

ANNEXURE

Sl.No	Package Name	Vendor Sl. No	Vendor proposed for approval	TSGENCO Remarks for YTPS (5x800MW)
1.	FLOW ELEMENT-ORIFICE	1	ASIAN INDUSTRIAL VALVES & INSTRUMENTS, TAMILNADU	Approved.
		2	GENERAL INSTRUMENTS CONSORTIUM, TAMILNADU	Approved.
		3	INSTRUMENTATION LTD., KERALA	Approved.
		4	INSTRUMENTATION ENGINEERS PVT LTD., HYDERABAD	Approved.
		5	MICRO PRECISION PRODUCTS PVT. LTD., HARYANA	Approved.
		6	STAR-MECH CONTROLS (I) PVT.LTD., PUNE	Approved.
		7	CHEMTROLS INDUSTRIES PVT. LTD., MUMBAI	Not Approved.
		8	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD., KARNATAKA	Not Approved.
		9	TANSA EQUIPMENTS PVT. LTD., MUMBAI	Approved.

		10	HYDROPNEUMATICS PVT. LTD., GOA	Approved.
		11	MINCO (INDIA) PRIVATE LIMITED, GOA	Not Approved.
		12	MINCO (INDIA) FLOW ELEMENTS PVT. LTD., GOA	Not Approved.
		13	SCIENTIFIC DEVICES (BOMBAY) PVT LTD, MUMBAI	Not Approved.
		14	FLOW STAR ENGINEERING PVT. LTD., FARIDABAD	Approved.
2.	FLOW ELEMENT- NOZZLE	1	ASIAN INDUSTRIAL VALVES & INSTRUMENTS,TAMILN ADU	Approved.
		2	BOPP & RUETHER HEINRICHS MESSTECHNI,GERMAN Y	Approved.
		3	GENERAL INSTRUMENTS CONSORTIUM,NEWDE LHI	Approved.
		4	HYDROPNEUMATICS PVT. LTD., GOA	Approved.
		5	INSTRUMENTATION LTD., KERALA	Approved.
		6	MICRO PRECISION PRODUCTS PVT. LTD., HARYANA	Approved.
		7	STAR-MECH CONTROLS (I) PVT.LTD., PUNE	Approved.
		8	TECHNOMATIC ITALY	Approved.

		9	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD., KARNATAKA	Not Approved.
		10	MINCO (INDIA) FLOW ELEMENTS PVT. LTD., GOA	Approved.
		11	MINCO (INDIA) PRIVATE LIMITED, GOA	Not Approved.
3.	CONTROL VALVE	1	BTG KALLE INVENTING, SWEDEN	Approved.
		2	CONTROL COMPONENT INC.,NEW DELHI	Approved.
		3	DAUME REGELARMATUREN GMBH,	Approved.
		4	DRESSER VALVE INDIA PVT. LTD, TAMIL NADU	Approved.
		5	DRESSER PRODUITS INDUSTRIELS, FRANCE	Approved.
		6	EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	Approved.
		7	FORBES MARSHALL ARCA PVT.LTD., PUNE	Approved.
		8	FISHER SANMAR LTD., NEWDELHI	Approved.

9	FLOWSERVE INDIA CONTROLS PVT. LTD., KOLKATA	Approved.
10	INSTRUMENTATION LTD., KERALA	Approved.
11	KSB MIL CONTROLS LTD., KERALA	Approved.
12	KOSOFLUID CONTROLS PALAKKAD, KERALA	Approved.
13	KOSO INDIA PRIVATE LIMITED, MAHARASHTRA	Approved.
14	LESLIE CONTROLS, INC, USA	Approved.
15	SEVERN GLOCON INDIA PVT. LTD., TAMIL NADU	Approved.
16	BOMAFA SPECIAL VALVE SOLUTIONS PVT LTD., GUJARAT	Approved.
17	MASCOT VALVES PVT. LTD., GUJARAT	Approved.
18	R.K.CONTROL INSTRUMENTS PVT. LTD., MAHARASHTRA	Approved.
19	SUZHOU DELAN ENERGY SCIENCE & TECHNOLOGY CO., LTD., CHINA	Not Approved.

		20	VALVITALIA S.P.A. , ITALY	Not Approved.
		21	WALDEMAR PRUSS ARMATURENFABRIK GMBH, GERMANY	Not Approved.
4.	ULTRASONIC FLOWMETER	1	CHEMTROLS INDUSTRIES LTD, MUMBAI	Approved.
		2	FLASH FORGE MUMBAI	Approved.
		3	ADEPT FLUIDYNE PVT. LTD., MAHARASHTRA	Approved.
		4	ELECTRONET EQUIPMENTS PVT LTD., PUNE	Approved.
		5	FLEXIM FLEXIBLE INDUSTRIEMESSTECH NIK GMBH, GERMANY	Not Approved.
		6	NIVUS GMBH, GERMANY	Not Approved.
		7	ROCKWIN FLOWMETER INDIA PVT. LTD., GHAZIABAD (UP)	Not Approved.

SI No.	Package Name	Vendor Name	LOCATION
1	LOCAL CONTROL PANELS	C and S ELECTRIC LTD.	New Delhi
		PYROTECH ELECTRONICS PVT. LTD.	Udaipur
		PROCON INSTRUMENTATION PVT. LTD.	Chennai
		INDUSTRIAL CONTROLS & APPLIANCES PVT LTD	Mumbai
2	ANALYSERS (ALL TYPES)	ABB INDUSTRIES AG	SWITZERLAND.
		ROSEMOUNT ANALYTICAL INC	IRVINE
		ENDRESS + HAUSER INDIA PVT. LTD.	MUMBAI
		HACH LANGE S.A.R.L CH-1222,	VESENAZ
		SWAN Analytische Instrumente AG, CH-8340	Hinwii
		METTLER-TOLEDO INDIA PVT. LTD.,	MUMBAI
		THERMO ORION INC	BEVERLY
3	UPS	EMERSON NETWORK POWER,	AMBERNATH
		EMERSON NETWORK POWER	PUNE
		HITACHI-HIREL,	GANDHINAGAR
		KELTRON,	TRIVANDRUM
		CONSUL NEOWATT POWER SOLUTIONS,	PUNE
5	MOTORISED ACTUATOR	ROTARK	UK
		AUMA	Bengaluru
		WEIR BDK VALVES	Hubli
		LIMITORQUE	Faridabad
6	AIR FILTER REGULATOR	PLACKA	Chennai
		SHAVO-NORGREN	Mumbai
		SCHRADER SCHORILL DUNCAN LTD.	Mumbai
		FAIRCHILD	USA
		SMC PNEUMATICS	Noida
7	SOLENOID VALVE	ASCO	USA
		ROTEX	Vadodra
		SCHRADER	Pune
		AVCON	Mumbai
		HERION-NORGREN	Germany
		IMI-NORGREN	Germany
		JAFFERSON	Argentina

Notes :-

1) The above sub-vendor list is tentative & reference only. However sub-vendor list is subject to BHEL/end user approval without any commercial/delivery implication.

2) New subvendor, if proposed by vendor during contract stage shall be subject to BHEL/end user approval without any commercial implication.



TITLE : 5X800 MW YADADRI THERMAL POWER STATION	SPECIFICATION NO. PE-TS-417-155A-A001	
	SECTION : I	
	SUB-SECTION: IA	
	REV. NO. 00	DATE :
TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT		

NOTE:

1. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL.

BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.

2. DEALERS ARE NOT ACCEPTABLE FOR ANY ITEM OF THE PACKAGE. BIDDER SHALL PROCURE ALL ITEMS INCLUDING PLATES, STRUCTURAL, FLANGES; COUNTER FLANGES ETC. FROM APPROVED SUB VENDOR ONLY.
3. THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ CUSTOMER.



TITLE:

**TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT
5X800 MW YADADRI THERMAL POWER STATION**

SPEC NO: PE-TS-417-155A-A001

SECTION: I

SUB-SECTION: I A

REV NO: 0

DATE:

ANNEXURE-III**PERFORMANCE GUARANTEES**

VOLUME : X**SECTION-I****PERFORMANCE GUARANTEES****1.00.00 PERFORMANCE GUARANTEES, PERFORMANCE/ACCEPTANCE TESTS & LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE**

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

- a) Those which attract liquidated damages, as listed below (Category-"A"). The Bidder shall furnish signed declarations in the manner prescribed in the bid proposal schedules for these guarantees.
- b) Those which do not attract liquidated damages, as listed below (Category-"B"). This guarantee list indicated in this section is not exhaustive and the Owner reserves the right to call upon the Bidder to demonstrate any parameter, operation, etc. of any equipment as specified and as required to meet the duty conditions.

