Detailed (L-2) and (L-3) networks would be submitted sequentially by the Contractor within two months from the date of issue of Letter of Award and finalised within one (1) month thereafter.

All such networks shall be provided in MS PROJECT software as well as in other format / software suitable to Owner.

The engineering management team should also co-ordinate all interface engineering activity between the Contractor and the equipment sub-vendors so as to ensure the correctness and completeness of related engineering documentation before the same is submitted to the Owner.

1.04.03 Contracts Management

Based on the master network, the Contractor shall submit L-2 programmes of manufacture and despatch. In addition, the master network shall also include periods considered for site activities viz. erection, commissioning etc. These L-2 programmes would be submitted in 2 months time from the date of award of contract and finalised within one (1) month thereafter. The Contractor will also submit site mobilisation plan. This programme would be submitted at the time of finalisation of award of contract and agreed immediately thereafter so that immediate development of the various activities at site could take place.

The Contractor should also submit L-3 programmes for the manufacturing, despatch of the various items. These networks shall also show the customer hold points (CHP) which have to be cleared by Owner or their authorised representative(s) before further manufacture can take place. These L-3 programmes for the manufacture and despatch would clearly identify responsibilities of the Contractor, sub-Contractor and Owner. These networks shall be submitted within one (1) month of the date of finalisation of the various sub-contracts by the Contractor.

In case all the manufacture is being done by the Contractor then the L-2 programmes would be themselves amplified to cover details of the manufacture, inspection, clearance by Owner and despatch.

The Contractor shall also submit the programme for procurement of boughtout items, detailed shipping schedule and cash flow statement for Owner's approval.

1.04.04 Quality Assurance, Inspection and Expediting

The Contractor shall submit the list of manufacturers/sub-vendors from whom the equipment are expected to be procured and the quality assurance plans thereof for the manufacture shall be approved by the QA group of Owner before the manufacture is commenced. The list of major suppliers would be submitted along with the bid and this shall be mutually discussed and approval will be given by the Owner during contract negotiation meeting prior to placement of Letter of Award. This approved list will be binding to the bidder. In the said list, Owner reserves the right to include reputed/reliable vendors of his own choice. Regarding the various other sub-vendors, the list would be submitted within six (6) months of the award of the contract that shall be scrutinized by the Owner to accord approval. In such list Owner

reserves the right to include vendors of his own choice. No further vendor approval will be given after six (6) months. On the quality plans, the customer hold points will also be identified based on which Owner would give clearance for the manufacture to proceed further.

Quality assurance/Inspection group of Owner or its representative would issue a material despatch clearance certificate (MDCC) after the inspection clearance which will enable the Contractor to despatch the equipment and claim the payment. In the despatch programme, the Contractor shall indicate a schedule of estimated programme, tonnages specifically identifying various oversize dimensioned consignments (ODC). Further the Contractor will also be required to ensure at all stages of shipment that packing of all shipments despatched are suitable for ocean freight to India, handling at the port of entry, inland transportation and preservation at site upto erection. All despatch details & item lists shall be made available to both Owner & site immediately after shipping.

The Contractor shall also expedite all despatches from their own works/works of their sub-vendors, so as to match with the various activities mentioned at 1.04.03 above.

1.04.05 Construction Management

Based on the L-1 Master Network Programme, within two (2) months of the issue of Letter of Award, the Contractor shall submit a programme of construction/erection/commissioning, either in continuation with the manufacture and despatch or separately for the implementation. These programmes would be amplified showing when the civil drawings shall be released by him and construction of civil works shall be completed by him to facilitate start of erection and subsequent activities and shall form the basis for site execution and detailed monitoring. The three monthly rolling programme with the first month's programme being tentative based on the site conditions would be prepared based on these L-3 programmes. The Contractor shall also be involved along with the Owner to tie up detailed resource mobilisation plan over the period of time of the contract matching with the performance targets.

The L-3 programme would be jointly finalised by the site in charge of the Contractor with the Owner's project coordinator as well as the site planning representative. The erection programme will also identify the sequential erectable tonnages that are required for various equipment which should be taken care of in the despatch programmes.

Erection and commissioning of the equipment shall also be done under the supervision of experts from the respective equipment/ system supplier.

1.04.06 Spares Management

Alongwith the proposal for the plant and equipment, the Contractor shall also submit proposals/schedule for the following:

a) Mandatory spares

b) Recommended spares

While the award for mandatory spares will be finalised at the time of the award of contract, recommended spares will be finalised thereafter.

1.05.00 **Project Progress Review Meetings**

Keeping in mind the overall responsibility of the Contractor it is intended that periodic progress reviews on the entire activities of execution in respect of Wanakbori Thermal Power Plant (Unit-8) will be held initially atleast once in two (2) months at Vadodara/site or in the country (India) depending on the circumstances and mutual agreement. During peak period it may be held once in a month. These meetings will be attended by reasonably higher officials of the Contractor and their leading sub- contractors and will be used as a forum for discussing all areas where progress needs to be speeded up. Actions will be placed on the concerned agencies and decisions will be taken to expedite/speed up the progress. Minutes of such meetings will be issued reflecting the major discussions and decisions taken and circulated to all concerned for reference and action. The Contractor shall be further responsible for ensuring that suitable steps are taken to meet various targets decided upon such meetings.

In addition to the above, and to streamline the construction and erection at site, a suitable frequency and forum of periodic meetings between the Contractor and the Owner will be decided upon as part of erection coordination procedure. Site co-ordination meeting may be held on weekly basis.

1.06.00 **Owner's Consultant**

The Owner would appoint a consultant to assist him in some of the areas mentioned at 1.01.00 above. The details of interaction and procedures for coordination between Owner/Owner's Consultant & Contractor/ Contractor's project management team shall be finalised during contract negotiations.

1.07.00 **Commissioning Management**

1.07.01 For commissioning of the various equipment/system covered under the scope of contract, Owner will form an organisation structure which may consist of the following committees. The Contractor shall nominate his representative on one or more of the committee as decided by the Owner:

a) Steering Committee

b) Commissioning Panel.

c) Working Parties

d) Testing Teams.

1.07.02 Commissioning documents shall be prepared by the Contractor in the following manner and submitted for Owner's approval :

a) Field Quality Plan

This document shall be prepared for the various equipment/ systems under commissioning and shall have the following objectives to fulfill and shall be submitted for Owner's approval at least six (6) months before their actual commissioning :

i) Establish design data against which Plant Performance will be compared.

ii) Set-out the testing objectives and proposals.

iii) Define the documentation required.

b) Testing/Commissioning Schedule

These shall be prepared for the various equipment/systems under consideration and shall contain sections like detailed testing method, programme, safety, individual responsibility and results.

c) Standard Check Lists

Standard check lists are intended for use at the completion of erection to ensure correct erection, testing and to a limited extent operation for repetitive items.

1.07.03 Test Reports

After the completion of commissioning activity of equipment/ systems, the Contractor shall prepare the test reports which shall include all the relevant information related to various commissioning checks, tests carried out, any deviations/commissions noticed with respect to the intended design requirements, sequence of various commissioning activities as actually adopted vis-a-vis as recommended in the procedures, programme schedules achieved and any other such information as required. These test reports shall be submitted in requisite number of copies to the Owner and this should be duly signed jointly by the Owner/Consultant and the Contractor/Equipment supplier, who are involved during the commissioning activities.

2.00.00 **SITE SERVICES**

These services shall be rendered by the Bidder as part of the overall project management service. The services shall broadly include but not be limited to the following :

2.01.00 Arranging material despatch from the shop by rail/road and/or sea as applicable.

2.02.00 Monitoring movement of materials & follow-up as necessary with Railways, road transport, port clearance etc. from the time of despatch F.O.R. works/ F.O.B. port of shipment by Contractor till receipt of the same at site.

2.03.00 Unloading of materials at Railway Station/Railway Siding inside project area/ Road Transportation, transportation to site store, assessment of lost/ damaged items in transit and arranging insurance claims and replacement of lost/damaged items. The Contractor shall submit to the Engineer a report detailing all the receipts during the week as well as storing, preservation of material at site.

2.04.00 Issuing materials from site store/open yard from time to time for erection as per the construction programme. The Contractor shall be the custodian of all the materials issued till the plant is officially taken over by the Owner after complete erection and successful trial run & commissioning.

2.05.00 Transportation of materials to their respective places of erection and erection of the complete plant & equipment as supplied under this specification.

2.06.00 Trial run and commissioning of individual equipment/sub-systems and the plant as a whole to the satisfaction of the Owner, including supply of temporary equipment & services for chemical cleaning, steam blowing as well as performance guarantee tests.

Apart from Boiler, proper chemical cleaning shall be carried out in following pipe lines/equipment before commissioning

a) Deaerator

b) Boiler feed suction, recirculation leak-off lines

c) Boiler Feed discharge line by passing heaters

d) Attemperation lines

e) Condensate suction & discharge piping upto de-aerator by passing the feed water heaters.

f) Fuel oil lines.

Provision for preservation of individual equipment after trial run and commissioning e.g. Nitrogen blanketing etc. as necessary shall also be in the scope of the Bidder.

Safe disposal of effluent after chemical cleaning shall be done by the contractor.

2.07.00 Supply and application of the final paints and first fill lubricants on all the equipment to be erected under this specification. Supply of LDO, chemicals, lub oils upto COD.

2.08.00 For the purpose of erection and commissioning the Contractor's scope of work shall include but not be limited to the following :

2.08.01 Deployment of all skilled and unskilled manpower required for erection, supervision of erection, watch & ward, commissioning and other services to be rendered under this specification.

2.08.02 Deployment of all erection tools & tackle, construction machinery, transportation vehicles and all other implements in adequate number and size, appropriate for the erection work to be handled under the scope of this specification.

2.08.03 Supply of all consumables, e.g. welding electrodes, cleaning agents, diesel oil, grease, lubricant etc. as well as materials required for temporary supports, scaffolding etc. as necessary for such erection work except those listed under exclusion elsewhere in this specification.

2.08.04 Construction of all civil/structural/architectural works, including construction of foundation for all equipment supplied as required, grouting of equipment on foundation after alignment, and all other incidental civil activities as detailed elsewhere.

2.08.05 All structural steel fabrication and erection work as detailed elsewhere in the specification.

2.08.06 Providing support services for the Contractor's erection staff e.g. construction of site offices, temporary stores, residential accommodation and transport to work site for erection personnel, insurance cover, watch & ward for security and safety of the materials under the Contractor's custody etc. as required.

2.08.07 Maintaining proper documentation of all the site activities undertaken by the Contractor as per the proforma mutually agreed with the Owner; submitting monthly progress reports as also any such document as and when desired by the Owner; taking approval of all statutory authorities e.g. Boiler Inspector, Factory Inspector, Inspector of Explosives etc. for respective portions of work under the jurisdiction of such statutes or laws.

2.08.08 The Contractor shall provide `Industrial Relations' unit and `Medical' unit to take care of his erection staff and the Owner shall have no obligation in the regard.

2.08.09 The successful Bidder shall arrange for Tower crane of adequate capacity for speedy erection activities.

2.09.00 **Site Organisation**

The Contractor shall maintain a site organisation of adequate strength in respect of manpower, construction machinery and other implements at all times for smooth execution of the contract. This organisation shall be reinforced from time to time, as required, to make up for slippages from the schedule without any commercial implication to the Owner. The site organisation shall be headed by a competent construction manager having sufficient authority to take decisions at site.

On award of contract, the Contractor shall submit to the Owner a site organisation chart indicating the various levels of experts to be deployed on the job. The Owner reserves the right to reject or approve the list of personnel proposed by the Contractor. The persons, whose bio-data have been approved by the Owner, will have to be posted at site and deviations in this regard will not generally be permitted.

The Contractor shall also submit to the Owner for approval a list of construction equipment, erection tools, tackle etc. prior to commencement of site activities. These tools & tackle shall not be removed from site without written permission of the Owner.

2.10.00 **General Guidelines for Field Activities**

2.10.01 The Contractor shall execute the works in a professional manner so as to achieve the target schedule without any sacrifice on quality and maintaining highest standards of safety and cleanliness.

2.10.02 The Contractor shall co-operate with the Owner and other Contractors working in site and arrange to perform his work in a manner so as to minimise interference with other Contractors' works. The Owner's engineer shall be notified promptly of any defect in other Contractor's works that could affect the Contractor's work. If rescheduling of Contractor's work is requested by the Owner's engineer in the interest of overall site activities, the same shall be complied with by the Contractor. In all cases of controversy, the decision of the Owner shall be final and binding on the Contractor without any commercial implication.

2.10.03 The Engineer shall hold weekly meetings of all the Contractors working at Site at a time and a place to be designated by the Engineer. The Contractor shall attend such meetings and take notes of discussions during the meeting and the decisions of the Engineer and shall strictly adhere to those decisions in performing his Work. In addition to the above weekly meeting, Engineer 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.

2.10.04 Time is the essence of the Contract and the Contractor shall be responsible for performance of his Work 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 of 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 Engineer, satisfying that his action will compensate for the delay. The Contractor shall not be allowed any extra compensation for such action.

2.10.05 The Engineer 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.

2.10.06 The works under execution shall be open to inspection & supervision by the Owner's engineer at all times. The Contractor shall give reasonable notice to the Owner before covering up or otherwise placing beyond the reach of inspection any work in order that same may be verified, if so desired by the Owner.

2.10.07 Every effort shall be made to maintain the highest quality of workmanship by stringent supervision and inspection at every stage of execution. Manufacturer's instruction manual and guidelines on sequence of erection and precautions shall be strictly followed. Should any error or ambiguity be discovered in such documents, the same shall be brought to the notice of the Owner's engineer. Manufacturer's interpretation in such cases shall be binding on the Contractor.

2.10.08 The Contractor shall comply with all the rules and regulations of the local authorities, all statutory laws including Minimum Wages, Workmen Compensation etc. All registration and statutory inspection fees, if any, in respect of the work executed by the Contractor shall be to his account.

2.10.09 All the works such as cleaning, checking, leveling, blue matching, aligning, assembling, temporary erection for alignment, opening, dismantling of certain equipments for checking and cleaning, surface preparation, edge preparation, fabrication of tubes and pipes as per general engineering practice at site, cutting grinding, straightening, chamfering, filling, chipping, drilling, reaming, scrapping, shaping, fitting-up bolting/welding, etc., as may be applicable in such erection and are necessary to complete the work satisfactorily, are to be treated as incidental and the same shall be carried out by the Contractor as part of the work.

2.10.10 In case of any class of work for which there is no such specification as laid down in the contract such as, blue matching, welding of stainless steel parts, etc., the work shall be carried out in accordance with the instructions and requirements of the Engineer.

2.10.11 It may sometimes be necessary to remove some of the erected structural members to facilitate erection of bigger/pre-assembled equipment. In such cases, the removal and re-erection of such members, which are essential, and if so agreed by the Engineer, will have to be done by the Contractor.

2.10.12 Attachment welding of necessary instrumentation tapping points, thermocouple pads, root valves, condensing vessels, flow nozzles and control valves etc., both for regular measurement and performance testing to be provided on equipment, its auxiliaries or pipelines covered within the scope of this tender, will also be the responsibility of the Contractor and the same will be done as per the instructions of Engineer. The erection and welding of all above items will be the Contractor's responsibility, even if :

a) Product groups under which these items are re-leased are not covered in the scope of this tender.

b) Items are supplied by an agency other than the Contractor.

2.10.13 Preservation of all materials/equipment under custody of the Contractor during storage, pre-assembly & erection, commissioning etc., shall be the responsibility of the Contractor. All necessary preservatives and consumables like paints, etc., shall be arranged by the Contractor. Necessary touch up painting, periodic application of preservatives/paints on pressure parts/other equipment even after erection until completion of work shall be carried out by the Contractor. The Contractor shall fabricate piping, install lub oil systems and carry out the acid cleaning of fabricated piping. The Contractor shall also service the lub. oil system, carryout the hydraulic test of oil coolers, etc.

2.10.14 It is responsibility of the Contractor to do the alignment etc. if necessary, repeatedly to satisfy Engineer, with all the necessary tools & tackles, manpower, etc. The alignment will be complete only when jointly certified so, by the Contractor's Engineer & Owner. Also the Contractor should ensure that the alignment is not disturbed afterwards.

2.10.15 Additional platforms for approaching different equipment as per site requirement, which may not be indicated in drawings, shall be fabricated and erected by the Contractor. The materials required for these works shall be supplied by the Contractor and he will have to fabricate them to suit the requirement.

2.10.16 Equipment and material which are wrongly installed shall be removed and reinstalled to comply with the design requirement at the Contractor's expense, to the satisfaction of the Owner/ Consultant.

2.10.17 Before erection of any equipment on a foundation, the Contractor shall check and undertake if necessary rectification of foundation bolts, reaming of holes, drilling of dowels, matching of bolts and nuts, making new dowel pin, etc.

2.10.18 Assistance for calibrating/testing the power cylinders, valves, gauges, instruments, etc., and setting of actuators coming under various groups shall be provided by Contractor.

2.10.19 It shall be the responsibility of the Contractor to provide ladders on columns for initial works till such time stairways are completed. For this, the ladder should not be welded on the column and should be prefabricated clamping type. No temporary welding on any structural member is permitted except under special circumstances with the approval of Owner.

2.10.20 Structural materials required for the supporting/operating platforms required for the valves at various levels for the same operation of valves will be arranged by the Contractor.

2.10.21 For civil, structural and architectural works, volume IIG/1 & IIG/2 may be referred. For Instrumentation and Electrical works Vol. IIE and Vol. IIF/1 & F/2 may be referred.

2.11.00 **Safety**

Safety and overall cleanliness of work site shall be given top priority.

2.11.01 The Contractor shall ensure the safety of all workmen, materials and equipment either belonging to him or to others working at site. He shall observe safety rules & codes applied by the Owner at site without exception.

2.11.02 The Contractor shall notify the Owner of his intention to bring to site any equipment or material which may create hazard. The Owner shall have the right to prescribe the conditions under which such equipment or material may be handled and the Contractor shall adhere to such instructions. The Owner may prohibit the use of any construction machinery, which according to him is unsafe. No claim for compensation due to such prohibition will be entertained by the Owner.

2.11.03 Storage of petroleum products & explosives for construction work shall be as per rules and regulation laid down in Petroleum Act, Explosive Act and Petroleum and Carbide of Calcium Manual. Approvals as necessary from Chief Inspector of Explosives or other statutory authorities shall be the responsibility of the Contractor.

2.11.04 The Contractor shall be responsible for safe storage of his and his sub-contractor's radioactive sources.

2.11.05 All requisite tests & inspection of handling equipment, lifting tools & tackle shall be periodically done by the Contractor. Defective equipment shall be removed from service. Any equipment shall not be loaded in excess of its recommended safe working load.

2.11.06 All combustible waste and rubbish shall be collected and removed from the worksite at least once each day. Use of undercoated canvas paper, corrugated paper, fabricated carton, plastic or other flammable materials shall be restricted to the minimum and promptly removed.

2.11.07 The Contractor shall provide adequate number of fire protection equipment of the required types for his stores, office, temporary structures, labour colony etc. Personnel trained for fire-fighting shall be made available by the Contractor at site during the entire period of the Contract.

2.11.08 All electrical appliances used in the work shall be in good working condition and shall be properly earthed. No maintenance work shall be carried out on live equipment. The Contractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installation.

2.11.09 All workmen of the Contractor working in construction site shall wear safety helmets, safety boots and safety belts. The Contractor shall take appropriate insurance cover against accidents for his workmen as well as third party.

2.11.10 All the worksites shall be provided with adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. by the Contractor for proper working environment during night times.

2.11.11 All safety precautions shall be taken for welding and cutting operations as per IS-818.

2.11.12 All safety precautions shall be taken for foundation and other excavation marks as per IS-3764.

2.12.00 **Taking Delivery & Storage**

2.12.01 The Contractor shall arrange issue of all equipment and materials to be erected under the contract from the stores/open yard at site by signing on standard indent forms. After completion of work, detailed auditing of the materials so issued shall be submitted to the Owner.

2.12.02 The Contractor shall arrange for proper and safe storage of materials till the same are taken over by the Owner as per terms of the contract. Manufacturer's instructions for preservation shall be strictly followed.

2.12.03 All empty containers, packing materials, gunny bags, transport frames and also surplus and unused materials reconciliation prior to completion of contract shall be the property of the Owner and returned to the Owner by the Contractor.

