The Contractor shall arrange for periodic inspection of material/equipment in his custody until taken over by the Purchaser and shall carry out all protective and preservative measures required thereupon.
- 23.13 The Contractor shall also keep a check on the deliveries of the equipment/material covered in his scope of erection and shall advise the Purchaser well in advance regarding possible hold-ups in his work due to expected delays in delivery of equipment, to enable the Purchaser to expedite the deliveries if Supplier is different from the Contractor.
- 23.14 All materials of Contractors should be received only during normal working hours. Damage of any of the roads due to movement of heavy trucks, trailers, crane and other equipment of the Contractor shall be made good by the Contractor. Otherwise same shall be got rectified by the Purchaser at the risk and cost of the Contractor.
- 23.15 All C&I electronic equipment shall be stored in Air-conditioned storage facility under the specified temperature and humidity conditions.

#### 24.0 CONSTRUCTION MANAGEMENT

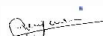
- 24.1 The field activities of the Contractors working at site, will be coordinated by the Purchaser/Consultant and the Purchaser/ Consultant's decision shall be final in resolving any disputes or conflicts between the Contractor and other Contractors of the Purchaser regarding scheduling and co-ordination of work..
- 24.2 The Purchaser/Consultant shall hold weekly meetings of all the Contractor's working at site, at time and a place to be decided by the Purchaser/Consultant. The Contractor shall attend such meetings and take notes of discussions during the meeting and the decisions of the Purchaser /



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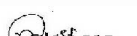
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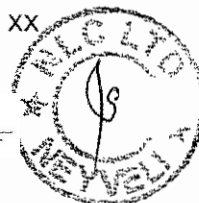
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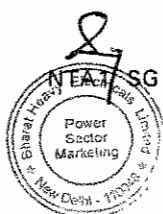
Consultant and shall strictly adhere to those decisions in performing his 'Works'. In addition to the above weekly meetings, the Purchaser / Consultant may call for other meetings either with individual Contractors or with selected number of Contractors and in such a case the Contractor, if called, will also attend such meetings.

24.3 Time is the essence of the 'Contract' and the Contractor shall be responsible for performance of its works in accordance with the specified construction schedule. If at any time, the Contractor is falling behind the schedule, he shall take necessary action to make good for such delays by increasing his work force or by working overtime or otherwise accelerate the progress of the work to comply with the schedule and shall communicate such action in writing to the Purchaser / Consultant satisfying that his action will compensate for the delay. The Contractor shall not be allowed any extra compensation for such action.

24.4 The Purchaser / Consultant shall however not be responsible for provision of additional labour and/or materials or supply or any other services to the Contractor except for the co-ordination work between various Contractors as set out earlier.

## 25.0 FIELD OFFICE RECORDS

25.1 The Contractor shall maintain at its site Office up-to-date copies of all drawings, specifications and other Contract Documents and any other supplementary data, complete with all the latest revisions thereto. The Contractor shall use only 'Approved-For Construction' drawings on the field, showing the approval stamp & category (Approval by Purchaser/Consultant). The Contractor shall also maintain, in addition, the continuous record of all changes, approval (by Purchaser/Consultant) status to the above Contract Documents, drawings, specifications, supplementary data, etc. effected at the field and on completion of his total assignment under the Contract shall incorporate all such changes on the drawings and other Consultant data to indicate as-built conditions of the equipment furnished and erected under the Contract. Such drawings and Engineering, data shall be submitted to the Purchaser / Consultant in required number of copies. A record of all readings taken during the alignment of the equipment shall be maintained by the Contractor. This shall be signed by the erection supervisor and the Purchaser/Consultant as a token of their acceptance of the same. All such records shall be handed over to the Purchaser on completion of the works.

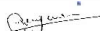


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## 26.0 CONTRACTOR'S MATERIAL BROUGHT TO SITE

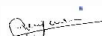
- 26.1 The Contractor shall bring to site all equipment, components, parts, materials including construction equipment, tools and tackles for the purpose of the works under intimation to the Purchaser/Consultant. All such goods shall, from the time of their being brought vest in Purchaser, but may be used for the purpose of the works only and shall not on any account be removed or taken away by the Contractor without the written permission of the Purchaser/Consultant. But the Contractor shall nevertheless be solely liable and responsible for any loss or destruction thereof and damage thereto.
- 26.2 The Purchaser shall have a lien on such goods belonging to the Contractor for any sum or sums, which may at any time, be due or owing to him by the Contractor, under, in respect of or by reasons of the 'Contract'. After giving a 30 (thirty) days notice in writing of his intention to do so, the Purchaser shall be at liberty to sell and dispose of any such goods, in such manner as he shall think fit including public auction or private treaty and to apply the proceeds in or towards the satisfaction of such sum or sums due as aforesaid.
- 26.3 After the completion of the works, the Contractor shall remove from the site under the direction of the Purchaser/Consultant the materials such as construction equipment, erection tools and tackles, scaffolding, etc. with the written permission of the Purchaser / Consultant. If the Contractor fails to remove such materials, within 30 (thirty) days of issue of a notice by the Purchaser/Consultant to do so, then the Purchaser/Consultant shall have the liberty to dispose of such materials as detailed under Clause 16.4 above and credit the proceeds to the account of the Contractor.
- 26.4 On completion of the work, all rubbish, kilns, vats, tanks materials and temporary structures of any sort or kind used for the purpose or connected with the construction/erection work are to be removed by the Contractor and all pits and excavations filled up and the site handed over in a tidy and workmanlike condition and no final payment or settlement of the account for the said work shall held or due shall be made to the Contractor till such site clearance shall have been effected by him and such clearance shall be made by the Purchaser at the expense of the Contractor in the event of his failure to comply with this provision within 7 (seven) days after receiving notice in writing from the Purchaser to that effect. If it becomes necessary for the Purchaser to have the site cleared as indicated above at the expense of the Contractor, the Purchaser shall under no circumstances be held liable for any



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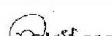
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losses of damages to such of Contractors property as may be on such site due to such removal there from, which removal may be effected by means of public sale of such materials and property in such a way as deemed fit and convenient to the Purchaser.

- 26.5 The Contractor must take sufficient care in moving his construction/erection plant and equipment from one place to another so that they may not cause any damage to the property of the Purchaser, particularly of the existing structures and overhead and underground services and in the event of the Contractors failure to do so, the cost of such damages shall be borne by the Contractor.

### 27.0 PROTECTION OF PROPERTY AND CONTRACTOR'S LIABILITY

- 27.1 The Contractor shall be responsible for any damage resulting from his operations. He shall also be responsible for protection of all persons including members of public and employees of the Purchaser and the Purchaser/Consultant and the employees of other Contractors and Sub-Contractors and all public and private property including structures, buildings, other plants and equipment and utilities either above or below the ground.
- 27.2 The Contractor will ensure provision of necessary safety equipment such as barriers, signboards, warning lights and alarms, etc. to provide adequate protection to persons and property. The Contractor shall be responsible to give reasonable notice to the Purchaser/Consultant and the Owner of public or private property and utilities when such property and utilities are likely to get damaged or injured during the performance of his 'Works' and shall make all necessary arrangements with such owners, related to removal and/or replacement or protection of such property and utilities.

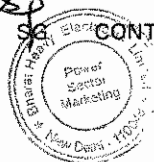
### 28.0 PAINTING

All exposed metal parts of the equipment including pipings, structures, railings, etc. after installation, unless otherwise surface protected, shall be first painted with at least one coat of suitable primer which matches the shop primer paint used, after thoroughly cleaning all such parts of all dirt, rust, scales, greases, oils and other foreign materials by wire brushing, scraping or shot blasting, and the same being inspected and approved by the Purchaser for painting. Afterwards, the above parts shall be finished with two coats of machinery enamel paints. The quality of the finish paint shall be as per the standards of ISI or equivalent and to be of the colour as approved by the Purchaser/Consultant.

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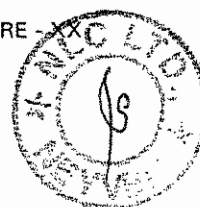


  
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## 29.0 INSURANCE

Refer Clause - Insurance under Schedule - 10 of this Volume.

## 30.0 UNFAVOURABLE WORKING CONDITIONS

The Contractor shall confine all his field operations to those works which can be performed without subjecting the equipment and materials to adverse effects, during inclement weather conditions, like monsoon, storms, etc. and during other unfavorable construction conditions. No field activities shall be performed by the Contractor under conditions which might adversely affect the quality and efficiency thereof, unless special precautions or measures are taken by the Contractor in a proper and satisfactory manner in the performance of such works and with the concurrence of the Purchaser/Consultant. Such unfavorable construction conditions will in no way relieve the Contractor of his responsibility to perform the 'Works' as per the schedule.

## 31.0 PROTECTION OF MONUMENTS AND REFERENCE POINTS

31.1 The Contractor shall ensure that any finds such as relic, antiquity, coins, fossils, etc. which he may come across during the course of performance of 'Works' either during excavation or elsewhere are properly protected and handed over to the Purchaser/Consultant.

31.2 Similarly the Contractor shall ensure that the bench marks, reference points, etc., which are marked out either with the help of Purchaser/Consultant or by the Purchaser/Consultant shall not be disturbed in any way during the performance of his 'Works'. If any work is to be performed which may disturb such references, the same shall be done only after these are transferred to other suitable locations under the direction of the Purchaser/Consultant. The Contractor shall provide all necessary materials and assistance for such relocation of reference points, etc.

## 32.0 WORK & SAFETY REGULATIONS

Refer Technical Specification and also Annexure-XVII of this Volume.

## 33.0 ELECTRICAL SAFETY REGULATIONS

Refer Technical Specification and also Annexure-XVII of this Volume.

## 34.0 FOREIGN PERSONNEL

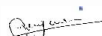
Refer Schedule-7 of this Volume.



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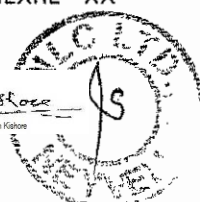
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### 35.0 PURCHASER'S INSTRUCTIONS

The Purchaser/Consultant may, in his absolute discretion, from time to time, issue further drawings and/or written instructions, details, directions and explanations, which are collectively referred to as "Purchaser's Instructions", in regard to :

1. Any additional drawings and explanations to exhibit or illustrate details.
2. The variation or modification of the design, quality or quantity of work or the additions or omission or substitution of any work.
3. Any discrepancy in the drawings or between the Schedule of Quantities and/or specification.
4. The removal from the site of any materials brought thereon by the Contractor and the substitution of other materials thereof.
5. The removal and/or re-execution of any work executed by the Contractor.
6. The dismissal from the work of any persons employed thereupon.
7. The opening up for inspection of any work covered up.
8. The amending and making good of any defects.
9. The Contractor shall comply with and duly execute any work covered in such 'Purchaser's Instructions' provided always that verbal instructions, directions, and explanations given to the Contractor or his foreman upon the work by the Purchaser/Consultant shall, if involving a variation, be confirmed in writing by the Purchaser/Consultant within 7 (seven) days.
10. If compliance with the 'Purchaser's Instructions' as aforesaid involves work and scope beyond that contemplated by the 'Contract', unless the same were issued owing to some breach of this 'Contract' by the Contractor, the Purchaser shall pay to the Contractor the price of the said work as hereinafter provided.
11. If the Contractor after receipt of written notice from the Purchaser/Consultant requiring compliance, with such further drawings and/or 'Purchaser's Instructions' fails to comply with the same within 15 (fifteen) days the Purchaser may employ and pay other agencies to execute any such work whatsoever, as may be necessary to give effect thereto, and all costs incurred in connections therewith shall be

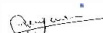


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recoverable from the Contractor by the Purchaser on a certificate by the Consultant as a debt or may be deducted by the Purchaser from any money that may become due to the Contractor.

### 36.0 RIGHTS OF THE PURCHASER/CONSULTANT

#### 36.1 Right to Illustrate and Explain Plans

36.1.1 The various parts of the 'Contract' are intended to be complementary to each other but should any discrepancy appear or any misunderstanding arise as to the import of anything contained therein, the explanation of the Purchaser/Consultant shall be final and binding.

36.1.2 The correction of any errors or omissions of the Drawings and Specifications may be made by the Purchaser / Consultant, when such correction is necessary to bring out clearly the intention which is indicated by the reasonable interpretation of the Drawings and Specifications as a whole.

36.1.3 Whenever in the Specifications or on the Drawings which are a part of the 'Contract' or which may be furnished to the Contractor for directing this work, the terms and descriptions of various qualities of workmanship, material, structures, processes, plant or other features of the 'Contract' are described in general terms, the meaning or fulfillment of which must depend upon individual judgement, then in all such cases the question of fulfillment of such specifications or requirements shall be decided by the Purchaser / Consultant and said material shall be furnished, said work shall be done, and said structure, process, plant or feature shall be constructed, furnished or carried on in full and complete accordance with his interpretation of the same and to his full satisfaction and approval, provided such interpretation is not in direct conflict with the Drawings and Specifications and generally accepted good engineering practice.

36.1.4 Details shown either on the Drawings or in the Specifications shall be done and furnished as if shown in both except where expressly except either in the Specifications or on the Drawings. Figured dimensions shall in all cases be taken in preference to scale measurements and detailed drawings consistent with general drawings shall be taken in preference to the general drawings of the same part of the work.

