

SECTION - 3

GENERAL TECHNICAL REQUIREMENTS

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipments and services covered under other sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

3.1 SITE INFORMATION

Particular	
Customer/ Owner	SATLUJ JAL VIDYUT NIGAM LIMITED
Purchaser	Bharat Heavy Electricals Limited
Project Title	Rampur Hydroelectric Project (H.P.) India

3.2 COMMUNICATION AND TRANSPORT LIMITATIONS

3.2.1 LOCATION AND ACCESS

3.2.1.1 The project site is located in the interior of Himachal Pradesh. The entire desilted water from the tail race outfall of Nathpa Hydroelectric Project will be diverted through the already constructed Rampur Intake located on the left bank of river Satluj at Jhakri. The surface type power house would be located at village Bayal, opposite Duttnagar, in distt. Shimla. The distance by road from Bayal to Jhakri upstream is about 20 km.

3.2.1.2 The rail head is at Kalka (Northern Railway) which is about 240 Kms from Bayal.

3.2.1.3 The major sea ports for imported equipment would be Mumbai,, Kolkata or Chennai as convenient. All these 3 sea ports are connected to Kalka by rail as well as roads. The rail/road distances from these sea-ports to Kalka are as follows:

	Distance From Kalka	To Mumbai	To Kolkata	To Chennai
i)	By rail	1906	1809	2558
ii)	By road	1753	1791	2482

- 3.2.1.4 The distance from Kalka to Delhi by road is 280 Kms.
- 3.2.1.5 From the Kalka rail head, the project is approachable by the following motorable roads:
- i) Kalka – Dharampur – Solan – Shimla – Narkanda - 235 Km
Kingal – Duttanagar – Rampur – Jhakri – (on NH-22).
- *ii) Kalka – Dharampur – Solan – Shimla – Dhalli Mashobra - Basantpur 252Km
– Kingal – Duttanagar– Rampur – Jhakri
- *iii) Kalka – Dharampur – Sabathu – Arki – Shalaghat – Dhami - 347Km
Basantpur – Kingal – Duttanagar – Rampur – Jhakri.

* All weather road but having limitation for transportation. Bidder may verify the same.

3.2.2 TRANSPORT LIMITATION

- 3.2.2.1 The transport limitation by road from Kalka rail head to the project site is the governing factor for determining permissible package size and weight.

- 3.2.2.2 The existing roads allow the transport of the packages of the following size and weight.

- i) Size (in mm) (l x b x h) 6500 x 6000 x 4500
- ii) Weight (Tonnes) 70 T (including weight of trailer)

3.3 TEMPERATURE DATA

Temperature of Air in shade

Maximum temp: 35.96 °C

Minimum temp: 2.47 °C

Average temp: 17.3 °C (MAX), 9.8 °C (MIN)

Maximum variation between day & night temperature during:

Winter: 15.36 °C

Summer: 15.76 °C (during June)

Maximum river water temperature: 7 °C

RELATIVE HUMIDITY

Maximum (during monsoons) : 91%

No. of months of tropical monsoon conditions

4 months (June to September)

Average annual rainfall

1424.8 mm

Average nos. of rainy days in a year
84.3 days
Occurrence of fog conditions
3.6 days

WIND DATA

Maximum wind pressure

Data available is from May 2006 onwards. Wind speed varies between 17.55 m/s to 0 m/s, with average speed 3.22 m/s. (Design wind speed shall be at least 180 km/hr)

Maximum no. of dust storms in a year

0.4 days

Maximum no. of thunderstorm days per annum

22.3 days

3.4 GENERAL TECHNICAL REQUIREMENT

3.4.1 GENERAL

This part covers technical conditions which form integral part of the Contract. The following provisions shall supplement all the detailed technical specifications and the requirements brought out in the various sections of this specification.

3.4.2 CODES AND STANDARDS

All materials and equipment shall generally comply in all respect with the latest edition of relevant international electro-technical commission (IEC) or any other internationally accepted standard which ensure equal or better quality or relevant Indian standard(IS) mentioned against each equipment and this specification.

The equipment are also to comply with latest and revised Indian electricity act and electricity rules and any other electrical statutory and provisional rules and regulations. In the event of supply of equipment conforming to any international or internationally recognised standard which will ensure equal or better than those standards specified for each equipment in this specification, salient features of comparison shall be brought out and furnish along with bid in English language. However, in case of standard other than IS & IEC or CBIP, if requested by the Engineer the supplier shall supply at his own expense three copies of the adopted standard in English language and one in original language. Brief detail of relevant standards has been given in section 2 for reference.

3.4.3 TYPE TESTS

All equipment/systems to be supplied shall conform to type tests as per relevant standards and proven type.

The Bidder / Contractor shall furnish the reports of all the type tests carried out in within last five years as listed in relevant clauses in respective electrical specification

and relevant standards for all components / equipment / systems. These reports should be for the tests conducted on identical/similar components/equipment/systems to those offered/proposed to be supplied under this contract.

In case Contractor is not able to submit report of type test(s) conducted in last five years, or in case type test report(s) are not found to be meeting the specification/relevant standard requirements, then all such tests shall be conducted under this contract by the Bidder free of cost to Employer, and reports shall be submitted for approval. No charges shall be paid under this contract.

Irrespective of the Contractor furnishing valid test report as indicated above, Employer will get some type test conducted under this contract specified as Mandatory Tests in other sections of this specification. The charges for each of these type tests shall be given in the offer.

All acceptance and routine tests as per relevant standards and specification shall be deemed to be included in the bid price.

3.4.4 DOCUMENTATION TO BE FURNISHED BY THE BIDDER

The number of copies/ prints/ reproducibles, manuals, computer CD-ROM's/ manuals to be furnished for various types of document is given in ANNEXURE-A.

The documentation shall include but not limited to the following as applicable, in addition to the documents if specified in Sections 1 and 2.

3.4.4.1 DETAILED ENGINEERING

1. Layout, General Arrangements, Elevations and Cross Section drawings of all equipment and facilities of the plant.
2. Flow diagram. Process & Instrumentation Diagrams
3. Technical Data Sheets.
4. Detail design calculations for components, system, piping etc. wherever applicable including sizing calculations.
5. Characteristic Curves/ Performance Correction Curves.
6. Power Supply Single Line Diagram, Block logic, Control Schematics, Electrical Schematics etc.
7. Protection System Diagrams and Relay Settings.
8. Cable Schedules and interconnection diagrams
9. Cable Routing Plan
10. Instrumentation schedule, measuring point list, functional write ups, installation drawings for field mounted instruments, wiring and tubing diagrams of the panels and enclosures etc. Drawings for open and closed loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc.
11. Alarm and annunciation/ Sequence of Event (SOE) list and trip set points.
12. Sequence and protection interlock schemes.

13. Type test reports (of tests conducted within 5 years)
14. Control system configuration diagrams and card circuit diagrams and maintenance details.
15. Detailed software manuals and software listing.
16. Detailed flow chart for digital control system.
17. Mimic diagram Layout
18. Civil drawings consisting of foundation and structural work, civil calculation sheets including structural analysis and design.
19. Model study reports wherever applicable
20. Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.

