

VOLUME - IA

Technical Conditions of Contract (TCC) for “ E&C of
Electromechanical packages for 1X250 MW STG & it's
Auxiliaries ” at JSW Dolvi CPP-4

FOR

JSW 1x250 MW STG project

BHARAT HEAVY ELECTRICALS LIMITED

Technical Conditions of Contract (TCC) for Electromechanical Works

 Technical Conditions Of Contract (TCC) PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD			Ref No: HY/PE&SD/Pr jects/TCC/20 25-26/E&C- 250MW/01		
			Rev. No. 01		
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Volume IA

Part I

Contract specific details

Chapter I- Project Information

JSW Steel Limited, Dolvi Works, at Geetapuram, district Raigard in the state of Maharashtra, India is presently operating 10.0 MTPA capacity of Integrate Steel Plant. JSW Steel Limited intends to enhance steel plant capacity up to 15 MTPA by addition of one number blast furnace, namely BF#3 of capacity 5339 m3 at Dolvi under its phase-III expansion. JSW has undertaken the installation of one power generation unit of 1X 250 MW and awarded BHEL for the total system / Plant and Equipment in all respect. This specification covers assembly, interconnection with existing unit, testing, packing, supply, storage at site, erection, start-up, commissioning and guarantee tests of One no. 250 MW Steam Turbine Generator set. Technical Specification along with their associated auxiliaries, auxiliary facilities, pipe work, electrics, instrumentation, control and automation as specified herein and are to be installed in the proposed power plant, and the location of the power plant will be inside the JSW steel, Dolvi premises.

Project Details			
1	Customer	:	JSW, Dolvi, Maharastra
2	Project Title	:	1X250MW STG
3	Owner 's Consultant		M/s MECON Ltd
4	Location	:	Dolvi, Maharastra
5	Address Detail	:	JSW ,DOLVI,PEN,MAHARASTRA-402107
6	Nearest Railway Station	:	PEN,8KM approximately
7	Road Approach	:	NH -66 &NH 166A
11	Nearest Air Port	:	CSM International Airport,Mumbai approximately 90 km
12	Ambient Air Temperature (Average)	:	a) Maximum : 390 C b) Minimum : 160 C
13	Average Relative Humidity	:	71 %
14	Climatic Condition	:	Tropical Climate

Bidder is advised to visit the project site and appraise himself about the local conditions and infrastructure available in the area for fulfilling their commitments under the contract. BHEL will not admit any claims whatsoever on account of Contractor's non-familiarization of local conditions

Chapter II- Scope of Work

2.0 The work to be carried out under the scope of these specifications is broadly as under:

Material handling (Receipt, Issue, Loading, unloading, preservation & Record keeping), Unloading of material consignment at BHEL stores, proper stacking, record keeping, Collection of materials from BHEL/client's stores/storage yard; transportation to site; complete erection, testing & commissioning, trial operation, PG Test and handing over of complete facilities of 1X250 MW STG & it's auxiliaries as below.

The scope will also include works for Electrical, Control & Instrumentation, Piping system, Spares handover etc as required by the system and elaborated in the ensuing texts.

1. Steam Turbines & Turbo Generators along with its auxiliaries.
2. Condensate system comprising of Surface condenser, Gland steam Condenser, Vacuum Pumps
3. Regenerative cycle auxiliaries comprising of CEPs, LP Heaters, HP Heaters along with associated piping
4. TG integral piping, Hot well make up Pump and associated piping & control valves.
5. Thermal insulation refractory & cladding of piping & equipment.
6. BFV's RE joints and filter.
7. Condenser On load Tube cleaning system.
8. Heat Exchangers
9. Special grouting with materials for STG and it's auxiliaries.
10. Power Cycle Pumps with Associated Auxiliaries etc. including Bought Out Items Brought out items
11. Chain Pulley Blocks
11. First filling & top up of H₂, CO₂ & N₂, lube oil, lubricants and consumable till commissioning.
12. Generator Hydrogen gas purity analyzer including all accessories like piping, valves, flanges etc.
13. Acoustic Enclosure for STG.
14. Insulation & Painting of all erected equipment and structures.
15. Electrical and C&I Panels, instrument mountings & cable terminations.

Detailed scope of works is provided in Part-II "Technical Specification" of TCC. In case of any ambiguity in the scope, The Scope matrix of the customer will supersede.

All the construction materials, tools & tackles are in the scope of the contractor

Chapter III- Facilities in the scope of BHEL/Contractor

S. No.	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.1	ESTABLISHMENT			
3.1.1	FOR CONSTRUCTION PURPOSE:			
a	Open space for office (as per availability)	Yes		
b	Open space for storage (as per availability)	Yes		
c	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
d	Bidder's all office equipment, office / store / canteen consumables		Yes	
e	Canteen facilities for the bidder's staff, supervisors and engineers etc.		Yes	
f	Firefighting equipment like buckets, extinguishers etc.		Yes	
g	Fencing of storage area, office, canteen etc. of the bidder		Yes	
3.1.2	FOR LIVING PURPOSES OF THE BIDDER			
a	Open space for labor colony (as per availability)		Yes	Subject to availability BHEL may arrange to provide land for labor colony from the customer, JSW on chargeable basis
b	Labor Colony with internal roads, sanitation, complying with statutory requirements		Yes	Subject to availability BHEL may arrange to provide accommodation for contractor's workers in existing labor colony of the customer, JSW on chargeable basis
3.2.0	ELECTRICITY			

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S. No.	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.2.1	Electricity For construction purposes		Yes	Electricity shall be provided by BHEL/JSW at one point free of cost. Further distribution shall be done by contractor at its own cost.
3.2.2	Electricity for the office, stores, canteen etc. of the bidder		Yes	
3.2.3	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc.		Yes	
3.3.0	WATER SUPPLY			
3.3.1	For construction purposes		Yes	Water shall be provided by JSW at one point free of cost. Further distribution shall be done by contractor at its own cost.
3.3.2	Water supply for bidder's office, stores, canteen etc.		Yes	
3.3.3	Water supply for Living Purpose		Yes	
3.4.0	LIGHTING			
a	For construction work (supply of all the necessary materials) At office/storage area At the preassembly area At the construction site /area		Yes	
b	For construction work (execution of the lighting work/ arrangements) 1. At office/storage area 2. At the preassembly area At the construction site /area		Yes	
c	Providing the necessary consumables like bulbs, switches, etc. during the course of project work		Yes	
d	Lighting for the living purposes of the bidder at the colony / quarters		Yes	
3.5.0	COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE BIDDER			

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S. No.	Description PART I	Scope / to be taken care by		Remarks
		BHEL	Bidder	
a	Téléphone, fax, internet, intranet, e-mail etc.		Yes	
3.6.0	COMPRESSED AIR wherever required for the work		Yes	
3.7.0	Demobilization of all the above facilities		Yes	
3.8.0	TRANSPORTATION			
a	For site personnel of the bidder		Yes	
b	For bidder's equipment and consumables (T&P, Consumables etc.)		Yes	

Sl. No	Description PART II 3.9.0 CONSTRUCTION FACILITIES	Scope / to be taken care by		Remarks
		BHEL	Bidder	
3.9.1	Engineering works for construction:			
a	Providing the construction drawings for all the works covered under this scope	Yes		Drawing schedule shall be finalized at the time of kick off meeting
b	Drawings for construction methods			NA
c	As-built drawings – where ever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes		Yes	In consultation with BHEL
d	Shipping lists etc. for reference and planning the activities		Yes	In consultation with BHEL
e	Preparation of construction (Concreting B/W, etc.) schedules and other input requirements		Yes	In consultation with BHEL
f	Review of performance and revision of site construction schedules in order to achieve the end dates and other commitments		Yes	In consultation with BHEL

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Sl. No	Description PART II 3.9.0 CONSTRUCTION FACILITIES	Scope / to be taken care by		Remarks
		BHEL	Bidder	
g	Weekly construction schedules based on S. No. e. hard copy to Construction manager, by email to HO.		Yes	In consultation with BHEL
h	Daily construction / work plan based on S. No. g. hard copy to Construction manager, by email to HO.		Yes	In consultation with BHEL
i	Periodic visit of senior official of the bidder to site to review the progress so that works are completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two Weeks.		Yes	
j	Arranging the materials required for Work		Yes	
k	Coordination for inspection & checking and getting clearance from customer		Yes	
l	Preparation of formats for completion of activities		Yes	
3.10	Work Permits, gate pass etc. from customer for manpower, machinery and material		Yes	
3.11	Ambulance Services for contractor's site staff as required		Yes	
3.12	Firefighting equipment like buckets, extinguishers(CO2,DCP,Foam type etc)		Yes	
3.13	Canteen facilities for the bidder's staff, supervisors and engineers etc		Yes	

Chapter – IV: T&Ps and MMDs to be deployed by Contractor

4.0 MAJOR MECHANICAL TOOLS AND PLANTS & MMDs TO BE DEPLOYED BY THE CONTRACTOR

1	TYRE MOUNTED HYDRAULIC CRANES		AS PER REQUIREMENT
2	TRAILER OF REQUIRED CAPACITY		DO-
3	TRAILER TROLLEY		-DO-
4	WELDING GENERATOR SETS (E L E C T R I C AS WELL AS DIESEL)		-DO-
5	3- PHASE COMPLETE SET UP FOR DRAWAL OF POWER		-DO-
6	RADIOGRAPHY ARRANGEMENT INCLUDING THE SOURCE AND FILM VIEWER		-DO-
7	TIG WELDING SET		-DO-
8	STRESS RELIEVING EQUIPMENT WITH TEMPERATURE RECORDERS		-DO-
9	ELECTRODE BAKING OVEN - BIG		-DO-
10	ELECTRODE BAKING OVEN - PORTABLE		-DO-
11	MIXER FOR GROUTING OF EQUIPMENT FOUNDATIONS		-DO-
12	VACUUM CLEANER (INDUSTRIAL)		-DO-
13	PIPE CUTTING AND BEVELLING MACHINE		-DO-
14	PIPE BENDING M/C	ELECTRIC/ ELECTRO HYD -	-DO-
15	AIR COMPRESSOR	120 CFM	01
16	STEP DOWN TRANSFORMER	230V/24V	DO
17	CONDENSER TUBE EXPANDER SET		
18	ELECTRICALLY OPERATED WINCHES	3T/5T	DO
19	JACKING BOLTS / PRESSOUT BOLTS OF ALL SIZES (FOR ST. TURBINE ROLL CHECKS ETC.)		DO
20	HYDRAULIC JACKS OF VARIOUS CAPACITIES FOR ST. TURBINE AND GENERATOR :		
	A) - JACKS (WITH HAND OPERATED PUMPS)	100 MT	04 NOS.
	B) - JACKS (WITH HAND OPERATED PUMPS)	50 MT	04 NOS.
	GANG OPERATED JACKS CONSISTING OF THE FOLLOWING:		
	A) JACKS (HAVING BROAD BASE ONE INCH LIFT)	100 MT	04 NOS.
	B) JACKS (WITH 4-6 INCH LIFT, FOR GEN. END SHIELDS)	63 MT	04 NOS

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C) - LONG HIGH PRESSURE HOSES (FOR
GENERATOR ALIGNMENT)

08 NOS

ABOVE JACKS FOR GENERATOR ALIGNMENT SHOULD HAVE SUITABLE COUPLING FOR JOINING THE TWO OR MORE HOSES TOGETHER TO GET DESIRED LENGTH OF HOSES, SHOULD HAVE HAND OPERATED PUMPS & ALSO SHOULD BE ABLE TO FIT WITH HYDRAULIC UNIT.

21	TORQUE WRENCH	0 TO 200 N-M	01 NO.
22	TORQUE WRENCH	UPTO 2000 N-M	01 NO.
23	SLINGS FOR LP TURBINE ROTOR		01SET
24	SLINGS FOR HP TURBINE MODULE		01SET
25	SLINGS FOR GENERATOR ROTOR		01SET
26	BOLT STRETCHING DEVICE (FOR TURBINE & GENERATOR FOUNDATION BOLTS)		AS PER REQUIREMENT
27	LONG FEELER GAUGE SET		AS PER REQUIREMENT
28	SPANNERS / EYE BOLTS (OF ALL SIZES)		AS PER REQUIREMENT
29	HYDRAULIC TEST PUMPS AND FILL PUMPS		AS PER REQUIREMENT
30.	CHEMICAL CLEANING PUMPS WITH STARTER, MOTOR, CABLES, ETC.- OF REQUIRED QUANTITY CAPACITY)		AS PER REQUIREMENT
31.	PRESSURE PUMP FOR TESTING OF PIPE LINES		AS PER REQUIREMENT
32.	HAND OPERATED HYDRAULIC TEST PUMP OF SUITABLE CAPACITY		AS PER REQUIREMENT
33.	FLAME GUN / INDUCTION HEATER		AS PER REQUIREMENT
33. STRANDS & JACKS / LIFT & SHIFT ARRANGEMENT FOR GENERATOR STATOR LIFTING ALONG WITH LIFTING SLINGS			

THE T & P LIST IS INDICATIVE ONLY. CONTRACTOR MAY HAVE TO ARRANGE ANY OTHER MAJOR T&P WHICH ARE REQUIRED FOR SATISFACTORY COMPLETION OF THE WORKS. Third Party Inspection (TPI) shall be carried out TPI Certificate shall be provided as per requirement on T & P s including strand Jack arrangement.

The contractor has to deploy cranes (except EOT crane) as per the details tabulated below:

Sl No	Description	Capacity/Qty	Remarks
1	EOT Crane in TG hall of capacity 100/25 MT	1No	Customer EOT crane available for handling and Erection between A-B Bay of TG building, subject to its capacity & accessibility /approachability.
2	Crane (in scope of contractor)	150/450 MT/as required	Contractor shall plan well in advance for bringing adequate capacity cranes and lifting/ shifting arrangements for smooth execution of contract as and when required at site without any extra cost to BHEL

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Note:

1.BHEL shall not provide any Chemical Cleaning /Flushing pumps / equipment as required for Chemical cleaning/flushing of piping and related equipment / systems. These Chemical pumps of suitable capacity along with motor starters, cables etc. shall have to be provided by the contractor as part of scope of work. Contractor shall arrange / provide all Chemical cleaning arrangements as per requirement and instructions of BHEL engineer without any delay/time lapse

2.Strand and Jack/Lift & Shift arrangement for lifting and placement of Generator Stator: Contractor shall arrange complete set up of Strand and Jacks/Lift & Shift arrangements and all Tools & Tackles as required for lifting and placement of Generator Stator to its designed elevation & foundation including the services of expert execution and supervision. Sleepers & Jack or Sand Bag & Jack or any methods/arrangement other than the one specified above for Lifting & Placement of Generator Stator will not be accepted.

3.Complete set of hydraulic jacks of required capacity (Tentative weight of Generator stator is 228.0 MT) shall be arranged by the contractor for use during erection and commissioning of Turbine. Also, hydraulic jacks along with long high-pressure hoses of suitable length for Generator erection and alignment shall be arranged by the contractor. These jacks shall of internationally reputed make, highly reliable and maintained in excellent working condition. They shall be tested for safe working before deploying in actual work. These jacks shall not be permitted for use anywhere other than Steam Turbine / Generator area.

4. All jack bolts that are required during erection for carrying out roll-check etc. will have to be arranged by the contractor. No jack bolts will be provided by BHEL. Contractor has to provide spanners of all sizes, Bolt stretching devices etc. as required for satisfactorily carrying out the complete erection / commissioning works. No spanners will be provided by BHEL to the contractor.

5.Contractor has to arrange slings of all sizes for completing the works covered under these specifications including the special slings for Generator Stator Lifting/Handling

6. Contractor shall make necessary arrangements like laying of sleepers; minor earth filling & consolidation; assembly & dismantling of heavy lift attachment, boom, jib etc for movement and operation of the crane.

7. BHEL will not provide any crane / arrangement for unloading & handling of Equipment. Contractor shall make his complete arrangements for responsibility and carry out the liaisoning and follow up with transporters, filling of ditches/levelling etc. for marching of trailer to unload at suitable location/point of lifting near the TG building, Shifting/dragging of Generator Stator by providing required arrangements like rails/plates/sleepers etc. (asper requirement), arranging the Strand And Jacks/Lift & Shift arrangements & their assembly /installation with expert supervision till lifting & placement of Generator, making resting Foundations/Footings to suit the installation of his Strand and Jack arrangements (as required) and Lifting & Placement of Generator Stator to

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required/designed foundation/elevation)

8. Complete operation of EOT crane along with providing the operator, day to day operation/maintenance, general cleanliness, attending of gear box leakages etc., applying caladium Compound on slings and holding / supporting the supply cables etc. provided by the contractor as per requirement.

EOT crane will be used on sharing basis by other agencies working within the TG hall under the instruction of JSW/BHEL Engineer In-charge. Contractor has to plan his activities well in advance and inform BHEL engineer In-charge / Construction Manager for the date of actual use.

9. HP Heaters (Horizontal Type), LP Heaters (Horizontal Type) & other equipment/axillaries are to be erected in TG Building at their designed foundations at different elevations. The customer's EOT crane 100/25T is located in TG Building and as such this EOT crane may not have direct accessibility /approachability to handle and place all this equipment to their foundations. Contractor may make use of this EOT crane as per prior approval of BHEL/Customer engineer subject to its readiness and approachability to carry out lifting and placement of these equipment to nearest location by using additional platform etc. along with dragging arrangements, wherever required. Contractor shall make his own arrangement of such requirements for shifting/dragging/making additional platforms etc. to place and assembled/ install these equipment to their respective designed foundations & elevations as part of scope of work. BHEL / Customer shall not provide any additional arrangements/infrastructure for this purpose.

Chapter V- Time Schedule

5.1 MOBILIZATION, TIME SCHEDULE & CONTRACT PERIOD

5.1.1. INITIAL MOBILIZATION

Contractor shall reach site, make his site establishment and be ready to commence the erection work within two weeks from the date of issue of Letter of Intent or as per the directions of Construction Manager/ Project Manager/Engineer-in-charge of BHEL.

5.1.2. MOBILIZATION FOR ERECTION, TESTING, ASSISTANCE FOR COMMISSIONING ETC

The activities for erection, testing etc shall be started as per the directions of construction manager of BHEL. Contractor shall mobilize further resources (in addition to those required for activities under clause no. 6.1.1) as per the requirement to commence the work of erection, testing etc of TG and auxiliaries and progressively augment the resources to match schedule of the project.

5.1.3. COMMENCEMENT OF CONTRACT PERIOD AND TENTATIVE SCHEDULE

The date of commencement of contract period shall be the mutually agreed date between the bidder and BHEL engineer to start the work. In case of discrepancy, the decision of BHEL engineer will be final.

Based on the availability of civil foundations from customer and materials from manufacturing units, contractor may have to advance the start of erection after getting clearance from construction manager, or the start of erection may get delayed due to site condition.

The contractor has to subsequently augment his resources in such a manner that following major milestones of erection & commission are achieved on specified schedules:

5.1.4 TENTATIVE SCHEDULE

Milestones	Tentative schedule of completion
Arrival of first material consignment	1 st Month
Start Condenser Erection	3 rd Month
Start Turbine (& Generator) Erection	5 th Month
Turbine generator Box Up	10 th Month
Completion of Oil Flushing	12 th Month
Barring Gear	14 th Month
Rolling & Synchronization	15 th Month
Trial operation /PG Test/Completion of all facilities	17 th month

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In order to meet above schedule in general, and any other intermediate targets set, to meet customer/project schedule requirements, contractor shall arrange & augment all necessary resources from time to time as per the instructions of BHEL.

5.1.5 DURATION

The total contract period for completion of entire work shall be **17 (Seventeen) months** from the start of erection as specified earlier.

However, the contractor shall have to mobilize his resources earlier than the start of contract period for preparatory work like taking over and chipping of foundations, blue-matching and grouting of packer plates etc.

The contractor shall complete all the works in the scope of this contract within the contract period. Pending points identified by the customer/BHEL during the execution of the contract are to be liquidated during the contract period itself. Contractor to carry out installation of impulse pipes, fittings, thermowells /thermo couples etc required for successful completion of Performance Guarantee test and provide in assistance for installation & removal of PG test instruments and conductance of test.