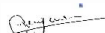
36.1.5 The Purchaser / Consultant may, from time to time, prepare for his own use estimates of quantities or bills of materials required for the work. Copies of such estimates or bills of materials which may be given to the Contractor for his convenience, or any lists, weights or quantities of materials or structures



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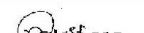
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which may appear on the drawings may not be considered as finally correct, sufficiently complete or accurately covering any portion or all of the work to be done under the 'Contract'. Such bills or estimates may be carefully assembled and prepared but their accuracy is not guaranteed. They may not be accurate as to any particular details and are given only as the best information available at the time of issue of the information. It is understood that any such lists or estimates are furnished to the Contractor for his convenience only and not as lists or estimates of work to be done, and many necessary items of work might have been omitted.

36.1.6 Additional drawings and explanations to exhibit or illustrate details may be provided by the Purchaser / Consultant whenever necessary and if so provided, and if consistent with the Drawings and Specifications, it shall be binding upon the Contractor to take cognizance of the same. The written decision of the Purchaser / Consultant as to the true construction and meaning of the Drawings and Specifications and of such additional drawings and explanations shall be binding upon the Contractor.

#### 36.2 Right to Direct Work

36.2.1 The Purchaser / Consultant shall have the right to direct the manner in which all work under this Contract shall be conducted, in so far as it may be necessary to secure the safe and proper progress and the specified quality of the work, and all work shall be done and all material shall be furnished to the satisfaction and approval of the Purchaser / Consultant.

36.2.2 Whenever, in the opinion of the Purchaser / Consultant, the Contractor has made marked departures from the schedule of completion laid down in the Contract or when untoward circumstances force a departure from the said schedule, the Purchaser / Consultant, in order to assure the compliance with the schedule and the provisions of the 'Contract', shall direct the order, pace and method of conducting the work, which shall be adhered to by the Contractor.

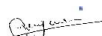
36.2.3 If, in the judgement of the Purchaser / Consultant, it becomes necessary at any time to accelerate the overall plant erection work, the Contractor, when ordered and directed by the Purchaser / Consultant, shall cease work at any particular point and transfer his men to such other point or points, and execute such portion of his work, as may be required, to enable others to hasten and properly engage and carry on their work, all as directed by the Purchaser / Consultant.



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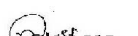
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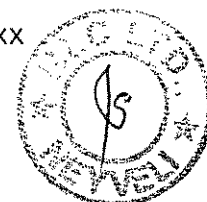
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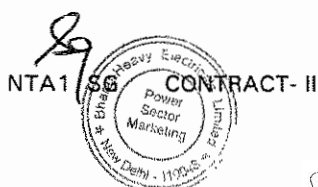
36.2.4 Night work will be permitted only with prior approval of the Purchaser / Consultant. The Purchaser / Consultant may also direct the Contractor to operate extra shifts over and above normal day shift for the completion of 'Contract' on schedule if, in his opinion, such work is required.

**36.3 Right to Order Modifications of Methods and Equipment**

36.3.1 If at any time the Contractor's methods, materials or equipment appear to the Purchaser / Consultant to be unsafe, inefficient or inadequate for securing the safety of the workmen or the public, the quality of work or the rate of progress required, he may order the Contractor to ensure their safety and increase their efficiency and adequacy, and the Contractor shall promptly comply with such orders. If at any time, the Contractor's working force and equipment are in the opinion of the Purchaser / Consultant, inadequate for securing the necessary progress, as herein stipulated, the Contractor shall, if so directed, increase the working force and equipment to such an extent as to give reasonable assurance of compliance with the schedule of completion. The absence of such demands from the Purchaser / Consultant shall not relieve the Contractor of his obligations to secure the quality, the safe conducting of the work, and the rate of progress required by the Contract, and the Contractor alone shall be and remain liable and responsible for the safety, efficiency and adequacy of his methods, materials, working force and equipment, irrespective of whether or not he makes any change as a result of any order or orders received from the Purchaser / Consultant.

**36.4 Right to Perform**

36.4.1 The Purchaser reserves the right to perform or have performed in and about the works during the time when the Contractor is performing his work hereunder, such other work as the Purchaser desires, and the Contractor shall make all reasonable effort to perform his work hereunder in such a manner as will enable such other work to be performed without hindrance and shall make no claim for damage against the Purchaser arising out of such other work to be performed against hindrance and shall make no claim for damage against the Purchaser arising out of such other work or interference there from. The Contractor shall work in harmony with such other Contractor's regardless of race, religion, colour or national origin and any dispute between Contractors shall be arbitrated by the Purchaser / Consultant.



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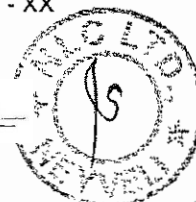
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### 37.0 MEASUREMENT OF WORK AND PROGRESS PAYMENTS

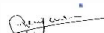
- 37.1 The Purchaser / Consultant may, from time to time, intimate the Contractor that he requires the works to be measured and the Contractor shall attend or send a qualified agent to assist the Purchaser / Consultant or its representative in taking such measurements and calculations and to furnish all particulars as may be required.
- 37.2 Where the erection of equipment, vessels and structural steel is involved, the basis of such measurements and progress evaluation shall be weights specified in the shipping documents or invoices or drawings as decided by the Purchaser / Consultant. Should the Contractor not attend or neglect or omit to send such agents, then the measurement taken by the Purchaser / Consultant or approved by him shall be taken to be the correct measurements of the work. The Contractor or its Agent may, at the time of measurement, take such notes of measurements as it may deem fit.
- 37.3 When measurements are effected by conditions already established, the Contractor shall take field measurements notwithstanding scale or dimensions shown on the drawings.
- 37.4 The measurements so taken and certified correct by the Purchaser / Consultant shall be the basis for the progress payment to the Contractor. Where the break-up of 'Contract on unit basis Price' is difficult to arrive at, the Purchaser / Consultant and the Contractor shall work out at the commencement of the 'Contract', the weightages or the cost or the cost break-ups to arrive at a mutually agreeable basis for computation of the progress estimates.
- 37.5 To the value so arrived at on the basis of the Contractor's monthly progress evaluated, shall be added the amounts earned by the Contractor under supplemental Contracts and orders if any, till date of the progress estimate. From the total thus computed, all previous payments plus any amounts due to the Purchaser in accordance with the terms of this Contract shall be deducted. The remainder shall be paid by the Purchaser to the Contractor under Interim Certificates from the Consultant.
- 37.6 In case work is nearly suspended or in case only unimportant progress is being made, or in case it is apparent that Contractor is about to forfeit his 'Contract' or that the money yet due to him shall not complete his 'Contract', the Purchaser may at his discretion withhold any payment which may be due to the Contractor.



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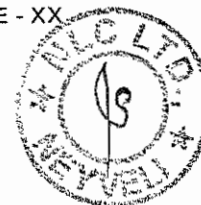
  
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37.7 The Purchaser may withhold part or whole of any payment for erection claimed by the Contractor, which in opinion of the Purchaser, is necessary to protect himself from loss on account of :

- (a) Defective work not remedied or guarantees not met.
- (b) Claims filed against the Contractor.
- (c) Failure of the Contractor to make due payment for materials supplied or labour employed by him.
- (d) Damage to other Contractor's Purchaser's or Other's property.
- (e) Failure to meet the mutually agreed schedules.
- (f) When the grounds for withholding payments are removed, payments of the amount due to the Contractor shall be made by the Purchaser within a reasonable period.
- (g) The Contractor shall not demand nor be entitled to receive payment for the work of portion thereof, except in the manner set forth in this 'Contract' and only after the Purchaser / Consultant shall have given a certificate for such payment.

### 38.0 ADHERENCE TO MANUFACTURER'S INSTRUCTION

Adherence to instructions of the Manufacturer's supervisory Consultants, is compulsory. The Contractor shall work under the guidance of the Manufacturer's supervisors to ensure that erection procedures adopted by the Contractor as well as completed erection of equipment is such as not to interfere with or prevent equipment from functioning as intended, as well as to the entire satisfaction of the Manufacturer's supervisor / Purchaser / Consultant. The Contractor shall also permit and provide all facilities for the Manufacturer's erection supervisors to carry out all checks that they may wish to, and approve any erection procedure and/or final setting and alignment of components, in order to satisfy themselves that erection has not been carried out as intended by them. This shall, however, in no way relieve the Contractor of his responsibility for providing adequate and competent supervision and quality workmanship.

### 39.0 MODIFICATIONS

The Contractor shall carry out all modifications at site as directed by the Purchaser / Consultant to complete the work covered in the Contract. It is the responsibility of the Contractor to get the prior approval for such modifications from the Purchaser / Consultant before such works are taken



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up. The Contractor shall also get the estimates and the actual time sheets certified by the Purchaser/Consultant, and these certified time sheets will be the basis for processing his bills for such modification works which are required to be carried out for no fault of the Contractor.

#### **40.0 DEFECTIVE WORK**

If the work or any portion thereof shall be damaged in any way excepting by the acts of the Purchaser or if defects not readily detected by prior inspection shall develop before the final completion and acceptance of the whole work, the Contractor shall forthwith make good, without compensation, such damage or defects in a manner satisfactorily to the Purchaser / Consultant. In no case shall defective or imperfect work be retained.

#### **41.0 WORK OF OTHERS**

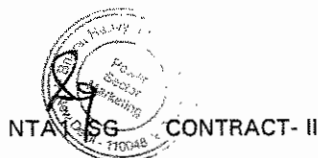
If any part of the Contractor's work depends, for proper execution, upon the work of any other Contractor, the Contractor shall inspect and promptly report in writing to the Purchaser / Consultant any defect in such work of other Contractors that render it unsuitable for proper execution of the work under the Contract. His failure to so inspect and report shall constitute an acceptance of the other Contractor's work as fit and proper for the reception of his work, except as to defects which may develop in the work of other Contractors after the proper execution of the work. To ensure proper execution of his subsequent work, the Contractor shall inspect work already in place and shall at once report to the Purchaser / Consultant any discrepancy between the executed work and the drawings.

This clause comes into effect only in the case of interferences between the Contractor and Purchaser's other Contractors. In such a case the Purchaser / Consultant will discuss with all the parties concerned to reach a consensus in the overall interest of the Project.

### **GENERAL CONDITIONS FOR CIVIL WORKS**

Intentionally deleted.

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ANNEXURE - XVII  
SAFETY CODE FOR CONTRACTOR

1.0 GENERAL

- 1.1 Safety is the responsibility of every employee, individually and collectively.
- 1.2 Head of the Dept/Division should ensure that a copy of this Contractor's Safety Code is handed over to every Contractor working under his control and he should in turn prominently display all rules on the office/site notice board for the benefit of all the men working under him.
- 1.3 The Contractor shall in connection with provide adequate guards, illumination, fencing and watch wherever necessary at the construction site & working area, for the safety & convenience of general public.
- 1.4 Fire extinguishers adequate in number and with proper validity shall always be kept by the Contractor at the site of works, where there is risk of fire hazard, especially near the site stores.
- 1.5 Adequate washing facilities with proper drainage shall be provided and properly maintained near the place of work but at a safe distance from railway tracks and busy roads.
- 1.6 Whenever work is to be undertaken near a place, where there is a risk of drowning, arrangements to be made for safe barricading of such areas. All necessary equipment shall be provided and kept ready for use and necessary steps taken for prompt rescue of any person in danger and adequate provision shall be made for prompt first-aid treatment of all injuries likely to be sustained during the course of the work, in case of a mishap.
- 1.7 To ensure effective enforcement of the rules and regulations relating to safety precautions, the arrangements made by the Contractor shall be open to inspection by the Safety Engineer, the Labour Officer, Engineer-in-charge of the concerned Department or their representatives.
- 1.8 Notwithstanding the above clauses, there is nothing in these to exempt the Contractor from the operation of any other Act or Rule in the Republic of India for the safety of men and materials.
- 1.9 An injury sustained in the plant, must be immediately reported to the First-Aid Station or next higher Supervisor/Officer in-charge, no matter how minor the nature of the injury.



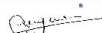
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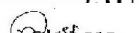
- 1.10 In case of a fatal accident, the Contractor must inform the Engineer in-charge of the department for which he is working and a report in writing should be made, clearly explaining the sequence of events leading to the accident.
- 1.11 Smoking or use of naked lights is strictly prohibited near gas lines, valves and any other equipment linked to the gas distribution networks.
- 1.12 Smoking and carrying of matches, lighters and other spark producing devices is strictly prohibited within the area where inflammable liquids are stored, handled or used or where loading or unloading operations are performed. Any tank or container containing inflammable liquid should be properly grounded for preventing ignition due to static electricity charges. Contractor should ear-mark such areas and provide necessary signage and warning signals.
- 1.13 Contractors should ensure that employees do not report to work while under the influence of intoxicants. Any employee found on duty under the influence of liquor or of intoxicating drugs, will be liable to severe disciplinary action.
- 1.14 Work surroundings should be kept clean, free from oil, grease and other obstructions or fallen objects like nuts bolts etc.
- 1.15 After a job or work is completed, all left-over junk and other scrap materials should be cleared from the area immediately.
- 1.16 Drums or other make-shift arrangement must not be used in place of ladders or as work benches or supports for any job.
- 1.17 Employees shall not walk through or cross any operating units unless their duties require them to do so, or they are authorised.
- 1.18 Compressed air should not be used for removing dust from one's clothes and deliberately directed or used on any person as it is likely to cause serious injury.
- 1.19 If an employee, in the course of his work, encounters conditions of unusual hazard with which he is not familiar, he should contact the supervisor for advice before proceeding further. He should also inform the Contractor as well as the Engineer in-charge.
- 1.20 Contractors should particularly ensure that they or their employees do not meddle with any equipment they are not concerned or unfamiliar with and see that they should generally keep away from such equipment.
- 1.21 It should be ensured that no one takes rest/shelter below any under cut pit/excavation or near any stock-pile of materials.