3.4.4.2 INSTRUCTION MANUALS

The instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically complied for this project. The instruction manual shall comprise of the following-

ERECTION MANUALS

The minimum contents of Erection Manual shall be as follows -

1. Erection Strategy
2. Sequence of Erection
3. Erection Instructions
4. Critical checks and permissible deviations/tolerances.
5. List of tool, tackles, heavy equipment like cranes, dozers etc.
6. Bill of Material
7. Procedure for erection
8. Procedure for initial checking after erection.
9. Procedure for testing and acceptance norms.
10. Procedure / Check List for pre-commissioning activities.
11. Procedure / Check List for commissioning of the system.
12. Safety precautions to be followed in electrical supply distribution during erection.

OPERATION AND MAINTENANCE MANUALS

The operating and maintenance instructions together with drawings (other than shop drawings) of the equipment, as completed shall be in sufficient detail to enable the Owner to operate, maintain, dismantle, reassemble and adjust all parts of the equipment. They shall give step by step procedure for all operations likely to be carried out during the life of the plant/equipment including operation, maintenance, dismantling and repair. Each manual shall also include a complete set of drawings together with performance / rating curves of the equipment and test certificates

wherever applicable.

If after the commissioning and initial operation of the plant, the manuals require any modification/ additions/ changes the same shall be incorporated and the updated instruction manuals shall be submitted to the Owners for records.

A separate section of the manual shall be for each size / type of the equipment and shall contain a detailed description of construction and operation, together with all relevant pamphlets and drawings.

The manuals shall include the following -

1. List of spare parts along with their drawings and catalogues and procedure for ordering spares.
2. Lubrication Schedules including charts showing lubrication checking, testing and replacement procedure to be carried out daily, weekly, monthly and at longer interval to ensure trouble free operation.
3. Wherever applicable, fault location charts shall be included to facilitate finding the cause of the mal-operation or break down.

Detailed specifications for the consumables including lubricant oils, greases, chemicals etc. shall be required for the complete plant.

3.4.4.3 DRAWINGS

1. All drawings shall be made in Autocad 2006 or latest Version. All drawings shall be plotted in ink. All dimensions and data shall be in SI metric units. All items of the equipment should be clearly identified by proper part numbers in the contract drawings. Such parts which are to be dispatched to site from works in dispatchable units and are re-assembled at site, should be marked by proper identification marks at works and indicated in the drawings and quantified. All the items of the shipping list should be identified in the drawing. The language for all inscriptions shall be English.
2. All drawings submitted by the contractor including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, external connection, fixing arrangement required, the dimensions required for installation and interconnections with other equipment and materials clearances and spaces required between various portions of equipment.
3. Each drawing shall bear a title block at the right hand bottom corner with clear mention of the name of the Owner, the System designation, specifications title, specifications number the name of the Projects drawing number and the revisions. If standard catalogue pages are submitted the applicable items shall be indicated there. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be metric units. **The title block for the drawings and documents and the numbering system shall be furnished to the successful bidder, which has to be strictly followed.**
4. The furnishing of detailed engineering data and drawings by the Contractor shall be in accordance with the time schedule for the Project. The review of these

documents /data/ drawings by the Owner will cover only general conformance of the data/ drawings/documents to the specifications and contract, interfaces with the equipment provided by others and external connections of the dimensions which might affect plant layout. The review by the Owner should not be construed to be thorough review of all dimensions, quantities and details of the equipment, material, any devices or items indicated or the accuracy of the information submitted. The review and/or approval by the Owner shall not relieve the Contractor of any of his responsibilities and liabilities under the contract.

5. After the approval of the drawings, further work by the Contractor shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Owner.
6. All manufacturing, fabrication and execution of the work in connection with the equipment/system, prior to the approval of the drawings shall be at Contractor's risk. The Contractor is not expected to make any change in the design of the equipment/system, once they are approved by the Owner. However, if some changes are necessitated in the design of the equipment/ system at a later date, the contractor may do so, but such change shall be promptly be brought to the notice of Owner indicating the reasons for the change and get the revised drawing approved again.
7. Drawing shall include all installation and detailed piping drawings. All piping of 100 mm and larger diameter shall be routed in detail and smaller pipe shall be shown schematically or by isometric drawing.
8. As Built Drawings - After final acceptance of individual equipment/ system by the Owner the contractor will update all original drawings and documents for the equipment /system to "As Built" conditions.
9. Drawings must be checked by the contractor prior to submission to the Owner. In case drawings are found to be submitted without proper checking by the contractor, the same shall not be reviewed and returned to the contractor for re-submission.
10. The Bidder shall submit the specified number of prints of drawings /data/ document **along with soft copy** for Owner's review and approval. The Owner shall review the drawings and return one (1) copy to the contractor authorizing either to proceed with manufacture or fabrication or marked to show changes desired. When changes are required, drawings shall be resubmitted promptly, with revisions clearly marked for the final review. Any delays arising out of the failure of the contractor to submit /rectify in time shall not be accepted as a reason for delay in the contract schedule.
11. The Bidder shall submit to the employer for approval within the time given in the contract or in the Program such drawing , samples , models or information as may be called for therein , and in the number therein required .During the progress of the works , such drawings of the general arrangements and details of the works as specified in the Contract. The Employer shall signify his approval or disapproval within 30 days. Approve drawings samples and models shall be signed or otherwise identified by the employer. The Contractor shall supply additional copies of drawings in the form and number stated in the contract.

12. The following Schedule and procedure of drawing approval to be followed:

Sl. No.	Steps	Action/Approved status Duration
1.	First Submission by Bidder (as per approved program)	COMMENTED 1- “Approved” 2- “Approved- Except As Noted” 3- “not Approved” 4- “For Information Only” 21 Days
2.	Second submission by Bidder within 10 days	For ‘1’ –Approved drawings Resubmitted with incorporation of comments/modifications with revision no. For ‘3’ –Returned with corrections/changes with Revision no. 15 Days
3.	third submission by Bidder within 07 days	For ‘1’ Approved 15 Days

Note-

Resubmission of ‘2’ category and ‘3’ category shall be within 7 days 10 days respectively to be recorded from the date of return of such drawings.

Approval of any drawing by the Employer shall not relieve the Bidder of his responsibility for the accuracy thereof or modification required during actual execution or for any deviation in scheme from Technical specification with accepted deviation if there by any.

3.4.5 QUALITY ASSURANCE PROGRAMME

To ensure that the equipment and services under the Scope of Contract, whether manufactured or performed within the Contractor’s works or at his Sub-Contractor’s premises or at the Owners’ site or at the other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programme shall be outlined by the Contractor and finally accepted by the Owner/ Authorized representative after discussions before the award of Contract. The QA programme shall be generally in line with ISO-9001/IS-14001. A quality programme shall be generally cover the following :

1. His Organization structure for the management and implementation of the proposed quality assurance programme.
2. Quality System Manual
3. Design Control System
4. Documentation Control System
5. Qualification data for Bidder’s key personnel

6. The procedure for purchase of materials, parts, components, and selection of Subcontractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchased etc.
7. System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.
8. Control of non-conforming items and system for corrective actions.
9. Inspection and test procedure both for manufacture and field activities.
10. Control of Calibration and testing of measuring, testing equipment.
11. System for quality audits.
12. System for indication and appraisal of inspection status.
13. System for authorizing release of manufactured product to the Owner.
14. System for handling, stores and delivery
15. System for maintenance of records.
16. Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of the equipment/ component as per format enclosed in SCHEDULE-4 & 5 of section -5.

QUALITY ASSURANCE DOCUMENTS

The Contractor shall submit the following Quality Assurance documents within three weeks after dispatch of the equipment.