GUARANTEE PERIOD

The guarantee period of twelve months shall commence from the date of completion of all works as certified by the BHEL site engineer

Chapter-VI: Terms of Payment

6.0

The progressive payment for Electromechanical works for Material handling, erection, testing and commissioning on accepted price of contract value per unit of STG Package rates will be released as per the break up given hereinafter:

Terms of Payment (Billing Break-up) for Part-A of SOQR for “ E&C of Electromechanical packages 1X250 MW STG & it’s Auxiliaries ” at JSW Dolvi

SI No		CND (1)	TUR (2)	GEN (3)	PUMP & Aux (4)	HEA TER S(5)	MISC . ITEM (6)	INTEG RAL PIPIN G(7)	ELECTR ICS & C&I(8)
A	Overall weightage for each area out of the derived value (Based on total awarded contract value) for part A of SOQR, for E&C (100%)	19%	23%	25%	2%	4%	8%	10%	9%

Terms of Payment		
S No.	Activity/Work Description	% Allocated
I) PRO RATA PAYMENTS (75%)		
1	CONDENSER (Weightage 19%)	
1.01	PREPARATION OF FOUNDATION	2
1.02	PLACEMENT,ALIGNMENT,ASSEMBLY AND WELDING OF BOTTOM PLATE SEGMENTS, HOTWELL, NDT AND SPRING ELEMENTS PLACEMENT & GROUTING	8
A	Placement of bottom Plates	1
B	Alignment & Welding of bottom plate	2

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Terms of Payment		
S No.	Activity/Work Description	% Allocated
C	NDT of bottom plate	1
D	Assembly of Hot Well	1
E	Placement of spring elements	1
F	Grouting of springs	1
G	Welding of hotwell with bottom plate	1
1.03	ASSEMBLY AND POSITIONING OF WATER CHAMBER, WATER BOX, SIDE PLATES ,BOTTOM PLATES,WELDING AND NDT INCLUDING HINGE ASSY	8
A	Assembly of front water chamber	1
B	Assembly of rear water chamber	1
C	Assembly & welding of side plates	2
D	NDT of side plates	1
E	Erection of Water boxes (Font Side & Right Side)	2
F	ERECTION, COMMISSIONING & LOAD TESTING OF HING ASSY	1
1.04	ASSY. ALIGNMENT AND WELDING & NDT OF TUBE SUPPORT PLATES AND INTERNALS LIKE BAFFLE PLATES, AIR EVACUATION PIPES ETC.	11
A	Assembly & alignment of TSP	5
B	Welding of TSP & baffle plates	2
C	NDT of TSP & baffle plates	2
D	Assembly & welding of air evacuation pipes(including erection of vacuum basket)	2
1.05	ASSEMBLY, WELDING & NDT OF DOME WALLS AND DOME STIFNERS, EXTRACTION PIPING AND STEAM THROW DEVICE,LPH-1 SUPPORT ETC.	10
A	Assembly & welding of dome walls	4
B	NDT of dome walls	3
C	Assembly & welding of dome wall stiffeners	3
1.06	INSERTION,EXPANSION,CUTTING ETC OF CONDENSER TUBES	17

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Terms of Payment		
S No.	Activity/Work Description	% Allocated
A	Insertion of tubes (including cleaning of holes)	10
B	Expansion & cutting of tubes	7
1.07	HYDRO TEST STEAM AND WATER SIDE	8
A	Water fill test of steam side	3
B	Hydro test of water side	3
C	Condenser flood test after neck welding and supporting piping	2
1.08	WELDING OF CONDENSER NECK JOINT AND NDT'S COMPLETION OF BALANCE WORKS	8
1.09	ERECTION,COMMISSIONING,LOAD TESTING OF CONDENSER WATER BOX	3
	Total	75
2	STEAM TURBINE (Weightage 23%)	
2.01	PREPARATION OF FOUNDATION PLACEMENT,ALIGNMENT AND GROUTING OF BASE PLATES OF LPC AND BEARING PEDESTALS	6
A	PREPARATION OF FOUNDATION	3
B	PLACEMENT,ALIGNMENT AND GROUTING OF BASE PLATES OF LPC AND BEARING PEDESTALS	3
2.02	PLACEMENT OF HP TURBINE,LOWERING OF HP ROTOR ON BEARING AND CHECKING OF CLEARANCES, COUPLING, HP TURBINE SWING CHECKS ETC	5
A	PLACEMENT OF HP TURBINE ON BEARING PEDESTAL	2
B	ALIGNMENT OF HP TURBINE, ROLL CHECK, BUMP CHECK ETC.	3
2.03	PLACEMENT AND ALIGNMENT OF IP TURBINE & ROLL CHECK, BUMP CHECK ETC	8
A	PLACEMENT OF IP TURBINE	2
B	ALIGNMENT OF IP TURBINE	3
C	ROLL CHECK, BUMP CHECK ETC. OF IP TURBINE	3

Technical Conditions of Contract (TCC) for Electromechanical Works

Terms of Payment		
S No.	Activity/Work Description	% Allocated
2.04	PLACEMENT AND ALIGNMENT OF LP OUTER CASSING BOTTOM PORTION AND CENTRE GUIDE KEYS	4
A	PLACEMENT OF END WALLS & CENTRE GUIDE BOLTS	1
B	WELDING OF GUIDE BOLTS	1
C	PLACEMENT OF LONGITUDINAL GIRDER & WELDING	1
D	ERECTION & WELDING OF GUSSET BLOCK	1
2.05	PLACEMENT OF LP ROTOR AND ALIGNMENT WITH INNER CASING AND CHECKING OF BLADE CLEARANCES	8
A	PLACEMENT & ALLIGNMENT OF INNER OUTER CASING BOTTOM HALF	3
B	PLACEMENT OF LP ROTOR	3
C	ALIGNMENT WITH INNER CASING INCLUDING BLADE CLEARANCE, CHECKING & ALIGNMENT	2
2.06	ASSEMBLY, ALIGNMENT & WELDING OF LP OUTER CASING UPPER HALF	7
A	PLACEMENT OF LP OUTER CASING, ALLIGNMENT INCLUDING FIT UP	3
B	WELDING OF LP OUTER CASING INCLUDING DPT / NDT	3
C	ASSY OF ATM RELIEF VALVE & LEAK TEST	1
2.07	BOXING UP OF LP INNER-INNER & INNER-OUTER AND ROLL CHECK	5
A	BOXING OF LPT INNER- INNER, INNER-OUTER CASING TOP HALF	3
B	ROLL CHECK OF LPT	2
2.08	ALIGNMENT OF ALL ROTORS INCLUDING REAMING, HONING AND FIXING OF COUPLING BOLTS	9
A	ALLIGNMENT OF HP-IP, IP-LP TURBINES	4
B	REAMING & HONING OF HP-IP-IP-LP COUPLINGS	2

Technical Conditions of Contract (TCC) for Electromechanical Works

Terms of Payment		
S No.	Activity/Work Description	% Allocated
c	COMBINED SWING CHECK OF HP-IP, IP-LP AND CORRECTION TO THE REQUIRED VALUE.	3
2.09	INSTALLATION OF ESV,IV, CV, LPBP VALVES,CRH NRV, MS STRAINERS (INTERNALS),HRH STRAINERS (INTERNALS)	6
A	INSTALLATION & ALIGNMENT OF ESV INCLUDING BREACH NUT AND TIGHTENING TO REQUIRED VALUE	1
B	INSTALLATION & ALIGNMENT OF IV, CV	1
C	INSTALLATION & ALIGNMENT OF LPBP	1
D	INSTALLATION & ALIGNMENT OF CRH NRV	1
E	INSTALLATION & ALIGNMENT OF MS STRAINERS INCLUDING INTERNALS	1
F	INSTALLATION & ALIGNMENT OF HRH STRAINERS INCLUDING INTERNALS	1
2.10	ERECTION,ALIGNMENT AND WELDING OF CROSS AROUND PIPING	3
A	ERECTION & ALIGNMENT OF CROSS AROUND PIPING INCLUDING BELLOWS	1
B	WELDING & NDT OF CROSS AROUND PIPING , BELLOWS UNLOCKING & SPRING ERECTION	2
2.11	FINAL BOX-UP OF LP TURBINE	5
A	ERECTION & WELDING OF EXTRACTION PIPES WITH BELLOWS INSIDE THE CONDENSER.	2
B	CHECKING OF BEARING CLERANCES AND CORRECTION SHIM THICKNESS	1
C	FINAL BOX UP OF LP TURBINE	2
2.12	ASSEMBLY OF GOVERNING SYSTEM/EQUIPMENT	5
A	PLACEMENT & ALIGNMENT OF GOVERNING EQUIPMENTS(SERVO MOTORS)	3
B	COMMISSIONING OF GOVERNING SYSTEM	2

Technical Conditions of Contract (TCC) for Electromechanical Works

Terms of Payment		
S No.	Activity/Work Description	% Allocated
2.13	FINAL BOXING UP OF PEDESTALS AFTER OIL FLUSHING COMPLETION	4
A	FINAL BOXING UP OF PEDESTALS AFTER OIL FLUSHING COMPLETION	2
B	CHECKING OF RADIAL & AXIAL KEYS DIMENSION, MACHINING TO CORRECT SIZE AND PLACEMENT	2
	Total	75
3	GENERATOR (Weightage 25 %)	
3.01	PREPARATION OF FOUNDATION, LEVELLING, MATCHING AND GROUTING OF FOUNDATION PLATES	5
3.02	LIFTING, LEVELLING AND ALIGNMENT OF STATOR INCLUDING ASSISTANCE IN ERECTION AND DISMANTLING OF STRAND JACK ARRANGEMENT	17
A	PLACEMENT OF STATOR	14
B	ALIGNMENT OF STATOR	3
3.03	FIXING OF END SHIELDS ON TO FOUNDATION BEAMS	5
3.04	ROTOR INSERTION	6
3.05	BOXING UP OF GENERATOR AND ASSEMBLY OF HYDROGEN SEALS	9
3.06	ALIGNMENT OF GENERATOR ROTOR, LP TURBINE ROTOR, RUN OUT CHECKS AND REAMING ,HONING OF COUPLING HOLES AND FIXING OF COUPLING BOLTS	9
3.07	ERECTION OF EXCITATION EQUIPMENTS & ALIGNMENT OF GEN-EXCITER ROTORS INCLUDING SWING CHECK AND COMPLETION OF BALANCE WORKS	10
A	PLACEMENT OF EXCITOR	3
B	CHECKING OF BEARING CLEARANCE AND CORRECTIONS IF ANY	3

Technical Conditions of Contract (TCC) for Electromechanical Works

Terms of Payment		
S No.	Activity/Work Description	% Allocated
C	ALIGNMENT WITH GENERATOR, SWING CHECK & COUPLING	4
3.08	INSTALATION OF ENCLOSURES OF GENERATOR/EXCITER WITH ALL AUXILIARIES INCLUDING COOLERS,	5
3.09	STATOR BASE PLATE GROUTING & SWING CHECK AT EXCITER END	3
3.10	FINAL SETTING CLEARANCES OF GEN ROTOR AS PER DRAWING & FINAL CRO OF GEN ROTOR COUPLINGS	2
3.11	FINAL GAS TIGHTNESS TEST OF STATOR WITH COMPLETE SYSTEM	4
A	GENERATOR ATT & ERECTION OF STROBOSCOPE, LIGHT ASSLY AND AIR DRYER	2
B	FINAL GAS FILLING	2
	Total	75
4	PUMP AND AUXILIARIES (Weightage 2%)	
4.01	ERECTION / TESTING AND COMMISSINING OF MAIN OIL PUMP, JOP, EOP, AOP, CENTRALISED LUBE OIL PURIFICATION SYSTEM, ALONG WITH ALL AUXILLIARIES.	40
A	ERECTION / TESTING AND COMMISSINING OF MAIN OIL PUMP ALONG WITH ALL AUXILLIARIES.	5
B	ERECTION & ALIGNMENT OF MAIN OIL TANK	10
C	ERECTION OF COOLERS & OIL FILTERS	5
D	ERECTION / TESTING AND COMMISSINING OF JOP ALONG WITH ALL AUXILLIARIES.	5
E	ERECTION / TESTING AND COMMISSINING OF EOP ALONG WITH ALL AUXILLIARIES.	5
F	ERECTION / TESTING AND COMMISSINING OF AOP ALONG WITH ALL AUXILLIARIES.	5

Technical Conditions of Contract (TCC) for Electromechanical Works

Terms of Payment		
S No.	Activity/Work Description	% Allocated
G	ERECTION / TESTING AND COMMISSINING OF CENTRALISED LUBE OIL PURIFICATION SYSTEM ALONG WITH ALL AUXILLIARIES.	5
4.02	ERECTION & TESTING, GROUTING ETC. MISCELLANEOUS PUMPS	5
A	PLACEMENT OF MOTOR & PUMPS	2
B	ALIGNMENT OF MOTOR WITH PUMPS	1
C	GROUTING OF MOTOR & PUMPS	1
D	MOTOR NO-LOAD TRIAL, COMMISSIONING OF MOTOR ALONG WITH PUMPS	1
4.03	ERECTION & TESTING, GROUTING ETC. OF 2 NOS CONDENSATE EXTRACTION PUMPS	30
A	PREPARATION OF FOUNDATION	2X3
B	CHECKING & ERECTION OF CANISTER	2X3
C	PLACEMENT OF PUMP & MOTOR	2X3
D	ASSEMBLY OF CEP BEARING INCLUDING CONNECTION OF COOLING WATER PIPING	2X3
E	COMMISSIONING OF MOTOR ALONG WITH PUMPS	2X3
	Total	75
5	HEATERS (Weightage 4 %)	
5.01	ERECTION, TESTING & COMMISSIONING OF HP & LP HEATERS	50
i.	ERECTION, TESTING & COMMISSIONING OF HP HEATER – 5 &6	20
A	PLACEMENT OF HEATER	2X3

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Terms of Payment		
S No.	Activity/Work Description	% Allocated
B	ALIGNMENT & GROUTING OF HEATER	2X3
C	ERECTION & WELDING OF STAND PIPE/ VALVE & INSTRUMENTS	2X2
D	COMMISSIONING OF HEATER	2X2
ii.	ERECTION, TESTING & COMMISSIONING OF LP HEATER - 1, 2 & 3	30
A	PLACEMENT OF HEATER	3X3
B	ALIGNMENT & GROUTING OF HEATER	3X3
C	ERECTION & WELDING OF STAND PIPE/VALVE & INSTRUMENTS	3X2
D	COMMISSIONING OF HEATER	3X2
5.02	ERECTION, TESTING & COMMISSIONING OF GLAND STEAM CONDENSER, DRAIN COOLER	25
A	PLACEMENT , GROUTING,ERECTION, TESTING & COMMISIONING OF GLAND STEAM CONDENSER	15
B	PLACEMENT , GROUTING, ERECTION,TESTING & COMMISIONING OF DRAIN COOLER	10
	Total	75
6	MISCELLANEOUS ITEMS (Weightage 8 %)	
6.01	CW PIPING, RE JOINTS, ME BELLOWES, DIRTY, CLEAN OIL TANKS, CO2/H2 CYLINDERS RACKS ETC.	28
A	CW PIPING, RE JOINTS	5

Technical Conditions of Contract (TCC) for Electromechanical Works

Terms of Payment		
S No.	Activity/Work Description	% Allocated
B	ME BELLOWS	2
C	DIRTY & CLEAN OIL TANKS, OIL UNLOADING VESSEL	2
D	CENTRAL LUBE OIL PURIFICATION SYSTEM	5
E	CO2/H2 CYLINDERS RACKS	2
F	STATOR CW OVER HEAD TANK WITH LOOSE ITEMS (01 SET)	2
G	SEAL OIL UNIT	2
H	LIQUID DETECTOR RACK & H2 DRIERS	2
I	SERVICE WATER TANK	2
J	POTABLE WATER TANK	2
K	PLACEMENT, ALIGNMENT AND COMMISSIONING OF HOTWELL PUMPS AND BOILER FILL PUMPS	2
6.02	ERECTION, TESTING & COMMISSIONING OF HPSU AND LPBP GOVERINING SYSTEM SKID, CONTROL FLUID TANK, C.F COOLERS, C.F PUMPS, PURIFICATION UNIT ETC.	20
A	ERECTION & ALIGNMENT OF CONTROL FLUID TANK	5
B	ERECTION, TESTING & COMMISSIONING OF C.F COOLERS	3
C	ERECTION, TESTING & COMMISSIONING OF C.F PUMPS	4
D	ERECTION, TESTING & COMMISSIONING OF PURIFICATION UNIT ETC.	3
E	PLACEMENT AND POSITIOING OF HPSU AND LPBP GOVERINING SYSTEM SKID ETC.	5
6.03	ERECTION, TESTING & COMMISSIONING OF FLASH TANKS & FLASH VESSELS	10

Technical Conditions of Contract (TCC) for Electromechanical Works

Terms of Payment		
S No.	Activity/Work Description	% Allocated
6.04	ERECTION, TESTING & COMMISSIONING OF CONDENSER ON LOAD TUBE CLEANING PACKAGE	10
6.05	ERECTION, TESTING AND COMMISSIONING OF Other BOI items.	7
	Total	75
7	PIPING (Weightage 10 %)	
7.01	TURBINE INTEGRAL PIPING AND GENERATOR INTEGRAL PIPING CONSISTING OF LUB OIL, JACKING OIL, OIL VAPOR EXTRACTION, SEAL OIL, CONTROL/GOVERNING OIL, SEAL STEAM, CONDENSATE SPRAY/EXHAUST HOOD SPRAY, TURBINE WATER DRAINAGE, GAS PIPING, LP BY PASS GOVERNING SYSTEM, COOLING WATER PIPING, DIRTY & CLEAN OIL PIPING ETC INCLUDING ALL ACCESSORIES LIKE THERMOWELLS, PROBES, ORIFICE, NRV ETC AND HANGERS & SUPPORTS (ERECTION & COMMISSIONING ON PRORATA BASIS)	75
A	ON PRE-ASSEMBLY WHEREEVER APPLICABLE (IF NOT APPLICABLE THEN THIS PORTION IS TO BE PAID ALONG WITH PLACEMENT IN POSITION	15
B	PLACEMENT IN POSITION	15
C	ALIGNMENT	15
D	WELDING/BOLTING/FIXING	15
E	COMPLETION OF NON DESTRUCTIVE EXAMINATION & STRESS RELIEVING/HEAT TREATMENT (IF NOT APPLICABLE THEN THIS PORTION TO BE CLUBBED WITH NEXT ACTIVITY	5
F	HANGERS & SUPPORTS ETC WHERE EVER NECESSARY AS PER DRG	5
G	ALL TYPES OF TESTS INCLUDING BLASTING, HYDRAULIC TEST/ PNEUMATIC TEST, ACID CLEANING ETC. WHERE EVER APPLICABLE	5
	Total	75

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Terms of Payment		
S No.	Activity/Work Description	% Allocated
8	ELECTRICAL AND C & I AS SPECIFIED IN BOW (Weightage 9 %)	
8.01	ALL TYPE OF PANELS/LCS/LPB ERECTION	20
8.02	INSTRUMENT MOUNTINGS	12
8.03	POWER/CONTROL/SIGNAL CABLING & TERMINATION	15
8.04	SUPPORT,TRAY AND Misc. WORKS	13
8.05	TESTING AND COMMISSIONING	15
	Total	75

(II)	STAGE/MILESTONE PAYMENTS) (25%)	CONDENSER (1)	STEAM TURBINE (2)	GENERATOR (3)	PUMP AND AUXILIARIES (4)	HEATERS (5)	MISCELLANEOUS ITEMS (6)	INTEGRAL PIPING (7)	ELECTRICAL AND C&I(8)
1	TG OIL FLUSHING COMPLETION	1	1	1	1	1	1	1	1
2	BARRING GEAR	1	1	1	1	1	1	1	1
3	ROLLING AND SYNCHRONISATION	3	3	3	3	3	3	3	3
4	FULL LOAD	2	2	2	2	2	2	2	2
5	TRIAL OPERATION OF UNIT	3	3	3	3	3	3	3	3
6	INSULATIONPAINTING (INCLUDING ARROW MARKING, NOMENCLATURE, ETC)	2	2	2	2	2	2	2	2

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7	AREA CLEANING, TEMPORARY STRUCTURES CUTTING/REMOVAL AND RETURN OF SCRAP	2	2	2	2	2	2	2	2
8	PUNCH LIST POINTS/PENDING POINTS LIQUIDATION	3	3	3	3	3	3	3	3
9	PG TEST	2	2	2	2	2	2	2	2
10	SUBMISSION OF AS BUILT DRAWINGS	2	2	2	2	2	2	2	2
11	MATERIAL RECONCILIATION & HANDING OVER OF ANDATORY SPARES TO CUSTOMER	2	2	2	2	2	2	2	2
12	COMPLETION OF CONTRACTUAL OBLIGATIONS	2	2	2	2	2	2	2	2
	Total for Milestone/ Stage Payments(25%)	25	25	25	25	25	25	25	25
	Total of (I) and (II) is 100%	100	100	100	100	100	100	100	100

Terms of Payment (Billing Break-up) for Part-B & C of SOQR for “ E&C of Electromechanical packages 1X250 MW STG & it's Auxiliaries ” at JSW Dolvi

S. No.	Description	Unit	Quantity	Rate (in Rs.) To be derived based on total awarded value and assigned weightage (%age shown here, rate to be derived)	Amount (in Rs.) To be derived based on total awarded value and assigned weightage	%age of total contract value
B	Material Handling	MT	2300			8.200

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C	Execution/Mobilisation of special resources of manpower deployment for BHEL's Support.					
C1	Engineer / Supervisor (Minimum Qualification Engineering (3-years' experience)/ Diploma (7-years' experience) - as per SOQR	Man month	15			1.457

Note: 1. Wherever application of INSULATION is applicable, same shall be covered under the respective item/equipment for 'Terms of Payment'

2.0 Stage Payment against "Material handling" shall be paid separately on weight basis upon receipt of project materials from BHEL units /Vendor works as per table above.