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

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

OR

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

1.03.00 All guaranteed parameters shall necessarily be quoted by the Bidder based on the established proven results obtained from similar units in successful operation. Evidence for this shall necessarily include the test codes used, acceptance test results, accuracies of various instruments used for the performance test, details of tolerances, if allowed, etc. While quoting the guaranteed parameters, the Bidder shall keep in view the requirements

specified in the specification especially regarding the reliability, operability and maintainability of the equipment proposed. The Owner reserves the right to evaluate the parameters quoted by the Bidder based on his experience and published material available.

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

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

1.06.00 **Performance/Acceptance Tests**

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

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

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

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

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

For the purpose of Taking over of the Plant, the following activities shall have to be completed successfully.

- i) Mechanical Completion
- ii) Preliminary Operation
- iii) Initial Operation
- iv) Reliability Operation
- v) Trial Operation
- vi) Performance Guarantee Tests

2.01.00 **Mechanical Completion**

- (a) Mechanical completion is defined as the state of readiness of works and completeness of Field Quality checks under the scope of contract to undergo the pre-commissioning checks, followed immediately thereafter by commissioning including preliminary operation, initial operation, reliability operation, performance tests including unit characteristics tests for functional or operational occupation of the

works.

- (b) Mechanical completion shall be deemed to occur when the contract erection/installation/construction and Field Quality check works are completed as per specifications for all equipment / systems including standby. It also include but not limited to the following:
 - (i) all installation/erection and Field Quality checks duly carried out and individual protocol viz. erection, FQA (Field Quality Assurance) and commissioning protocol to be signed.
 - (ii) all defects/deficiencies notified by the Purchaser during installation/erection rectified to the satisfaction of Purchaser which, in the opinion of the Purchaser, will not affect the safe operability and maintainability of the works, and
 - (iii) the contract works, in the opinion of Purchaser, subject to sub-clause (ii) above, being fit, sound, safe and operable for undertaking the pre-commissioning checks, preliminary operation, initial operation, reliability operation and performance tests including unit characteristics tests followed by subsequent commercial operation without interruption for reason of defect/deficiency or unfulfilled obligations of the Contractor in the erection/installation work.

2.02.00

Specific Requirements of Mechanical Completion

- (a) Mechanical completion in different disciplines shall be determined based on the following characteristics, signifying the readiness of the works/plants and systems for undertaking the pre-commissioning checks and subsequent preliminary operation, initial operation, reliability operation and performance tests including unit characteristics tests as applicable to the contract works:
 - (i) All plant construction/installation in various disciplines, as detailed under (b) below and as applicable to the contract are completed including aesthetic and workmanship and safety aspects, with all installation/construction checks as per specification, relevant codes, standards and practices ensuring conformity to contract and meeting any applicable statutory requirements.
 - (ii) All contractual obligations up to the stage of completion of construction / installation are fulfilled to the satisfaction of the Purchaser.
- (b) All contract works or otherwise ready to be taken into service, or for functional or operational occupation save pre-commissioning/ commissioning checks, preliminary operation, initial operation, reliability operation, performance tests, unit characteristics tests are to be carried out as per approved commissioning procedure submitted by the contractor including but not limited to the following:

- (i) Areas inclusive of all roads, accesses, structures, housings, platforms, walkways, stairs, ladders, safe approach to equipments, safety/ protective guards, covers, hand rails and such items of work are constructed as per specification and approved for use.
- (ii) Drains, sewers, waste disposal channels, vents, chutes, ducts and such works are constructed and connected to treatment and other disposal systems.
- (iii) Equipment and piping in different systems/disciplines with all appurtenances, auxiliaries and accessories along with supporting structures, hangers, mounts, etc., are erected/ installed, supported, anchored, aligned, grouted and adjusted for operating conditions.
- (iv) Electrical power supply, control, communication and lighting equipment along with control panels, control desks, switchgear, local starters and such accessories along with protective systems, interlocks and integral and auxiliary systems are permanently installed, aligned and adjusted, with megger, continuity and specified installation checks duly carried out.
- (v) Cables are laid, routed, supported, dressed, clamped, tagged, ferruled and terminated with clamp terminals designated and all continuity and megger checks duly carried out.
- (vi) Safety/relief valves are calibrated and set to operating conditions and tried out. All safety systems are installed, calibrated, checked and accepted.
- (vii) Plant identification numbers, colour codes, tags, nameplates are duly mounted / painted/affixed.
- (viii) All painting, lining and insulation works are completed with specified checks to the satisfaction of the Purchaser.

2.03.00

Other Prerequisites for Mechanical Completion

The Contractor shall also meet the following prerequisites for mechanical completion:

- (a) Submit a compilation of all reports of shop tests, material tests and various stage inspection establishing total compliance to contract specification in manufacturing items of supply of contract.
- (b) Submission of a certificate by the Contractor in a format agreed by the Purchaser that the contract works have been designed, selected, manufactured, furnished and installed under the full responsibility of the Contractor.
- (c) All erected plants, structures, equipment and systems are maintained and preserved in sound condition and are fit and sound to undertake

pre-commissioning checks and 'tests before commercial operation' for operational and functional occupation immediately thereafter.

- (d) All areas and constructed works are cleared daily upto the satisfaction of the Owner of all construction materials, temporary works, debris, rubbish water and all such impediments to render the contract works safe, sound and operable.
- (e) All safety features and safety equipment are functional.
- (f) Fire prevention and fire extinguishing system in all fire prone areas are to be made functional.
- (g) Any specific statutory approvals pre-requisite to commissioning of the plant are duly obtained.

2.04.00 **Preliminary Operation**

Preliminary operation shall mean all activities undertaken as part of commissioning after mechanical completion upto commencement of initial operation and shall include mechanical and electrical checkouts, calibration of instruments and protection devices, commissioning of sub/supporting systems covered under the contract.

2.05.00 **Initial Operation**

Initial operation shall include all operations undertaken as part of commissioning after completion of preliminary operation upto commencement of reliability operation. It shall be the first integral operation of the complete BOP integrated with Boiler, Turbine Generator package covered under the contract and shall include first light up / initial equipment rolling, equipment stretch-out, dry-out no-load / partial load /full loads runs for mechanical / electrical tryout and gathering of operational data, calibration, setting and commissioning of controls systems; and shutdown inspection and adjustment after running trails of the plant under the contract.

During initial operation each and every activity wise commissioning protocols are to be jointly signed by the Purchaser and Contractor commissioning team.

The auto loop control tuning shall continue upto the commencement of 72 hour full load operation of trial run.

The initial operations shall include operation of unit as a whole under normal operating conditions for twenty four (24) consecutive hours at the 100% TGMCR load or twelve (12) consecutive hours for two (2) consecutive days at the 100% TGMCR load unless otherwise agreed to by the Purchaser or restricted by system load conditions. The completion of initial operation will be certified in writing by the Purchaser.

2.06.00 **Reliability Operation**

- (a) After the initial operations, the plant shall be on reliability operation. During the reliability operation, the Contractor will be allowed to make

minor adjustments as may be necessary, provided that such adjustments do not interfere with or prevent the commercial use of the plant or result in significant reduction of output. The duration of the reliability operation of plant shall be spread over a period of thirty (30) days. The maximum number of interruption attributable to Contractor shall be of four (4) numbers each not exceeding four (4) hours duration. In case either the number of interruptions, attributable to the Contractor, exceeds four (4) or the duration of any of the four (4) interruptions exceeds four (4) hours the reliability test shall be repeated.