1. Material mill test reports on components as specified by the specification and approved Quality Plans.
2. The inspection plan with verification, inspection plan check points verification sketches, if used and methods used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.
3. Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
4. Non-destructive examination results reports including radiography interpretation reports.
5. Factory tests results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.
6. Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed customer hold points

During the course of inspection, the following will also be recorded.

- (A) When some important repair work is involved to make the job acceptable and
- (B) The repair work remains part of the accepted product quality
7. All the accepted deviations shall be included with complete technical details.

ENGINEER'S SUPERVISION

To eliminate delays and avoid disputes and litigation all matters and questions shall be referred to the Owner and Contractor shall proceed to comply with the Owner's decision

The work shall be performed under the supervision of the Owner. The scope of the duties of the Owner pursuant to the Contract will include but not be limited to the following.

1. Interpretation of all the terms and conditions of these documents and specifications.
2. Review and interpretation of all the Contractor's drawings, engineering data etc.
3. Witness or his authorized representative to witness tests and trials either at the manufacturer's work or at site, or at any place where work is performed under the contract.
4. Inspect, accept or reject any equipment, material and work under the contract.
5. Issue certificate of acceptance and/or progressive payment and final payment certificates.
6. Review and suggest modifications and improvement in completion schedules from time to time.
7. Supervise the quality assurance programme implementation at all stages of the work.

INSPECTION, TESTING AND INSPECTION CERTIFICATES

1. The word 'Inspector' shall mean the Owner and/or his authorized representative and/or an outside inspection agency acting on behalf of the Owner to inspect and examine the materials and workmanship or the works during its manufacture or erection.
2. The Owner, his duly authorized representative and or an outside inspection agency acting on behalf of the Owner shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the contractor shall obtain for the Owner and for his duly authorized representative permission to inspect as if the works were manufactured or assembled on the contractors own premises or works.
3. The contractor shall give the Owner/inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the contractor's account except for the expenses of the inspector's. The Owner/inspector, unless the witnessing of the tests is virtually waived, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for tests/inspection and he shall forthwith forward to the inspector duly certified copies of test reports.
4. The Owner or inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in

accordance with the contract. The contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall confirm in writing to the Owner/inspector giving reasons therein, that no modifications are necessary to comply with the contract.

5. When the factory tests have been completed at the contractor's or subcontractors works the Owner/inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Owner/inspectors the certificates shall be issued within fifteen (15) days of the receipt of the contractor's test certificate by the Owner/inspector. Failure of Owner /inspector to issue such a certificate shall not prevent the contractor from proceedings with the works. The completion of these tests, or the issue of the certificates shall not bind the Owner to accept the equipment should it, on further tests after erection be found not to comply with the contract.
6. In all cases where the contract provides for tests whether at the premises or works of the contractor or any sub contractor, the contractor except where otherwise specified shall provide free of charges such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Owner/inspector or his authorized representatives to carry out effectively such tests on the equipment in accordance with the contract and shall give facilities to the Owner/inspector or to his authorized representative to accomplish testing.
7. The inspection by Owner and issue of inspection certificate there on shall in no way limit the liabilities and responsibilities of the contractor in respect of the agreed quality assurance programme forming a part of the contract.
8. To facilitate advance planning of inspection in a addition to giving inspection notice as per clause 3 of 3.2.8, the contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at customer hold point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.
9. All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The contractor shall maintain all the relevant records of periodic calibration and instrument identification and shall produce the same for inspection by Owner. Wherever asked specifically the contractor shall recalibrate the measuring test equipment in the presence of Owner engineer.

GENERAL REQUIREMENTS QUALITY ASSURANCE

1. All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all stages, as per a comprehensive Quality Assurance Programme. An indicative programme of inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is however, not intended to form a comprehensive programme as it is the contractor responsibility to draw up and implement such programme duly approved by the Owner. The detailed quality plans for manufacturing and field activities should be drawn by the Bidder, separately in the format attached at Section 5 and will be submitted to Owner for approval. Schedule of finalization of such quality plans will be finalized before

award.

2. Manufacturing quality plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by contractor's quality control organization, the relevant reference documents and standards, acceptance norms, inspection documents raised etc. during all stages of material procurement, manufacture, assembly and final testing performance testing.
3. Field quality plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the contractors site quality control organization, during various stages of site activities from receipt of materials/equipment at site. Format for field Quality Plan is given in Section 5.
4. However if Owners/ Purchasers Standard Manufacturing Quality Plan OR the Standard Check List is furnished at Section 5 of this specification or at contract stage separately, the Bidder shall give his concurrence to the same. In case Owners Standard Manufacturing Quality Plan OR the Standard Check List is furnished then Contractor's Manufacturing Quality Plan is not required.
5. The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in quality plans along-with quality plans. These quality plans and reference documents/standards etc. will be subject to Owner's approval without which manufacture shall not proceed. These approved documents shall form a part of the contract. In these approved quality plans Owner shall identify Customer Hold Points (CHP), i.e test/checks which shall be carried out in presence of the Owner's engineer or his authorized representative and beyond which the work will not proceed without consent of Owner/authorized representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner along with technical justification for approval and disposition.
6. The contractor shall submit to the Owner field welding schedule for field welding activities if applicable. The field welding schedules shall be submitted to the Owner along with all supporting procedures, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site. The format for the welding schedules shall be furnished at contract stage, if applicable.
7. No material shall be dispatched from the manufacturer's work before the same is accepted subsequent to pre-dispatch final inspection including verification of records of all previous tests/inspection by Owner's engineer/ authorized representative, and duly authorized for dispatch issuance of MDCC.
8. All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties, chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.

9. WELDING AND BRAZING

All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section-IX/BS-4870 or other international equivalent standard acceptable to the Owner.

All welding/brazing procedures shall be submitted to the Owner or its authorized representative for approval prior to carrying out the welding/brazing.

All brazers, welders and welding operators employed on any part of the contract either in contractors/his subcontractors works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Owner

Test results of qualification tests and specimen testing shall be furnished to the Owner for approval. However, where required by the Owner, tests shall be conducted in presence of Owner/authorized representative.

For all pressure parts and high pressure piping welding the latest applicable requirements of the IBR(Indian Boiler regulations) shall also be essentially complied with. Similarly, any other statutory requirements for the equipment /systems shall also be complied with.

All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.

No welding shall be carried out on cast iron components for repair.

Unless otherwise proven and specifically agreed with the Owner, welding of dissimilar materials and high alloy materials shall be carried out at shop only.

All non-destructive examination shall be performed in accordance with written procedures as per International Standard. The NDT operator shall be qualified as per SNT-TC-IA(of the American Society of Non-destructive Examination). NDT shall be recorded in report which includes details of methods and equipment used, result evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.

10. SUB-VENDORS

All the sub-vendors proposed by the contractor for procurement of major bought out item including castings, forging, semi-finished and finished components/equipment, list of which shall be drawn up by the contractor and finalized with the Owner shall be subject to Owners approval. The contractors proposal shall include vendors facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. alongwith his own technical evaluation and shall be submitted to the Owner for approval prior to any procurement. Such vendor approval shall not relieve the contractor from any obligation duty or responsibility under the contract.

For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Owner, the contractors,

purchaser, specification, and engineering shall call for quality plans to be submitted by the suppliers along with their proposals. The quality plans called for from the vendors shall set out, during the various stages of manufacture and installation, the quality practice and procedures followed by the vendor's quality control organization, the relevant reference documents/standards used, acceptance level, inspection of documentation raised etc.