3.0 Stage Payment against "Execution/Mobilization of special resources of manpower deployment for BHEL's Support" shall be paid separately man month basis as per table above.

Chapter-VII: Taxes and Other Duties

Taxes and Duties

7.1 The quoted rates shall be exclusive of GST but inclusive of all other taxes, including any cess or surcharge or levy/tax by whatever name called, imposed under GST law or any other law at any time,

Technical Conditions of Contract (TCC) for Electromechanical Works

for which input credit is not available to BHEL under any interpretation of the law. GST at the applicable rates shall be payable extra.

TDS under GST as and when applicable, shall be deducted at prevailing rates.

GST as applicable on the LD/Penalty shall also be recoverable in addition to LD/Penalty applicable on delayed supplies.

Contractors have to comply with all requirements of the GST law as may be prescribed by the Government from time to time (including provisions related to E-way bills as and when prescribed). In the event of any noncompliance to any of the requirements of the GST law by the supplier/contractor, any consequential financial implication to BHEL, including interest on delayed discharge of BHEL's GST liability, denial of input credit of GST, etc., shall be recoverable from the supplier/contractor.

7.2 SERVICES:

Contractors have to issue GST compliant invoices showing: BHEL, State of Maharashtra (State in which the project site is located) GSTIN of BHEL in such State (to be obtained by the contractors before raising any invoice) under "Details of Receiver (Billed To) BHEL's Customers details (mentioned in SCC/Dispatch Instructions) under "Details of Consignee (Shipped To) State in which the project is located, as the "Place of Supply".

Chapter-VIII : Specific Inclusions

SPECIFIC INCLUSIONS

8.1

All terminal connections for equipment & piping covered in this specification.

Condenser cooling water: Up to tapping provision on condenser.

Condensate line (CEP): Dearator vapour tank (including final joint welding, NDT etc)

Exhaust and vents: To atmosphere at safe elevation for steam vents

All drains: To the nearest drain trench

Instrument air: To the nearest point of Turbine building

Gland sealing piping: TG supplier terminal point will be outlet of the PRDS- Approx 50 mtr piping

CEP Sealing DM water: Up to tapping provision on CEP with isolation Valve

LP bypass Dump Tube: condenser end and welding joint

8.2. Impulse/ pneumatic piping between customer's battery limit and equipments.

8.3. Servicing and assembly of control valves/regulating valves, fixing of filter elements/strainers & steam blowing & blanking devices in LP bypass, MS strainer, HRH strainer & and blanking of LP bypass, ESV & IV system, for hydro test, steam blowing etc is the part of scope of work.

8.4. It may be specifically noted that it should not be construed or claimed by the contractor that with the technical specification and "exclusions and/or inclusions" detailed in this tender specification, BHEL has covered the entire scope of work and/or the details thereof to be executed by the contractor.

8.5. Complete control fluid system of both HP and LP bypass system is included in this specification. Associated assistance for commissioning like lube oil flushing, filling and topping up of lube oil etc shall be part of the work.

8.6. Assembly and installation of strainer elements of MS and HRH system is within the scope of work. Cleaning of these strainer elements during trial operation of machine is also covered under this scope.

8.7. Chipping of foundation, placement, erection, alignment, commissioning, grouting, mounting of equipment mount instruments, panels and other fittings of BHEL (PEM bought out items) supplied pumps & packages are in scope of the work. Erection and commissioning of these equipments/pumps & packages will be required to complete and meet the commissioning schedule/ milestone activities of other areas like boiler, etc. Contractor shall plan and complete

Technical Conditions of Contract (TCC) for Electromechanical Works

erection & commissioning of these equipments on priority as per decision of BHEL engineer/customer requirement. Details of such systems are furnished in relevant appendix.

8.8. Most of the Misc. Pumps with drive motors, base frame, fittings etc will be supplied in loose parts/ dismantled condition as skid mount. These pumps along with drive and fittings shall be assembled at site. The Delivery will be taken from BHEL stores/storage yard and will be assembled/ installed at different locations as per drawing and instruction of BHEL Engineer at site. The work involved is preservation, assembly, installation, erection, alignment, foundation grouting including providing non-shrink free flow grout mix material, fixing of loose items, filling of lubricants, greasing, commissioning, no load/ load trial run of motors & pumps. All the works shall be carried out as part of scope of work.

These Misc. pumps will be required for erection and commissioning of other systems, pipings, equipments which will be under scope of erection of other agencies. Contractor shall carry out the installation, erection and alignment works etc. as per priority decided by BHEL Engineer at site to enable the other agencies to proceed with their work. Contractor shall carry out the welding of terminal point/interface/matching & connected flanges joints, pipe joints etc. of other system & other agencies as scope of work. The decision of BHEL Engineer shall be final and binding on contractor.

8.9. Electric wire rope hoists & Chain block pulley shall be erected tested and commissioned if it is supplied along with the equipment supplier for the system completion as required at site.

8.10

CONSUMABLE

The contractor shall provide all consumables required for carrying out the work covered under these specifications excepting those which are specifically indicated as BHEL scope.

TG special consumables like hylomar / golden hermetite / stag-b / molykote/ anabond compounds / rubber fixing compounds etc will have to be arranged by the contractor.

8.11. All consumables to be used for the work shall have prior approval of BHEL engineer with regard to brand and quality specifications. Test reports / certificates in respect of these consumables, wherever applicable, shall be submitted to BHEL engineer.

8.12

PRIMERS & PAINTS

BHEL will provide paint & primer for final painting only in cases equipment & pipes (Less than 2” pipes will be supplied in loose) are received from manufacturing units without paint. The contractor will provide appropriate paints as per painting schedule in case touch up painting for all equipments, pipes and other facilities. Primers and paints for other requirements are in contractor's scope.

8.13.WELDING ELECTRODES, FILLER WIRES FOR TIG WELDING AND GASES

All welding consumables including filler wires are in the contractor's scope.

8.14. All the required welding electrodes as approved by BHEL shall be arranged by contractor at his cost. It shall be the responsibility of the contractor to obtain prior approval of BHEL, before procurement, regarding manufacturer, type of electrodes etc. on receipt of the electrodes at site, it shall be subject to inspection and approval by BHEL regarding type of electrodes, batch number, date of expiry etc. Batch test certificates shall be made available for verification & record before the actual use of the welding consumables.

BHEL reserves the right to reject the use of any electrodes, if found non-acceptable because of bad quality, deterioration in quality due to improper storage, shelf life expiry, unapproved type / brand etc.

8.15.The contractor shall provide all consumables required for carrying out the work covered under this scope of work including TIG wires for welding of piping joints.

8.16.All the required gases like argon, oxygen, and acetylene etc including required high purity nitrogen gas (for purging of generator stator water system) shall be arranged by the contractor at his cost.

Chapter-IX: Specific Exclusions

The following works are excluded from the Tenderer's scope of work:

All foundation work, civil engineering work & building structures.

All utility and service lines from the steel plant up to terminal point as indicated in this specification such as trestle carrying pipelines for Main steam for TG, DM water and re-circulating cooling water supply and return headers as indicated in this section.

Buildings & road lighting.

Firefighting system except firefighting arrangement in Turbine & Auxiliaries area.

Chilled water plant, air-conditioning and ventilation system.

Circulating water pumps and cooling towers.

Water treatment plant.

De-mineralized water (DM) plant.

Electrics as per scope /BOQ enclosed

Crane & Hoist, except specified in this specification.

Plant communication system

Chapter-X: Weight details

1x250 MW STG & it's Auxillaries "Weight & Dimension "				
TURBINE	(BHEL Haridwar Supply)			
Sl no	Item Description	Total Qty	Dimensions	Grosswt(KG)
1	SOLE PLATE PEDESTAL ANCHOR	1	3400X1200X800	2510
2	BASE PLATE ASSEMBLY	1	4500X1400X1200	4500
3	BASE PLATE ASSEMBLY	1	2300X1250X600	2560
4	BASE PLATE L.P.CASING	1	2300X2075X981	2680
5	LP OUTER CASING PARTS	1	7060X1480X2760	8085
6	LP OUTER CASING PARTS	1	7060X1480X2760	8085
7	LPC OUTER CASING PARTS	1	4570X3230X980	2500
8	LPC OUTER CASING PARTS	1	4570X3230X980	2500
9	COMPONENTS OF LP CASING UPPER PART	1	3500X300X300	495
10	L.P OUTER CASING PARTS	1	3450X1000X1100	900
11	HP-IP BREARING PEDESTAL ASSLY.	1	4080X2005X2126	13275
12	HP/IP BRG.PED.PARTS	1	1000X600X600	438
13	HP/IP BRG.PED.PARTS	1	500X200X150	37.5
14	CAP(SPRING SUPPORT)	1	825X500X400	400
15	CAP(SPRING SUPPORT)	1	825X500X400	400
16	CAP (COMPEN.ASSY)	1	3240X1740X1340	3316
17	CAP (COMPEN.ASSY)	1	3240X1740X1340	3512
18	CAP(OBLIQUE REDUCER ASSLY)	1	1400X1400X1200	590
19	CAP (MITRE BEND ASSY)	1	1550X1550X1300	670
20	CAP (COMPEN.ASSY)	1	3240X1740X1340	3512
21	CAP (MAN-HOLE ASSLY)	1	1500X1600X1100	750
22	CAP (MAN-HOLE ASSLY)	1	1500X1600X1100	750
23	CAP(MITRE BEND ASSY)	1	1550X1550X1300	670
24	CAP (MITRE BEND ASSY)	1	1550X1550X1300	670
25	CAP (PIPE ASSLY)	1	2000X1100X1200	485
26	CAP (MITRE BEND ASSY)	1	1550X1550X1300	670
27	LONGITUDINAL GIRDER (LEFT)	1	6800X1820X1570	15182
28	LONGITUDINAL GIRDER (RIGHT)	1	6800X1820X1570	15182
29	LP FRONT WALL (TS)	1	6820X3750X910	10053
30	LP FRONT WALL (GS)	1	6820X3750X910	10053
31	LP SHAFT SEALING FRONT	1	1800X1700X740	2260
32	LP SHAFT SEAL COMPENSATOR ASSLY.(TS)	1	1440X1420X520	1456
33	LP SHAFT SEALING (REAR)	1	1800X1700X740	2260

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34	LP SHAFT SEAL COMPENSATOR ASSLY.(GS)	1	1440X1420X520	1456
35	LP CASING ASSEMBLY (FASTENERS)	1	1800X1700X740	2653
36	LP CASING ASSEMBLY (PARTS)	1	3760X2060X860	4689
37	LP CASING ASSEMBLY (PARTS)	1	450X450X250	340
38	EXTRACTION PIPE LINE (LPC)	1	2600X1100X700	607
39	EXTRACTION PIPE LINE (LPC)	1	2700X1350X750	670
40	EXTRACTION PIPE LINE (LPC)	1	2000X1200X600	1004
41	EXTRACTION PIPE LINE (LPC)	1	2600X1100X700	607
42	EXTRACTION PIPE LINE (LPC)	1	1650X800X450	470
43	EXTRACTION PIPE LINE (LPC)	1	2700X1200X750	575
44	EXTRACTION PIPE LINE (LPC)	1	1100X850X850	307.6
45	EXTRACTION PIPE LINE (LPC)	1	2700X1750X1100	689
46	EXTRACTION PIPE LINE (LPC)	1	1550X1450X900	530
47	EXTRACTION PIPE LINE(LPC)	1	2000X600X600	366
48	L.P. EXTRACTION PIPE SHEATHING	1	2600X2000X1400	1330
49	INNER GUIDE PLATE OF DIFFUSER (TS)	1	2600X2400X1000	2118
50	INNER GUIDE PLATE OF DIFFUSER (GS)	1	2600X2400X1000	2118
51	DIFFUSER (TS)	1	4880X1730X2340	3640
52	DIFFUSER (GS)	1	4880X1730X2340	3640
53	LP-GEN. PEDESTAL ASSEMBLY	1	3220X2285X2075	10200
54	IP-LP PEDESTAL ASSEMBLY	1	3700X1860X2100	14600
55	LP INNER OUTER CASING (U/H)	1	6720X3150X2325	21750
56	LP INNER OUTER CASING (L/H) & LP INNER INNER CASING (L/H)	1	6750X3500X2350	30907
57	LP INNER CASING ASSY.FASTENERS	1	1800X1700X740	1760
58	LP INNER-INNER CASING (U/H) PARTIAL	1	4000X1570X2000	11722
59	STEAM INLET PIPE (LPT)	1	2700X1300X900	840
60	L.P. ROTOR	1	7210X3300X3350	62049
61	BEARING PEDESTAL ARRANGT.PARTS	1	1800X900X800	1100
62	IP TURBINE	1	4860X3753X3210	81679
63	HP TURBINE	1	5060X3100X2900	56100
64	HP INLET ASSEMBLY	1	450X450X200	45
65	H.P. EXHAUST ASSEMBLY	1	1625X1335X675	1378
66	HPT RELATED PARTS	1	1000X1000X500	190
67	HP FRONT BEARING PEDESTAL	1	3500X3000X2050	11939
68	HP FRONT BRG. PEDESTAL PARTS	1	1800X1700X1000	844
69	I.P TURBINE PARTS	1	700X700X500	285

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70	RATING, COLLABORATION AND MONOGRAM PLATES	1	850X550X150	50
71	OIL FLUSHING AND PRESSURE TEST DEVICE	1	750X400X550	130
72	SUPPORT FOR IV VALVE	1	1500X1000X750	410
73	ESV & CV CASING WITH VALVES	1	3000X3000X1900	9800
74	ESV & CV CASING WITH VALVES	1	3000X3000X1900	9800
75	IV & CV CASING WITH VALVES.	1	4500X3500X2600	21500
76	IV & CV CASING WITH VALVES.	1	4500X3500X2600	21500
77	PARTS OF IV & CV CASING	1	1500X1000X200	100
78	PARTS OF IV & CV CASING	1	1500X1000X200	100
79	INJECTOR FOR SUC. PIPE NB350	1	3300X1750X1210	1029
80	MAIN OIL TANK & NOZZLE ARRGT. ASSY.	1	5180X3260X2650	9100
81	MAIN OIL TANK & NOZZLE ARRANGEMENT	1	4200X1100X800	550
82	OIL STRIPPER	1	600X600X850	133
83	OIL STRAINERS	1	2050X1200X1410	568
84	VARIABLE ORIFICES THROTTLE VALVES & FLUSHING PARTS	1	1000X500X250	115
85	HOUSING FOR MS STRAINER	1	1700X1025X900	3000
86	HOUSING FOR M.S STRAINER	1	1725X1250X730	3000
87	HOUSING FOR HRH STEAM STRAINER	1	2200X1450X1100	3500
88	HOUSING FOR HRH STEAM STRAINER	1	2200X1450X1100	3500
89	STEAM STRAINER (MS)	1	1100X700X350	374
90	STEAM STRAINER (HRH)	1	1600X1450X750	485
91	BLANKING ARRANGEMENT FOR MS STRAINER HOUSING	1	1000X900X500	490
92	BLANKING ARRANGEMENT FOR HRH STEAM STRAINER HOUSING	1	1600X1200X600	1090
93	BLANKING ARRANGEMENT FOR MS STRAINER HOUSING	1	1000X900X500	490
94	BLANKING ARRANGEMENT FOR HRH STEAM STRAINER HOUSING	1	1600X1200X600	1090
95	STEAM STRAINER HOUSING GASKETS	1	700X700X300	50
96	COMPENSATOR	1	600X600X900	50
97	LEAKAGE OIL TANK	1	1000X1000X3000	515
98	WASTE OIL TANK	1	1000X1000X3000	515
99	INJECTOR FOR SUC. PIPE NB 400	1	3500X750X750	922
100	PRESSURE LIMIT VALVE	1	400x250x200	20
101	Temp. & Pressure Connections	1	1700X750X750	350
102	IMPULSE PIPES (CARBON STEEL)	1	7000X900X800	1585
103	TEMP. INSTRUMENTS & SENSORS	1	800X800X500	281

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Technical Conditions of Contract (TCC) for Electromechanical Works

104	LEVEL INSTRUMENTS & SENSORS	1	700X450X450	50
105	TSE SENSOR FOR IP TURBINE	1	800X800X300	30
106	TRANSMITTERS & J.B.OF BEARINGS	1	800X600X600	50
107	IMPULSE PIPES (ALLOY STEEL)	1	7000X500X500	400
108	CONSUMABLES-EXCITER	1	500X600X300	17.1
109	BRUSHLESS EXCITER SET	1	5100X2150X2557	23005
110	EXCITER FRONT COVER	1	4100X2700X2972	2803
111	RR WHL.COVER & SEALING WALL DE FOR EXCITER	1	1800X1600X1600	970
112	EXCITER REAR COVER	1	4100X2900X2772	3213
113	EXCITER BED PLATE ACCESSORIES	1	5500X1050X800	3212
114	EXCITER ACCESSORIES	1	2000X600X600	350
115	COOLER RACK ASSEMBLY	1	3000X1800X1100	1551
116	SEAL OIL UNIT	1	5900X2400X3400	9325
117	SEAL OIL STORAGE TANK	1	3500X1300X1280	1460
118	GAS UNIT	1	2550X1790X2560	1150
119	HYDROGEN DISTRIBUTOR	1	3480X1540X440	333
120	CO2 DISTRIBUTOR	1	2770X1240X440	247
121	LIQUID DETECTOR RACK	1	1850X900X1800	450
122	GEN & H2 COOLER PIPING -VALVES	1	2000X1300X800	1072
123	GEN & H2 COOLER PIPING-INST.	1	600X600X500	40
124	CO2 VAPOURISER	1	1520X640X840	225
125	EXCITER AIR COOLER	1	2700X850X550	892
126	EXCITER AIR COOLER	1	2700X850X550	892
127	Turbine Oil	348 Drums		69600
128	Control fluid (FRF)	23 Drums		5865
129	Seal steam valve	1	1.5x.7x.6	400
130	Leak off steam valve	1	3.0x1.8x1.1	2400
131	Hydraulic power supply unit	1	3.2x2.8x3.2	7500
132	Electro-hydraulic actuator of Turbine valves	1	1.45x.9x1.15	882
133		1	1.45x.91x1.15	882
134		1	1.82x.91x1.02	1024
135		1	1.82x.91x1.02	1024
136		1	1.22x.91x1.15	824
137		1	1.22x.91x1.15	824
138		1	1.49x.91x1.155	933
139		1	1.49x.91x1.155	933
140	THERMAL INSULATION OF TURBINE	1		800

Technical Conditions of Contract (TCC) for Electromechanical Works

141	DRYAIR PRESERVATION SYSTEM	1	2.7x2.1x2.5	750
142	CALIBRATED FLOW NOZZLE ASSLY.	1	9.5x1.5x2.5	1100
143	OIL VAPOUR EXHAUSTER	1	0.8x.8x.8	150.0
144	AOP (A.C.) - 2 Nos	2	1x1.6x3	2400.0
145	EOP (D.C.)	1	1x1.6x3	700.0
146	JOP (A.C.) - 2 Nos	2	.9x.9x3	1500.0
147	OIL CENTRIFUGE (Unit)	1	7x6x6.6	3000.0
148	GEAR PUMP (LUB OIL RE-CIRCULATION)	1	.5x.4x.4	50.0
149	DUPLEX FILTER (LUB OIL)	1	2x1.2x2.2	800.0
150	DUPLEX FILTER (JACKING OIL)	1	.8x.7x.9	400.0
151	BUTTERFLY VALVES	1	2x2x2	400.0
152	PRESSURE LIMIT VALVE	1	.5x.4x.4	50.0
153	NRV WITH ALUMINIUM FLAP	1	1x1x1	50.0
154	DOUBLE THREE WAY VALVE - LUB OIL	1	1.5x1.5x1.5	300.0
155	THREE WAY TEMP CONTROL VALVE - LUB OIL	1	3x1.5x2	1000.0
156	SPRAY NOZZLE	1	.5x.5x.5	50.0
157	DIRT CATCHER	1	.5x.5x.5	50.0
158	LIFTING BEAM	1		4000
159	EMPTY H2 CYLINDER	140		20000
160	EMPTY CO2 CYLINDER	75		
161	VAPOUR EXHAUSTER	2		
162	REFRIGERATION GAS DRYER	2		
163	STROBOSCOPE	1		
164	EXCITER COVER COMPLETE WITH FA	1		
165	MOISTURE MEASURING EQUIPMENT	1		
166	MOTORISED TEMPERATURE CONTROL VALVE WITH ACTUATOR NB250 VAR-02	1		
167	H2 GAS ANALYSER CABINET	1		
168	STARTING RESISTOR FOR DC S.O MOTOR	1		
GENERATOR(BHEL Hyderabad Supply)				
Sl no	Item Description	Total Qty	Dimensions	Grosswt(KG)
1	CEP assly with counter flanges	2		12000.00
2	canister assy with snbr&flgs	2		6000.00
3	suction strainer simplex basket	2		2600.00
4	foundation ring assy	2		1500.00
5	LGB	1		300.00