- (b) For the period of reliability operation, the time of actual operation shall be counted. In case the duration of actual continuous operation of any of the above modes is discontinued for reasons, which are not due to Contractor's fault or negligence, that particular test would be deemed to have satisfied the reliability operation test. However, should the test be discontinued due to Contractor fault, the test shall be restarted for that particular case.
- (c) Should any failure (other than of an entirely minor nature) due to or arising out of faulty design, materials, or workmanship (but not otherwise) occur in any item of the plant, sufficient to prevent commercial use of the plant, the reliability test period of thirty (30) days shall recommence for that item after the defect has been remedied by the manufacturer/Contractor. The onus of proving that any failure is not due to faulty design, materials and workmanship will lie with the Contractor.
- (d) A 'reliability operation' report comprising observations and recordings of various parameters measured in respect of the 'reliability operation' shall be prepared and submitted to the Purchaser. This report, besides recording the details of various observations during 'reliability operation' shall also include the dates of start and finish of the reliability operation and shall be signed by the representatives of both the parties. The report shall have recordings of all details of interruptions that occurred, adjustments made and any repairs carried out during the 'reliability operation'.

Also a punch list is to be prepared during the reliability test and the defects are to be rectified by the contractor before commencement of 72 hour operation at full load during trial operation.

- (e) Should any failure or interruption occur in any portion of the tests due to or arising from faulty design, materials, workmanship, omissions, incorrect erection, or inadequate instructions by the Contractor's supervisors, sufficient to prevent safe commercial use of the plant, the reliability operation test at the particular load shall be considered void and the reliability test shall recommence after the Contractor has remedied the cause of the defect.
- (f) During the reliability operation all the equipments, Raw/ DM water system and sub-systems, control loops, interlocks and protection including switchyard installations will be in service and change over to standby equipments are to be done on running condition of the unit.

- (g) The 'reliability operations' shall be considered successful, provided that each item of plant can meet the above requirements.
- (h) Upon the completion of 'reliability operations', as soon as practicable, or at such time as may be otherwise agreed to by the parties concerned, the Contractor shall notify in writing to the Purchaser that the Plant is ready for performance tests.

2.07.00

TRIAL OPERATION:

1. On completion of erection of any major items along with its auxiliaries, the same shall be thoroughly inspected by the Contractor together with the TSGENCO's Engineers for correctness and completeness and acceptability for pre-commissioning tests. Though the TSGENCO's Engineers associate themselves with such inspection, the responsibility for declaration for correctness, completeness and acceptability shall rest with the Contractor and the pre-commissioning tests and inspections shall be carried out after such declaration. The pre-commissioning tests to be performed at site as well as necessary documentation and formats for the protocols to be signed during and after the tests shall be prepared by the Contractor taking into account relevant Indian/International/ Manufacturers standard as applicable and finalized by the TSGENCO sufficiently in advance through mutual discussions. On conclusion of satisfactory pre-commissioning tests of each individual equipment, the trial operation of the unit shall start consistent with parameters of the technical specifications.
2. The duration of trial operation shall be for 14 days during which period the unit shall be run from half to full load or any other load cycle mutually agreed to during which period the unit shall run at full load for 72 hours continuously. However, if required, the Purchaser and the Contractor may mutually agree for economical load operation for 48 hours continuously. Any interruption caused by the Contractor up to 24 hours will not effect the period of 14 days indicated above. In case of such interruption occurring for more than 24 hours, the above period shall be extended correspondingly. During the above trial operation the standby auxiliary equipment shall also be run for a minimum period of more than 72 hours during which period the equipment shall run at its rated capacity for a minimum period of 24 hours. Further the above trial operation shall be carried out in full fledged manner with the associated instruments and controls. The unit is deemed to be commissioned on successful completion of the above trial operation.
3. A document shall be prepared on the results of trial operation. This document besides recording of the details of the various observations during the trial run will also include the date of start and finish of the trial operation and will be signed by the representative of both the parties. The document of the trial operation shall have log sheets and all adjustments, repairs, interruptions etc., shall be recorded therein. If any major adjustment is carried out which has been changed from the initial operation value, then the reason for it is to be furnished in the

report in detail.

The Purchaser and the Contractor will observe the plant overall reliability and shall test the equipment runback, rundown, auto start of equipments, CMC function and its reliability, complete automation of the plant system etc.

4. The readiness of the unit for the trial operation shall be intimated by written notice to the TSGENCO after mutual discussions. After receipt of such notice if the trial operation could not be performed or could not be completed due to any reasons not attributable to the Contractor and if the situation continues, the Contractor shall be absolved of the responsibility for the delay and the plant shall be deemed to have been taken over by the TSGENCO at the end of 60 days after the Contractor's notifications of readiness of the same.
5. The trial operation shall be carried out in compliance with relevant manufacturer's standards and/or relevant Indian/International standards and manufacturer's operation directions before starting them.
6. Defects which are minor in nature and do not endanger the safe operation of the plant, shall not be considered as reasons for not taking over the plant by the TSGENCO. These defects shall be listed in the above mentioned documents and shall be rectified by the Contractor in accordance with the agreement made in this respect.

2.08.00

Performance Tests

- (a) PG test notification to be given by the contractor to the purchaser after COD. The performance tests shall be conducted at site on all major systems by the Contractor. The Contractor's commissioning Engineers shall make the entire plant ready for such tests and assist the Purchaser in operation during the tests. The test shall be commenced after the 'Plant/Equipment' has attained stable operation at the end of 'reliability operation'. The date of commencement of the performance tests shall be as soon as practicable on completion of the 'reliability operation' or as may be mutually agreed upon between the Contractor and Purchaser.

Final trial operation shall be carried out for a period of seventy two (72) hours at 100% TGMCR before 'taking over'.

- (b) **Independent Inspector**

The Purchaser reserves his right to appoint an independent inspector at his own cost as his representative to discuss the test programme, to approve the instrumentation, to witness the tests and to analyze the test results.

- (c) The tests shall be binding on both the parties of the contract to determine compliance of the 'plant'/'equipment' with the performance

guarantees.

- (d) The performance tests shall be carried out to prove the guarantees. The purpose of the performance tests is to check whether the plant meets the guaranteed performances.
- (e) The performance test procedure, the instrumentation to be installed, the instrument accuracy classes, including the definition of the calculation method to be used, the areas of responsibility and the items which specifically require preparation and agreement shall be submitted by the Contractor for review and approval during detail engineering phase. The schematics identifying the guarantee test instrumentation shall be submitted along with procedure. It shall be ensured that necessary test points and spool pieces are installed during the detail-engineering phase and also identified in process and instrumentation drawings. Code of the PG test is to be fixed up during detail engineering stage. The Contractor shall furnish detail test programme during detail engineering stage.
- (f) The performance test instruments shall be of precision type with instrument accuracy limits as required and defined in the applicable performance test codes such that measurement uncertainty does not exceed the values agreed to by the Contractor in the Schedule of Performance Guarantees.
- (g) All test instrumentation for the performance tests as required shall be supplied by the Contractor on loan basis. All costs associated with the supply, calibration, installation and return of the test instrumentation are deemed to have been included in the contract price. The test shall be in accordance with those specified or as per agreed performance test codes. Batch calibration shall not be accepted.
- (h) Any special equipment, tools and tackle required for successful completion of the performance tests shall be provided by the Contractor.
- (i) It is Contractor's responsibility to co-ordinate for carrying out the performance tests. The duration of the test shall be in accordance with the agreed test codes. All other tests to prove the guarantees as indicated in the Contractor's offer shall also be conducted.
- (j) The plant parameters during the performance test shall be adjusted as far as practicable to the guaranteed performance test conditions. The tests shall be conducted to provide guaranteed parameters as defined in the contract.
- (k) Category-B tests are to be completed before Category-A PG test. Protocols are to be signed jointly by the Purchaser and Contractor for each Category-B test.
- (l) **Reporting of Test Results**
 - (a) Within two weeks after the conclusion of the performance test,

the Contractor shall submit ten (10) copies of test reports to the Purchaser stating whether the plant passed or failed such test(s), accompanied by sufficient test data and calculations to demonstrate the level of performance attained with respect to each of the tested parameters.

- (b) The report(s) shall include as a minimum, the following:-
 - (i) Scope
 - (ii) Various guaranteed parameters & tests as per the contract.
 - (iii) Codes/standards used
 - (iv) . Description of the test procedures
 - (v) Full schematic diagrams with indication of test instruments locations and identification tags of same.
 - (vi) Instrumentation details and calibration.
 - (vii) Duration of test, frequency of readings and number of test runs
 - (viii) Test logs and summary of test readings used for performance calculations.
 - (ix) Full set of correction curves.
 - (x) Computation of test results.
 - (xi) Sample calculation
 - (xii) Performance calculation
 - (xiii) Computations to prove measurement uncertainty is within acceptable limits.
 - (xiv) Acceptance criteria
 - (xv) Any other information required for conducting the test
 - (xvi) Conclusions of performance tests.
- (m) Within fifteen (15) days of receipt of such test report(s), the Purchaser shall submit a notice to the Contractor stating either:-
 - (i) That Purchaser concurs with the information provided in the test report(s), or
 - (ii) That Purchaser disputes some or all of the information provided

in the Contractor's test report(s), the areas being disputed, and the levels of performance being disputed.

