consultant for record purpose.

Further, nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere. Distribution of nine (9) copies of Shop Test Certificates for approval will be Two (2) copies to owner, Three (3) copies to site, Two (2) copies to consultant, Two (2) copies to owner's library / record.

16.01.05 Under no circumstances any repair or welding of castings be carried out without the consent of the Owner's Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer along with Defect Map.

16.01.06 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.

Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Contractor shall allow for trial assembly prior to despatch from place of manufacture.

16.01.07 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Purchaser. The certificates shall include tests for mechanical properties and chemical analysis of representative material or any other test as required by approved QAP/ Material specification.

16.01.08 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one hour. Other parts shall be tested for one and half times the maximum operating pressure or as required by design code of that part, for a period not less than one hour.

16.01.09 All necessary non-destructive examinations shall be performed to meet the applicable code requirements.

16.01.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination magnuflux and ultrasonic testing shall be employed wherever necessary/recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed.

16.01.11 Statutory payments in respect of IBR approvals including inspection for design and manufacturer of equipment shall be made by the Bidder. All payment for erection and testing at site (i.e. under IBR jurisdiction) shall also be made by the Bidder. In such case Contractor's scope shall also be extended to preparation of all necessary documents, co-ordination and follow-up with IBR authorities for above approval.

16.02.00 **Performance Tests at Site**

16.02.01 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected System shall be tested by the Contractor on site under normal operating conditions. The Contractor shall also ensure the correct performance of the System under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks, etc.

16.02.02 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site.

16.02.03 The Contractor shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection, pre-commissioning to tests on completion and commissioning of the complete system/equipment.

16.03.00 For details of specific tests required on individual equipment refer to respective section of this specification.

17.00.00 TRAINING OF OWNER'S PERSONNEL

The Contractor shall extend all possible assistance and co-operation to the Purchaser regarding the transfer of technology and developing expertise in the area of engineering operation and maintenance of the Plant.

Number of man-days of training as mentioned below shall be included in his Tender.

17.01.00 Training at Contractor's Premises

The Contractor shall conduct training of sixty (60) engineers of the Owner on engineering, operation and maintenance of the Plant at the Contractor's or Associates or Sub-contractor's premises where adequate training facilities are available during the design and manufacturing stage of the Contractor.

The total man-months for training of engineers shall be maximum sixty (60), having following indicative break-up :

Discipline	No. of Engineers	No. of Man-month
Operation	20 heads	20
Maintenance Boiler, Turbine, Mechanical	20 heads	20
Electrical Maintenance	8 heads	4
Control & Instrumentation	8 heads	4
Maintenance Planning	4 heads	2
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However, the details of the training programme will be discussed and finalised with the successful Bidder.

The training may also be arranged by the Contractor in any Plant where the equipment manufactured by the Contractor or his Associates is under installation, operation or testing to enable the trainees to become familiar with the equipment being furnished by the Contractor. All expenses inherently related to the training shall be borne by the Contractor and shall include but not limited to travel expenses (international and inland fares), lodging and per diem charges as well as medical insurance, instructors fee, programme and miscellaneous cost to be incurred during the training.

The training programme shall be adequate for the trainees to acquire the necessary expertise and competence in the area of engineering, operation and maintenance and as trainers for in-house technology transfer programme of the Purchaser.

The Contractor shall be responsible for the development of the Training Module and Programme Schedule which shall be submitted to the Purchaser for approval.

The components of the training modules shall include but not be limited to the training procedures/methodology, instructional materials such as audio visual materials, CDs and slides and manuals for each trainee.

Three (3) sets of the materials included in the training modules shall be handed over to the Purchaser upon completion of the training. An evaluation shall be jointly undertaken by the Contractor and the Purchaser's representative on the adequacy, appropriateness and relevance of the training and the programme effectiveness after the training. The training material shall be in English language only.

The content of the training programme shall include but not be limited to:

1. Coal fired thermal plant principles in management and practice for operators, technicians and maintenance personnel.

2. Plant operation and systems training for operators including simulator training as applicable.

3. Maintenance training programme covering electrical, mechanical and instrumentation and control.

Said training programme shall be submitted to the Purchaser for approval.

The timing of the training should be such that the participants will be conversant with sufficient know-how to participate in the pre-commissioning and commissioning tests of the Plant.

The Contractor shall provide qualified English speaking instructors and training coordinator(s) during the tenure of the training programme.

17.02.00 **Operation and Maintenance Training at Site**

The Contractor shall provide a comprehensive training programme related to design application, plant management, operation and maintenance, including trouble shooting, of the Contractor's supplied system and equipment at the Site starting from Start of Commissioning and thereafter up to the Final Acceptance of the first Unit.

The following instructors shall be at the Site continuously during the training :

a) One (1) for Steam Generator and Auxiliaries ;

b) One (1) for Turbine Generator and Auxiliaries ;

c) One (1) for Electrical Works ;

d) One (1) for Instrumentation and Control (Boiler and Auxiliaries) ;

e) One (1) for Instrumentation and Control (Turbine and Auxiliaries).

17.03.00 **On-the-Job Training**

During the period of pre-commissioning, commissioning and trial operation, the Purchaser shall provide operation and maintenance personnel to assist the Contractor in the operation and maintenance of his supply and work under the direction of the Contractor for the purpose of on-the-job training.

The Purchaser shall have the right to send to the Site his employees later intended to operate and maintain the equipment supplied under this Contract. The Contractor shall, without additional cost, use his site staff to instruct these employees on the operation and maintenance of the equipment. All instructions shall be in the English language.

17.04.00 For detail C&I training refer to Volume-VI, Section-9.

18.00.00 **DEVIATIONS**

The Bidder is required to submit with his proposal in the relevant schedules a detail list of any and all deviations taken by him clearly without any ambiguity. In the absence of such a list it will be understood and agreed that the Bidder's proposal is based on strict conformance to this specification and no post-contract negotiations would be allowed in this regard.

Unless otherwise specifically indicated in the deviation list, it will be construed and agreed that details indicated in documents & drawings furnished by the Bidder along with the offer is in-line with the specification requirement.

ANNEXURE-I

LIST OF STANDARDS FOR REFERENCE

a) International Standards Organisation (ISO).

b) International Electro-technical Commission (IEC).

c) American Society of Mechanical Engineers (ASME).

d) American National Standards Institute (ANSI).

e) American Society for Testing and Materials (ASTM).

f) American Institute of Steel Construction (AISC).

g) American Welding Society (AWS).

h) Architecture Institute of Japan (AIJ).

i) National Fire Protection Association (NFPA).

j) National Electrical Manufacturer's Association (NEMA).

k) Japanese Electro-technical Committee (JEC).

l) Institute of Electrical and Electronics Engineers (IEEE).

m) Federal Occupational Safety and Health Regulations (OSHA).

n) Instrument Society of America (ISA).

o) National Electric Code (NEC).

p) Heat Exchanger Institute (HEI).

q) Tubular Exchanger Manufacturer's Association (TEMA).

r) Hydraulic Institute (HIS).

s) International Electro-Technical Commission (IEC) Publications.

t) Power Test Code for Steam Turbines (PTC).

u) Applicable German Standards (DIN).

v) Applicable British Standards (BS).

w) Applicable Japanese Standards (JIS).

x) Electric Power Research Institute (EPRI).

y) Standards of Manufacturer's Standardization Society (MSS).

z) Bureau of Indian Standards Institution (BIS).

aa) Indian Electricity Rules.

bb) Indian Boiler Regulations (IBR).

cc) Indian Explosives Act.

dd) Indian Factories Act.

ee) Tariff Advisory Committee (TAC) rules.

ff) Emission regulation of Central Pollution Control Board (CPCB).

gg) Pollution Control regulations of Dept. of Environment, Govt. of India

hh) Central Board of Irrigation and Power (CBIP) Publications.

ii) The Air Prevention and Control of Pollution Act.

jj) The Environmental Protection Act

kk) The Public Liability Insurance Act.

ll) The Forest Conservation Act

mm) The Wildlife protection Act.

nn) The EIA Notification, 1994.

oo) IS: 14665-Specification for Electric Traction Lift

pp) Any other statutory Codes/Standards/Regulations

CRITERIA FOR LAYOUT

PLOT PLAN LAYOUT REQUIREMENTS

	ITEM	SPECIFICATION REQUIREMENT
A.	Site conditions to be considered	
1.	Prevalent wind direction	See wind-rose in plot plan. Also refer Metrological Data.
B.	Layout Requirements	
1.	Maximum permissible slope in	
a)	Rail track	1 in 400
b)	Road	1 in 30
c)	Sides of unpaved embankment	1 in 2
2.	Required road width	
a)	Main roads	Refer VII-A, B, C.
b)	Auxiliary interconnections	Refer VII-A, B, C.
c)	Road to the power house unloading bay :	
	• Only for entry to the unloading bay	Yes
	• To pass through the unloading bay	No
3.	Required minimum horizontal distance between the nearest points of	
a)	Plant boundary and the boundary of residential area	(Local municipality/factory rule)
b)	Electrical transformer and any other building/facility	As per the Tariff Advisory Committee/ LPA Rules
c)	Fire water supply installation and any building/facility subject to fire risk.	As per the Tariff Advisory Committee/ LPA Rules
d)	Inflammable liquid (fuel oil, etc.) storage & handling installation and their fencing and other buildings/facilities.	Rules of the Indian Explosive (Indian Explosives Act) and Indian Petroleum Code

4.	Required minimum vertical clearance	
a)	Under pipes/cable racks at road crossings	8.0 Metres
b)	Soil coverage over underground pipes	1.0 Metre (minimum)
5.	Railway Wagon clearance	Rules of the Indian Railways
6.	Minimum Clearance between any road edge and building/structure/ any fixed installation.	3 Metres
7.	Required level, above the local developed grade level, of	
a)	top of all roads	150 mm above FGL
b)	all outdoor paved areas	100 mm above FGL
c)	Temporary storage areas, workshops, offices, residence etc. required at the time of erection work.	Yes
d)	Green belt around power plant area	As per environmental guidelines of MOEF, Govt. of India.

BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS

A.	Minimum clear space required at all working and walking areas for operating & maintenance personnel	
1.	Horizontal, in all directions	
a)	Adjacent to any electrical equipment, electrical cables, running (rotating/reciprocating) equipment, safety valve or vent/drain pipe outlet, pipe/ equipment of surface temperature exceeding 60°C.	1200 mm
b)	Adjacent to any other plant facilities (including walls/structures)	1000 mm
2.	Vertical (head-room clearance)	
a)	Under any pipe/equipment surface of temperature exceeding 60°C and any electrical cables or other electrical items.	2.5 Metre
b)	Under any other plant facilities (including structures, pipes etc.)	2.5 Metre

	ITEM	SPECIFICATION REQUIREMENT
3.	For all areas where any equipment (including trucks, trolleys and other material handling equipment) will move or maneuver.	Minimum 500 mm clear in all direction from the outer edges of the equipment
4.	Minimum clear hand space required for	
a)	The application of thermal insulation	100 mm
b)	Welding work	150 mm
c)	Bolt tightening	150 mm
B.	Floors, platforms, staircase, ladders, walls, doors & windows	
1.	Statutory Requirement	As per the regulations of Tariff Advisory Committee, Indian National Building Code, Indian Factories Act, Local Municipal Rules, etc.
2.	Operation & Maintenance Requirement	
a)	Adequate floor space shall be kept to permit dismantling, temporary storing and in-situ maintenance of plant & equipment parts, satisfying the clear space requirements stated above. A separate unloading bay for such purpose is required.	Yes
b)	Floors or fixed/portable platforms with stairs/ ladders shall be provided for easy approach to any plant item, including valves, instruments, etc. to be operated, observed and/or to be frequently (more than once a month) maintained.	Yes
3.	Plinth level of all buildings, above the finished grade level	500 mm
4.	Minimum access opening required (with rolling shutter) for transportation, wherever entry of truck for material handling is envisaged	3.5M wide x 4M high or, more depending upon the equipment size to be handled.

	ITEM	SPECIFICATION REQUIREMENT
C.	Other Maintenance Requirement	
1.	Generator stator handling In case the Generator stator cannot be handled by the turbine house crane, all provisions for its overhauling, including the arrangement to slide the stator on the turbine house floor, the foundation work for stator jacking /lowering assembly, dismantling of building end walls/structures etc. shall be kept.	Yes
2.	Maintenance of the internals/impellers of all important equipment, like boiler feed pumps, feed water heaters, Surface Condenser, fans of the boiler draft plant, Intake and circulating water pumps, cooling water pumps, coal mills, compressors, blowers, heat exchangers, fuel oil pumps, filters etc.	Shall be possible without disconnecting or dismant-ling any piping/ducting.
3.	Overhauling and handling of the casings for the above items	Shall be possible without disturbing/dismantling any piping/ducting not directly connected to them.
4.	Crane Approach	
	Wherever required the unobstructed approach of the crane hook/other hoisting equipment hook to various plant & equipment shall be possible.	Yes
D.	Central Control Room	
	All electronic equipment other than those directly associated with control, operation or presentation of displays shall be mounted external to the control room in air conditioned control equipment room.	Yes
	The bidder shall describe in his bid the proposed layout philosophy of the Central Control Room and Control Equipment Room and the arrangement of equipment best suited for the system offered by him and as per good ergonomically consideration.	
	However, as a guide line, following features are given :	
a)	False ceiling and false flooring shall be provided.	
b)	Uniform height, colouring schemes for cabinets etc. shall be available.	

ITEM		SPECIFICATION REQUIREMENT
c)	The total area of floor space covered by Control Consoles/Panels in the Control Room shall not exceed 15% of floor area.	
d)	No opening shall be provided from Boiler side.	
e)	Two double leaf doors, suitably located for entering the Control room shall be provided with opening towards the turbine floor.	
f)	Cable entry for the panels/consoles shall be from bottom and suitable openings shall be provided.	
g)	The Control Room lighting shall be designed to provide a glare free uniform illumination. The level of illumination shall be minimum 400 LUX.	
h)	Necessary Air Conditioning shall be provided for Central Control room, Control Equipment Room and SWAS room etc.	
i)	Basic amenities like toilet, Tiffin rooms, wash basins, rest rooms etc. shall be provided near the Control Room.	
E.	Toilet and drinking water facility	Required in all buildings and on all floors wherever operating personnel are to be deployed.

PROJECT MANAGEMENT AND SITE SERVICES

CONTENT

PROJECT MANAGEMENT AND SITE SERVICES

1.00.00 **PROJECT MANAGEMENT SERVICES**

1.01.00 **Responsibility**

The Bidder shall identify a separate and independent project management team headed by a Project Manager for the execution of this project. Responsibilities of this project Management team shall cover the areas listed below :

a) Planning and Monitoring

b) Engineering Management

c) Contracts Management

d) Project Safety Management

e) Quality Assurance, Inspection & Expediting

f) Construction Management

g) Spares Management

h) Erection & Commissioning Management

Detailed responsibilities in the above areas are discussed below :

1.02.00 **Organisation**

1.02.01 Headquarters

The headquarters of the project management team shall be headed by a senior level executive designated as the Project Manager who shall be responsible to Owner for the execution of the project. He should have adequate financial power and authority to give decision.

Separately, designated leaders shall be identified for each of the areas mentioned under 1.01.00, who, in turn, will report to the Project Manager for all matters relative to this contract.

1.02.02 Central Co-ordination Cell

The central coordination cell shall have sufficient technical personnel to coordinate technical matters and to quickly resolve day to day queries or references made by Owner and his Consultants without having the need to refer to his headquarters each time.

1.02.03 Site Organisation

The site should have a competent construction manager for all site operations with adequate financial power and sufficient level of authority to take site decisions. The organisation chart for site should indicate the various levels of experts to be posted for supervision in the various fields in civil construction, erection, commissioning etc.

1.02.04 Organisation Chart

The Bidder shall furnish a detailed organisation chart for the project management team, clearly identifying the key personnel in each of the areas mentioned at 1.01.00 above. The expected number of executives at different levels shall also be indicated, separately for headquarters, central coordination cell and site organisation.

1.03.00 **Implementation Schedule**

The schedule for the completion of the Project would be as follows :

		Period in Months from Zero date (Taken as advance payment date of EPC Package)
a)	Boiler Hydro-test	By Bidder
b)	Boiler light up	By Bidder
e)	Commercial operation	50

To achieve these targets, the Contractor shall furnish to the Owner, various schedules as defined below:

1.03.01 Engineering Schedules

These schedules shall cover various design submissions indicating different engineering activities to be performed. Such schedules shall be furnished by the Bidder for each and every plant/systems/ equipment item covered in the scope of this specification.

1.03.02 Manufacturing Schedule

The Contractor shall submit to the Engineer his manufacturing and delivery schedules for all equipment within thirty (30) days from the date of issue of the Letter of Intent (LOI). Such schedules shall be in line with the detailed network for all phases of the work of the Contractor. Such schedules shall be reviewed, updated and submitted to the Engineer, once in every two months thereafter, by the Contractor. Schedules shall also include the materials and equipment purchased from outside suppliers.

1.03.03 Erection Schedules

In order to achieve the overall completion schedule, the Contractor shall provide the Owner all the information covering erection sequence, testing and commissioning activities. These schedules may be based on the recommended erection procedures and will be subject to discussions/ agreements with the Owner subsequent to the award of contract.

1.03.04 The successful Bidder shall have to provide all the above schedules (i.e. 1.03.01, 1.03.02 & 1.03.03) in a tabular form in addition to that in the form of L2 & L3 networks and these shall necessarily include information not limited to the earliest and latest dates for various activities/submissions and also any related constraints. However, the Bidder shall include in his proposal a Level-1 (L-1) network showing the major activities and various milestones to achieve the above mentioned completion schedule.

1.03.05 The Contractor shall provide the Owner the original disc/software for all such schedules alongwith requisite no. of copies (as required by the Owner) within an agreed time schedule. This time schedule will be agreed between Owner/Bidder at the time of award of contract. The Contractor's project management software shall be compatible with that of the Owner and the input data shall be furnished to the Owner in a manner compatible with Owner's project management software, SAP.

1.04.00 **Detailed Responsibilities**

1.04.01 Planning & Monitoring

a) Planning

The Bidder shall prepare a Master Network Schedule in the form of PERT network.

The network shall be prepared on a Work Breakdown Structure for the project which sub-divides the project into a set of manageable systems/sub-systems. The master network will identify milestones of key events for each system/package in the areas of engineering, procurement, manufacture and despatch and erection and commissioning. The master network shall represent the Level-I plan and will form the basis for development of detailed second and third tier execution plans. The master network shall conform to the overall schedule prescribed by Owner.