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6	Cable tray	4		240.00
7	Piping and Misc loose items	1		7000.00
8	Foundation item for Generator	1		8000.00
9	LAVT & NG Cubicles	1		2000.00
10	Control & relay Panel	1		2500.00
11	Generator Stator with Coolers	1	8000x5000x4800	218000.00
12	Generator Rotor (including transport frame)	1	10800x2000x2000	48000.00
13	Generator End shields	2		24000.00
CONDENSER(BHEL Bhopal Supply)				
Sl no	Item Description	Total Qty	Dimensions	Grosswt(KG)
1	Bottom plate		11000x7100	22205.00
2	Lower dome wall Gen end		1100x4760	8368.00
3	Lower dome wall(Tur End)		1100x4760	8670.00
4	Lower dome wall(fwb side)		7502x5046	7716.00
5	Lower dome wall (rwb side)		7502x5047	8346.00
6	Upper dome wall(Gen End)		6800x3080	1108.00
7	Upper dome wall(Tur end)		6800x3080	1108.00
8	Upper dome wall(fwb side)		5300x3080	3360.00
9	upper dome (rwb side)		5300x3080	3431.00
10	Dome internal stiffeners			11477.00
11	Shell Internals		7032x4700	69712.00
12	Front water Box turbine side		3550x4600	13910.00
13	Front water Box Gen side		3550x4600	13910.00
14	Rear water box Tur side		3550x4600	9240.00
15	Rear water box Gen side		3550x4600	9240.00
16	Water box removal device			5705.00
17	Hot well		1100x1632	6497.00
18	Side wall Tur side		10780x5248	7800.00
19	Side wall Gen side		10780x5248	7800.00
20	Condensor spring support			15449.00
21	Air extraction pipe,instrument-fittings.steam throw pipe,loose item etc			6547.00
22	Tubes			85800.00
23	Vacuum Pump set	2	10500X2200X2400	10000
24	HP Heater-1	1	11600X2200X2400	35000

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25	HP Heater-2	1	12000X1500X1500	42000
26	LP Heater-1	1	11000X1900X1300	12000
27	LP Heater-2	1	11000X1900X1300	11500
28	LP Heater-3	1	5600x1000x1200	11500
29	Drain Cooler	1	1380X980X980	3000
30	Gland Steam Condenser (GSC)	1		1000
31	Dirty Oil Tank	1	2800X2000X750	
32	BF Valve	4	1200X2600X2600	25000
33	RE Joint	4		12000
PESD,Hyd Supply				
Sl no	Item Description	Total Qty (Nos)	Dimensions	Gross wt(KG)
	BOP-MECH			
1	Control Valves(Pneumatic Actuated CVs for Level, Pressure & Flow control v/v & Flow control			
1.1	12"- #300	2		20
1.2	8"- #600	3		30
1.3	8"- #300	3		30
1.4	6"- #150	2		20
1.5	4"- #150	2		20
1.6	2"- #300	2		20
1.7	2"- #150	4		40
1.8	1.5"- #300	1		10
1.9	Atmospheric Flash Tank		Dia 1.5 x2.0	2500
1.10	Condenser online tube cleaning system a) Ball recirculation skid b) Ball separators	1 each	a)4x2.5x2 b) Dia2.2x2.5	13000

Technical Conditions of Contract (TCC) for Electromechanical Works

1.11	Pressure safety valve		trichy supply input awaited	1000
2	PIPING			
2.1	AUXILIARY STEAM (IBR)			41
2.2	EXTRACTION STEAM (IBR)			7930
2.3	CONDENSATE(CS)			8950
2.4	HEATER DRAINS(CS)			1700
2.5	HEATER VENTS(CS)			50
2.6	PSV & VENT VALVE VENTS(CS)			1880
2.7	OTHER PROCESS DRAINS(CS)			1750
2.8	UTILITIES(CS)			4530
2.9	LUBE OIL(CS)			90
2.10	GENERATOR INTEGRAL PIPING(CS)			2040
2.11	TURBINE INTEGRAL PIPING(CS)			6250
2.12	TURBINE INTEGRAL PIPING(AS)			8250
2.13	GENERATOR INTEGRAL PIPING(SS)			4430
2.14	TURBINE INTEGRAL PIPING(SS)			1950
3	FITTING & FLANGE			0
3.1	AUXILIARY STEAM (IBR)			40
3.2	EXTRACTION STEAM (IBR)			7930
3.3	CONDENSATE(CS)			8950
3.4	HEATER DRAINS(CS)			1700
3.5	HEATER VENTS(CS)			50
3.6	PSV & VENT VALVE VENTS(CS)			1880
3.7	OTHER PROCESS DRAINS(CS)			1750
3.8	OTHER PROCESS VENTS(CS)			0
3.9	UTILITIES(CS)			4530
3.10	LUBE OIL(CS)			90
3.11	GENERATOR INTEGRAL PIPING(CS)			2040
3.12	TURBINE INTEGRAL PIPING(CS)			6250
3.13	TURBINE INTEGRAL PIPING(AS)			8250
3.14	GENERATOR INTEGRAL PIPING(SS)			960
3.15	TURBINE INTEGRAL PIPING(SS)			1220
4	VALVES			0
4.1	AUXILIARY STEAM (IBR)			0
4.2	EXTRACTION STEAM (IBR)			10300
4.3	CONDENSATE(CS)			19160
4.4	HEATER DRAINS(CS)			800
4.5	HEATER VENTS(CS)			50

Technical Conditions of Contract (TCC) for Electromechanical Works

4.6	PSV & VENT VALVE VENTS(CS)			0
4.7	OTHER PROCESS DRAINS(CS)			580
4.8	OTHER PROCESS VENTS(CS)			0
4.9	UTILITIES(CS)			2220
4.10	LUBE OIL(CS)			130
4.11	GENERATOR INTEGRAL PIPING(CS)			2250
4.12	TURBINE INTEGRAL PIPING(CS)			2960
4.13	TURBINE INTEGRAL PIPING(AS)			19530
4.14	GENERATOR INTEGRAL PIPING(SS)			2250
4.15	TURBINE INTEGRAL PIPING(SS)			950
4.16	SPECIALITIES (VENT SILENCERS, STEAM TRAPS, STRAINERS)			3000
4.17	INSULATION CLADDING			10000
4.18	INSULATION MATTRESS			10000
4.19	INSULATION ANCILLARIES			7000
4.20	RAW MATERIAL FOR PIPING, INCLUDING SPRING HANGERS AND ROD HANGERS			10000
5	Supply & installation by Executing agency			
5.1	ADDITIONAL STEEL FOR APPROACH PLATFORM			25000
6	BOP-Electricals			
6.1	CEP Motor-600kW	2	2.5x1.5x1.5 Mtr	3600
6.2	Local Control Station (LCS) with Start/ Stop PBs and ON/ OFF/ Trip Indicating Lamps	28	300 x 120 x 300 mm	7
	LT POWER CABLE			
6.3	4Cx4Sq.mm/Cu/XLPE	150		96.15
6.4	4Cx70sq.mm/AL/XLPE	100		160.6
6.5	1Cx240sq.mm/AL/XLPE	200		235.8
6.6	CABLE GLANDS PACKAGE			
6.7	12-16.5	120		50
6.8	16.5-18.5	25		
6.9	18.5-20	50		
6.10	20-23	5		
6.11	23-26	5		
6.12	26-30	10		
6.13	30-33	10		

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	CABLE LUGs PACKAGE (Tinned Copper)			
6.14	2.5 SQ.MM Tinned Cu Lug	800		
6.15	4 SQ.MM Tinned Cu Lug	120		
6.16	6 SQ.MM Tinned Cu Lug	30		
6.17	16 SQ.MM Tinned Cu Lug	30		
6.18	25 SQ.MM Tinned Cu Lug	40		
6.19	35 SQ.MM Tinned Cu Lug	30		
6.2	70 SQ.MM Tinned Cu Lug	100		
6.21	240 SQ.MM Tinned Cu Lug	10		100
	STRUCTURAL STEEL			
6.22	ISA-50x50x6			500
6.23	ISM-100			300
	supply & installation by Executing agency			
6.24	Cable Tags Aluminum /Stainless Steel(At entry, exit and at every 30 M of cable run length)	2000	75*20*2	100
6.25	Clamps for multicore cables – Aluminum Flats(At every 3M of cable length)	1500		50
6.26	Erection Hardware like Nuts, Bolts, Washers etc.	1		50
6.27	3mm dia. Nylon Cord (Required for tying cables to trays, at every 5 mtrs.)	1		10
7	BOP-C&I : Equipment			
7.1	Flow Elements: Flanged Flow orifice	4		800
7.2	Flowmeters	5		500
7.3	Level Gauges	9		270
7.4	Level Transmitter	12		120
7.5	Pressure Gauge	43		215
7.6	Differential pressure Gauge	1		5
7.7	Pressure Transmitters (HART)	10		54
7.8	Differential Pressure Transmitter	1		5.4

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7.9	Temperature Element (RTD & T/C) with Thermowell M33*2	18		90
7.10	Temperature Gauges with Thermowell M33*2	39		195
7.11	Temperature Transmitters (HART)	17		85
7.12	FRP Canopies	40		20
7.13	Junction Box	40		200
7.14	Hand Held Communicator (HART)	2		1
7.15	Gauge boards on equipment skids	1 lot		10
7.16	Local instrument Enclosure/ Rack	4		400
7.17	PIPE (SM LS), SA 106 Gr. B -21.3 X 4.78 (Meter)	900		720
7.18	NIPPLE (SMLS) A 106 Gr B 1/ 2" PL x NPT(M)	210		42
7.19	EQUAL TEE 1/ 2" SW	80		24
7.20	COUPLING 1/ 2" SW	36		7.2
7.21	GATE VALVE 1/ 2" SW	130		26
7.22	Ball Valve (Quarter Turn)	3		0.6
7.23	ELBOW 1/ 2" SW	160		32
7.24	CAP 1/ 2" NPT(F)	130		26
7.25	CONDENSATE POT Ø1/ 2" SW	7		8.4
7.26	TUBE (SM LS)- 1/ 2" x 1.65M M THK	200		60
7.27	TUBE (SM LS)- 6mm OD X 1 mm THK	30		6
7.28	TUBE UNION ½" OD	30		6
7.29	TUBE UNION 6mm OD	3		0.6
7.30	FEM ALE CONNECTOR 1/ 4" NPT(F) x 6mm OD TUBE	3		0.6
7.31	M ALE CONNECTOR 1/ 4" NPT(M) x 6mm OD TUBE	7		1.4
7.32	REDUCER 1/ 2" SW x 1/ 4" NPT(M)	3		0.6
7.33	FEM ALE CONNECTOR 1/ 2"NPT(F) x 1/ 2" OD TUBE	30		6
7.34	M ALE CONNECTOR 1/ 2"NPT(M) x 1/ 2" OD TUBE	30		6

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7.35	5 WAY M ANIFOLD	3		2.4
7.36	2-WAY MANIFOLD (T-Type) with drain tube	48		38.4
7.37	3 Piece Union	48		9.6
7.38	ANCHOR BOLT M 10 X 160	500		100
7.39	SCRU HEX M 10X50 P8.8	300		3
7.4	NUT HEX P M 10-8	300		3
7.41	WASHER M CD 10.5-ST	528		5.28
7.42	SHELL TYPE PIPE CLAM P 1/ 4"	10		0.2
7.43	U-BOLT GALVZD 1/ 2"	330		6.6
	Signal Cable			
7.44	1P x 1.5 mm2, IS, OS	17000M		935
7.45	4P x 1.5 mm2, IS, I&OS	900M		108
7.46	6P x 1.5 mm2, IS, I&OS	11000M		2200
7.47	12P X 1.5 MM2 IS, I&OS	3000M		2250
7.48	Thermo-couple Extension Cable			
7.49	1PX16 AWG, T/C N-IS	500M		8.5
7.5	Triad Cable			
7.51	1T x 1.5 mm2, IS	1000M		800
7.52	PIPE IS 1239 2" SH HVY	85M		459
7.53	Str Steel MS Angle (50x50x6 mm)			1262
7.54	STR STEEL 6 mm PLATE (250 x 250 x 6)			581
7.55	ISMC MS Channel (100x50)			1068
7.56	Base Plate (200x200x6)			114
	Supply & installation by Executing agency			
7.57	Cable gland double compression ss			
7.58	1/2"	400		200
7.59	3/4"	400		
7.60	1"	400		
7.61	1-1/4"	400		
7.62	1-1/2"	400		
7.63	2"	400		
7.64	Tinned Cable Lugs at both ends for 1.0mmsq cable,(Normal & fork)	1200		
7.65	PVC Cable Gland shrouds (covers)	1500		
7.66	Cable ferruling numbers & characters	10000		

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7.67	Name plates/Tag plates with tying/fixing material for cable's both end & filed instruments	10000	
7.68	Cable Markers@ 100 meters per run of cable	8000	
7.69	Adapters for cable glands & Junction boxes	5000	

BHEL -HPEP CABLES

Sl. No	Type of Cable	From	To	No. of Runs	Qty (Meters)
1	3Cx2.5 Sq.mm	GCP	AVR	5	25
		GCP	Turbine Control Panel(TCP)	5	225
		GCP	GTCB	10	1500
		GRP	BLE	2	100
		GRP	NGT cubicle	5	450
		GRP	GCP	5	25
2	5CX2.5 Sq.mm	GRP	LAVT cubicle	10	1000
		Busduct (CTMB)	GRP	15	1500
		Busduct (CTMB)	GCP	5	500
		AVR	GCP	5	25
		AVR	GRP	5	25
		GCP	GTCB	10	1500
		GRP	GTCB	10	1500
		GRP	TCP	5	225
		GRP	GCP	10	50
		GRP	AVR	10	100
3	10C X 2.5 Sq.mm	GRP	GTCB	10	1500
		GCP	GTCB	10	1500
		GRP	GCP	10	50
		GRP	AVR	10	100

Technical Conditions of Contract (TCC) for Electromechanical Works

4	10Tx1.5 Sq.mm	Generator	GCP	10	500
		Exciter	GCP	10	500
5	3Cx4 Sq.mm	ACDB	GCP	1	100
		DCDB	GCP	2	200
		ACDB	GRP	1	100
		DCDB	GRP	2	200
		UPS	GCP	1	100
		ACDB	LAVT cubicle	1	100
		ACDB	NG Cubicle	1	100

EDN Bangalore Panels

S. No.	Equipment	Qty	UoM	Weight	Dimension (mm3)
1	Vibration Sensors	1	Set	250 kg	950 x 1010 x 1500
2	Vibration I/O Units	1	Set	250 kg	950 x 1010 x 1500
3	REG-1	1	Set	500 kg	950 x 1010 x 2700
4	REG-2	1	Set	500 kg	950 x 1010 x 2700
5	THY Cubicle	1	Set	500 kg	950 x 1010 x 2700
6	FS Cubicle	1	Set	500 kg	950 x 1010 x 2700
7	CJJ01	1	Set	500 kg	950 x 1010 x 2700
8	CJJ02	1	Set	500 kg	950 x 1010 x 2700
9	CJJ03	1	Set	500 kg	950 x 1010 x 2700
10	CJJ05	1	Set	500 kg	950 x 1010 x 2700

Technical Conditions of Contract (TCC) for Electromechanical Works

11	CJJ55	1	Set	500 kg	950 x 1010 x 2700
12	CJJ06	1	Set	500 kg	950 x 1010 x 2700
13	CJJ07	1	Set	500 kg	950 x 1010 x 2700
14	CCA01	1	Set	500 kg	950 x 1010 x 2700
15	CCA02	1	Set	500 kg	950 x 1010 x 2700
16	CCA03	1	Set	500 kg	950 x 1010 x 2700
17	CCA04	1	Set	500 kg	950 x 1010 x 2700
18	CCA05	1	Set	500 kg	950 x 1010 x 2700
19	CCA06	1	Set	500 kg	950 x 1010 x 2700
20	CCA10	1	Set	500 kg	950 x 1010 x 2700
21	CCA11	1	Set	500 kg	950 x 1010 x 2700
22	CJJ08	1	Set	500 kg	950 x 1010 x 2700
23	CJJ41	1	Set	500 kg	950 x 1010 x 2700
24	BoP Panel-1	1	Set	500 kg	950 x 1010 x 2700
25	BoP Panel-2	1	Set	500 kg	950 x 1010 x 2700
26	BoP Panel-3	1	Set	500 kg	950 x 1010 x 2700
27	BoP Panel-4	1	Set	500 kg	950 x 1010 x 2700
28	BoP Panel-5	1	Set	500 kg	950 x 1010 x 2700
29	BoP Panel-6	1	Set	500 kg	950 x 1010 x 2700
30	BoP Panel-7	1	Set	500 kg	950 x 1010 x 2700

TCC No: HY/PE&SD/SC-PROJECTS/2025-26/TCC/JSW 250MW/ E&C of Electromech works/01, Rev.00
Bharat Heavy Electrical Limited, Project Engineering & System Division, RC Puram, Hyd-32.

Technical Conditions of Contract (TCC) for Electromechanical Works

31	BoP Panel-8	1	Set	500 kg	950 x 1010 x 2700
32	BoP Panel-9	1	Set	500 kg	950 x 1010 x 2700
33	BoP Panel-10	1	Set	500 kg	950 x 1010 x 2700
34	BoP Panel-11	1	Set	500 kg	950 x 1010 x 2700
35	BoP Panel-12	1	Set	500 kg	950 x 1010 x 2700
36	BoP Panel-13	1	Set	500 kg	950 x 1010 x 2700
37	BoP Panel-14	1	Set	500 kg	950 x 1010 x 2700
38	BoP Panel-15	1	Set	500 kg	950 x 1010 x 2700
39	BoP Panel-16	1	Set	500 kg	950 x 1010 x 2700
40	BoP Panel-17	1	Set	500 kg	950 x 1010 x 2700
41	BoP Panel-18	1	Set	500 kg	950 x 1010 x 2700
42	BoP Panel-19	1	Set	500 kg	950 x 1010 x 2700
43	BoP Panel-20	1	Set	500 kg	950 x 1010 x 2700
44	BoP Panel-21	1	Set	500 kg	950 x 1010 x 2700
45	BoP Panel-22	1	Set	500 kg	950 x 1010 x 2700
46	BoP Panel-23	1	Set	500 kg	950 x 1010 x 2700
47	BoP Panel-24	1	Set	500 kg	950 x 1010 x 2700
48	BoP Panel-25	1	Set	500 kg	950 x 1010 x 2700
49	BoP Panel-26	1	Set	500 kg	950 x 1010 x 2700
50	BoP Panel-27	1	Set	500 kg	950 x 1010 x 2700

TCC No: HY/PE&SD/SC-PROJECTS/2025-26/TCC/JSW 250MW/ E&C of Electromech works/01, Rev.00
Bharat Heavy Electrical Limited, Project Engineering & System Division, RC Puram, Hyd-32.

Technical Conditions of Contract (TCC) for Electromechanical Works

51	BoP Panel-28	1	Set	500 kg	950 x 1010 x 2700
52	BoP Panel-29	1	Set	500 kg	950 x 1010 x 2700
53	BoP Panel-30	1	Set	500 kg	950 x 1010 x 2700
54	HMI Accessories	1	Set	500 kg	950 x 1010 x 2700
55	LVS	1	Set	500 kg	950 x 1010 x 2700
56	Furniture	1	Set	500 kg	950 x 1010 x 1500 (5 boxes)

NOTE:

- 1.The list is tentative and has been provided to enable the contractor to study the nature of work to be done in this contract. There may be variation in size, weight etc. and no claim, whatsoever, will be entertained on account of this by BHEL.
2. Some of the packages may be sent in parts to suit the site condition / transportation, the same is to be assembled at site without any extra cost, likewise the package may be assembled together and send as a single assembly. Contractor may have to dismantle and erect or erect as single assembly as per the instruction of BHEL engineers without any extra cost

Chapter-XI: Proposed Painting Scheme

11.1

Painting scheme

For a complete painting scheme of any item being painted, all types of paints are to be procured from the same manufacturer as approved by the Owner.

The painting scheme to be followed for various mechanical/ electrical equipment / structures will be provided to vendor & the vendor has to comply with.

Chapter XII- Statutory Regulation

12.1 GST: For All types of works excepting works covered under sl no 12.2

12.2 INTER-STATE MIGRANT WORKMEN ACT, 1979 (IN CASE BIDDER ENGAGE MANPOWER FROM OTHER STATE)

It shall be the sole responsibility of the contractor in the capacity of employer to forthwith (within a period of 15 days from the award of work) apply for a license to the Competent Authority under the ISMW Act as applicable and obtain proper certificate thereof by specifying the scope of its work. It shall also be responsibility of the contractor to furnish a copy of such certificate of license / permission to BHEL within a period of one month from the date of award of contract.

It shall be the sole responsibility of the contractor as employer to ensure compliance of all the statutory obligations under these acts and rules including that of payment / deposit of cess as per the applicability under above referred Acts within a period of one month from the receipt of payment. It shall be the responsibility of the sub-contractor to furnish the receipts / challans towards deposit of the cess together with the number, name and other details of beneficiaries (building/Inter-state Migrant workmen) engaged by the sub-contractor during the preceding month. It shall be the absolute responsibility of the sub-contractor to make payment of all statutory payments & compensations to its workers including that is provided under the Workmen's Compensation Act, 1923.