Such quality plans of the successful vendors shall be finalized with the Owner and such approved quality plans shall form a part of the purchase order/contract between the contractor and vendor. Within three weeks of the release of the purchase order/contracts for such bought out items/components, a copy of the same without price details but together with the quality plans and delivery conditions shall be furnished to the Owner by the contractor.

11. Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the contractors or their sub-vendors quality management and control activities. The contractor shall provide all necessary assistance to enable the Owner to carry out such audit and surveillance.

The contractor shall carry out an inspection and testing programme during manufacture in his works and that of his sub-contractors and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identify and acceptability of all materials parts and equipment. He shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.

12. Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Owner to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings etc.

For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

13. Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Owner/authorized representative

FIELD INSPECTION & TESTS

The following field inspections and tests will be carried out in the sequence detailed below, and the successful performance and completion of all the tests taken together shall constitute the OWNER ACCEPTANCE TESTS -

1. On completion of erection of the equipment and before start-up, each item of the equipment shall be thoroughly cleaned and then inspected jointly by the Owner and the contractor for correctness and completeness of installation and acceptability for start-up, leading to initial pre-commissioning tests at site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the contractor's quality assurance programme.

2. The contractor's commissioning/start-up engineers, specially identified as far as possible shall be responsible for carrying out all the pre-commissioning tests at site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over the complete equipment shall be placed on initial operation during which period the complete equipment shall be operated integral with sub-systems and supporting equipment as a complete plant.
3. All piping system shall be flushed steam blown as required and cleanliness demonstrated using acceptable industry standards procedures to accomplish this work shall be submitted for approval to the Owner six months prior to the respective implementations. The Owner will approve final verification of cleanliness.
4. The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.
5. The check outs during the pre-commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Owners commissioning (start-up) Engineer(s) should be checked out and cleaned. The checking and inspection of individual system should then follow a prescribed schedule to be agreed by Owner.
6. The contractor during trial operation and performance testing conduct vibration testing to determine the base line of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable.

MATERIAL AND WORKMANSHIP

All material used for the construction of equipment shall be new and shall be in accordance with the requirement of this specification. Material utilized for various components shall be those which have established themselves for use in such applications.

All castings shall be true to pattern, free from defects and of uniform quality and condition. The surfaces of castings, which do not undergo machining, shall be free from foundry irregularities. The casting shall be tested for NDT, chemical, mechanical and metallographic tests. This shall be specified in quality plan for the specific equipment. All components machined or fabricated from plate, sheet or bar stock shall meet the material requirements of ASTM. Structural steel rolled shapes, bars, etc. shall comply with the latest ASTM.

All or a representative number of such components shall be subjected to one or more of the tests: visual, dye penetration, magnetic particle (transverse and longitudinal), ultrasonic or radiograph. These tests shall be in accordance with the ASTM. The acceptance shall be as per ASTM Specifications.

All joints and fastening shall be so designed, constructed and registered that the component part may be accurately positioned and restrained to fulfil their required function. The heads of all bolts shall register flush on the surfaces, which they fasten.

All the information concerning materials or components to be used in manufacture, machinery, equipment, materials and components supplied, installed or used shall be

submitted for approval. Without such approval the Contractor shall run risk of subsequent rejection. The cost as well as time delay associated with such rejection shall be borne by the Contractor.

All components exposed to rain shall be designed with sloped upper surface to avoid water pools.

AUXILIARY SUPPLY

The sub-station auxiliary supply is normally met through a system indicated under section-5 having the following parameters. The auxiliary power for station supply, including the equipment drive, cooling system of any equipment, air-conditioning, lighting etc shall be designed for the specified Parameters as under. The DC supply for the instrumentation and PLCC system shall also conform to the parameters as indicated in the following.

<i>Normal Voltage</i>	<i>Variation Voltage</i>	<i>in Frequency HZ</i>	<i>in Phases</i>	<i>Neutral connection</i>
415V	+/- 1 0%	50 +/- 5%	3/4-Wire	Solidly
240V	+/- 1 0%	50 +/- 5%	1 /2-wire	Earthed.
220V	+/- 1 0%	DC	2-wire	Isolated
50 V	+/-1 0%	DC	2-wire	Isolated

Combined variation of voltage and frequency shall be limited to +/- 10%.

RATING PLATES, NAME PLATES AND LABELS

1. General

Labels and data plates shall be provided in accordance with applicable standards and as detailed hereunder:

The proposed material of the labels, size, exact label lettering and proposals for the arrangement of the labels shall be submitted to the Engineer for approval.

Where applicable, designations in the selected local language shall appear above or to the right of the designation in the Contract language. The translations into and writings in the local language shall be submitted for approval.

2. Equipment Labels and Instruction Plates

Labels written in the contract language shall be provided for all instruments, relays, control switches, push buttons, indication lights, breakers etc. In case of instruments, instrument switches and control switches, where the function is indicated on the device, no label is required. The label shall be fixed close to the device in such a way that easy identification is possible. Fixing on the dial glass of instruments will not be accepted. The wording shall conform to the wording used in engineering documents.

Each separate construction unit (cubicle, panel, desk, box, etc.) shall be identified by its Works identification number. Cubicles and similar units shall also bear this identification number. Cubicles and similar units shall also bear this identification number on the rear side if rear access is possible. Overall designation of each unit shall

be given in the Contract language and – if required – also in a selected local language. These labels shall be made of anodised aluminium with black engraved inscription, arranged at the top section of the units. Manufacturer's trade label shall – if desired – appear in the bottom section of the units.

All works inside cubicles, panels, boxes, etc. shall be properly labelled with their item number. This number shall be the same as indicated in the pertaining documents (wiring diagram, Works list, etc.)

Instruction plates in the Contract and selected local language, the sequence diagrams or instructions for maintenance shall be fitted on the inside of the front door of the electrical switchboards.

3. Warning Labels

Warning labels shall be made of synthetic resin with letters engraved in the contract and selected local language, where required in particular cases.

For indoor circuit breakers, starters, etc. transparent plastic material with suitably contrasting colours and engraved lettering would be acceptable.

4. Labels for conduits, etc.

The material shall be non-corrosive and the description be done with 4 mm high letters/figures.

5. Labels for Cables

Each cable when completely installed shall have permanently attached to each end and at intermediate positions as may be considered necessary by the Engineer, non-corrosive labels detailing identification number of the cable, voltage, and conductor size. The cable identification number shall comply with those of the cable list.

All cables in cable pits and at the entry to buildings shall be labelled utilising the aforementioned type of label.

6. Rating Plates

Works (hoists, machines, transformers, etc.) rating plates and other technical data/informative plates shall either be of the enamelled type or be of stainless steel suitably protected after engraving with a transparent paint resistant to aggressive atmosphere and solar radiation.

7. Single Line Diagram

Each Switchgear room shall be furnished with a copy of the final as built single line diagram detailing all electrical data and denominations, separate for each individual switchgear/distribution board/MCC, placed under glass and frame/wall mounted at an approved location.

8. Key System for Electric Boards

Key interlocked switches shall be provided with Yale or other approved locks for locking in the neutral position. Similar locks shall be provided for selector switches for locking the switches in any of the positions.