The master network should be submitted along with the bid which would be mutually discussed and finalised before the Award of Contract. This master network would clearly indicate the responsibility of the Bidder and project management team. This master network would form a part of the contract. The master network shall also identify a complete list of inputs to be furnished by the Owner which may be required for proper interfacing and tie-up. Scheduled dates for providing such inputs shall also be indicated, which will be mutually discussed and finalised.

b) Monitoring & Progress Reporting

The progress reports would be emanated every month, one from the head office of the Contractor and another from the site office. The progress report emanating from the head office should necessarily include the following sections:

i) Report on key milestones.

ii) Management summary indicating critical areas with details of actions initiated and effect of any on the project.

iii) Action needing attention of the Owner/Consultant.

iv) Detailed packagewise status of engineering submissions, quality plan submissions and approval, procurement manufacture and despatch.

The monthly report generated from the site office should necessarily include:

i) Report on key milestones.

ii) Management summary indicating critical areas with details of actions initiated and effect if any on the project.

iii) Action needing attention of the Owner/Consultant.

iv) This report would also cover the areas pertaining to the receipt of the equipment at the port, port clearance, transport, receipt at site, erection and commissioning.

In addition to the above, as the project execution progresses, the Contractor shall also be responsible for generating more frequent reports in the form of fax/e-mail information on progress in critical areas so that actions can be expedited. The exact format of the progress report shall be finalised after award of Contract.

1.04.02 Engineering Management

Based on the master network for the project (L-1) the Contractor will prepare an exhaustive list of engineering activities for the equipment/systems covered in his scope and a detailed programme of accomplishing the same within the time frame specified in the master network. This schedule will form the Level-2 (L-2) network for engineering activities.

Based on (L-2) network, the Contractor shall further develop the Level-3 (L-3) network for engineering activities which will indicate schedule for data availability, drawing release date and document submission dates.

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 Intent 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.

TSGENCO is implementing SAP ERP. Hence the bidder apart from submission of the hard copies shall upload all the documents, drawings etc. in soft format in the relevant C- folder environment (web based) and comply with the additional requirements, if any.

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 Intent. 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 twelve (12) 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 Intent, 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 of the project will be held initially at least once in two (2) months at Hyderabad/site/ at the discretion of the Owner.. 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 and 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 deaerator 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 chemicals, lub oils and other consumables 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, Electrical Inspector 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 cranes 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 and as per the Standards.

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 & tackle, 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 VII-A, VII-B, VII-C may be referred. For Instrumentation and Electrical works Vol. VI, V-A and V-B 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 done by the Contractor and certified copies shall be supplied to the Owner. 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 surface 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 : V, VI & VII of this specification.

3.00.00 PROJECT INFORMATION AND MANAGEMENT SYSTEM, INCLUDING DCOUMENT MANAGMENT SERVER (DMS)

3.01.00 Contractor shall submit as part of its Work Scope detailed documentation as outlined in this section and / or required by the Technical Requirements. The content and format of the documentation to be submitted are subject to Owner's approval.

3.02.00 Contractor shall utilise a computer based system for control and management of project documentation. The system must be capable of producing customized reports and information on demand. This control system should have been successfully applied to similar projects and be familiar to the project control personnel selected. Contractor's detailed project documentation plan shall identify all documentation requirements for the project, the party responsible for production of the document, the basic content of the document and the required timing for issue. This plan shall include, but not be limited to the details of all Drawings to be produced, plant specification / definition documentation, equipment orders and manuals. The documentation identified shall be entered into the computer based control system The database thus created shall be capable of being sorted and ordered on a variety of selected parameters such as document type, subject description, responsible party, start date and finish date, to enable review and update to be conducted only on those documents which are relevant.

3.03.00 Regular documentation control progress reports shall be prepared by the Contractor to record the status of documentation. In the event either Party or Engineer expresses concern with the content of such progress reports, the accuracy of progress reports, status of documentation production and other such matters, the concern will be identified to the Project Manager. Within five days of notification of this concern, the Project Manager will attend a meeting with relevant Owner Representatives and provide details of specific actions to be initiated to satisfactorily overcome the difficulties identified. It will be the Project Manger,s responsibility to initiate whatever action is necessary to ensure that the production of documentation is completely in accordance with Project Information Management System (PIMS).

3.04.00 Within 90 days after Effective Date of Contract, the Contractor shall establish an integrated PIMS which will support the needs of Project and management, detail design and engineering, procurement, construction and operation, and maintenance.

PIMS shall utilise software which links various software and database programs to form a composite system. The typical scope of PIMS shall include, but not be limited to, the following:

(a) Power plant systems and equipment data, from which Project specific flow diagrams, data sheets and other integrated data are derived. The Power plant systems and equipment data, from which Project specific flow diagrams, data sheets and other integrated data are derived. This data shall include, but not be limited to, the following:

   (i) System descriptions and design requirements and design criteria

   (ii) Equipment and material technical specifications for all engineering disciplines

(b) Detail engineering data to create flow diagrams, plant arrangements, piping configurations, equipment layout and design, electrical and instrumentation systems, structures, and other systems. The software tool used shall be capable of manipulation and storage of plant layout and design information. The 3D model of the plant shall also contain details of the various components like pipe, structural steel work, etc., and relevant information shall be available on-line from relevant data base. Software shall be multi-user, multi-access nature allowing the designers of Contractor and major Sub-Contractors, if required, to work in interactive real time environment and software shall be capable of interference checking. The software shall allow access to different types of information held in the database. It shall estimate the type and quantity of materials required to build the plant and it shall be possible for such data to be taken off the system at any time.

(c) Construction data to monitor and manage site activities, including material control, scheduling and progress, quality control, start-up and testing, operation, maintenance, training, and all other site functions.

(d) Plant design and construction records to provide data for safe and efficient maintenance and operation. Records to include may be maintenance schedule, man power tracking, tools, spare parts, and test equipment inventory, equipment list, drawing, control, technical specifications, and equipment instruction manuals.

3.05.00 The PIMS shall be installed in a distributed processing array system and operated through personal computer work stations at the Contractor's site office. A complete integrated system shall be implemented. This system shall be utilised by Contractor during the Project execution.

ENGINEERING SERVICES

CONTENT

ATTACHMENTS

ENGINEERING SERVICES

1.00.00 GENERAL

1.01.00 As part of the overall project management activity, the Contractor shall be responsible for proper engineering and co-ordination of activities during various phases of execution of the contract. The Contractor shall identify a person, designated as Project Manager, with whom the Owner, the Consulting Engineer or the Review Consultant shall interact on matters related to engineering as well as execution of the contract. The Project Manager shall be the single-point contact person on behalf of the Contractor and shall be responsible for all engineering co-ordination. The Owner/Consultant/Review Consultant shall interact with the Project Manager only on all matters of co-ordination between the Owner and the Contractor or on matters involving the Contractor, his manufacturing units and sub-vendors. For the purpose of expediting the Owner or his representative may sometimes interact with the manufacturing units or sub-vendors of the contractors. However such interaction will not, under any circumstance, dilute the responsibility of the Contractor to provide a fully engineered and co-ordinated package under this contract.

1.02.00 On finalization of the contract, a procedure for exchange of engineering information will be mutually agreed and finalized between the Owner and the Contractor.

2.00.00 DESIGN COORDINATION MEETING

The Contractor and his sub-vendors will be called upon to attend design co-ordination meetings with the Engineer, other Contractors and the Consultants of the Owner during the period of execution of contract. The Contractor including his sub-vendors shall attend such meetings at their own cost at Owner's or Consultant's office in Kolkata or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

3.00.00 CO-OPERATION WITH OTHER CONTRACTORS AND CONSULTING ENGINEERS

The Contractor shall agree to cooperate with the Owner's other Contractors and Consulting Engineers and freely exchange with them such technical information as is necessary to obtain the most efficient and economical design and to avoid unnecessary duplication of efforts. The Engineer shall be provided with copies of all correspondences addressed by the Contractor to other Sub- contractors and Consulting Engineers in respect of such exchange of technical information.

4.00.00 **GUIDELINES FOR ENGINEERING SERVICES**

4.01.00 Prior to commencement of the engineering work as part of design submissions, all aspects of design viz., criteria for selection and sizing of all equipment and systems, design margins etc. including that for structural steel and civil work shall be outlined and these shall form the basis for the detailed engineering work.

4.02.00 Engineering work shall be performed on modern and proven concepts and internationally accepted good engineering practices but fully compatible with the Indian environments. Owner shall have the right to review and approve the engineering work by themselves and/or through consultant and ask for any clarifications and changes/modifications to the work performed by Contractor.

4.03.00 At any stage during the performance of assignment, the Contractor may be required to make certain changes/modification/improvements in design/ drawing/other documents which are applicable to 800 MW Unit, which in the opinion of the Owner could result in better improved design, layout, operability, plant availability, maintainability, reliability or economy of the plant and its systems/sub-systems in view of revised and more accurate information/data available at a later date(s) or feedback(s) received during execution / operation of similar units. Such changes / modifications/ improvements required could be identified by Owner and/or consultant and mutually discussed. Owner requires the Bidder to incorporate such action in the subject assignment appropriately without any additional cost liability and time implication to the Owner and same shall be within the responsibilities and scope of the Contractor.