Chapter XIII- Field quality control plan

13.1

Work shall be executed as per approved field quality control plan (FQCP). Vendor may require to Submit FQCP and same shall be reviewed and approved by BHEL in accordance with the Customer requirements.

Chapter XIV- General

14.0 GENERAL

14.1 All the work shall be carried out as per the instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the Bidder.

14.2 The Bidder shall at his cost perform any services, tests etc, although not specified but nevertheless required for the completion of work.

14.3 If any portion of the work is found to be defective in workmanship or not conforming to BHEL requirements, the Contractor shall re-do the work at his cost failing which the work will be got done by BHEL and recovery shall be made on actuals plus 5% overheads.

14.4 The terminal points as decided by BHEL shall be final and binding on the Contractor.

All tools and tackles, fixtures, equipment, materials, manpower, supervisors/ engineers, consumables etc. required for this scope of work shall be provided by the Contractor. All expenditure including taxes and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clause.

14.5 The contractor shall make adequate security arrangements including employment of security personnel and ensure protection from theft, fire, pilferage, damage and loss of materials/equipment kept under bidder custody..

14.6 All equipment shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings etc, shall be used for handling of the equipment without the specific permission of the engineer.

14.7 Contractor shall ensure proper housekeeping and remove all scrap materials periodically from various work area covered in the scope and deposit the same at the place earmarked for this purpose. In case of contractor's failure to do the same, BHEL reserves the right to remove scrap and recovery shall be made on actuals plus 5% overheads.

14.8 Access to site for inspection by BHEL and customer engineers shall be made available by the contractor at all times.

14.9 Contractor shall mobilize sufficient quantity of sleepers for stacking of materials in his custody.

14.10 Site Inspection: The owner/employer / BHEL or his authorized agents may inspect various stages of work during the period of contract awarded to him. The contractor shall make necessary arrangements for such

Technical Conditions of Contract (TCC) for Electromechanical Works

inspection and carryout the rectification pointed out by the owner/employer without any extra cost. No cost whatsoever for such duplication of inspection/work will be entertained.

14.11 Field Quality Assurance Formats: It is the responsibility of the contractor to collect and fill up relevant FQA Log sheets and present the same to BHEL after carrying out the necessary checks as per the log sheets and obtaining the signature of BHEL/Customer in token of their acceptance. Monthly Running Bill Payment to the contractor will be linked with the submission of these log sheets.

14.12 The contractor agrees to indemnify the company against all claims and losses arising as a liability under the Payment of Wages Act, Employees Provident Fund & Miscellaneous Provisions Act, Industrial Disputes Act, Employees State Insurance Act, Contract Labour (Regulation and Abolition) Act, Workmen's Compensation Act, Arbitration Act, Minimum Wages Act, Inter State Migration Act, etc. or criminal law in force so far as they relate to security personnel employed by the contractor for the company.

14.13 Income Tax or any other statutory dues liable to be paid by the contractor shall be recovered from the bills of the contractor for which TDS certificate will be issued by BHEL.

14.14 With regard to the interpretation of the terms and conditions of this contract, the decision of the Head of the Region/BHEL PE&SD shall be final.

14.15 Any dispute arising out of this contract shall be within the jurisdiction of the Court of Hyderabad only.

1.16 Any addition/ deletion on the scope of work and terms and conditions under this contract shall be implemented based on mutual discussions between the "company" and the "contractor".

14.17 Letter of Award No ----- issued by BHEL/PE&SD, Hyderabad (including the enclosures) shall form the integral part of this agreement.

14.18 Contractor shall provide FIRST AID / emergency medical facilities and maintain these facilities throughout the contract period & extension period (if any) as scope of work.

For any items or class of work not specified herein but required for total completion of work, the same shall be carried out as per BHEL requirement. However, payment of these items/class of work shall be regulated on the basis of rate arrived by the following method:

1) Based on unit rate of items in the rate schedule.

2) Wherever any item rate for similar type of work or nearby item rate does not exist in the rate schedule, rate will be worked out on the basis of work element or from fundamentals of estimation.

14.19 Wherever any discrepancy/difference is observed in technical specification between BHEL & Customer-JSW technical specification, customer specification shall supersede and shall be followed.

Chapter XV- Documentation

15.0 DOCUMENTATION

15.1 The following information shall be furnished within one weeks of award of contract for purchaser's approval a) Mobilization Plan b) Detailed organization chart c) Details of T&P available with contractors with document proofs.

15.2 The following information shall be furnished after testing and inspection: d) Revalidation of Test certificates of various T&P's, if certificates are found to be invalid or any discrepancies/abnormalities observed in T&P's during execution

Chapter XVI: Obligations of the Contractors

16.1 The contractor shall fully comply with the following enactments:

- a) Contract Labour (R & A) Act, 1970 and rules formed therein under Central Rules.
- b) Minimum Wages Act 1948 (Wage Rates not less than that notified by State Labour Department / Central Labour Dept., / BHEL whichever is higher from time to time).
- c) Payment of Wages Act 1936
- d) ESI Act, 1948
- e) EPF Act, 1952
- f) Employees' Compensation Act, 1923.
- g) Provisions of Factories Act 1948 & Rules thereof
- h) The inter-state migrant workmen (regulation of employment and conditions of service) Act, 1979
- i) Payment of Bonus Act, 1965
- j) Payment of Gratuity Act, 1972
- k) Fatal accidents act 1985
- l) Industrial disputes act 1947
- m) Maternity benefits act 1961
- n) Personal Injuries (Compensation Insurance act 1963)
- o) Persons with disability act 1995
- p) Protection of Human rights act 1933
- q) Public liability Insurance Act 1991
- r) Right to information act 2005
- s) Official Language act 1963(Implementation)
- t) The sexual harassment of women at Working place prevention, prohibition and redressal) Act 2013

16.2 The contractor shall obtain License from the Assistant Labor Commissioner (Central), or appropriate government if he engages twenty or more workmen.

16.3 The Contractor shall produce the following Registers and forms before commencement of work, for verification by the Executing Officer.

- a) Form XII - Register of contractors
- b) Form XIII - Register of workmen employed by contractor (Rule 75)
- c) Form XIV - Employment card issued by contractor (Rule 76)
- d) Form XVI - Muster Roll (Rule 78(1)(a)(i))
- e) Form XVII - Register of wages (Rule 78(1)(a)(i))
- f) Form XVIII - Register of wages-cum Muster Roll (in case of weekly payment)
- g) Form XIX - Wage Slip (Rule 78(b))
- h) Form XX - Register of deduction for damages or loss (Rule 78(1)(a)(ii))
- i) Form XXI - Register of files (Rule 78(1)(a)(ii))
- j) Form XXII - Register of advances (Rule 78(1)(a)(ii))
- k) Form XXIII - Register of overtime (Rule 78(1)(a)(iii))
- l) Form XXIV - Return to be sent by the contractor to licensing officer (Rule 82(1))

Technical Conditions of Contract (TCC) for Electromechanical Works

16.4 The contractor shall make himself or his representative (supervisor) available at the work spot every day during execution of work, for effective supervision.

16.5 The contractor shall attend to all inspections notified/conducted by the Human Resource department, Labor department, P.F. authorities, Inspector of Factories, ESI inspectors, or any other such authorities.

16.6 Non-compliance of any provisions under the act/rule/instructions/guidelines shall make the contractor liable for penal action including termination of contract.

16.7 Contractor shall furnish in a separate letter his place of residence and postal address. The delivery at the above-named place or posting in a Post Box regularly maintained by the Post and Telegraph Department or sending letters registered for acknowledgement of any notice, letter or other communication to the contractor shall be deemed sufficient service there upon he contractor. Change in address shall come into force at any time by an instrument executed by the contractor and delivered to the BHEL official who has signed the contract.

16.8 The contractor must satisfy himself by personal study thoroughly the scope of proposed work in detail and all conditions affecting the work before entering into the contract. There shall not be at any time, dispute/complaint of any nature regarding scope of work and interpretation of specifications or any misunderstanding with regard to nature or omission of the work to be done nor shall any application for compensation in terms of time and money shall be accepted by BHEL regarding the above.

16.9 Contractor shall in his absence keep competent agent constantly on the works and any directions or explanations given by the "Contract Executing Officer" or his representative to such agent shall be held to have been given to the contractor himself.

16.10 Contractor on the advice of BHEL officials shall immediately remove any person employed by him, who may in the opinion of the BHEL official, is incompetent or involves himself in misconduct. Such persons shall not be again employed on the works without written permission of the BHEL official.

16.11 The contractor shall give all notices required by the Acts, regulation, bye laws, Legal Acts and pay all fees in connection therewith unless and otherwise arranged and decided in writing with BHEL. He shall also ensure that no attachments are made against materials or work forming part of or for the use of the contractor. In all such cases, contractor shall protect and indemnify BHEL against any claim or liability arising from or based on the violation of any such laws, ordinances, regulations, orders, decrees or attachment either by himself or by his employees.

16.12 It shall be contractor's sole responsibility to protect the public and his employees against accident from any cause and provide required safety equipment and shall indemnify BHEL against any claims for damages for injury to the person or property resulting from any such accidents and shall, where the provisions of the Employees Compensation Act and Public Liability Act as applicable, take steps to properly insure against any claims thereunder.

16.13 In the event of any accident in respect of which compensation may become payable under the Employees Compensation Act, VIII of 1923 whether by the contractor or by BHEL as Principal Employer, it

Technical Conditions of Contract (TCC) for Electromechanical Works

shall be lawful for BHEL to retain out of monies due and payable to the contractor such sum or sums of money as may, in the opinion of BHEL shall be final in regard to all matter arising in this clause.

16.14 No work shall be done on Sundays or on other declared Holidays of BHEL without the written permission of BHEL officer in charge of the work. The contractor shall comply with the provisions of the Factories Act 1948 if the same are applicable. No contract labour shall be engaged on any National Holidays.

16.15 The contractor shall keep his work place clean and safe to avoid injuries to men and damage to finished products / equipment.

16.16 On the occurrence of an accident, which results in the death of any of the workmen employed by the contractor or which is so serious as to be likely to result in the death of any such workmen, the contractor shall within 24 hours of the happening of such an accident intimate in writing to the BHEL official in charge of the work.

16.17 The contractor shall indemnify BHEL against all losses or damages sustained by BHEL resulting directly or indirectly from his failure to give intimation in the manner aforesaid including the penalties or dues if any and become payable by BHEL, as a consequence of failure, BHEL to give notice under the Employees Compensation Act 1923 or otherwise confirm to the provisions of the said Act in regard to such accident. 1.18 The contractor shall ensure adherence to all statutory requirements applicable to BHEL.

16.19 The contractor shall ensure abidance by all the labour laws especially including Contract labour (R&A) Act 1970, Payment of Wages Act 1936, Employees Compensation Act 1923, Minimum Wages Act 1948, ESI Act 1948, Payment of Bonus Act 1965, and Provident Fund Misc. Prov. Act 1952, as amended from time to time.

16.20 The contractor shall comply with provisions of Provident Fund Misc. Prov. Act 1952 through PF code allotted to him / her.

16.21 Notwithstanding the above clause, in case of any financial loss incurred by company on account of contravention of the Provident Fund regulations or any regulations of rule touching the same by the contractor, the contractor shall submit an undertaking to indemnify the company to the extent of the loss incurred by the company.

16.22 The contractor should engage only those laborers whose age is 18 (eighteen) years or more.

16.23 The contractor shall not resort to subcontracting under any circumstances without prior permission of BHEL. If found sub-contracting at a later date, BHEL reserves the right to take whatever action it deems fit, including cancellation of the Contract.

16.24 The contractor shall provide the required safety equipment to the labors engaged by him / her.

16.25 Contractor shall issue "Employment Card" as per statute to all labour and supervisors covered under the job work contract.

16.26 The contractor shall be responsible to settle any grievances of the labour deployed by him.

16.27 The contractor is responsible for IBR approvals and inspections as per requirement at his own cost for all related equipments and pipings as per customer Technical Specification MEC/11/S3/E/0002/TS/002/R-01,Rev 01 ,Sep'2024

Chapter XVII: HSE (Health, Safety, Environment) and PPE (personal Protective Equipment) Guidelines

17.1 Contractor shall follow all the HSE guidelines as mentioned chapter IX off SCC and JSW guideline

17.2 Contractor shall deploy two (2) numbers of qualified and experienced safety officer & Two no's Quality engineer for the entire period of contract without any extra cost to BHEL

17.3 Contractor shall submit the biodata of safety officer to BHEL/Customer (JSW), for approval.

17.4 In case of any dispute/ contradiction, JSW HSE rules and guidelines shall prevail.

Volume IA Part II Technical Specification Chapter-I General

1.0 The work covered under this specification is of highly sophisticated nature, requiring the best quality of workmanship for fabrication, engineering and construction management. The Bidder should ensure timely completion of work. The Bidder must have adequate quantity of tools, construction aids, equipment etc., in his possession. He must also have on his rolls adequate, trained, qualified and experienced supervisory staff and skilled personnel.

The work shall be executed under the usual conditions affecting major power plant construction and in conjunction with numerous other operations at site. The Bidder and his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

All the work shall be carried out as per the instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the Bidder.

The Bidder shall at his cost perform any services, tests etc., although not specified but nevertheless required for the completion of work.

Contractor shall erect all the equipment as per sequence prescribed by BHEL at site. The sequence of erection, methodology will be decided by the BHEL engineers depending upon the availability of material, work fronts etc. No claims for extra payment from the Contractor will be entertained on the grounds of deviation from the methods and sequence of erection adopted in erection of similar TG sets or for any reasons whatsoever.

All the necessary certificates and licenses required to carry out this work are to be arranged by the Contractor expeditiously at his cost.

The work to be carried out under the scope of these specifications covers the complete work of receipt of material consignment, unloading at BHEL stores, proper stacking & upkeep, record keeping, collection from stores/storage yard, handling, transporting, unloading at erection site, pre-assembly, erection, alignment, hot alignment, bolting, fastening, welding, radiography, leveling, cold pulling, adjusting, Non-destructive testing, Post weld heat treatment, hydraulic test, chemical cleaning, passivation, steam blowing, oil flushing, water flushing, air flushing, pre-commissioning tests, trial running of auxiliaries covered under these specifications, commissioning Test and all other activities till handing over of the unit. The work shall conform to dimensions and tolerances specified in the various drawings, documents etc. That will be provided during the course of installation. If any portion of the work is found to be defective in workmanship or not conforming to drawings or other specifications, the Contractor shall dismantle and re-do the work duly replacing the defective materials at his cost failing which the work will be got done by BHEL at the cost and risk of the contractor.

Technical Conditions of Contract (TCC) for Electromechanical Works

The terminal points as decided by BHEL shall be final and binding on the Contractor.

The indicative schedule of weight of major equipment given in relevant appendices is meant for providing a general idea to the Contractor about the magnitude of the work involved.

During the course of execution of this work, certain rework/ modification/ rectification/ repairs/fabrication etc. will be necessary on account of feedback from various thermal power stations on units already commissioned and/or units under erection and commissioning and also on account of design discrepancies and manufacturing defects and site operation/maintenance requirements. Contractor shall carryout such rework/ modification/ rectification/ fabrication/repairs etc. promptly and expeditiously. Daily log sheets indicating the details of work carried out, man hours; consumables used etc., shall be maintained by the Contractor and got signed by BHEL engineer every day. Claims of contractor, if any, for such works will be dealt as per relevant clauses of General Conditions of Contract.

All tools and tackles, fixtures, equipment, materials, manpower, supervisors/ engineers, consumables etc. required for this scope of work shall be provided by the Contractor. All expenditure including taxes and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clause.

The contractor shall make adequate security arrangements including employment of security personnel and ensure protection from theft, fire, pilferage, damage and loss of materials/equipment issued to him for the work. Special care will have to be taken to guard against pilferage / theft of copper tubing, brass fittings, brass valves and other costly materials.

All equipment shall be handled very carefully to prevent any damage or loss. No bare wire ropes, slings etc., shall be used for handling of the equipment without the specific permission of the engineer.

Contractor shall ensure proper housekeeping and remove all scrap materials periodically from various work area covered in the scope and deposit the same at the place earmarked for this purpose. In case of contractor's failure to do the same, BHEL reserves the right to remove scrap at contractor's cost and risk.

Access to site for inspection by BHEL and customer engineers shall be made available by the contractor at all times. Contractor shall mobilize sufficient quantity of sleepers for stacking of materials in his custody.

Performance test of equipment and system will also form part of the work to be carried out by the contractor.

Tools & Tackles, thermo wells (screwed as well as welded), instruments / devices including flow devices, matching flanges, impulse piping & valves, etc. and any special equipment required for successful completion of the tests shall be provided by the Bidder free of cost

The Contractor's scope of work is further described in the following clauses:

1.1 RECEIPT, UNLOADING, STACKING, UPKEEP, COLLECTION AND RETURN OF EQUIPMENTS, MATERIALS & CONSUMABLES

Technical Conditions of Contract (TCC) for Electromechanical Works

Contractor shall receive all incoming material consignment, unload at BHEL stores or other areas as directed, stack them properly, upkeep, record keeping, and further take delivery of the components, equipment, lubricants, chemicals, special consumables, steel etc. from the storage yard/stores/sheds of BHEL/ client. The Contractor should note that the transport of equipment to erection site, assembly yards etc. should be done by the prescribed route, without disturbing the other works and contractors and in the most professional manner. Special equipment such as laboratory equipment, measuring and controls equipment, special electrodes, valves, shims, packing materials for joints and seals, lubricants, actuators etc., shall be stored, when taken over by the Contractor, in appropriate manner as per BHEL's instructions.

The contractor shall return all parts, materials, consumables etc. remaining extra over the normal requirement with proper identification tags to BHEL stores. In case of any misuse or use over actual requirement, BHEL reserves the right to recover the cost of parts/materials used in excess or misused, with departmental charges.

Transportation of lube oil, Chemicals, Gas cylinders etc. from stores, is included in the scope of this contract. The contractor shall have to return all the empty and excess drums to the customer/BHEL stores. Similarly, transport of chemicals for various pre-commissioning activities/processes mentioned in clauses herein from BHEL/customer's stores and charging of chemicals into the system for carrying out various pre-commissioning activities and processes mentioned herein and returning of remaining and/or the empty containers of the chemicals to customer/BHEL stores is the responsibility of contractor. After completion of oil flushing operation, the used oil shall be filled in empty drums and which in turn shall be returned to BHEL/customer's stores.

1.2 TEST TAPPING POINTS

Installation and welding of Tapping Points for taking performance test measurements shall be carried out by the contractor as part of this work for the equipment covered under this tender specification under the guidance of BHEL engineer.

All packing and forwarding material shall be returned as soon as the material is unpacked. The location for storage of such materials shall be as indicated by BHEL Engineer.

All Measuring and Monitoring Devices (MMD) used for the work in scope of these tender specifications shall be calibrated by the accredited agencies that are approved by BHEL or calibration tractability is established up to National Physical Laboratory.

Contractor shall furnish the consumption details of chemicals, lubricants, TIG welding filler wire, welding electrodes and other consumables on monthly basis for record purpose.

Technical Conditions of Contract (TCC) for Electromechanical Works

During the course of erection, platforms and floor grills are to be cut at certain places to route steam, oil, water and air piping, cable trays, etc. or for accommodating erection, rigging etc, the cutting of platforms and grills should be minimum and as approved by BHEL Engineer. After completion of work, the platform/grills cut shall be made good neatly as instructed by BHEL engineer.

Erection and welding of stainless-steel fittings including supply of necessary stainless steel welding electrodes is within the scope of the work/specification.

No temporary supports should be welded on to the piping.

Contractor shall carry out preservation painting on all items taken from stores. The preservation painting has to be carried out on material taken from stores and also on material erected wherever the shop painting has given away. Periodical inspection shall be made as per the instructions of BHEL engineer and the portion of items or the complete items needing painting shall be carried out to the satisfaction of BHEL engineer. This facility shall be provided by the contractor till the commissioning and handing over of the equipment to the customer. Preservative and touch up painting on equipment covered under this specification stored at stores/storage yard shall also be carried out by the contractor.

Adjustment of spring hangers for piping shall be done by the contractor during initial erection. After initial commissioning trials, it is possible that the spring hangers have to be adjusted repeatedly till the correct spring compression is achieved. Contractor shall do the same to the satisfaction of BHEL engineer. The marking of cold and hot positions on the hangers shall be done by the contractor.

The contractor shall return to BHEL the excess materials left over after completion of work, materials issued for temporary pipelines for HT, chemical cleaning, flushing, blowing etc. and materials issued on returnable basis in neatly dressed condition. Necessary grinding, edge cutting (square facing), edge preparation (vee), painting etc. to the condition similar to the one at the time of issue shall be in scope of work.

Wherever the equipment are erected by the contractor and connected piping is done by other agency, contractor shall weld / tighten the incoming pipes to either the equipment or the counter flange provided on the equipment

Chapter-II **CIVIL WORKS, FOUNDATION, GROUTING**

2.1

BHEL will provide only shims and packer plates (either machined or plain), which are received from BHEL's manufacturing plants and go as permanent part of the equipment. Additional packer plates and shims if required will have to be prepared by the contractor out of steel plates, steel sheets to meet site requirements. Necessary steel plates for this purpose will be provided by BHEL free of cost.