2.13.00 **Site Welding & Heat Treatment**

2.13.01 Welding shall be done in accordance with IS-813, IS-816, IS-9595 & other relevant IS/International standards and as per instructions of Contractor. Only those welders, who are qualified as per IS-817 for ordinary welds and as per IBR/ASME Section-IX for high pressure welds, shall be employed in the job.

2.13.02 All welders shall be tested and approved by Engineer before they are actually engaged on the work even though they may possess the requisite certificates. The Owner reserves the right to reject any welder without assigning any reason. The welder identification code as approved by the Engineer shall be stamped by the welder on each joint done by them. The Contractor will be responsible for the periodic renewal, re-testing of the welders as demanded by Owner.

2.13.03 The Engineer is entitled to stop Contractor's any welder from his work if his work is unsatisfactory for any technical reason or there is a high percentage of the rejection of joints welded by him, which in the opinion of Engineer will adversely affect the quality of welding even though the welder has earlier passed the tests. The welders having passed the tests do not relieve the Contractor from his contractual obligations, to check the performance of the welders.

2.13.04 All charges for testing of welders including destructive and non-destructive tests if conducted by Owner or by the inspection authority at site shall have to be borne by the Contractor. The necessary test materials and consumables will have to be arranged by the Contractor and all testing facility made available, as required.

2.13.05 All welded joints shall be subject to acceptance by Engineer. Inspection of welds shall be in accordance with IS-822 or equivalent code.

2.13.06 Preheating/post heating and stress relieving after welding are part of fabrication and erection work and shall be performed by the Contractor in accordance with the instruction of Engineer. Contractor shall arrange to supply heating equipment with automatic recording devices. Also the Contractor shall have to arrange for the labour, heating elements, thermocouples, compensating cables, insulation materials like mineral wools, asbestos cloth, ceramic beads, asbestos rope, etc. required for the heat-treatment and stress relieving works. During pre- heat/stress relieving operations, the temperature shall be measured at one or more points as required by attaching thermocouples and recorded on a continuous printing type recorder. All the record graphs for the heat treatment works carried out shall be got signed by the Engineer prior to the commencement of each cycle and handed over to Engineer on completion. The graphs will be the property of Owner. The Contractor has to provide thermo-chalks temperature recorders, thermocouple attachments, units, graph sheets, etc. required for the job and maintain them in good condition.

2.13.07 All electrodes shall be baked and dried in the electric/electrode drying oven to the required temperature and for the period specified by the Engineer before they are used in erection work. The electrodes used shall be as per IS-814, IS-815, IS-1442, IS-7280 and other codes as applicable, and shall be of

approved reputed manufacture. The electrodes shall meet the requirement of the pipe material. No electrode manufactured more than 12 months ago and the type covered under certificate issued after conducting tests more than 6 months ago shall be used. All electrodes shall be preserved at works and at site as per manufacturer's recommendations.

2.13.08 Oxy-acetylene flame or Exothermic chemical heating for stress relieving is not permitted. Heating shall be by means, of electric induction coil or electric resistance coil.

2.13.09 It may become necessary to adopt inter layer radiography/MPT/UT depending upon the site/technical requirement necessitating interruptions in continuation of the work and making necessary arrangement for carrying out the above work.

2.13.10 Gas tungsten arc welding process (TIG) shall be adopted for all root pass welds except for structural works until 4.75 mm thickness is deposited. Subsequent welding after root pass can be carried out by manual metal arc welding with coated electrodes. For pipes of thickness less than 6 mm the entire welding has to be carried out by TIG welding.

Fillet weld shall be made by shielded metal arc process as per applicable codes.

However, the Engineer will have the option of changing the method of welding as per site requirement. The method adopted for manual arc welding shall be weaving technique and the width of weaving shall not exceed 1.5 times of the dia. of the electrode.

In case of deviation from welding process and electrodes, the Contractor shall take approval of the Owner prior to adoption of same.

2.13.11 The root pass for butt joints shall be such as to achieve full penetration with complete fusion of root edges.

2.13.12 Each pass shall be cleared and freed of slag before the next pass is deposited.

2.13.13 On completion of each run, craters, weld irregularities, slag etc. shall be removed by grinding or chipping.

2.13.14 Each layer of welding shall have an even and smooth appearance.

2.13.15 Welding sequence shall be adjusted in such a way that distortion due to welding shrinkage is minimised. Further any movement, shock or vibration during welding shall be avoided to prevent weld cracks.

2.13.16 Proper protection of welders and the work shall be taken during periods of rain. No welding shall be carried out when surfaced to be welded are wet from any cause.

2.13.17 Following will be stages of inspection during welding :

a) Two pieces to be joined shall be individually checked for the weld edge preparation and profile dimensionally and to the template. Dye penetrant check shall be carried out on edge prepared surfaces at random. The percentage will depend upon on criticality as specified by Engineer.

b) Joint fit up will be a stage of inspection. Misalignment after fit up may vary from 0.3 mm to 1.6 mm depending on outside diameter and thickness.

c) All joints shall be offered for visual inspection after root run. Subsequent welding should be made only after the approval of root run.

2.13.18 All welded joints shall be painted with anti-corrosive paint immediately on completion of radiography and stress-relieving.

2.14.00 For further details on procedures of work at site on civil, architectural, electrical and instrumentation & control services, refer Volume : II-E, II-F & II-G of this specification.

CONTENT

VOLUME : II-A

SECTION-X

PERFORMANCE GUARANTEES AND TESTS

1.00.00 PERFORMANCE GUARANTEES, PERFORMANCE/ACCEPTANCE TESTS & LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE

1.01.00 The Bidder shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment covered in this specification. The guarantees are categorised as:

a) Those which attract liquidated damages, as listed below (Category-"A"). The Bidder shall furnish signed declarations in the manner prescribed in the bid proposal schedules for these guarantees.

b) Those which do not attract liquidated damages, as listed below (Category-"B"). This guarantee list indicated in this section is not exhaustive and the Owner reserves the right to call upon the Bidder to demonstrate any parameter, operation, etc. of any equipment as specified and as required to meet the duty conditions.

1.02.00 The guaranteed parameters shall be without any tolerance values. The Bidder shall demonstrate all the guarantees covered in various volumes and sections of this specification during Performance/Acceptance test. In case during tests it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modification to make the equipment/ system comply with guaranteed requirements. However, if the Contractor is not able to demonstrate the guarantees, even after the modifications within ninety (90) days of notification by the Owner, the Owner will at his discretion :

i. reject the equipment and recover the payment already made or accept the equipment only after levying liquidated damages as identified in this section for those guarantees which are covered under category "A".

OR

ii. reject the equipment and recover the payment already made or accept the equipment only after assessing and deducting from the contract price an amount equivalent to the deficiency of the equipment/system as assessed by the Owner, for those guarantees which are covered under Category-B.

1.03.00 All guaranteed parameters shall necessarily be quoted by the Bidder based on the established proven results obtained from similar units in successful operation. Evidence for this shall necessarily include the test codes used, acceptance test results, accuracies of various instruments used for the performance test, details of tolerances, if allowed, etc. While quoting the guaranteed parameters, the Bidder shall keep in view the requirements specified in the specification especially regarding the reliability, operability and maintainability of the equipment proposed. The Owner reserves the right to evaluate the parameters quoted by the Bidder based on his experience and published material available.

1.04.00 The liquidated damages shall be calculated prorata for the fractional parts of the unit unless stated otherwise.

1.05.00 The turbine generator, boiler, auxiliaries, and all other plant equipment and system shall perform continuously without the noise level (individual or collectively) exceeding the values specified in respective equipment specification over the entire range of output and operating frequencies.

1.06.00 **Performance/Acceptance Tests**

1.06.01 The performance/acceptance tests for various equipment and systems shall be carried out as specified under the respective equipment specifications and those specified below shall be specifically applicable. All the guarantees shall be tested together as far as practicable.

1.06.02 In case of systems with stand-by equipment the liquidated damages for non-performance will be levied for normal operating number of equipment only. However, for this purpose all the equipment including standby equipment shall be tested and average values arrived at.

1.06.03 For instrument inaccuracies during PG Test, refer subsequent clauses of this section.

1.06.04 For Total Auxiliary Power Consumption, the transformers listed under the respective clauses, shall be taken together for purposes of guarantee and not individually.

2.00.00 **START-UP, INITIAL OPERATION, RELIABILITY RUN AND PERFORMANCE TESTS**

2.01.00 The Contractor shall provide commissioning & start-up supervisory engineering staff specially identified for the period commencing with start-up and extending from initial operation to all performance tests. During this period, the Contractor shall furnish the calibration devices, special test instruments, etc. required to prepare for and conduct the performance tests. The Owner will associate his operating personnel and necessary supporting staff and shall make available the main fuel; i.e. coal and the system electrical load.

Contractor's commissioning, & start-up supervisory engineering personnel shall conduct training for the Owner's personnel prior to and during this period and shall train them so that they will be able to operate and maintain the new equipment satisfactorily after acceptance by the Owner.

2.02.00 The following field inspections and tests shall 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. The Contractor shall provide supervisory services during field inspection and tests.

2.02.01 Inspection and Checking of the Units

After completion of erection and/or installation, and before being put into operation, the unit and all its appurtenances shall be thoroughly cleaned and then inspected, for correctness and completeness of installation and acceptability for placing in operation. All piping system shall be flushed, chemically cleaned, steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be subject to Owner's approval.

The check outs during the pre-commissioning period should be programmed to follow the construction completion schedule. Each system, as it is completed by construction and turned over to the commissioning (start-up) engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed schedule.

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.

When the equipment is operating properly, its characteristics shall be recorded on the start-up report sheets. Copies of typical start-up report shall be given to the Owner. Start-up reports for all equipment shall be completed before the start of the Reliability Run.

2.02.02 Initial Operation, Reliability Run

The plant shall be on Reliability Run during which period all necessary adjustments shall be made while operating over the full load range enabling the plant to be made ready for performance and guarantee tests.

The duration of Reliability Run of the complete plant & equipment in the automatic mode of control shall be fourteen (14) days out of which atleast seventy two (72) hours shall be in continuous operation on full load or any other duration as may be agreed to between the Owner and the Contractor. The Reliability Run shall be considered successful, provided such item of the equipment can be operated, continuously at the specified operating characteristics for the period of Reliability Run.

For the period of Reliability Run, the time of operation with minimum 85% load shall be counted, minor interruptions not exceeding one(1) to Two(2) hours at a time caused during the continuous operation shall not affect the total duration of Reliability Run. Maximum number of such interruption during the reliability run shall be four(4). However, if in the opinion of the Owner, the interruption is long, the Reliability Run shall be prolonged for the period equivalent to the duration of interruption.

A Reliability Run report comprising observations and recordings of various parameters to be measured, in respect of the above run shall be prepared by the Contractor. This report besides recording the details of the various observations during operation shall also include the dates of start and finish of the Reliability Run and shall be signed by the representatives of both the parties. The report shall have sheets, recording and print out of all the details of

interruption occurred, adjustments made, any minor repairs done during the Reliability Run. Based on the observations, necessary modifications/repairs to the plant shall be carried out to the full satisfaction of the Owner to enable the later to accord permission to carry out Performance and Guarantee Tests on the plant. However, minor defects which do not endanger the safe operation of the equipment shall not be considered as reasons for with holding the aforesaid permission.

Should any major failure or interruption occur in any portion of the plant due to or arising from faulty design, materials, workmanship or omissions or incorrect erection, sufficient to prevent safe and full commercial use of the plant, the reliability run shall be considered void and the reliability test period of 14 days shall recommence after the Contractor has remedied the cause of defect.

2.02.03 Performance and Guarantee Test

a) The final tests as to the performance and guarantees shall be conducted at site, after the reliability run, by the Contractor with full involvement of the Owner. The necessary operating inputs shall be provided by the Owner. The Contractor's engineering staff for commissioning and start-up shall ensure that the equipment are ready for such tests. The Owner shall associate his necessary supporting staff with the Contractor to carry out the various activities related to PG tests. The necessary labour/supporting staff etc. shall be provided by the Contractor. Such tests will be conducted within a period of two (2) months after the successful completion of Reliability Run. Any extension of time beyond the above two (2) months shall be mutually agreed upon.

b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the performance guarantees.

The Contractor shall submit the test procedure for Owner's approval within twelve (12) months from the date of letter of award of the contract. The test shall be carried out by the test grade instruments as stipulated in the applicable test code. These instruments shall be calibrated by the Contractor in a laboratory duly approved by Owner. Batch calibration will not be acceptable. The available instrumentation and control equipment in the plant if found suitable could also be used with the prior approval of the Owner after calibrations in the plant/outside laboratory. The tests will be conducted at the specified load points, and as near the specified cycle conditions as practicable. Proper corrections in calculations to take into account the conditions which do not correspond to the specified conditions will be applied in the test report as brought out under the respective sections of the specification.

The contractor shall submit for Purchaser’s approval the detailed Performance Test procedure containing the following :

i. Object of the test

ii. Scope

iii. Various guaranteed parameters & tests as per contract

iv. Method of conductance of test and test code

v. Duration of test, frequency of readings & number of test runs.

vi. Method of calculation

vii. Correction curves

viii. Instrument list consisting of range, accuracy, least count and location of instruments.

ix. Scheme showing measurement points

x. Sample calculation

xi. Acceptance criteria

xii. Any other information required for conducting the test.

c) All special test grade instruments, including flow nozzles etc., equipment, tools and tackles, required for the successful completion of the Performance and Guarantee Tests shall be brought for the purpose of test, free of cost by the Contractor.

d) The guaranteed performance figures of the equipment shall be proved by the Contractor during these Performance and Guarantee Tests. The Contractor shall submit a detailed test report in the manner, already agreed to within one (1) month time of completion of the test, for Owner's approval. Should the Owner's assessment of these tests show any deterioration from the guaranteed values the Contractor/Owner shall modify the equipment as required to enable it to meet the guarantees. In such case Performance and Guarantee Tests shall be repeated after one (1) month, from the date the equipment is ready for retest and all costs for modifications including labour, materials and the cost of additional testing to prove that the equipment meets the guarantees, shall be borne by the Contractor.

e) The specific tests to be conducted on equipment have been brought out in the technical specifications. The procedure to be submitted by the Contractor should include the detailed methodology to conduct these tests/verify the guarantees offered by the Contractor notwithstanding whether these attract liquidated damages or not.

f) The test results shall be considered as calculated from test observations with only corrections as are provided in the code ASME PTC-6.

The guaranteed parameters shall be without any tolerance or allowance values. Uncertainty analysis shall not be used to adjust test results.

g) The Bidder shall establish the following modes of operation to the satisfaction of the Owner before acceptance test :

i. Operation of each system by remote manual control.

ii. Operation of the entire system in integrated manner on auto control.

iii. Operation of the entire plant with auto-control loops fully implemented including different modes of load control with the help of control system.

h) Ten (10) copies of the test reports are to be furnished by the Contractor to the Owner backed up with jointly signed data sheets.

Wherever it is not practicable to conduct the performance guarantee test at site, and an accurate test to prove the guaranteed parameter has already been conducted in the shop test, such a test may not be repeated, if so agreed by the Owner. However, in such cases, should there be any short fall in the performance during shop tests, the liquidated damages will be calculated on that basis.

3.00.00 SCHEDULE OF GUARANTEES WHICH ATTRACT LIQUIDATED DAMAGES [CATEGORY-A]

Sl. No.	Plant/ System	Parameter for Performance Guarantee	Liquidated Damages
3.01.00	**Plant**		
3.01.01	Guaranteed Output	800 MW Continuous output at 100% TMCR, at Generator terminals (excluding excitation power), at 0.85 power factor lagging and at rated hydrogen pressure and 39^{o}C cooling water temperature for Generator, under rated steam conditions at Turbine Inlet (250 ± 3 kg/cm^2, 566 ± 3^{0}C, 593^{0}C) and CW temperature of 33^{o}C for condenser and with zero percent make-up.	As per Volume-I.
3.01.02	Guaranteed Overall Heat Rate	Overall Heat rate in Kcal/Kwh at 100% & 80% TMCR under rated steam conditions at turbine inlet & design condenser vacuum and cooling water temperature of 33 deg C with zero make up. (Refer Note-1 for estimation of overall Heat Rate)	As per Volume-I.
3.01.03	Guaranteed Total Auxiliary Power Consumption	Total Auxiliary power consumption (kW) of the plant on the basis of measured output at Generator terminals minus sent out power measured downstream of Generator Transformer and station transformer at 100% TMCR with rated steam conditions and design condenser vacuum with zero make-up and with 34^{0}C ambient air temperature and 65% RH **(Refer Note 2, 3 & 4 for the basis of computation of Auxiliary power)**	As per Volume-I.

Sl. No.	Plant/ System	Parameter for Performance Guarantee	Liquidated Damages
3.02.00	**System**		
3.02.01	Guaranteed DM Water Consumption	Continuous consumption of DM water in m^3/hr.	As per Volume-I.

Note :

1. For items 3.01.02, Overall Heat Rate shall be estimated as follows :

   a) Overall Heat Rate = $\dfrac{\text{Turbine Cycle Heat Rate}}{\text{Boiler Efficiency}}$

   For estimation of turbine cycle heat rate, refer Cl. No. 4.01.00 in Vol-IIC-Sec.01.

   b) Guaranteed Overall Heat rate= $\dfrac{\text{HR at 80\% TMCR x 1955 hrs+ HR at 100\% TMCR x 6320 hrs}}{(1955 + 6320)}$

2. For computation of Auxiliary Power, output measured at Generator terminals minus sent out power measured downstream of Generator Transformer, applicable Losses (No load loss + Load loss+ auxiliary loss for coolers) for Station Transformers, Unit Transformers and Bus duct losses shall be considered.

3. For intermittent running auxiliaries i.e., AC & Ventilation system, and outdoor area Illumination, a duty factor of 0.5 shall be considered.

4. For computation of auxiliary power consumption of Ash Handling Plant, Bidder to follow the methodology as below :
   - Duty factor for Lean Slurry Bottom Ash System shall be considered as 0.3.
   - Duty factor for Dry Fly Ash System shall be considered as 0.6.
   - Duty factor for HCSD & Ash Water Recovery System shall be considered as 1.0.

5. For auxiliary power consumption of coal handling plant following shall be considered :
   - Total power consumption of all conveyor drives and other equipments shall be at the guaranteed design capacity of 1400 MTPH with flow path from Wagon Tippler to Boiler Bunker.
   - Single Stream Operation.
   - Duty Factor = 0.5.

6. Power consumption for Fire Pumps, Sump Pumps and Fuel oil transfer system drives, Elevators, EOT Cranes shall not be considered in the Auxiliary Power consumption estimate.

7. Heat Rate of TG Cycle : Maximum 1850 Kcal/Kwh with Steam Turbine driven BFP.

8. Steam Generator Efficiency : More than 87%

9. Auxiliary Power Consumption shall be limited to 6% with Steam Turbine driven BFP.

10. Bidder has to furnish the expected availability of plant & plant reliability.

4.00.00 **SCHEDULE OF GUARANTEES WHICH DO NOT ATTRACT LIQUIDATED DAMAGES FOR VARIOUS EQUIPMENT WHICH INCLUDE BUT ARE NOT LIMITED TO THE FOLLOWING [CATEGORY-B]:**

4.01.00 **Steam Generator**

4.01.01 Capacity in T/hr of steam at rated steam parameters at superheater outlet (with any combination of mills working as per Owner's discretion) and the coal being fired within range specified, corresponding to 100% BMCR at 1% make up, 33 deg.C CW temperature and auxiliary steam consumption.

Bidder shall consider necessary provision for demonstration of steam generation at 100% BMCR condition.

4.01.02 Efficiency in percentage at 100% & 80% TMCR and 34 deg. C ambient air temperature and 65% RH with zero make-up, design condenser vacuum while firing the design coal at rated steam parameters at Superheater and Reheater outlet and rated excess air and with any combination of mills working as per Owner's discretion.

4.01.03 Air heater air-in-leakage after 3000 hrs. of operation from taking over date. To be demonstrated.

4.01.04 NOx emission.

NOx emission from the unit – shall not be more than 365 ppm or 750 mg/Nm^3 (equivalent NO_2) at the ESP outlet at 6% excess oxygen.

4.01.05 Mill capacity at rated fineness.

4.01.06 Gas tightness efficiency of Guillotine dampers.

4.01.07 Bidder to demonstrate the steam parameters at 30% load without HFO/LDO support (only coal firing). No fuel oil support shall be required at 30% of BMCR and above.