- (n) If Purchaser concurs with the information in the Contractor's test report(s), the Purchaser shall, within fifteen (15) days of receipt of the test report, provide a written notice to the Contractor accepting the results of the tests.
- (o) If Purchaser disputes any or all of the results contained in the Contractor's test report(s), the Contractor and Purchaser shall meet within fifteen (15) days of the receipt of the Purchaser notice at a mutually acceptable location to review and discuss the dispute.

All the category-B test results are to be computed and to be submitted along with the PG test report for detail study by the Purchaser.

2.08.00 **Notice of Tests**

The Contractor shall issue 21 days notice to the Purchaser of the date after which he will be ready to commence the tests and the Contractor shall commence the tests promptly thereafter.

2.09.00 **Delayed Tests**

- (a) If the tests could be carried out but are being unduly delayed by the Contractor, the Purchaser may by notice inform the Contractor to conduct the tests within 14 days after the receipt of such notice. The Contractor shall conduct the tests on such days within that period as the Contractor may fix and of which he shall issue notice to the Purchaser.
- (b) If the Contractor fails to conduct the tests within such notice period, the Purchaser may himself proceed with the tests. All tests so conducted by the Purchaser shall be at the risk and cost of the Contractor and the cost thereof shall be deducted from the contract price or charged to the Contractor. The tests shall then be deemed to have been conducted by the Contractor and the test results shall be binding on the Contractor.

(c) **Facilities for Tests on Completion**

Except where otherwise specified, the Contractor shall provide and bear costs for these items, as may be required to carry out the tests on completion.

(d) **Retesting**

If the plant fails to pass the test (which in the case of performance tests means not achieving the acceptable limits), the Purchaser may require such tests to be repeated on the same terms and conditions save that only reasonable notice of the date and time of such tests shall be required to be given by the Contractor to the Purchaser.

(e) **Disagreement as a Result of Tests**

If the Purchaser and the Contractor disagree on the interpretation of the test results, each shall give a statement of his views to other within 14 days after such disagreement arises. The statement shall be accompanied by all relevant evidence.

3.00.00

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

Sl. No.	Plant/ System	Parameter for Performance Guarantee	Liquidated Damages
3.01.00	Plant		
3.01.01	Efficiency of steam generator	Efficiency of the steam generator at 100% & 80% TMCR while firing the Design coal at rated steam parameters, rated coal fineness and rated excess air. (Refer Note-1 for estimation of weightage factor.) Design coal shall be blended coal (50% imported coal + 50% indigenous coal).	As per Volume-I.
3.01.02	Steam generating capacity	Steam generating capacity in T/hr of steam at rated steam parameters at superheater outlet (with any combination of mills working) with the coal being fired from within the range specified.	As per Volume-I.
3.01.03	Turbine Cycle Heat rate	Turbine Cycle Heat rate in kcal/kWh under rated steam conditions, design condenser pressure with zero make up at 100% & 80% of rated load (Refer Note-1 for estimation of weightage factor.)	As per Volume-I.
3.01.04	Output	Continuous output (MW) of 100% TMCR at Generator terminals under rated steam conditions at Turbine Inlet (247 kg/cm ² (a), 565°C, 593°C) and CW temperature of 33°C with 0% make-up with excitation power deducted	As per Volume-I.
3.01.05	Condenser Pressure	Condenser pressure in mm Hg (abs) under VVO conditions, 3% make up, design CW temperature and CW flow.	As per Volume-I.



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

NOT APPLICABLE

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

1.02.00 CONDENSATE POLISHING UNIT (CATEGORY-B)

1.02.01 The design flow (through working vessels) for each condensate polishing plant shall be the corresponding condensate flow of TG unit at VWO (Valve wide open) condition at 1% cycle make-up (Flow through each service vessel indicated in the data sheet).

1.02.02 During Normal Operation, the following dissolved solids concentration and conditions shall be used as a basis of design for the condensate polishing system. The ionic concentrations indicated below are as such.

CONTAMINANT	UNIT	INFLUENT	EFFLUENT
Ammonia	ppb	250	Below detectable limit.
Total dissolved solids (TDS, ammonia excluded)	ppb	110	< 25
Conductivity (at 25°C) (After removal of all amines)	Micro S/cm	As actual	< 0.1 (after hydrogen column at 25°C)
Silica (as SiO ₂)	ppb	30	< 5 (Refer note # 1)
Total Ferric Iron	ppb	50	< 2
Sodium(as Na)	ppb	10	< 2
Chloride (as Cl)	ppb	20	< 2
pH (polisher runs at 25°C with H/OH mode)		8.5-9.0	6.5-7.5
Crud (mostly black oxide of iron)	ppb	50	< 5

Note: 1. For temperature 50°C and above the silica value in the effluent shall be based on the resin supplier's recommendations.

Under the Normal Condition, each Condensate Polisher Mixed Bed shall be designed to operate in hydrogen cycle for not less than 240 hours of continuous operation, while maintaining the above treated condensate quality.

1.02.03 During start up conditions, quality of the influent may deteriorate to –

CONTAMINANT	UNIT	INFLUENT	EFFLUENT
Ammonia	ppb	1500	Below detectable limit.
Total dissolved solids (TDS, ammonia excluded)	ppb	As actual	< 50
Conductivity(at 25°C)	Micro S/cm	As actual	< 0.2 (after hydrogen column at 25°C)
Silica (as SiO ₂)	ppb	500	< 20 (Refer note # 1)
Crud (mostly black oxide of iron)	ppb	1000	< 100
pH(polisher runs at 25°C with H/OH mode)		9.0-9.6	6.5-7.5
Total Ferric Iron	ppb	1000	< 10
Sodium(as Na)	ppb	20	< 5
Chloride (as Cl)	ppb	100	< 10

Note-1: For temperature 50°C and above the silica value in the effluent shall be based on the resin supplier's recommendations.

Useful service run under this condition shall be 48 hours before regeneration.



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1.02.04 CONDENSER TUBE LEAKAGE CONDITION:

During condenser tube conditions, quality of the influent may deteriorate to:

CONTAMINANT	UNIT	INFLUENT	EFFLUENT
Total dissolved solids (TDS, ammonia excluded) (In addition to normal influent contaminants stated in clause 1.02.02 above)	ppb	2000	---
Silica (as SiO ₂)	ppb	<i>As actual</i>	< 20 (Refer note # 1)
Sodium(as Na)	ppb	<i>As actual</i>	< 20

Note-1: For temperature 50°C and above the silica value in the effluent shall be based on the resin supplier's recommendations.

Useful service run between regeneration under the Startup conditions and under condenser tube leakage condition shall not be less than 48 hours each.

1.02.05 Influent water quality as indicated in the above clauses is minimum only. Bidder to check the same and higher values, if felt by them, shall be considered in the design so as to meet the specified effluent quality.

1.02.06 The bed cross section in the service vessels shall be such that the average velocity of condensate through it shall not exceed 2 meters/min (120 M3/hr/M2) at the design flow rate for spherical vessel. Internal diameter of the service vessels (excluding the rubber lining) of spherical type shall be selected meeting the above mentioned velocity criteria. The effective depth of mixed bed in condensate polisher service vessel shall be not less than 1100 mm.

1.02.07 At the design flow rate, the pressure drop across the polisher service vessels with clean resin bed shall not exceed 2.0 bar. This pressure drop shall include losses due to entrance and exit nozzles, distributors, under drains, resins and the effluent resin traps. Maximum pressure drop under dirty conditions will be restricted to 3.5 bar including the pressure drop across effluent resin traps.

1.02.08 Cation resins shall be regenerated by technical grade hydrochloric acid to IS:265 (concentration 30-33% by volume) and anion resins by sodium hydroxide, rayon grade to IS:252 available as 40-48% lye or as flakes. For calculations regeneration temperature should be taken as 25 Deg. C.