The locks or padlocks shall be co-ordinated for the different applications and shall be supplied with three keys. A key cabinet at the end of each board (distribution board, MCC, control cubicles, etc.) shall be provided for storing the keys of that board. All keys shall have six master keys to open any lock or padlock supplied. Each key shall have one identification label fixed above the key-hanging hook inside cabinet.

The cabinet door keys shall be similar and shall be six(6) in number.

GROUND TERMINAL

Each equipment shall be provided with two grounding pads, each with two holes for M12 bolts and spring washers suitable for connection to 75mm x 12mm galvanized steel flat. The two pads shall be provided, one each at the middle of the two opposite sides of the bottom frame of the equipment.

BOLTS, NUTS AND WASHERS

Bolts, nuts and plain washers of size M12 and above shall be hot-dip galvanized, while sizes below M12 shall be electro-galvanized or stainless steel. Bolts and nuts shall be hexagonal or socket headed. All spring washers shall be electro-galvanized mild steel suitable for at least service condition. The shall supply the net quantities plus 5 percent of all permanent bolts, screws and other similar items and materials required for installation at site.

In general, screw threads shall be standard ISO metric threads. The use of other thread form will be used only after prior approval. The Contractor shall furnish locking devices for threaded fasteners, which will lock them in such a manner so as to prevent them from coming loose in transport and in service.

NOISE LEVEL

The noise level caused by the installed Works shall not exceed the following values if not otherwise stated in the particular technical specification:

- Machine hall, workshop, etc. max. 85 dB (A) at any place 1 M distant from operating equipment.
- Offices, control rooms, first aid max. 55 dB (A) rooms, canteens, etc.
- Residential areas, daytime max. 50 dB (A) night time max. 35 dB(A)

The noise level definition and measurement shall be in accordance with ISO and IEC. The values stated shall be adhered to taking a normal civil construction into account.

Notwithstanding reference made to various standards all equipment and works as per provisions and requirements of relevant and latest Indian Standards shall be acceptable.

CONTROL CABINETS/ BOXES/ PANELS

Cubicles and control panel enclosures shall be of cold rolled sheet steel with minimum thickness for load bearing members as 2.5mm and non load bearing as 2 mm, of rigid, self-supporting construction and supplied with channel bases made to ensure no bulging takes place.

Cubicles shall be fitted with close fitting, gasketed, hinged, lift-off doors capable of being opened through 180 deg. The doors shall be provided with integral lock and master key.

Cubicles and panels shall be vermin proof. Removable gland plates shall be supplied and located to provide adequate working clearance for the termination of cables. Under no circumstances shall the floor/roof plate be used as a gland plate. The cables and wiring shall enter from bottom or top as approved or directed by the Engineer.

The cubicles and panels shall be adequately ventilated, if required, by vents or louvers, and shall be so placed as not to detract from the appearance. All ventilating openings shall be provided with corrosion-resistant metal screens or a suitable filter to prevent entrance of insects or vermin. Space heating elements with thermostatic control shall be included in each panel.

Where cubicles are split between panels for shipping, terminal blocks shall be provided on each side of the split with all necessary cable extensions across the splits. These cable extensions shall be confined within the panels with suitable internal cable ducts.

Unless stated otherwise, all cubicles and panels shall be provided with a ground bus with 40mm copper bar extending through out the length. Each end of this bus shall be drilled and provided with lugs for connecting ground cables ranging from 70 to 120mm .

The standard phase arrangement when facing the front of the motor control centres and switchboard shall be RYB from left to right, from top to bottom and front to back. All instruments, devices, buses and other equipments involving 3 phase circuits shall be arranged and connected in accordance with the standard phase arrangement, where possible. Electrical clearances shall conform to applicable standards and shall not require cutting away of adjacent framework.

All instruments, control knobs and indicating lamps shall be flush mounted on the panels. Relays and other devices sensitive to vibration shall not be installed on doors or hinged panels, and no equipment shall be installed on rear access doors.

The instrument and control wiring, including all electrical interlocks and all interconnecting wiring between sections, shall be completely installed and connected to terminal blocks by the manufacturer.

The arrangement of control and protection devices on the panels and the exterior finish of the panels shall be subject to the approval of the Engineer. The interior of all cubicles and panels shall have a mat white finish unless specified otherwise.

Switched interior light and socket outlets shall be provided for all cubicles and control panels.

All cubicles and control panels shall be provided with lamacoid nameplates,

identifying the purpose of the panel and all of its components.

Alarm contacts

Where applicable, all alarm contacts shall be of galvanically isolated type and provide inputs to the following devices.

- Local annunciator
- Station annunciator
- Supervisory control and sequence of events / fault recorder system.

All alarm contacts shall be changeover type. Where required, relays shall be provided as contact multiplier.

All types of panels shall generally conform to IS5039, IS8623 and IEC 439 as applicable.

Suitable 240 V, single phase, 50 Hz heaters with thermostats controlled by switch and fuse shall be provided to maintain inside temperature 10 deg. above the ambient. The heaters shall be suitably designed to prevent any contact between the heater wire and air. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

The size of the enclosure and the layout of equipment inside shall provide generous clearances. Each cabinet/box/Kiosk/panel shall be provided with 15 A 240 V AC. 2 pole, 3 pin, industrial grade receptacle with switch. For incoming supply MCB of suitable rating shall be provided. Illumination of each compartment shall be with door operated incandescent lamp. All control switches shall be rotary switch type.

Each box shall be provided with two earthing pads to receive GS flat. The connection shall be bolted type with two bolts per pad. The hinged door shall be connected to body using flexible wire.

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass or galvanized steel to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

The labels etc. on these panels shall be as per clause above.

Electric Motors

1. General

All motors shall be of approved manufacture and shall comply with the requirements of this Chapter. Motors of the same type and size shall be fully interchangeable and shall comply - as far as applicable - to IEC standard motor dimensions.

The general construction shall be stiff and rigid; no light metal alloy casings will be accepted. All precautions shall be taken to avoid any type of corrosion.

All motors shall be fitted with approved types of lifting hooks or eyebolts as suitable.

AC motors shall have squirrel cage type rotors.

Motor Voltages and Power Ratings

The service voltages and corresponding power ratings for electric motors to be used in the Project shall be as follows:

Motors up to 100 kW

- Service voltage : 3-phase a.c. 415/240 V, 50 HZ
- Mode of starting : direct-on-line up to 50 kW above 50 kW with suitable starters

Motors up to 0.75 kW

- Service voltage : single-phase a.c. 240 V, 50 HZ
- Mode of starting : condenser

Motors intended to work on the d.c. System

Service voltage : 220 V D.C.

Mode of starting : resistor

2. Rating

The rating of the motors shall be adequate to meet the requirements of its associated equipment. The service factor, being the ratio of the installed motor output to the required power at the shaft of the driven machine at its expected maximum power demand, shall be applied as follows:

Power Demand of Driven Machine Service Factor

Up to 5 kW 1.2

More than 5 kW 1.1

A.C. motors shall be capable of operating continuously under rated output conditions at any frequency between 95% and 105% of the rated frequency and/or with any voltage variation between 90% and 110% of the nominal voltage. A transient overvoltage of 130% of the nominal voltage shall as well be sustained.

Further, the motors shall be capable of maintaining stable operation when running at 70% nominal voltage for a period of 10 seconds. The pullout torque for continuously loaded motors shall be at least 160% of the rated torque and for intermittently loaded motors 200% of the rated torque.

D.C. motors shall be capable of operating continuously under rated output conditions at any voltage between 90% and 110% of the nominal voltage with a fixed brush setting for all loads. Unless otherwise approved, the speed drop between no-load and full-load shall not exceed 10% of no-load speed.