4.04.00 During the course of review of detailed engineering stages, it may be essential in the opinion of Owner to obtain certain classified data for review purposes only. In case Owner so desires, the Bidder shall submit such data to Owner.

4.05.00 During the course of review of detailed engineering, it may be essential in Owner's opinion to obtain data and information on similar equipment and plants engineered by the Bidder. In case Owner so desires the Bidder shall submit such data and information to the Owner.

4.06.00 It is not the intent to give details of every single task covered in the total engineering work to be carried out by Contractor, however, all engineering work required for the satisfactory completion of the plant/systems as specified shall be carried out by the Contractor. Broadly, the following are the minimum requirements in respect of scope of major items of work:

4.06.01 Preparation, updating and finalisation of scheme drawings, control and interlock diagrams, detailed and fully dimensioned layout drawings (plant layout and equipment layout detailed plan, elevation and cross-sectional drawings at different elevations / floor levels) covering all mechanical, electrical, C&I, civil and structural items, equipment, systems and facilities. Drawings and Schedules prepared by the Contractor from time to time, as detailed designs are developed, shall be submitted for Owner's / Consultant's approval before the work is taken up. Revisions, corrections, additions to drawings and schedules shall not be considered to change the scope of work.

4.06.02 Preparation of detailed technical specifications including data sheets, tender drawings and bill of material for all bought out items, as also finalisation of corresponding sub-contractors.

4.06.03 Review of sub-contractor's data, drawings, design calculations, schedules, bill of materials, instruction manuals etc. for all equipment, before forwarding them to Owner/Consultant for approval.

4.06.04 Preparation of civil construction drawings for all equipment showing foundation details and full details regarding equipment loads, floor openings, details of embedments etc. required for preparation of civil construction drawings and also as referred at relevant sections of Scope, Terminal Points & Exclusions. These documents shall be preceded by appropriate design calculations, static and dynamic analysis as necessary.

4.06.05 Preparation and finalisation of process piping and instrumentation diagrams and schematics, complete in all respects for all systems/packages of the power plant.

4.06.06 Preparation of consolidated schedules and bills of materials, including line numbers, tag numbers, source of supply, service conditions, specifications, materials, types and connections details, quantities for items of the plant including dampers, steam traps, strainers, instrumentations, ducting.

4.06.07 Sizing of all piping and equipment as per the stipulated design criteria; carrying out of flexibility analysis/dynamic analysis as necessary; hangers & support engineering.

4.06.08 Final revision of all documents including preparation and compilation of Instruction Manuals for installation, commissioning, operation and maintenance for all equipment and systems. Refer clause 5.00.00 for the specific requirement in this regard.

4.06.09 Certification and submission of final as-built drawings for all areas.

4.06.10 Preparation and compilation of all drawings, schedules and instructions which may be required at site, whether separately mentioned or not.

4.06.11 All erection and assembly drawings which may be required at site.

4.06.12 For all bought out item packages, the Contractor shall provide complete material / component list along with detail specification, drawings, component part no. etc. during detail engineering stage prior to final approval. Such approved drawing/document shall be made available at site in adequate number prior to commencement of work. Moreover, such document/drawing shall be provided in soft form (CD)

4.06.13 Preparation of necessary documentation, design calculations etc. required for submission to statutory authorities like IBR, Chief Electric Inspector, Factory Inspector etc.

5.00.00 OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS

5.01.00 The Contractor shall provide at least six (6) months before the time of commissioning and before taking over of the plant and equipment, all necessary maintenance manuals and operating instructions. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hard copies as per distribution schedule (Annexure-1).

5.02.00 The information provided, which shall be contained in loose leaf stiff backed covers, shall include :

a) A complete inventory of all main items of plant, with identification details.

b) Service manuals for all plant and equipment giving full descriptions of the main items and auxiliary items such as power packs, hydraulic equipment, actuators, lubricating pumps, etc.

c) A separate electrical manual covering items such as switchgear, cabling, instrumentation, controls, cabling layouts and wiring diagrams.

d) A schedule of recommendations for routine maintenance of all electrical and mechanical equipment, recommended inspection point, information on detection, cause and rectifications of troubles & faults.

e) A lubrication schedule with all necessary drawings diagrams to identify the lubrication points.

f) Manufacturer's literature.

5.03.00 The instruction manual shall be subject to the approval of Owner.

6.00.00 PLANT HANDBOOK

The Contractor shall submit to the Engineer, a preliminary plant handbook preferably in A-4 size sheets which shall contain the design and performance data of various plant, equipment and systems covering the complete project including single line flow diagrams, within twenty four (24) months from the date of his acceptance of the Letter of Intent. The final plant handbook complete in all respects shall be submitted by the Contractor six (6) months before start-up and commissioning activities. The plant handbook shall be submitted as per distribution schedule.

7.00.00 CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE

7.01.00 Within fifteen (15) days to one month of issue of Letter of Intent (LOI) by the Owner, the Contractor shall furnish a schedule of drawings and design document to be submitted by him to the Owner/Engineer indicating dates against each document.

The documents shall be divided into two categories : a) for approval and b) for information/further engineering and co-ordination by the Owner.

In preparing this schedule, the Contractor shall allow two (2) weeks from date of receipt for review and comments by the Owner/Engineer for each submission of a document.

This document submission schedule shall require approval by the Owner/ Engineer.

7.02.00 All contract documents shall be marked, without fail, with the name of the Owner, the Project, the specification title and number and the unit designation.

All dimensions shall be in metric units.

All notes, markings etc. shall be in English.

7.03.00 Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval / information of the Owner/Engineer.

7.04.00 Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Engineer:

a) List of sub-vendors (from Owner only)

b) System scheme and instrumentation diagrams

c) Design basis justifying selection of equipment & process parameters where not specified in the Contract

d) Equipment data sheets and general arrangement drawings

e) Materials of construction

f) Layout drawings.

g) Operation logic diagrams.

h) Typical control circuit.

i) Drawings of Instrumentation and control.

7.05.00 Unless specified otherwise, the following categories of documents/ drawings would be treated for information/further engineering by the Owner/Engineer. The Contractor shall, however, incorporate all additional information and clarifications in these documents / drawings as and when desired by the Owner/Engineer.

a) Equipment foundation drawings.

b) Equipment cross-section drawings, product literature etc. which are of proprietary nature.

c) Predicted performance curves of equipment.

d) Various bills of quantity, schedules etc.

e) Piping fabrication drawings, isometrics etc.

f) Panel wiring diagrams.

g) Instruction/Operation manuals.

h) Service manuals and trouble shooting guide for C & I system including field instruments.

i) Cable schedule and interconnection chart.

j) Drive/feederwise control scheme showing all external interfaces.

In essence, the Contractor is solely responsible for corrections and adequacy of design & engineering for documents under this category.

7.06.00 Upon review, the Owner/Engineer shall put his remarks and one of the following action stamps on the drawing/document:

a) A - Drawing submitted as approved, proceed with fabrication

b) B - Drawing approved subject to comments noted, proceed with fabrication, considering our comments. Correct as necessary and resubmit for record.

c) C - See attached memo.

d) D - Correct your original drawing incorporating our comments and resubmit for approval.

e) E - Information furnished is noted.

f) F - Prints not enclosed

For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner/Engineer. For action stamp in category (b), further review by Owner/Engineer would not be necessary provided the Contractor agrees & incorporates the comments made on the document.

Except for action stamp under category (c) & (d), the Contractor can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/ Engineer.

The Owner/Engineer may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Contractor shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds. Approval of contract documents by the Owner/ Engineer shall not relieve the Contractor of his responsibility for any errors and fulfillment of contract requirements.

The Contractor's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Owner/Engineer.

7.07.00 Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.

7.08.00 For review by the Consulting Engineer, the Contractor shall furnish soft copies of drawings & documents and three (3) prints of each drawing/ document. Two (2) prints of such submission shall also be sent to the Owner. After review, comment/approval will be sent to the Contractor. Upon action under category (a) or (e), the Contractor shall directly distribute the documents to the various offices of the Owner and other agencies in number of copies as specified in the contract document. Such distribution copies shall be marked with the reference and date of the letter by which the Owner/ Engineer has accorded his final approval. Penal action shall be taken against the Contractor for any unauthorised revision in the drawings so distributed from the drawings approved by the Owner/Engineer. The contractor shall furnish three (3) CDs of all as built/final drawings for Owner/Consultant site.

7.09.00 In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.

7.10.00 For details of documentation for Civil, Structural and Architectural works, VII-A, VII-B and VII-C may be referred.

8.00.00 TENDER STAGE DOCUMENT SUBMISSION

8.01.00 The Bidder shall submit along with his bid all documents/drawings as requested in respective specifications. The documents shall include but not be limited to the following :

a) All Bid proposal sheets duly filled up.

b) Detailed experience list and financial resources of the prime bidder his collaborators/associates in this bid as well as the sub-vendors proposed.

c) Scheme drawings indicating scope of supply and service as offered by the Bidder indicating clearly exclusions, if any.

d) List of terminal points of the package offered together with quality and quantity of various input (i.e. water, air, electricity etc.) as required from the Owner at such interfaces.

e) Equipment GA, Layout, Design Calculations, interlock and other write-up, catalogues/literature etc. as required for clear understanding of the bid submitted.

f) L-1 network indicating target dates for intermediate milestones and final commissioning of equipment supplied; This network shall be supplemented by a detailed write-up on proposal procedure of project implementation, deployment schedule for Key personnel with their bio-data, schedule of construction machinery etc.

g) List of suppliers for all bought out items.