In no case, the regeneration levels cannot be lower than the values indicated below:

- a) Cation resin: 125 kg of 100% HCl per cubic meter of resin
- b) Anion resin: 160 kg of 100% NaOH per cubic meter of resin.

1.02.09 Each rinse water outlet header of condensate polishing unit shall be provided with a pressure reducing station with isolating valves, suitably designed to enable the water entry to the both condenser's hot well which is operating under vacuum. Each pressure reducing station shall consist of either a pressure reducing valve from design pressure of service vessel to condenser vacuum or a combination of orifice plates to reduce pressure from design pressure of service vessel to 2 kg/cm² and a pressure reducing valve from 2 kg/cm² to condenser vacuum.

1.02.10 While calculating pump head, 10% margin (minimum) shall be considered of the value of friction losses. Pipe friction loss shall be calculated as per Willam-Hazen formula and "C" value to be adopted shall be as below:-

1. Carbon Steel pipe	:	100
2. CI pipe/ductile Iron	:	100
3. Rubber lined steel pipe	:	120
4. Stainless steel pipe	:	100
5. PVC/HDPE pipe	:	140



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- 1.02.11 Each Pump shall be guaranteed for capacity, total dynamic head and power consumption for CPU package.
- 1.02.12 All blowers shall be guaranteed for head and power consumption for CPU package.
- 1.02.13 Each Condensate Polisher Mixed Bed will have a rated continuous treated water output capacity of not less than design value. Each Condensate Polisher Mixed Bed Unit shall be regenerated once after every 240 hours of continuous service run during normal operation.
- 1.02.14 Net output from each of Condensate Polisher Mixed Beds shall be not less than design volume of treated water for the design water analysis as exhibited in cl. no. 1.02.02, 1.02.03 & 1.02.04. In case water analysis is different from the design values, guaranteed quantity shall be calculated as indicated elsewhere in this Specification and guarantee shall be applicable on this calculated quantity.
- 1.02.15 Chemical consumption of the Condensate Polisher Mixed Bed as indicated by the Bidder shall be guaranteed against the regeneration level employed and resin volume provided without any tolerance.
- 1.02.16 Qualities of treated water from Condensate Polisher Mixed Bed shall be as per treated water analysis as exhibited in cl. no. 1.02.02, 1.02.03 & 1.02.04.
- 1.02.17 Noise level of all pumps and blowers at the rated duty point shall be demonstrated at site.
- Maximum noise level shall not exceed 85 dB (A) when measured at 1.0M away from the noise emission source.
 - Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, 'Ambient Air Quality Standards' in respect of noise.
 - Any statutory changes in stipulations regarding noise limitation that may occur in future according to State Pollution Control Board or Central Pollution Control Board or Ministry of Environment & Forest regulation during tenure of the contract, the Bidder shall comply with the requirement.

1.02.18 Liquidate Damages (LD) for Non Achievement of Specific Performance:

The performance Guarantee parameters for Condensate Polishing System have been indicated in above clauses.

No negative tolerance in respect flow, head and other performance guarantee parameters are acceptable to the Purchaser. In case, any equipment of Condensate Polishing System is not able to achieve the performance guarantee parameters during the Performance Guarantee Tests, Bidder shall make necessary modifications or replace the Equipment/ Plant or any part. If even after rectification, the Equipment/Plant is not able to achieve the guaranteed performance parameters, the Purchaser shall have right to reject the Equipment/Plant. In such case, the Bidder shall pay back the total amount paid to them with reference to the Equipment/Plant (with all taxes and duties as applicable) to the Purchaser.

PROCEDURE FOR CONDUCTING PG TESTS

Telangana State Power Generation Corporation Ltd.**EPC Bid Document
e-PCT/TS/K/02/2014-15**

design C W flow and CW i nlet temperature corresponding to guranteed vacuum. T he c leanliness f actor s hall be det ermined in ac cordance with t he latest edition of ASME PTC-12.2.

4.07.00 Feed Water Heaters and Drain Cooler

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

4.08.00 Deaerator

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

The di ssolved o xygen c ontent i n f eed water at outlet of deaer ator s hall be determined b y A SME-D 888. R eference Method A an d an y r ecognised modification thereof.

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

1.00.00 STATUTORY REQUIREMENTS

All par ameters of plant, equipment & facilities which are under j urisdiction of Statutory A uthorities, l ike M OEF, TPCB etc., s hall be g uaranteed. Conformance to the performance parameters under statutory requirement is mandatory.

2.00.00 CONDENSATE POLISHING UNIT

For Condensate polishing plant, the performance test shall be carried out as per the respective equipment specification and the applicable codes.



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ANNEXURE IV

DRAWING DOCUMENTS SUBMISSION/DISTRIBUTION PROCEDURE



TITLE :
**5X800 MW YADADRI THERMAL POWER
STATION**

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DRAWING DOCUMENTS SUBMISSION/DISTRIBUTION PROCEDURE

- Bidder shall submit soft copy/hard copy/CD ROMs of all the finally approved drawings and O&M Manuals as required by Customer/Customer consultant/BHEL-site/BHEL-PEM. The exact number of hard copies/CD ROMs of these documents to be submitted shall be notified to the bidder at the time of detailed engineering and bidder shall submit the same without any commercial/delivery implications to BHEL/Customer.
- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.
- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.
- Editable copy of all the drawings and documents shall be provided.
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copies whichever is later.
- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.
- Vendor to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.
- Bidder to submit instrument schedule, cable schedule and valve schedule in MS- Excel format during detailed engineering.
- Bidder to also furnish the auto cad copy/MS-Excel/MS-word (as applicable) of the following documents after award of contract. However any other auto cad copy/MS-Excel/MS-word of any other document as per the insistence of BHEL and customer will also be submitted by the bidder without any delivery and commercial implication to BHEL and customer.
 - P&IDs.
 - Equipment lay out of the service vessel area and regeneration area.
 - Equipment Cable tray layout for service vessel area and regeneration area
 - Equipment earthing layout service vessel area and regeneration area
 - Civil scope drawings.
 - Piping lay out drawing for Service vessel area, regenerative area and yard piping layout.
 - Valve schedule
 - Instrument schedule
 - Cable Schedule

ii) Other requirements

- Successful bidder shall furnish detailed erection manual for each of the equipment as well as complete system supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.
- Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion. However, in case changes are necessitated due to any constraints at customer end, delay in review/ approval of such revised drawing beyond one month will be to customer's account



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DISTRIBUTION SCHEDULE

S. No	Description	TSGENCO										M/S DCPL, KOLKATA			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			



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S. No	Description	TSGENCO								M/S DCPL, KOLKATA			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	
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

NOTES:

The above schedule of submission does not include Docs/Drgs. of quality assurance/inspection and delivery/dispatches.

All documents & drawings shall be in English and in metric units.



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ANNEXURE V

PAINTING SPECIFICATION

**TECHNICAL SPECIFICATION
FOR
PROTECTIVE LINING AND PAINTING**

SECTION-XIII
TECHNICAL SPECIFICATION
FOR
PROTECTIVE LINING AND PAINTING
C O N T E N T S

<u>CLAUSE NO</u>	<u>DESCRIPTION</u>	<u>PAGE NO.</u>
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2.00.00	CODES & STANDARDS	1
3.00.00	GENERAL REQUIREMENTS	2
4.00.00	EQUIPMENT, MATERIAL AND SERVICES TO BE FURNISHED BY THE BIDDER	4
5.00.00	COATING PROCEDURE AND APPLICATION	7
6.00.00	TEST REQUIREMENTS	8
7.00.00	INFORMATION / DATA REQUIRED	12

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

1.00.00 INTENT OF SPECIFICATION

1.01.00 This specification addresses the requirements of all labour, material, and appliances necessary with reference to preparations for lining / painting, application as well as finishing of all lining / painting for all mechanical and electrical equipment, piping and valves, structures etc. included under the scope of this Package.

1.02.00 The Bidder shall furnish and apply all lining, primers including wash primers if required, under-coats, finish coats and colour bands as described hereinafter or necessary to complete the work in all respects.

2.00.00 CODES & STANDARDS

2.01.00 The Bidder shall follow relevant Indian and International Standards wherever applicable in cleaning of surface, selection of lining material / paints and their application. The entire work shall conform to the following standards / specifications (latest revision or as specified).