3. Starting

A.C. motors shall be designed for direct on-line starting. They shall be capable of being switched on without damage to an infinite busbar at 110% of the nominal

voltage with an inherent residual voltage of 100% even in phase opposition. For starting the motors from the individual main and auxiliary busbars, a momentary voltage drop of 20% referred to nominal voltage should be taken into consideration. With 85% of the nominal voltage applied to the motor terminals, each motor shall be capable of accelerating its associated load to full speed with a minimum accelerating torque of 5% of full load torque.

The maximum starting currents (without any tolerance) shall not exceed the following values: -

- 5 times of rated current for L.V. motors rated 100 kW or above
- 2 times of rated current for D.C. motors (by means of starting resistors)

Generally, all motors shall be able to withstand three cold starts per hour, equally spaced. In addition, each M.V. motor shall be capable of enduring two successive starts with the motor initially at operating temperature. Each L.V. motor shall be capable of withstanding three successive starts under the same conditions or once every twenty minutes without detrimental heating.

Motors for frequent automatic starting shall have an adequate rating. In the motor list the Contractor shall state the frequency of starts permitted in compliance with the motor design.

4. Windings and Insulation Class

The insulation of all motors shall be of class F but maintain in operation the temperature limits of class B materials. It shall be suitable for operation in damp locations, for occasional contact with corrosive gases and vapors and for considerable fluctuations in temperature.

The stator winding shall be suitably braced to withstand the forces due to direct-on-line starting and transfer conditions as mentioned before. The winding envelopment and tails shall be non-hygroscopic. The stator winding shall withstand the maximum fault current for the period determined by the associated protective devices.

The rotor winding (if applicable) shall be designed to give trouble-free continuous service including repeated direct-on-line starting. The rotor shall be subjected to a 120% over speed test for 2 minutes without showing any winding dislocation.

5. Ventilation and Type of Enclosure

All motors shall be of the totally enclosed fan-cooled type, protection class IP 54 according to IEC Recommendation 144. Cable termination points shall be of class IP55.

They shall have a closed internal cooling air circuit recooled by an external cooling air circuit drawn from the opposite side of the driving end.

Where motors are installed outdoors, a weatherproof design shall be chosen. L.V. motors of IEC size 132 and above shall be equipped with automatically controlled heating elements for protection against internal condensation of moisture during standstill periods. Such A.C. heater shall be suitably fixed inside the motor casing; the leads shall be led to a separate L.V. terminal box.

Motors installed outdoors and directly subjected to solar radiation shall be rated such as not to exceed a maximum metal temperature of 85°C. Where necessary, such motors shall be provided with sun shields.

Vertical motors shall be provided with a top cover to prevent the ingress of dirt, etc.

6. Bearings

As far as possible, the motors shall have sealed ball or roller bearings lubricated for life. All other motors with ratings of about 1 kW and above shall be equipped with lubricators permitting greasing while the motor is running and preventing over-lubrication. Additionally, the bearings shall be fitted with grease nipples permitting the use of a universal grease gun.

Vertical motors shall have approved thrust bearings.

Where sleeve bearings are being used, they shall be of the self or forced lubricating type. If forced lubrication is required, it shall be arranged common to both the motor and the driven machine and provisions shall be made to ensure lubrication during start-up and shutdown operations without the necessity to start an auxiliary lube oil pump. Self-lubricated bearings shall be equipped with an easily accessible oil reservoir with overflow pipe and oil collecting vessel.

All bearings shall be easily controllable during operation or standstill without dismantling the bearings. The bearings shall further be protected and sealed against dust penetration and oil leakage.

In case of independent bearings, motor and bearing pedestals shall be fitted on a common base plate.

For the transport of motors equipped with ball or roller bearings, special bearing inserts shall be provided to prevent transport damage.

Service hour meters shall be installed in the motor control centres if maintenance work such as regreasing, oil change etc. depend on the operation time of the motors.

7. Shafts and Couplings

The motors shall be provided with a free shaft extension of cylindrical shape with key and keyway according to IEC Recommendation 72-1 and with the motorside-coupling, which shall be pressed on the motor shaft and be balanced together with it. A coupling guard shall be provided.

8. Brushgear and Commutators

Brushgear for D.C. motors shall be designed to ensure constant brush pressure. Carbon brushes shall be provided which stand at least 6 months of operation without replacement. Each brush shall be independently adjustable but should not require adjustment throughout its life. A design of brushgear which permits the brush holder to touch the commutator as the brushes wear or which passes current through the pressure fingers will not be accepted.

A sufficient number of brushes, not less than two per pole, shall be fitted to ensure that vibrations do not affect the commutation.

The minimum safe wearing margin of commutators shall not be less than 20 (twenty)

per cent of the total thickness of the commutator bars and the minimum safe diameter shall be clearly marked on it.

9. Terminal Boxes and Earthing

The terminal leads, terminals, terminal boxes and associated equipment shall be suitable for terminating the respective type of cables as specified in these General Technical Specifications and in the Particular Technical Specifications.

The terminal boxes shall be of ample size to enable connections to be made in a satisfactory manner. Supports shall be provided at terminal boxes as required for proper guidance and fixing of the incoming cable.

The terminal boxes with the cables installed shall be suitable for connection to supply systems with the short-circuit current and the fault clearance time determined by the motor protective devices.

A permanently attached connection diagram shall be mounted inside the terminal box cover. If motors are provided for only one direction of rotation, this shall be clearly indicated.

Terminal boxes shall be totally enclosed and designed to prevent the ingress of moisture and dust. All joints shall be flanged with gaskets of neoprene or similar material. For motors above 1 kW, the terminal box shall be sealed from the internal air circuit of the motor.

Depending on the size, the terminal box of L.V. motors shall be fitted either with an approved cable sealing-end or with a gland plate drilled as required and provided with suitable fittings for cable fixing and sealing. Such openings shall be temporarily plugged or sealed during transportation.

For earthing purposes, each motor shall have adequately sized bolts with washers at the lower part of the frame. In addition, each terminal box shall contain one earthing screw. Each equipment/panel shall be earthed by at least two separate earthing strips.

The cable termination philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field-mounted group. JB'S at strategic locations (where large concentration of signals are available, e.g switchgear) is done. Termination / Junction boxes shall have either maxi- terminal or cage clamp type terminals

10. Noise-Level and Vibrations

Under all operating conditions, the noise level of motors shall not exceed 85 dB (A).

In order to prevent undue and harmful vibrations, all motors shall be statically and dynamically balanced.

Vibration displacements or velocity shall be measured in accordance with relevant IS for IEC motor sizes 80 to 315. The results for all motors shall be within the "R" (reduced) limits.

11. Tests

Each motor shall be factory tested and shall undergo a test at site. The following tests shall be performed under full responsibility of the Contractor.

Workshop Tests:

Measurement of winding resistances
No-load and short-circuit measurements
Measurement of starting current and torque
Efficiency measurement (type test)
Heat test run
Dielectric test
Measurement of insulating resistance
Overspeed test

Site Tests:

Measurement of insulation resistance
Measurement of motor vibrations
Measurement of starting time.

PROTECTION CLASS OF CABINETS/PANELS, ENCLOSURES, MOTORS ETC.

