भारत हेवी इलेक्ट्रिकल्स लिमिटेड
(भारत सरकार का उपक्रम)
BHARAT HEAVY ELECTRICALS LIMITED
(A Govt. of India Undertaking)

TCN – 06

Ref: PSER:SCT:NKP-M1634:TCN-06 Date: 14-01-2015

Sub	Tender change notice (TCN) 06	
Job	Design, engineering, manufacturing, supply, erection, testing, commissioning, etc of CPU System for 3x660 MW units at North Karanpura super thermal power project, Jharkhand.	
Ref	1.0	Tender no PSER:SCT:NKP-M1634:14
	2.0	BHEL's NIT, vide reference no PSER:SCT: NKP-M1634:4111, dated 09-12-2014
	3.0	BHEL's TCN-01, vide reference no PSER:SCT:NKP-M1634:TCN-01, dated 18-12-2014.
	4.0	BHEL's TCN-02, vide reference no PSER:SCT:NKP-M1634:TCN-02, dated 24-12-2014.
	5.0	BHEL's TCN-03, vide reference no PSER:SCT:NKP-M1634:TCN-03, dated 02-01-2015.
	6.0	BHEL's TCN-04, vide reference no PSER:SCT:NKP-M1634:TCN-04, dated 07-01-2015.
	7.0	BHEL's TCN-05, vide reference no PSER:SCT:NKP-M1634:TCN-05, dated 12-01-2015.
	8.0	All other pertinent issues till date.

With reference to above, following points/ documents, relevant to tender, may please be noted and complied with while submitting offer.

1.0 Amendment to technical specification attached as per Annexure-I.
2.0 Revised `No deviation certificate' as per enclosed Annexure-2. Bidder shall submit no deviation certificate as per enclosed format only.
3.0 All other terms & conditions shall remain unchanged.

Thanking you,

Yours faithfully,
for BHARAT HEAVY ELECTRICALS LTD

SR.ENGR (SCT)

Encl
1.0 As above.

पावर सेक्टर पूर्वी क्षेत्र (मुख्यालय)
POWER SECTOR EASTERN REGION, DJ-9/1, SECTOR-II, SALT LAKE CITY, KOLKATA - 700 091
फैक्स/Fax : (033) 23211960 फोन/Phone : बोर्ड/EPABX : 23211691, 23211798, 23211796

ANNEXURE-2

FORMAT FOR NO DEVIATION CERTIFICATE
(To be submitted in the bidder's letter head)

BHARAT HEAVY ELECTRICALS LIMITED,
Power Sector - Eastern Region,
Plot no 9/1, DJ Block, Sector – II, Salt Lake City,
Kolkata – 700 091

Sub	No Deviation Certificate.	
Job	Design, engineering, manufacturing, supply, erection, testing, commissioning, etc of CPU System for 3x660 MW units at North Karanpura super thermal power project, Jharkhand.	
Ref	1.0	Tender no PSER:SCT:NKP-M1634:14
	2.0	BHEL's NIT, vide reference no PSER:SCT: NKP-M1634:4111, dated 09-12-2014
	3.0	BHEL's TCN-01, vide reference no PSER:SCT:NKP-M1634:TCN-01, dated 18-12-2014.
	4.0	BHEL's TCN-02, vide reference no PSER:SCT:NKP-M1634:TCN-02, dated 24-12-2014.
	5.0	BHEL's TCN-03, vide reference no PSER:SCT:NKP-M1634:TCN-03, dated 02-01-2015.
	6.0	BHEL's TCN-04, vide reference no PSER:SCT:NKP-M1634:TCN-04, dated 07-01-2015.
	7.0	BHEL's TCN-05, vide reference no PSER:SCT:NKP-M1634:TCN-05, dated 12-01-2015.
	8.0	BHEL's TCN-06, vide reference no PSER:SCT:NKP-M1634:TCN-06, dated 14-01-2015.
	9.0	All other pertinent issues till date.

Dear Sirs,

With reference to above, this is to confirm that as per tender conditions, we have visited site before submission of our offer and noted the job content & site conditions etc. We also confirm that we have not changed/ modified the tender documents as appeared in the website/ issued by you and in case of such observance at any stage, it shall be treated as null and void.

We hereby confirm that we have not taken any deviation from tender clauses together with other references as enumerated in the above referred NIT. We hereby confirm our unqualified acceptance to all terms & conditions, unqualified compliance to technical specification, integrity pact (if applicable) and acceptance to reverse auctioning process.

In the event of observance of any deviation in any part of our offer at a later date whether implicit or explicit, the deviations shall stand null & void.

We confirm to have submitted offer in accordance with tender instructions and as per aforesaid references.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized representative of the bidder)

	AMENDMENT ON TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT	SPECIFICATION NO.: PE-TS-405-155A-A001
		AMENDMENT NO # 1
	3X660 MW NTPC NORTH KARANPURA STPP	REV. NO. 00 / DATE: 13.01.15
		Page **1** of **2**

The following modifications with respect to Technical Specification for Condensate Polishing Unit, BHEL's Technical specification no PE-TS-405-155A-A001 shall apply.

Bidder to note that existing clauses/page numbers as appearing in the specification stands deleted and clauses/page numbers as mentioned in "Modified to" column shall be applicable and complied by the bidder.

MODIFIED CLAUSES/PAGE NUMBERS.

Sl no.	Vol. No.	Section/ Description	Clause no	Page no	Existing	Modified to
1.	IIB	SECTION – C1	D16)	23 OF 505	Engineering for this project is to be carried out in Integrated Intelligent Engineering environment. The engineering platform on which BHEL is doing the project is based on SmartPlant Suite. This is being done to have automated interface checking and thereby minimising rework at site. The engineering for entire condensate polishing unit plant package including each regeneration area will essentially be done using Intelligent P&ID, Intelligent Electrical, Intelligent Instrumentation and 3D modelling by Bidder. Review model in compatible format is to be provided to BHEL during detailed engineering stage.Hence in line with above, bidder is required to prepare PIDs, Electrical drawings and all layout drawings using intelligent software with capability for transfer of data to and from corresponding Software being used by PEM. The data of models of facilities will be made available to BHEL as per the BHEL schedule for importing into BHEL model for interface checking and raising of integrated plant model. Layout and PID/electrical drawings will be extracted from the model. Standard write up on format compatibility of the BHEL's engineering platform for this project is attached elsewhere in the specification. Data/Reports other than listed drawings/documents will also be made available to BHEL as and when required for import into BHEL model. These drawings will also be made available to BHEL in soft for checking interface with other agencies in consolidated layout drawings. **Bidder's inability to prepare drawing using 3D Modelling software will not be criterion for evaluation of their bid.**	Engineering for this project is to be carried out in Integrated Intelligent Engineering environment. The engineering platform on which BHEL is doing the project is based on SmartPlant Suite. This is being done to have automated interface checking and thereby minimising rework at site. The engineering for entire condensate polishing unit plant package including each regeneration area will essentially be done using Intelligent P&ID, Intelligent Electrical, Intelligent Instrumentation and 3D modelling by Bidder. Review model in compatible format is to be provided to BHEL during detailed engineering stage. Hence in line with above, bidder is required to prepare PIDs, Electrical drawings and all layout drawings using intelligent software with capability for transfer of data to and from corresponding Software being used by PEM. The data of models of facilities will be made available to BHEL as per the BHEL schedule for importing into BHEL model for interface checking and raising of integrated plant model. Layout and PID/electrical drawings will be extracted from the model. Standard write up on format compatibility of the BHEL's engineering platform for this project is attached elsewhere in the specification. Data/Reports other than listed drawings/documents will also be made available to BHEL as and when required for import into BHEL model. These drawings will also be made available to BHEL in soft for checking interface with other agencies in consolidated layout drawings.