  
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- 1.22 For any work involving repair & maintenance underground, the Contractor shall follow the safety procedural orders/instruction issued by the Purchaser.
- 1.23 The Contractor shall ensure supervision of such jobs by competent persons within the meaning of Factories Act & Rules.
- 1.24 All persons engage on such jobs shall have to have before hand proper training instructions as required under Factories Act & Rules.

## 2.0 SAFETY MEASURES IN CONTRACT WORK

Whereas, it is necessary to take steps to ensure safety at work sites by the executing contractual agency, it is incumbent of the Purchaser to introduce all measures to guide, induce, train and bind the agencies concerned to adopt remedial steps to prevent accidents. Problem gets aggravated in contractual zones due to lack of training, in-adequate supply of personal protective equipment, shortage of skilled labour changing deployment of works etc. Accordingly, the following measures are intended to be introduced and the salient clauses will be included in the contract documents.

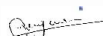
- 2.1 The Contractor shall take all safety precautions and provide adequate supervision in order to carryout the job safely and without damage to men & equipment.
- 2.2 Any special safety precautions, if required to be followed by the Contractor, such clauses shall be added.
- 2.3 The executing department would take necessary shut-downs wherever there are hazards of gases, electricity, moving machinery etc. The Contractor shall ensure that the shut-down/clearance are taken before deploying workers to such locations.
- 2.4 The Contractor shall supply safety appliance such as safety shoes, safety belts, helmets, gloves, harness etc. to his workers depending on working conditions and life saving jackets shall always be kept in readiness at the site. The Contractor shall not deploy any workmen without safety shoes and safety helmet and the safety applicable to the specific work conditions.
- 2.5 Before starting the day's job, the Purchaser's Supervisor/representatives will ensure that safety briefing has been done to the Contractor's supervisor who has previously been imparted safety induction training.
- 2.6 Head / Zonal in-charge will nominate Engineer in-charge of the contractual work under reference who will be fully responsible for the safe execution of the work at site.



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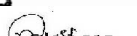
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- 2.7 In case of injury to persons, the Contractors shall first take the injured person to nearest hospital with the necessary forms. In no case the Contractors are allowed to take injured persons directly to their own Doctors.
- 2.8 The Contractor shall abide by the provisions of Factories Act, State Factory Rules, Workmen's Compensation Act, Payment of Wages Act, Contract Labour (Regulation) Act etc. and keep the Purchaser indemnified of provision the above Acts and Rules.
- 2.9 The Head of Deptt. executing the contract upon the satisfaction that the Contractor is not conforming to the Safety requirements may direct stoppage of work and require the Contractor to remedy the defects. The Contractor shall not proceed with the work until he has complied with each directions to the satisfaction of such Head of the Department.
- 2.10 The Contractor shall be fully responsible for accidents caused due to him or his agents or workmen's negligence or carelessness in regard to the observance of the safety requirements and shall be liable to pay compensation for injuries.
- 2.11 Without prejudice to the right conferred by the above clause, for stoppage of work for violations of safety requirements the Contractor shall be liable for penalty as deemed fit for violation of safety rules & regulations upto first two instances. For the third violation he shall be liable to be debarred from further contracts upto a period of one year from the date of issue of debarring notice.
- 2.12 The Head of the Safety Engg. Deptt. or the Head of the Deptt. executing the contract will assess the penalty amount having regard to the circumstances, in particular, the nature and gravity of the violation. After issuing a notice to the Contractor to show cause why the amount specified therein shall not be imposed as a penalty and considering the cause shown by the Contractors, if any, he shall pass final orders which shall then be final and binding on the Contractor. The penalty amount will be recoverable from any bill and/or EMD/SD of the Contractor without any further reference to him.
- 2.13 Whenever work, at heights is involved, Contractor must obtain necessary permissions and clearances from the Safety Engg. Dept. for such persons required to do work at height.
- 2.14 Contractor must insure all the workmen under the "Workmen Compensation Act."

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**SCHEDULE-9**

**PERFORMANCE GUARANTEES**

**9.1 General**

1. The contractor shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment covered in the Contract specifications.
2. The contractor shall demonstrate and establish performance guarantee for various equipment and achieve performance guarantee values as per Contract Specification, at site in the presence of the Purchaser/Consultant for each unit individually.
3. Details of performance guarantee tests and method of computation of performance values shall be as per Contract Specification.
4. The Contractor shall supervise and direct the operation during performance tests and shall take complete responsibility in this regard.
5. During performance tests, the Purchaser shall make available necessary normal operating & maintenance personnel.
6. The Contractor shall provide and install all measuring instruments required for checking the guaranteed performance which are not included among the permanent measuring instruments of the system/sub-system. Such instruments shall be furnished by the Contractor on a temporary basis for the duration of the performance guarantee tests.

**9.2 Performance Guarantee Values, Categories, Demonstration of Performance/Acceptance Tests and Liquidated Damages for Shortfall in performance / Non-Performance**

1. Performance and ratings of the various offered equipment, as covered in this specification, shall be guaranteed by the Contractor.
2. The guaranteed performance parameters furnished by the contractor in its offer, shall be without any tolerance values and all margins required for instrument inaccuracies and other uncertainties (permitted as per agreed test codes) and other uncertainties shall be deemed to have been included in the guaranteed figures.
3. The Contractor, during performance guarantee / acceptance test, shall demonstrate all the guarantees as covered in this Schedule. Bid price quoted by the Contractor shall include all costs associated with the tests.
4. Ambient conditions for guaranteed efficiency of steam generator shall be as follows:
  - (a) Ambient Air Temperature : 27°C
  - (b) Relative Humidity : 71%
  - (c) Design Fuel / Lignite : As per Vol-IIA Specifications
5. Contractor shall quote the steam generator efficiency (by heat loss method) as per the requirement of BS EN 12952-15, 2003 (reaffirmed, latest). The

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guaranteed efficiency quoted by the Contractor shall comply with following limiting parameters with lignite firing.

- (a) Excess air at economizer outlet (at TMCR load) :  $\geq 17\%$ . If (i) quoted / (ii) actual value during the PG tests is higher than 17% the higher value will be taken.
- (b) Corrected flue gas temperature at RAPH outlet (at TMCR Load) :  $150^{\circ}\text{C}$  or as predicted by the Contractor, whichever is higher
- (c) Loss due to un-burnt carbon in bottom ash at 100% TMCR) in : 1.5% (minimum) or quoted/actual value during the PG tests whichever is higher.

**Note!** No credit shall be given to the Contractor, in the evaluation of the results of the guarantee tests for performance predictions / guarantee etc. if the values considered by the contractor for parameters indicated above are lower (or better) than those specified above.

6. The performance guarantee tests shall be conducted by the Contractor for each unit individually and liquidated damages for non-performance as indicated under this schedule will be levied separately for each unit.

### 9.3 Performance Guarantee / Acceptance Test

- The final test (performance guarantee / acceptance test) shall be conducted at site by the Contractor in presence of the Purchaser / Consultant. Such test will be completed, within a period of 3 (three) months after the successful completion of Trial Operation.
- Instrumentation used, their accuracy class, their numbers & location etc. for carrying out performance guarantee / acceptance / demonstration tests shall be as per relevant codes and shall be subject to Purchaser's approval. In addition the values of parameters shall also be logged from the information system provided under Purchaser's DDCMIS (under Purchaser's scope) Tests will be conducted at specified load points.
- Any special equipment, tools and tackles required for the successful completion of the performance guarantee / acceptance / demonstration tests shall be provided by the contractor at its cost.
- If equipment / system fail to meet the guarantees, all necessary modifications and / or replacements shall be carried out by the successful Contractor(contrctor) without any extra cost to the Purchaser so that the equipment / system comply with the guaranteed requirements. However, if even after above modifications / replacements, the contractor is not able to demonstrate the guarantees within 90 days or within a reasonable period allowed by the Purchaser (reckoned from the date on which the tests have been completed) the Purchaser will have the right to the following:
  - To reject the equipment / system / plant and recover the payment already made



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**OR**

to accept the equipment / system / plant after levying Liquidated Damages (LD) as specified in this Schedule (These are termed as "Category – I" Guarantees)

- (b). To reject the equipment / system / plant and recover the payment already made. (These are termed as "Category – II" Guarantees and conformance to the performance requirement is mandatory. Category - II Guarantees do not attract LD)
- (c). To reject the equipment / system / plant and recover the payment already made

**OR**

Accept the equipment / system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the Purchaser. (These are termed as "Category – III" Guarantees and do not attract LD)

**9.4 Schedule of Guarantees**

(Unless specifically mentioned otherwise, the fuel to be considered for the following guarantees shall be design lignite fuel indicated in Vol-IIA of Contract Specification.

**9.4.1 Category-I, Guarantees: Performance Guarantees Attracting Liquidated Damages**

S.No	Description	Parameter for Performance Guarantee	Liquidated Damages
1.	Steam Generator Efficiency (%)	For shortfall in guaranteed efficiency percentage of SG while firing design lignite at rated steam parameters & rated excess air and other stipulated conditions at 100% TMCR	Rs. 5,69,40,000/- (Indian Rupees Five Crores, Sixty Nine Lakhs and Forty Thousand only) for every 0.1% short fall in the efficiency or part thereof from guaranteed value at 100 % TMCR load
2.	Steam Generator Capacity TPH)	For shortfall in steam generating capacity in tonnes per hour of steam at rated steam parameters at superheater outlet (with any combination of mills working as per Purchaser's choice) while firing design lignite at 100% BMCR.	Rs. 3,77,40,000/- (Indian Rupees Three Crores, Seventy Seven Lakhs, Forty Thousand only) for every one (1) tonne per hour or part there of short fall in the steam output from the TPH specified / guaranteed
3.	Auxiliary Power Consumption (kW)	For increase in auxiliary power consumption in kW of all continuously operating power consuming auxiliaries of steam generator at 100% TMCR load. (Refer Clause 9.5)	Rs. 1,99,000/ (Indian Rupees One Lakh, Ninety Nine Thousand only) for every 1 kW increase in auxiliary power consumption or part there of from the guaranteed value.



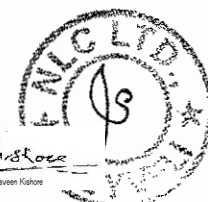
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**9.4.2 Category-II, Guarantees (conformance to Guarantees is mandatory)**

S.No	Description	Parameter	Requirement
(a)	NOx Emission Limit	Contractor shall guarantee that max. NOx emission from the unit will not be more than 260 grams of NOx per gigajoule of heat input (from thermal as well as fuel) to the boiler during the entire operating range of steam generator for the range of lignite specified in Vol-IIA of Contract Specification.	Mandatory requirement to be compulsorily met.
(b)	Dust concentration / Emission (Maximum) at ESP outlet	Contractor shall guarantee Dust concentration (Maximum) at ESP outlet with any one field out of service at 100% TMCR for the (worst lignite specified ) at 27°C ambient and a minimum flue gas temperature of 150°C (corrected) shall not exceed 50 mg/Nm3	Mandatory requirement to be compulsorily met.

Emission shall be measured during steam generating capacity test. Contractor, in his offer shall furnish the methodology of measurement and demonstration of variations with respect to load upto 60% of the total load.

**9.4.3 Category – III, Guarantees (Demonstration parameters, which do not attract LD)**

**(a). No fuel oil support required above 40% BMCR**

Design of steam generator shall be such as not to call for oil support for flame stabilization beyond 40% of rated load when firing the lignite from the range specified in Vol-IIA of Contract Specification. Contractor shall guarantee and demonstrate that with any combination of mills (as per Purchaser's choice) in service, the steam generator does not require any oil firing for stable and efficient boiler operation at all loads above 40% BMCR. (Refer Vol. IIA of Contract Specification)

**(b). Furnace Exit Gas Temperature**

Maximum Furnace Exit Gas Temperature shall be guaranteed and demonstrated by the successful Contractor after commissioning of units with mill combinations as per Purchaser's choice and all other requirement of heat release rates as specified. (Refer Volume IIA of the Contract Specification)

**(c). Steam Temperature at Superheater (SH) and Reheater(RH) Outlet**

The Contractor shall guarantee and demonstrate that steam temperature at the outlet of superheater and reheater shall be as follows:

S.No	Description	Value
(i)	Steam temperature at superheater outlet (at Main Steam Stop Valve) at 100% TMCR while firing design lignite specified in Vol-IIA of Contract Specification.	540 ± 5°C
(ii)	Steam temperature at Reheater outlet at 100% TMCR while firing design lignite specified in Vol-IIA of Contract Specification.	568 ± 5°C

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Prasen Kishore



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**(d). SH / RH Attenuation System**

The Contractor shall guarantee and demonstrate that spray water flow for SH attenuation system does not exceed 8% of the main steam flow, while firing design lignite and while maintaining the rated SH outlet steam temperature at 100% TMCR.

The Contractor shall guarantee and demonstrate that spray water flow for RH attenuation system does not exceed 0.6% of the RH steam flow while firing design lignite and while maintaining the rated Reheater outlet temperature at 100% TMCR.