4.01.08 Performance characteristics of pumps, fans, etc. viz; capacity, head developed etc.

4.01.09 Capabilities of all drives.

4.01.10 Margins on fans. Through operation of single fan at a time.

4.01.11 Equal load sharing of pumps/fans while running in parallel shall be demonstrated.

4.01.12 Run back capabilities.

4.01.13 Ramp/sudden load change withstand capability. Sudden load throw off typically 25%, 50%, 75% and 100% shall be demonstrated.

4.01.14 Life of mill wear parts

4.01.15 Steam Temperature Imbalance

The Bidder shall guarantee and demonstrate that at SH and RH outlets (in case of more than one outlet) the temperature imbalance between the outlets does not exceed 10 Deg.C.

4.01.16 SH/RH Attemperation System

The Bidder shall guarantee and demonstrate that the spray water flow to SH attemperation system does not exceed the value considered for design (to be indicated in the bid) while maintaining the rated SH outlet steam temperature at BMCR. The Bidder shall also guarantee and demonstrate that the RH temperature is maintained at the rated value without any spray water requirement, for the secondary attemperation system, at all loads for which the specified RH steam temperature is required to be maintained at the rated value.

4.02.00 **Electrostatic Precipitator**

4.02.01 Pressure drop across the electrostatic precipitator.

4.02.02 Collection efficiency and outlet dust concentration shall be as per cl. no. 3.01.00 of Section-II in Volume-II-B.

4.03.00 **Turbine Generator**

4.03.01 Turbine Generator-Set Capability

The steam turbine generator unit shall be capable of delivering continuously at generator terminals the output as indicated by the Bidder in the following heat balances detailed out elsewhere with equipment specification submitted alongwith the bid.

a) Output corresponding to top HP heaters out of operation (for 1x100% HP heater configuration).

b) Output corresponding to one string of HP heater out of operation (for 2x50% HP heaters configuration).

c) Output corresponding to all HP heaters out of operation.

d) Output corresponding to VWO rating, at rated steam conditions with condenser CW temperature 33°C & design condenser vacuum with zero make-up.

e) Output corresponding to overpressure operation of the boiler-turbine-generator set, at rated main steam and hot reheat steam temperature with condenser CW temperature corresponding to design Condenser vacuum with zero make-up.

4.03.02 Operating Frequency Range

As per the stipulations of Cl. No. 7.06.00 Vol. II-C, Section-I.

4.03.03 Constant Pressure and Sliding Pressure Operation

The constant pressure operation and sliding pressure operation from 30% turbine MCR to VWO condition of the unit in conjunction with the steam generator, HP-LP bypass system and instrumentation & control system shall be demonstrated.

In sliding pressure mode of operation, during quick load increase the idle control valve (s) must respond rapidly to pick up 20% of operating load, so that immediate increase of boiler pressure is not required. The load response capability shall be demonstrated in steps of 5 %.

Change-over from constant pressure mode to sliding pressure mode and vice-versa shall also be demonstrated.

4.03.04 Start-up, Loading, Unloading and Shutdown Capabilities

Start-up, loading, unloading and shutdown characteristics and startup time and loading capabilities for the steam turbine generator and steam generator both operating as a unit for cold start conditions (greater than 36 hours shutdown), warm start conditions (between 8 and 36 hours shutdown) and hot start conditions (less than 8 hours shutdown) under constant pressure and variable pressure mode and suitability for cyclic operation as indicated by the Bidder in the offer and accepted by the Owner shall be demonstrated ensuring the parameters of vibration, differential expansion, etc.

4.03.05 Vacuum Pulling time

Vacuum pulling time from condenser at atmospheric pressure to rated vacuum compatible to start Steam Turbine

4.03.06 Sudden Total Loss of External Load

On occasions, the steam turbine generator system may experience sudden total loss of all external load. Under these conditions, the steam turbine generator unit shall not trip on overspeed but shall continue in operation under the control of its speed governor to supply power for the plant auxiliary load station transformers, while staying within the prescribed permissible limits of steam metal temperature mismatch, exhaust hood temperature, absolute and differential expansion, vibration and eccentricity acceptable to the Owner.

4.03.07 Capacity with Reduced Hydrogen Pressure

Generator shall be capable of operating at reduced capacity at reduced generator hydrogen pressure in accordance with values furnished by the Bidder in his proposal and accepted by the Owner.

4.03.08 HP/LP Bypass Capabilities

i. HP/LP bypass capacity and capabilities under various modes of operation shall be demonstrated.

ii. Condenser performance with HPLP Bypass operating at rated conditions.

4.03.09 Lube Oil Purification System - Capacity and Purity

Lube oil purification system capacity and the purity of purified oil at the outlet of the centrifuge and the outlet of the polishing filter, shall be demonstrated. If purity check is not possible at site, this shall be carried out at Vendor's works.

4.03.10 Extraction and CRH NRVs

Operation of the valves under turbine trip and high water level in the heaters, shall be demonstrated.

4.03.11 The performance of the condenser, i.e., the back pressure achieved at design CW flow and inlet temp. and cleanliness factors, VWO heat load shall be demonstrated.

4.03.12 Temp. of condensate at outlet of condenser shall not be less than saturation temp. corresponding to the condenser pressure at all loads.

4.03.13 Oxygen content in condensate at hot-well outlet shall not exceed 0.015 cc/litre over the entire load range and shall be determined according to an internationally approved codes/standard.

4.03.14 When one half of the condenser is isolated, condenser capability shall be demonstrated to take at least 60% T.G. load under TMCR conditions.

4.04.00 **Deaerator**

4.04.01 The dissolved oxygen content in feed-water measured at deaerator outlet shall not exceed 0.005 cc/litre at all loads from no load to VWO condition with 1% cycle make-up with normal pressure and overpressure with incoming condensate presumed to be saturated with oxygen (without any chemical dosing).

4.04.02 Free carbon dioxide in deaerator effluent shall be non-traceable at all loads from zero to VWO with 1% cycle make-up with normal pressure according to ASTM standards.

4.05.00 **Power Cycle Pumps**

Performance of each pump (flow, head, vibration, noise, parallel operation) to be demonstrated.

4.06.00 **Automatic On Line Turbine Testing (ATT) System**

Demonstrated without disturbing normal operation.

4.07.00 **Coal Handling Plant**

Refer Cl. No. 11.00.00 in Volume-II-K/1.

4.08.00 **Condensate Polishing Unit**

Bidder shall ensure that condensate temperature for CPU shall not go beyond 50^{o}C during normal steady state operation.

4.09.00 **DM Plant**

Performance Gurantee of DM plant shall be in accordance with Cl. No. 8.04.00 in Section-1, Volume-II-K/3.

4.10.00 **Instrumentation and Control**

The Bidder shall demonstrate that the Instrumentation and Control system meets all the functional/performance requirements, specified in technical specifications.

4.11.00 **Noise Level**

The Bidder shall demonstrate Noise Level of various plants/equipments/ systems as per Clause no. 17.02.00 in Section-IV of Volume-II-A.

5.00.00 **PERFORMANCE/ACCEPTANCE TESTS PROCEDURES**

5.01.00 **Steam Generator**

The performance tests shall be conducted in accordance with the latest version of ANSI PTC 4.0 except for the specific requirements brought out herein below. This test may be done simultaneously or immediately after P-G test of Turbine Generator set. During this test, Boiler unit shall be fully on automatic control under steady load condition.

5.01.01 The efficiency tests shall be carried out with the steam generator operating at the guaranteed point condition i.e. corresponding to 100%, 80% Turbine rated loads, or at the agreed loads as near these as possible, with the boiler operating at the rated excess air, rated SH/RH attemperation flows, flue gas temperature, coal fineness, etc. corresponding to the loads on boiler. At control load, the stable and efficient operation of the unit with the rated excess air, rated mill outlet coal fineness, while achieving the rated S/H, R/H steam parameters shall be demonstrated by the Contractor to the satisfaction of the Owner.

5.01.02 For finding out the performance values, two sets of consistent reading shall be taken and the average of the above values shall be considered for the guarantee purpose.

5.01.03 Corrections shall be applied to the tested efficiency, to correct it to the design conditions, for variations in the following parameters only :

a) Feed water temperature at economiser inlet.

b) Ambient air temperature

c) Relative humidity of ambient air.

d) Hydrogen in coal.

e) Moisture in coal.

f) Gross calorific value of coal.

The Bidder shall furnish correction curves, for Owner's approval, covering the expected ranges of variations for all these parameters for the range of coals specified.

5.01.04 In all other aspects, not spelt out above, or in specifications, where ANSI code stipulates agreement between the parties concerned before the test, Bidder shall get these approved by the Owner.

5.01.05 No negative tolerance on account of instrument in-accuracies or otherwise shall be allowed on the guaranteed values.

5.01.06 Performance tests shall also be conducted to prove the steam generating capacity of the steam generator at rated parameters at stipulated loads.

5.01.07 Necessary write ups, schemes, instrument schedules, detailed procedures clearly indicating periods of tests, frequency of observations, etc. shall be prepared and submitted for all the tests for Owner's review and shall be got specifically approved from the Owner within one year of L.O.A. issue.

5.02.00 **Mill Performance Warranty**

5.02.01 Performance testing shall be done on the mill towards establishing its capacity specified at the specified fineness applying corrections for the variations in coal characteristics i.e. HGI, moisture, etc.

5.02.02 The Bidder shall guarantee a capacity output not less than the offered value, at each mill outlet, with coal fineness of not less than 70% through 200 mesh and not less than 98% through 50 mesh screen, when grinding coal having specified grindability index, total moisture content including surface moisture, etc. Bidder shall guarantee that the above capacity will be maintained and demonstrated with the originally installed grinding elements in nearly wornout condition as mutually agreed for the purpose of ascertaining wear life of any of the wear parts or when pulveriser grinding elements have successfully completed the specified guaranteed hours of operation as mentioned by the

Bidder, whichever is earlier. During the above mentioned operating period of the mill, manufacturer's operation instructions will be followed and mill will be operated with the specified range of coal without any such readjustment that requires a shutdown of the mill or reduction of the load and/or any replacement of any mill wear parts.

For the purpose of testing to demonstrate the capacity, if grindability and surface moisture vary from those given above, the pulveriser measured capacity shall be corrected using the capacity correction curves furnished by the Bidder alongwith the offer. HGI vs grindability factor curve shall be furnished for HGI variations upto a value above which the capacity remains constant.

Capacity guarantee shall be conducted on all the mills. However, should the results of test as conducted above indicate that deficiency in capacity guarantee is observed in case of one or two mills only and that Owner is further, convinced that such deficiency does not occur out of reasons attributable to mill manufacture and supplier, Owner may waive off the requirement of demonstration of capacity guarantee for such mills only.

5.02.03 Mill Wear part life guarantee

The Bidder shall guarantee the wear life of all wear parts of the mill when grinding the specified range of coals. For this purpose the wear parts shall be defined as those parts of the mill which are in contact with coal or coal dust and are likely to wear out during the operation of the mill (except for the grinding media balls). The guarantee shall be demonstrated on each mill after establishing successful operation of the mill continuously for a period of not less than 24 hours at or near its guaranteed rated capacity. The establishment of the guarantee will be based on actual total hours of operation of the mill regardless of the specified range of coal or fuel loading. The mill wear parts shall be considered to have passed their guaranteed operating life when they have demonstrated their capability to meet the full load rated capacity of the mill at the rated power consumption at the end of the guarantee trial period. In case any of the wear parts has worn out to such an extent that either the normal and safe operation of the mill is jeopardised if it is not replaced/repaired or its continued use may lead to exposure or wear of other parts which are not meant for the purpose, that part shall be deemed to have completed its life for the purposes of checking the short fall in wear life even if there is no reduction in mill rated capacity and rated power consumption shall be as quoted by the Bidder when grinding the coal having parameters specified in Vol-II-A, Section-IX and achieving the grind fineness of not less than 70% through 200 mesh and 98% through 50 mesh.

5.03.00 **Electrostatic Precipitator**

5.03.01 The performance test on electrostatic precipitator will commence after completion of reliability run along with the testing of Boiler and Turbine. During the interval between the commencement of trial operation and the commencement of performance test only routine maintenance shall be carried out. No physical or chemical cleaning of ESP shall be permitted during this period or immediately before the conductance of the performing tests.

5.03.02 The test efficiency shall be based on the overall performance of the electrostatic precipitator over a mutually agreed period of operation under the conditions given in this specification and following the normal operation of the unit including rapping and normal soot blowing and/or warm up guns. Outlet dust concentration of ESP shall be as specified in relevant section under Steam Generator subject to applicable modification adopted by Environmental Department, Government of India, at the time of project execution.

5.03.03 The performance tests shall be carried out in accordance with Method-17 of EPA (Environmental Protection Agency of USA) code. The details of the tests shall, however be mutually agreed upon between the OWNER and the CONTRACTOR.

5.03.04 All calibration procedures and standards shall be subjected to the approval of the Owner. The protecting tubes, pressure connections and other test connections required for conducting guarantee test and maintenance testing shall conform to the relevant codes. The Bidder shall fully elaborate, in his proposal, the provisions made to this effect. Method of measurement for all air leakage test and power consumption test proposed by the Bidder shall be clearly indicated in his offer, and shall be subject to Owner's approval.

5.04.00 **Turbine Generator**

5.04.01 The performance test for the turbine generator set shall be conducted in accordance with the latest edition of ASME-PTC-6 - full scale test method.

The test results shall be considered as calculated from test observations with only corrections as are provided in the Code PTC-6.

The guaranteed parameters shall be without any tolerance or allowance values. Uncertainty analysis shall not be used to adjust test results.

For determination of primary flow to the turbine, low beta ratio throat tap nozzle assembly including required machined straight length meeting the requirements of ASME-PTC-6 shall be provided.

5.04.02 The performance tests shall be carried out to determine compliance with the following heat balance conditions :

a) 100% TMCR condition under rated steam parameters at condenser CW temperature 33^{o}C and design condenser vacuum with zero make-up.

b) 80% TMCR condition under rated steam parameters, at condenser CW temperature 33^{o}C and design condenser vacuum with zero make-up.

5.04.03 The test heat rate under the above load conditions shall be computed as per relevant clause of T.G. Specification.

The performance test shall be carried out with Turbine driven BFPs in service. To account for the conditions during the conductance of the test which do not correspond to the specified conditions, necessary corrections shall be applied.

5.04.04 The test results shall be considered as calculated from test observations with only corrections as are provided in the code ASME PTC-6.

The guaranteed parameters shall be without any tolerance or allowance values. Uncertainty analysis shall not be used to adjust test results.

5.04.05 The tests shall be arranged in a manner such that the Owner's operation is not disrupted. Duplicate test run will be performed at the 100% and 80% unit loads. The test results of corrected heat rate of the duplicate test runs shall agree within 0.25%. If they differ by more than 0.25% a third test shall be run at the same test points. Corrected results of anyone of the three test runs which deviates from the corrected average heat rate of all the runs by more than 0.25%, shall be eliminated, otherwise the results of the test with the highest heat rate figure will be considered.

The test for TG test capacity shall be carried out alongwith the heat rate test. Instrumentation and other details shall comply as above.

5.04.06 Condenser

Performance test for the condenser shall be conducted in accordance with the latest edition of ASME PTC-12.2. The condenser pressure shall be measured at 300 mm above the top row of tubes under VWO condition, zero make-up and design CW flow and CW inlet temperature corresponding to guranteed vacuum. The cleanliness factor shall be determined in accordance with the latest edition of ASME PTC-12.2.

5.04.07 Feed Water Heaters and Drain Cooler

Performance test for feed water heaters shall be conducted in accordance with the latest edition of ASME PTC-12.1.

5.04.08 Deaerator

Performance test for deaerator shall be conducted in accordance with the latest edition of ASME PTC-12.3.

The dissolved oxygen content in feed water at outlet of deaerator shall be determined by ASME-D 888. Reference Method A and any recognised modification thereof.

Free carbondioxide content of deaerator effluent shall be measured by APHA method.

5.05.00 **Statutory Requirements**

All parameters of plant, equipment & facilities which are under jurisdiction of Statutory Authorities, like MOEF, GPCB etc., shall be guaranteed. Conformance to the performance parameters under statutory requirement is mandatory.

5.06.00 **Remaining Plant and Equipment**

For other equipment, plants and systems, the performance test shall be carried out as per the respective equipment specification and the applicable codes.

PERFROMANCE GUARANTEE TESTS FOR COMPRESSED AIR SYSTEM

At Shop:

1. Capacity and discharge pressure of each air compressor.

2. Power consumption of each air compressor at its rated duty point with its own motor.

The tests shall be demonstrated at manufacturer's work.

At Site:

1. Parallel operations of air compressors.

2. Capacity & dew point of air at the outlet of air drying plants of instrument air compressors.

3. Pressure drop across the air drying plants of air compressors.

4. Vibration & noise level of air compressors, blowers of air drying plant (if applicable).

- Vibration limits shall be as per VD I 3836 applic able for the oil-free screw compressors.

- All machines / components / system sha ll be acous tically designed for a surface sound pressure level of Lp < 85 dB (A), measured in accordance with ISO 374 6 respectively at a distance of 1.0 m from equipment s urface and at a height of 1.5m above ground level. The surf ace sound pressure level (Lp) shall be aver aged over the measurement surface and corrected fo r effect of background noise and the influence of reflected sound at measurement surface (environmental correction). With sound pressure levels of 85 dB (A) or less according ISO it shall be ensured that maximum surface noise levels of any item of plant of le ss than 85 dB (A) at 1.0 m from outline and a height of 1.5m from the floor shall be net during normal operating conditions.

- In case during test it is found that the equipment/system has failed to meet the guarantees, the contractor shall carry out all necessary modifications and/or replacements to make the equipment/ system comply with the guaranteed requirements at no ext ra cost to the Employ er. Howev er, if the contractor is not able to demons trate the guarantees, even afte r the abov e modifications/replac ements within ninety (90) days or a reasonable period al lowed by BHEL, after the tests hav e been completed, BHEL will have the right to Reject the equipment / system / plant and recover the payment s already made or a accept t he equipm ent / system after assessing the deficiency in respect of t he various ratings, performance parameters and capa bilities and recover from the contra ct price an amou nt equiva lent to the damages as determined by BHEL.

- The bidd er will pre pare a document titled "HANDLING OVER P ROTOCALL" successful consisting various activities to be demonstrated by them for handing over of the package.

CONTENT

VOLUME : IIA

SECTION-VII

QUALITY ASSURANCE REQUIREMENTS

1.00.00 **QUALITY ASSURANCE PROGRAMME**

1.01.00 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 Owner's site or at any other place or 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 programmes shall be outlined by the Contractor and shall be finally accepted by the Owner/Authorised representative after discussions before the award of contract. A quality assurance programme of the Contractor shall generally cover the following :

a) His organisation structure for the management and implementation of the proposed quality assurance programme.

b) Documentation control system.

c) Qualification data for Bidder's key personnel.

d) The procedure for purchase of materials, parts, components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.

e) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

f) Control of non-conforming items and system for corrective actions.

g) Inspection and test procedure both for manufacture and all site related works.

h) Control of calibration and testing of measuring and testing equipments.

i) System for quality audit.

j) System for indication and appraisal of inspection status.

k) System for authorising release of manufactured product to the Owner.

l) System for handling storage and delivery.

m) System for maintenance of records.

n) 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 equipment/component as per format enclosed at Annexure-I to this section.

2.00.00 **GENERAL REQUIREMENTS - QUALITY ASSURANCE**

2.01.00 All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the 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's responsibility to draw up and implement such programme duly approved by the Owner/Consultant. The detailed Quality Plans for manufacturing and field activities should be drawn up by the Bidder, separately in the format attached at Annexure-I and will be submitted to Owner/Authorised representative for approval. Schedule of finalisation of such quality plans will be finalised before award.

2.02.00 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 organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing.

2.03.00 Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's site Quality Control organisation, during various stages of site activities from receipt of materials/ equipment at site.

2.04.00 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/Authorised representative shall identify customer hold points (CHP), test/checks which shall be carried out in presence of the Owners Engineer or his authorised representative and beyond which the work will not proceed without consent of Owner/Authorised representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Owner/Authorised representative for approval and dispositioning.

2.05.00 No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Owner's Engineer/ Authorised representative, and duly authorised for despatch issuance of Material Despatch Clearance Certificate (MDCC).

2.06.00 Materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report as per Owner's approved QAP. These certificates and reports shall indicate the sheet numbers or other such acceptable identification numbers of the material. The material certified shall also have the identification details stamped on it.

2.07.00 Castings and forgings used for construction shall be of tested quality. Details of results of chemical analysis, heat treatment record, mechanical property test results shall be furnished.

2.08.00 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 brazers, welders etc. employed on any part of the contract at Contractor's/ Sub-Contractor's works or at site shall be qualified as per ASME Section-IX or BS-4871 or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner/his authorised representative.