- a) SSPC SP 10 / NACE 2 / : Near White Blast Cleaning
- b) SSPC PA 2 : Measurement of dry film Coating Thickness with magnetic gauges.
- c) ASTM D 4541 : Method for pull off strength using portable Adhesion Tester.
- d) NACE RP 0274 – 2004 : High-Voltage Electrical Inspection of Pipeline Coatings
- e) NACE SP 0188 – 2006 : Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

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- f) NACE RP 0169 – 2002 : Control of External Corrosion on Underground or Submerged Metallic Piping Systems
 - g) AWWA C 210 – 2007 : Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
 - h) IS 3589:2001 Annexure B : Steel Pipes for Water and Sewage Specification.
 - i) AWWA C222-2000 : Polyurethane Coating for the Interior and Exterior of Steel Water Pipe and Fittings.
 - j) IS 13213 : 2000 : Polyurethane Full Gloss Enamel (Two pack)

3.00.00 GENERAL REQUIREMENTS

- 3.01.00** The steel surface preparation prior to actual commencement of coating shall conform to SSPC SP 10 / NACE 2 / Sa2½ (near white metal) with sand blasting.
- 3.02.00** The contractor shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to Owner/Consultant for approval.
- 3.03.00** The contractor shall also provide copies of test reports from NABL approved laboratory (like National Test House, Kolkata) in support of the paint/primer materials to be used shall conform to the specification requirement.
- 3.04.00** The contractor shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) shall also be submitted prior to commencement of supply of material and field application.
- 3.05.00** Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.

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- | | |
|---------|--|
| 3.06.00 | Applied coating shall be tested for dry film thickness, holiday (electrical inspection for continuity) and adhesion as per relevant standard such as SSPC PA 2, NACE RP 0274 and ASTM D 4541. |
| 3.07.00 | If necessary, the material may be heated and applied by airless spray / plural component spray system. |
| 3.08.00 | Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints. |
| 3.09.00 | In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a Purchaser approved method shall be adopted. |
| 3.10.00 | The colour scheme of the entire Plant, covered under this specification shall be approved by the Purchaser in advance before application. |
| 3.11.00 | All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by Purchaser. |
| 3.12.00 | Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti corrosive painting. |
| 3.13.00 | For vessels / tanks requiring lining and epoxy painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing. |
| 3.14.00 | Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm. |
| 3.15.00 | Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore). |
| 3.16.00 | After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining. |
-

3.17.00 All lining projecting outside of the vessel shall be protected adequately from mechanical damages during shipment, handling storage etc.

3.18.00 Suitable warnings, indicating the special care that must be taken with respect to these lined vessels shall be stenciled on their outside surface with the letters at least 12 mm high.

3.19.00 All insulated piping shall have aluminium sheet jacketing.

4.00.00 EQUIPMENT, MATERIAL AND SERVICES TO BE FURNISHED BY THE BIDDER

4.01.00 After erection at site, the outside surfaces of all equipment having a shop coat shall be given further priming coat and finished coats of paint as detailed in following clauses. However, if the painting system is such that the shop coat and primer coat to be applied at site are not compatible, then shop coat has to be removed from the surface of equipment before application of primer coat with prior blasting.

All factory finished paints shall be touched up at site as required.

All uninsulated piping shall be finished with final paintings after use of proper wash primer and primer. Aluminium sheet jacketed piping need not be painted. Colour bands of Purchaser's approved shade shall however be applied on jacketed piping near walls or partitions, at all junctions, near valves and all other places as instructed by the Purchaser. All structures shall be painted with approved paint.

4.02.00 Surface Preparation

4.02.01 Unless mentioned otherwise, all rust and mill scale shall be removed by blasting to Sa 2-1/2 Swiss Standard before applying the primer.

4.02.02 Special care shall be taken to remove grease and oil by means of suitable solvents like Trichloroethylene or Carbon Tetrachloride.

4.02.03 The minimum degree of surface preparations for all equipment, piping, fittings, valves, structures etc. shall be "Near White" according to Steel Structure, Painting Council-SSPC-SP-10 before application of any primer/paint.

4.03.00 Painting

-
- 4.03.01 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc. to be installed indoor shall be as follows :
- Surface preparation shall be done either manually or by any other approved method.
 - Primer Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based zinc phosphate.
 - Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based paint pigmented with Titanium Dioxide.
 - Top Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber paint of approved shade and colour with glossy finish.
 - Total DFT of paint system shall not be less than 150 microns.
- 4.03.02 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc to be installed **outdoor** shall be as follows :
- Surface preparation shall be done by means of sand blasting, which shall conform to Sa 2-1/2 Swiss Standard.
 - Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer.
 - Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.
 - Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade and colour with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.
 - Total DFT of paint system shall not be less than 300 microns.
- 4.03.03 Specification for application of paints for external surfaces protection of steel pipes and fittings which are **buried underground / laid in side a hum e pipe & or submerged Under Water and laid under Pipe Trenches** (in road/rail/pipe or trench crossings) shall be as follows :

External surface of the pipe, fittings, specialties etc. handling raw water/clarified water/filter water shall be painted with one coat of two part chemically cured polyurethane primer of min 50 micron dry film thickness followed by three or maximum four coats of two part solvent less polyurethane to build up coating of dry film thickness of 2000 micron including primer coat.

- 4.03.04 Specification for application of paints for **internal surface protection of large diameter pipes** (sizes above 600 mm NB and above) if any, shall be as follows :
- a) All Internal surfaces of steel pipes, fittings, specialties etc. buried underground or located within pipe trenches shall be given epoxy coating to protect them from (except for drinking water service, where the compatible painting shall be so selected to meet relevant quality standards) corrosion.
 - b) Internal surface of the pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT (dry film thickness) followed by two part polyamide cured solvent less epoxy.
 - c) The minimum dry film thickness (DFT) of internal lining shall be 600 micron.
- 4.03.05 Specification for application of paints for protection of **internal surfaces of DM Water Storage Tank(s)** shall be as follows :
- a) Primer - One coat of epoxy primer containing high level of Zinc Phosphate anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.
 - b) Finish Paint - Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.
 - c) Total thickness of primer and paint should not be less than 500 microns.
- 4.03.06 All motors, local push button stations, cable racks, structures used for supports etc. are to be painted with acid proof paint.
- 4.03.07 The following surfaces shall not be painted - stainless steel, galvanized steel, aluminum, copper, brass, bronze and other nonferrous materials.
- 4.03.08 No painting or filler shall be applied until all repairs, hydrostatic tests and final shop inspection are completed.

4.03.09 All machined surfaces shall have two (2) coats of water repellant grease after thorough cleaning.

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface Preparation :

Pipe shall be blast cleaned by sand. The cleanliness achieved prior to application shall be in accordance with the requirement of SSPC SP 10 / NACE 2 / Sa2½ of ISO 8501 (near white metal)

- a) The blast pattern or profile depth shall be 40 to 100 micron and shall be measured by dial micrometer.
- b) Before sand blasting is started or during blasting or coating, temperature of the pipe surface should be more than 3°C above dew point temperature. Blast cleaned surface should be primed within 4 hours and shall be protected from rainfall or surface moisture and shall not be allowed to flash rust. If the rust occurs, the surface again to be prepared by sand blasting or wire brushing.

5.02.00 Application of Epoxy Coating

- a) Coating shall be applied when
 - i) When the pipe surface temperature shall be atleast 3°C above dew point temperature.
 - ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater than 50°C.
- b) Material preparation shall be in accordance with manufacturer's recommendations.
- c) Application of epoxy coating system :

The epoxy coating system shall be applied as per recommendation of the manufacturer and shall be applied by airless spray / plural component spray machine. For more than one coat, the second shall be applied with the time limits as recommended by the manufacturer.

5.03.00 Application of PU Coating

-
- a) PU coating shall be applied when the pipe surface temperature atleast 3°C above dew point temperature (when R.H is more than 85%).
 - b) Material preparation and application shall be done as per manufacturer recommendation.

6.00.00 TEST REQUIREMENTS :

6.01.00 Measurement of dry film thickness

Measurement of dry film thickness of coating : Coating thickness shall be in the range of $\pm 20\%$ and as per SSPC PA 2.

6.01.01 Apparatus / Instrument:-

The instrument used for dry film thickness may be Type 1 pull of gauges or Type 2 electronic gauges.