**(e). Noise Level**

The Contractor shall demonstrate that the noise level of all the equipments are not higher than the respective stipulated values indicated in Volume IIA of the Contract specification during the entire operating range of the steam generator for the whole range of lignite fuel in Vol-IIA of Contract Specification and under the operating conditions including the guaranteed output and efficiency points.

Sound pressure shall be measured all around the equipment at a distance of 1(one) m, horizontally from the nearest surface of any equipment/machine and at a height of 1.5 m above the floor level in elevation.

Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirements of IEC 651 or BS: 5969 or IS:9779.

**(f). Mill Capacity at Rated Fineness**

Performance testing shall be done on each mill toward establishing its capacity specified at the rated fineness, applying corrections for the variation in lignite fuel characteristics i.e. HGI and moisture.

Contractor shall guarantee capacity output of each mill at rated fineness and shall demonstrate the same with following conditions:





S.No	Description	Value
(i)	Lignite Fuel finess	<ul style="list-style-type: none"> <li>40% pass through 0.09 mm mesh screen</li> <li>80% pass through 0.3 mm mesh screen</li> </ul>
(ii)	Mill Loading	Max permissible mill loading for selection of mill capacity shall not exceed 85% of maximum load.
(iii)	Lignite quality	Design Lignite

Should the HGI and total moisture content of lignite vary from that given in the lignite fuel characteristics during demonstration test, corrections shall be applied to the measured capacity of mill based on the correction curves. These correction curves shall be furnished along with the Bid and shall be subject to Purchaser's acceptance.



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**9.4.4 Auxiliary Boiler**

- (i). Rated steam flow.
- (ii). Rated steam temperature and pressure.

**9.4.5 Compressed Air System**

The following performance criteria for the compressed air system shall be guaranteed and demonstrated by the Contractor.

- (i). Capacity of compressor in Nm<sup>3</sup>/min at rated discharge pressure of 8.5 kg/m<sup>2</sup>(g).
- (ii). Quality of instrument air (dew point) coming out of the air dryer.
- (iii). Discharge air pressure at outlet of each compressor, kg/cm<sup>2</sup> (g)
- (iv). Discharge air temperature at outlet of each compressor, °C.

**9.5 Auxiliaries to be Considered for Auxiliary Power Consumption Guarantee**

- (a) Mills
- (b) FD fans
- (c) ID fans
- (d) RAPHs
- (e) Electrostatic Precipitator (Corona Power)
- (f) Boiler water circulating pumps
- (g) Seal air Fans
- (h) Lignite Feeders
- (i) ABGs
- (j) Submerged Scrapper Chain Conveyor
- (k) Bottom ash overflow recycling system equipments

**9.6 Performance Test of Steam Generator**

The performance tests shall be conducted (heat loss method) in accordance with the latest version of BS EN – 12952 – 15:2003 (by heat loss method) except for the specific requirements brought out herein below.

1. In order to correct the tested efficiency to the design condition, correction to the tested efficiency shall be applicable for variation in following parameters only:
  - (a) Feed water temperature at economiser inlet.
  - (b) Ambient air temperature
  - (c) Relative humidity of ambient air
  - (d) Hydrogen in lignite fuel
  - (e) Moisture in lignite
  - (f) Gross calorific value of lignite
  - (g) Percentage of ash in lignite

The Contractor, during detailed engineering, shall furnish correction curves to the Purchaser / Consultant, covering the expected ranges of variations for all these parameters for the range of lignite specified. Correction curves shall normally be within ± 5% only and shall be mutually discussed and agreed.

2. For all other aspects, not mentioned above, or in the specifications where BS code stipulates agreement between the parties concerned before the test, the Contractor shall obtain such approval from the Purchaser/Consultant.

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3. The number, location, type and accuracy of the test grade thermocouples and pressure gauges shall be to Purchaser's approval.
4. The steam generator efficiency testing shall be carried out with any combination of mills in operation.
5. Performance tests shall also be conducted to prove the steam generating capacity of the steam generator at rated parameters and auxiliary power consumption of all continuously working steam generator auxiliaries (as listed in Clause 9.5 above) at stipulated loads.
6. Necessary write ups, schemes, instruments, schedules, detailed procedures clearly indicating period of tests, frequency of observations, etc. shall be prepared and submitted for all the tests for Purchaser's/Consultant's review and shall be got specifically approved from the Purchaser/Consultant at least one year before the tests are carried out.

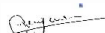
### 9.7 Liquidated Damages for Non Performance

1. Should the results of the formal test show that the Steam Generator has failed to meet its guarantee, the Contractor shall carry out the modification at its own cost, if considered necessary, to meet the guaranteed values. In such a case the performance and guarantee tests shall be repeated by the Contractor within one (1) month from the date the equipment is ready for retest. If the specified guarantees are not established within 90 days of notification by the Purchaser, the Purchaser may at his discretion reject the equipment and recover the payments already made or accept the equipment after assessing the liquidated damages payable at the rates specified in Cl 9.4.1 of this Schedule for each steam generator. The recovery of such amount shall be from the amounts due to the Contractor. These liquidated damages shall be prorated for fractional parts of the deficiencies.
2. Specific performance guarantees which attract liquidated damages are detailed in Cl.9.4.1 of this schedule.
3. Other performance parameters as detailed in Clause 9.4.2 and 9.4.3 of this schedule, which do not attract liquidated damages, will be termed as demonstration parameters. Demonstration parameters / capabilities shall be demonstrated during the trial operation period/guarantee tests of the respective system/equipment as per the detailed test procedure to be approved by the Purchaser/Consultant.
4. The Guaranteed values by the Contractor for the Performance Guarantee Parameters for this Package (unit wise) are herewith attached.

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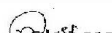
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**SCHEDULE OF PERFORMANCE GUARANTEE PARAMETERS**

**FOR UNIT-I**

**Section – A: Performance Guarantees under Liquidated Damages [L.D]**

S. No	Particulars	Unit	Value inclusive of design, manufacture and all other Tolerances including measurement uncertainty
(i)	Steam Generator efficiency while firing design lignite at rated steam parameters and rated excess air and other stipulated conditions at 100%TMCR i.e. 500 MW unit load	%	89.79 According to EN12952-15 (LHV basis, with 1.5% loss due to unburnt carbon)
(ii)	Steam Generator output at 100 % BMCR at rated steam parameters at superheater outlet (with any combination of mills working as per Purchaser's choice) while firing design lignite.	TPH	1600
(iii)	Total Auxiliary power consumption of the following continuously running drives combined together for the Steam Generator (SG) island at 100 % TMCR as detailed below for each unit	kW	11190
	<ul style="list-style-type: none"> <li>a) Mills</li> <li>b) FD fans</li> <li>c) ID fans</li> <li>d) RAPHs</li> <li>e) Electrostatic Precipitator (Corona Power)</li> <li>f) Boiler water circulating pumps</li> <li>g) Seal Air Fans - Not applicable</li> <li>h) Lignite Feeders</li> <li>i) ABGs</li> <li>j) Submerged Scrapper Chain Conveyor</li> <li>k) Bottom Ash Overflow Recycling System Equipment</li> </ul>	kW	The auxiliary power consumption guaranteed above is restricted to the auxiliaries listed in Sl.No. (iii) (a) to (k) only.

**Section – B: Performance Guarantees Under Correction**

**Part -1: Mandatory requirement under Correction category:**

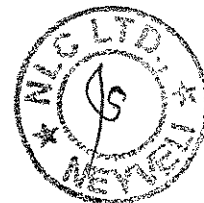
S. No	Particulars	Unit	Value Inclusive of design, manufacture and all other tolerances including measurement uncertainty
a)	NOx emission for the entire operating range of steam generator for the range of fuel specified	Grams/gigajoule of heat input	260

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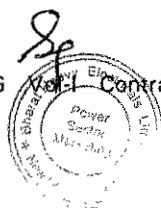
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S. No	Particulars	Unit	Value Inclusive of design, manufacture and all other tolerances including measurement uncertainty
b)	Dust concentration / Emission (maximum) at ESP outlet with any one field out of service at 100% TMCR for the (worst lignite specified) at 27°C ambient and minimum flue gas temperature of 150°C (corrected)	mg/Nm <sup>3</sup>	50

**Part -2: Requirement under Correction Category**

S. No	Particulars	Unit	Value Inclusive of design, manufacture and all other tolerances including measurement uncertainty
a)	Steam temperature at main steam stop valve at 100% TMCR.	°C	540 ± 5
b)	Steam temperature at reheater outlet at 100% TMCR.	°C	568 ± 5
c)	Furnace exit gas temperature (Refer Volume IIA of Tender specification)	°C	As per Tender (By back working from Economiser outlet gas temperature)
d)	Reheater attemperation flow at 100 % TMCR firing design lignite	TPH	7.85
e)	Superheater attemperation flow at 100%TMCR	TPH	117
f)	Minimum rated stable load with lignite firing alone and without any oil support	%	40% BMCR
g)	Noise Level at a height of 1.5m above floor level in elevation and at a distance of one meter horizontally from the nearest equipment/ machine furnished and installed under these specifications, expressed in decibels to a reference of 0.0002 microbar.	dBA	85 dB(A) for continuously running equipments except for coal mills which will be 92 dB(A). Excluded from the noise requirements are the boiler transient conditions such as Boiler start-up and shut down, HP bypass operation, Pressure relief valve, safety valve operation and Air Motor for AH
h)	Capacity of Mill	TPH	100
i)	Lignite fineness while firing design fuel -lignite	%	a) 40% pass through 0.09 mm mesh screen. b) 80% pass through 0.3 mm mesh screen. (a) and (b) with new beater plates

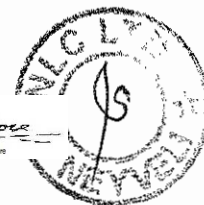


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**SCHEDULE OF PERFORMANCE GUARANTEE PARAMETERS  
FOR UNIT-II**

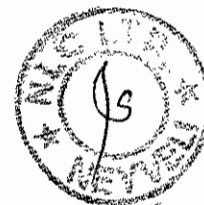
**Section – A: Performance Guarantees under Liquidated Damages [L.D]**

S. No	Particulars	Unit	Value inclusive of design, manufacture and all other Tolerances including measurement uncertainty
(i)	Steam Generator efficiency while firing design lignite at rated steam parameters and rated excess air and other stipulated conditions at 100%TMCR i.e. 500 MW unit load	%	89.79 According to EN12952-15 (LHV basis, with 1.5% loss due to unburnt carbon)
(ii)	Steam Generator output at 100 % BMCR at rated steam parameters at superheater outlet (with any combination of mills working as per Purchaser's choice) while firing design lignite.	TPH	1600
(iii)	Total Auxiliary power consumption of the following continuously running drives combined together for the Steam Generator (SG) island at 100 % TMCR as detailed below for each unit	kW	11190
	a) Mills b) FD fans c) ID fans d) RAPHs e) Electrostatic Precipitator (Corona Power) f) Boiler water circulating pumps g) Seal Air Fans - Not applicable h) Lignite Feeders i) ABGs j) Submerged Scraper Chain Conveyor k) Bottom Ash Overflow Recycling System Equipment	kW	The auxiliary power consumption guaranteed above is restricted to the auxiliaries listed in Sl.No. (iii) (a) to (k) only.

**Section – B: Performance Guarantees Under Correction**

**Part -1: Mandatory requirement under Correction category:**

S. No	Particulars	Unit	Value Inclusive of design, manufacture and all other tolerances including measurement uncertainty
a)	NOx emission for the entire operating range of steam generator for the range of fuel specified	Grams/gigajoule of heat input	260





S. No	Particulars	Unit	Value Inclusive of design, manufacture and all other tolerances including measurement uncertainty
b)	Dust concentration / Emission (maximum) at ESP outlet with any one field out of service at 100% TMCR for the (worst lignite specified) at 27°C ambient and minimum flue gas temperature of 150°C (corrected)	mg/Nm <sup>3</sup>	50

**Part -2: Requirement under Correction Category**

S. No	Particulars	Unit	Value Inclusive of design, manufacture and all other tolerances including measurement uncertainty
a)	Steam temperature at main steam stop valve at 100% TMCR.	°C	540 ± 5
b)	Steam temperature at reheater outlet at 100% TMCR.	°C	568 ± 5
c)	Furnace exit gas temperature (Refer Volume IIA of Tender specification)	°C	As per Tender (By back working from Economiser outlet gas temperature)
d)	Reheater attemperation flow at 100 % TMCR firing design lignite	TPH	7.85
e)	Superheater attemperation flow at 100%TMCR	TPH	117
f)	Minimum rated stable load with lignite firing alone and without any oil support	%	40% BMCR
g)	Noise Level at a height of 1.5m above floor level in elevation and at a distance of one meter horizontally from the nearest equipment/ machine furnished and installed under these specifications, expressed in decibels to a reference of 0.0002 microbar.	dBA	85 dB(A) for continuously running equipments except for coal mills which will be 92 dB(A). Excluded from the noise requirements are the boiler transient conditions such as Boiler start-up and shut down, HP bypass operation, Pressure relief valve, safety valve operation and Air Motor for AH
h)	Capacity of Mill	TPH	100
i)	Lignite fineness while firing design fuel -lignite	%	a) 40% pass through 0.09 mm mesh screen. b) 80% pass through 0.3 mm mesh screen. (a) and (b) with new beater plates

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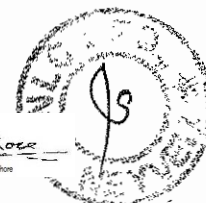
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**2x500 MW NNTPP  
SG PACKAGE  
AIR CONDITIONING SYSTEM  
PAINTING SPECIFICATIONS**

**SPECIFICATION No: PE-TS-400-553-A001**

**VOLUME: II B**

**SECTION : C 2C**


**REV. 01**

**DATE: DEC 2015**

**SECTION: C 2C**

**CUSTOMER SPECIFICATIONS**

**PAINTING SPECIFICATIONS**

  
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**2x500 MW NNTPP  
SG PACKAGE  
AIR CONDITIONING SYSTEM  
PAINTING SPECIFICATIONS**

**SPECIFICATION No: PE-TS-400-553-A001**


**VOLUME: II B**

**SECTION : C 2C**

**REV. 01**

**DATE: DEC 2015**

- All the Equipments shall be protected against external corrosion by providing suitable painting.
- The surfaces of stainless steel, Galvanised steel, Gunmetal, brass, bronze and non-metallic components shall not be applied with any painting. The Bidder shall clean the external surfaces and internal surfaces before Erection by wire brushing and air blowing. The steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shot blasting etc as per the agreed procedure.
- For all the steel surfaces (external) exposed to atmosphere (outdoor installation), a coat of red oxide primer of thickness 30 to 35 microns followed up with three coats of synthetic enamel paint, with 25 microns as thickness of each coat, shall be applied.
- For all the steel surfaces inside the building (indoor installation), a coat of red oxide primer of thickness 30 to 35 microns followed up with two coats of synthetic enamel paint, with 25 microns as thickness of each coat, shall be applied.
- However for all parts coming in contact with acid fumes (in Battery rooms), a coat of epoxy resin based zinc phosphate primer of minimum thickness 30 to 35 microns followed up with undercoat of epoxy resin based paint pigmented with Titanium dioxide of minimum thickness of 25 microns shall be applied and a top coat consisting of one coat of epoxy paint of approved shade and colour with glossy finish of minimum thickness of 25 microns.