For welding of pressure parts and high pressure piping the requirements of IBR shall also be complied with.

2.09.00 All non-destructive examination (NDT) shall be carried out in accordance with approved international standard. The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non- destructive examination). Results of NDT shall be properly recorded and submitted for approval.

2.10.00 All the sub-vendors proposed by the Contractor for procurement of major bought out items including castings, forgings, semi-finished and finished components/equipment list of which shall be drawn up by the Contractor and finalised with the Owner shall be subject to Owner's approval. Quality Plans of the successful vendors shall be discussed, finalised and approved by the Owner/Authorised representative and form part of the Purchase Order between the Contractor and the Vendor.

2.11.00 All the purchase specifications for the major bought-out items, list of which shall be drawn up by the Contractor and finalised with the Owner shall be furnished to the Owner for comments and subsequent approval before orders are placed.

Owner reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-vendor's quality management and control activities. The Contractor shall provide all necessary assistance to enable the Owner carry out such audit and surveillance.

Quality audit/approval of the results of tests and inspection will not prejudice the right of the Owner to reject an equipment not giving the desired performance after erection and shall not in no way limit the liabilities and responsibilities of the Contractor in earning satisfactory performance of equipment as per specification.

2.12.00 Quality requirements for main equipment shall equally apply for spares and replacement items.

2.13.00 Repair/rectification procedures to be adopted to make any job acceptable shall be subject to the approval of the Owner.

2.14.00 For quality assurance of all civil works refer to the specifications for civil works.

3.00.00 QUALITY ASSURANCE DOCUMENTS

3.01.00 The Contractor shall be required to submit two (2) copies and two (2) sets of microfilms of the following Quality Assurance documents within three (3) weeks after despatch of the equipment :

a) Material mill test reports on components as specified by the specification.

b) 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.

c) Non-destructive examination results /reports including radiography interpretation reports.

d) Factory tests results for testing required as per applicable codes and standards referred in the specification.

e) Welder identification list listing welder's and welding operator's qualification procedure and welding identification symbols.

f) Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.

g) Stress relief time temperature charts.

h) Inspection reports duly signed by QA personnel of the Owner and Contractor for the agreed inspection hold points. During the course of inspection, the following will also be recorded :

   i) When some important repair work is involved to make the job acceptable.

   ii) The repair work remains part of the accepted product quality.

i) Letter of conformity certifying that the requirement is in compliance with finalised specification requirements.

4.00.00 INSPECTION, TESTING AND INSPECTION CERTIFICATES

4.01.00 The Engineer, his duly authorised 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 Engineer and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.

4.02.00 The Contractor shall give the Engineer/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. The Engineer/ 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 notified as being ready for test/inspection failing which the Contractor may proceed with test which shall be deemed to have been made in the Inspector's presence and he shall forthwith forward to the Inspector duly certified copies of test reports in six (6) copies.

4.03.00 The Engineer 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 Engineer/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

4.04.00 When the factory tests have been completed at the Contractor's or sub-contractor's works, the Engineer/Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Engineer/Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Contractor's test certificate by the Engineer/Inspector. Failure of the Engineer/Inspector to issue such a certificate shall not prevent the Contractor from proceeding 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.

4.05.00 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 charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Engineer/Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Engineer/ Inspector or to his authorised representative to accomplish testing.

4.06.00 To facilitate advance planning of inspection in addition to giving inspection notice as per Clause 4.02.00, 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.

ANNEXURE-I

FORMAT OF QUALITY ASSURANCE PROGRAMME

Name of Company/ Contractor	NAME OF CONTRACT PACKAGE			QUALITY PLAN FOR						
	Package No. : _____ Contractor : _____			QP No. : _____ Date _____ Rev. No.: _____ Date _____						
Sl. No.	Component & Operation	Characteristics	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norm	Format of Record	Agency	Remarks

Note: All the information for QAP as stipulated above shall be finalized and agreed during contract execution.

STANDARD CHECL LIST FOR :Insulation & Cladding
PACKAGE-FULE OIL SYSTEM
PROJECT-
CHECL LIST NO.:PE-QP-XXX-166-A801
REV.NO. 0
DATE: 31/03/2012

SL. No.	TESTS/CHECKS	QUANTUM OF CHECKS	REFERENCE DOC./ ACCEPTANCE NORMS	AGENCY				REMARKS
				M	C	N	D	
1.0	Review of Manufacturer's TC for Mineral wool	Sampling as per IS:8183	Appd.Data Sheet/ IS:8183	P	V	V	√	Ref, Note 1
2.0	Review of Material TC for Aluminium sheet	One/Lot	Appd.Data Sheet/ IS:737	P	V	V	√	Ref. Note 2
2.1	Dimensional Check	At random (10%)	-do-	P	V	V	√	
3.0	Packing & Marking	100%	IS:8183/Mfr's Std.	P	V	V	√	

Legend:
Records identified with "√"shall be essentially included by contractor in QA documentation
M= Manufacturer, C= Main Vendor
N= BHEL/Customer
P= Perform, W= Witness, V= Verification
Note:1.MTC Will comprise the tests in line with IS:8183
2. MTC will Comprise of chemical & mechanical properties.

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD CHECK LIST FOR: PRESSURE REDUCING VALVE

PACKAGE-FULE OIL SYSTEM

PROJECT-

CHECK LIST NO.:PE-QP-XXX-166-A802

REV.NO. 0

DATE: 31/03/2012

SL. No.	TESTS/CHECKS	QUANTUM OF CHECKS	REFERENCE DOC./ ACCEPTANCE NORMS	AGENCY M	AGENCY C	AGENCY N	AGENCY D	REMARKS
1	Review of Material TC for body & diaphragm	One/Lot	Appd.Data Sheet/ Relevant Std.	P	V	V	√	
2	Hydro test of body	100%	Appd.Data Sheet	P	W	V	√	
3	End Connection	100%	-do-	P	W	V	√	
4	Check for IBR TC	100%	-do-	P	V	V	√	

Legend:
Records identified with ' √ ' shall be essentially included by contractor in QA documentation
M= Manufacturer, C= Main vendor/Sub vendor
N= BHEL/Customer,
P= Perform, W= Witness, V= Verification
Note: 1.For IBR Valves, no physical inspection is carried out by contractor/customer.Material will be accepted based on review of IBR Test Certificates.

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

PEM MAUX

STANDARD QUALITY PLAN FOR

STRUCTURAL STEEL

QUALITY PLAN NO.:	**PE-QP-XXX-166-A803**
PACKAGE-	**FULE OIL SYSTEM**
PROJECT-	
REV.NO.	**0** **DATE:** 31/03/2012
SHEET	**1 OF 1**

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY D	AGENCY M	AGENCY C	AGENCY CU	REMARKS
1	2	3	4	5	6	7	8	9			10		11
1.0	Structural	a) Chemical Composition	M	Chemical Analysis	Sample	IS:2062/ Spec./Drg.	IS:2062/ Spec./Drg.	Mfr's TC	✓	P	V*	V	
		b) Mechanical test	M	Mechanical Properties	-do-	-do-	-do-	Mfr's TC	✓	P	V*	V	
		c) Dimensional conformity	M	Measurement	100%	-	-	Mfr's TC	✓	P	W**	V	

***** In case material is procured from dealer, and co-related TCs are not available, check test on identified sample will be carried out at recogonised testing laboratory.

****** In case material is despatched directly from SAIL/IISCO plant to project site, the witnessing required is waived and material will be accepted on challan & MTC of SAIL/IISCO

LEGEND:
RECORDS INDENTIFIED WITH "✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.
M - MANUFACTURER
C - MAIN VENDOR
CU - BHEL/CUSTOMER/NOMINATED INSPECTION AGENCY
"P" PERFORM, "W" WITNESS AND V VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

PEM MAUX

STANDARD QUALITY PLAN FOR STEEL PLATE

QUALITY PLAN NO.:PE-QP-XXX-166-A804	
PACKAGE-FULE OIL SYSTEM	
PROJECT-	
REV.NO. 0	DATE: 31/03/2012
SHEET 1 OF 1	

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS CHECKED	CATEGORY	TYP/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY P	AGENCY W	AGENCY V	REMARKS
1.0	Steel Plate	a) Chemical Composition	MA	Chemical Analysis	Sample	IS:2062/ Spec./Drg.	IS:2062/ Spec./Drg.	Mfr's TC	3		2*,1	
		b) Mechanical test	MA	Mechanical Properties	-do-	-do-	-do-	Mfr's TC	3		2*,1	
		c) Dimensional conformity	MA	Measurement	100%	-	-	Mfr's TC	3	2**	1	

* In case material is procured from dealer, and co-related TCs are not available, check test on identified sample will be carried out at testing laboratory.

** In case material is despatched directly from SAIL/TISCO plant/Stock yard to project site, the witnessing required is waived and material will be accepted on MTC of SAIL/TISCO

LEGEND

CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL 4-CUSTOMER
2 - Vendor
3 - Sub-vendor

MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP)

REVIEWING AGENCY (SIGN WITH DATE & STAMP)

APPROVING AGENCY (SIGN WITH DATE & STAMP)

STANDARD CHECK LIST FOR: :Safety Relief Valve
PACKAGE-FULE OIL SYSTEM
PROJECT-
CHECK LIST NO.:PE-QP-XXX-166-A805
REV.NO.0
DATE:31/03/2012

SL. No.	TESTS/CHECKS	QUANTUM OF CHECKS	REFERENCE DOC./ ACCEPTANCE NORMS	AGENCY				REMARKS
				M	C	CU	D	
1	Review of Material TC for body & stem	One/Lot	Appd.Data Sheet/ Relevant Std.	P	V	V	√	
2	Hydro test of body	100%	Appd.Data Sheet	P	W	V	√	
3	Set pressure	100%	-do-	P	W	V	√	
4	Check for IBR TC	100%	-do-	P	V	V	√	

Legend:
Records identified with ' √ shall be essentially included by contractor in QA documentation
M= Manufacturer, C= Main vendor
CU=BHEL/Customer
P= Perform, W= Witness, V= Verification
For IBR Valves, no physical inspection carried out by contractor/customer.Material will be accepted based on review of IBR test certificates.

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR

SUMP PUMP

QUALITY PLAN NO.:PE-QP-XXX-166-A807

PACKAGE-FULE OIL SYSTEM

PROJECT-

REV.NO. 0 **DATE: 31/03/2012**

SHEET 1 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY M	AGENCY C	AGENCY CU	AGENCY D	REMARKS
1	2	3	4	5	6	7	8	9	10				11
1.0	**RAW MATERIAL**												
1.1	CASING/ROTOR(IMPELLER) HOUSING	i) SURFACE DEFECTS	MAJOR	VISUAL	100%	APPD.DATA SHEET/ DRG./	APPD.DATA SHEET/ DRG./	IR & TC	P	V	-		
		ii) DIMENSIONAL CONFORMITY		MEASUREMENT	100%	MFR's DRG./IS:210 Gr.	MFR's DRG./IS:210 Gr.						
		iii) MECHANICAL & CHEMICAL TEST		PHYSICAL PROPERTIES/ CHEM. ANALYSIS	1/HEAT	FG 200/RELEVANT STD.	FG 200/RELEVANT STD.						
		iv) HARDNESS TEST		MEASUREMENT	100%								
1.2	IMPELLER	i) SURFACE DEFECTS	MAJOR	VISUAL	100%	APPD.DATA SHEET/DRG.	APPD.DATA SHEET/DRG.	IR & TC	P	V	-		
		ii) DIMENSIONAL CONFORMITY		MEASUREMENT	100%	MFR's DRG./	MFR's DRG./						
		ii) MECHANICAL & CHEMICAL TEST		PHYSICAL PROPERTIES/ CHEM. ANALYSIS	1/HEAT	RELEVANT STD.	RELEVANT STD.						
		iv) HARDNESS		MEASUREMENT	100%								
		v) DYPENETRATION TEST (AFTER MACHINING)		DYEPENETRATION TEST	100%	ASTM E165	NO LINEAR INDICATION	IR & TC	P	V	V	✓	
1.3	SHAFT	i) DIMENSIONAL CONFORMITY	MAJOR	MEASUREMENT	100%	MFR's DRG./	MFR's DRG./	IR & TC	P	V	-		
		ii) MECHANICAL & CHEMICAL TEST		PHYSICAL PROPERTIES/ CHEM. ANALYSIS	1/HEAT	APPD. DATA SHEET/ MFR's CATALOGUE	MFR's CATALOGUE/ RELEVANT STD.						
		iii) UT DIA > 50MM **		UT	100%	ASTM A388	ASTM A388		P	V	V	✓	(**) WHEN BACKWALL ECHO IS SET TO 100% OF FSH IN SOUND AREA: 1) DEFECT ECHO NOT TO EXCEED 20% OF FSH 2) BACK WALL ECHO HEIGHT TO BE 80% MIN. OF FSH. FREQ. 2 MH_Z MIN.
1.4	SHAFT SLEEVE	i) CHEMICAL ANALYSIS	MAJOR	CHEMICAL	1/HEAT	MFR's STD./MFR's	RELEVANT STANDARD/	IR & TC	P	V	-		
		ii) HARDNESS		MEASUREMENT	100%	CATALOGUE	IS						
1.5	WEARING RINGS	i) MECHANICAL & CHEMICAL TEST	MAJOR	PHYSICAL PROPERTIES/ CHEM. PROPERTIES	1/HEAT	MFR's STD./MFR's CATALOGUE	RELEVANT STANDARD/ IS	IR & TC	P	V	-		
		ii) HARDNESS		MEASUREMENT	100%								

LEGEND:

RECORDS INDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

M - MANUFACTURER

C - MAIN VENDOR

CU - BHEL/CUSTOMER

INDICATE "P" PERFORM "W" WITNESS AND V VERIFICATION

IR - INSPECTION REPORT, MTC - MTRL./MFR'S TEST CERTIFICATES

MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP)

REVIEWING AGENCY (SIGN WITH DATE & STAMP)

APPROVING AGENCY (SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
SUMP PUMP

QUALITY PLAN NO.:PE-QP-XXX-166-A807
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 2 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY M	AGENCY C	AGENCY CU	AGENCY D	REMARKS
1	2	3	4	5	6	7	8	9	10				11
2.0	**INTERNAL TEST**												
2.1	CASING	SOUNDNESS OF CASTING	MAJOR	HYDROSTATIC TEST	100%	HYDROSTATIC TEST AT 200% OF PUMP RATED HEAD OR 150% SHUT OFF HEAD WHICHEVER IS HIGHER FOR 30 MTS.	NO LEAKAGE	IR & TC	P	V	V	✓	
2.2	SHAFT	DP ON SHAFT	MAJOR	DPT	100%	ASME E165	NO LINEAR DEFECTS	IR & TC	P	V	V	✓	
2.3	IMPELLER	RESIDUAL UNBALANCE	MAJOR	DYNAMIC/STATIC BALANCING	100%	ISO 1940 GR.6.3	ISO 1940 GR.6.3	IR & TC	P	V	V	✓	
3.0	**FINAL INSPECTION**												
3.1	OVERALL DIMENSION	DIMENSIONAL	MAJOR	MEASUREMENT	100%	APPD. DRAWING/ MFR's DRAWING	APPD. DRAWING/ MFR's DRAWING	IR & TC	P	W	W	✓	
3.2	PERFORMANCE TEST WITH LAB MOTOR	i) Q V/s HEAD ii) Q V/s POWER iii) Q V/s EFFICIENCY iv) NOISE LEVEL & VIBRATION	CRITICAL	MEASUREMENT	100%	APPD.DRG./MFR's DRG./APPROVED. DATASHEET/HIS	APPD.DRG./MFR's DRG./APPROVED. DATASHEET/HIS 85 dBA MAX. AT 1Mtr, & 75 MICRON MAX.	IR & TC	P	W	W	✓	
3.3	STRIP TEST	STRIP TEST	CRITICAL	VISUAL (WEAR & TEAR)		**	NO UNDUE WEAR	IR & TC	P	W	W	✓	
3.4	REVIEW OF DOCUMENTATIONS					APPD. QAP	APPD. QAP		V	V	V	✓	
3.5	PAINTING	VISUAL	MINOR	VISUAL	100%	SPECIFICATION/ PAINTING SCH-EDULE/Mfr's Std.	SPECIFICATION/ PAINTING SCH-EDULE/Mfr's Std.	IR	P	V	-		** STRIP DOWN TEST ON 100% BASIS SHALL BE DONE INCASE ABNORMAL PERFORMANCE OTHERWISE SAME SHALL BE RESTRICTED TO BEARING INSPECTION ONLY
	NOTE: ALL MATERIAL OF CONSTRUCTION SHALL BE AS PER APPROVED DATA SHEET/DRAWING												

LEGEND:
RECORDS INDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

M - MANUFACTURER
C - MAIN VENDOR
CU - BHEL/CUSTOMER
INDICATE "P" PERFORM "W" WITNESS AND V VERIFICATION
IR - INSPECTION REPORT, MTC - MTRL./MFR'S TEST CERTIFICATES

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
BALL VALVE

QUALITY PLAN NO.:PE-QP-XXX-166-A808
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 3

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY				REMARKS
									D	M	C	CU	
1	2	3	4	5	6	7	8	9				10	
1.0	**MATERIALS:**												
1.1	BODY & END PIECE	CHEMICAL COMPOSITION	CRITICAL	CHEM. TEST	ONE/ HEAT	APPD.DRG./ DATA SHEET	APPD.DRG./ DATA SHEET/ RELEVANT STD.	MATRL. TC/ MFR'S TC	✓	P	V	V	
		MECHANICAL PROPERTIES	- DO -	MECH. TEST	ONE/HEAT/ HEAT TREAT-MENT BATCH	- DO -	- DO -	- DO -	✓	P	V	V	
		HEAT TREATMENT	- DO -	REVIEW OF HT CHART	100%	- DO -	- DO -	- DO -/HT CHART	✓	P	V	V	
		IDENTIFICATION & CORRELATION	MAJOR	VISUAL	100%	- DO -	- DO -	INTERNAL RECORD		P	V	-	
		SURFACE DEFECTS	- DO -	- DO -	100%	MSS-SP-55	FREE FROM DEFECTS	- DO -	✓	P	V	-	
		DIMENSIONAL	- DO -	MEASU-REMENT	100%	APPD. DRG./ RELEVANT STD.	APPD. DRG./ RELEVANT STD.	LOG BOOK		P	V	-	

LEGEND:
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M: MANUFACTURER .
C:MAIN VENDOR, CU: BHEL/CUSTOMER
INDICATE "P" PERFORM, "W" WITNESS AND "V" VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
BALL VALVE

QUALITY PLAN NO.:PE-QP-XXX-166-A808
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 2 OF 3

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY D	AGENCY M	AGENCY C	AGENCY CU	REMARKS
1	2	3	4	5	6	7	8	9	10				11
1.2	BALL, SPINDLE, GLAND, LEVER FASTENERS	CHEMICAL COMPOSITION	CRITICAL	CHEM. TEST	ONE/ HEAT	APPD.DRG./ DATA SHEET	APPD.DRG./ DATA SHEET/ RELEVANT STD.	TEST CERT.	✓	P	V	V	
		MECHANICAL PROPERTIES	- DO -	MECH. TEST	ONE/HEAT/ HEAT TREAT-MENT BATCH	- DO -	- DO -	- DO -	✓	P	V	V	
		HEAT TREATMENT (as applicable)	- DO -	REVIEW OF HT CHART	100|%	- DO -	- DO -	- DO -/ HT CHART	✓	P	V	V	
		SURFACE DEFECTS	MAJOR	- DO -	100%	MSS-SP-55	FREE FROM DEFECTS	- DO -	✓	P	V	-	
		DIMENSIONS	- DO -	MEASU-REMENT	100%	APPD. DRG./ RELEVANT STD.	- DO -	LOG BOOK		P	V	-	
1.3	BODY SEAL, STEM SEAL, GLAND PACKING	DIMENSIONS	- DO -	- DO -	100%	- DO -	- DO -	INTERNAL RECORD		P	V	-	
		TEMPERATURE RESISTANCE	- DO -	TEMP. CHECK	100%	PTFE /RELE-VANT STD.	RELEVANT STD.	TEST CER-TIFICATE	✓	P	V	V	
2.0	**IN-PROCESS INSPECTION:**												
2.1	MACHINING OF BODY END-PIECE GLAND BALL, SPINDLE	DIMENSIONS	-DO-	MEASU-REMENT	100%	MFG. DRG.	MFG. DRG.	LOG BOOK		P	V	-	
		SURFACE FINISH	- DO -	VISUAL	100%	- DO -	MFG. DRG./MFG. STD.	- DO -		P	V	-	
2.2	BALL, SPINDLE	HARDNESS	-DO -	HARDN-ESS TEST	100%	APPD. DRG./ DATA SHEET/ TECH.SPEC.	APPD. DRG./ DATA SHEET/ TECH.SPEC./MFG. STD.	TEST CERT.	✓	P	V	V	
		SURFACE DEFECTS	CRITICAL	DPT	100%	ASTM-E-165	NO LINEAR INDICATION	INTERNAL RECORD	✓	P	V	-	