Sl no.	Vol. No.	Section/ Description	Clause no	Page no	Existing	Modified to
2.	IIB	SECTION – C1	17.0	30 OF 505	BIDDER TO FURNISH FOLLOWING DOCUMENTS/INFORMATION ALONG WITH THE BID (FOR ELECTRICAL AND C&I PLEASE REFER THE RESPECTIVE SECTION OF THE SPECIFICATION).	In addition to the list of documents to be furnished along with the bid as indicated in tender technical specification, bidder to please furnish the DM water required for one regeneration operation of one TG unit including resin transfer operations from Condensate Polishing Plant to regeneration plant and regeneration plant to Condensate Polishing Plant and for preparation of chemicals for one regeneration of one unit.
3.	IIB	SECTION – C2	--	92 TO 94 OF 505	Page no. 92 TO 94 OF 505	Refer attached Annexure – A.
4.	IIB	SECTION – C2	--	95 TO 97 OF 505	Page no. 95 TO 97 OF 505	Refer attached Annexure – B.
5.	IIB	SECTION – C2	--	98 OF 505	Page no. 98 OF 505	Refer attached Annexure – C.
6.	IIB	SECTION – C2	--	99 OF 505	Page no. 99 OF 505	Refer attached Annexure – D.
7.	IIB	SECTION – D2	--	359 to 404 OF 505	Page no. 359 to 404 OF 505	Stands Deleted.
8.	IIB	SECTION – C1	--	--	--	The PRE-COMMISSIONING & COMMISSIONING ACTIVITIES have been attached herewith as Annexure E for bidder's compliance.

	TITLE : **ELECTRICAL EQUIPMENT SPECIFICATION FOR CONDENSATE POLISHING UNIT 3X660MW NORTH KARANPURA STPP**	SPECIFICATION NO. PE-TS-405-155A-A001 VOLUME NO. : **II-B** SECTION : **C2** REV NO. : **00** DATE : 13.01.15 SHEET : 1 OF 3

ANNEXURE - A

TECHNICAL SPECIFICATION

FOR

CONDENSATE POLISHING UNIT

(ELECTRICAL PORTION

BHEL	TITLE : **ELECTRICAL EQUIPMENT SPECIFICATION FOR CONDENSATE POLISHING UNIT 3X660MW NORTH KARANPURA STPP**	SPECIFICATION NO. PE-TS-405-155A-A001 VOLUME NO. : **II-B** SECTION : **C2** REV NO. : **00** DATE : 13.01.15 SHEET : 2 OF 3

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

a) Services and equipment as per "Electrical Scope between BHEL and Vendor".

b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.

c) Supply of mandatory spares as specified in the specifications of mechanical equipments.

d) Electrical load requirement for Condensate Poilishing Unit

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

f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL

g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.

h) Motor shall meet minimum requirement of motor specification.

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

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

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer "Electrical Scope between BHEL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 List of enclosures :

a) Electrical scope between BHEL & vendor (Annexure –B)
b) Technical specification for motors.
c) Datasheets & quality plan for motors.
d) Electrical Load data format (Annexure –C)
e) BHEL cable listing format (Annexure –D)

ANNEXURE- B

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES : CONDENSATE POLISHING UNIT
SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT
PROJECT: 3X660 MW NORTH KARANPURA STPP

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

ANNEXURE- B

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES : CONDENSATE POLISHING UNIT

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

PROJECT: 3X660 MW NORTH KARANPURA STPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
9	Lighting	BHEL	BHEL	
10	Equipment grounding & lightning protection	BHEL	BHEL	
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable (excluding power cables) in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish Electrical equipment layout & cable tray layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts, conduits etc.) shall be decided during contract stage. Electrical equipment layout & cable tray layout drawing shall be subjected to BHEL/ customer approval without any commercial implications to BHEL.

ANNEXURE- B

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES : CONDENSATE POLISHING UNIT

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

PROJECT: 3X660 MW NORTH KARANPURA STPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

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

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

ANNEXURE-C

NOTES:
1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER
2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

LOAD DATA (ELECTRICAL)	JOB NO.	405	ORIGINATING AGENCY		PEM (ELECTRICAL)
	PROJECT TITLE	3X660 MW NORTH KARANPURA	NAME		DATA FILLED UP ON
	SYSTEM	CONDENSATE POLISHING UNIT	SIGN.		DATA ENTERED ON
	DEPTT. / SECTION	MAX	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE

3X660 MW NTPC NORTH KARANPURA STPP
CONDENSATE POLISHING UNIT
THIS IS A PART OF TECHNICAL SPECIFICATION NO.-PE-TS-405-155A-A001

CABLE SCHEDULE FORMAT

ANNEXURE D

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

ANNEXURE - E

VOLUME- IIB
SECTION - C1

PRE-COMMISSIONING & COMMISSIONING ACTIVITIES.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	PRE-COMMISSIONING ACTIVITIES, COMMISSIONING OF FACILITIES AND INITIAL OPERATIONS
1.00.00	**GENERAL**
1.01.00	The pre-commissioning and commissioning activities including Guarantee tests, checks and initial operations of the equipment furnished and installed by the Contractor shall be the responsibility of the Contractor as detailed in relevant clauses in Technical Specification. The Contractor shall provide, in addition, test instruments, calibrating devices, etc. and labour required for successful performance of these operations. If it is anticipated that the above test may prolong for a long time, the Contractor's workmen required for the above test shall always be present at Site during such operations.
1.02.00	It shall be the responsibility of the Contractor to provide all necessary temporary instrumentation and other measuring devices required during start-up and initial operation of the equipment systems which are installed by him. The Contractor shall also be responsible for flushing & initial filling of all oils & lubricants required for the equipment furnished and installed by him so as to make such equipment ready for operation. The Contractor shall be responsible for supplying such flushing oil and other lubricants unless otherwise specified elsewhere in these specifications & documents.
1.03.00	The Contractor upon completion of installation of equipments and systems, shall conduct pre-commissioning and commissioning activities, to make the facilities ready for sustained safe, reliable and efficient operation. All pre-commissioning/commissioning activities considered essential for such readiness of the facilities including those mutually agreed and included in the Contractors quality assurance program as well as those indicated in clauses elsewhere in the technical specifications shall be performed by the Contractor.
2.00.00	**TESTING / COMMISSIONING PROCEDURES** The contractor shall submit his testing / commissioning check lists and procedures for various equipments / systems covered under the contract at least 18 months before the actual commissioning of the equipments / systems for review and approval of employer. The testing / commissioning procedures are to be of a standard format in order to maintain consistency of presentation, content and reporting. The list of commissioning check lists and procedures to be submitted and their content details shall be agreed upon during preaward discussions. An indicative list of Testing / Commissioning procedures/schedules and Standard Checklists and the details regarding the contents of testing/commissioning are enclosed as annexure at the end of this sub-section of section-VI, Part B. The actual list of such equipments / systems shall depend on the equipments / systems being supplied by the contractor. i) Annexure-I : Standard Checklist of items ii) Annexure-II : Testing / Commissioning Procedure/schedules iii) Annexure-III : Commissioning procedures requiring approval of Employer. iv) Annexure – IV : Demonstration/Acceptance test procedures during Commissioning/Initial operation v) Annexure – V : Brief write up on Contents of Testing / Commissioning Procedures Procedure/schedules shall be approved by the employer.