6.01.02 Procedures:-

- a) Number of measurements:
For 100 square feet (9.29 square meters), five (5) spots per test area (each spot is 3.8 cm) in diameter. Three gauge readings per spot (average becomes the spot measurement).
- b) If the structure is less than 300 square feet, each 100 square feet should be measured.
- c) If the structure is between 300 and 1000 sq ft, select 3 random 100 square feet test areas and measure.
- d) For structure exceeding 1000 square feet, select 3 random 100 square feet testing areas for the first 1000 sq ft and select 1 random 100 square feet testing area for each additional 1000 square feet
- e) Coating thickness Tolerance: Individual reading taken to get a representative measurement for the spot are unrestricted (usually low or high readings are discarded). Spot measurements (the average of 3 gauge readings) must be within 80% of the minimum thickness and 120% of the maximum thickness.
Area measurement must be within specified range.

6.02.00 Electrical Inspection (Holiday) Test

-
- 6.02.01 All the coated / lined pipes shall be tested with an approved high voltage holiday detector preferably equipped with an audio visual signaling device to indicate any faults, holes, breaks or conductive particles in the protective coating.
- 6.02.02 The applied output voltage of holiday detector shall have a spark discharge of thickness equal to at least twice the thickness of the coating to assure adequate inspection voltage and compensate for any variation in coating thickness. The electrode shall be passed over the coated surface at approximately half the spark discharge distance from the coated surface only one time at the rate of approximately 10 to 20m/min. The edge effect shall be ignored. Excessive voltage shall be avoided as it tends to induce holiday in the coated surface thereby giving erroneous readings.
- 6.02.03 While selecting test voltages, consideration should be given to the tolerance on coating thickness and voltage should be selected on the basis of maximum coating thickness likely to be encountered during testing of a particular pipe.
- The testing voltage shall be calculated by using following formula. (as per NACE 0274 : 2004)
- Testing Voltage $V = 7900 \sqrt{T} \pm 10$ percent where T is the average coating thickness in mm.
- 6.02.04 Any audio visual sound or spark leads to indicate pinhole, break or conductive particle.
- 6.03.00 Adhesion Pull off Test :**
- After holiday the coated surface is subjected to adhesion pull off test as per ASTM D 4541.
- 6.03.01 Apparatus / Instrument: Adhesion tester consists of three basic components:
- A hand wheel, a black column containing a dragging indicator pin and scale in the middle and a base containing three legs and a pulling "Jaw" at the bottom and also dollies.
- 6.03.02 Prepare the test surface :
- Once test area is selected, test area shall be free of grease, oil, dirt, water. The area should be flat surfaces and large enough to accommodate the specified number of replicate test.
- 6.03.03 Prepare Dolly (Test Pull Stub) :

The dolly is a round, two sided aluminium fixture. Both sides of the dolly looks same, however, one side sloped on top surface while flat on bottom surface. As the surface of the dolly is polished aluminium, roughen the same using a coarse sand paper.

6.03.04 Select an adhesive:

Use araldite, a 100% solid epoxy adhesive. This adhesive requires at least 24 hours at room temperature to cure.

6.03.05 Attach the dolly to the surface.

- a) Using a wooden stick, apply an even layer of adhesive to the entire contact surface area of the dolly.
- b) Carefully remove the excessive adhesive by using a cotton swab. Allow the adhesive to fully cure before performing the adhesion test.
- c) Attach the dolly to the coated surface and gently push downward to displace any excessive adhesive.
- d) Push the dolly inward against the surface, then apply tape across the head of the dolly.

6.03.06 Adhesion Test Procedure

- a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.
- b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.
- c) Slide the dragging indicator pin on the black column to zero by pushing it downward.
- d) Firmly hold the base of the instrument in one hand and rotate the handwheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum PSI/MPa/Kg/cm² required by project specification is exceeded and the test is discontinued, (b) the maximum PSI/MPa/Kg/cm² of adhesion tester has been achieved and dolly is still attached, (c) The force applied by the adhesion tester causes the dolly to dislodge.

-
- e) Read the scale and record the adhesion value.

6.04.00 Coating Repair

Defective Coating shall be repaired in accordance with the following subsections.

6.04.01 Surface Preparation:

Accessible areas of pipe requiring coating repairs shall be cleaned to remove debris and damaged coating using surface grinders or other means. The adjacent coating shall be feathered by sanding, grinding or other method. Accumulated debris shall be removed by blowing with contaminant free air or wiping with clean rags.

6.04.02 Areas not accessible for coating repair such as interior surfaces of small diameter pipe shall be reprocessed and recoated.

6.04.03 Coating Application :

The coating system shall be applied to the prepared areas in accordance with procedure.

6.04.04 Repair Inspection :

Repaired portion shall be electrically inspected using a holiday detector.

6.05.00 Welded Field Joints

6.05.01 Preparation :

The weld joints shall be cleaned so as to be free from mud, oil, grease, welding flux, weld spatter and other foreign contaminants. The cleaned metal surfaces of the weld joint shall then be blasted or abraded using rotary abrading pads. The adjacent liquid Epoxy / PU coating shall be feathered by abrading the coating surface for a distance of 25 mm.

6.05.02 Electrical Inspection :

After curing the coating system applied to the welding joints shall be holiday tested. Any holidays indicated by the detector shall be marked with chalk to identify the area of repair.

7.00.00 INFORMATION/ DATA REQUIRED

The Bidder shall submit complete list of paints and primers proposed, giving detail information, such as, chemical composition, drying time etc. and also unit rates for application of each type of paint along with supply shall be furnished.

NOTE-

Bidder to note that the paint shade shall be informed/finalized during detailed engineering. The same shall be complied by bidder without any price & delivery implication to BHEL & Customer.



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**TECHNICAL SPECIFICATION FOR CONDENSATE
POLISHING UNIT**

ANNEXURE VI

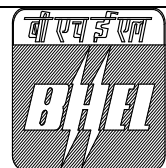
MANDATORY SPARE LIST



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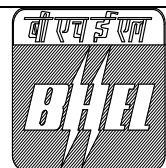
MANDATORY SPARES LIST FOR CONDENSATE POLISHING UNIT

Condensate Polishing Plant (Mandatory Spares List)		
S.No.	Equipment	Spares Quantity for 5 Units
1	Spares for Horizontal Centrifugal Pumps	
1.1	Shaft	2 Nos.
1.2	Shaft Sleeve	4 Nos.
1.3	Impeller	2 Nos.
1.4	Impeller locking nut and bolt	8 Nos.
1.5	Impeller wear ring	8 Nos.
1.6	Casing wear ring	8 Nos.
1.7	Oil Seal	8 Nos.
1.8	Oil Deflector	6 Nos.
1.9	Oil Ring	6 Nos.
1.1	Gland Packing	8 Nos.
1.11	Lantern Ring	6 Nos.
1.12	Mech Seal Assembly	2 Nos.
1.13	Stationary/Carbon Packing and O "Ring for Mechanical Seal"	6 Sets
1.14	Oil Level Gauge	6 Nos.
1.15	Coupling	4 Nos.
1.16	Rubber Bush for Coupling	4 Nos.
1.17	O " Rings "	4 Sets
1.18	Suction Strainers Element	6 Nos.
1.19	Bearing for Pump Motor	4 Sets
2	Spares for Vertical Type Centrifugal Pumps (at Neutralising Pit)	
2.1	Complete Bowl assembly	2 Sets
2.2	Impeller (s)	2 Sets
2.3	Shafts	2 Sets
2.4	Casing wearing (s)	2 Sets
2.5	Impeller wear ring (s)	2 Sets
2.6	Shaft Sleeves	4 Sets
2.7	Shaft Couplings	2 Sets
2.8	Shaft nuts & keys	2 Sets
2.9	Lantern rings	2 Sets
2.1	Bell mouth liner	2 Sets
2.11	Bearings	2 Sets
2.12	Pump motor coupling	2 Sets
3	Spares for Agitators	
3.1	Gear Box Unit Complete	2 Nos.
3.2	Bearing for Gear Box Unit	2 Sets
3.3	Coupling complete (Motor/Gear box and gear box/agitator)	2 Sets