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MAIN VENDOR/SUB-VENDOR
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REVIEWING AGENCY
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APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
BALL VALVE

QUALITY PLAN NO.:PE-QP-XXX-166-A808
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 3 OF 3

SL .NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY				REMARKS
									D	M	C	CU	
1	2	3	4	5	6	7	8	9		10			11
2.3	BALL & SEAT	BLUE MATCH	CRITICAL	BLUE MATCHING	100%	THE SURFACE WILL BE SMOOTH & WILL HAVE UNIFORM METAL TO METAL CONT-ACT	SAME AS COL.7	LOG BOOK	✓	P	V	V	
3.0	**ASSEMBLY**	DIMENSIONS	MAJOR	MEASUR-EMENT	*AS PER NOTE-1 BELOW	APPD. DRG./ RELEVANT STD.	APPD. DRG./ RELEVANT STD.	INTERNAL RECORD	✓	P	W	W	
		OPENING & CLOSING	- DO -	OPERA-TION	- DO -	SMOOTH OPERA-TION OF VALVE	- DO -	- DO -	✓	P	W	W	
4.0	**TESTING:**												
4.1	SHELL	LEAKAGE	CRITICAL	HYDRO-STATIC	*AS PER NOTE-1 BELOW	APPD. DRG./ DATA SHEET	NO LEAKAGE	TEST CER-TIFCATE	✓	P	W	W	
4.2	SEAT	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	- DO -	✓	P	W	W	
4.3	SEAT	- DO -	- DO -	AIR	- DO -	- DO -	- DO -	- DO -	✓	P	W	W	
4.4	FIRE SAFE TEST REPORT WITNESSED BY LLOYD/BV SHALL BE FURNISHED FOR REVIEW								✓	P	V	V	
4.5	REVIEW OF QA DOCUMENTATION AS PER APPD. QP								✓	P	V	V	
5.0	**PAINTING :**	QUALITY & THICK-NESS OF PAINT	MAJOR	VISUAL & MEASU-REMENT	100%	TECH. SPEC./ DATA SHEET/ MFG. STD.	SAME AS COL.7	INTERNAL RECORD		P	V	-	
6.0	**PACKING:**		MAJOR	VISUAL	100%			INTERNAL RECORD		P	-	-	

NOTE-1:
100% BY MANUFACTURER
10% BY TECHNO
For Actuator operating valves - Actuator test certificate shall be furnished to BHEL for review.
For Fire safe valves - valves are to be accepted based on fire test certificates

LEGEND:
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INDICATE "P" PERFORM, "W" WITNESS AND "V" VERIFICATION

MAIN VENDOR/SUB-VENDOR
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APPROVING AGENCY
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STANDARD QUALITY PLAN FOR
CS PIPE -ERW

QUALITY PLAN NO.:PE-QP-XXX-166-A809
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 1

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY D	AGENCY M	AGENCY C	AGENCY CU	REMARKS
1	2	3	4	5	6	7	8	9			10		11
1.0	ERW PIPE	a) Physical & Chemical test	M	Physical & Chemical Properties	Sample	IS:1239 Pt.1/ API 5L Gr. B/ Appd. Data sheet	IS:1239 Pt.1/ API 5L Gr. B/ Appd. Data sheet	MTC/ Mfr's TC	✓	P	V	V	Refer Note-1
		b) Dimensional conformity	M	Measurement	At random	-do-	-do-	MTC/ Mfr's TC	✓	P	V	V	
		c) Hydro test	M	Leak test	100%	-do-	-do-	MTC/ Mfr's TC	✓	P	V	V	

Note-1: In case material is procured from dealer, and co-related Mfr's TCs are not available, check test on identified sample will be carried out at testing laboratory and hydro test at pressure 1.5 times of design pressure on10% of total quantity will be witnessed by BHEL.

LEGEND:
RECORDS INDENTIFIED WITH "✓" " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

M - MANUFACTURER
C - MAIN VENDOR
CU - BHEL/CUSTOMER
"P" PERFORM, "W" WITNESS AND V VERIFICATION

MAIN VENDOR/SUB-VENDOR
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APPROVING AGENCY
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STANDARD QUALITY PLAN FOR
CCS /CFS GATE,GLOBE & CHECK VALVE
(UP TO 50 NB-FCS #800 & 1 NO. 50 NB GLOBE VALVE #600) (65 NB & ABOVE CCS # 150)

QUALITY PLAN NO.:PE-QP-XXX-166-A810
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY D	AGENCY M	AGENCY C	AGENCY N	REMARKS
1	2	3	4	5	6	7	8	9			10		11
1	**Raw Material:**												
	Body, bonet, gld.,Flange, Disc, / wedge	Chem. & mech. Test	CR	Chem.& mech.Test	Per Heat	Appd.Drg/.	Relevant Standard	MTC	✓	P	V	V	Body will carry the heat
		Dimensions	MR	Measurement	100%	Mfg. Drg./ Data Sheet	Mfg. Drg./ Data Sheet	IR	✓	P	V	V	mark for co-relation with
		Surface quality	MR	Visual	100%	Mfg. Drg./ Data Sheet	Defect Free	IR	✓	P	V	V	CMT
1.1	Stem,body seat ring,gland.	Chem. & mech. Test	CR	Chem.& mech.Test	Per Heat	Appd.Drg./Relevant Std.	Appd.Drg./Relevant Std.	MTC	✓	P	V	V	
1.2	Fasteners	Chem. & mech. Test	MR	Chem.& mech.Test	Per Heat	Appd.Drg./Relevant Std.	Appd.Drg./Relevant Std.	IR	✓	P	V	V	
1.3	Gasket & gland packing	Compliance to PO	MR	Measurement	100%	Appd.Drg./Relevant Std.	Appd.Drg./Relevant Std.	IR	✓	P	V	V	
2.0	**In Process Inspection**												
2.1	Machining of valves components	Surface quality	MR	Visual	100%	Mfg. Drg.	Mfg. Drg.	IR	✓	P	V	V	
		Dimension	MR	Measurement	100%	Mfg. Drg.	Mfg. Drg.	IR	✓	P	V	V	
2.2	Spindle	Surface finish	MR	Measurement	100%	Mfg. Drg.	Mfg. Drg.	IR	✓	P	V	V	
2.3	Wedge / disc , seatring, stem & back seat	Lapping	MR	Blue Matching	100%	100% metal to metal contact	100% metal to metal contact	IR	✓	P	V	V	

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M MANUFACTURER/SUB-CONTRACTOR
C CONTRACTOR/NOMINATED INSPECTION AGENCY,
N CUSTOMER. INDICATE "P" PERFORM "W" WITNESS AND
V VERIFICATION AS APPROPRIATE CHP
SHALL INDENTIFIED IN COLUMN "N"
IR - INSPECTION REPORT, CMT-CERTIFICATE OF MATERIAL &TEST

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
CCS /CFS GATE,GLOBE & CHECK VALVE
(UP TO 50 NB-FCS #800
(65 NB & ABOVE CCS # 150)

QUALITY PLAN NO.:PE-QP-XXX-166-A810
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 2 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY D	AGENCY M	AGENCY C	N	REMARKS
1	2	3	4	5	6	7	8	9			10		11
3.0	**Testing & Final Inspection**												
3.1	Performance	Operation	CR	Manual	100%	Appd. Drg./Data Sheet	Should be smooth	IR	✓	P	W	W*	
3.2	Shell &Sheet / backseat	Pr. Testing	CR	Hyd. Testing	100%	Appd. Drg./Data Sheet	Relevant Standard / Data Sheet	CMT	✓	P	W	W*	
3.3	Seat	Pr. Testing	CR	Pneumatic Testing	100%	Appd. Drg./Data Sheet	Relevant Standard / Data Sheet	CMT	✓	P	W	W*	Not Applicable for Check Valve
3.4	Valve Assembly	1. Chk. For completeness/ Visual Inspection	MR	Visual	100%	Appd. Drg. / Tech. Spec./ Data Sheet	Appd. Drg./Data Sheet	IR	✓	P	W	W*	
		2. Dimention	MR	Measurement	10%	Appd. Drg./Data Sheet	Appd. Drg./Data Sheet	IR	✓	P	W	W*	*RANDOM 10% BY CUSTOMER
		3. Wear Travel / valve lift	MR	Manual	100%	Appd. Drg.	Appd. Drg.	IR	✓	P	W	W*	
4.0	**Painting & Packaging**												
		1. Painting & Packaging	MR	Manual	100%	Appd. Drg. / Tech. Spec.	Appd. Drg. / Tech. Spec.	IR		P	V		
		2. Tagging	MR	Manual	100%	Appd. Drg. / Tech. Spec.	Appd. Drg. / Tech. Spec.	PS / RS		P	V		

LEGEND:
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V VERIFICATION AS APPROPRIATE CHP
SHALL INDENTIFIED IN COLUMN "N"
IR - INSPECTION REPORT, CMT-CERTIFICATE OF MATERIAL &TEST

MAIN VENDOR/SUB-VENDOR
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APPROVING AGENCY
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STANDARD QUALITY PLAN FOR

OIL STRAINER

QUALITY PLAN NO.:PE-QP-XXX-166-A811
PACKAGE-FULE OIL SYSTEM

PROJECT-

REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
									D	M	C	CU	
1	2	3	4	5	6	7	8	9		10			11
1.0	**Raw Material**												
1.1	Body, flange, dished end	Physical & Chemical Properties	MA	Physical & Chemical Test	1/Sample	Appd. Drg.	Appd. Drg./ Mfg.Std.	Mtrl.TC	√	P	V	V	
1.2	Screen	1. Chem. composition	MA	Chem. Test	1/Sheet	- do -	- do -	- do -	√	P	V	V	
		2. Dimension, Mesh Size	MA	Meas.	100%	- do -	- do -	log book		P	V	V	
2.0	**In Process**												
2.1	Welding Procedure Specification	Parameter	MA	Verification	100%	ASME-IX	ASME-IX	QW-482	√	P	V	V	BHEL approved WPS & PQR Shall be furnished for review.
2.2	Procedure Qualification Record & Welder Qualification	Weld Soundness/ Qualification	MA	Qualification test RT	100%	ASME-IX	ASME-IX	QW-483/484	√	P	V	V	
3.0	Weld fit up	Dimension alignment orientation	MA	Meas./ Visual	100%	Appd. WPS	Appd. WPS	log book		P	V	V	
4.0	Weldments - Final Run (all welds)	Surface Defect	MA	Penetration Test	10%	ASTME-165	No defects	- do -	√	P	V	V	
4.1	Root run (butt welds & back gauged welds)	-do-	MA	-do-	100%	-do-	-do-	-do-	√	P	V	V	

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"M" MANUFACTURER
"C" MAIN VENDOR
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INDICATE "P" PERFORM "W" WITNESS AND"
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MAIN VENDOR/SUB-VENDOR
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STANDARD QUALITY PLAN FOR

OIL STRAINER

QUALITY PLAN NO.:PE-QP-XXX-166-A811
PACKAGE-FULE OIL SYSTEM

PROJECT-

REV.NO. 0 **DATE: 31/03/2012**
SHEET 2 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
									D	M	C	CU	
1	2	3	4	5	6	7	8	9		10			11
5.0	Assembly of Internal Fittings Basket placement	Orientation Location of Tapping Points & fitting of Internals	MA	Visual & Meas.	100%	Appd. Drg.	Appd. Drg./ Mfg.Std.	log book		P	V	V	
6.0	Final Assembly												
6.1	Final Inspection	Completeness Cleanliness Dimension	MA	Visual & Meas.	100%	- do -	Appd. Drg./ Data Sheet	Inspection Report		P	W	W	
		Leak tightness	CR	Hyd. Test at 1.5 times of design pr. for 30 min.	100%	- do -	No leakage	Test Record	√	P	W	W	
7.0	Review of QA Documents as per QP												

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STANDARD QUALITY PLAN FOR
POSITIVE DISPLACEMENT PUMP
(SINGLE/TWIN SCREW PUMP)

QUALITY PLAN NO.:PE-QP-XXX-166-A812
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 2

SL. NO. 1	COMPONENT & OPERATIONS 2	CHARACTERISTICS 3	CLASS 4	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9		AGENCY			REMARKS 11
									D	M	C 10	CU	
1.0	**Raw Material & Bought Out Items**												
1.1	Casing, stuffing box & end cover	i) Chemical test	MA	Chemical Analysis	Sample/ heat	Appd. Data Sheet/ Appd. Drg./ IS:210 FG260	Same as Cl.7	Material TC	√	P	V	V	
		ii) Physical test	MA	Physical Properties	Sample/ heat	- do -	Same as Cl.7	Material TC	√	P	V	V	
		iii) Hardness	MA	Meas.	At random	As per Appd. Data Sheet	- do -	Material TC	√	P	V	V	
1.2	Shaft, Rotor,Step-up gear,Timing gear	i) Chemical test	MA	Chemical Analysis	Sample/ heat	As per Appd. Data Sheet/ Drg.	Same as Cl.7	Material TC	√	P	V	V	
		ii) Physical test	MA	Physical Properties	- do -	- do -	Same as Cl.7	Material TC	√	P	V	V	
		iii) Heat treatment	MA	Heat treatment	100%	- do -	- do -	HT Chart	√	P	V	V	
		iv) Hardness	MA	Meas.	- do -	- do -	- do -	- do -	√	P	V	V	
1.3	Bearing	Make, size & bearing No.	MA	Visual	100%	Mfg. Drawing/ Mfg.Catalogue	- do -	Log Book		P	-	-	
2.0	**In Process Control**												
2.1	Machining of all Components	i) Dimension	MA	Meas.	100%	- do -	- do -	- do -		P	V	V	
		ii) Surface finish	MA	Visual	100%	- do -	- do -	- do -		P	-	-	
2.2	Casing	Pressure test	MA	Hyd.Test with water	100%	1.5 x max. discharge pr. for 15 minutes.	No leakage/Seepage	Test Report	√	P	V	V	
2.3	Shaft, Rotor/Screw, Step-up gear, timing gear	1. Internal Defects	CR	UT(after skin - machining)	100%	ASTM A388	Refer Note.1 (page2)	Test Report	√	P	V	V	
		2. Surface Defects	CR	DPT(after - final machining)	100%	ASTM E:165	No linear indication >1.6mm	Test Report	√	P	V	V	
		3. Case Hardness of timinng gear	CR	Hardness	100%	EN-36 to BS970/ As per data sheet	After case carburising, hardened & tempered to have tooth hardness of 56 to 59 HRC	H T report	√	P	V	V	NA
2.4	Balancing of Rotor Assly.	Static & Dynamic	CR	Balancing	100%	VDI 2060 Cl. 6.3/ ISO 1940 Gr.6.3	ISO 1940 Gr.6.3	Test Report	√	P	V	V	only in case of Twin Screw Pump

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"V" VERIFICATION

MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP)

REVIEWING AGENCY (SIGN WITH DATE & STAMP)

APPROVING AGENCY (SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
POSITIVE DISPLACEMENT PUMP
(SINGLE/TWIN SCREW PUMP)

QUALITY PLAN NO.:PE-QP-XXX-166-A812
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 2 OF 2

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
										M	C	CU	
1	2	3	4	5	6	7	8	9	D		10		11
3.0	**Assembly Control Final Inspection & Testing:**												
3.1	Pump Assembly	i) Completeness, correctness, overall dimension	MA	Visual & Meas.	100%	Appd. Drg.	Same as Cl.7	Log Book	√	P	W	W	
3.2	Performance Test - with test bed motor	1.Performance for capacity, head,power consp., speed, efficiency.	CR	Performance Test	100%	VDMA/ HIS/Appd. Data sheet	Appd. Data sheet/curves/ VDMA/HIS	Test Report	√	P	W	W	
		2. NPSHR for twin Screw pump	CR	- do -	10%	-do-	Appd. Data sheet/curves Appd. Document	- do -	√	P	W	W	
		3. Vibration/Noise	CR	- do -	100%	Appd. Data Sheet/ Value given in Cl.8	75 micron at bearings 85 dbA measured at a distance of 1 mtr.	- do -	√	P	W	W	Noise & vibration value measured at shop is for reference only.
		4. Relief valve set pr.	CR	- do -	100%	Appd. Data Sheet	Same as Cl.7	- do -	√	P	W	W	
3.3	Review of QA Documentation as per approved QP			-	-	-	-	-		V	V	V	
3.4	Painting	Surface Preparation & shade of painting	MA	Visual	100%	As per Mfg. Std.	Same as Cl.7	-		P	V	-	

Note: 1. Defect giving echo height more than 20% on total CRT Screen height shall be treated as unacceptable..
Defect causing reduction in backwall echo less than 80% of Screen height shall be treated as unacceptable. Frequency 2 MHz min.
2. In case of mismatch in material in QP with Data Sheet, the material indicated in approved data sheet will be final.

LEGEND:
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"C" MAIN VENDOR
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"P" PERFORM "W" WITNESS AND
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MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
CS PIPE -SEAMLESS

QUALITY PLAN NO.:PE-QP-XXX-166-A813
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 1

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY D	AGENCY M	AGENCY C	AGENCY CU	REMARKS
1	2	3	4	5	6	7	8	9			10		11
1.0	SEAMLESS PIPE	a) Physical & Chemical test	M	Physical & Chemical Properties	Sample	ASTM A106 Gr.B/ Appd. Data sheet	ASTM A106 Gr.B/ Appd. Data sheet/ Relevant Std.	MTC/ Mfr's TC	✓	P	V	V	Refer Note-1
		b) Dimensional conformity	M	Measurement	100%	-do-	-do-	MTC/ Mfr's TC/IR	✓	P	V	V	
		c) Hydro test	M	Leak test	100%	-do-	-do-	MTC/ Mfr's TC	✓	P	V	V	

Note-1: In case material is procured from dealer, and co-related Mfr's TCs are not available, check test on identified sample will be carried out at testing laboratory and hydro test at pressure 1.5 times of design pressure on10% of total quantity will be witnessed by BHEL

LEGEND:
RECORDS INDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

M - MANUFACTURER
C - MAIN VENDOR
CU - BHEL/CUSTOMER
"P" PERFORM, "W" WITNESS AND V VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
IB TYPE & TD TYPE STEAM TRAP 25NB & 15NB

QUALITY PLAN NO.:PE-QP-XXX-166-A814
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 1

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									D	M	C	CU	
1	2	3	4	5	6	7	8	9			10		11
1	**Raw Material**												
	Body, Filter cap, Disc, Cover & Filter screen	I) Chemical Composition	Major	Chemical Analysis	Sample Check	As per Appd. Drg./ Data Sheet	As per Appd. Drg./ Data Sheet	MTC	✓	P	V	V	
		ii) Mechanical Test	Major	Physical properties	- do -	- do -	- do -	- do -		P	V	V	
2	**Final Inspection**												
		i) Visual	Major	Visual Inspn.	100%	As per Appd. Drg.	As per Appd. Drg.	Inspn. Report		P	W	V	
		ii) Dimension	Major	Meas.	100%	- do -	- do -	- do -		P	W	V	
		iii) Hyd. Test	Major	Leak Test	100%	As per Appd. Drg./ Data sheet	As per Appd. Drg./ Data sheet	Test Report	✓	P	W	V	
3	Review of QA Documents as per approved QP									V	V	V	IBR certificate as applicable shall be furnished as part of QA documentation.