CLAUSE NO.	TECHNICAL REQUIREMENTS
3.00.00	**PRECOMMISSIONING & COMMISSIONING ACTIVITIES**
3.01.00	**General** The pre-commissioning activities including some of the important checks & tests for certain major equipment/ systems (as a minimum) are described below, although it is the Contractor's responsibility to draw up a detailed sequential & systematic list of checks / tests and various activities / procedures connected with pre-commissioning of the complete facilities with all systems, sub-systems and equipment supplied and installed by him and get the same approved by the Employer.
3.02.00	**PRE-COMMISSIONING ACTIVITIES/TESTS:** **Steam Generator**
3.02.01	**Hydraulic Testing of Pressure Parts** On completion of installation of the Steam Generator pressure parts and high pressure boiler external piping & non boiler external piping a hydraulic test in accordance with the requirements of the Indian Boiler Regulations, shall be performed by the Contractor. However, making use of valves/control valves supplied by others and installed on the contractor's piping system during hydraulic testing shall be subjected to the acceptance of respective valve supplier otherwise hydraulic cap/blanking arrangement as required shall be used. The procedure adopted for hydraulic test and preservation shall have the prior approval of the Employer. The detailed schemes and procedure for carrying out hydraulic testing shall be prepared and furnished by the contractor and it shall be discussed and finalized during detailed engineering stage. The water for hydraulic test shall be made alkaline by addition of suitable chemicals. After the test, the Steam Generator and high pressure external piping shall be suitably drained and preserved. All blank flanges, removable plugs, temporary valves, pipes & fittings, spools, other accessories and services required for carrying out hydraulic testing of boiler external pipings & non boiler external pipings and boiler & its pressure parts shall be furnished by the Contractor. The pressurization equipment including water piping and any chemicals for preservation, needed for the above test shall also be furnished by the Contractor. Any defect noticed during the testing shall be rectified and the unit shall be retested by the Contractor. In the case of branch connections/ tap-off piping (in others scope) from contractor's scope of piping are not ready or not erected at the time of hydrostatic testing of piping in contractor's scope, then the contractor to supply/use necessary blanking arrangement as required at these tap-off /branch connections. The hydraulic test shall be considered successful only on certification to that effect by the concerned inspecting authority as per the provision of the IBR and the Project Manager.
3.02.02	**Air & Gas Tightness Test** After completion of installation of furnace tubes and/or inner skin casing wherever applicable ducts and airheaters, and before commencement of application of thermal insulation a test shall be performed on the Steam Generator by the contractor to prove or to establish the tightness of the erected equipments from the outlet of FD fan through Steam Generator to the stack. Such test shall be done, as far as possible, with all mountings like soot blowers etc. installed in position. The procedure adopted for such tests shall have the prior approval of the Employer. Normally physical leak detection method by pressurising the section under test by running FD Fan / PA Fan / Temporary blower, as the case may be, is adopted. The contractor may adopt any other better method of testing.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	All equipments including any temporary blanking, if required, for the above test shall be provided by the Contractor. The Contractor's air and gas tightness test procedure shall be such that it shall enable conductance of air/gas tightness test on the ducts in segmented manner (as and when these duct segments are ready), so that these duct segments can be immediately released for application of insulation after their air/gas tightness tests. Contractor shall made all necessary arrangement for conducting tests in this manner. Any blanking etc. on the duct side required for testing of duct segments shall be provided by Contractor. Contractor shall bring fan / blower (s) of adequate size / capacity and other necessary instruments so that these tests can be conducted without necessity of FD / PA fans. The above equipment shall be brought to site by the Contractor on temporary basis and shall be taken back after successful completion of air / gas tightness test.
3.02.03	**Chemical Cleaning of Pressure Parts** The Contractor shall perform thorough and efficient cleaning operations of all the internal parts of the boiler, like economiser, water wall / evaporator, separator, feed water line, piping, start-up recirculation lines and associated piping and all other pressure parts and associated high pressure piping covered under these specifications (except those portions which are to be steam blown). The cleaning operation shall consist of De-mineralised (DM) water flushing, the chemical cleaning using acids like hydrofluoric acid or as recommended by the manufacturer, DM water rinsing, DM water flushing, nitrogen capping etc. Complete chemical cleaning procedure, the scheme and layout including parameters of the pumps, size of tanks, materials of construction, the rate of consumption and total requirements of steam and water for such cleaning process shall have the approval of the Employer. The Contractor shall furnish all labour, materials such as the required chemicals and other consumables, all equipment such as acid/chemical transfer and acid/chemical circulating pumps complete with drive motors, acid storage and acid/chemical mixing tanks, all temporary piping, valves and specialities and local instruments for pressure, temperature and flow measurements and any other items needed to carry out the process. All equipment required for chemical cleaning of Steam Generator shall be supplied by the contractor. The Contractor shall take care to dispose off the used chemicals and the effluents from the cleaning operations, after neutralisation, meeting all the statutory regulations and in a manner acceptable to the Project Manager and which would comply with the norms of the State Pollution Control Board. This includes construction of suitable neutralization pit, channels, disposal equipments etc. The Contractor shall specifically make all necessary arrangements for prevention of any fire accidents, explosions etc. during the performance of the chemical cleaning operations. The Contractor shall ensure that during the cleaning process the procedure adopted shall be such as to consume minimum demineralized water. The cleaning procedure shall include final flushing and draining of the boiler under a nitrogen gas cap and/or filling the boiler with inhibited water or any other proven procedure recommended by the manufacturer for the preservation of the boiler which is acceptable to the Employer. The Contractor shall furnish a detailed procedure for boiler preservation during detailed engineering for Employer's approval. All equipment needed for such preservation including the nitrogen cylinders, interconnecting piping and any regulating equipment for N2 cap and other preservatives shall be provided by the Contractor for the Steam Generator and the same shall also become the property of the Employer after completion of the chemical cleaning.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	The Contractor shall provide adequate safety and protective equipment for all his employees and ensure that they are worn at all times of danger. Specialized treatment equipment (such as required for first aid when using hydrofluoric acid/chemical) must be provided at the place of handling acid/chemical. An acid/chemical cleaning report and log of each cleaning must be provided by the Contractor to the Employer, immediately after the cleaning operation.
3.02.04	**Steam Blowing** Steam blowing of complete Superheaters, Reheaters and various boiler external piping and non boiler external piping shall be carried out by the Contractor as per requirements/scope of work (indicated in Part-A & Part-B, Section-VI) of this specification. Temporary materials as required for steam blowing of these piping systems shall be supplied by the contractor. Steam blowing of contractor's scope of piping systems shall be performed without valves/control valves supplied in steam blowing circuit otherwise valve supplier's acceptance to include these valves for steam blowing operation is to be submitted by the contractor. Based on the above the Contractor shall give recommended procedures, method of blowing and scheme for steam blowing indicating clearly additional system, if any, to be cleaned by steam blowing and furnish data/ write-up/ layouts/ drawings to that effect to the Employer for approval. The Contractor shall furnish his recommendations regarding use of various test equipments and instruments and termination/acceptance criteria for steam blowing, which in any case shall meet the steam turbine-generator requirements. The systems which should be ready and operational before steam blowing shall be made ready/operational by the Contractor by the scheduled date for starting of steam blowing. For equipments/components installed on high pressure external piping, such as various thermo-wells, flow meter, control valves, HP/LP Bypass valves etc., the Contractor shall comply with guidelines to be followed during steam blowing, with respect to removal / blanking / replacement of such items their internals etc. by spool pieces as given by the respective manufacturer/sub-contractor. Supply of all such spools (as above) and/or blanks, temporary piping and supports etc. as required, cutting / welding / edge preparation and rewelding required for blanking, temporary piping connection and/or for replacements by spool pieces shall be the responsibility of the Contractor. After steam blowing removal of spool pieces & temporary piping and reinstallation of various components, shall also be the responsibility of the Contractor. In the case of branch connections/ tap-off piping are not ready or not erected at the time of steam blowing operation then the contractor to supply/use necessary blanking arrangement as required at these tap-off / branch connections. It will be the responsibility of the Contractor to operate the Steam Generator and its accessories equipment to generate adequate steam at the parameter and quality in line with the requirements of steam blowing procedure. The Contractor shall make adequate provisions for temporary enhancement of fuel oil firing capacity of the steam generators by changing oil gun tips etc. as may be required so as to be able to conduct complete steam blowing operation by oil firing alone. All necessary precautions to avoid fires and cold end corrosion of Air preheater, during such oil firing at enhanced SG loads, shall be taken by the Contractor. The Contractor shall ensure successful and timely completion of steam blowing of all systems and will render all help/services as required including: (i) Services of test/operating personnel/supervisors.