  
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**2x500 MW NNTPP  
SG PACKAGE  
AIR CONDITIONING SYSTEM  
TECHNICAL SPECIFICATION  
(ELECTRICAL PORTION)**

**SPECIFICATION No: PE-TS-400-553-A001**

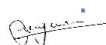
**VOLUME: II B**

**SECTION : C-3**

**REV. 01**

**DATE: DEC 2015**

**SECTION: C-3  
TECHNICAL SPECIFICATION (ELECTRICAL PORTION)**

  
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Pritesh Kothari


2x500 MW NEYVELI NEW THERMAL POWER STATION  
(NNTPS)

TECHNICAL SPECIFICATION

FOR

AC SYSTEM

(ELECTRICAL PORTION)

  
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S A Khan

  
K. Keshav

  
Praveen Kothari



TITLE : <b>ELECTRICAL EQUIPMENT SPECIFICATION FOR AC SYSTEM</b>  2x500 MW NEYVELI NEW THERMAL POWER STATION (NNTPS)	SPECIFICATION NO. PE-TS-400-552-A000
	VOLUME NO. : <b>II-B</b>
	SECTION: <b>C</b>
	REV NO. : <b>00</b> DATE: 18.11.15
	SHEET: 1 OF 1

- 1.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:**
- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
  - b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.
  - c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
  - d) Erection and commissioning spares.
  - e) Erection & Maintenance tools & tackles.
  - f) Electrical load requirement for Air conditioning System.
  - g) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
  - h) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer /BHEL approval without any commercial and delivery implications to BHEL.
  - i) Various drawings, data sheet as per required format, quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer /BHEL approval without any commercial implications to BHEL.
  - j) Motor shall meet minimum requirement of specification AC/DC motors.
- 2.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:**  
Refer “Electrical Scope between BHEL and Vendor”.
- 3.0 **DOCUMENTS TO BE SUBMITTED ALONG WITH BID**
- 3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following:
- a) A copy of this sheet “Electrical Equipment Specification for Ventillation System” and sheet “Electrical Scope between BHEL and Vendor” with bidder’s signature and company stamp.
  - b) List of Erection and Commissioning spares.
  - c) List of Erection & Maintenance tools & tackles.
  - d) Electrical load requirement.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.
- 4.0 **LIST OF ENCLOSURES**
- 4.1 Electrical scope between BHEL & vendor.- 2 sheets.
  - 4.2 Std. Technical specification for LV motors.- 5 sheets
  - 4.3 Std. Technical specification for Cabling installation.- 6 sheets.
  - 4.4 Data Sheets (A) for 415V Electric Motors.- 2 sheets.
  - 4.5 Data Sheets (C) for 415V Electric Motors- 2 sheets.
  - 4.6 Quality plan for motor below 75kW.- 2 sheets
  - 4.7 Quality plan for motor above 75kW.- 9 sheets
  - 4.8 Load data format.- 1 sheet

Varun Jain

S A Khan

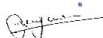
K Keshav

Praveen Kishore

## Scope sheet for Scope between BHEL & Vendor

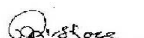
PROJECT : 2 x 500 MW NEYVELI TPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	1. 415 V AC/240 V AC supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract including power supply equipment (battery charger etc) required for the PLC/control panel (as applicable) for the system supplied by vendor. 2. Interposing relays (RE 302 of Jyoti make or equivalent), if required for PLC and microprocessor based systems, shall be provided by BHEL in MCCs. Requirement of these relays shall be furnished by vendor during detailed engineering stage.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope <span style="border: 1px solid red; padding: 2px;">in case of one end being PLC, scope of E&amp;C of cables shall be in PLC supplier scope.</span>	BHEL BHEL BHEL	BHEL Vendor BHEL	1. Sizes and quantity of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL). Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Laying of cables by BHEL except for cabling in vendor scope. 3. Termination at BHEL equipment terminals by BHEL. 4. Termination at Vendor equipment terminals by Vendor.
4	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	Vendor	
5	Cable trays, accessories & cable trays supporting system	BHEL	BHEL	
6	Cable glands and lugs for equipments supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power cables 3. Solder less crimping type heavy duty copper lugs for control cables.
7	Conduit and conduit accessories for cabling between equipments supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537. Makes of conduits shall be subject to customer/ BHEL approval at contract stage.
8	Lighting	BHEL	BHEL	
9	Equipment grounding & lightning protection	BHEL	BHEL	
10	Below grade grounding	BHEL	BHEL	
11	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
12	Mandatory spares	Vendor	-	Vendor to quote as per specification.

  
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S A Khan

  
K Keshav

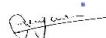
  
Praveen Kishore

### Scope sheet for Scope between BHEL & Vendor

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
13	Recommended O & M spares, E & C spares, erection & maintenance tools & tackle.	Vendor	-	As per specification
14	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
15	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for C & I systems for vendor supplied equipment shall be furnished during detail engineering by vendor in soft copies in the BHEL cable schedule format.
16	Equipment layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipments requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Electrical equipment layout drawing shall be to BHEL approval. For necessary interface review.
17	Electrical Equipment GA drawing	Vendor	-	
18	Junction Boxes	Vendor	Vendor	

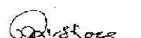
**NOTES:**

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.

  
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S A Khan

  
K Keshav

  
Praveen Kishore



TITLE :  
**GENERAL TECHNICAL REQUIREMENTS**  
  
**FOR**  
  
**LV MOTORS**


SPECIFICATION NO.  
PE-SS-999-506-E101  
VOLUME NO. : **II-B**  
SECTION : **D**  
REV NO. : **00** DATE : 01.08.14  
SHEET : 1 OF 1

## **GENERAL TECHNICAL REQUIREMENTS**

**FOR**

**LV MOTORS**

**SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00**

  
Varun Jain

  
S A Khan

  
K Keshav

  
Pritesh Kothari



TITLE :  
**GENERAL TECHNICAL REQUIREMENTS**  
**FOR**  
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SPECIFICATION NO.  
PE-SS-999-506-E101  
VOLUME NO. : **II-B**  
SECTION : **D**  
REV NO. : **00** DATE : 01.08.14  
SHEET : 1 OF 4

**1.0 INTENT OF SPECIFICATION**

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

**2.0 CODES AND STANDARDS**

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement of rotating electrical machines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines
IS:12615	<b>Energy Efficient Induction Motors - Three Phase Squirrel Cage</b>

In case of imported motors, motors as per IEC-34 shall also be acceptable.

**3.0 DESIGN REQUIREMENTS**

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information  
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

**3.3 Starting Requirements**

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.



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SPECIFICATION NO.  
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The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

- i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)
- iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

4.0 **CONSTRUCTIONAL FEATURES**

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.



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SPECIFICATION NO.  
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- 4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.
- 4.5. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.
- 4.6. In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.  
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.
- 4.7. **Terminals and Terminal Boxes**
- 4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.  
  
Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".
- 4.7.2 Unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.
- 4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or V W & V respectively.
- 4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.
- 4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.
- 4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.
- 4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.
- 4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.
- 4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.
- 4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

	<b>TITLE :</b> <b>GENERAL TECHNICAL REQUIREMENTS</b>  <b>FOR</b>  <b>LV MOTORS</b>	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : <b>II-B</b>
		SECTION : <b>D</b>
		REV NO. : <b>00</b> DATE : 01.08.14
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#### 4.9 General

- 4.9.1 Motors provided for similar drives shall be interchangeable.
- 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.
- 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.
- 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.
- 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.
- 4.9.6 Name plate with all particulars as per IS: 325 shall be provided
- 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

#### 5.0 INSPECTION AND TESTING

- 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.
- 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.
- 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.
- 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

#### 6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

- a) OGA drawing showing the position of terminal boxes, earthing connections etc.
- b) Arrangement drawing of terminal boxes.
- c) Characteristic curves:  
(To be given for motor above 55 kW unless otherwise specified in Data Sheet).
  - i) Current vs. time at rated voltage and minimum starting voltage.
  - ii) Speed vs. time at rated voltage and minimum starting voltage.
  - iii) Torque vs. speed at rated voltage and minimum voltage.  
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
  - iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.



TITLE :  
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## **GENERAL TECHNICAL REQUIREMENTS**

**FOR**

**LV MOTORS**

**SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00**



TITLE :  
**GENERAL TECHNICAL REQUIREMENTS**  
**FOR**  
**LV MOTORS**

SPECIFICATION NO.  
PE-SS-999-506-E101

VOLUME NO. : **II-B**

SECTION : **D**

REV NO. : **00** DATE : 01.08.14

SHEET : 1 OF 4

### 1.0 INTENT OF SPECIFICATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

### 2.0 CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement of rotating electrical machines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines
IS:12615	<b>Energy Efficient Induction Motors - Three Phase Squirrel Cage</b>

In case of imported motors, motors as per IEC-34 shall also be acceptable.

### 3.0 DESIGN REQUIREMENTS

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information  
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

#### 3.3 Starting Requirements

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.



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The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

- i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)
- iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

4.0 **CONSTRUCTIONAL FEATURES**

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.



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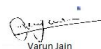
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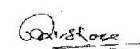
SHEET : 3 OF 4

- 4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.
- 4.5. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.
- 4.6. In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.  
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.
- 4.7. **Terminals and Terminal Boxes**
- 4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.  
  
Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".
- 4.7.2 Unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.
- 4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or V W & V respectively.
- 4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.
- 4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.
- 4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.
- 4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.
- 4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.
- 4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.
- 4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

  
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S A Khan

  
K. Keshav

  
Preeten Khatke



TITLE :  
**GENERAL TECHNICAL REQUIREMENTS**  
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SPECIFICATION NO.  
PE-SS-999-506-E101

VOLUME NO. : **II-B**

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REV NO. : **00** DATE : 01.08.14

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**4.9 General**

- 4.9.1 Motors provided for similar drives shall be interchangeable.
- 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.
- 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.
- 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.
- 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.
- 4.9.6 Name plate with all particulars as per IS: 325 shall be provided
- 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

**5.0 INSPECTION AND TESTING**

- 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.
- 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.
- 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.
- 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

**6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT**

- a) OGA drawing showing the position of terminal boxes, earthing connections etc.
- b) Arrangement drawing of terminal boxes.
- c) Characteristic curves:  
(To be given for motor above 55 kW unless otherwise specified in Data Sheet).
- i) Current vs. time at rated voltage and minimum starting voltage.
- ii) Speed vs. time at rated voltage and minimum starting voltage.
- iii) Torque vs. speed at rated voltage and minimum voltage.  
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
- iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.