DISTRIBUTION SCHEDULE

S. No	Description	TSGENCO								CONSULTANT			Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/ KTPS	SE/ Civil KTPS	SE/E&M / KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS		
A	**Letter Of Intent or Contract Documents**	1	1	1	S	1	2	2	1	1	1	1	2	
B	**Vendor Drawings**													
1.	Preliminary	1	1	1	2	1	1	2	2	12	1	-	S	
2.	Return preliminary with comments	-	-	1	2	1	1	1	1	S	1	-	1	
3.	Final and any revision thereof													
	a. Civil	1	1	6+1T	1	1	6+1T	1	-	2+1T	1	1	S	
	b. E&M	1	1	1	6+1T	1	1	6+1T	1	2+1T	1	1	S	
C.	**Design Drawings**													
1.	Preliminary													
	a. Civil	1	1	2	1	1	2	1	1	4	1	1	S	
	b. E&M	1	1	1	2	1	1	2	1	4	1	1	S	
2.	Released for construction													
	a. Civil	1	1	2	1	1	6	1	1	1	1	2	S	
	b. E&M	1	1	1	1	2	1	6	1	1	1	2	S	
3.	Return marked 'As built'													
	a. Civil	-	-	1	-	-	1	-	-	1	1	S	1	
	b. E&M	-	-	-	1	-	-	1	1	1	1	S	1	
4.	As built drawings													
	a. Civil	-	-	1+1T	-	2+1T	5+1T	-	1	1+1T	-	1	S	
	b. E&M	-	-	1	2+1T	2+1T	-	5+1T	1+1T	1+1T	-	1	S	

S. No	Description	TSGENCO								CONSULTANT			Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/ KTPS	SE/ Civil KTPS	SE/E&M / KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS		
D	Progress Report Monthly													
1.	Equipment vendor	1	1	1	2	1	1	2	1	1	1	1	S	
2.	M/s DCPL, Kolkata	1	1	2	2	1	1	2	1	S	1	1	Nil	
E	Test & Inspection Reports													
1.	Equipment manufacturer													
	a. Civil	1	1	1	2	1	1	1	-	11	1	1	S	
s	b. E&M	1	1	-	2	1	-	1	1	11	1	1	S	
2.	M/s DCPL, Kolkata	1	1	-	2	1	-	1	1	S	-	1	-	
F	Instruction Manuals/Data Books													
1.	Equipment manufacturer													
	a. Civil	1	1	1+1T	1	1	6+1T	1	1	2+1T	1	1	S	
	b. E&M	1	1	-	3+1T	1	-	6+1T	2	3+1T	1	1	S	
2.	M/s DCPL, Kolkata	1	1	-	10+1T	1	-	15+1T	-	S	1	1	Nil	
G	M/s DCPL, Kolkata Criteria	1	1	1	8+1T	1	1	2	1	1	1	1	S	
H	Design Calculations	1	1	1	8+1T	1	1	2	1	1	1	1	S	
I	Final consulting Engineering Report	1	1	1	10	1	1	2	1	S	1	1	Nil	

S – Source, T – Transparency & Soft Copy on CD,

TSGENCO : Telangana State Power Generation Corporation Limited

Director, Projects, Hyd : Director/ Projects, TSGENCO, Vidyut Soudha, Hyderabad – 500 082

QUALITY ASSURANCE REQUIREMENTS

CONTENT

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 for Owners approval

o) Internal standards, if referred in the quality plans shall generally be compatible with National / International standards and shall be mentioned in the quality plans. Alternatively bidder shall furnish extracts of the internal standards detailing out acceptance norm for the product / material.

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.

Contractor shall furnish list of Manufacturing Quality Plans of major equipments indicating proposed inspection catagorisation indicating items that will be offered for Owner's inspection etc and the Field Quality Plans

2.02.00 Manufacturing Quality Plan for all the major equipment will detail out their respective important components, their in-process various tests/inspection & final inspection / tests, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's Quality Control organization. The relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing are to be comprehensibly documented by Contractor.

Manufacturing Quality Plan for all major equipments/ items will be approved by owner. 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 shall not proceed without consent of Owner / Authorised representative in writing. Inspection/ Test reports are to be submitted to owner as specified in final approved Manufacturing Quality Plans.

2.03.00 Field Quality Plans / Procedures for all field activities shall be submitted to owner for review / approval. These Quality Plans / procedures will detail out, for all 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 major deviations in the form of Non Conformity Report shall be 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 for “CHP” and “W” points marked in quality plans , and duly authorised for despatch by issuance of Material Despatch Clearance Certificate (MDCC). For items which is not under owner’s inspection the contractor shall apply for despatch clearance (MDCC) from owner by submitting their internal inspection reports and quality records

2.06.00 All materials used or supplied shall be accompanied by valid and approved materials certificates and tests and inspection report. These certificates and reports shall indicate the sheet serial 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 (latest edition) 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 (latest edition) or equivalent international standard approved by the Owner. Such qualification tests shall be conducted in presence of Owner / his authorised representative or owner approved Third Party Inspection Agency(TPIA). Previously qualified WPS & PQR shall be acceptable if witnessed by owner’s approved TPIA.

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

2.09.00 All non-destructive examination (NDT) shall be carried out in accordance with LIST OF STANDARDS FOR REFERENCE as given below in this section.

The NDT operator shall be qualified as per SNT-TC-IA (of American Society of non- destructive examination). Results of NDT for the list major equipments / items identified for owner's inspection shall be properly recorded and submitted for review and approval. Other items not covered under owner's inspection, contractor shall review and approve the NDT results and such reports shall be submitted to owner in the final documentation of the items / equipments

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 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 / CDs 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 Owner’s Engineer, or his duly authorised representative and/or an outside inspection agency acting on behalf of the Owner shall have access inside the workshops, test labs, establishments at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Owner’s 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 Owner’s Engineer/ Authorized Inspector twenty one (21) days written notice for “CHP” / “W” points of any material being ready for testing by owner’ engineer / Authorized inspector. 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. If owner’s Engineer / Authorised Inspector fail to attend the inspection, next mutually convenient date for test shall be agreed with Contractor. Contractor shall, in no case proceed with the test without owner or his authorized inspectors, unless the witnessing is officially waived and advised Contactor to proceed with the test. Contractor shall forthwith forward duly certified completed test report and a product quality certificate in six (6) copies to owner upon completion of such test.

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 / QAP or other approved quality documents. 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 / QAP or other approved quality documents.

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 excluding the test completion date subject to submission of all certified documents related to the test, 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 owner's 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 / QAP or other approved quality documents.

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 owner's Engineer/Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contract / QAP or other approved quality documents. Contractor and shall give facilities to the owner's 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 proposed 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.

LIST OF STANDARDS FOR REFERENCE

a) International Standards Organisation (ISO).

b) International Electro-technical Commission (IEC).

c) American Society of Mechanical Engineers(ASME)

d) American National Standards Institute (ANSI).

e) American Society for Testing and Materials (ASTM).

f) American Institute of Steel Construction (AISC).

g) American Welding Society (AWS).

h) Architecture Institute of Japan (AIJ).

i) National Fire Protection Association (NFPA).

j) National Electrical Manufacturer's Association (NEMA).

k) Japanese Electro-technical Committee (JEC).

l) Institute of Electrical and Electronics Engineers (IEEE).

m) Federal Occupational Safety and Health Regulations (OSHA).

n) Instrument Society of America (ISA).

o) National Electric Code (NEC).

p) Heat Exchanger Institute (HEI).

q) Tubular Exchanger Manufacturer's Association (TEMA).

r) Hydraulic Institute (HIS).

s) International Electro-Technical Commission Publications.

t) Power Test Code for Steam Turbines (PTC).

u) Applicable German Standards (DIN).

v) Applicable British Standards (BS).

w) Applicable Japanese Standards (JIS).

x) Electric Power Research Institute (EPRI).

y) Standards of Manufacturer's Standardization Society (MSS)

z) Bureau of Indian Standards Institution (BIS).

aa) Indian Electricity Rules.

bb) Indian Boiler Regulations (IBR).

cc) Indian Explosives Act.

dd) Indian Factories Act.

ee) Tariff Advisory Committee (TAC) rules.

ff) Emission regulation of Central Pollution Control Board (CPCB).

gg) Pollution Control regulations of Dept. of Environment, Govt. of India

hh) Central Board of Irrigation and Power (CBIP) Publications

FORMAT OF QUALITY ASSURANCE PROGRAMME

VENDOR'S LOGO , NAME & ADDRESS	MANUFACTURING QUALITY ASSURANCE PLAN	DOC NO:	XXXXX-CAL-QAP-M-0001				
	ITEM : -	REV NO :	0	1	2	3	4
		DATE :					

CLIENT :		LOCATION :	
PROJECT :		REFERENCE PURCHASE ORDER NO. & DT :	
VENDOR :		REFERENCE APPROVED DATA SHEET :	
SUB VENDOR :		REFERENCE APPROVED DRAWING. NO. :	

ABBREVIATIONS :

QAP - QUALITY ASSURANCE PLAN,
CR - CRITICAL,
MA - MAJOR,
MI - MINOR
SPEC - SPECIFICATION,
TC - TEST CERTIFICATES
P - PERFORM
w - WITNESS
V - VERIFY
CHP - CUSTOMER HOLD POINT

MATL - MATERIAL,
APP - APPROVED,
DWG - DRAWING,
SUPL - SUPPLIER,
PROC - PROCEDURE

AGENCY :

1 - DCPL/PROJECT AUTHORITY
2 - SUPPLIER
3 - SUB-SUPPLIER
4 - MANUFACTURER
5 - THIRD PARTY INSPECTION AGENCY

GENERAL REMARKS

1 THE ITEMS WHICH ARE FALLING UNDER ANY STATUTORY AUTHORITY'S (LIKE I.B.R. ETC.) SCOPE SHALL BE SUBJECTED TO THAT STATUTORY AUTHORITY'S INSPECTION CLEARENCE.