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	(ii) Extending all cooperation during erection, pre-commissioning of plant and equipment to be made ready and operational before starting steam blowing. (iii) Extending all cooperation for interface engineering of equipments/components of temporary system required for steam blowing operation. (iv) Contractor's engineers shall be available for all coordination meetings arranged by the Employer for finalizing the details of temporary system for steam blowing. For the steam blowing operation, steam conditions like pressure, temperature etc. at the Steam Generator outlet shall be so selected that a minimum cleaning ratio/ disturbance factor of 1.6 is achieved. A cycle of heating, cooling and blowing/ purging, is to be repeated to ensure thorough cleaning of the interior of the pipes/ tubes etc. The final indication of cleanliness shall be demonstrated by purging through target plates positioned at the discharge point.
3.02.05	**ESP** Complete pre-commissioning work including tests of facilities such as air and gas tightness tests of ESP, pressure drop test of ESP, gas distribution test of ESPs etc. and all other tests as mutually agreed in the Contractor's quality assurance program as well as those identified in the specification.
3.02.06	Any other pre-commissioning activity such as floating of safety valves etc. as considered essential for readiness of facilities for commencement of commissioning activities shall also be undertaken by the Contractor.
3.03.00	**Demonstration/Acceptance tests during Commissioning/Initial Operation** The following tests shall be demonstrated during commissioning for which the bidder has to furnish the procedure and get the approval of the employer:
3.03.01	**Start-up, Loading, Unloading and Shutdown Capabilities (For Turbine Generator)** (i) **Unit Start Up** Start-up time (upto full load), and loading capabilities for the Turbine Generator together for cold start conditions (greater than 36 hours shutdown), warm start conditions (between 8 and 36 hours shutdown) and hot start conditions (less than 8 hours shutdown) as indicated by the Contractor in the offer and accepted by the EMPLOYER shall be demonstrated, ensuring that the various turbine operational parameters like vibration, absolute and differential expansion, eccentricity and steam-metal temperature mismatch etc. are within design limits. (ii) **Sudden Total Loss of External Load** On occasions, the steam turbine generator unit may experience sudden total loss of all external load. Under these conditions, the steam turbine generator unit shall not trip but shall continue to be in operation under the control of its speed governor to supply power for the plant auxiliary load with HP-LP bypass in operation while staying within the agreed limits of steam to metal temperature mismatch, exhaust hood temperature, absolute and differential expansion, vibration and eccentricity. The same shall be demonstrated. Further, the provisions of Part-B, Section-VI, shall also be complied with.

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	(iii) **Steam Metal Temperature Mismatch Limitation** The steam-metal temperature differential for cold, warm and hot start up , loading / unloading and shutdown conditions shall be within the permissible limits indicated by the Bidder in the offer and accepted by the Employer.
3.03.02	**Turbine Generator Set Capability** The steam turbine generator unit shall be capable of delivering at generator terminals the output as indicated by the BIDDER in the heat balances submitted along with his bid, under the following condition. (a) Maximum continuous output at generator terminals corresponding to both strings of HP heaters out of operation, under rated steam conditions, at a specified ambient temperature and 3% make up. **NOTE:** While conducting the tests of (a) above the condenser pressure measurement shall be done at 300mm downstream of LPT exhaust flange.
3.03.03	**Turbine Auxiliaries** (i) **H.P./L.P. Bypass Capabilities** The HP & LP Bypass system should satisfy the following functional requirements under automatic interlock action. It should come into operation automatically under the following conditions: (a) Generator circuit breaker opening. (b) HP - IP stop valves closing due to turbine tripping. (c) Sudden reduction in demand to house load. Under all these conditions, while passing the required steam flows as per the relevant heat balances, the condenser should be able to swallow the entire steam without increasing the exhaust hood temperature and condenser pressure beyond the maximum permissible value indicated by the BIDDER in his offer and accepted by the EMPLOYER. The same shall be demonstrated. (ii) **Steam Condensing Plant for main turbine** (a) Temperature of condensate, at outlet of condenser, shall not be less than saturation temperature corresponding to the condenser pressure at all loads. (b) Oxygen content in condensate, at hotwell outlet, shall not exceed 0.015 CC per litre over the entire load range and shall be determined according to calorimetric Indigo - Carmine method. (c) Air leakage in the condenser under full load condition shall not exceed more than 50% of design value taken for sizing the condenser air evacuation system. (e) The capacity of each vacuum pump in free dry air under standard conditions at a condenser pressure of 25.4 mm Hg (abs) and sub cooled to 4.17 deg.C below the temperature corresponding to absolute suction pressure shall not

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	be less than as specified elsewhere. Correction curves for establishing the capacity at site conditions shall also be furnished. (f) The air and vapour mixture from air cooling zone of condenser shall be 4.17 deg.C below the saturation temperature corresponding to 25.4 mm Hg (abs) suction pressure. Correction curves for establishing the same at site conditions shall also be furnished. (iii) **Feed water heaters & Deaerator** (a) TTD's and DCA's of feed water heaters in line with 660 MW heat rate guarantee heat balance shall be demonstrated. (b) Dissolved O2 content in Deaerator effluent at deaerator outlet without chemical dosing at all loads, not to exceed 0.005 CC/ litre determined as per ASTM-D-888 - Reference method-A or Indigo Carmine method. (c) Difference between saturation temperature of steam entering the deaerator and temperature of feed water leaving deaerator. (iv) **Condensate Extraction Pumps** (a) Each CEP set shall be capable of delivering flow & total dynamic head corresponding to runout point as specified. (b) The vibration, noise level and parallel operation of any two of the three pumps shall be demonstrated. (v) **Drip Pumps (if envisaged)** (a) Each drip pump shall be capable of delivering flow & total dynamic head corresponding to design point as specified. (b) The vibration and noise level shall be demonstrated. (vi) **Boiler feed pumps** (a) Each boiler feed pump set shall be capable to deliver flow and total dynamic head corresponding to runout point as specified elsewhere. (b) The vibration, noise level and parallel operation of any two of the three pumps shall be demonstrated as per specification requirements. (c) Cold start up / hot start up of the unit using TDBFP with motive steam from auxiliary steam header.
3.03.04	**Balance Pumps, Blowers, Fans, Compressors and rotating equipment.** a) The vibration, noise level and parallel operation, wherever applicable, of the pumps, blowers, fans, compressors and rotating equipment shall be demonstrated. b) Pumps, blowers, fans, compressors and rotating equipment shall be capable of delivering flow and head corresponding to design point as specified.