LEGEND:
RECORDS INDENTIFIED WITH " ✓ " SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

M - MANUFACTURER
C - MAIN VENDOR
CU - BHEL/CUSTOMER.
INDICATE "P" PERFORM "W" WITNESS AND V VERIFICATION
IR - INSPECTION REPORT, MTC - MTRL./MFR'S TEST CERTIFICATES

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
SUCTION HEATER (HEAT EXCHANGER)

QUALITY PLAN NO.:PE-QP-XXX-166-A815
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 1

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
									D	M	C	N	
1	2	3	4	5	6	7	8	9			10		11
1.	Materials												
	a) Shell, plates for tube sheet, & Dished end	i) Chemical Composition	Major	Chemical Analysis	Sample	Appd.Drg./ASME SEC-II	Same as Cl.7	Material Test Cert.	✓	P	V	V	
		ii) Mechanical Test	Major	Physical Properties	- do -	- do -	- do -	- do -	✓	P	V	V	
	b) Tubes	i) Chemical Composition	Major	Chemical Analysis	- do -	- do -	- do -	- do -	✓	P	V	V	
		ii) Mechanical Test	Major	Physical Properties	- do -	- do -	- do -	- do -	✓	P	V	V	
2.	In Process Inspection												
A.	U-Tube	i) Thinning Test on tubes	Major	By Destruction test	Sample	TEMA' C/Appd. Drg.	17% thining	Inspn. Report	✓	P	V	V	
		ii) Mock-up Test on tube to tube sheet joint	Major	- do -	100%	- do -	- do -	- do -	✓	P	V	V	
		iii) Dimensional Check	Major	By Meas.	100%	Appd. Drg.	- do -	- do -		P	V	-	
		iv) Hydraulic Test (for tube bundle)	Major	Hydraulic	100%	Appd. Drg.	No Leakage	- do -	✓	P	V	V	
B.	Shell	a) Welding Procedure	Major	WPS	100%	ASME-Sec.IX	Same as Cl.7	QW-482	✓	P	V	V	WPS to be approved by BHEL/ NTPC. Qualified welders only
		b) Welder Procedure Qualification Test	Major	PQR	100%	- do -	- do -	QW-483	✓	P	V	V	to be employed.

LEGEND:
RECORDS INDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

"M" MANUFACTURER/SUB-CONTRACTOR
"C" CONTRACTOR/NOMINATED INSPECTION AGENCY,
"N" CUSTOMER. INDICATE "P" PERFORM "W" WITNESS AND
"V" VERIFICATION AS APPROPRIATE CHP
SHALL INDENTIFIED IN COLUMN "N"

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD QUALITY PLAN FOR
SUCTION HEATER (HEAT EXCHANGER)

QUALITY PLAN NO.:PE-QP-XXX-166-A815
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0 **DATE: 31/03/2012**
SHEET 1 OF 1

SL. NO. 1	COMPONENT & OPERATIONS 2	CHARACTERISTICS 3	CLASS 4	TYPE OF CHECK 5	QUANTUM OF CHECK 6	REFERENCE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY D	AGENCY M 10	AGENCY C 10	AGENCY N 10	REMARKS 11
		c) Dimensional Check	Major	Meas.	100%	Appd. Drg.	Same as Cl.7	Inspn. Report		P	V	-	
C.	Tube Sheets	a) Dimensional Check	Major	Meas.	100%	- do -	- do -	- do -		P	V	-	
		b) Assembly Check	Major	Visual	100%	- do -	- do -	- do -		P	V	-	
3.	Final Inspection												
	Finished Product after completion	i) Welding	Major	Visual	100%	Appd. WPS	- do -	- do -		P	V	V	
		ii) NDT for Shell fabrication	Major	DP test	100%	ASME SEC-V	- do -	- do -		P	V	V	
		iii) NDT for Dished end to Shell joint	Major	Spot Radiography	10%	- do -	- do -	Radiography Report	✓	P	V	V	
		iv) NDT for Shell to Tube sheet joint	Major	DP test	100%	- do -	- do -	Inspn. Report		P	V	V	
		v) NDT for Dish fabrication	Major	DP test on Knuckle	100%	- do -	- do -	- do -		P	V	V	
		vi) Dimensional Check	Major	Meas.	100%	Appd. Drg.	- do -	- do -	✓	P	W	W	} CHP
		vii) Hydraulic Test for Shell side and tube side	Critical	Hydrostatic	100%	Appd. Drg./ 1.5 x Design Pr.	No Leakage	- do -	✓	P	W	W	} CHP
		viii) Review of QA Document as per approved QP	-	-	-	-	-	-		-	-	-	
		ix) Painting	Major	Visual	100%	Mfg. Std.	Same as Cl.7	-		P	-	-	

LEGEND:
RECORDS INDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

"M" MANUFACTURER/SUB-CONTRACTOR
"C" CONTRACTOR/NOMINATED INSPECTION AGENCY,
"N" CUSTOMER. INDICATE "P" PERFORM "W" WITNESS AND
"V" VERIFICATION AS APPROPRIATE CHP
SHALL INDENTIFIED IN COLUMN "N"

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

STANDARD CHECK LIST FOR OIL HOSE

CHECK LIST NO.:PE-QP-XXX-166-A816
PACKAGE-FULE OIL SYSTEM
PROJECT-
REV.NO. 0
SHEET 1 OF 1
REV.NO. 0 **DATE: 31/03/2012**

SL. NO. 1	COMPONENT & (2	CHARACTERISTICS 3	TYPE OF CHECK 4	REFERENCE DOCUMENT 5	ACCEPTANCE NORMS 6	FORMAT OF RECORD 7	AGENCY M	AGENCY C	AGENCY N	REMARKS 9
								8		
1	Material for									
1.1	Synthetic Rubber	Polymer Confirmation	Chemical Analysis	Appd.data sheet/ Relavent Code	Same as Cl.7	Lab Test Certificate	P	V	V	
1.2	Canvas	Mechanical Test	Tensile	-do-	-do-	- do -	P	V	V	
1.3	Bonding Agents	Bonding Strength	Properties	-do-	-do-	- do -	P	V	V	
1.4	End Fittings	Chem. & Mech. Test	Chem.& Mech properties	-do-	-do-	- do -	P	V	V	
2	In Process Inspection									
2.1	Compound									
	Oil Resistance	i) Oil Resistance test	Oil Resistance check	-do-	-do-	Lab Test Report	P	V	V	
		ii) Heat Resistance	Heat Resistance check	-do-	-do-	Lab Test	P	V	V	
2.2	Sheeting	i) Visual Inspection	Visual	Mfg. Drg.	Mfg. Drg.	Inspn. Report	P	-	-	
		ii) Dimension	Meas.	- do -	- do -	- do -	P	-	-	
2.3	Hose Making	i) Visual Inspection	Visual	- do -	- do -	- do -	P	-	-	
		ii) Dimensional	Meas.	- do -	- do -	- do -	P	-	-	
2.4	Wrapping	Tightening	Visual	- do -	- do -	- do -	P	-	-	
2.5	Flange	Dimension	Meas.	- do -	- do -	- do -	P	-	-	

LEGEND:

"M" MANUFACTURER/SUB-CONTRACTOR
"C" CONTRACTOR/NOMINATED INSPECTION AGENCY,
"N" CUSTOMER. INDICATE "P" PERFORM "W" WITNESS AND
"V" VERIFICATION AS APPROPRIATE CHP
SHALL INDENTIFIED IN COLUMN "N"

MAIN VENDOR/SUB-VENDOR (SIGN WITH DATE & STAMP)

REVIEWING AGENCY (SIGN WITH DATE & STAMP)

APPROVING AGENCY (SIGN WITH DATE & STAMP)

MANUFACTURERS NAME & ADDRESS	MANUFACTURING QUALITY PLAN ITEM : QAP FOR OIL HOSE. PAGE 1 OF1	PROJECT: PACKAGE : CONTRACT CONTRACT DOC NO. P

SL. NO.	COMPOMENT& OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTAM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY D	M	C	N	REMARKS
1	2	3	4	5	6	7	8	9			10		11
A	RAW MATERIALS												
1.0	NEOPRENE & NITRILE	POLYMER IDENTIFICATION	MAJOR	CHEMICAL	SAMPLE	ASTM -D297	ASTM - D297	LAB CERT./ QC REPORT		P	V	V	
B.	END FITTINGS												
1.1	FLANGE	CHEMICAL COMPOSITION	MAJOR	CHEMICAL	SAMPLE	IS-2062 GR.B	IS-2062 GR.B	- DO -		P	V	V	
1.2	PIPE	PHYSICAL & CHEMICAL	MAJOR	PHYSICAL & CHEMICAL	SAMPLE	ASTM A 106 GR.B	ASTM A 106 GR.B	- DO -		P	V	V	
C.	IN PROCESS CHECKS												
1.3	RUBBER TEST SLAB	a). TENSILE STRENGTH	MAJOR	BEFORE & AFTER AGEING	SAMPLE	IS-10733/83 TYPE-2B	IS-10733/83 TYPE- 2B	- DO -		P	V	V	
		b) ELONGATION AT BREAK	MAJOR	- DO -	SAMPLE	- DO -	- DO -	- DO -		P	V	V	
		c) ADHESION TEST	MAJOR	ADHESION	SAMPLE	- DO -	- DO -	- DO -		P	V	V	
		d). OIL RESISTANCE TEST	MAJOR	OIL RESISTANCE COMPOUND	SAMPLE	- DO -	- DO -	- DO -		P	V	V	
D.	FINAL INSPECTION												
1.4	FINISHED PRODUCT CHECK FOR COMPLETENESS	a). VISUAL & DIMENSIONAL	MAJOR	VISUAL & DIMENSIONS	100%	APP. DRG./BS-1435/75	APP. DRG./BS-1435/75	- DO -		P	W	V	}10% QUANTITY
		b). HYDRAULIC TEST	MAJOR	PRESSURE TEST	100%	EN-1765/2004	- DO-	- DO -		P	W	V	} MAY BE
		c). ELONGATION CHECK	MAJOR	ELONGATION MESSURE	100%	- DO-	- DO-	- DO -		P	W	V	} SELECTED AT
		d). BENDING RADIUS CHECK	MAJOR	BEND RADIUS CHECK	100%	- DO-	- DO-	- DO -		P	W	V	}RANDOM FOR
		e). VACUUM TEST	MAJOR	VACUUM CHECK	100%	- DO-	- DO-	- DO -		P	W	V	}WITNESS
		f). MARKING CHECK	MAJOR	VISUAL	100%	- DO-	- DO-	- DO -		P	W	V	

CLIENT		LEGEND : * RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY DETERMINED BY CONTRACTOR IN QA DOCUMENTATION "M" MANUFACTURER C' CONTRACTOR, 'P' PERFORM, 'W' WITNESS, 'V' VERIFICATION AS APPROPRIATE CHP BHEL SHALL IDENTIFIED IN COLUMN 'N' BHEL.	FOR BHEL USE	REV.
CONTRACTOR				
MANUFACTURE				NAME & SIGN OF APPROVING AUTHORITY & SEAL
SIGNATURE			REVIEWED BY	

STANDARD CHECK LIST
STANDARD CHECK LIST FOR: CS-FITTINGS (FORGED/SEAMLESS)
PACKAGE-FULE OIL SYSTEM
PROJECT-
CHECK LIST NO.:PE-QP-XXX-166-A817
REV.NO. 0
DATE: 31/03/2012 **Sheet 1 of 1**

SL. NO.	TESTS/CHECKS	QUANTUM OF CHECKS	REFERENCE DOCUMENT./ ACCEPTANCE NORMS	AGENCY M	C	N	D	REMARKS
1	2	3	4	5				6
1	Visual and Dimensional Checks for each size and type	100% by Manufacturer and 10% by BHEL	Appd. Data Sheet/ Relevant Standard	P	W	W	√	Inspn. Report shall be furnished
2	Check for Logo mark & Specification	-do-	-do-	P	V	V		
3	Check for TC of mother pipe/forgings	100%	-do-	P	V	V	√	Manufacturer's TCs of mother pipe/forgings shall be furnished
4	Cross check for Mech/Chem properties of mother pipe/forging	One/Heat	-do-	P	V	V	√	-do-

LEGEND:
RECORDS INDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

M= MANUFACTURER/SUB-CONTRACTOR
C= CONTRACTOR/NOMINATED INSPECTION AGENCY,
N= CUSTOMER
P= PERFORM; W= WITNESS; V= VERIFICATION

MAIN VENDOR/SUB-VENDOR
(SIGN WITH DATE & STAMP)

REVIEWING AGENCY
(SIGN WITH DATE & STAMP)

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

CHECK LIST

Check list for item : Dished-end for Flash Tank
Check list No. :
Project :
Package : Fuel Oil Handling
Contract No. :
Contractor : BHEL
Sub-Contractor :

SL. NO.	TESTS/CHECKS	QUANTUM OF CHECKS	REFERENCE DOCUMENT/ ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY			REMARKS
					D	S	C	N	
A.	RAW MATERIAL								
	Plate - conforming to IS 2002 Gr.A								
	Chemical Composition & Physical Properties	1 sample/heat	IS:2002 Gr.A	Material TC	√	V	V	V	
B	IN PROCESS INSPECTION								
	UT on Plate	100%	ASTM A388 (Defect giving echo height more than 20% on total CRT Screen height shall be treated unacceptable. Defect causing reduction in backwall echo less than 80% of Screen height shall be treated as unacceptable)	UT Report	√	P	V	V	
C.	FINAL INSPECTION								
1	Visual Exam.	100%	Appd.Drg.	Inspn. Report	√	P	V	V	
2	Dimensional Check	100%	Appd.Drg.	-do-	√	P	V	V	
3	DP on Knuckle	100%	ASTM E165	-do-	√	P	V	V	

Legend

S = SUB-CONTRACTOR
C= CONTRACTOR
N= CUSTOMER
P= PERFORM; W= WITNESS; V= VERIFICATION
" √ " Marked document to be furnished along with QA Doc. Pkg.

Manufacturer's Name & Address :

QUALITY ASSURANCE PLAN

Item : Plug Valve

Sub-System : Fuel Oil System

Page No.: 1 OF 4

Project :

Contract

Contracto

Sub-Contr

Sl. No.	Components & Operations	Characteristic/Item	Class	Type of check	Extent of Check	Reference Document	Acceptance Norm	Format of Record	D	Agency P	Agency W	Agency V	Remarks
1	2	3	4	5	6	7	8	9		10			11
A	**RAW MATERIAL**												
1	Castings (Body, Cover, Plug)	a) Verification	MA	Material TC	100%	Appr. Drg. Tech. Specs.	Tech. Specs.	Material TC	√	3	3	1,2	
		b) Size/Class	MA	Material TC	100%	Appr. Drg. Tech. Specs.	Tech. Specs.	Material TC	√	3	3	1,2	
		c) Material Id.	MA	Material TC	100%	Appr. Drg. Tech. Specs.	Tech. Specs.	Material TC	√	3	3	1,2	
		d) Heat No.	MA	Material TC	100%	Appr. Drg. Tech. Specs.	Tech. Specs.	Material TC	√	3	3	1,2	
		e) Surface Defect	MA	Visual	100%	MSS-SP-55	No crack acceptable	Inspection Report		3	3	1,2	
		f) Dimension	MA	Vernier scale	100%	Mfg. Drg	Mfg. drg.	Mfg. drg.		3	3	1,2	
		g)RT on body	MA	Physical	100%	NDT Report	ANSI B16.34 ANNEX-I	NDT REPORT	√	3	3	1,2	
		h) Tensile Properties	MA	Verification of foundry TC	100%	Tech. Specs.	Relevant Standard			3	3	1,2	
		i) Chemical Properties	MA	Verification of foundry TC	100%	Tech. Specs.	Relevant Standard			3	3	1,2	
		j) Heat Treatment	MA	Verification of foundry TC	100%	Tech. Specs.	Relevant Standard			3	3	1,2	

BHEL

CONTRACTOR

SUB-CONTRACTOR

SIGNATURE

LEGEND :

Records identified with " √ " shall essentially be included by Contractor in QA Documents

1 - BHEL

2 - PACKAGE SUPPLIER

3 - Manufacturer

P - Agency Performing the Test

W - Agency Witnessing the Test

V - Agency Verifying the Test

CR - Critical Characteristics

MA - Major Characteristics

MI - Minor Characteristics

IR - Inspection Report, MTC - Material/Manufacturer's Test Certificate

CLIENT NO

REV. CAT. .....

REVIEWED BY

NAME & SIGNATURE OF APPROVING AUTHORITY

Manufacturer's Name & Address :	QUALITY ASSURANCE PLAN Item : Plug Valve Sub-System : Fuel Oil System	Page No.: 2 of 4	Project Contract Contract Sub-Cont

Sl. No.	Components & Operations	Characteristic/Item	Class	Type of check	Extent of Check	Reference Document	Acceptance Norm	Format of Record		Agency P	Agency W	Agency V	Remarks
1	2	3	4	5	6	7	8	9	D	10			11
2	Fastners	a) Dimension	MA	Dimensional	1/Lot/Size	Appr. Drg	Appr. Drg	...		3	3	1,2	
		b) Tensile Properties	MA	Verification of Supplier TC	100%	Appr. Drg	Relevant Std	Mfg. TC	√	3	3	1,2	
		c) Chemical Properties	MA	Verification of Supplier TC	100%	Appr. Drg	Relevant Std	Mfg. TC	√	3	3	1,2	
		d) Heat Treatment	MA	Verification of Supplier TC	100%	Appr. Drg	Relevant Std	Mfg. TC	√	3	3	1,2	
3	Limit Switch	a) Dimension	MA	Dimensional	1/Lot/Size	PO	Mfg. Drg	Mfg. TC	√	3	3	3	
		b) Chemical properties	MA	Mfg. TC	1/Lot/Size	Relevant Std	Relevant Std	...		3	3	3	
4	Hand Wheel	a) Dimension		Dimensional	1/Lot/Size	PO	Mfg. Drg	GRIR		3	3	1,2	
		b) Surface Defect	MA	Visual	100%	PO	Mfg. Drg	No crack acceptable		3	3	1,2	

BHEL

CONTRACTOR

SUB-CONTRACTOR

SIGNATURE

LEGEND :

Records identified with " √ " shall essentially be included by Contractor in QA Documents

1 - BHEL
2 - PACKAGE SUPPLIER
3 - Manufacturer

P - Agency Performing the Test
W - Agency Witnessing the Test
V - Agency Verifying the Test

CR - Critical Characteristics
MA - Major Characteristics
MI - Minor Characteristics

IR - Inspection Report, MTC - Material/Manufacturer's Test Certificate

CLIENT NO.

REV. 00 CAT. .....

REVIEWED BY

NAME & SIGNATURE OF APPROVING AUTHORITY

Manufacturer's Name & Address :

QUALITY ASSURANCE PLAN

Item : Plug Valve

Sub-System : Fuel Oil System

Page No.: 3 of 4

Project :

Contract I

Contracto

Sub-Contr

Sl. No.	Components & Operations	Characteristic/Item	Class	Type of check	Extent of Check	Reference Document	Acceptance Norm	Format of Record	D	Agency P	Agency W	Agency V	Remarks
1	2	3	4	5	6	7	8	9		10			11
B	IN PROCESS INSPECTION												
1	Body / Cover	a) Mechined surface	MA	Visual	100%	Mfg. Drg.	No blow holes are acceptable	...		3	3	3	
		b) Dimension	MA	Dimensional	100%	Mfg. Drg.	Mfg. Drg	...		3	3	3	
2	Plug	Mechined surface	MA	Visual	100%	Mfg. Drg.	No blow holes are acceptable	...		3	3	3	
3	Component	Diamension	MA	Dimensional	100%	Mfg. Drg.	Mfg. Std.	...		3	3	3	
4	Assembly	Operational Test	MA	Ful opening / closing test	100%	GA Drg	Mfg. Std.	...		3	3	3	
				Min. Stem Projection	100%	...	Mfg. Drg	...		3	3	3	
				Smooth operation	100%	...	Mfg. Std.	...		3	3	3	

BHEL

MANUFACTURE
SUB-CONTRACTOR

CONTRACTOR

SIGNATURE

LEGEND :

Records identified with " √ " shall essentially be included by Contractor in QA Documents

1 - BHEL /DVC
2 - PACKAGE SUPPLIER
3 - Manufacturer

P - Agency Performing the Test
W - Agency Witnessing the Test
V - Agency Verifying the Test

CR - Critical Characteristics
MA - Major Characteristics
MI - Minor Characteristics

IR - Inspection Report, MTC - Material/Manufacturer's Test Certificate

CLIENT NO.

REV. 00 CAT. .....