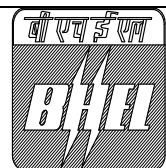
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3.4	Coupling Bolts	2 Sets
3.5	Coupling shim pack (if applicable)	8 Sets
3.6	Oil seals	8 Sets
4	Spares for Valves	
4.1	i) Manual Diaphragm valves	20% of total quantity used for each type and size with minimum no. four (4) for each type and size.
	ii) Auto Diaphragm valves	20% of total quantity used for each type and size with minimum no. four (4) for each type and size.
	iii) Spare Diaphragm for above	20% of total quantity used for each type and size with minimum no. four (4) for each type and size.
	iv) Diaphragm	20% of total quantity used for each type and size with minimum no. two (2) for each type and size.
4.2	i) Non return valves (NRV)	4 nos. of each size & type
	ii) Flaps for above NRV	4 nos. of each size
4.3	Gate/Globe/Ball valves/plug valve/needle valve	
	i) Up to 4"	20% of total quantity used for each type and size with minimum no. four (4) for each type, size.
	ii) Above 4"	2 nos. each type and size.
4.4	Butter fly valve	
	i) Up to 4"	20% of total quantity used for each type and size with minimum no. four (4) for each type, size.
	ii) Above 4"	2 nos. each type and size.
5	Spares for Filter Media/ ION Exchange Resins	
5.1	Media for Activated Carbon Filters	20% of total quantity
5.2	Resins for each type of exchangers	20% of total quantity
5.3	Ejectors	Four (4) nos. of each type
6	Spares for Air Blowers	
6.1	Impeller with shaft	2 Sets
6.2	Bearings	2 Sets
6.3	Oil seals	10 Sets
6.4	Filter	2 Sets
7	Pneumatic Control Valve	
7.1	Pneumatic Diaphragm for Diaphragm actuated valve	4 Nos. for each type of Actuator
7.2	Gland Packing	2 sets for each type of Control Valve
7.3	Plug, Seat, Cage, Stem etc.	2 sets for each type of Control Valve
7.4	Retainer Ring, Seal Ring etc.	2 sets for each type of Control Valve
7.5	Gasket	4 Sets for each type of Control Valve
7.6	Position Transmitter complete set	20% of total quantity used in the system for



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		each type and model.
7.7	Control Valve E/P Positioner complete Set	20% of total quantity used in the system for each type and model.
7.8	Complete Set of Solenoid Valve for Pneumatic type On/Off Valve	4 Nos. for each type & ratings
7.9	Solenoid Coil for Pneumatic type On/Off Valve	10 Nos. for each type & ratings
7.10	Position Limit Switch for Pneumatic type On/Off Valve	20 Nos. for each type & ratings
8	C&I Items	
8.1	Transmitters/ Gauges/Switches etc. along with relevant accessories	20% of total or at least four (whichever is higher) for each type along with accessories.
8.2	Temperature Element (RTD/Thermo-couple) with thermo well	20% of each type, range and immersion length. Minimum 10 nos.
8.3	Analysers	
a)	Field sensor	4 nos.
b)	Field transmitter/ complete electronic unit	2 nos.
c)	Power supply card	2 nos.
d)	Instrumentation hardware	2 nos. each item
8.4	Pneumatic Control Valves & Block Valves	
a)	Plot Relay	2 sets for each valve
b)	Actuator Diaphragm	2 nos. for each valve
c)	Feedback Linkage	2 nos. for each valve
d)	Smart Positioners	20% of total quantity of each model/type
e)	I/P Converters (If any)	20% of total quantity or minimum 30 nos.
f)	Complete Consumables for Valve Viz. O-ring, Gland Packing, Packing Ring, Bonnet Seal etc	4 Sets each size, rating, type
g)	Valve Disc	4 Sets each size, rating, type
h)	Valve Spindle	4 Sets each size, rating, type
i)	Valve Seat	4 Sets each size, rating, type
j)	Bush	4 Sets each size, rating, type
k)	Guide	4 Sets each size, rating, type
l)	Guide Bush	4 Sets each size, rating, type
m)	Coupling Nut	4 Sets each size, rating, type
n)	Actuator Piston with Rod & Seal	4 Sets each size, rating, type
o)	Control valve stem packing and spare operator moulded rubber diaphragms	2 sets for each size, rating, type
p)	Valve trim (including cage, plug, stem, seat rings, guide bushings etc.) for each of the control valves as offered.	2 sets for each size, rating, type
q)	Solenoid valves, position transmitters, limit switches, I/P convertors, positioners etc of each type	20% of total quantity spare with minimum 2 no. for each size, rating, type
8.5	Solenoid Valves	
a)	Solenoid Valve Coil	4 nos. of each rating & insulation



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b)	Plunger	2 nos. of each type
c)	Seat	4 nos. of each type & size
d)	Gaskets	4 sets of each type & size
e)	O-Ring set	10 sets of each type & size
8.6	Flow Elements	
a)	Root valves	4 nos. for each flow element
b)	Gland packing for root valves	4 nos. for each flow element
c)	Gaskets	6 nos. for each flow element
8.7	Process Connection Piping (Impulse piping/tubing, sampling piping / tubing & air supply piping as applicable)	
a)	Valves of all types	20% of each type, class, size & model
b)	Valve Manifolds (2 way/3 way/5 way)	20% of each type, class, size & model
c)	Fittings	20% of each type, class, size & model
d)	Filter Regulators	40% of each model
9	Electrical Items	
10	Motor	
10.1	415 Volt Motor (above 30KW Rating up to 200KW)	
10.1.1	End Shield Cover Driving & Non-Driving End	2 Sets for each type and rating of Motor
10.1.2	Driving End & Non-Driving End Bearing	2 Sets for each type and rating of Motor
10.1.3	Cooling Fan	2 Nos. for each type and rating of Motor
10.1.4	Motor Space Heater	2 Nos. for each type and rating of Motor
10.1.5	Motor Terminal Block	2 Nos. for each type and rating of Motor
10.1.6	Complete Set of Coupling	2 Sets for each Application
10.2	415 Volt Motor (Up to 30KW Rating)	
10.2.1	Driving End & Non-Driving End Bearing	6 Sets for each type and rating of Motor
10.2.2	Cooling Fan	4 Nos. for each type and rating of Motor
10.2.3	Motor Terminal Block	10 Nos. for each type and rating of Motor
10.2.4	Complete Set of Coupling	2 Sets for each Application
10.3	Lugs & Glands	
10.3.1	Glands & Lugs	40 % of each type, size & rating of cables

NOTE:	
1	Unless stated otherwise, a "set" or "Lot" means items required for complete replacement in one equipment of each type / size/ range.
2	Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the population of the item required for station. Station means 5 TG unit (CPU service vessel area)=2 regeneration system along with the interconnection of the systems.
3	In case of Bought Out items, itemised spares list may be vendor specific and may differ from the list of spares mentioned above. In such cases, The quoted price shall be considered for applicable items only without any change in the contract price.



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NOTES:

- i) Unless stated otherwise, a "set" or "Lot" means items required for complete replacement in one equipment of each type / size/ range.
- ii) Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.
- iii) Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the population of the item required for station, as specified above.
- iv) All the Mandatory spares for the equipment under the contract provided by the vendor will strictly conform to the specifications and documents and will be identical to the corresponding main Equipment/components supplied under the contract.
- v) All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments.
- vi) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.
- vii) Inspection of mandatory spares shall be in line with the approved quality plans for the respective Items/equipments. The inspection categorisation of mandatory spares shall also be in line with the approved categorisation plan for the respective items/equipment.
- viii) In case, mandatory spares are not applicable as per equipment / item selected, bidder has to provide equivalent mandatory spare as per for selected equipment / item in line with list of mandatory spares.
- ix) In case mandatory spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities in line with list of mandatory spares.

THE VENDOR WARRANTS:

1. That all spares supplied will be new and in accordance with the contract document and will be free from defects in design, material and workmanship and shall further guarantee as under:
2. In case of any failure in the original component/equipments due to faulty designs, materials and workmanship, the corresponding spare parts if any, supplied will be replaced without any extra cost to the BHEL and customer unless a joint examination and analysis by BHEL and/or customer of such spare parts prove that the defect found in the original part that failed can safely be assured not to be present in spare parts.
3. The long term availability of spares to the BHEL and the customer for the full life of the equipment covered under the contract and that before going out of production of spare parts of the equipment covered under the contract, vendor and his sub-vendors shall give the BHEL and the customer at least 24 (Twenty-Four) months advance notice so that the latter may order his bulk requirements of spares, if he so desires. The same provision will also be applicable to the