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3.03.05	**Balancing of Coal/Primary air flow** Contractor shall balance the primary air as well as coal flows in the pulverised fuel pipes such that the minimum PF and PA flow imbalance in the PF pipes from each coal pulveriser does not exceed 5% of average flows. The above balancing shall be checked by the Contractor by carrying out both clean air test and dirty air test (using dirty pitot tubes).
3.03.06	**Demonstration of boiler operation, rate of change of load and sudden load change withstand capability** Refer Sub section-A-02 and A-03 ,Part-B(Mechanical), Section VI of Technical Specification..
3.03.07	**Steam Temperature Imbalance** The Contractor shall demonstrate that at SH and RH outlets (in case of more than one outlet) the temperature imbalance between the outlets does not exceed 10 deg C under all loads including transients.
3.03.08	**No fuel oil support shall be required above 40% BMCR** Contractor shall demonstrate that oil support for flame stabilization shall not be required beyond 40% of BMCR load when firing the coals from the range identified. The Contractor shall demonstrate that with any combination of mills/ adjacent mills in service (to Employer's choice) the Steam Generator does not require any oil firing for stable and efficient boiler operation at and above 40% BMCR loads.
3.03.09	**Capabilities of all drives** After completion of installation of drives, contractor shall demonstrate the capability of all drives as specified elsewhere in Section VI Part B of Technical Specifications.
3.03.10	**Margin on Fans** After completion of installation of fan drives, Fans, inlet and outlet ducting, measuring equipments etc. contractor shall demonstrate the margin on seal air fans, primary fans, Forced draft fans and induced draft fans as specified elsewhere in Section VI Part B of Technical Specifications.
3.03.11	**Cold Air Velocity Test (CAVT)** A CAVT shall be conducted on each Steam Generator during commissioning before its initial operation to establish the average cold air velocity and the velocity distribution at minimum three predetermined sections (Employer's Choice) of steam generator. The data obtained from the CAVT will be used to compute the actual flue gas velocities as well as their distribution at the test sections during actual operation by correlating the CAVT data with the test/computed data from Thermal Performance Test as per Clauses 1.03.04 (iii) sub section-IV, Section-VI- Part-A. Should the CAVT results after this correlation with TPT data indicate actual localized high flue gas velocity zones/ mal-distribution of gas flow and/or flue gas laning, suitably designed stainless steel screens at required SG cross sections shall be provided by the Contractor to bring the deviation of the localized gas velocity within ± 20% of average gas velocity specified. Through this test the Contractor shall also demonstrate the compliance with the specification requirements regarding the maximum allowable flue gas velocities at various sections of the Steam Generator, refer sub-sectdion-A-03, Part-B of Technical Specifications.

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	The detailed CAVT procedure shall be to Employer's approved. The Contractor shall submit a detailed CAVT report and the computations of actual velocities after correlating CAVT data with TPT data to the Employer for approval.
3.03.12	**Capabilities of firing of 30% imported coal** Contractor shall demonstrate the capability of Steam generator and its auxiliaries to operate at rated parameters safely and on sustained basis at TMCR load while firing range of Indian coal(s) as specified in Table-1(A) ,sub section-IB ,Part-A of Section-VI blended with imported coal up o 30% by weight specified in Table-1(B) sub section-IB ,Part-A, Section-VI. Such demonstration shall be for 72 hours of continuous operation
3.03.12 a)	Performance characteristic of fans (PA/FD/ID fan capacity, head developed, etc.)
3.03.13	Passenger & good elevators for steam generator – overload tests, travel and hoist speed checks.
3.03.14	Auxiliary Boiler Rating Contractor shall demonstrate the rated parameters of Auxiliary Boiler, its steam generating capacity as per Clause 1.05.20 of Sub-section A-02.
3.03.15	ESP Air in Leakage Contractor shall demonstrate that ESP air in leakage shall be limited to 1% of the total gas flow under guarantee point condition.
3.03.16	Pressure Drop Across ESP Contractor shall demonstrate that the maximum flue gas pressure drop across the ESP under specified guarantee point condition shall not exceed 20 mmwc.
3.03.17	Hydrogen Generation Plant a) Parallel operation of two streams shall be demonstrated at site. Purity level and moisture contents of Hydrogen shall also be demonstrated at site. b) Hydrogen Generation Plant capacity of each stream shall be demonstrated at site.
3.04.00	**Pre-commissioning & Commissioning activities requiring approval of the employer:** (a) Hydraulic Test for STG integral piping, heat exchangers, condenser tubes & condenser, equipment cooling water system pipes and associated equipment etc. shall be done. The hydraulic test of other piping system as per statutory requirement and specified elsewhere shall also be carried out. All equipment needed for the tests shall be furnished by the Contractor. (b) Oil flushing of lube oil system, control & jacking oil system, etc. for turbines shall be done. Entire flushing oil requirement & refilling with fresh oil and other consumables along with flushing equipment shall be met by the Contractor. (c) High Pressure/Low Pressure (HP/LP) bypass tests, vacuum tightness test as per approved procedures shall be done by the Contractor after arranging & lining up of all the necessary equipment by him.

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	(d) Steam blowing & chemical cleaning, as applicable of integral piping of the turbo-generator, Low pressure piping, Power cycle piping & other piping in the scope of the Contractor shall be done by the Contractor. (e) Steam blowing & chemical cleaning, as applicable of integral piping of CEP sets & other piping in the scope of the Contractor shall be done by the Contractor. (f) All tests and activities pertaining to the CEP and its drive as per manufacturer's recommendations and as given in the chapter and covered in the specification. (g) Steam blowing & chemical cleaning, as applicable of integral piping of Drip Pump sets & other piping (if applicable) shall be done by the Contractor. (h) All tests and activities pertaining to the Drip Pump and its drive (if applicable) as per manufacturer's recommendations and as given in the chapter and covered in the specification. (i) Steam blowing & chemical cleaning, as applicable of integral piping of the Heaters & other components shall be done by the Contractor. (j) All tests and activities pertaining to the Heater as per manufacturer's recommendations and as given in the chapter and covered in the specification. (k) Oil flushing of lube oil system, control & jacking oil system, for BFP sets shall be done. Entire flushing oil requirement & refilling with fresh oil and other consumables along with flushing equipment shall be met by the Contractor. (l) Steam blowing & chemical cleaning, as applicable of integral piping of BFP sets & other piping shall be done by the Contractor. (m) All tests and activities pertaining to the BFP and its drive as per manufacturer's recommendations and as given in the chapter and covered in the specification. (n) Hydraulic Test for all low and high pressure piping, equipment cooling water system pipes and associated equipment etc. shall be done as per statutory requirement and specified elsewhere shall be carried out. All equipment needed for the tests shall be furnished by the Contractor. (o) All tests and activities pertaining to the Generator and Excitation as per manufacturer's recommendations and covered in the specification. (p) All tests and activities pertaining to the Generator Auxiliaries viz Primary water system, Seal oil system, Gas system etc., as per manufacturer's recommendations and covered in the specification. (q) Any other pre-commissioning checks/ tests and activities as described below and also those mutually agreed between the Contractor & the Employer shall be undertaken.
3.05.00	**COMMISSIONING OF FACILITIES** **General** Upon completion of pre-commissioning activities/test the Contractor shall initiate commissioning of facilities. During commissioning the Contractor shall carryout system checking and reliability trials on various parts of the facilities.