REVIEWED BY

NAME & SIGNATURE OF APPROVING AUTHORITY

Manufacturer's Name & Address :

QUALITY ASSURANCE PLAN

Item : Plug Valve

Sub-System : Fuel Oil System

Page No.: 4 of 4

Project :

Contract

Contractor

Sub-Contr

Sl. No.	Components & Operations	Characteristic/Item	Class	Type of check	Extent of Check	Reference Document	Acceptance Norm	Format of Record	D	Agency P	Agency W	Agency V	Remarks
1	2	3	4	5	6	7	8	9		10			11
C	**FINAL INSPECTION (Before Painting)**												
1	Complete valve	a) Dimension	MA	Fig. Drilling face to face	100%	Relevant Std	Relevant Std	Dimensional Report	√	3	1, 2	1, 2	100% Inspection by Manufacturer & 10% by Inspection Agency
		b) Operational Test	MA	Full opening / closing test	100%	Relevant Std	PO	Testing Register	√	3	1, 2	1, 2	
		c) Pressure testing	MA	i) Hydro shell	100%	Relevant Std	Relevant Std	Testing Register	√	3	1, 2	1, 2	
				ii) Hydro seat	100%	Relevant Std	Relevant Std	Testing Register	√	3	1, 2	1, 2	
		Fire Safe Testing	MA	Fire Safe	1/proto type	API 607/ BS 6755 P-II	Relevant Std	Testing Register	√	3	3	1, 2	
2	Paint & Packing	Surface	MA	Visual	Dryness	PO	PO	Testing Register		3	3	3	
				Visual	Two coats of redoxide	PO	PO	Testing Register		3	3	3	
				Visual	One coat of hammer tone dark grey	PO	PO	Testing Register		3	3	3	
				Visual	Anti rust layer at machined surface	PO	PO	Testing Register		3	3	3	
				Visual	Fixing of wooden/ plastic end protector	PO	PO	Testing Register		3	3	3	

BHEL

CONTRACTOR

SUB-CONTRACTOR

SIGNATURE

LEGEND :

Records identified with " √ " d by Contractor in QA Documents

1 - BHEL
2 - PACKAGE SUPPLIER
3 - Manufacturer

P - Agency Performing the Test
W - Agency Witnessing the Test
V - Agency Verifying the Test

CR - Critical Characteristics
MA - Major Characteristics
MI - Minor Characteristics

IR - Inspection Report, MTC - Material/Manufacturer's Test Certificate

CLIENT NO.

REV. 00 CAT. .....

REVIEWED BY

NAME & SIGNATURE OF APPROVING AUTHORITY

	STANDARD QUALITY PLAN FOR AUXILIARY STEAM PRDS	CUSTOMER :	.	SPECIFICATION NUMBR
		BIDDER/ VENDOR : AS PER APPROVED LIST	SPECIFICATION TITLE : **AUXILIARY STEAM P.R.D.S**	
	SHEET 1 of 2	SYSTEM ITEM : **STEAM DESUPERHEATER**	QUALITY PLAN NUMBR	SECTION VOLUME

SL. NO.	COMPONENT/ OPERATION	CHARACT-ERISTIC CHECK	CAT.	TYPE METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	**Raw Materials**											
1.1	Pipes	Mechanical & Chemical Prop.		Mechanical & Chemical	100%	Appd Specn./ Data Sheet/Drg.	Appd Specn./ Data Sheet/Drg.	TC	3/2	-	1	Correlation required
		Leakproofness		Hydraulic test	100%	-do-	-do-	TC	3/2	-	1	
		Dimensions		Measurement	100%	-do-	-do-	IR	3/2	-	1	
1.2	Forging	Physical & Chemical Prop.		Physical & Chemical Prop.	1/heat	Appd Specn./ Data Sheet/Drg.	Appd Specn./ Data Sheet/Drg.	TC	3/2	-	1	Correlation required
		Dimensions		Measurement	100%	-do-	-do-	IR	3/2	-	1	
		Heat Treatment		Scrutiny	100%	-do-	-do-	HT/SR Chart	3/2	-	1	Correlation required
2.0	**In Process**											
2.1	Forgings	Internal defects		U.T	100%	ASTMA 435	ASTMA 435	IR	3/2	-	1	
2.2	Machining Body Internals	Dimensions		Measurement	100%	Appd.Drg.	Appd.Drg.	IR	3/2	-	1	Correlation required
2.3	Body	Surface Defects		D.P. Check	100%	ASTME165	ASME-B 16.34 ,Appendix-III	TC	3/2	-	1	

PARTICULARS	CUSTOMER/CONSULTANT	BHEL	BIDDER / VENDOR	
NAME				
SIGNATURE				
DATE				BIDDER'S/ VENDOR'S COMPANY SEALS

	STANDARD QUALITY PLAN FOR AUXILIARY STEAM PRDS	CUSTOMER :	.	SPECIFICATION NUMBR
		BIDDER/ VENDOR : AS PER APPROVED LIST	SPECIFICATION TITLE : **AUXILIARY STEAM P.R.D.S**	
	SHEET 2 of 2	SYSTEM ITEM : **STEAM DESUPERHEATER**	QUALITY PLAN NUMBR	SECTION VOLUME

SL. NO.	COMPONENT/ OPERATION	CHARACT-ERISTIC CHECK	CAT.	TYPE METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.4	WPS,PQR,WPQ	WPS,PQR,WPQ		Physical	100%	ASME Sec-IX/IBR	ASMESec-IX/IBR	Format	3/2	-	1	Records to be shown
3.0	**Final Inspection**											
3.1	Assembly	Completeness and Marking		Visual	100%	Appd Specn./Data Sheet/Drg.	Appd Specn./Data Sheet/Drg.	IR	3/2	1	-	
		Dimensional		Measurement	100%	Appd Specn./Data Sheet/Drg.	Appd Specn./Data Sheet/Drg.	IR	3/2	1	-	
3.2	Pressure Test	Leak Proofness		Hydraulic Test	100%	-do-	-do-	IR	3/2	1	-	
4.0	**Painting**	Surface Prepn., Uniformity, Shade & Thick.		Visual, Measurement	100%	-do-	-do-	IR	3/2	-	1	
5.0	**Packing**	Soundness of Packing, Marking		Visual	100%	Appd Specn./Mfr. Standard	Appd Specn./Mfr. Standard	IR	3/2	-	1	
	Note:: IBR –Certificate in Form III C shall be submitted.											

LEGEND P – PERFORM W – WITNESS V – VERIFICATION
1 – BHEL, CUSTOMER/CONSULTANT 2 – VENDOR 3 – SUB VENDOR

PARTICULARS	CUSTOMER/CONSULTANT	BHEL	BIDDER / VENDOR	
NAME				
SIGNATURE				
DATE				BIDDER'S/ VENDOR'S COMPANY SEALS

ANNEXURE-II

FIELD WELDING SCHEDULE

PROJECT : FWS NO :

CONTRACTOR : REV NO. :

PACKAGE : FIELD WELDING CODE :

SYSTEM : PAGE NO. :

Sl No.	Drawing No. for Weld Locations & Identification mark	Description of parts to be welded	Material specification	Dimensions	Process of Welding	Type of Weld	Electrode Filler Specification	WPS No.	Minimum Pre-heat Temperature	Heat Treatment Temperature [Holding Time in secs]	NDT Method Quantum	NDT Specification Number	Acceptance Norm Ref.	Remarks

The Field Welding Schedule should be submitted for :

- Pressure Parts
- Tanks/Vessels
- Piping
- Heavy/Important Structural Steel
- Heat Exchangers
- Bus Ducts

SECTION: C-2C
FUNCTIONAL / PERFROMANCE / DEMOSTRATION / GUARANTEE TESTS

Following test to be conducted by vendor on completion of fohs for ascertaining performance of the system:

1) Shop test report shall be considered for pump guaranteed for capacity and total dynamic head.
2) Unloading pump vibration and noise within limit at site.
3) Drain oil pump and sump pump noise and vibration under limit at site.
4) Water filled test on tank and other test as indicated in IS803 / API650 for tank leakage etc. will be carried out for tank stability.
5) Tank temperature and suction heater outlet temperature measurement.
6) Entire piping and support for smooth operation: Hydro test shall be carried out for checking the weld tightness and support checking.
7) Operation of the complete system as per Control philosophy.

Above test will be demonstrated at the time of commissioning of FOHS and based on same system performance will be ascertained.

For other requirements please refer relevant clauses in Section C2-B of the technical specification

SECTION: C-2D
QUALITY ASSURANCE

(INCLUDED IN SECTION C2-B)

SECTION: C-3
TECHNICAL SPECIFICATION (ELECTRICAL PORTION)

CONTENTS

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

The equipment and services to be provided by bidder under this specification shall be as detailed here below but shall not be limited to the following:

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) Electrical load requirement for Fuel Oil Handling and Storage System.

e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.

f) 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.

g) Various drawings including GA drg, data sheet as per required format, quality plans, calculations, test reports, test certificates, operation and maintenance manuals, characteristic curves, wiring diagrams/schemes etc. shall be furnished as specified at contract stage. All documents shall be subject to customer / BHEL approval without any commercial implications to BHEL.

h) The sub-vendor list for various electrical items is subject to BHEL/Customer approval without any commercial implications.

i) Motors shall meet minimum requirement of Electric motor specification.

j) Purchaser will furnish data sheets to the vendor after award of contract. Vendor shall furnish filled in data sheets meeting the specification requirements.

k) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.

l) Cable BOQ worked out based on routing of cable listing provided by the vendor for "both end equipment in vendor's scope" shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

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 Fuel Oil Handling and Storage System" and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
b) 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
4.2 Technical specification – Specification for Electric Motors/Actuators
4.3 Datasheets & quality plan for motors.
4.4 Load Data Format. (Annexure –II)
4.5 BHEL Cable listing format (Annexure –III)

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE : FUEL OIL SYSTEM

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	1. 415 V AC (3 Phase, 3 Wire) supply to motors, 415 V AC (3 Phase, 4 Wire) /240 V AC supply to other equipment etc. shall be provided by BHEL based on load data provided by vendor at contract stage for the equipment supplied by vendor as part of contract. 2. Any other voltage level (AC/DC) required will be derived by the vendor.
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	 BHEL BHEL BHEL	 BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, optical fibre etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type Aluminium lugs for Aluminium power cables and heavy duty tinned copper lugs for copper power cables 3. Solder less crimping type heavy duty copper lugs for control cables.
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE : FUEL OIL SYSTEM

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
9	Lighting	BHEL	BHEL	
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	a. In case, vendor's Fuel oil pump house building is located as combined with Heating & Pumping building (BHEL-TRICHY), cable tray/trench layout inside combined building shall be prepared by BHEL-PEM. Vendor to furnish drawing (both in print form as well as in AUTOCAD) of Fuel oil pump house layout clearly indicating all pumps, panels, JB's etc. which require cabling along with their terminal box/location/ Foundation etc. b. In case, vendor's Fuel oil pump house building is separate from Heating & Pumping building (BHEL-TRICHY), vendor shall prepare & submit cable tray/trench & equipment layout (both in print form as well as in AUTOCAD) of the complete Fuel oil pump house building indicating location and identification of all equipment requiring cabling for BHEL review & approval.

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE : FUEL OIL SYSTEM

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
				Vendor to ensure the cable tray lay out shall confirm to NFPA (National fire prevention act)/TAC (Tariff advisory committee) applicable for hazardous area classification.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

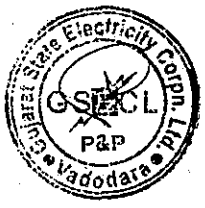
NOTES:

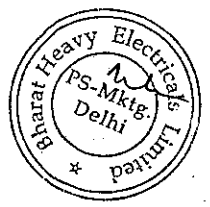
1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.

VOLUME : IIF/1

SECTION-II

TECHNICAL SPECIFICATION FOR A.C. & D.C. MOTORS





CONTENT

VOLUME : IIF/1

SECTION-II

TECHNICAL SPECIFICATION FOR A.C. & D.C. MOTORS

1.00.00 SCOPE

1.01.00 This section covers the general requirements of the drive motors for power station auxiliary equipment.

1.02.00 Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.

1.03.00 In case of any discrepancy, the driven equipment specification shall govern.

2.00.00 STANDARDS

2.01.00 All motors shall conform to the latest applicable IS, IEC and CBIP Standards/ Publications except when otherwise stated herein or in the driven equipment specification.

2.02.00 Major standards, which shall be followed, are listed below other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed :

IS-325

IS-12615

IEC-34

3.00.00 SERVICE CONDITIONS

3.01.00 The motors will be installed in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.

3.02.00 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the annexure to this specification.

3.03.00 For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature.

4.00.00 **TYPE AND RATING**

4.01.00 **A.C. Motors**

4.01.01 Motors shall be general purpose, constant speed, squirrel cage, three/single phase, induction type.

4.01.02 All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity.

4.01.03 The motor name-plate rating at 50°C shall have at least 10% margin over the input power requirement of the driven HT equipment and 15% for LT driven equipment at rated duty point unless stated otherwise in driven equipment specification or in general electrical specification.

4.01.04 The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.

4.01.05 All HT & LT motors shall be energy efficient type as per IS. However for HT motors, if the same is not specified in IS, minimum efficiency of all HT motors shall be considered as 90%.

4.02.00 **D.C. Motors**

4.02.01 D.C. motor provided for emergency service shall be shunt/compound wound type. All DC motors shall be energy efficient type with minimum efficiency of 80%.

4.02.02 Motor shall be sized for operation with fixed resistance starter for maximum reliability.

Starter panel complete with all accessories shall be included in the scope of supply.

5.00.00 **PERFORMANCE**

5.01.00 **Running Requirements**

5.01.01 Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given in the annexure

5.01.02 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.

5.01.03 The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.

5.02.00 **Starting Requirements**

Motor shall be designed for direct online starting at full voltage. Starting current shall not exceed 6 times full load current for all HT motors except boiler feed pump motor where the starting current shall be limited to 4.5 times. No further tolerances are applicable on starting current specified above

for HT motors. For LT motors, the applicable starting current shall be limited to 7.2 times of full load current including all tolerance.

5.02.01 The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage.

5.02.02 Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminal except BFP motor. In case of BFP motor, it shall be 80% rated voltage. Minimum starting requirement for mill motor (double cage) shall be 80% rated voltage at motor terminals. However for mill motors if the minimum starting voltage is more than 80% rated voltage at motor terminal and within 90% rated voltage, bidder shall provide necessary arrangement to keep the motor terminal voltage above that voltage to achieve smooth start of the motor.

5.02.03
a) Motor shall be capable of three equally spread starts per hour, two starts in quick succession from cold condition and one restart from hot condition.

b) Cranking motor shall be capable of six equally spread starts per hour, three starts in quick succession from cold condition and one restart from hot condition. The coal conveyor and crusher motors shall be suitable for 3 consecutive hot starts with maximum 20 starts per day.

c) Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction.

5.02.04 HT pump motors shall be suitable to start with forward rotation.

5.02.05 The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage

5.03.00 **Stress During Bus Transfer**

5.03.01 The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.

5.03.02 The motor shall be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.

5.04.00 **Locked Rotor Withstand Time**

5.04.01 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time.

5.04.02 Starting time mentioned above is at minimum permissible voltage of 80% rated voltage.

5.04.03 Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilising motor rated capacity.

6.00.00 **SPECIFIC REQUIREMENTS**

6.01.00 **Enclosure**

6.01.01 All motor enclosures for outdoor, semi-outdoor & indoor application shall conform to the degree of protection IP-55 unless otherwise specified. Motor for outdoor or semi-outdoor service shall be of weather-proof construction with canopy.

6.01.02 Motors for circulating water pumps of large output ratings, located indoor and not directly exposed to coal dust or fly ash, could have screen protected drip proof enclosure conforming to IP-23.

6.01.03 For hazardous area approved type of increased safety enclosure shall be furnished.

6.02.00 **Cooling**

6.02.01 The motor shall be self ventilated type, either totally enclosed fan cooled (TEFC) or closed air circuit air- cooled (CACA) or totally enclosed tube ventilated (TETV) type. Totally enclosed tube ventilated (TETV) type motors shall be acceptable for HT motors only.

6.02.02 For large capacity motors, closed air circuit water cooled (CACW) may be considered for acceptance.

6.03.00 **Winding and Insulation**

6.03.01 All insulated winding shall be of copper.

6.03.02 All motors shall have class F insulation but limited to class B temperature rise.

6.03.03 Windings shall be impregnated to make them non-hygroscopic and oil resistant.

6.04.00 **Tropical Protection**

6.04.01 All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

6.04.02 All fittings and hardwares shall be corrosion resistant.

6.05.00 **Bearings**

6.05.01 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application.

6.05.02 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.

6.05.03 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.

6.05.04 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.

6.05.05 Grease lubricated bearings shall be prelubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication.

6.05.06 Oiled bearing shall have an integral self cooled oil reservoir with oil ring inspection ports, oil sight glass with oil level marked for standstill and running conditions and oil fill and drain plugs.

6.05.07 Forced lubricated or water cooled bearing shall not be used without prior approval of Owner.

6.05.08 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.

6.05.09 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.

6.06.00 **Noise & Vibration**

6.06.01 The noise level shall not exceed 85db (A) at 1.5 metres from the motor at no load condition.

6.06.02 The peak amplitude of the vibration shall be within IS/IEC specified limits.

6.07.00 **Motor Terminal Box**

6.07.01 HT Motor terminal box (Phase side) shall be Phase Segregated (PSTB) type and LT motor terminal box shall be non-phase segregated type. Both HT & LT motor terminal box shall be located in accordance with Indian Standards clearing the motor base- plate/ foundation.

6.07.02 Terminal box shall be capable of being turned 360 Deg. in steps of 180 Deg. for HT motors and 90 Deg. for LT motors unless otherwise approved.

6.07.03 The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.

6.07.04 The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.

6.07.05 Motor main terminal box shall be located right hand side of motor body looking from driving end.

6.07.06 Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.

6.07.07 The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.

6.07.08 The terminal box shall be capable of withstanding maximum system fault current for a duration of 0.25 sec.

6.07.09 HT motor phase side terminal box shall be phase-segregated type and HT motor neutral leads shall be brought out in a separate terminal box preferably

opposite side of phase terminal box & may not be necessarily phase segregated type with shorting links for star connection.

6.07.10 Motor terminal box shall be furnished with suitable cable lugs and nickel plated double compression brass glands to match with cable used.

6.07.11 The gland plate for single core cable shall be non-magnetic type.

6.08.00 **Grounding**

6.08.01 The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer.

6.08.02 The grounding connection shall be suitable for accommodation of ground conductors as follows :

HT Motor (11kV, 6.6kV & 3.3 kV)	:	75 X 10 mm GS Flat
LT Motor above 90 KW	:	50 x 6 mm GS Flat
Motor above 30 KW up to 90 KW	:	35 x 6 mm GS Flat
Motor above 5 KW up to 30 KW	:	25 x 3 mm GS Flat
Motor up to 5 KW	:	8 SWG GI Wire

6.08.03 The cable terminal box shall have a separate grounding pad.

6.09.00 **Rating Plate**

In addition to the minimum information required by IS, the following information shall be shown on motor rating plate :

a) Temperature rise in Deg.C under rated condition and method of measurement.

b) Degree of protection.

c) Bearing identification no. and recommended lubricant.

d) Location of insulated bearings.

7.00.00 **ACCESSORIES**

7.01.00 **General**

Accessories shall be furnished, as listed below, or if otherwise required by driven equipment specification or application.

7.02.00 **Space Heater**

7.02.01 Motor of rating 30 KW and above shall be provided with space heaters, suitably located for easy removal or replacement.

7.02.02 The space heater shall be rated 240 V, 1 phase 50 Hz and sized to maintain the motor internal temperature above dew point when the motor is idle.

7.03.00 **Temperature Detectors**

7.03.01 All 11000V, 6600V and 3300V motors shall be provided with twelve (12) nos. simplex type winding temperature detectors, four (4) nos. per phase. Six (6) nos. duplex type winding temperature detectors, two (2) nos. per phase shall only be acceptable for special application motors only subject to approval of owner.

7.03.02 11000V, 6600V and 3300V motor bearing shall be provided with duplex type temperature detectors.

7.03.03 The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0°C.

7.03.04 Leads of all simplex type motor winding RTDS and motor bearing RTDS shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDS will be connected to numerical protection relay and another set shall be kept free for DCS connectivity.

7.03.05 Five numbers of Temperature detectors / thermisters shall be provided for L.T. motors above 90 KW (3 nos. winding temperatures & 2 nos. bearing temperatures)

7.04.00 **Indicator/Switch**

7.04.01 Dial type local indicator with alarm contacts shall be provided for the following:

a) 11000 V, 6600V and 3300V motor bearing temperature.

b) Hot and cold air temperature of the closed air circuit for CACA and CACW motor.

7.04.02 Flow switches shall be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing, if used.

7.04.03 Alarm switch contact rating shall be minimum 0.5 A at 220V D.C. and 5A at 240V A.C.

7.05.00 **Current Transformer for Differential Protection**

7.05.01 Motor 1000 KW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure. Loose 3 nos. CT for mounting on switchgear side shall be in bidder's scope.