NOTES:

1. EXACT MATERIAL / PROCESS / INSPECTION / TESTS FOLLOWED BY THE MANUFACTURER SHALL BE SPECIFIED
2. EXACT REFERENCE DOCUMENT/ACCEPTANCE STANDARD SHALL BE SPECIFIED
3. IN CASE SPECIFIED ACCEPTANCE STANDARD / NORMS IS OTHER THAN NATIONAL / INTERNATIONAL STANDARDS . STANDARD / COPY OF THE ACCEPTANCE NORMS FOLLOWED BY THE MANUFACTURER SHALL BE SUBMITTED FOR REVIEW RECORD
4. FINAL INSPECTION DOSSIER SHALL BE PREPARED BY MANUFACTURER & SHALL BE ENDORSED BY INSPECTIONTION AGENCY

	Prepared by			Checked by			Approved By		
Revision	R0	R1	R2	R0	R1	R2	R0	R1	R2
DATE									

VENDOR'S LOGO, NAME & ADDRESS	ITEM :	DOC NO:			
		REV NO :	R0	R1	R2
		DATE :			

SL NO.	DESCRIPTION	CHECKS			CATEGORY	REF DOCS	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
		TYPE	METHOD	QUANTUM					P	W	V	
1	2	3	4	5	6	7	8	9	12	13	14	15
1.00												

Notes:

	Prepared by			Checked by			Approved By		
Revision	R0	R1	R2	R0	R1	R2	R0	R1	R2
DATE									

बी एच ई एल BHEL	**TECHNICAL SPECIFICATION FOR FUEL OIL HANDLING SYSTEM** **5X800MW YADADRI TPS**	SPECIFICATION NO. PE-TS-417-166-A001	
		SECTION ‘I-A’	
		REVISION 00	DATE: 26.09.2018
		PAGE 1 of 1	

SECTION- IA

QUALITY ASSURANCE AND INSPECTION REQUIREMENT

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)**

BHEL

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)**

BHEL 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	C	CU	D	REMARKS
1	2	3	4	5	6	7	8	9	10				11
1.0	**RAW MATERIAL**												
1.1	CASING/ROTOR(IMPELLER)	i) SURFACE DEFECTS	MAJOR	VISUAL	100%	APPD.DATA SHEET/ DRG./	APPD.DATA SHEET/ DRG./	IR & TC	P	V	-		
	HOUSING	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
1.4	SHAFT SLEEVE	i) CHEMICAL ANALYSIS	MAJOR	CHEMICAL	1/HEAT	MFR's STD./MFR's	RELEVANT STANDARD/	IR & TC	P	V	-		FSH IN SOUND AREA:
		ii) HARDNESS		MEASUREMENT	100%	CATALOGUE	IS						1) DEFECT ECHO NOT TO EXCEED 20% OF FSH
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	-		2) BACK WALL ECHO HEIGHT TO BE 80% MIN. OF FSH.
		ii) HARDNESS		MEASUREMENT	100%								FREQ. 2 MH_Z MIN.

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:
RECORDS, IDENTIFIED WITH ✓ ' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

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	-	

LEGEND:
RECORDS, IDENTIFIED WITH '✓' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

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 3 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
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:
RECORDS, IDENTIFIED WITH ' ✓ ' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.

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
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 (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 & 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	M	C	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 mark for co-relation with CMT
		Dimensions	MR	Measurement	100%	Mfg. Drg./ Data Sheet	Mfg. Drg./ Data Sheet	IR	✓	P	V	V	
		Surface quality	MR	Visual	100%	Mfg. Drg./ Data Sheet	Defect Free	IR	✓	P	V	V	
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	

LEGEND:
RECORDS INDENTIFIED WITH " ✓ " 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"
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	AGENCY 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:
RECORDS INDENTIFIED WITH " ✓ " 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"
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 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	D	AGENCY M	C	CU	REMARKS
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	

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

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

REVIEWING AGENCY
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APPROVING AGENCY
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7334/2020/PS-PEM-MAX

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 D	AGENCY M	AGENCY C	AGENCY CU	REMARKS
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												

LEGEND:
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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)

बी एच ई एल BHEL	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 10 D	M	C	CU	REMARKS 11
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

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 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	D	AGENCY M	AGENCY C	AGENCY CU	REMARKS
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:
RECORDS INDENTIFIED WITH "√" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENT.

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"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
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	Refer Note-1
		c) Hydro test	M	Leak test	100%	-do-	-do-	MTC/ Mfr's TC	√	P	V	V	Refer Note-1

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	REVIEWING AGENCY	APPROVING AGENCY
(SIGN WITH DATE & STAMP)	(SIGN WITH DATE & STAMP)	(SIGN WITH DATE & STAMP)

बी एच ई एल BHEL

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 D	AGENCY M	AGENCY C	AGENCY CU	REMARKS
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)**

BHEL

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 D	M	C	N	REMARKS
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.	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
		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.	<u>Final Inspection</u>												
	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:
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"C" CONTRACTOR/NOMINATED INSPECTION AGENCY,
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SHALL INDENTIFIED IN COLUMN "N"

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

APPROVING AGENCY
(SIGN WITH DATE & STAMP)

7334/2020/PS-PEM-MAX

बी एच ई एल BHEL

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 8 M	C	N	REMARKS 9
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
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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		Project :
	Item : Plug Valve Sub-System : Fuel Oil System	Page No.: 1 OF 4	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	D	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

SUB-CONTRACTOR

CONTRACTOR

SIGNATURE

LEGEND :

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

1 - BHEL	P - Agency Performing the Test
2 - PACKAGE SUPPLIER	W - Agency Witnessing the Test
3 - Manufacturer	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		Project
	Item : Plug Valve Sub-System : Fuel Oil System	Page No.: 2 of 4	Contract Contract Sub-Cont

Sl. No.	Components & Operations	Characteristic/Item	Class	Type of check	Extent of Check	Reference Document	Acceptance Norm	Format of Record	D	Agency P	W	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

LEGEND :

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

CLIENT NO.

REV. 00 CAT. ……

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

SUB-CONTRACTOR | CONTRACTOR | SIGNATURE

REVIEWED BY | NAME & SIGNATURE OF APPROVING AUTHORITY

Manufacturer's Name & Address :	QUALITY ASSURANCE PLAN		Project :
	Item : Plug Valve Sub-System : Fuel Oil System	Page No.: 3 of 4	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	D	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

LEGEND :

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

1 - BHEL /DVC	P - Agency Performing the Test
2 - PACKAGE SUPPLIER	W - Agency Witnessing the Test
3 - Manufacturer	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. ……

MANUFACTURE SUB-CONTRACTOR | CONTRACTOR

SIGNATURE

REVIEWED BY | NAME & SIGNATURE OF APPROVING AUTHORITY

Manufacturer's Name & Address :	QUALITY ASSURANCE PLAN		Project :
	Item : Plug Valve Sub-System : Fuel Oil System	Page No.: 4 of 4	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	D	10			11
C	FINAL INSPECTION (Before Painting)												
1	Complete valve	a) Dimension	MA	Flg. 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	P - Agency Performing the Test
2 - PACKAGE SUPPLIER	W - Agency Witnessing the Test
3 - Manufacturer	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

BHEL	**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 P	AGENCY W	AGENCY V	REMARKS
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
BHEL		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 P	AGENCY W	AGENCY V	REMARKS
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

SECTION: I-A

FUNCTIONAL / PERFROMANCE / DEMOSTRATION / GUARANTEE TESTS

BHEL	TECHNICAL SPECIFICATION FOR FUEL OIL HANDLING SYSTEM 5X800MW YADADRI TPS	SPECIFICATION NO. PE-TS-417-166-A001	
		SECTION 'I-A'	
		REVISION 00	DATE: 26.09.2018
		PAGE 2 of 2	

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.