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	Contractor shall carry out these checks/tests at site to prove to the Employer that each equipment of the supply complies with requirements stipulated and is installed in accordance with requirements specified. Before the plant is put into initial operation the Contractor shall be required to conduct test to demonstrate to the Employer that each item of the plant is capable of correctly performing the functions for which it was specified and its performance, parameters etc. are as per the specified/approved values. These tests may be conducted concurrently with those required under commissioning sequence. The Contractor shall finalize the protocol of check lists, after erection of the system and equipment, as per International Codes/Standard with the Employer. The Contractor shall furnish requisite no. of copies of procedures and list of start up, pre-commissioning, commissioning and initial operation tests for Employer's approval. The Contractor shall also demonstrate the performance of all C&I equipment, the tests on main equipment or prior to that as the case may be. Other tests shall be conducted, if required by the Employer, to establish that the plant equipments are in accordance with requirements of the specifications.
3.05.01	The Commissioning tests/checks shall specifically include but will not be limited to following: (a) Checks on the operation of all controls of isolating gas and air dampers. (b) Checks on operation of all fans to ascertain level of noise and vibration. (c) Test running of all pumps. (d) Checks on operation of all air heaters and adjustment of seals, if necessary when each heater is upto its working temperature. (e) Checks on operation of all soot blowers and retraction gear and the sequences control. (f) Check run on the Pulverised Fuel (P.F.) Mills including clean air flow test. (g) Standard commissioning tests and procedures as per Contractor's practice for Steam Generator and other equipment / auxiliaries. (h) Checks on operation of all individual control loops in the Steam Generator control loops in the Steam Generator control system. (i) Checks on inter-relation between each control loop in the Steam Generator control system. Checks on inter-relation between each control loop in the turbine generator control system. (j) Checks on correct functioning of the Burner Management System (BMS). (k) Calibration tests of orifice, flow nozzles, instruments and control equipment to the extent included in these specifications. (l) Tests on Control & Instrumentation (C&I) Equipments:

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3.05.02	**LIST OF TEST / ACTIVITIES TO BE PERFORMED ON TG & AUXILIARY (but not limited to folowing)**
A)	**COMMISSIONING TESTS/CHECKS**
	1. Test running of all pumps
	2. Condenser vacuum test, feed water heater operational tests for establishing correct cascaded flow, heater water levels etc. & checking of all parameters as per approved heat balance diagrams.
	3. Test for HP/LP bypass valves operation & their control system.
	4. Test for operation of governing control system for turbines.
	5. Standard commissioning tests and procedures as per Contractor's practice for steam turbine generator and other equipment / auxiliaries within the Contractor's scope of work.
	6. Checks on operation of all individual control loops in the turbine generator control system.
	7. Checks on correct functioning of the Turbine Protection System (TPS), Turbine Supervisory Control System (TSCS) for main turbine, Automatic Turbine Run-up System (ATRS), Automatic Testing of Turbine (ATT).
	8. Standard commissioning tests and procedures as per Contractor's practice for CEP and other equipment / auxiliaries within the Contractor's scope of work.
	9. Checks on operation of all individual control loops in the CEP control system.
	10. Standard commissioning tests and procedures as per Contractor's practice for Drip Pump (if applicable) and other equipment / auxiliaries within the Contractor's scope of work.
	11. Checks on operation of all individual control loops in the Drip Pump control (if applicable) system.
	12. Feed water heater operational test for establishing correct cascaded flow, heater water levels and checking of all parameters as per approved heat balance diagram.
	13. standard commissioning tests and procedures as per contractor's practice for heaters and de-aerator and other equipment/auxiliaries within the contractor's scope of work.
	14. Checks on operation of all individual control loops in the heater and deaerator control system.
	15. Test for operation of governing control system for BFP turbines.
	16. Standard commissioning tests and procedures as per Contractor's practice for BFP and other equipment / auxiliaries within the Contractor's scope of work.
	17. Checks on operation of all individual control loops in the BFP control system.

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	18. Checks on correct functioning of the BFP Turbine for Turbine Protection System (TPS), Turbine Supervisory Control System (TSCS) for main turbine, Automatic Turbine Run-up System (ATRS), Automatic Testing of Turbine (ATT). 19. Calibration tests of orifice, flow nozzles, instruments and control equipment to the extent included in these specifications. 20. Checks on operation of all rotating equipments to ascertain level of noise and vibration 21. Checks on operation of all static equipments to ascertain level of noise and vibration 22. Standard commissioning tests and procedures as per manufacturer's practice for Generator, Excitation and its auxiliaries within the Contractor's scope of work.
3.06.00	**Balance of Plant equipment & systems** All pre-commissioning tests &activities as required for successful running of the equipment or as mentioned in the technical specification elsewhere shall be performed by the contractor.
4.00.00	**Initial Operation** Upon completion of system checking/tests and as a part of commissioning of facilities, complete plant/facilities shall be put on initial operation for a period of thirty (30) days or 720 hours as stipulated in General Technical Requirements.
5.00.00	The Contractor shall conduct all the commissioning tests and undertake commissioning activities pertaining to all other auxiliaries and equipments including all Electrical & C&I equipment/systems not specifically brought out above but are within the scope of work and facilities being supplied & installed by the Contractor and follow the guidelines indicated above or elsewhere in these technical specifications (Section-VI).
6.00.00	The Contractor shall conduct the comprehensive guarantee tests on the Steam Generator in co-ordination with the Steam Generator to establish the functional guarantee values at stipulated conditions as per Sub-section-IV, Part-A, Section-VI.
7.00.00	The Contractor shall conduct all the commissioning tests and undertake commissioning activities pertaining to all other auxiliaries and equipments including all Electrical & C&I equipment/systems not specifically brought out above but are within the scope of work and facilities being supplied & installed by the Contractor and follow the guidelines indicated above or elsewhere in these technical specifications (Section-VI).
8.00.00	**COMMISSIONING SPARES**
8.01.00	It will be the responsibility of the Contractor to provide all commissioning spares including consumable spares required for initial operation till the Completion of Facilities. The Contractor shall furnish a list of all commissioning spares within 60 days from the date of Notification of Award and such list shall be reviewed by the Employer and mutually agreed to. However, such review and agreement will not absolve the Contractor of his responsibilities to supply all commissioning spares so that initial operation do not suffer for want of commissioning spares. All commissioning spares shall be deemed to be included in the scope of the Contract at no extra cost to the Employer.
8.02.00	These spare will be received and stored by the Contractor at least 3 months prior to the schedule date of commencement of initial operation of the respective equipment and utilized

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	as and when required. The unutilized spares and replaced parts, if any, at the end of successful completion of guarantee tests shall be the property of the Contractor and he will be allowed to take these parts back at his own cost with the permission of Employer.