TITLE

**LV MOTORS****DATA SHEET-A**2x500 MW NEYVELI NEW THERMAL POWER  
STATION (NNTPS)

SPECIFICATION NO. PE-TS-400--552-A000

VOLUME II B

SECTION D

REV NO. DATE 01.08.2014

SHEET 1 OF 1

- 1.0 Design ambient temperature : 50 °C
- 2.0 Maximum acceptable kW rating of LV motor : 160KW \*
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Details of supply system
- a) Rated voltage (with variation) : 415V ± 10%
  - b) Rated frequency (with variation) : 50 Hz + 3 % to - 5%
  - c) Combined voltage & freq. variation : 10% (sum of absolute values)
  - d) System fault level at rated voltage : 50 kA for 1 sec
  - e) Short time rating for terminal boxes
    - o 90 kW and above (Breaker controlled) : 50 KA for 0.25 sec.
    - o Below 90 kW (Contactor controlled) : 50 KA protected by HRC fuse
  - f) LV System grounding : Solidly
- 5.0 Class of insulation : Class 'F', with temp rise limited to class B.
- 6.0 Minimum voltage for starting (As percentage of rated voltage) : 85% of rated voltage
- 7.0 Power cables data : Shall be given during Detailed engg
- 8.0 Earth Conductor Size & Material : Shall be given during Detailed engg
- 9.0 Space heater supply : 240 V, 1ϕ , 50 Hz
- 10.0 Rating up to which Single phase motor : Acceptable below 0.20 kW
- 11.0 Locked rotor current
- a) Limit as percentage of FLC : As per IS 12615\*
- 12.0 Flame-proof motor
- a) Enclosure suitable (As per IS:2148) : As per requirement
  - b) Classification of Hazardous area (As per IS: 5572 part-I) : As per requirement
- 13.0 Makes : BHEL/ Customer approval
- 14.0 Paint shade : Shall be given during Detailed engg
- 15.0 Degree Of protection for motor/ terminal box : As per IS 4691

\* LT motors of continuous duty shall be energy efficient IE2 class conforming to IS12615

  
Varun Jain  
S A Khan  
K. Keshav  
Praveen Kishore



TITLE

# LV MOTORS

## DATA SHEET-A

2x500 MW NEYVELI NEW THERMAL POWER  
STATION (NNTPS)

SPECIFICATION NO. PE-TS-400--552-A000

VOLUME II B

SECTION D

REV NO. DATE 01.08.2014

SHEET 1 OF 1


### 16.0 TESTING

#### 16.1 Type Tests

For HT & LT Motors above 50kW, type test reports for type tests as per IS: 325/ IS: 12615 conducted on equipment similar to those proposed to be supplied and carried out within last five years from the date of bid opening viz. February 2012 shall be submitted. However, if such reports are not available, one motor of each type shall be subjected to type tests for free of cost.


#### 16.2 Routine Tests

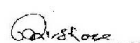
All motors shall be subjected to routine tests as per IS: 325/ IS: 12615 in the presence of customer or customer representative.


	TITLE	SPECIFICATION NO.
	MOTOR	VOLUME II B
	DATA SHEET - C	SECTION D
		REV NO. 00 DATE 01.08.14
		SHEET 1 OF 2

S. No.	Description	Data to be filled by successful bidder
<b>A.</b>	<b>General</b>	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
<b>B.</b>	<b>Design and Performance Data</b>	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a) Voltage	
6	b) Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB)	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	

NAME OF VENDOR			SEAL	REV.
NAME	SIGNATURE	DATE		








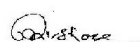
	TITLE	SPECIFICATION NO.
	MOTOR	VOLUME II B
	DATA SHEET - C	SECTION D
		REV NO. 00 DATE 01.08.14
		SHEET 2 OF 2

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
<b>C.</b>	<b>Constructional Features</b>	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level ( kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
<b>D.</b>	<b>Characteristic curves/ drawings</b> (To be enclosed for motors of rating $\geq 55KW$ )	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			




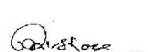
 Varun Jain  
 S A Khan  
 K. Keshav  
 Praveen Kulkarni

SL. NO.		COMPONENT/OPERATION		QUALITY PLAN		CUSTOMER :				PROJECT				SPECIFICATION :					
						BIDDER/ VENDOR SYSTEM		TITLE		QUALITY PLAN		NUMBER :		SPECIFICATION		TITLE		NUMBER :	
SHEET 1 OF 2		CHARACTERISTICS CHECK		CAT.		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD		SECTION		VOLUME III		REMARKS	
				4		6		7		8		9		10		11			
				MA		SAMPLE		MANUF'R'S SPEC./BHEL SPEC./RELEVANT STANDARD		BHEL SPEC. SAME AS COL.7		LOG BOOK		3					
1.0 PAINTING		1. SHADE		MA		VISUAL		VISUAL		100%		100%		MANUF'S SPEC		-DO-		3	
2.0 ASSEMBLY		1. WORKMANSHIP		MA		VISUAL		VISUAL		100%		100%		MFG. DRG./ MFG. SPEC.		-DO-		3	
		2. DIMENSIONS		MA		-DO-		-DO-		-DO-		-DO-		MFG. DRG./ MFG. SPEC.		-DO-		3	
		3. CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE		MA		VISUAL		VISUAL		100%		100%		MFG. SPEC./ RELEVANT IS		-DO-		3	
3.0 TESTS		1. ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.		MA		-DO-		-DO-		100%		100%		IS-325/ BHEL SPEC./ DATA SHEET		TEST REPORT		3	
		2. OVERALL DIMENSIONS & ORIENTATION		MA		MEASUREMENT & VISUAL		MEASUREMENT & VISUAL		100%		100%		APPROVED DRG./DATA SHEET		INSPN. REPORT		2	
<b>BHEL</b>				<b>PARTICULARS</b>				<b>BIDDER/VENDOR</b>											
				<b>NAME</b>															
				<b>SIGNATURE</b>															
				<b>DATE</b>															
												<b>BIDDERS/VENDORS COMPANY SEAL</b>							

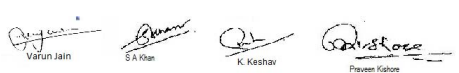
 Varun Jain  
 S A Khan  
 K Keshav  
 Preet Kishore



CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :		SPECIFICATION : TITLE		SECTION		VOLUME III	
										AGENCY	REMARKS
QUALITY PLAN		QUALITY PLAN		QUALITY PLAN		QUALITY PLAN		QUALITY PLAN		QUALITY PLAN	
BIDDER/ VENDOR SYSTEM		NUMBER PED-506-00-Q-007/2		NUMBER PED-506-00-Q-007/2		NUMBER PED-506-00-Q-007/2		NUMBER PED-506-00-Q-007/2		NUMBER PED-506-00-Q-007/2	
SHEET 1 OF 9		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)	
SL. NO.	COMPONENT/OPERATION	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	P	W	V	
1	2	4	5	6	7	8	9	10	11		
1.0	RAW MATERIAL & BROUGHT CONTROL	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
	3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPC. REPORT	3	-	-	
1.2	HARDWARES	MA	VISUAL	100%	MANFR'S DRG./SPEC	FREE FROM CRACKS, UNEVENNESS ETC.	-DO-	3	-	-	
	2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVENT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	MA	VISUAL	100%	MANFR'S DRG./SPEC	FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	-	
	2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIERS TC	3	-	2	HEAT NO. SHALL BE VERIFIED
	3.DIMENSIONS	MA	MEASUREMENT	100%	MANFR'S DRG.	MANUFUR'S DRG.	LOG BOOK	3	-	-	
1.4	PAINT & VARNISH	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	-	
BHEL		PARTICULARS		BIDDER/VENDOR							
		NAME									
		SIGNATURE									
		DATE									
										BIDDER'S/VENDORS COMPANY SEAL	

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 S A Khan  
 K Keshav  
 Praveen Khatke



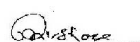
SL. NO.	COMPONENT/OPERATION	QUALITY PLAN CHARACTERISTIC CHECK	CUSTOMER :				PROJECT TITLE				SPECIFICATION :	
			BIDDER/ VENDOR	SYSTEM CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION	NUMBER :
1	2	3	4	5	6	7	8	9	P	W	V	VOLUME III REMARKS
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND. 2. CHEM. & PHYSICAL PROPERTIES 3. DIMENSIONS 4. INTERNAL FLOWS	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTID'S	1. MAKE & RATING 2. PHYSICAL COND. 3. DIMENSIONS (WHEREVER APPLICABLE) 4. PERFORMANCE/ CALIBRATION	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
			MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	-	
			CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE
			MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	-	
			MA	-DO-	-DO-	-	NO BREAKAGE ON OTHER PHY. DESIGN	-DO-	3	-	-	
			MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	-	
			MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	-	
<b>BHEL</b>												
PARTICULARS												
NAME												
SIGNATURE												
DATE												
												BIDDER'S/VENDORS COMPANY SEAL


  
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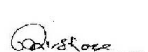







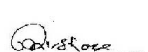
SL. NO.		COMPONENT/OPERATION	QUALITY PLAN		CUSTOMER :			PROJECT			SPECIFICATION :		
			CHARACTERISTIC CHECK	SYSTEM	BIDDER/ VENDOR	TITLE	QUALITY PLAN	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION	VOLUME III
1		2	3	4	5	6	7	8	9	10	11		
SHEET 5 OF 9		CAT.		TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION	VOLUME III	REMARKS	
2.0	IN PROCESS												
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS 2.DIMENSIONS	MA	VISUAL MEASUREMENT	100% -DO-	-DO- MANUF'S DRG	GOOD FINISH MANUF'S DRG	LOG BOOK -DO-	3	-	-		
2.2	MACHINING	1.FINISH 2.DIMENSIONS 3.SHAFT SURFACE FLOWS	MA	VISUAL MEASUREMENT PT	100% -DO- -DO-	-DO- MANUF'S DRG RELEVANT SPEC./ ASTM-E165	GOOD FINISH MANUF'S DRG MANUF'S SPEC./ BHEL SPEC./	LOG BOOK -DO- -DO-	3	-	-	1	
2.3	PAINTING	1.SURFACE PREPARATION 2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT) 3.SHADE 4.ADHESION	MA	VISUAL MEASUREMENT BY ELCOMETER VISUAL CROSS CUTTING & TAPE TEST	100% SAMPLE -DO- -DO-	MANUF'S SPEC./ BHEL SPEC./ RELEVANT STAND -DO- -DO- -DO-	BHEL SPEC. SAME AS COL.7 -DO- -DO- -DO-	LOG BOOK -DO- Log Book Log Book	3	-	-	2	
		PARTICULARS		BIDDER/VENDOR									
		NAME											
		SIGNATURE											
		DATE											
		BHEL											
		BIDDER'S/VENDORS COMPANY SEAL											

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 K. Keshav  
 Praveen Khatore


CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :						
BIDDER/ VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007/2		SPECIFICATION : TITLE						
SYSTEM		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		SECTION						
CAT.		REFERENCE DOCUMENT		AGENCY						
TYPE/ METHOD OF CHECK		ACCEPTANCE NORM		P W V						
EXTENT OF CHECK		FORMAT OF RECORD		REMARKS						
CAT.		7		10						
4		8		11						
3		9								
1	2	3	4	5	6	7	8	9	10	11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	3	-
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	3	-
		3.CORE LOSS & HOTOPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	3	2
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	3	-
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	-
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	3	-
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	2
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	2
		6.SURGE WITH STAND AND TAN.DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	2
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	3	-
		2.TEMP. PRESSURE VACCUUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	3	-
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	3	2
										THREE DIPS TO BE GIVEN
BHEL		PARTICULARS		BIDDER/VENDOR						
		NAME		SIGNATURE						
		DATE								
						BIDDER'S/VENDORS COMPANY SEAL				



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SHEET 7 OF 9		QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION :			
COMPONENT/OPERATION		CHARACTERISTIC CHECK		SYSTEM CAT.		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		NUMBER :			
SL. NO.	2	3	4	5	6	7	8	9	10	11	
				TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	VOLUME III REMARKS	
									P	W	V
1											
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION 1.COMPACTNESS & CLEANLINESS	MA MA	-DO- VISUAL	-DO- 100%	-DO- -DO-	-DO- -DO-	Log Book Log Book	3 3	- -	2 -
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS 2.SOUNDNESS 3.HV	CR CR MA	-DO- MALLET TEST & MV TEST ELECT. TEST	-DO- -DO- -DO-	-DO- -DO- -DO-	-DO- -DO- -DO-	Log Book Log Book Log Book	3 3 3	- - -	- - -
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE 2.SOUNDNESS OF DIE CASTING	CR CR	DYN. BALANCE ELECT. (GROWLER TEST)	-DO- -DO-	MFG SPEC./ ISO 1940 MFG. SPEC.	MFG. DWG. MFG. SPEC.	Log Book Log Book	3 3	2 2	1 -
2.10	ASSEMBLY	1.ALIGNMENT 2.WORKMANSHIP 3.AXIAL PLAY 4.DIMENSIONS 5.CORRECTNESS, COMPLETENESS, TERMINATIONS/ MARKING/ COLOUR CODE	MA MA MA MA MA	MEAS. VISUAL MEAS. -DO- VISUAL	-DO- -DO- -DO- -DO- 100%	-DO- -DO- -DO- MFG DRG/ MFG SPEC. MFG SPEC. RELEVANT IS	-DO- -DO- -DO- MFG DRG/ RELEVANT IS MFG SPEC. RELEVANT IS	Log Book Log Book Log Book Log Book Log Book	3 3 3 3 3	- - - - -	- - 2 - -
<b>BHEL</b>											
						<b>BIDDER/VENDOR</b>					
						<b>PARTICULARS</b>					
						<b>NAME</b>					
						<b>SIGNATURE</b>					
						<b>DATE</b>					
						<b>BIDDER'S/VENDORS COMPANY SEAL</b>					

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 K. Keshav  
 Preeten Khatke

CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :	
BIDDER/ VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007/2		SPECIFICATION : TITLE	
SYSTEM		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		SECTION	
CAT.		REFERENCE DOCUMENT		AGENCY	
TYPE/ METHOD OF CHECK		EXTENT OF CHECK		P W V	
4		6		10	
5		8		11	
3		9		REMARKS	
1		2		3	
3.0		3		3	
1		4		3	
2		5		3	
3		6		3	
4		7		3	
5		8		3	
6		9		3	
7		10		3	
8		11		3	
9		12		3	
10		13		3	
11		14		3	
12		15		3	
13		16		3	
14		17		3	
15		18		3	
16		19		3	
17		20		3	
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39		42		3	
40		43		3	
41		44		3	
42		45		3	
43		46		3	
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65		68		3	
66		69		3	
67		70		3	
68		71		3	
69		72		3	
70		73		3	
71		74		3	
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	<b>QUALITY PLAN</b>		<b>CUSTOMER :</b>				<b>PROJECT TITLE</b>		<b>SPECIFICATION :</b>			
	<b>QUALITY PLAN</b>		<b>BIDDER/ VENDOR :</b>				<b>QUALITY PLAN</b>		<b>NUMBER :</b>			
<b>SHEET 9 OF 9</b>		<b>SYSTEM</b>		<b>ITEM: AC ELECT. MOTORS 75KW &amp; ABOVE (LV &amp; MV)</b>		<b>NUMBER PED-506-00-Q-007/2</b>		<b>TITLE</b>				
<b>SL. NO.</b>	<b>COMPONENT/OPERATION</b>	<b>CHARACTERISTIC CHECK</b>	<b>CAT.</b>	<b>TYPE/ METHOD OF CHECK</b>	<b>EXTENT OF CHECK</b>	<b>REFERENCE DOCUMENT</b>	<b>ACCEPTANCE NORM</b>	<b>FORMAT OF RECORD</b>	<b>AGENCY</b>	<b>SECTION</b>	<b>VOLUME III</b>	<b>REMARKS</b>
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>		
<b>NOTES:</b>												
1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION WITH THE CUSTOMERS, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.												
<b>BHEL</b>			<b>PARTICULARS</b>			<b>BIDDER/VENDOR</b>						
			<b>NAME</b>									
			<b>SIGNATURE</b>									
			<b>DATE</b>						<b>BIDDERS/VENDORS COMPANY SEAL</b>			

 Varun Jain  
 S A Khan  
 K Keshav  
 Praveen Khatore





**2x500 MW NNTPP  
TG PACKAGE  
AIR CONDITIONING SYSTEM  
TECHNICAL SPECIFICATION  
(C&I PORTION)**

**SPECIFICATION No: PE-TS-402-553-A001**

**VOLUME: II B**

**SECTION : C-4**

**REV. 01**

**DATE: DEC 2015**

**SECTION: C-4  
TECHNICAL SPECIFICATION (C&I PORTION)**

**C&I SPECIFICATION**  
**FOR**  
**AIR CONDITIONING SYSTEM**  
**FOR**  
**2X500MW NNTPP (SG PACKAGE)**

  
Varun Jain

  
S.A. Khan

  
K. Keshav

  
Praveen Kishore

**2X500 MW NNTPP- (SG PACKAGE)**

**SPECIFIC TECHNICAL REQUIREMENTS (C&I)  
AIR CONDITIONING SYSTEM**

**Specific Technical Requirements (C&I):**

- 1.0 The control of Air Conditioning System shall be through PLC based control system having hot redundant Central Processing Unit. The PLC based control system shall be supplied under Air Conditioning System for NNTPP-TG package. The operation and control philosophy of Air Conditioning System and Ventilation system has been elaborated in separate section in the specification. The PLC shall be common for both units, and shall be located in AC Plant Room. All the interface requirements of air conditioning system which are to be hooked up with PLC in AC Plant Room shall be taken care by the bidder.
- 1.1 Bidder to keep the provision for accepting fire signals from Fire Alarm & Protection System and the closure of relevant fire dampers in Air Conditioning and Ventilation System.
- 1.2 The solenoid valves shall have limit switches for open/close feedback.
- 1.3 All electrical actuators shall be of non-integral starter type.
- 1.4 Interface of MCC, HT SWGR, field instruments, Actuators etc. with PLC based control system shall be as per Drive Control Philosophy attached in the specification.
- 1.5 All the instruments/drives shall be terminated on JB's/Panels in field. JB's/Panels shall be in Bidder's scope.
- 1.6 Soft link connectivity between microprocessor based panels (VAM/Chillers) & DCS is required for monitoring & is in bidder scope.
- 1.7 LPB station for start/stop & open/close shall be provided for testing & maintenance facility.
- 1.8 Communication to main plant DCS for monitoring shall be OPC compliant (Data Access 2.0) TCP/IP on Fibre Optic link.
- 1.9 Scope of Instrumentation cables (Screened Control Cables), Fibre Optic cable & Control cables shall be as per Electrical Cable scope matrix in Electrical portion of specification.

  
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**2X500 MW NNTPP- (SG PACKAGE)**

**SPECIFIC TECHNICAL REQUIREMENTS (C&I)  
AIR CONDITIONING SYSTEM**

1.10 The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.

1.11 Following documents to be furnished by the bidder along with the bid:

- List of drives pertaining to Air Conditioning System
- I/O List for Air Conditioning System
- Duly stamped and signed copy of Quality Plan.

1.12 Drawings/Documents and data to be furnished after award of the contract shall be as per list attached.

  
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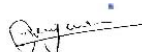
  
Praveen Kishore

**LIST OF VENDOR DELIVERABLES FOR C&I FOR AIR CONDITIONING SYSTEM (2 X 500 MW NNTPP- SG PACKAGE)**

**DOCUMENT NUMBER PE-GL-400-145-I100**

**SHEET 1 of 1**


SI.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CAT OF APPROVAL	FROM	USER	REMARKS
			BHEL			
1	PE-V9-400-554-I901	INSTRUMENT DATA SHEETS	A	VENDOR	C&I	
2	PE-V9-400-554-I902	INSTRUMENT SCHEDULE	I	VENDOR	C&I	
3	PE-V9-400-554-I903	INSTRUMENT HOOK UP	A	VENDOR	C&I	
4	PE-V9-400-554-I904	FIELD JB TERMINATIONS	I	VENDOR	C&I	
5	PE-V9-400-554-I905	QUALITY PLANS/CHECK LISTS (For all applicable instruments)	A	VENDOR	C&I	
6	PE-V9-400-554-I914	CONTROL SCHEMES (BLOCK LOGIC)	A	VENDOR	C&I	
7	PE-V9-400-554-I924	LIST OF SIGNAL EXCHANGE WITH DCS (BOTH HARDWIRED & SERIAL INTERFACE IN BHEL FORMAT)	A	VENDOR	C&I	
8	PE-V9-400-554-I925	PROCESS GRAPHIC MANUSCRIPTS PLC	I	VENDOR	C&I	
9	PE-V9-400-554-I926	PROCESS GRAPHIC MANUSCRIPTS FOR DCS	I	VENDOR	C&I	
10	PE-V9-400-554-I927	CABLE SCHEDULE & INTERCONNECTION	I	VENDOR	C&I	
11	PE-V9-400-554-I928	ANNUNCIATION LIST	A	VENDOR	C&I	
12	PE-V9-400-554-I929	POWER DISTRIBUTION SCHEME	A	VENDOR	C&I	
13	PE-V9-400-554-I932	BILL OF MATERIAL INCLUDING MANDATORY SPARES	A	VENDOR	C&I	
<b>Notes:</b>						
1. ANY OTHER DOCUMENT DECIDED DURING DETAILED ENGINEERING SHALL BE PROVIDED BY BIDDER WITHOUT ANY COMMERCIAL/TECHNICAL IMPLICATION.						

  
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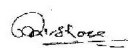
  
Praveen Kishore

	<b>SPECIFICATION FOR MOTORISED VALVE ACTUATOR</b>		SPECIFICATION NO.:		
			VOLUME		
			SECTION		
			REV. NO.	DATE:	
			SHEET	1 OF 3	
<b>Data Sheet A &amp; B</b>					
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)		
<b>GENERAL*</b>	* PROJECT				
	OFFER REFERENCE				
	* TAG NO. SERVICE				
	* DUTY	<input type="checkbox"/> ON / OFF	<input type="checkbox"/> INCHING		
	* LINE SIZE (inlet/outlet): MATERIAL				
	* VALVE TYPE	<input type="checkbox"/> GLOBE <input type="checkbox"/> GATE <input type="checkbox"/> REG. GLOBE <input type="checkbox"/> BUTTERFLY			
	* OPENING / CLOSING TIME				
	* WORKING PRESSURE				
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%			
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY			
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY			
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY			
<b>CONSTRUCTION AND SIZING</b>	CONSTRUCTION	TOTALLY ENCLOSED, DUST TIGHT, WEATHER PROOF, IP:67			
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL			
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.			
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.			
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 90% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR REGULATING SERVICE - 150 STARTS/HR MINIMUM			
<b>HANDWHEEL</b>	* REQUIRED	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO		
	* ORIENTATION	<input type="checkbox"/> TOP MOUNTED	<input type="checkbox"/> SIDE MOUNTED		
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.				
<b>ELECTRIC ACTUATOR</b>	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY			
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY			
	@ MOTOR TYPE	IE1 TYPE AS PER IS: 12615, SQUIRREL CAGE INDUCTION MOTOR SUITABLE FOR DOL STARTING.			
	ACTUATOR APPLICABLE WIRING DIAGRAM	<input checked="" type="checkbox"/> ENCLOSED (BIDDER TO CONFIRM) <input checked="" type="checkbox"/> DRG. NO. 4-V-MISC-90271 R11			
	COLOUR SHADE	<input checked="" type="checkbox"/> BLUE (RAL 5012), To be decided during detail engg.			
	PAINT TYPE (## Refer Notes)	<input type="checkbox"/> ENAMEL	<input checked="" type="checkbox"/> EPOXY	<input type="checkbox"/> .....	
	SHAFT RPM	BIDDER TO SPECIFY			
	OLR SET VALUE	BIDDER TO SPECIFY			
	@ STARTING / FULL LOAD CURRENT	600% OF FLC INCLUSIVE OF I.S. TOLERANCE			
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY			
	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC	DOL STARTER		
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER <input type="checkbox"/> 230 V <input type="checkbox"/> 110 V			
	@ ENCLOSURE CLASS OF MOTOR	<input checked="" type="checkbox"/> IP 67 <input type="checkbox"/> FLAME PROOF			
@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B				


  
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**SPECIFICATION  
FOR  
MOTORISED VALVE ACTUATOR**

SPECIFICATION NO.:	
VOLUME	
SECTION	
REV. NO.	DATE:
SHEET 2	OF 3

**Data Sheet A & B**

DATA SHEET-A  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY BIDDER)

	@ WINDING TEMP PROTECTION	<input checked="" type="checkbox"/> THERMOSTAT (3 Nos.,1 IN EACH PHASE) <input type="checkbox"/> -----		
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED		
<b>INTEGRAL STARTER</b>	INTEGRAL STARTER	<input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED		
	TYPE OF SWITCHING DEVICE	<input type="checkbox"/> CONTACTORS <input type="checkbox"/> THYRISTORS		
	TYPE	<input type="checkbox"/> CONVENTIONAL <input type="checkbox"/> SMART (NON-INTRUSIVE)		
	<b>IF SMART</b>			
	a) SERIAL LINK INTERFACE	<input type="checkbox"/> INTEGRAL <input type="checkbox"/> FIELD MOUNTED		
	b) SERIAL LINK PROTOCOL	<input type="checkbox"/> FOUNDATION FIELD-BUS <input type="checkbox"/> PROFI-BUS <input type="checkbox"/> DEVICE NET <input type="checkbox"/> .....		
	c) SERIAL LINK MEDIA	<input type="checkbox"/> TWISTED PAIR Cu-CBL <input type="checkbox"/> CO-AXIAL Cu-CBL <input type="checkbox"/> OFC		
	d) HAND HELD PROGRAMMER	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	e) TYPE OF HAND HELD PROGRAMMER	<input type="checkbox"/> BLUETOOTH <input type="checkbox"/> INFRARED <input type="checkbox"/> .....		
	f) MASTER STATION	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	g) MASTER STN INTRFACE WITH DCS	<input type="checkbox"/> MODBUS <input type="checkbox"/> TCP/IP		
	h) DETAILS OF SPECIAL CABLE	<input type="checkbox"/> ENCLOSED <input type="checkbox"/> NOT REQUIRED		
	STEP DOWN CONT. TRANSFORMER	<input type="checkbox"/> REQUIRED		
	OPEN / CLOSE PB	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	STOP PB	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	INDICATING LAMPS	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
LOCAL REMOTE S/S	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED			
STATUS CONTACTS FOR MONITORING	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED			
INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY)			
<b>INTERPOSING RELAY/OPTO COUPLER</b> (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	<input type="checkbox"/> INTERPOSING RELAY <input type="checkbox"/> OPTO COUPLER <input type="checkbox"/> EITHER		
	QUANTITY	<input type="checkbox"/> 2 NOs. <input type="checkbox"/> 3 NOs.		
	DRIVING VOLTAGE	<input checked="" type="checkbox"/> 20.5 – 24V DC <input type="checkbox"/> _____ V DC		
	DRIVING CURRENT	<input checked="" type="checkbox"/> 125mA MAX <input type="checkbox"/> _____ mA MAX		
	LOAD RESISTANCE	<input checked="" type="checkbox"/> > 192 ohms - <25 k ohms <input type="checkbox"/> > _____ ohms - < _____ ohms		
<b>TORQUE SWITCH</b> (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN / CLOSE	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos. / <input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos		
	CONTACT TYPE	2 NO + 2 NC		
	RATING	5A 240V AC AND 0.5A 220V DC		
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE		
	ACCURACY	+3% OF SET VALUE		
<b>LIMIT SWITCH</b> (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN : INT : CLOSE	<input checked="" type="checkbox"/> 1 No <input type="checkbox"/> 2 Nos.	2 Nos. (ADJ.)	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos.
	CONTACT TYPE	2 NO + 2 NC		
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC		