2.2

The contractor shall carry out scrapping and matching of embedded plates, permanent spacers and all the matching parts of turbine, generator, pumps and other equipment under scope wherever required. The support and sole plates matching and concrete surface bedding is also covered in the scope of work. The fine dressing of concrete shall be with Prussian blue-match checks.

2.3

Packer plates shall not only be blue matched with foundations but also inter-packer contact surfaces, contact surfaces between packer and pedestals, contact surface between packer and foundation frame etc. shall also be blue matched and required percentage contact shall be achieved by chipping and scrapping as per engineer's instructions.

PREPARATION OF FOUNDATION

2.4

Buildings, foundations and other necessary civil works for supporting structures, equipment etc., will be provided by the customer. The checking of dimensional accuracy, axes, elevation, levels etc., with reference to bench marks of foundations and anchor bolt pits and also adjustments of foundation level, dressing and chipping of foundation surfaces of all equipment contractor/BHEL shall prepare protocols before taking over the foundations. Dressing and chipping of foundations up to 25mm for achieving proper levels will be within the scope of work/specification.

2.5

All minor foundations and anchor points required for installing erection equipment like winches, anchors etc. are to be cast by the contractor.

2.6

The complete work of secondary grouting of equipment is included in the scope of work/specification. Contractor shall arrange all manpower, T&P, form work and shuttering materials, all grouting materials such as ordinary Portland cement, sand, stone chips etc. & quick-setting-non-shrink-free-flow special grout mix of required specification (like conbextra-gp- 2 or equivalent).

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2.7

The quick-setting-non-shrink-free-flow special grout mix shall be purchased only from the following BHEL approved vendors:

1. M/S FOSROC CHEMICALS (INDIA) PVT LTD;
2. M/S SIKA INDIA PVT LTD;
3. M/S PAGEL CONCRETE TECHNOLOGIES PVT LTD;
4. M/S PIDILITE INDUSTRIES LTD.

In order to ensure the quality, the major grouting of equipment using any of above grout mixes shall essential be done as per the recommendations of supplier with regard to grout preparation and use of machinery etc under the supervision of the respective supplier. BHEL has arrangement with above suppliers for supervision services and the supervision charges for the same will be borne by BHEL. However, the contractor shall ensure readiness of equipment for grouting in all respect before such a service is requisitioned and the duration is not prolonged unduly. Any overstay required due to contractor shall be charged to the contractor with BHEL's departmental charges. Contract shall consult BHEL engineer before deciding upon the vendor for the above.

2.8

Cleaning of the foundation surfaces, pocket holes, anchor bolt pits and de-watering and making them free of oil, grease, sand and other foreign materials by soda washing, water washing, compressed air and other approved methods will be within the scope of this work.

2.9

BHEL will provide only shims and packer plates (either machined or plain), which are received from BHEL's manufacturing plants and go as permanent part of the equipment. Additional packer plates and shims if required will have to be prepared by the contractor out of steel plates, steel sheets to meet site requirements. Necessary steel plates for this purpose will be provided by BHEL free of cost.

2.10

The contractor shall carry out scrapping and matching of embedded plates, permanent spacers and all the matching parts of turbine, generator, pumps and other equipment under scope wherever required. The support and sole plates matching and concrete surface bedding is also covered in the scope of work. The fine dressing of concrete shall be with Prussian blue-match checks.

2.11

Packer plates shall not only be blue matched with foundations but also inter-packer contact surfaces, contact surfaces between packer and pedestals, contact surface between packer and foundation frame etc. shall also be blue matched and required percentage contact shall be achieved by chipping and scrapping as per engineer's instructions.

Chapter-III EQUIPMENT INSTALLATION

Broadly the equipment and materials of major components is specified hereunder and each of the unit will include but will not be limited to the following

3 EQUIPMENTS INSTALLATION – COMMON REQUIREMENTS

3.1

Filling of lubricants for steam turbine, turbo-generator and other rotating auxiliaries for purpose of oil flushing, initial fill up and subsequent topping up during various stages of work is in the scope of the contractor.

3.2

All works such as cleaning, leveling, aligning, hot alignment, trial assembly, dismantling of certain equipments/components for checking and cleaning, surface preparation, fabrication of sheets, tubes and pipes as per general engineering practice and as per BHEL engineer's instructions at site, cutting, grinding, straightening, chamfering, filling, machining, chipping, drilling, reaming, scraping, lapping, shaping, fitting-up, drilling of holes, making dowel pins, minor rectification of foundation bolts etc. are incidental to the erection/commissioning and any other work/activity which is necessary to complete the work satisfactorily, shall be carried out by the contractor as part of the work.

3.3

Cleaning, servicing, lubrication of actuators, pumps, headers, governing system, ESV & IV, control valves, LP bypass, HP Overload Bypass valves, Cold Re-heat Non Return Valves with power cylinders and other valves, tanks, vessels etc. during erection and commissioning stages is in the scope of work. However, gaskets/pickings/lubricants for replacement will be provided by BHEL free of cost.

3.4

All equipment shall be preserved and protected periodically before and after erection as per advice of BHEL engineer. The journals of steam turbine rotors, generator rotor, HT motors and other rotating machines shall be thoroughly cleaned, greased/painted with preservative agents periodically as instructed by BHEL engineer.

3.5

Trial run of all motors including checking direction of rotation in uncoupled condition, check alignment and re-couple the motor to driven equipment.

3.6

After initial trial of rotating equipment, control and power cabling for motors and other equipment/instrumentation may have to be disconnected for checking alignment and

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resetting/realignment/hot alignment. Contractor will have to provide services for disconnection and reconnection of control and power cables.

3.7

All racks or assembled units like Governing Rack, LP Bypass Rack & HP Bypass system, Cold Re-heat Non-Return Valve, Seal Oil Unit, Gas Unit, Seal Oil Valve Rack, Gas Cylinder Racks etc. supplied from manufacturing units will be tested in BHEL/ Customer stores or at site. This may require transportation, filling of oil, water etc. in these racks for carrying out testing of these racks. Defects noticed during testing of these racks will have to be rectified by the contractor free of charges. Further, any pipeline / flanges / fittings not found assembled properly, the same have to be rectified / corrected by the contractor free of charges.

Chapter-IV PIPING INSTALLATION

4.0 TG integral Piping, Power Piping & Low-Pressure piping

4.1. TG - Integral and Other Miscellaneous Piping- Supply Philosophy

For all pipes above 2” Pre-fab piping package with one fitting welded to the cut pipe spool (as per isometric drawings), including complete surface preparation and painting.

For all pipes below and including 2” , piping & fitting’s shall be loose supply , in painted condition only .

The philosophy shall be applicable for all the TIP,GIP, and balance piping (IBR & NON IBR) .

4.2. TG - Integral and Other Miscellaneous Piping- Scope

The scope of work for TG integral and miscellaneous piping covered under the specification will include but not limited to the following systems.

- a) Condenser air evacuation system
- b) Control fluid system
- c) Central oil storage and purification system
- d) Gland steam sealing system
- e) Governing oil system for TG and drive turbine of boiler feed pump.
- f) Lube oil system for TG, drive turbine of BFP and turbine driven BFP as well as motor driven BFP.
- g) Generator Seal oil system
- h) Generator Stator water cooling system
- i) Generator Hydrogen & Carbon dioxide System
- j) Exhaust hood spray system
- k) Gland sealing (of valves and pumps) system
- l) Condenser on load tube cleaning system
- m) Self-cleaning type Debris filters at the inlet to the condensers.
- n) Any other piping system required to complete the plant within the battery limit

4.2. Power Cycle piping

- a. Main steam, HRH, HP & LP by pass system, LP steam piping with in the battery limit as required.
- b. Aux. steam piping system as required
- c. All extraction steam piping
- d. Complete condensate piping from condenser to Deaerator and complete feed water piping from deaerator to final HP heater outlet up

- to the battery limit.
- e. Complete CEP recirculation line
- f. Condenser make up system
- g. Heater drains, vents including necessary flash tanks
- h. Equipment drains including necessary flash tanks
- i. Valve gland sealing piping system
- j. Miscellaneous line drains and vents including necessary flash tanks
- k. Complete safety valve exhaust piping for safety valves on heaters,
- l. Complete steam blowing piping system (Temporary)
- m. Complete chemical cleaning piping system (temporary)
- n. Any other piping system or piping for any other auxiliary services required to complete the plant within the battery limit

4.3. Low pressure piping

- a. Condenser cooling water
- b. Auxiliary cooling water
- c. Potable/ drinking water system
- d. Plant Instrument air system
- e. Plant service air system
- f. DM make up water
- g. Drain water system
- h. Any other piping system for any other auxiliary services required to complete the plant within the battery limit

All the pipelines / ducts carrying hot media will be insulated and will be properly secured and cladded. Pipe racks including civil work wherever necessary will be provided by the bidder.

4.4 Miscellaneous Items, Piping, Valves, Hangers, Supports

The following items will be included in the scope of the Contractor

- a) All sampling lines up to sampling table at sample testing station with sample take off devices and coolers.
- b) All impulse piping along with root valves, equalizing vessels, condensing pots, separating vessels, drain cocks, three-way cocks and other accessories.
- c) All equipment base plates, lifting lugs, foundation bolts, sleeves, nuts, inserts, embedded plates, etc. as required for efficient installation of all equipment.
- d) All drain piping from safety valves, drains and vent lines will be led to and terminated at trenches/ drains at ground level.

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- e) All hangers and supports with auxiliary steel structure, including columns and beams, base plates, foundation bolts, nuts and washers wherever applicable, thermal insulation with cladding and accessories for all the piping covered herein.
- f) Complete piping and fittings for LP chemical dosing system.
- g) Complete Instrument air, Service air, cooling water, service water, drinking water pipelines as specified.
- h) All the above piping systems will be complete with valves, specialties, stubs including instrument stubs, pipe reducers/expanders, matching flanges and suitable gaskets, nuts and bolts etc.
- i) The specialties to be provided by the Contractor will include all categories of hangers, restraints, secondary steel support, anchors, etc. as required for the complete piping system.
- j) All pipe hangers, supports, restraints, anchors with all auxiliary structural members to be fixed with building structures and floor/trench embedded plates.
- k) Necessary steel platforms (1000 mm wide) with stairs and supports required for operating any equipment, valves, gauge glass etc., including platform around deaerator, LP bypass valve area and walkway around turbo generator.

4.5

The scope of work in piping system (air, Gas, Water, Oil, Steam, Governing oil/Control oil etc.) will include cutting to required length, edge preparation, laying, fixing and welding of the elbows/fittings/valves etc, fixing supports/hangers/shock absorbers/ guides and restraints etc and carrying out all other activities/works to complete the erection and also carrying out all pre-commissioning/ commissioning operations mentioned in these specifications as per engineer's instructions and/or as per approved drawings. Weld joints and NDT requirement for all TG Integral piping, and other piping's as applicable under tender specification shall be as per drawings/schemes and suiting to site requirement. The necessary drawings/documents for these weld joints will be provided at site during execution of work.

4.6

Carrying out of piping as per the specifications between equipments constituting terminal points, whether the terminal equipments fall within the scope of the work/specification or not, is within the scope of the work/specification. The contractor shall complete terminal joints at either ends, with due NDE & PWHT if applicable, for all the piping schemes covered in the scope of work.

4.7

Fit up and welding/bolting/fastening of piping to the terminal points (such as stubs, valves, flanges on terminal points/equipments, stubs on headers, battery limits etc) forming part of the scope of work/specification and stress relieving and radiography of joints so made are also within the scope of work. Permanent fasteners and gaskets will be supplied by BHEL.

4.8

Interconnection/ Hook-up, if any, with the existing system shall form part of work. Such interconnections, hook-ups may require shut down of running plant and the relevant work has to be completed within such

Technical Conditions of Contract (TCC) for Electromechanical Works

planned shutdowns. This may call for working with enhanced resources and on extended hours. Contractor's offer shall cover all such contingencies.

4.9

All drains / vents / relief / escapes / safety valve piping to various tanks/ sewage / drain canal /flash box / condenser / sump / atmosphere etc. from the stubs on the piping and equipments Eerected by contractor is completely covered in the scope of this tender specification.

4.10

The following items of work shall be incidental and forming part of piping fabrication and erection:

- 1) To locate cause of vibrations in equipments/auxiliaries/pipelines and carrying out necessary corrections in case the same is attributed to the contractor.
- 2) Fabrication and erection & welding of racks, steel supports, guides, restraints for all the piping. Steel for this purpose will be supplied by BHEL free of charge in random and running lengths.
- 3) Pre-assembly of spring suspension/hangers and shock absorber as per requirement.
- 4) Erection of steam traps, filters, flow nozzles/ flow indicators/ flow orifices other measuring elements in the piping. These may have been supplied either by BHEL or their customer. This may involve cutting of pipe lines, fresh edge preparation and welding with stress relieving wherever applicable.
- 5) Fabrication / making of bends for pipes and tubes of diameter up to 65mm.
- 6) Matching of all fittings like tees, bends, flanges, reducers valves, socket fittings, etc with pipes for welding
- 7) Servicing of valves, Power Cylinders and actuators etc.
- 8) Cleaning of all pipes by wire brushing / blowing by compressed air.
- 9) Welding of root valves with small length of piping to the pressure, flow and level tapping points on piping or flow nozzles/orifices/metering/ measuring elements fixed on piping
- 10) Welding of blanks with stress relieving if required on a temporary basis.

4.11

Pipelines will be field routed as per schemes/ suggestive layout or as per the instructions of BHEL engineer. Pipes & tubes will be supplied in random lengths and running lengths. The contractor shall have to lay the piping after carrying out the necessary fabrication, edge preparation, routing etc. to suit site requirement in best professional manner.

4.12

As far as possible, pre-assembly shall be done. The pipe laying shall be carried out from the available terminal point/points or any other area between the terminal points. The erection can be carried out on temporary supports to obtain proper alignment and welding. After fixing the permanent supports, all the temporary supports shall be removed. The alignment, distances and loading of the supports shall be checked and the required settings to be ensured as per requirement.

Chapter-V

CONDENSER INSTALLATION

5 CONDENSER INSTALLATION

5.1

The condenser will be dispatched in loose parts mainly comprising of bottom plates, dome valves, front and rear water chamber, front and rear water boxes, side walls, hot well, spring elements, support plates, air extraction pipes, baffles, stiffening rods and pipes etc. the condenser is to be assembled at site in position by welding the different parts. Condenser tubing and tube expansion (roller expansion) is to be done at site by the contractor, after taking due care to clean all the tube holes. After final alignment and leveling of turbine exhaust and condenser, the same has to be welded to the exhaust position of LP exhaust as per the sequential welding procedure. Condenser tube material is stainless steel.

5.2

Before insertion of tubes, the contractor shall clean the holes in the tube plates and tube support plates to remove paint, corrosion spots, oxide scales etc. Usage of suitable cleaning agent may also be required which has to be supplied by the contractor.

5.3

The tubes shall be expanded using an Automatic Electronic Torque Controlled Tube Expanding unit or Pneumatic Tube Expander. Tube expansion shall be checked with dial bore gauge. The total set up including tube expanders and tube cutting tools etc. for carrying out the complete condenser tube expansion works shall be provided by the contractor.

5.4

The contractor shall carry out the condenser neck welding with LP cylinder exhaust hood only after final installation of LP casing. Neck welding shall be subjected to specified non-destructive testing.

5.5

The hydrostatic testing of steam space and hydraulic testing of water space up to the terminal point after assembly of water boxes are also included in the scope.

5.6

Work of painting of condenser surfaces in various area and at various stages of work are specified elsewhere in these specifications.

Chapter-VI

GENERATOR INSTALLATION & HANDLING HEAVIER EQUIPMENTS

6.1 GENERATOR STATOR LIFTING & PLACEMENT

The Generator Stator, weighing 228 Metric Tonnes (approx.), will be dispatched to site by Road on trailer. The customer's EOT (capacity 100/25 Tones) in TG hall shall not be suitable for lifting of Generator Stator and this Generator Stator shall be lifted by Strand and Jacks / Lift & Shift arrangement method. The Scope of contractor shall be to take complete responsibility and carry out the liaisoning and follow up with transporters, filling of ditches/levelling etc. for marching of trailer to unload at suitable location/point of lifting near the TG building, Shifting/dragging of Generator Stator by providing required arrangements like rails/plates/sleepers etc. (as per requirement), arranging the Strand And Jacks/Lift & Shift arrangements & their assembly /installation with expert supervision till lifting & placement of Generator. All required associated T & P, Engineers/Supervisors, operators, riggers, helpers and any other required resources shall be arranged by the contractor without any extra charges.

Contractor shall plan all his activities / operations so as to avoid the delay in unloading and releasing the transporters Carrier/trailer. For any demurrage Charges by Transporter / Customer on account of delay in Handling, Unloading from Trailer after arrival at site shall be the responsibility of Contractor. The all above complete works of receipt from trailer, unloading, shifting, Lifting & placement to required foundation /elevation of Generator Stator is the part of scope of work under this contract.

The Generator Stator will have to be lifted from space outside TG building. Lifting and placement of Generator Stator from this side may require to hold casting of certain civil foundations of some Auxiliaries TG hall column structural bracings etc., Contractor shall visit site and discuss his plan with Customer & BHEL Engineer at site and submit his plan of Generator Stator lifting along with Technical Bid. The contractor shall submit the drawing indicating the foundation location and load data of strand jack. Contractor shall deploy his above Generator Stator lifting Strand and Jack arrangements & other resources well in time to suit the site requirement so as to lift & place it on required foundation in minimum possible time. Contractor is advised to visit the site and plan the arrangements.

Generator Stator shall be required to be lifted and put on foundation within one week time after availability of material and other essential inputs, and clear the holds for further civil & structural works. All above shall be the part of scope of work and progressive payment for same shall be made per relevant chapter of Technical Conditions of Contract.

Special Note: The bidder is required to deploy Strand Jack from reputed brand after obtaining approval from BHEL.

6.2 Lifting of Generator Stator other than Strand and Jack arrangements is not permitted

Immediately after completion of Generator Stator lifting work, Contractor shall dismantle his Strand and Jack arrangements and vacate the holds within a week time to enable customer to proceed with further works of civil foundations and structural works kept under hold for Generator Stator lifting

6.3 HANDLING OF HEAVIER EQUIPMENTS

Heavy and voluminous Equipment/consignments like HP Turbine module, IP Turbine module), LP Rotor, LP turbine (Inner-Outer & Inner-Inner) Lower half casing, LP turbine (Inner outer) Upper half casing, Generator stator/rotor, Brushless Exciter, HP & LP Heaters etc. along with other Equipment shall be handled carefully. Contractor shall have to arrange his own Tools & Tackles, Trailer of suitable capacity including additional suitable capacity lifting Crane and any other arrangement required to handle right from collection of materials from BHEL/Customer store yards/stores, transportation to site of works and erection & their placement on respective elevation/foundation. BHEL shall not provide any T&P other than those specified for the specific work.

Chapter-VII **HYDROSTATIC TESTING, PRESERVATION & OTHER TESTS**

7.0 HYDROSTATIC TESTING, PRESERVATION & OTHER TESTS

7.1

Contractor shall carry out the following tests required to complete the erection and commissioning of the TG Set:

(1) Hydraulic testing of individual equipment like condenser, coolers, heaters, other auxiliaries and equipment. Required capacity Hydraulic test pump/Fill pump and other necessary arrangement shall be provided by contractor to carry out hydraulic testing, chemical cleaning of the equipment and piping as part of scope of work under this tender specification.

(2) Ultrasonic test

(3) Dye Penetrate test

(4) Magnetic Particle Test.

All above facilities (men, materials, equipment, consumables etc.) with operating engineer/experienced person and proper approach wherever required shall be provided by the contractor for satisfactory completion of the above tests.

7.2

Contractor shall lay all necessary temporary piping, welding, supports, install pumps, valves, pressure gauges, electric cables and switches etc., required for the Hydro test, Air leak test, Chemical cleaning, Steam blowing etc. After the test is over, all the temporary piping, pumps, etc. will be removed. It may also specifically be noted that servicing, erection and dismantling of piping and equipment for conducting above tests will be done by the contractor. No separate payment shall be made for this purpose.

7.3

All the above tests shall be repeated till all the equipment, piping and systems satisfy the technical and statutory requirements. All related works form part of the scope.

7.4

Suitable welding and stress relieving of temporary blanks or suitably fixing temporary blank flanges with gaskets and fasteners and welding and providing suitable de-aeration/ venting /drain points with valves as per BHEL engineer's instruction, for performing hydro test of piping is within the scope of work. Required valves, fasteners, blank flanges, blanks or steel for blank flanges shall be provided by contractor. After completion of hydraulic test, welded blanks shall be cut and removed and weld burrs ground finished and cavities/scars of cutting weld filled and ground as per BHEL engineers' instruction.

7.5

Hydro test of piping may have to be repeated several times to meet technical and statutory requirements before application of insulation.

Chapter-VIII

Electrical and C&I

8.0 The contractor's scope of services/Erection & commissioning for various equipment indicated in Part-1, Chapter X are detailed in this chapter.