5 X 800 MW YADADRI TPS

TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM

ANNEXURE-A

(FUEL OIL ANALYSIS)

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT PPEI, NOIDA-INDIA

ANNEXURE-A, FUEL OIL ANALYSIS

HEAVY FUEL OIL (HFO) ANALYSIS AS PER IS 1593, 1982 (GRADE-HV)

Sl no.	Characteristics	Heavy Furnace Oil IS-1593,(Latest Revision)- Grade HV
1.1	Total Sulphur content Max. (By Weight)	4.5% Max
1.2	Gross calorific value (Kcal/kg)	10,000
1.3	Flash point (Min.)	66^0C
1.4	Water content by volume (Max.)	1.00%
1.5	Sediment by weight (Max.)	0.25%
1.6	Density at 15^0 C(Approximate), Kg/m^3	890-950
1.7	Kinematic viscosity in centistokes at 50^0C (Max.)	370
1.8	Ash content by weight (Max.)	0.10%
1.9	Pour Point (Max.)	20^0C - 25^0C (max)
	Total Sulphur percent by mass, Max.	4.5

* - assumed value: to be confirmed by customer / consultant

LIGHT DIESEL OIL (LDO) ANALYSIS AS PER IS 15770: 2008

Sl No.	Characteristics	Light Diesel Oil (LDO)
1.1	Kinematic Viscosity in centistokes at 40^o C	2.5 to 15.7
1.2	Acidity (inorganic)	Nil
1.3	Waste content percent by volume (Max.)	0.25
1.4	Sediment percent by mass (Max.)	0.10
1.5	Total Sulphur percent by mass, Max.	1.5
1.6	Ash percentage by mass (Max.)	0.02
1.7	Water Content Max, % Volume	0.25
1.8	Density at 15^0C(approximate), Kg/m^3	850-870
1.9	a) Flash point, Min- Pensky Martens b) Pour point:	66^0C 21^0C in Summer and 12^0C in Winter
1.10	Gross calorific value (Kcal/kg)	10000-10500
1.11	Carbon Residue (Ramsbottom) percent by mass (Max.)	1.5

5 X 800MW YADADRI TPS

TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM

ANNEXURE - B

(SUB-VENDOR LIST)

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

BHEL	TECHNICAL SPECIFICATION FOR FUEL OIL HANDLING SYSTEM SUB-VENDOR LIST	SPECIFICATION NO. PE-TS-XXX-166-A001 REVISION 01 DATE: 07/07/2015 PAGE 2 of 15

SUB-VENDOR LIST - FUEL OIL UNLOADING AND STORAGE SYSTEM				
SL. NO	ITEM	SUB-VENDORS	PLACE	TECHNICAL LIMIT
MECHANICAL				
1	GATE, GLOBE AND CHECK (CARBON STEEL VALVES)	A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		M/S GM ENGINEERING	RAJKOT	
		INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C)SUPPLIER NOT REGISTERED FOR NR VALVES
		LEADER VALVES LTD.	JALANDHAR	
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
		NSSL LIMITED.	NAGPUR	
		STEEL STRONG VALVES (I) PVT.LTD.	MUMBAI	LIMIT AS PER VD FILE AS ATTACHED IN SHEET 2
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CC/CSS-GATE-BBT-UPTO600NB CL UPTO300,GATE-PSBT UPTO250NB CL 1500,GLV-BBT-UPTO300NB CL UPTO600,SCNRV-BBT-UPTO600NB CL UPTO150,SCNRV-BBT-UPTO300NB CL 300,SCNRV-PSBT-UPTO150NB CL UPTO900
		VALTECH INDUSTRIES	MUMBAI	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE-GV/150/900,GV/300/400, GV/600/300 , GV/GLV/NRV/900/250 , GLV/300/300,GLV/150/350/ , SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.
		V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES	NEW DELHI	
		AUDCO -L&T	CHENNAI / COIMBATORE	
		OSWAL INDUSTRIES		
		HITECH	AHMEDABAD	
		KSB WATER PUMPS / VALVES	COIMBATORE	
		KBL	KONDHAPURI	
		HAWA ENGINEERS	AHMEDABAD	
		BHEL	GOINDWAL	
		FOURESS ENGG	MUMBAI	UPTO 600 NB, CL-300 & 300NB CL-600
		FOURESS ENGG	AURANGABAD	

BHEL	TECHNICAL SPECIFICATION FOR FUEL OIL HANDLING SYSTEM SUB-VENDOR LIST	SPECIFICATION NO. PE-TS-XXX-166-A001 REVISION 01 DATE: 07/07/2015 PAGE 3 of 15

2	CS BALL VALVES	A.V. VALVES LTD	AGRA	
		AKAY INDUSTRIES PVT.LTD.	DHARWAD	
		BELGAUM AQUA VALVES PVT. LTD.	BELGAUN	
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS.	CHENNAI	
		ATAM VALVES PVT. LTD.	JALANDHAR	(1) BALL VALVES: FCS/FSS - 1/2" TO 2" #800 & CCS/CSS - 2.1/2" TO 4" # 150 (2) BALL VALVES: GUN METAL VALVES SIZE 15 NB TO 80 NB - UPTO PN16.0
		DEMBLA VALVES LTD.	THANE	
		M/S GM ENGINEERING	RAJKOT	
		HAWA VALVES (INDIA) PVT. LTD.	THANE	SIZE UP TO 2" & #800 WITH MOC AS FCS & FSS AND FOR SIZE FROM 65 NB TO 150 NB & #150 WITH MOC AS CCS AND CSS.
		INTERVALVE (INDIA) LTD.	PUNE	STEEL BALL VALVES UPTO 50NB, #800 AND 65NB TO 150NB. #150
		LEADER VALVES LTD.	JALANDHAR	CAST STEEL UPTO 200 MM, CLASS 150/300.
		MICROFINISH VALVES PVT LTD.	HUBLI	
		NILON VALVES PRIVATE LIMITED	AHMEDABAD	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	FOR CARBON STEEL/STAINLESS STEEL UPTO SIZE 200NB.
		UNIFLOW	CHENNAI	
		VALTECH INDUSTRIES	MUMBAI	FORGED CARBON & ALLOY STEEL BALL VALVES, SCREWED TYPE BALL VALVES RATING 800, SIZES UPTO 50 & CC& ALLOY STEEL BALL VALVES RATING 150 , SIZES 65 TO 200 FLANGED TYPE.
		VAAS AUTOMATION PVT. LTD.	DELHI	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	DELHI	
		PEC	NASHIK	(UPTO 400 NB CLASS 150)
		L&T VALVES	COIMBATORE	
		L&T VALVES (AUDCO)	CHHENNAI	
		FLOW CHEM	AHMEDABAD	(UPTO 350 NB CLASS 150)
		BELGUAM AQUA VALVES	BELGAUM	UPTO 200 NB, CL 150
3	**CS PLUG VALVES**	FLOWSERVE (AUDCO)	CHENNAI	
		MICROFINISH	HUBLI	
		WEIR BDK	HUBLI	UPTO 150 NB CLASS 300 & UPTO 400 NB CLASS 150
		FISHER XOMOX	CHENNAI	
		LEADER VALVES LTD.	JALANDHAR	
4	**SUMP PUMP (VERTICAL**	DARLING PUMPS PVT. LTD	INDORE	
		FLOWMORE LTD.	GURGAON	

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	CENTRIFUGAL)	SU MOTORS PVT. LTD.	MUMBAI	
		VARAT PUMP AND MACHINERY PVT. LTD.	KOLKATA	
		WPIL LIMITED	KOLKATA	
		SAM TURBO INDUSTRY LTD	COIMBATORE	
		KISHORE	PUNE	
		AQUA MACHINERY	AHMEDABAD	
		FLOWMORE PUMP	GHAZIABAD	
		M&P	PUNE	
		B & C ENGG(BECON WEIR)	CHENNAI	
5	**SCREW PUMPS**	ROTO PUMPS	NOIDA	
		TUSHACO	MUMBAI	
		UT PUMPS	FARIDABAD	
6	**API 5L ERW PIPE**	TISCO	JAMSHEDPUR	
		SURYA ROSHNI	BAHADURGARH	UP TO 400 NB
		JINDAL	GHAZIABAD	UP TO 350 NB
		MSL	RAIGAD	200 TO 500 NB
		SAIL	ROURKELA	
		RATNAMANI	KUTCH	UP TO 400 NB
7	**ASTM A 106, CS SEAMLESS PIPE**	ISMT	AHMED NAGAR	UP TO 150 NB
		MSL	RAIGAD	UP TO 350 NB
		JINDAL SAW LTD	NASHIK	
		REMI METAL GUJRAT LTD	BHARUCH	UP TO 150 NB HOT FINISH & UPTO 100NB COLD FINISH
		ISMT	BARAMATI	UP TO 200 NB
8	**CS ERW PIPE (IS 1239 / 3589)**	SURYA ROSHNI	BAHADURGARH	UPTO 400 NB ERW PIPES AS PER IS 1239/3589 AND SAW AS PER IS 3589
		JINDAL	GHAZIBAD/HISSAR	UP TO 350 NB
		MSL	RAIGAD	200-500 NB ERW PIPES AS PER IS 3589
		SAIL	ROURKELA	
		WELSPUN	ANJAR/BHARUCH	UPTO 400 NB ERW PIPES AS PER IS 1239/3589 AND SAW AS PER IS 3589
		INDUS TUBE	GAUTAM BUDDH NAGAR	UP TO 300 NB
		RATNAMANI	KUTCH /AHMEDABAD / CHHATRAL	UPTO 400 NB ERW PIPES AS PER IS 3589 AND SAW AS PER IS 3589
		TATA TUBE	JAMSHEDPUR	UPTO 150 NB ERW PIPES AS PER IS 1239
		PSL	CHENNAI/VIZAG/ KUTCH/DAMAN	SPIRAL WELD SAW AS PER IS 3589
		LALIT PROFILE	THANE	SPIRAL WELD SAW AS PER IS 3589
		SAMSHI PIPES INDUSTRIES	VADODARA	SPIRAL WELD SAW AS PER IS 3589