All panels desk cabinets and enclosures furnished shall at least comply with the requirements of protection classes as indicated below unless otherwise specified in Section 1 or 2 :

- | | |
|--------------------------------------|------|
| 1. Indoor air conditioned (AC) areas | IP22 |
| 2. Indoor Non AC areas | |
| b. Ventilated enclosures | IP42 |
| c. Non Ventilated enclosures | IP54 |
| 3. Outdoor | IP55 |

SURGE PROTECTION FOR SOLID STATE EQUIPMENT

All solid state systems/equipment shall be able to withstand the electrical noise and surge as encountered in actual service conditions and inherent in a power plant and shall meet the requirements of surge protections as defined in ANSI C37.90.1-1989 or its suitable equivalent class of IEC 254-4. Details of the features incorporated and relevant tests carried out. The test certificates etc. shall be submitted by the Contractor.

INSTRUMENT AIR SYSTEM

The instrument air supply system shall be supplied by the Contractor for various pneumatic control and instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping/tubing etc.

Each pneumatic instrument shall have an individual air shut-off valve. The pressure regulating valve shall be equipped with an internal filter, a 50mm pressure gauge and a built-in filter housing blow down valve.

Tapping points shall include probes, wherever applicable, for analytical measurements and samplings.

For direct temperature measurement of all working media, one stub with internal

threading of approved pattern shall be provided along with suitable plug and washer. The contractor will be intimated about thread standard to be adopted.

The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Contractor.

1. Temperature test pockets with stub and thermo-well.
2. Pressure test pockets.

LUBRICATION

Equipment shall be lubricated by the systems designed for continuous operation. Lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.

LUBRICANTS, SERVO FLUIDS AND CHEMICALS

The Bidder's scope includes first fill of all lubricants, servo fluids, gases and chemicals. Consumption of all these consumables during the trial operation and final filling after the trial operation shall also be included in the scope of the Bidder. Bidder shall also supply a quantity one year topping requirement of each variety of lubricants, servo fluids and the chemicals used unless specially excluded under Exclusion in the specification. As far as possible, lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible.

COLOUR CODE FOR ALL EQUIPMENT/ PIPING/ PIPE SERVICES

All equipment / piping/ pipe services are to be painted by the Contractor in accordance with Owner's standard colour coding scheme, which will be furnished to the Contractor during detailed engineering stage.

PROTECTION

All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either metallic or a non-metallic protection device. All ends of valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from the damage. The parts which are likely to get rusted, due to exposure to weather, should also be properly treated and protected in a suitable manner. All primers/ paints / shall take into account the hot humid, corrosive and saline atmospheric conditions applicable for a coastal area.

All exposed metallic surfaces subject to corrosion shall be protected by the shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to finish painted after installation or require corrosion protection until installation, shall be shop painted with at least two coats of primer.

Shop primer for all steel surfaces which will be exposed to operating temperature

below 95 degrees Celsius shall be selected by the Contractor after obtaining specific approval of the Owner regarding quality of the primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Owner.

All other steel surfaces which are not to be painted shall be coated with suitable dust preventive compound subject to the approval of the Owner.

All piping shall be cleaned after shop assembly by shot blasting or other means approved by the Owner. Lube oil piping or carbon steel shall be pickled.

All metal surfaces shall be treated to provide anti-corrosion protection. All ferrous surfaces for external use shall be hot-dip galvanized after fabrication. High Tensile steel nuts and bolts and spring washers shall be electro-galvanized to service condition 4. All steel conductors including those used for earthing / grounding (above ground level) shall also be galvanized according to IS- 2629.

FUNGISTATIC VARNISH -Special moisture and fungus resistant varnish shall be applied to parts, which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface or part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

All Switchgear panels and Control / Relay Panels shall be painted by powder coating. Paint shade for electrical equipment shall be 692 for indoor and 631 of IS: 5 for outdoor equipment. However paint shade has to be matched with existing equipments, which shall be furnished at the detailed design engineering stage.

GALVANIZING

The galvanized surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the steel by dry process. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surfaces, flaking and peeling off, etc.

Unless otherwise specified in Section 1 or 2, the minimum weight of the zinc coating shall be as follows –

It shall be 610 gm/sq.m and minimum thickness of coating shall be 85 microns for all items thicker than 6 mm. The average coating thickness shall be 95 microns. For items less than 6 mm, requirements of coating thickness shall be as per clause 4.1 of IS 4759, 1984. For surfaces which will be embedded in concrete, the zinc coating shall be 900 gm/sq.m minimum. Galvanizing of each member shall be carried out in one complete immersion.

After galvanizing, no drilling or welding shall be performed on the galvanized parts of the equipment.

1. All bolts, nuts, lock nuts, washers, etc. shall be hot dip galvanized. Nuts, however,

- may be tapped, but not to cause
2. Adhesion test as per IS 2629 :1985
 3. Mass of zinc coating as per IS 6745 :1972

Terminal Blocks

Control circuits and power circuits shall be completely separated by use of divided or separate terminal blocks

Terminal blocks shall be 1100V grade and have continuous rating to carry the maximum expected current on the terminals. The terminal blocks shall be cage clamp type (Wago or equivalent) or non-disconnecting stud type (Elmex type CAT-M4 or equivalent). The insulating material of terminal block shall be nylon 6.6 which shall be free of halogens, fluorocarbons etc.

Terminal blocks for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. The current transformer secondary leads shall also be provided with short circuiting and earthing facilities.

The terminal blocks shall be of expandable design.

The terminal blocks shall have locking arrangement to prevent its escape from the mounting rails.

The terminal blocks shall be fully enclosed with removable covers of transparent, non-deteriorating type plastic material. Insulating barriers shall be provided between the terminal blocks. These barriers shall not hinder the operator from carrying out the wiring without removing the barriers.

Unless otherwise specified terminal blocks shall be suitable for connecting the following conductors on each side.

All circuits except CT /PT circuits Minimum of two of 2.5 sq. mm copper flexible

All CT/ PT circuits Minimum of 2 nos. of 6 sq. mm copper flexible

The arrangements shall be made in such a manner so that it is possible to safely connect or disconnect terminals on live circuits and replace fuse links when the cabinet is live.

At least 20% spare terminals shall be provided on each panel/ cubicle/ box and these spare terminals shall be uniformly distributed on all terminals rows.

There shall be minimum clearance of 250 mm between the first/ bottom row of terminal block and the associated cable gland plate. Also, the clearance between two rows of terminal blocks shall be a minimum of 150 mm

3.5 SEISMIC WITHSTAND TEST

The seismic withstand test on complete equipment shall be carried out along with the supporting structure.

The Contractor shall arrange to transport the structure from the structure Contractor's works/ project site or alternatively arrange the structure as per approved drawings for the purpose of seismic withstand test only.

The seismic level specified shall be applied at the base of the structure. The accelerometers shall be provided at the terminal pads of the equipment and any other point as agreed by the Owner. The seismic test shall be carried out in all possible combinations of the equipment. The seismic test procedure shall be furnished for approval of the Owner.

3.6 TOOLS AND TACKLES

The Contractor shall supply with the equipment one complete set of all special tools and tackles and other instruments required for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also include special material handling, jigs and fixtures for maintenance and calibration/ readjustment. Checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder alongwith the offer.