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ANNEXURE-I

STANDARD CHECKLIST

This is an indicative list of items. The actual list shall depend on the Equipment / System being supplied by the contractor.

MECHANICAL

VALVES

1. Manually Operated Valve
2. Electrically Operated Valve
3. Pneumatically Actuated Valve
4. Hydraulically Actuated Valve
5. Safety Valve
6. Electromatic Relief Valve
7. Steam Trap
8. Non Return Valve (including Hydraulic/ Pneumatic QCNRVS)
9. Control Valve
10. Relief Valve
11. Differential Pressure Regulating Valve
12. Butterfly valve (Electrically Operated)
13. Butterfly valve (Manually Operated)
14. Butterfly valve (Fourway -Electrical)
15. One spare EOTV for steam blowing

TANKS & PRESSURE VESSELS

1. Tanks (metal) up to 20 M^3
2. Tanks (Large Storage)
3. Pressure Vessel (Below 17 bars)
4. Air Receiver
5. Pressure Vessel – Access Door

PUMPS

1. Pump-Low Pressure Centrifugal (Motor driven)
2. Pump-Up to 350HP
3. Pump-Sump installation
4. Gear Pump/Screw pump

PIPE WORK SYSTEM

1. Steam services
2. Water services
3. Oil / Fire Resistant fluid system

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4. Air services (Compressor)
5. High pressure services
6. Constant load support
7. Spring supports
8. PF Coal
9. Hangers and other Supports

STRAINER AND FILTER

1. Strainer / Filter Basket Type
2. Strainer Rotary (Low Pressure)
3. Filter & Strainers Centrifugal Separators
4. Filter & Strainer Y-Type
5. Filter & Strainer (Plate Type)
6. Purifier
7. Filter – Compressed Air Line

HEAT EXCHANGER

1. Heat Exchanger (General)
2. Heat Exchanger – Oil / Water
3. Rotary Air Heater

FANS & COMPRESSORS

1. Fans –Non-Pressure Lubricated
2. Fans – Axial Flow pressure Lubricated
3. Compressors-General including H2 gas compressor

DAMPERS & GATES

1. Manually Operated Damper
2. Pneumatically Operated Damper
3. Electrically Operated Damper
4. Manually Operated Gates
5. Pneumatically Operated Gate
6. Electrically Operated Gate

DUCT WORK

1. Air & Flue Gas Ducting
2. Expansion Joints
3. Observation & Access Door

CRANES AND ELEVATORS

1. Auxiliary Overhead Crane
2. Travel Support Structure for Crane
3. Long Travel & Cross Traverse Motion of Crane

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4. Main Aux. Hoist Motion (Crane)
5. Crane Electric Hoist

POWER TRNAMISSION

1. Power Transmission Gear Box
2. Bearings
3. Fluid Couplings

BOILER & AUX.SYSTEM

1. Soot Blower Long Retractable
2. Wall Deslagger/Soot Blower
3. Bottom Ash Hopper
4. Fly Ash Hopper
5. Lubricator –Compressed Air Lines
6. Wind Box Assembly
7. Mixer / Stirrer
8. Compressed Air Breathing Apparatus
9. Oil Burner
10. Ignitors
11. Scanner
12. Manual Lubricators
13. Air Motor
14. Driers-Non Regenerative /Regenerative
15. Coal Bunker

ELELCTRICAL

1. D.C. Motor
2. HV Squirrel Cage Induction Motor
3. 415 V Squirrel Cage Induction Motor
4. Motor Operated Actuators
5. Soot Blower (Deslagger)
6. Soot Blower (Long Retractable)
7. Soot Blower (Air Heater)
8. Aux. Control and Relay Panel Desk
9. LT SWITCHGEARS/MCC
   - a) STANDARD CHECLISTS FOR ALL TYPES OF RELAYS USED IN SWITCHGEARS PROTECTION SYSTEM
   - B) PT CARRIAGE AND CUBICLES
   - C) CABLE/BUS DUCT/BUS BARS
   - D) CONTRACTOR MODULE
   - E) SWITCH FUSE MODULE
   - F) MASTER PANEL OF LUBE OIL PANEL

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G) FEEDER PANEL OF LUBE OIL PANEL
H) SPACE HEATER AND CABLE MODULE
I) HT CIRCUIT BREAKER
J) 415 V CIRCUIT BREAKER
K) POWER CABLE
L) AUXILIARY CABLE
M) D.C. CABLE
N) EXPLOSION PROOF ELECTRICAL EQUIPMENT
O) JUNCTION BOX
P) CONTROL TRANSFORMER MODULE
Q) BRUSH GEAR ASSEMBLY
R) AUX. CONTROL AND RELAY PANEL DESK
S) INDICATING INSTRUMENT
T) RECORDING INSTRUMENT
u) INTEGRATING INSTRUMENT

CONTROL & INSTRUMENTATION

1. Conductivity Measuring Equipment Including Test Procedures
2. pH Analyser Including Test procedure
3. Silica Analyser
4. Level Switch (Float Actuated)
5. Level Switch (Electrode Type)
6. Level Switch (Displacer Actuated)
7. Transmitter (Float Operated Pneumatic Output including Testing procedures
8. Level indicator (Float/Pulley Type)
9. Local Temperature Indicator Including Test Procedure
10. Resistance Thermometer Element Including Test procedure
11. Thermocouple Element and Connecting Cable
12. Thermocouple and Resistance Thermometer Convertor/Transmitter Including Test Procedures
13. Temperature Switch Including Test Procedure
14. Cold Junction Boxes
15. 0_2Analyser
16. 0_2 in Hydrogen including Test procedures
17. Pressure and Vacuum Gauge
18. Pressure and Vacuum Switch Including Test procedures
19. Differential Pressure Transmitter including Test Procedures
20. Differential pressure switch including Test procedures
21. Flow indicator (Variable Area)
22. Orifice plate
23. Flow Switch

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	24. Nozzle 25. Flow Integrator (pneumatic input) including test procedure 26. Flow indicator (Float Operated) Including Test Procedure 27. Venturi (Fluid) 28. Flow Switch (Magnetic Type) 29. Limit Switches 30. Turbine Supervisory Measuring System 31. Position Measurement & Indication Including Test procedures 32. Vibration Measurement 33. Digital Indicator 34. Moving Coil Indicator Including Test Procedures 35. Recorder Including Test procedure 36. Flame Scanner 37. Electrical Auto Manual Control Station 38. Push Button Module 39. Test Procedure for Electronic Modules of DDCMIS 40. Alarm Annunciator Equipment Including Test Procedure 41. Test procedure for Adjustment of Modulating Controller-PID Term 42. Test Procedure Indicating Controller-Electrical Input & Pneumatic Output

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ANNEXURE-II

TESTING / COMMISSIONING PROCEDURES

Following is an indicative list of equipments / systems for which Testing / Commissioning procedures are to be submitted. The actual list will depend on the equipment / system being supplied by the Contractor.