**SPECIFICATION  
FOR  
MOTORISED VALVE ACTUATOR**

SPECIFICATION NO.:	
VOLUME	
SECTION	
REV. NO.	DATE:
SHEET 3	OF 3

**Data Sheet A & B**

DATA SHEET-A  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY BIDDER)

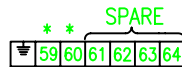
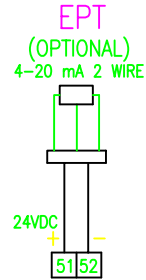
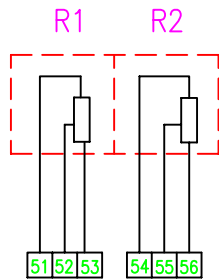
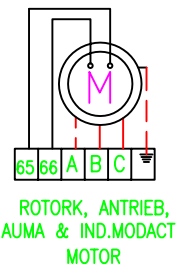
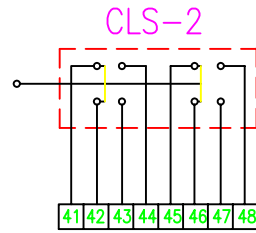
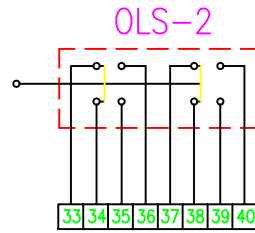
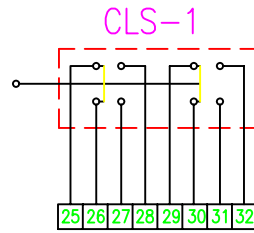
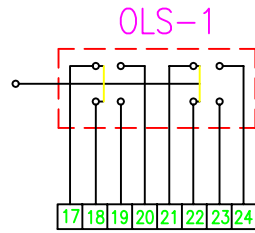
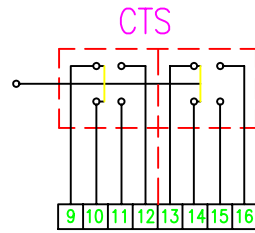
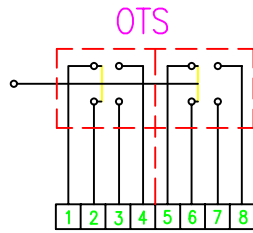
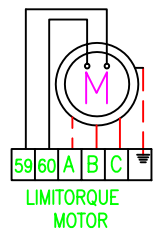
<b>POSITION TRANSMITTER</b>	POSITION TRANSMITTER (For inching duty & other specific applications)	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	<input type="checkbox"/> ELECTRONIC (2 WIRE) R/I CONVERTER <input checked="" type="checkbox"/> ELECTRONIC (2 WIRE) CONTACTLESS	
	SUPPLY	<input checked="" type="checkbox"/> 24V DC <input type="checkbox"/> .....	
	OUTPUT	<input checked="" type="checkbox"/> 4-20mA	
	ACCURACY	± 1% FS	
<b>SPACE HEATER</b>	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON INTEGRAL)	230V AC,1 PH.,50 Hz	
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY	
	@ RATING	FOR MOTORS WITH RATING >30 KW	
<b>TERMINAL BOX</b>	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED	
	ENCL CLASS ACTUATOR/MOTOR T.B.	@ <input type="checkbox"/> IP 68                      @ <input type="checkbox"/> .....	
	@ EARTHING TERMINAL	8 SWG GI WIRE	
	PLUG & SOCKET(9 PIN) (FOR COMM, LS/TS FEED BACK, PoT)	<input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED <input type="checkbox"/> 2 NOS. <input type="checkbox"/> .....	
<b>CABLE GLANDS</b>	@ POWER CABLE GLAND	SIZE:DDE	
	@ SPACE HEATER CABLE GLAND	SIZE:DDE	
	OTHER CONTROL CABLE GLANDS-1	<input type="checkbox"/> 1No. for BFV of CW PUMP(Cable size 2Px1.5mm2)	
	OTHER CONTROL CABLE GLANDS-2	QUANTITY & SIZE: 1no., 2.5 sq. mm	
<b>WEIGHT</b>	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY _____ Kg.	

**NOTES:**

- SCOPE:** DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
  - CODES & STANDARDS:** DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATION STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:  
IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691, IS 12615 AND IS-4722
  - TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
  - CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL, WITH NICKEL COATING SHALL BE PROVIDED.
  - THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION.THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
  - THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
  - THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.
- \$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.**
- ## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.**

	<b>PREPARED BY</b>	<b>CHECKED BY</b>	<b>APPROVED BY</b>	<b>VENDOR COMPANY SEAL</b>
<b>NAME</b>				<b>NAME</b>
<b>SIGNATURE</b>				<b>SIGNATURE</b>
<b>DATE</b>				<b>DATE</b>

NOTES\* = TO BE FILLED BY MPL (LEAD AGENCY).    @= TO BE FILLED BY ES



\* - SPARE FOR ROTORK, AUMA, ANTRIEB & IND.MODACT

SWITCHES - ALL ARE POTENTIAL FREE AND TWO PAIR OF CONTACTS CAN BE USED FOR DIFFERENT SUPPLY  
THERMOSTAT - 65-66 (ROTORK, AUMA, ANTRIEB & IND.MODACT), 59-60 (LIMITORQUE).

EPT - ELECTRONIC POSITION TRANSMITTER (POTENTIOMETRIC TYPE, FOR INCHING DUTY)

THERMOSTAT TERMINALS - TERMINATED IN MOTOR TB IN ANTRIEB & IND.MODACT AND IN MAIN TB IN OTHER MAKES

CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE) - 2 NO+2 NC

OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN) - 2 NO+2 NC

OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN - 2 NO+2 NC

CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE - 2 NO+2 NC

OTS, CTS - TWO INDEPENDENT SWITCHES IN ANTRIEB & LIMITORQUE

OLS-2 & CLS-2 - CAM DISC IN ROTORK & ANTRIEB

R1-R2- POTENTIOMETER 2 x 100 OHMS

H - SPACE HEATER 1ϕ 240V AC SUPPLY

M - MOTOR 3ϕ 415V 50 Hz AC SUPPLY

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF 100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS	CLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS	CTS	⊙

⊙ - CLS NOT TO BE CONNECTED IN TRIP CIRCUIT

NOTE:

1. BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY)
2. CONNECT THERMOSTAT WITHOUT FAIL IN THE STARTER CIRCUIT

CONTACT DEVELOPMENT DIAGRAM				
OTS	1-2			
	5-6	OFF AT OVER TORQUE DURING OPENING TRAVEL		
	3-4			
CTS	7-8	ON AT OVER TORQUE DURING OPENING TRAVEL		
	9-10			
	13-14	OFF AT OVER TORQUE DURING CLOSING TRAVEL		
OLS-1	11-12	ON AT OVER TORQUE DURING CLOSING TRAVEL		
	15-16			
	17-18			
CLS-1	21-22			
	19-20			
	23-24			
OLS-2	25-26			
	27-28			
	29-30			
CLS-2	31-32			
	33-34			
	35-36			
SWITCH	37-38			
	39-40			
	41-42			
TERMINAL NO.	43-44			
	45-46			
	47-48			
	FULL OPEN	a	INTERMEDIATE	b
		VALVE POSITION		
		INDICATES CONTACT CLOSED		
		INDICATES CONTACT OPEN		

CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC

Varun Jain  
 S A Khan  
 K. Keshav  
 Praveen Kishore

				<b>BHARAT HEAVY ELECTRICALS LTD.</b>	
		365-139		UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI 620014.	
		DRAWN	N.P.ESWAR	TITLE	
		CHECKED	K.ARUNACHALAM	INTERNAL WIRING DIAGRAM	
		APPROVED	P.LOGANATHAN	FOR	
		DATE	09.09.2000	ELECTRICAL VALVE ACTUATORS (AC)	
		CONTACT DEV. FIG.ADDED.		(DRAWN FOR INTERMEDIATE POSITION OF VALVES)	
11	09.09.2000			DRAWING No.	4-V-MISC-90271
REV	DATE	CHD	APPD	DESCRIPTION	REV 11

RETRACED WITH REVISION 11



## 9. FIELD INSTRUMENTS & FINAL CONTROL ELEMENTS

### 9.1 General Requirements

1. Measuring instruments/equipment and subsystems offered by the Contractor shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further, all instruments shall be of proven reliability, accuracy, repeatability requiring a minimum of maintenance. They shall comply with the acceptable international standards and shall be subject to Owner's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specifications, ranges, make/ numbers as approved by the Owner during detailed engineering.
2. Every panel mounted instrument requiring power supply shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.
3. All local gauges as well as transmitters, sensors, and switches for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance as well as for operator and management information (including all computation) of equipment under the scope of specification shall be provided.
4. The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tappings where the pressure exceeds 40 kg/sq cm.
5. For protection purposes, transmitters can be considered in place of switches.

### 9.2 Pressure / Differential Pressure / Flow / Level Transmitter

Table 9.1

Specifications for Pressure / Differential Pressure / Flow / Level Transmitter

S.N	Features	Minimum Requirements
1	Type	Microprocessor based 2 wire type, HART protocol compatible
2	Sensor Type	Capacitive/ Piezo-electric
3	Output Signal	4-20 mA signals superimposed with HART signal.
4	Signal Processing Unit	Microprocessor based



S.N	Features	Minimum Requirements
5	Overpressure	150% of max. operating pressure. For vacuum service, the element shall have under – range protection to full vacuum
6	Turn-down Ratio	10:1 for vacuum / very low pressure applications. 100:1 for other applications.
7	Stability	± 0.1% of calibrated span for six months up to 70 Kg/cm <sup>2</sup> and ± 0.25% for range more than 70 Kg/cm <sup>2</sup> (g).
8	Span and Zero drift	± 0.015% per deg. C at max span & 0.11 % per deg. C at min. span.
9	Enclosure Class	Weather proof as per IP 67 with corrosion resistance coating. For hazardous area explosion proof enclosure as described in NEC article 500
10	Zero & span adjustability	Continuous, tamper proof, remote as well as manual from instrument with zero suppression and elevation facility.
11	Local Indicator	To be provided
12	Display	Digital LCD Integral Display (minimum 5 digit) Engineering Unit
13	Process connection	½ " NPT (F)
14	Electrical Connection	½ " NPT
15	MOC of Electrical Housing	Aluminum Alloy or better
16	Ambient Temperature	65 Deg. C
17	Operating Voltage	16 – 40 Volts DC
18	Load	600 Ohms (minimum) at 24 Volts DC
19	Accuracy	± 0.075% of span or better
20	Response Time	100 millisecond or better
21	Adjustment/ calibration/ maintenance	Port/provision for Centralised PC based system maintenance.

- All transmitters shall be equipped with all necessary accessories like valve manifolds, mounting bracket etc. Pulsation dampeners shall be used where the process media is unstable for measurement such as at the discharge of a pump. For absolute pressure transmitter, 2 valve manifold; for gauge / vacuum pressure transmitter, 3 valve manifolds and for DP / level / flow transmitter, 5 valve manifold shall be provided. In case if it becomes necessary to use a DP transmitter for pressure measurement then a 3 valve manifold shall be used in place of 2 valve manifold.
- Pressure transmitter shall have easily accessible span, zero and time constant adjustments. A range suppression / elevation device shall be provided wherever required.
- For pressure / differential pressure transmitter, proof pressure shall be 200% of maximum static process pressure.
- All transmitter cases shall be dust – tight and rugged. Weather – proof and explosion – proof cases shall be used in outdoor and hazardous areas respectively. Protection class shall be of IP 67 or better.



3. Transmitters for pressure / DP measurements of liquid and steam shall always be installed below the sampling point, preferably with the connection at the top.
4. Transmitters for pressure / DP measurements for gases and air shall always be installed above the sampling point, preferably with the connection at the bottom.
5. Transmitters with diaphragm seal system shall be considered when
  - The process temperature is outside of the normal operating ranges of the transmitter and cannot be brought into those limits with impulse piping or
  - The process is corrosive and would require frequent transmitter replacement or unusual materials of construction or
  - The process contains suspended solids or is viscous and may plug the impulse piping or
  - There is a need to make density or interface measurements or
  - The process medium may freeze or solidify in transmitter or impulse piping.
6. Diaphragm seal shall be either capillary type or direct mounted type depending upon the application. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.
7. Differential pressure type level transmitters shall be used for range above 1219 mm, for services requiring purge or where liquid might boil in external portions.
8. Differential pressure type level transmitters for use on corrosive service shall generally be diaphragm wafer with extended filled capillary type. Flush or extended diaphragm type DP transmitter shall be considered for special application. Diaphragm material shall normally be stainless steel or any other special alloy.
9. Differential pressure type flow transmitters shall have in-built square-root extractors.

### 9.3 Temperature Transmitter

**Table 9.2  
Specifications for Temperature Transmitter**

S.N	Features	Minimum Requirements
1	Type	2-Wire, Smart (HART)
2	Output Signal	4-20 mA signals superimposed with HART signal.
3	Signal Processing Unit	Microprocessor based
4	Accuracy	± 0.075 % of span or better
5	Local Indicator	To be provided (Not applicable for DIN Rail Mounted type)
6	Display	Digital LCD Integral Display (minimum 5 digit)