The work will comprise of, but not limited to the following:

8.1. One (1) no. 250MW, kV, 3 phase, 50 Hz, air cooled, synchronous generator as per specification requirement etc, complete with excitation system, cooling system.

8.2. One (1) set of LAVT & Surge Protection cubicles and Neutral Grounding Transformer panels as per specification requirement and complete with fittings and accessories.

8.3. One (1) set of Generator Control, Metering, Synchronizing Panel with mimic and semaphore switches for unit

8.4. One (1) set of Relay and Protection Panel for Generator, located in unit control room.

8.5. One (1) Lot of HT drive motors, LT drive motors and motorized valves for all the equipment for TG equipment complete with all fittings and accessories.

8.6. DC feeders/capacity for drives,

8.7. One (1) Lot of Local Push Button Stations (LPBS) for all HT, LT drive motors and motorized valves

8.8. One (1) Lot of GI Pipes, GI conduits, Adapter Boxes, Terminal Boxes, Junction Boxes etc and all other cabling accessories .

8.9. One (1) Lot of DC motors & DC starter panels for Emergency Oil Pumps .

8.10. All HT, LT & control cables & instrument cabling between BHELscope supplied panel/JB to BHEL supplied panel/JB expect special cables . However, these cables will be issued by JSW for completing cabling works.

8.11. Laying and termination (including supplying of all necessary materials like double compression glands, lugs, bolts, nuts, consumables, etc.) of all HT,LT power and control cables including termination on both sides complete with accessories for all interconnections between all the HT/LT panels and Control panel etc to various loads/consumers, drive motors, actuators, Local Push button stations and interlocking cables from space heater power supply feeders to TG HT motors in HV MCC to TG motor feeders in 6.6 kV unit auxiliary switchgear is included in the scope of work.

8.15. Galvanized Cable trays with supporting wherever required with in the terminal point.

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8.16. Equipment Earthing including above ground and below ground earthing & interconnection with Main earth mat, cable tray earthing is in JSW Scope

8.17. Erection of all supplied electrics including erection consumables.

8.18. Relay coordination/settings for 1x250MW Turbo generator & its auxiliaries. Installation/Erection supervision, Testing and Commissioning

The scope of the bidder shall also include the following:

Erection supervision, testing, commissioning including transportation of all equipment and material, associated controls and electrics.

Necessary coordination work required for erection, testing & commissioning and resolving problems of all equipment. All equipment, components, erection accessories or consumables required for the completion of the electrical job shall be in the scope of the bidder.

8.19 LIST OF TOOLS AND PLANT - C&I, AND ELECTRICALS WORKS:

The following tools and equipment but not limited to, are required for the installation and commissioning instrumentation & electrical works. The contractor shall make them available for erection, testing and commissioning purposes, including all consumables likely to be used at his own cost at the time of mobilization and get them certified by Engineer in charge.

S.No.	Description
1.	2.
1.	Pipe bending machine (5mm to 25 mm)
2.	Pipe wrenches (6", 8", 12")
3.	Screw spanners (7", 8")
4.	Set of screw drivers
5.	Set of Allen keys (mm & inch)
6.	Set of spanners
7.	Set of needle files (Round, triangular, square, half round and knife edge)
8.	Copper tube cutters
9.	Stainless steel tube cutter and flaming tool

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10. SS Tube bender
11. Small size hacksaw & fraksaw
12. Cutting pliers
13. Nose pliers
14. Insulation stripers
15. Dry cable jointer
16. Crimping tool for control and power cables
17. Die set 1/4", 1/2", 3/4", 1 1/2", 2", ET, NPT, M20X1, M20X1.5
18. Tap set of above sizes
19. Drill bits
20. Number punches
21. Alphabet punch
22. Embossing machine with cassettes (Numbers and alphabets)
23. Portable drilling machine up to 1-1/2"
24. Soldering gun
25. Soldering Iron
26. Multimeter (a) Digital 3-1/2 digit (b) Analog with Comet AC/DC 0-10A & Voltage-1000V.
27. Avometer
28. Megger 500V, 1000V, 2500V/ 5kv Motorized
29. Calibration kit for thermocouples RTDS
30. Continuity tester
31. Calibration kit for vibration equipment
32. 0-30 MA ammeter
33. Standard gauge for pneumatic instrument calibration.
34. Manometer 0-2 M of H2O
35. Vacuum pump
36. Standard pressure gauges 0-2.5 Kg/cm², 0-100 Kg/cm², 0-160 Kg/cm², 0-250 Kg/cm².
37. Pneumatic calibrating kit
38. Telephone headphones with accessories for cable testing etc.
39. Hydraulic pump capable of generating 400 kg/cm² pressure.
40. Dead weight tester for pressure gauges calibration up to 400 kg/cm² range

41. Universal watch makers screw driver set
42. Day welding and cutting set
43. Welding DC Generator set with regulator etc.
44. Spring balance 0-2 Kg/cm
45. Torque wrench 0-60 Kgm
46. Dual channel Oscilloscope
47. Micro ohmmeter digital 0-200m ohm/0-10 amps DC
48. Phase sequence meter
49. Tong tester (a) 0-300 amps AC (b) 0-100 amps DC
50. Three phase variac 0-10 A, 415/450 V
51. Single phase variac 0-250 V, 10A
52. HV Test kit 0-30 KV DC
53. Relay test kit with phase shifter

8.20. CONSUMABLES:-

1. Birkosit
2. Hylomer
3. Led plate 200
4. Loctite 221,601,621
5. Molykote 321 R
6. Industrial Grease

NOTE: -

- i) All the tools should be procured in sufficient quantities by the Contractor.
- ii) The list of tools & tackles mentioned above are indicative only. The contractor has to mobilize the required tools & Plant in sufficient quantity to carry out the erection, testing and commissioning. However, on instruction of Resident Construction Manager, additional tools and tackles has to be arranged by Bidder for smooth E & C activities of the project.

8.21 ERECTION OF INSTRUMENTATION WORKS

- The Contractor shall, execute the entire instrumentation work within the battery limits as indicated in BHEL drawings and the work includes erection, testing, calibration, and commissioning of instrumentation and control panels and gauges, boards for all equipment and associated auxiliaries.

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- BHEL will furnish the contractor with necessary P&I diagrams in which all the instruments required for the control & protection of the system are shown.
- The Contractor shall erect all local instruments and junction boxes in the field with suitable and permanent supports as per BHEL standards. Vibration free locations at which instruments shall be installed will be indicated by BHEL site engineer.
- The contractor will provide necessary tap off points on the equipment, vessels, auxiliaries and pipe lines up to the first isolation valve and shall carryout further process connection from these tap off points to various instruments like pressure gauges, pressure transmitter, differential pressure transmitters, pressure switches etc. All temperature gauges with capillary type should be mounted on separate stand and capillary to be routed in separate perforated tray.
- The process line connections between the tap off points and respective instruments shall be carried out in accordance with the BHEL standards furnished to the contractor, or as instructed by BHEL Engineer at site.
- The contractor shall route process impulse lines from the respective tap off points up to the primary instruments via the shortest possible route employing minimum number of bends. They shall be carried out with the concurrence of the BHEL site engineer.
- The instrument air for each services will be provided at the battery limit of the respective services. The contractor shall route the instrument air header to the local control panels and the various local pneumatic instruments, which shall be carried out under the supervision of BHEL site Engineer.
- The contractor shall install an isolation valve and air filter regulator near the local instrument on a permanent support and carryout connections from air header to various pneumatic instruments.
- The Contractor shall connect the primary pneumatic instruments to the secondary instruments as per the P & I diagrams by means of 6 X 1 mm PVC covered copper tubes / S. S. tubes joined by S.S. socket weld straight coupling by Argon welding, or compression fittings as required at site.
- The Contractor shall plan the routing of pneumatic impulse lines and cables with the concurrence of BHEL Engineer. He shall carryout pre-modifications suggested by BHEL site Engineer in line with layout of pneumatic tubes and electrical cables, wherever found necessary.
- After finalizing routing plan for cables and tubes, the contractor shall erect slotted sheet metal trays/angle trays as the case may be from the local instruments and junction boxes up to panels & gauge boards and from the junction boxes to the local control panels. The Contractor shall use natural bends wherever slotted sheet metal/ angle tray junctions are encountered. These cable trays shall be erected securely and shall be fixed to the walls or steel beams with proper support

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or with hangers. The routing shall be carried out in such a way that they should be kept away from hot environment and allow enough room to lay additional cables easily at a later date.

- The contractor shall lay pneumatic tubes and electrical cables on independent trays. All cables shall be protected at both ends and also strands shall be ferruled for easy testing and termination. All tubes, cables shall be laid properly and fixed securely to the trays by means of clamps. All junction boxes shall be numbered using paint as per the directions of BHEL site engineer.
- Metallic tags inscribing the junction box number shall be tied securely to the cable or tube at the primary elements like pressure transmitters, pressure switches, etc. and a metallic tag at the junction boxes inscribing the tag number of the instrument.
- The contractor shall connect multi-tube/ multi-core cables to the control panel bulk head/terminal box from the respective junction boxes. Multi-cable/multi-tube shall be laid in the same way as mentioned before, and shall be secured by cable glands/ bulk heads.

8.22 CONTROL PANELS, STARTERS, LOCAL GAUGE BOARDS:

- Panel erection shall include chipping, levelling, grouting, fabrication of base frame if required and modifications in panel wiring if any, removal of instruments/ relays for calibration, testing and re-fixing of the same after calibration / testing.
- Gauge boards, as and when received at site, shall be unloaded, cleaned and shall be immediately installed at location as shown in layout / as suggested by BHEL engineer.
- The Contractor shall drill required No. of holes on gland plates of panels and local gauge boards for entry of electrical cables, pneumatic tubes and process impulse lines. All cables shall be provided with suitable glands. Any extra hole shall be plugged to avoid dust/moist air entry into panel.
- All cables & pneumatic tubes shall be identified and tagged with the instrument tag numbers connected to terminal strip/bulk heads as per the panel drawing supplied to the contractor.
- On completion of work, all carbon steel components viz, impulse line, instrument supports, angles, cable racks shall be properly cleaned and painted firstly with a coat of suitable/applicable primer and double coat of suitable / applicable anti corrosive paint.

8.23 Cable Laying (Power / Control / Instrumentation shielded cables / Triad Cable / plug-in cables / UTP cables for Ethernet / armored / Un-Armored, single / multi-core, PVC/HR PVC / FRLS / Teflon / XLP insulation)

8.23.1 Cable laying (erection) will include:

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- a) Cutting to the required length, laying in overhead/underground cable trench/ through pipes/flexible conduits. Cable rollers have to be used as per requirement. The contractor shall prepare the drum schedule in order to minimize the wastage.
- b) Dressing/Clamping in tray etc.
- c) Drilling of holes in gland plates in panels and junction boxes for the entry of cable.
- d) Cable glanding, splicing, dressing of spliced wire inside the panel and JB's
- e) Providing printed ferrules. Wherever required ferrules shall be one-piece heat shrinkable type. **Contractor has to arrange for suitable ferrule printing machine(s).**
- f) Termination by using crimp type lugs copper tinned/ aluminium (insulated/ un-insulated).
- g) Providing identification cable tags, aluminium at both the ends and at appropriate interval (30m) throughout the route length. Tags to be arranged by the contractor.
- h) Continuity checking, insulation resistance checking, High Voltage test on HT cables, as applicable.
- i) LT Power cable trefoil clamps (Die cast Aluminium of good quality) are to be arranged by the contractor within the quoted rates.

8.23.2 Entry to the panels, JB may be from top, side or bottom. All cable shall be supported and clamped near the panels/JBs.

8.23.3 Wherever cable glanding is not possible, either due to the gland plate size limitations or more number of cable entries, suitable alternative arrangement as specified by BHEL/end user shall be done. Pre-Fab plug-in cables, for such cases, cables may have to be lifted inside the panel

either making cut-out in gland plate and providing Rubber profile for sharp edge protection or alternatively, provide 4/6" PVC pipe coupling gland and these pipe coupling gland shall be supplied by contractor within the quoted rate of cable laying.

8.23.4 Copper Tinned lugs of various type (pin, ring, fork, snap-on), PVC cable ties, PVC ferrules (printed), PVC buttons and tapes, cable identification tag of metallic, clamping and dressing material with hardware, PVC sleeves etc shall be supplied by the contractor within the quoted rate for cable laying. The quality of material shall be got approved from BHEL engineer prior to their procurement.

8.23.5 All care should be taken to avoid abrasion, tension, twisting, kinking, and stretching of cables during installation.

8.23.6 Cable shielding – all signal cables are supplied with bare shielded copper wire/with braided wire shield, generally shield wire is kept isolated at instrument/field device end and continuity is maintained through JB's and getting earth at panel end only. While terminating the shield wire either in panel or JB's, PVC sleeves is to be used to avoid two-point earthing. Supply of PVC sleeves of appropriate color is in contractor's scope.

8.23.7 Wherever cable ducts/tray, conduits pass through fire barriers such as walls, floors etc., the openings/ passage shall be sealed using fireproof/ weatherproof sealing compound. Similarly, cable entry in panels, MCC, Instruments, Electrical Actuators etc are also required to be sealed. These shall

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be done as per the specifications of BHEL. Required consumable shall be in contractor scope of supply within quoted rate for cabling.

8.23.8 Normally, junction boxes are received with mounted cables glands. While terminating the cables as per drawings, the cable glands to be removed and fixed. Wherever cable glands are not received along with junction boxes, no separate payment will be made for fixing the cable glands to the junction boxes including the drilling of holes.

8.23.9 Many of the cables may have to be laid in the cable trenches constructed by end user. For this purpose, the cover of trenches has to be opened for working inside. All safety precautions have to be observed while laying the cables in the trench. After completing the work, the trench has to be cleaned and covers put back into position. The contractor, if required, shall do de-watering of trenches.

8.23.10 Terminations:

The types of cable terminations are as detailed below:

- a) Power cable: Crimping hydraulic / Manual
- b) Control cable: Manual crimping
- c) Crimped/soldered plug-in-type Screwed type.

All console devices / computer peripherals shall be screwed, crimped, soldered plug in type

UTP cable with RJ 45 connector. The contractor shall arrange for special tools and skilled manpower required for any type of cable termination (like fiber optic jointing kit and RJ45 crimping tool etc) as mentioned above. Additionally ferrule printing machine(s) for printing of sleeved ferrules of various sizes will also be arranged by the Contractor.

8.23.11

Looping wire at terminal block of panels and electrical actuator as shown in the inter-connection diagram is to be done by contractor at no extra cost.

8.24 Wastage allowance

Contractor shall carefully plan the cutting schedule of each cable drum in consultation with BHEL site engineer such that wastages are minimized. Recovery will be made in case the wastages are exceeding the wastage allowances fixed in this contract.

The erection contractor shall make every effort to minimize wastage during erection work. In any case, the wastage shall not exceed the following limits;

Power Cables 1.5%

Control & Instrumentation Cables 2.0%

Fabrication steel 2.0%

Impulse pipe/tubes/GI pipes/copper tube 1.0%

If however, the bidder quotes for more wastage than specified above, the excess portion will be considered for adjustment during the tender evaluation at the quoted supply rate of material. If the actual wastage be more than the specified figure, then equivalent price of the excess portion will be deducted from the contractor's bill. Cable cut-pieces in lengths 10 m & above in both the above categories will be considered

as useable and shall be taken in to account for computing net issued quantity when returned to BHEL stores/storage yard.

8.25 CALIBRATION AND TESTING:

- All local pneumatic/ electrical instruments shall be calibrated, aligned, and set as per the data furnished and priority set by BHEL Engineer. Calibration shall be carried out by the contractor in the presence of BHEL Engineer or staff deputed by BHEL Engineer. The contractor shall fill in the pro-forma for each instrument indicating data, tag. No, service, instrument make, and calibration values etc. Each pro forma shall be signed by BHEL Engineer and customer's representative.
- All panel instruments, service wise, shall be calibrated, aligned and set as per the data furnished by BHEL Engineer in the order of priority. The Contractor shall fill in the pro forma as said above and shall be signed by BHEL Engineer & Customer representative.
- Calibration of all local instruments and instruments mounted on local gauge boards and control panels shall be carried out in position as far as possible and any deviation shall be duly certified by BHEL Engineer.
- All control valves shall be checked/ calibrated for full range operation with required pneumatic/electric signal. Report shall be prepared and countersigned by BHEL Engineer/Customer Engineer.
- All safety valves shall be removed and shall carry it to the instrument room, to be checked with the set value as advised by the BHEL engineer and if necessary contractor shall adjust and set value. Contractor shall fill in pro-forma indicating the service, tag No. set value etc. and BHEL engineer and customer's representative shall sign.
- After setting the safety valve shall be installed in its original position.
- The contractor shall carry hydraulic test for all process impulse lines with 1.5 times the normal operating pressure of the line, isolating the instrument. The test pressure shall be maintained for thirty minutes. If any leak is found in the process impulse line the contractor shall rectify the same. After rectification, hydraulic test shall be carried out once again & BHEL Engineer shall certify each line after successful hydraulic test.
- Contractor shall arrange for necessary standard test equipment/kits required for calibration of instruments. Test equipment / instruments shall be accredited by an authorized agency or the OE

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M & a copy of the certificate, indicating accuracy, validity period of the instrument usability etc., shall be furnished to BHEL engineer for approval.

- All pneumatic impulse lines shall be tested by the contractor for leakages at connections with air/nitrogen at a pressure of 10kg/sq. cm. or at the value advised by BHEL Engineer, isolating instruments and with soap solution for loop checking. If any leakage is found contractor shall rectify the same and repeat the test. The Contractor shall obtain signature of BHEL Engineer for each line after successful testing.
- All pneumatic air headers shall also be tested by the contractor in the same way as mentioned above
- All electrical cables shall be tested for continuity and insulation. Contractor shall earth the equipment and cables where ever required as per BHEL Engineer's advice.

8.26 LOOP CHECKING:

- All pneumatic loops shown in P & I schemes shall be checked / tested for their functioning. The loop shall include primary elements and final elements etc. The loop shall be checked / tested by simulating the process condition by means of variable inputs to the primary elements/transducers. If any of the instrument's calibration is found drifted, the contractor shall re calibrate the instrument and check the loop again.
- The Contractor shall check/test all panel internal Electrical / Pneumatic circuitry with ref to the panel drawings / schemes, and if any deviations noticed, he shall intimate the BHEL Engineer and shall act as per his advice.

8.27 TESTING OF CONTROLS AND PROTECTIONS & RELAY TESTING

- electrical testing/commissioning of generator control and protection relay panels, LT MCC & other electrical panels and associated equipment shall involve various activities like relay testing/setting, simulation checks, testing of energy meters, on/off line functional checks on integrated system. The brief scope of work under the "integrated
- testing/ commissioning of generator controls and protections relay panel & associated equipments" is defined as below, but not limited to the following.
- Relay testing in static condition for generator, and associated system by secondary current injection at different current and recording the time duration.
- Testing and checking of control and protection interlock scheme in static condition and simulation of protection device contact from internal and external devices.

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- Measurement of Insulations, Winding Resistance, Polarization Index of winding of Generator & associated equipment/ system, DC resistance test & Impedance test on rotor, Brushless excitation system at the time of rotor insertion as well as during pre-commissioning stage / commissioning stage/ post commissioning stage.
- Relay setting and checking the stability of protection relays in static and dynamic condition during the OCC (open circuit characteristic) & SCC (short circuit characteristic)
- Functional checks / testing of synchronizing schemes during the static and dynamic by simulation / back charging of generator transformer conditions.
- Monitoring & recording the various parameters during open circuit and short circuit conditions test on generator & associated field equipment like generator transformer, unit auxiliary transformer. Recording and monitoring measurement.
- Testing of protection current transformer for ratio test by primary injection, magnetization characteristic, polarity test, and IR measurement. Functional checks of relays of protection system by primary injection.
- Testing of potential transformer for ratio test by voltage ratio, polarity test, insulation resistance measurement etc, testing of surge capacitors, PT isolator in PTPS cubicle etc. (theses are housed in generator side line & neutral cubicle).
- Measurement of Insulation resistance of individual equipment and connected together.
- Calibration of energy meters, tri-vector meters, voltmeters, ammeters, current & power transducers etc.
- Providing temporary shorting link on bus duct or any other location while testing & normalization after the test.
- High voltage test on inter connecting bus-duct between generator and line/ neutral side cubicle.
- Contractor shall discuss & finalize testing procedure with BHEL engineer in-charge for the test to be conducted on generator control & relay panel testing. Drawing & documents shall be provided by BHEL at the time of testing. BHEL decision in this regard shall be final and binding on the contractor.
- Checking & testing of neutral grounding transformer & resistor.
- Compilation of test records.

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- In case contractor has not done similar work, they are free to tie –up with experienced agency who has carried out similar nature of work and having adequate resources i.e. Experienced manpower, T&P / testing/ measuring instruments. Contractor shall submit documents in support of such tie –up arrangement of such parties along with the offer. Credential of such parties shall be submitted.
- It is to be noted in general that for any testing of protection relays, MCC etc., where the contractor is not sufficiently experienced, they shall arrange for the services of suitable agencies for carrying out the work, within the quoted rates.