S. No	DESCRIPTION
	Boiler
1.	ID Fan
2.	FD Fan
3.	PA Fan
4.	Air Heater
5.	Scanner Air Fans
6.	Fuel Firing System
7.	Milling System
8.	Soot Blower System
9.	Aux. Steam System
10.	Mill Reject Handling System
11.	HP Bypass System
12.	S.A.D.C. and its control
13.	Boiler Chemical Analysis Equipment
14.	SH / RH Spray system
15.	Chemical Dosing System
16.	Boiler Air and Gas System -Interlock Operation
17.	Boiler Start-up Re-Circulation Pump
18.	Coal Feeders
19.	Electrostatic Precipitator

CLAUSE NO.	TECHNICAL REQUIREMENTS

20.	Dosing System
21.	Seal Air Fans
22.	Boiler Safety Valves

LIST OF TEST / ACTIVITIES TO BE PERFORMED ON TG & AUXILIARY

(BUT NOT LIMITED TO THE FOLLOWING)

A) **TESTING SCHEDULES**

1. TURBINE ON BARRING GEAR
2. BEARING AND JACKING OIL INITIAL CIRCULATION
3. HP BYPASS SYSTEM
4. LP BYPASS SYSTEM
5. GOVERNOR OIL CONTROL SYSTEM
6. VACUUM RAISING PLANT
7. CONDENSER & COLTCS SYSTEM
8. CENTRAL OIL PURIFICATION PLANT
9. HYDRAULIC TEST PROCEUDRE FOR
   - A) LUB OIL SYSTEM
   - B) CONTROL OIL & JACKING OIL SYSTEM
   - C) GENERATOR SEAL OIL SYSTEM
   - D) GENERATOR STATOR WATER SYSTEM
   - E) GENERATOR GAS SYSTEM (Alternatively, pneumatic test with suitable leak detection method shall also be acceptable subject to owner's approval)
   - F) HEATERS
10. OIL FLUSHING OF LUB OIL SYSTEM
11. OIL FLUSHING OF CONTROL & JACKING OIL SYSTEM
12. OIL FLUSHING OF GENERATOR SEAL OIL SYSTEM
13. ALKALI FLUSHING FOR CONDENSATE SYSTEM
14. HP/ LP BYPASS SYSTEM

CLAUSE NO.	TECHNICAL REQUIREMENTS

15. CONDENSER FLOOD TEST

16. CONDENSER VACUUM TIGHTNESS TEST

17. STEAM BLOWING OF GLAND SEAL PIPE LINES, AUX. STEAM PIPELINE

18. CEP

19. Drip Pump (if applicable)

20. HEATER

21. DEAERATOR

22. BFP

23. BEARING AND JACKING OIL INITIAL CIRCULATION

24. GOVERNOR OIL CONTROL SYSTEM

25. HYDRAULIC TEST PROCEDURE FOR

    A) LUB OIL SYSTEM

    B) CONTROL OIL & JACKING OIL SYSTEM

    C) WATER SYSTEM

    D) HEAT EXCHANGERS

26. OIL FLUSHING OF LUB OIL SYSTEM

27. OIL FLUSHING OF CONTROL & JACKING OIL SYSTEM

28. STEAM BLOWING OF GLAND SEAL PIPE LINES, AUX. STEAM PIPELINE

29 HT MOTORS

B) COMMISSIONING SCHEDULE

1. Turbine Gland sealing system for Main Turbine

2. HP-LP Bypass system

3. Turbine Initial Run up for Main Turbine

4. Lube Oil / Governing Oil System for Main Turbine

5. LP HEATERS

6. HP HEATERS

7. DEAERATOR STEAM OPERATION

CLAUSE NO.	TECHNICAL REQUIREMENTS

8. Turbine Gland sealing system for BFP turbine
9. Turbine Initial Run up for BFP turbine
10. Lube Oil / Governing Oil System for BFP turbine

11. Generator and excitation system
12. Generator seal oil system
13. Generator stator water system
14. Generator gas system

OFFSITE	
1.	Circulating Water System
2.	Raw Water System
3.	Clarified Water System
4.	DM Plant
5.	Cooling Tower
6.	Compressed Air System
7.	Hydrogen Generation/ Bottling Plant
8.	Fire Protection & Detection System
9.	Air Conditioning and Ventilation System
10.	Ash Handling System • Bottom Ash System • Coarse Ash System(Economiser Ash) • Fly Ash System (ESP and APH) • Ash Slurry Disposal System • Ash water System
11.	Fuel Oil System

CLAUSE NO.	TECHNICAL REQUIREMENTS

ANNEXURE-III

COMMISSIONING PROCEDURES REQUIRING APPROVAL OF CORPORATE OS DIVISION OF EMPLOYER

S.NO.	DESCRIPTION
1.	BOILER HYDRAULIC TEST & PRESERVATION
2.	OIL FLUSHING OF LUB OIL SYSTEM OF ROTARY EQUIPMENTS
3.	DETERGENT FLUSHING OF PRE-BOILER AND CONDENSATE SYSTEMS
4.	AIR & GAS TIGHTNESS TEST FOR FURNACE AND DUCTS
5.	AIR IN LEAK TEST OF ESP
6.	CHEMICAL CLEANING OF BOILER
7.	STEAM BLOWING & OIL FLUSHING OF FUEL OIL LINES
8.	STEAM BLOWING OF BOILER, ASSOCIATED STEAM LINES & AUX STEAM LINES
9.	GD TEST OF ESP
10	CLEAN AIR FLOW TEST OF MILLS
11	FLUSHING & HYDRAULIC TEST OF TG LUB OIL & JACKING OIL SYSTEMS
12	FLUSHING & HYDRAULIC TEST OF CONTROL FLUID SYSTEM
13	OIL FLUSHING OF LUB OIL SYSTEM OF MDBFP
14	COMMISSIONING OF HP BYPASS SYSTEM
15	COMMISSIONING OF LP BYPASS SYSTEM
16	FLUSHING & HYDRAULIC TEST OF GENERATOR SEAL OIL SYSTEM
17	FLUSHING & HYDRAULIC TEST OF GENERATOR PW SYSTEM
18	GENERATOR AIR TIGHTNESS TEST
19	CONDENSER FLOOD TEST & VACUUM TIGHTNESS TEST
20	GENERATOR TESTING PROCEDURE FOR 1ST SYNCHRONISATION

CLAUSE NO.	TECHNICAL REQUIREMENTS

ANNEXURE-IV

Demonstration/Acceptance tests during Commissioning/Initial Operation

The following tests shall be demonstrated during commissioning for which the bidder has to furnish the procedure and get the approval of the employer:

1. Start-up, Loading, Unloading and Shutdown Capabilities (For Turbine Generator)
2. Turbine Generator Set Capability
3. Turbine Auxiliaries
4. Balance Pumps, Blowers, Fans, Compressors and rotating equipment.
5. Balancing of Coal/Primary air flow
6. Demonstration of boiler operation, rate of change of load and sudden load change withstand capability
7. Steam Temperature Imbalance
8. No fuel oil support shall be required above 40% BMCR
9. Capability of all drives
10. Margin on Fans
11. Cold Air Velocity Test (CAVT)

CLAUSE NO.	TECHNICAL REQUIREMENTS

ANNEXURE-V

BRIEF WRITE UP ON THE CONTENTS OF TESTING / COMMISSIONING PROCEDURE

Testing / Commissioning Procedure is required to be of a standard format in order to maintain consistency of presentation, content and reporting. These should contain the following sections to make the document a self contained one.

1. Plant Details / Design data
2. Objective
3. Proposal
4. Services Required
5. Safety Precautions
6. Emergency Procedures
7. State of the Plant (Status in respect of erection completion of Mech, Elect and C&I items)
8. Method
9. Completion / Acceptance Criteria
10. Appendix
    - Result
    - Log sheet
    - Drawing etc.