7.05.02 The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match Owner's requirements to be intimated later.

7.06.00 **Accessory Terminal Box**

7.06.01 All accessory equipment such as space heater, temperature detector, current transformers etc., shall be wired to and terminated in terminal boxes, separate from and independent of motor (power) terminal box.

7.06.02 Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit cable connections.

7.07.00 **Drain Plug**

Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.

7.08.00 **Lifting Provisions**

Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.

7.09.00 **Dowel Pins**

The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.

7.10.00 **Painting**

Motor including fan shall be painted with corrosion proof paints of colour battle ship grey shade 632 of IS-5.

8.00.00 **TESTS**

Routine and Type Tests are to be conducted in presence of customer's representative as per IS:325 and required copies of test certificates are to be furnished for approval. In addition, following tests shall have to be carried out on the motors in presence of OWNER's representative on 3.3kV/6.6kV/11kV motors.

a. Impulse test by 1.2 / 50 micro sec. On sample coil of Stator winding insulation as type test as per IEC-60034, part -15 test voltages as under :

Voltage rating of motor	Impulse Test Voltage
3.3 kV	18 kV peak
6.6 kV	31 kV peak
11 kV	49 kV peak

b. Tan delta, charging current and dielectric loss measurements on each phase of motor stator winding as routine test.

c. Polarization Index Test as per IS:7816 as routine test

d. Test for suitability of IPW– 55 (Weather proof) as per IS 4691 as type test. Type test certificate for first numeral shall be acceptable in lieu to test, provided the test motor is identical to motor being supplied.

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Second numeral test shall be carried out on one motor of each type and rating.

e. Fault Withstand Test for main terminal box as type test. Type test certificate shall be acceptable, if the test is conducted on exactly identical terminal box.

f. Test for noise level as routine test.

g. Test for vibration as routine test.

h. Tan delta measurement on coils.

i. Surge withstand test for inter turn insulation.

Tests indicated at (h), (i), shall be carried out during manufacture of the coils and shall be furnished for verification.

Furnished type test certificates of motor shall not be older than five (5) years from the date of Inspection, otherwise type test shall be conducted without any price implication.

9.00.00 **DRAWINGS, DATA & MANUALS**

Drawings, data & manuals for the motors shall be submitted as indicated below:

9.01.00 **Along with the bid**

a) List of the motors

b) Individual motor data sheet as per format of the proposal data sheets.

c) Scheme & write up on forced lubrication system, if any

d) Type test report

9.02.00 **After Award of the Contract**

a) Dimensional General Arrangement drawing

b) Foundation Plan & Loading

c) Cable end box details

d) Space requirement for rotor removal

e) Thermal withstand curves hot & cold

f) Starting and speed torque characteristics at 80% & 100% voltage

g) Complete motor data

h) Erection & Maintenance Manual

i) Test reports

j) Data sheets to be enclosed

ANNEXURE-A
DESIGN DATA

1.0 AUXILIARY POWER SUPPLY

Supply	Description	Consumer
H.T. Supply	11000 V, 3Ø, 3W, 50 Hz, non-effectively earthed	Motors above 2000 KW & all mill motors
	Fault level 44 KA symm.	
	3300 V, 3Ø, 3W, 50 Hz, non-effectively earthed	Motors above 160 KW upto and including 2000 KW
	6600 V, 3Ø, 3W, 50 Hz, non-effectively earthed	Motors of CHP system and Water System above 160kW
	Fault level 40 KA symm for 3300V & 6600V	
L.T. Supply	415V, 3Ø, 3W, 50 Hz effectively earthed	Motors upto and including160KW
	Fault level 50 KA symm.	
	240V, 1Ø, 2W, 50 Hz effectively earthed	Lighting, space heating, A.C. control & protective devices
D.C. Supply	220V, 2W, unearthed	D.C. alarm, control & protective devices
	Fault level 25* KA.	

* Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation.

2.0 RANGE OF VARIATION

A.C. Supply :

Voltage : ± 10% Frequency : ± 5% Combined Volt : 10% (absolute sum) + frequency

During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance.

D.C. Supply :

Voltage : 187 to 242 Volt

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VOLUME : IIF/1

SECTION-III

TECHNICAL SPECIFICATION FOR ELECTRIC MOTOR ACTUATORS

CONTENT

Bharat Heavy Electricals Limited PS-Mktg. Delhi

Gujarat State Electricity Corpn. Ltd. GSECL Baroda

VOLUME : IIF/1

SECTION-III

TECHNICAL SPECIFICATION FOR ELECTRIC MOTOR ACTUATORS

1.00.00 SCOPE

1.01.00 This Section covers the general requirements of Electric Motor Actuators for valves, dampers and gates.

1.02.00 All electric motor actuators shall be furnished in accordance with this general specification and the accompanying driven equipment specification.

2.00.00 STANDARDS

2.01.00 All electrical equipment shall conform to the latest applicable IS, ANSI and NEMA Standards, except when stated otherwise herein or in driven equipment specification.

2.02.00 Major standards, which shall be followed, are listed below. Other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed

i) IS-9334

ii) IS-325

3.00.00 SERVICE CONDITIONS

3.01.00 The actuator shall be suitable for operation in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.

3.02.00 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the general specification.

3.03.00 For actuator motor installed outdoor and exposed to direct sun rays , the effect of solar heat [manufacturer to decide] shall be considered or overhead shed shall be provided locally to avoid direct sun rays.

4.00.00 RATING

4.01.00 For isolating service, the actuator shall be rated for three successive open-close operation of the valve/damper or 15 minutes, whichever is longer.

4.02.00 For regulating service, the actuator shall be suitably time-rated for the duty cycle involved with necessary number of starts per hour, but in no case less than 150 starts per hour.

5.00.00 **PERFORMANCE**

The actuator shall meet the following performance requirements:

5.01.00 Open and close the valve completely and make leak-tight valve closure without jamming.

5.02.00 Attain full speed operation before valve load is encountered and impart an unseating blow to start the valve in motion (hammer blow effect).

5.03.00 Operate the valve stem at standard stem speed and shall function against design differential pressure across the valve seat.

5.04.00 The motor reduction gearing shall be sufficient to lock the shaft when the motor is de-energised and prevent drift from torque switch spring pressure.

5.05.00 The entire mechanism shall withstand shock resulting from closing with improper setting of limit switches or from lodging of foreign matter under the valve seat.

6.00.00 **SPECIFIC REQUIREMENT**

6.01.00 **Construction**

6.01.01 The actuator shall essentially comprise the drive motor, torque/ limit switches, gear train, clutch, hand wheel, position indicator/ transmitter, in-built thermostat for over load protection, space heater and internal wiring. Actuator shall be non integral type.

6.01.02 The actuator enclosure shall be totally enclosed, dust tight, weather-proof suitable for outdoor use without necessity of any canopy.

6.01.03 All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.

6.01.04 The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficulty.

6.02.00 **Motor**

6.02.01 The drive motor shall be three phase, squirrel cage, induction machine with minimum class B insulation and IPW-55 enclosure, designed for high torque and reversing service. Canopy shall be provided for outdoor service.

6.02.02 The motor shall be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current.

6.02.03 The motor shall be capable of starting at 85 percent of rated voltage and running at 80 percent of rated voltage at rated torque and 85 percent rated voltage at 33 percent excess rated torque for a period of 5 minutes each.

6.02.04 Motor leads shall be terminated in the limit switch compartment.

6.02.05 Motor actuators for valves/dampers shall be non-integral type with separate starter units and operable from remote.

6.02.06 Earthing terminals shall be provided on either side of the motor.

6.03.00 **Limit Switches**

Each actuator shall be provided with following limit switches: -

6.03.01 2 torque limit switches, one for each direction of travel, self-locking, adjustable torque type.

6.03.02 4 end-of-travel limit switches, two for each direction of travel.

6.03.03 2 position limit switches, one for each direction of travel, each adjustable at any position from fully open to fully closed positions of the valve/damper.

6.03.04 Each limit switch shall have 2 NO + 2 NC potential free contacts. Contact rating shall be 5A at 240V A.C. or 0.5A at 220V D.C.

6.04.00 **Hand Wheel**

Each actuator shall be provided with a hand wheel for emergency manual operation. The hand wheel shall declutch automatically when the motor is energized.

6.05.00 Position Indicator/Transmitter

The actuator shall have:

6.05.01 One (1) built-in local position indicator for 0-100% travel.

6.05.02 One (1) position transmitter, potentiometer type, for remote indicator.

6.06.00 **Space Heater**

A space heater shall be included in the limit switch compartment suitable for 240V, 1 phase, 50 Hz supply.

6.07.00 **Wiring**

All electrical devices shall be wired up to and terminated in a terminal box. The internal wiring shall be of sufficient size for the power rating involved but in no case less than 1.5 Sq.mm copper. All wiring shall be identified at both ends with ferrules. All wires shall be fire resistance type.

6.08.00 **Terminal Box**

The terminal box shall be weather proof, with removable front cover and cable glands for cable connection. The terminal shall be suitable for connection of 2.5 Sq.mm copper conductor.

7.00.00 **ACCESSORIES**

As required for the driven equipment, the actuator shall be furnished with starting equipment mounted on the actuator. This shall include:

7.01.00 One (1) triple pole MCCB for local isolation near the actuator

7.02.00 One (1) reversing starter with mechanically interlocked contactors, 3 thermal overload relays, 2 NO + 2 NC auxiliary contacts for each contactor.

7.03.00 One (1) remote-local selector switch.

7.04.00 CLOSE-STOP-OPEN oil tight push buttons with indication lights.

7.05.00 415/240 V or 415/110V control transformer with primary protected by fuse & secondary protected by Miniature Circuit Breaker (MCB).

8.00.00 **TEST**

The actuator and all components thereof shall be subject to tests as per relevant Standards. In addition, if any special test is called for in equipment specification, the same shall be performed.

9.00.00 **DRAWINGS, DATA & MANUALS**

9.01.01 To be Submitted with Bid

Data sheet for each type of actuator shall be furnished along with internal wiring diagram, suggested control schematic and torque limit switch contact development and manufacturer's catalogues.

9.01.02 To be Submitted after Award of Contract

a) Actuator Data Sheet

b) Internal wiring diagram and suggested control schematic

c) Torque switch and limit switch contact development

d) Manufacturer's Catalogue

e) Instruction manual indicating clearly the installation methods, check ups and tests to be carried out before commissioning of the equipment.

f) Any other relevant drawings, documents or data necessary for satisfactory installation , operation and manufacturing.

9.02.00 The Bidder may note that the drawings, data and manuals listed herein are minimum requirements only. The Bidder shall ensure that all other necessary write-ups, curves and information required to fully describe the equipment are submitted with his bid.

LT MOTORS

A. GENERAL

1. Manufacturer & Country of origin.
(Shall be as per approved QA make)

2. Equipment driven by motor

3. Motor type

4. Quantity

B. DESIGN AND PERFORMANCE DATA

1. Frame size

2. Type of duty

3. Type of enclosure /Method of cooling/Degree of protection

4. Applicable standard to which motor generally conforms

5. Efficiency class as per IS 12615

6. (a) Whether motor is flame proof — Yes/No

   (b) If yes, the gas group to which it conforms as per IS:2148

7. Type of mounting

8. Direction of rotation as viewed from DE END__

9. Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)

10. Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)

11. Maximum continuous load demand of driven equipment in KW

12. Rated Voltage (volts)

13. Permissible variation of :

a. Voltage (Volts)

b. Frequency (Hz)

c. Combined voltage and frequency

14. Rated speed at rated voltage and frequency(RPM)

15. At rated Voltage and frequency:

a. Full load current

b. No load current

16. Power Factor at

a. 100% load

b. NO load

c. Starting.

17. Efficiency at rated voltage and frequrecy,

a. 100% load

b. 75% load

c. 50% load

18. Starting current (amps) at

a. 100 % voltage

b. 85% voltage

c. 80% voltage

19. Minimum permissible starting Voltage (Volts)

20. Starting time with minimum permissible voltage

a. Without driven equipment coupled

b. With driven equipment coupled

21. Safe stall time with 100% and 110% of rated voltage

    a. From hot condition

    b. From cold condition

22. Torques :

    a. Starting torque at min. permissible voltage(kg-mtr.)

    b. Pull up torque at rated voltage.

    c. Pull out torque

    d. Min accelerating torque (kg.m) available

    e. Rated torque (kg.m)

23. Stator winding resistance per phase (ohms at 20 Deg.C.)

24. GD^2 value of motors

25. No of permissible successive starts when motor is in hot condition

26. Locked Rotor KVA Input

27. Locked Rotor KVA/KW

28. Vibration limit :Velocity (mm/s)

29. Noise level limit (dBA)

C. CONSTRUCTIONAL FEATURES

1. Stator winding insulation

    a. Class & Type

    b. Winding Insulation Process

    c. Tropicalised (Yes/No)

d. Temperature rise over specified maximum ambient temperature of 50 deg C

e. Method of temperature measurement

f. Stator winding connection

2. Main Terminal Box

a. Type

b. Location (viewed from NDE side)

c. Entry of cables(bottom/side)

d. Recommended cable size (To be matched with cable size envisaged by owner)

e. Fault level (MVA), Fault level duration (sec)

f. Cable glands & lugs details (shall be suitable for power cable)

3. Type of DE/NDE Bearing

4. Motor Paint shade

5. Weight of

a. Motor stator (KG)

b. Motor Rotor (KG)

c. Total weight (KG)

D. List of accessories.

1. Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage)

2. Terminal Box for Space Heater (Yes/No)

3. Speed switch (Yes/No)
No of contacts and contact ratings of speed switch

4. Insulation of bearing (Yes/No)

5. Noise reducer(Yes/No)

6. Grounding pads

   i) No and size on motor body

   ii) Nos on terminal Box

7. Vibration pads

   i) Nos and size

   ii) Location

8. Any other fitments

E. List of curves.

1. Torque speed characteristic of the motor

2. Thermal withstand characteristic

3. Starting. current Vs. Time

4. Starting. current Vs speed

5. P.F. and Effi. Vs Load

F. Additional Data to be filled for each rating of DC Motor

1. Rated armature voltage (Volt)

2. Rated field excitation (Amp)

3. Permissible % variation in voltage

4. Minimum Permissible Starting voltage (volt)

5. At rated voltage

   i) Full load Armature current.(Amp)

   ii) Full load Field current (Amp)

iii) No load Armature current (Amp)

6. Full load Field current (Amp)

7. No load Aramature current (Amp)

8. Minimum permissible field current(Amp) to avoid overspeeding at

   i) Maximum permissible voltage

   ii) Rated voltage

   iii) Minimum Permissible Voltage

9. Resistance (indicative Values) in ohm

   i) Armature winding (Arm + IP + Series) at 25 deg.C

   ii) Field Winding at 25 deg. C

10. Inductance (indicative values)

    i) Armature winding

    ii) Field winding

11. Value of trimmer resistance (ohm) to be connected in series with the shunt field to obtain rated speed at

    i) 220 V DC

    ii) 250 V DC

    iii) 187 V DC

12. Value of the external resistance (ohm) required to be connected in series with armature during starting only

13. Technical data sheet for external resistance box

14. GA drawing of motor

15. Starting time calculation

16. Starter resistance design calculation

17. Electrical connection diagram of motor

	QUALITY PLAN		CUSTOMER :			PROJECT 1X800MW WANAKBORI TPS TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION TITLE			
	SHEET 1 OF 2		SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE, TYPE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1*		* NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3

BHEL	**PARTICULARS**	**BIDDER/VENDOR**
	NAME	
	SIGNATURE	

	QUALITY PLAN	CUSTOMER :			PROJECT TITLE	1X800MW WANAKBORI TPS		SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION : TITLE :			
	SHEET 2 OF 2	SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	

NOTES:

ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE, TYPE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. TYPE TEST CERTIFICATES ON SIMILAR RATING OF MOTOR SHALL BE FURNISHED FOR APPROVAL. TYPE TEST CERTIFICATE SHALL NOT BE OLDER THAN FIVE(5) YEARS FROM THE DATE OF INSPECTION, OTHERWISE TYPE

1 TEST TO BE CONDUCTED FREE OF COST.
2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.
3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE 1X800MW WANAKBORI TPS			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 1 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	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-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS 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	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
BHEL			**PARTICULARS**		**BIDDER/VENDOR**							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

	QUALITY PLAN		CUSTOMER :			PROJECT 1X800MW WANAKBORI TPS TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 2 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE 1X800MW WANAKBORI TPS			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 3 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2	
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG. .	MANUFR'S DRG.	-DO-	3	-	2	FOR MV MOTOR INSULA-TION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
		2.ELECT. PROP, & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	RELEVANT IS/ BS OR OTHER STANDARDS	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER :			PROJECT TITLE 1X800MW WANAKBORI TPS			SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 4 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
1.10	BEARINGS	1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	

BHEL	PARTICULARS	BIDDER/VENDOR	
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	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER :			PROJECT TITLE 1X800MW WANAKBORI TPS			SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 5 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVENT SPEC./ ASTM-E165	MANUFR'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER :			PROJECT TITLE 1X800MW WANAKBORI TPS			SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 6 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
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	2	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	FOR MV MOTOR
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	THREE DIPS TO BE GIVEN

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE 1X800MW WANAKBORI TPS			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 7 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.7	COMPLETE STATOR ASSEMBLY	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	VERIFICATION FOR MV MOTOR ONLY
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	QUALITY PLAN		CUSTOMER :			PROJECT TITLE 1X800MW WANAKBORI TPS			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 8 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1$	1	$ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1$	1	$ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1$	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY $ NOTE - 2

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE 1X800MW WANAKBORI TPS			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 9 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11

NOTES:

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, TYPE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. TYPE TEST CERTIFICATES ON SIMILAR RATING OF MOTOR SHALL BE FURNISHED FOR APPROVAL. TYPE TEST CERTIFICATE SHALL NOT BE OLDER THAN FIVE(5) YEARS FROM THE DATE OF INSPECTION, OTHERWISE TYPE TEST TO BE CONDUCTED FREE OF COST.

3 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

ANNEXURE-I

SUB-VENDOR LIST

The list of approved make of the LT Motors are as mentioned below:

S.No.	LIST OF LT MOTORS
1.	BHARAT BIJLEE LTD.
2.	CROMPTON GREAVES
3.	ASEA BROWN BOVERI
4.	KIRLOSKAR ELECTRIC CO LTD.
5.	NGEF
6.	SIEMENS
7.	MARATHON
8.	GE-POWER
9.	RAJINDRA ELECT INDUSTRIES
10.	LAXMI HYDRAULICS PVT. LTD

However, the final list of makes for the LT Motors is subjected to BHEL/Customer approval, during contract stage, without any commercial implications.

LOAD TITLE	RATING (KW / A)		FULL LOAD CURRENT FLC(A)	UNIT (U)/STN. (S)	Nos.		VOLTAGE CODE*	FEEDER CODE*	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME> 5 SEC (Y)	LOCATION (Tag. No.)	RATING & FLC CHECKED FROM MOTOR/VALVE APPROVED DATASHEET (Y/N)	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.	KKS NO.
	NAME PALTE	MAX. CONT. DEMAND (MCR)			RUNNING	STANDBY									SIZE CODE	Nos					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22

NOTES: 1. COLUMN 1 TO 14 & 20 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

2. ABBREVIATTIONS : * VOLTAGE CODE (7):- (AC) A=11 KV, B=6.6.KV, C= 3.3 KV, D=415 V, E = 240 V (1 PH), F = 110 V (DC) : G =220V, H = 110 V, J = 48 V, K = +24V, L= -24V

: **FEEDER CODE (8) :- U = UNIDIRECTIONAL STARTER, B = BIDIRECTIONAL STARTER, S = SUPPLY FEEDER, D = SUPPLY FEEDER (CONTACTOR CONTROLLED)

BHEL	LOAD DATA (ELECTRICAL)		JOB NO.						ORIGINATING AGENCY		PEM (ELECTRICAL)	
			PROJECT TITLE						NAME		DATA FILLED UP ON	
			SYSTEM / S						SIGN.		DATA ENTERED ON	
			DEPTT. /SECTION						SHEET 1/2	REV. R0	DE'S SIGN. & DATE	

CABLE SCHEDULE FORMAT **ANNEXURE III**

UNITCABLENO	FROM	TO	PURPOSE	CABLE SCOPE (BHEL PEM/ VENDOR)	REMARKS	CABLESIZE	PATHCABLENO	TENTATIVE CABLE LENGTH