The prices of each tool/ tackle shall be deemed to have been included in the total bid price. The tools and tackles shall be separately packed and sent to site. This set of tools and tackles shall not be used during erection and trial operation. For this purpose a separate set of tools and tackles shall be brought/ supplied by the Contractor. In case the above mentioned set is used during erection, commissioning or trial operation the same shall be refurbished repaired/ replaced as required to the satisfaction of the Owner before handing over. All tools and tackles shall be of reputed make acceptable to the Owner.

3.7 PACKING AND TRANSPORTATION

All the equipment shall be suitably protected coated covered or boxed and crated to prevent damage of deterioration during transit, handling and storage at site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing.

PACKING IN CRATES

For the equipment packed in crates, the packing wood shall be as per relevant Indian/ International standards. The base of the crate shall be made of wooden batons and planks giving necessary reinforcement, so that the bottom of the equipment is at a height of 100mm minimum from the ground level. The size of the plank shall be decided by the sub-contractor to suit the weight of equipment. Minimum thickness of the plank shall be 25mm and minimum width shall be 150mm. Crate shall be made while keeping the gap from 25mm to 200mm depending upon the size of equipment and weight. However, the responsibility of proper packing and safe delivery of the equipment to site lies with the supplier

3.8 DEVIATIONS FROM SPECIFICATIONS

Deviation, if any, from any of these specifications shall be listed out separately. Bidder shall attach a separate sheet titled as “DEVIATIONS FROM SPECIFICATIONS” and list all deviations details of each deviation Section wise and Clause wise. In absence of any deviation listed out separately, adherence to the specifications shall be assumed.

3.9 Training

The Contractor shall arrange training to familiarize the customer's personnel about

constructional and O&M aspects of equipment wherever need of specialized training is felt during detail engineering. Cost of such training shall be borne by the Contractor. Traveling and living expenses, of the personnel deputed on such training, however, shall be borne by the Employer.

Besides above, the Contractor shall hold training sessions to familiarize the Employer's personnel with all aspects of operation and maintenance of the plant and sub-systems before the beginning of the dry tests on site. The technical documentation used in the training sessions shall include the Contractor's draft operation and maintenance manuals and test procedure descriptions approved by the Employer.

The Contractor shall provide training for each phase of work as per details agreed at the time of award.

1. General requirements of training

The Contractor shall provide suitable instructors, training material and facilities (instruments, apparatus, simulators, documents, drawings, protective clothing, rooms, office supplies, etc.) for the personnel made available by the Employer for training.

One month before the training start, the Employer will send the list of the trainees and any comments on the training program proposed by the Contractor. This program shall be adapted to the design and nature of the Works, and the needs of trainees. Trainees shall be suitably trained in the various aspects of design, manufacture, installation/erection, operation and maintenance, relevant to the training, of works similar to the Works

The Contractor shall supervise and provide direction to, and be liable for the acts or omissions, other than negligent or willful misconduct of such personnel, of the Employer's trainees.

The Contractor shall provide the training described hereafter in accordance with any further specific requirements stated in the Employer's Requirements.

The Contractor shall assist the Employer in obtaining any visas and other formalities for entering or leaving the territory on which the training is being provided.

The Contractor shall bear responsibility for ensuring the safety of the trainees during their stay in the country of the training. On their part, the trainees shall comply with the laws, regulations and customs of the country in which training is being provided.

In the event of illness or accident, the Contractor shall take all steps to provide the trainees with the appropriate medical care.

2. Training of Employer's personnel

The scope of service under training of Employer's engineers shall include a training module covering the following:

2.1. Training during engineering/ manufacturing phase

This shall cover all the related areas like design familiarisation, training on product design features and product design software of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of

equipment, quality assurance and testing, plant visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing, erection, welding etc. The training in areas of Operation and Maintenance shall take place preferably during end of manufacture/ tests.

2.2. Training during the erection / installation / site work

Independently from the supervision and inspection functions of the Employer's Representative, the Contractor shall authorize the Employer's Personnel to follow the erection / installation / site work at his site.

The Employer's Start-up Personnel shall take no part in the equipment erection and/or installation operations, which shall be exclusively carried out by the Contractor and under his entire responsibility.

This on site training shall cover each phase of erection / installation / site work and shall be of sufficient duration.

The Contractor shall supply the information or measurements concerning the erection requested by the Employer's Representative or/and by the Employer's personnel.

2.3. Training during the tests on completion phase

The Contractor shall provide on the-job training in the operation and maintenance of the Works to the Employer's Operating Personnel. Such training shall start at least 30 days prior to commencement of Tests on Completion and continue until Taking Over. Its scope and quality shall be such as to provide the trainees with comprehensive understanding of all operational and maintenance aspects of the work. Such training shall also include safety and environmental protection aspects applicable to the work.

3.10 INFORMATION TO BE FURNISHED BY THE CONTRACTOR/ SUB CONTRACTOR

Information/ documents to be furnished at the TENDER / CONTRACT STAGE shall be as given below: (marked 'X' in the appropriate column)

DETAILS OF DOCUMENTATION TO BE FURNISHED	At Tender Stage	At Contract Stage
Technical offer with details of equipment, scope etc	X	
Guaranteed Technical particulars	X	X
Schedule of Tests to be conducted	X	
Schedule of deviations, if any, Section wise, clause wise, with respect to technical specifications	X	
List of past supplies complete with purchase & project ref., quantity, order ref., etc. where identical equipment have been supplied.	X	-
Manufacturing Quality Plan/ Standard Check List	X	X
Field Quality Plan	X	X
GA drg with dimensions & weight and foundation/ fixing details	X	X
Drg & Data submission schedule (to be furnished at contract stage shall be specified date-wise here).	X	X
Type test Reports.	X	X
Bar chart showing the time schedule indicating the timer	X	

required for design submission of drawing, manufacture of eqpt, test and inspection.		
Routine / Acceptance test reports.		X
Installation , Operation & Maintenance Manual	X	X
Field Quality Plan for receipt and storage, installation, testing and commissioning with details of test equipment, tests to be conducted and acceptance values	X	X

ANNEXURE-A

NUMBER OF COPIES AND MODES OF DOCUMENTATION TO BE SUBMITTED

Sl. No.	DESCRIPTION	TENDER STAGE	CONTRACT STAGE		
		PRINTS	PRINTS	CD-ROM	MANUALS
1.	Drawings & GTP data sheets for approval	2	7		
2.	Drawings & GTP data sheets after revision for approval		7		
3.	Drawings & GTP data sheets after revision for approval (Final)		12		
4.	Drawings and GTP-data sheets as build		12	4	
5.	RTFs of approved drawings		3		
6.	Test Procedures for approval	1	7		
7.	Type Test & Routine test Reports for approval	1	7		
8.	Type Test & Routine test Reports for after approval		12		
9.	Draft copies of the following for approval				
9.1	Erection Manual		7		
9.2	O & M Manual		7		
9.3	Commissioning and Performance procedure manual		7		
10.	Approved final copies of the following				
10.1	Erection Manual			4	12
10.2	O & M Manual			4	12
10.3	Commissioning and Performance procedure manual			4	12
11.	Draft copies of the following for approval				
11.1	Manufacturing Quality Plan		7		
11.2	Field Quality Plan		7		
12.	Approved final copies of the following				
12.1	Manufacturing Quality Plan				12
12.2	Field Quality Plan				12
13.	Inspection and Test Reports		7		12

NOTE:

Quality Documentation shall be arranged in plastic folders in the same order as they appear in the QP, with cover sheet and index with QP itself as the first document at the top.

Final Documentation shall be submitted in bound volumes with Customer & Project etc. written on top.