		MUKUT PIPES	RAJPURA	LONGITUDINAL SAW (SINGLE SIDE WELD) AS PER IS 3589
		INDUS TUBES	G B NAGAR	UPTO 300 NB ERW PIPES AS PER IS 1239/3589
		MANN IND	INDORE	SPIRAL WELD SAW AS PER IS 3589
		SURENDRA ENGG	RAJPURA	SPIRAL WELD SAW AS PER IS 3589
		PRATIBHA PIPES & STRUCTURE PVT LTD	THANE	SPIRAL WELD SAW AS PER IS 3589
		JCO GAS PIPE	CHINDWARA	SPIRAL WELD SAW AS PER IS 3589
		NUKAT TANKS AND VESSELS	TARAPUR	LONGITUDINAL SAW (SINGLE SIDE WELD) AS PER IS 3589
		DADU PIPES	SIKRANDRABAD	UPTO 300 NB ERW PIPES AS PER IS 1239/3589
		APL APOLLO TUBES LTD	SIKRANDRABAD	IS3589 UPTO 250 NB
9	**SUCTION HEATER**	PARKAIRE	DELHI	
		MVS	DELHI	
		MELCON	DELHI	
		GASO ENERGY	PUNE	
		INDCON	DELHI	
		TEMASME	NOIDA	
10	**PRESSURE REDUCING VALVE & DESUPERHEATER**	CIRCOR (EARLIER MAZDA)	AHMEDABAD	
		SPIRAX MARSHALL	PUNE	
		LEADER VALVES LTD.	JALANDHAR	
		SPX CORPORATION, USA	M/S SPX FLOW TECHNOLOGY INDIA PVT. LTD, GUJARAT	
		CONTROL COMPONENT INDIA PVT. LTD.	NOIDA	
		DAUME REGELARMATUREN GMBH,	GERMANY	
		HOLTER REGELARMATUREN GMBH & CO.	GERMANY	
		INSTRUMENTATION LTD.	PALAKKAD	
11	**STRAINERS (DUPLEX / SIMPLEX BASKET TYPE)**	GENERAL MECHANICAL WORKS PVT LTD	VADODARA	
		GRAND PRIX	FARIDABAD	
		GUJARAT OTOFILT	VATVA , AHMEDABAD	
		FILTRATION ENGRS	MUMBAI	
		JAYPEE INDUSTRIES PVT. LTD.	NEW DELHI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI	
		OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		BHATIA ENGINEERING CO.	NEW DELHI	SIMPLEX ONLY
		FILTERATION ENGINEERS (I) PVT. LTD.	MUMBAI	SIMPLEX ONLY
		SUNGOV ENGINEERING PVT. LTD.	CHENNAI	

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		SAROJINI ENTERPRISE	HOWRA	SIMPLEX ONLY
12	CONTROL VALVE	SPX CORPORATION, USA	M/S SPX FLOW TECHNOLOGY INDIA PVT. LTD. (AHMEDABAD)	
		CONTROL COMPONENT INC.	USA	
		DRESSER VALVE INDIA PVT. LTD	COIMBATORE	
		DAUME REGELARMATUREN GMBH,	GERMANY	
		EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	CHENNAI	
		FORBES MARSHALL ARCA PVT.LTD.	PUNE	
		WEIR VALVES & CONTROLS UK LTD.	UK	
		HOLTER REGELARMATUREN GMBH & CO.KG	GERMANY	
		INSTRUMENTATION LTD.	PALAKKAD	
		KOSO INDIA PRIVATE LIMITED,	NASHIK	
		LESLIE CONTROLS, INC	USA	
		MIL CONTROLS LTD.	THRISSUR	
		METSO SINGAPORE PTE. LTD.,	SINGAPORE	
		PARCOL S.P.A	ITALY	
		R.K.CONTROL INSTRUMENTS PVT. LTD.	THANE	
		RINGO VALVULAS S.L,	SPAIN	
		SEVERN GLOCON INDIA PVT. LTD.	CHENNAI	
		SHENJIANG VALVE CO. LTD.	CHINA	
		VALVITALIA S.P.A. ,	ITALY	
		WALDEMAR PRUSS ARMATURENFABRIK GMBH	GERMANY	
13	STEAM TRAP	SPIRAX MARSHALL	PUNE	MAIN CONTRACTOR COC +MANUFACTURER STANDARD TC SHALL BE SUBMITTED FOR ISSUING DESPATCH CLEARANCE
		UNIKLINGER	PUNE	
		LEADER	JULLANDHAR	
		CRECENT VALVE MFG CO LTD	MUMBAI	
		PENNANT ENGINEERING	PUNE	
14	THERMAL INSULATION	GOENKA ROCKWOOL (INDIA) PVT.LTD.	RAIPUR	
		LLOYD INSULATIONS (INDIA) LTD.	NEW DELHI	
		MINWOOL ROCK FIBRES LTD.	RAJNANDGAON	
		POLYBOND INSULATION PRIVATE LIMITED,	BHILAI	
		ROCKWOOL (INDIA) PVT. LTD.	HYDERABAD	
		SHREERAM EQUITECH PRIVATE LIMITED	DURG	
		THERMOCARE ROCKWOOL INDIA PRIVATE LTD.	CHATTISGARH	

BHEL	TECHNICAL SPECIFICATION FOR FUEL OIL HANDLING SYSTEM SUB-VENDOR LIST	SPECIFICATION NO. PE-TS-XXX-166-A001	
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		LOPINUS ROCKWOOL	GWALIOR	
15	STRUCTURAL STEEL / MS-PLATE	SAIL		
		ESSAR STEEL		
		TISCO		
		RINL		
		JINDAL		
		M/S UTTAM VALUE STEEL (LLOYDS)		
		ISPAT		
		JSW		
		INDIAN IRON & STEEL CO. LTD		
16	SAFETY RELIEF VALVE	SPIRAX MARSHALL	PUNE	
		FISCHER SANMAR	CHENNAI	
		BHEL	TRICHY	
		KEYSTONE	BARODA	
		LEADER	JULLANDHAR	
17	PAINT	ASIAN PAINT		
		BERGER		
		KANSAI NEROLAC		
		JOTUN		
		SHALIMAR		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		AKZONOBEL COATINGS		
18	FITTINGS (MS/SS)	PIPE FIT ENGINEERS	VADODARA	
		GUJRAT INFRA PIPES	VADODARA	
		MS FITTINGS	KOLKATA	
		TUBE PRODUCT	VADODARA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
		NL HAZRA	KOLKATA	
		EXCEL METAL		
		INTERTECH		
		FITTECH		
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
19	OIL HOSE	D WREN & CO	KOLKATA	
		SUDEEP INDUSTRIES	KOLKATA	
		HYDROKRIMP	MUMBAI	
		PRESIDENCY RUBBER	KOLKATA	

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20	**STEAM AND CONDENSATE HOSE**	ALLZFLEX ENGINEERS	VADODARA	
		SUDEEP INDUSTRIES	KOLKATA	
21	**FLOWMETER (CORIOLIS TYPE)**	EMERSON PROCESS MANAGEMENT	CHENNAI	
		E&H	CHENNAI	
		KROHNE MARSHALL	PUNE	
22	**ALUMINUM CLADDING**	BHARAT ALUMINIUM COMPANY LTD	DELHI	
		CHONGQING LANREN ALUMINIUM CO. LTD., CHINA	CHINA	
		HINDALCO INDUSTRIES LTD	MUMBAI	
		NATIONAL ALUMINIUM COMPANY LTD.	ODISHA	
23	**METALLIC EXPANSION BELLOWS**	AEROSUN TOLA EXPANSION JOINT CO. LTD.,	CHINA	
		B. D. ENGINEERS	AHMEDABAD	
		FLEXICAN BELLOWS AND HOSES PVT. LTD.	BARODA	
		FLEXATHERM EXPANLLOW PVT. LTD.	VADODARA	
		LONESTAR INDUSTRIES	CHENNAI	
		MB METALLIC BELLOWS PVT. LTD.	CHENNAI	
		METALLIC BELOWS INDIA PVT. LTD.	CHENNAI	
		QINHUANGDAO NORTH METAL HOSE CO. LTD.,	CHINA	
		TEDDINGTON ENGINEERED SOLUTIONS LTD.	UK	
ELECTRICAL AND C&I				
24	**LEVEL TRANSMITTER (RADAR AND ULTRASONIC TYPE)**	K TEK (ABB)	FARIDABAD	
		E & H	AURANGABAD	
		MEGNETROL	BELGIUM	ONLY RADAR TYPE
		EMERSON PROCESS MGT	PAWANE	
		MOORE INDUSTRIES INTERNATIONAL INC.	USA	
		SIEMENS LIMITED	MUMBAI	
		SMART INSTRUMENTS LTD, BRAZIL	MUMBAI	LD-301 & T-301 TRANSMITTER FROM M/S SMART EQUIPMENTS BRAZIL.
		HONEYWELL AUTOMATION INDIA LIMITED	DELHI	
		TOSHNIWAL INDUSTRIES PVT. LTD.,	AJMER	
		V. AUTOMAT & INTRUMENTS (P) LTD.	DELHI	
		YOKOGAWA INDIA LIMITED,	BANGALORE	
		SIEMENS MILTRONICS	CANADA	ONLY RADAR TYPE
		NIVELCO	HUNGRY	ONLY RADAR TYPE
		HAWK	AUSTRALIA	ONLY RADAR TYPE
25	**LT MOTORS**	CROMPTON GREAVES LIMITED	AHMEDNAGAR	
		KIRLOSKAR ELECTRIC COMPANY	BANGALORE /	