Chapter-IX

PRE-COMMISSIONING TESTS, COMMISSIONING, POST COMMISSIONING

9.0 PRE-COMMISSIONING TESTS, COMMISSIONING, POST COMMISSIONING

9.1

Commissioning of the STG equipments with associated Aux. and other Equipments with auxiliaries shall involve the following tests and activities of the equipments erected:

- (a) Trial run of CEP, Vacuum Pumps, Booster Pump, etc and other pumps/equipments like Misc pumps etc and other various rotating machineries / pumps as per tender specification.
- (b) Trial run of motors/ drives for various auxiliaries.
- (c) Hydraulic Test, Chemical Cleaning, Oil flushing of lube oil system, Jacking oil/Lifting oil, HP oil supply system, Governing oil system/Control oil system, LP Bypass system, Air cleaning/Steam blowing of pipelines, closed systems, Tanks and Vessels.
- (d) Flushing of all pipelines by air/oil/water/Chemicals/steam as the case may be.
- (e) Servicing of all valves, Hydraulic Power cylinders, HP Valves (ESV), HP Overload Bypass valves, IP Valves, LP Bypass valves, CRHNRV and fittings.
- (f) Manual/mechanical cleaning of Oil tanks, Suction Strainers / Filter elements of CEP, BFP, Booster Pump, Vacuum Pumps, Misc. Pumps, and other various equipments & tanks /vessels erected by the contractor. This may have to be repeated several times during the commissioning process.
- (g) Chemical cleaning of piping systems, as per requirement. Contractor shall carry out disassembly and reassembly of vulnerable components like spray nozzles, gauges, instruments etc. as instructed by BHEL during this process.
- (h) Putting turbine on barring gear.
- (i) Rolling and synchronization.
- (j) Full load operation.
- (k) Trial operation
- (l) Assistance in PG Test.

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The above activities/tests/trial runs may have to be repeated till satisfactory results are obtained and also to meet the technical and IBR statutory requirements.

Contractor shall arrange and lay temporary pipelines with fittings, gaskets and accessories etc. as instructed by BHEL engineer for the purpose of pre-commissioning and commissioning activities like Hydraulic testing, chemical cleaning, oil flushing, steam blowing etc. of piping and other equipments as part of the scope of work. Required materials as specified above for temporary installations shall be arranged and after the activity completion shall be dismantled by the contractor.

9.2

The contractor shall provide necessary assistance to facilitate/enable electrical and instrumentation testing and commissioning of equipments under this scope of work, to BHEL and their Testing & Commissioning agency.

9.3

The contractor shall carry out any other test as desired by BHEL engineer on erected equipments covered under the scope of this contract during testing, pre-commissioning and commissioning, to demonstrate the completion of any part or parts of work performed by the contractor.

9.4

In case any malfunctioning and / or defect is found during tests / trial runs such as loose components, undue noise or vibrations, strain on connected equipment etc. The contractor shall immediately attend to these defects/ malfunctioning and take necessary corrective measures. If any readjustment and realignments are necessary, the same shall be done as per BHEL engineer's instructions, free of cost.

9.5

Cleaning of oil tank by sand blasting or other methods as per instructions of BHEL engineer before and after oil flushing is responsibility of contractor.

9.6

The contractor shall associate for initial and subsequent fillings of gas in generator gas system as and when required till unit is handed over to Customer.

9.7

The contractor shall carry out leak test of generator air cooling system to the satisfaction of BHEL engineer.

9.8

Replacing/changing mechanical/other seals of equipment, pumps etc. during commissioning stage is within the scope of work.

9.9

During the stages of commissioning, and till Unit is handed over, if any part of TG and auxiliaries need repair/rectification/rework/replacement, the same shall be done expeditiously and promptly by the contractor. Contractor's claim if any, for such repair/rectification/rework/

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replacement etc for reasons not attributable to the contractor will be governed by relevant clauses of 'General Conditions of Contract'. The parts to be replaced shall however, be provided by BHEL free of cost.

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During this period, though BHEL's and customer's engineers will also be associated in the work, the contractor's responsibility will be to make available resources in his scope till such time the commissioned units are taken over by the customer.

9.11

In case any malfunctioning and/or defects are found during tests, trial run such as loose component, undue noise or vibration, strain on connected equipment etc., The contractor shall immediately attend to these defects/ malfunctions and take necessary corrective measures. If any readjustment or realignment is necessary, same shall be done as per BHEL engineer's instruction.

9.12

The pre-commissioning activities will start prior to Lube oil, HP Oil supply System, Governing/Control oil flushing etc. of the TG and various trials, commissioning operations shall continue till the TG is handed over to customer. Simultaneous commissioning checks, activities will be in progress in various areas like trial run of various equipment, checking of equipment erected, making ready for trial runs, filling up of lubricants, chemicals etc. All these works need specialized gangs including electricians, Instrument Technicians, Fitters, in each area to render assistance to BHEL commissioning staff. Contractor shall earmark separate manpower for various commissioning activities. This manpower shall not be disturbed or diverted. The mobilization of these commissioning gangs shall be sufficient so that planned commissioning activities are taken up in time and also completed as per schedule and the work is to be undertaken round the clock if required.

9.13

Contractor shall cut open works if needed as per BHEL engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over, without any extra payment.

9.14

After the start of commercial operation of machine, commissioning activities will continue. It shall be the responsibility of contractor to provide following manpower along with supervisor as part of commissioning assistance for a period of minimum three months and then after if required till satisfactory completion of commissioning activities and handover to customer.

1) Supervisor: 2 Nos.

2) Pipe fitter/Millwright fitter: 2 Nos.

3) Welder: 2 Nos.

4) Rigger: 2 Nos.

5) Electrician/instrument technician 1 No. each

6) Unskilled worker 6 Nos.

9.15

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The above figures shows only minimum required over and above labour required for completing pending erection and commissioning works and clearing of punch lists. Contractor has to provide number of personnel and other resources as per work demand.

9.16

It shall be specifically noted that above employees of the contractor may have to work round the clock along with BHEL commissioning engineers.

9.17

During commissioning, opening of valves, changing of gaskets, checking, realigning of rotating and other equipment, attending to leakages in piping, tanks etc and adjustments of erected equipment may arise. Valves shall be serviced and lubricated to the satisfaction of BHEL engineer during the erection and commissioning as per BHEL engineer's instructions.

9.18

It is the responsibility of the contractor to provide for necessary resources till the completion of work under these specifications, even in case erection, testing and commissioning of the TG and other equipments are delayed due to reasons not attributable to the contractor.

Chapter-X

WELDING, HEAT TREATMENT, RADIOGRAPHY

10.1 WELDING AND HEAT TREATMENT

10.1.1

Removal of welding slag and burrs by hand files, with brushes and/or flexible grinders will be carried out simultaneously.

10.1.2

On all steam, oil, instrument, gas, air (Instrument air/services air) piping, Cooling water Piping, DM water piping etc. both TIG welding and subsequent arc welding or total TIG welding process is to be adopted as instructed by BHEL engineer.

10.1.3

All weld joints on piping shall be ground / filed / dressed on completion of welding and before NDE as per instructions BHEL engineer.

10.1.4

The Contractor shall procure all electrodes and filler wires of approved quality / brand as per the standards and specifications of BHEL and instruction of BHEL Engineer.

10.1.5

Contractor should purchase the electrodes as per the recommendations of BHEL engineer, welding manual, welding schedule and other relevant documents. The electrodes shall be purchased only from BHEL approved manufacturers.

10.1.6

The purchase of electrodes shall be accompanied by proper test certificate and these certificates should be submitted regularly for the scrutiny of BHEL engineer.

10.1.7

All electrodes shall be stored in a clean dry area. The storage room shall be of permanent nature and damp proof, and the room shall be exclusively meant for storage of welding electrodes and filler wires. Excepting for a vent in the top, it is not preferred to have any other opening like windows or ventilators. The temperature inside the room has to be kept in the range of 8-100 c above atmospheric temperature and humidity should be less than 50%. This is to be accomplished by using electric heaters or infrared lamps. The storage room must be provided with hygrometer and thermometer. Temperature and humidity are to be monitored regularly. 15-20 holders, welding cables, connecting cables to equipments and other welding accessories including temporary electrical connection from construction power point to individual equipment like winches, hoisting equipment, welding generators, transformers, heat treatment equipment and other construction equipment shall be arranged by contractor.

10.1.8

All racks and other items used for storage of electrodes shall be of steel and not of wood.

10.1.9

All electrodes soon after purchase shall be offered for inspection to the BHEL engineer. Contractor shall be strictly prohibited from using electrodes not inspected/approved by BHEL engineer.

10.1.10

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All welding consumables shall be issued to the welders only by authorized person who is controlled by contractor's welding engineer. The necessary baking requirements are to be ensured by Contractor's welding engineer.

10.1.11

All welders shall be tested and approved by BHEL engineer/customer before they are actually engaged on work though they may possess the requisite certificate. BHEL reserves the right to reject any welder without assigning any reasons. Statutory requirements like IBR approval for welders are to be complied with before starting of the work. If required, the welders may have to undergo Procedure Qualification test also. The decision of BHEL Engineer will be final in this regard.

10.1.12

All charges for testing of contractor's welders including destructive and non-destructive tests conducted by BHEL at site shall have to be borne by the contractor. However for initial testing of welders the test will be provided by BHEL. However, if deployed welders fails in initial testing due to lack of experience OR frequent testing of new welders, due to non-availability/non-deployment of earlier qualified/tested welders, it shall be the responsibility of Contractor to provide necessary test plates at his cost for above testing.

10.1.13

BHEL engineer is entitled to stop any welder from his work if his work is unsatisfactory for any technical reason or if there is a high percentage of rejection of joints welded by him, which, in the opinion of BHEL engineers, will adversely affect the quality of welding though the welder has earlier passed the tests prescribed. The fact that the welders have passed the test does not relieve the contractor from his contractual obligations to check the performance of the welders. Contractor shall submit a monthly performance record of all welders.

10.1.14

All welded joints shall be subject to acceptance by BHEL engineer whose decision will be final and binding.

Pre-heating and stress relieving before and after welding are part of erection work and shall be performed by the contractor in accordance with instructions of BHEL engineer. Contractor has to arrange for the recorders along with accessories and suitable technicians for heat treatment purpose. The temperature recorders and thermocouples shall be duly calibrated. During preheat and stress relieving operations the temperature shall be measured as per the instructions of BHEL engineers by thermocouples and recorded graphs for the heat treatment works carried out shall be the property of BHEL.

10.1.16

For the purpose of stress relieving, thermocouples have to be attached to the weld joint. The number of temperature measuring points and locations are as per the standards of BHEL. Thermocouples have to be attached using battery operated portable thermocouple attachment unit and not by manual arc welding. Contractor shall arrange sufficient number of thermocouple attachment units.

10.1.17

Wherever necessary, contractor should provide temperature indicator/temperature recorder as required by BHEL engineer for measuring preheat temperature for welding or for controlling temperature of metal for hot correction etc. Decision of BHEL engineer on method and of checking preheat temperature or controlling temperature for hot correction and welding shall be final and binding on contractor.

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10.1.18

Heat treatment may be required to be carried out at any time (day or night) to ensure the continuity of the process. The contractor shall make all necessary arrangements including labour required for the same as per directions of BHEL.

10.1.19

Heat treatment requirements shall be as per the Welding Schedules of BHEL

10.1.20

For weld joints of heavy structural items like beams, I-sections, if heat treatment is required, the same shall be carried out as part of the work.

10.1.21

Checking effectiveness of stress relieving by hardness tests (either by Poldi Hardness Tester or other approved test methods as per BHEL engineer's instruction) including necessary testing equipments is within the scope of the work/specification.

10.1.22

TIG welding process is to be used for all root pass welds in pipes. Subsequent welding after root pass can be carried out by manual metal arc welding with basic coated electrodes. For the pipe of thickness less than 6mm, the entire welding has to be carried out by TIG welding. However, BHEL site engineer will have the option of changing the method adopted. For manual arc welding shall be done as per weaving technique and the width of weaving shall not exceed 1.5 times of the dia of the electrodes. Two pieces to be joined shall be individually checked for the weld edge preparation and profile dimensions and with respect to the template. Dye penetrant check shall be carried out on edge prepared surfaces at random. The percentage shall depend on piping system as specified by BHEL engineer.

10.1.24

Joint fit up will be a stage for inspection.

10.1.25

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

10.2 RADIOGRAPHY

10.2.1

Radiographic inspection of welds shall be arranged by the contractor including all consumables like isotope camera, x-ray film, chemicals etc. Scaffolding and approaches for taking radiographs.

The contractor shall provide the necessary skilled technician and labours for taking the radiographs. While taking radiographs, the contractor has to use proper penetrometer/ image quality indicators as instructed by the BHEL engineer. All the processed and accepted films will be the property of BHEL. In this regard, the contractor has to adhere to the safety rules/regulations laid by BARC authorities from time to time. It may please be noted that invariably the radiographic work will be carried after the normal working hours.

10.2.2

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Contractor shall note that 100% radiography shall be taken on all high pressure welding till such time the welders' performance is found to be satisfactory. Subsequently, subject to consistency in welder's performance, the percentage of radiography will be based on BHEL's standard practice/code requirement. The defects shall be rectified immediately and to the satisfaction of BHEL engineer. The decision of BHEL engineer regarding acceptance/rejection of the joints will be final and binding on the contractor.

10.2.3

Wherever radiographs are not accepted, on account of bad shot, joints shall be re-radiographed and re-shots submitted for evaluation. Radiographs shall be taken on joints after carrying out repairs. However, if defect persists after first repair, as per radiograph, carrying out repairs and radiography shall be repeated till joint is made acceptable in case, the joint is not repairable, the same shall have to be cut and repaired at contractor's cost. Decision of BHEL engineer in all these matters is final and binding on the contractor.

10.2.4

100% radiography of weld joints of certain piping has to be carried out as per BHEL standards/drawings/specification.

It may also become necessary to adopt inter-layer radiography/MPT/UT depending upon the site/technical requirement necessitating interruptions in continuity of the work and making necessary arrangements for carrying out the above work. Necessary trained personnel shall be deployed for this purpose

Chapter-XI

ACID CLEANING/ALKALI FLUSHING/STEAM BLOWING/OIL FLUSHING

11.0 ACID CLEANING/ ALKALI FLUSHING/ STEAM BLOWING/ OIL FLUSHING ETC

11.1

Contractor shall lay and erect temporary pipelines with fittings and accessories and also erect/commission the chemical cleaning/ circulating pumps after servicing as per requirements, tanks and other installations, as a system as instructed by BHEL for the purpose of chemical cleaning, steam blowing, steam washing, steam flushing, water flushing, water washing, oil flushing of piping and shall provide all other arrangements as per requirement as part of scope of work.

It shall be specifically noted by the contractor that all pipes for above works shall be supplied in random length and in loose condition. Contractor has to assemble and erect them as per schemes / drawings provided by BHEL. Further, flanges bend etc for completing the scheme shall be machined/ fabricated by the contractor at his own cost. However, plates/ steel etc for the same will be provided by BHEL free of charges. Gaskets and blinds if required for Flushing / Steam blowing shall be in contractor scope.

11.2

After the chemical cleaning/ flushing have been successfully completed, dismantling of all temporary installations as instructed by BHEL is within the scope of work under this specification. The dismantled materials shall be dressed and returned to BHEL as stated elsewhere in this tender spec.

11.3

Preservation of the cleaned surfaces will be the responsibility of contractor under the guidance of BHEL engineer.

11.4

Hydraulic test of temporary piping is to be carried out as per the instructions of BHEL Engineer. Carrying out repairs, if any, is in the scope of work/specification.

11.5

For chemical cleaning of the piping system, contractor will have to lay temporary piping to connect the entire system irrespective of whether the equipment/system connected is in the scope of contractor or not. Decision of BHEL Engineer in this regard will be final and binding on the contractor.

11.6

During the initial stages of work, trenches for draining water may not be available after alkali flushing or mass flushing for discharging and emptying. Necessary low point drains and temporary piping for this will have to be provided by contractor from materials provided by BHEL.

11.7

Technical Conditions of Contract (TCC) for Electromechanical Works

Laying effluent discharge line from mixing tank (for acid cleaning or any other chemical cleaning process) as per the instructions of BHEL engineer and dismantling, servicing for preservation and handing over the same to BHEL stores after completion of the job is within the scope of work/specification.

11.8

Radiographic examination of weld joints on temporary pipes as required by the Engineer In-charge should be carried out.

11.9

Contractor shall also carry out the repairs or attend leaks etc., in the temporary piping and equipments for the above operations / activities while carrying out the above activities / operations.

11.10

For chemical cleaning of system which consist of equipment/piping erected by the contractor and also equipment/piping erected by other contractors of BHEL/customer's contractor has to arrange for workers and supervisory staff as required supplementing/complimenting the labour and supervisory staff mobilized by other agencies for chemical cleaning of the portion of equipment erected by them in the system. Decision on the strength of gangs and supervisory staff for deployment of labour and allocation of work for them at site by BHEL engineer is final and binding on the contractor.

11.11

Contractors quoted rate shall be inclusive of fabrication, cost of consumables, erection, dismantling of temporary piping and servicing of the equipments and valves and handing over to BHEL. No separate payment on this account shall be entertained.

11.12

After acid cleaning/pickling of lubricating system (including oil piping of lube oil system, HP Oil supply system, oil tank and other fittings) of rotating machines, oil flushing for lubricating systems, LP Bypass systems etc as per instructions of BHEL Engineer shall be carried out. Cleaning of oil tank of lubricating oil system of rotating machineries, cooler etc before and after oil flushing is the responsibility of the contractor.

11.13

For full welding of structures, tanks and piping etc, only welding generators shall be used. The use of welding transformers will be subject to the approval of BHEL Engineer.

11.14

Technical Conditions of Contract (TCC) for Electromechanical Works

Erection and commissioning of connecting piping – permanent and temporary for oil purification equipments and all operations for cleaning, oil flushing, dismantling of temporary piping during

pre and post-commissioning of equipment up to full load shall be the responsibility of contractor as part of scope of work

Chapter-XII

TOOLS AND TACKLES, MEASURING AND MONITORING DEVICES

12.0 TOOLS AND TACKLES, MEASURING AND MONITORING DEVICES

12.1

The contractor shall provide all (except those indicated in BHEL scope) required tools and plants, monitoring and measuring devices (MMD) and handling & transportation equipments for the scope of work covered under these specifications. Contractor has to provide suitable cranes for material handling at BHEL/client's stores/storage yard. BHEL's crane will not be available for this purpose.

12.2

All tools and tackles to be deployed by the contractor for the work shall have the prior approval of BHEL engineer with regard to brand, quality and specification. Indicative list of major T&P to be arranged by contractor has been furnished in relevant appendix. Contractor shall also mobilize all other T&P necessary for timely and satisfactory completion of the work in scope.

12.4

Contractor shall provide all required suitable cranes and trailers for materials handling during collection from BHEL/ client's stores/ storage yard, transportation to site of work and at worksite for all equipments and consignments including heavy and voluminous equipments/components/ consignments like HP turbine module, LP turbine inner-outer casing, LP turbine inner casing, LP rotor, generator rotor, brushless exciter, HP heaters, etc. BHEL/customer shall not provide any T&P other than mentioned in relevant appendix for the purpose identified. The contractor shall make suitable arrangements/arrange crane well in advance for lifting and placement to final position of sections at required elevation/ location with utmost care.

12.5

Contractor shall provide the complete operating crew like operator, helpers for handling trailing cable for EOT. It may be specifically noted that the EOT crane shall be shared by many other agencies working within the TG hall. The contractor shall have to extend the services of the EOT crane operation to all such other agencies as instructed by BHEL.

12.6

Contractor has to provide spanners of all sizes for carrying out the complete erection / commissioning works. No spanners will be provided by BHEL to the contractor.

12.7

Technical Conditions of Contract (TCC) for Electromechanical Works

Contractor has to arrange slings of all sizes for completing the works covered under these specifications except the special slings for generator stator lifting/handling, which will be provided by BHEL free of charges on returnable basis.

12.8

All tools and tackles to be deployed by the contractor for the work shall have the prior approval of BHEL engineer with regard to brand, quality and specification.

12.9

Timely deployment of adequate quantity of T&P is the responsibility of the contractor. The contractor shall be prepared to augment the T&P at short notice to match the planned program and to achieve the milestones.

12.10

Complete set of hydraulic jacks of 50 tonnes and 100 tonnes capacity shall be arranged by the contractor for use during erection and commissioning of turbine. Also, the contractor shall arrange hydraulic jacks of 100 tonnes and 63 tonnes capacity along with long high pressure hoses of suitable length for generator erection and alignment. These jacks shall be of internationally reputed make, highly reliable and maintained in excellent working condition. They shall be tested for safe working before deploying in actual work. These jacks shall not be permitted for use anywhere other than steam turbine/ generator area.

12.11

All jack bolts that are required during erection for carrying out roll-check etc will have to be arranged by the contractor. No jack bolts will be provided by BHEL.

12.12

Contractor shall maintain and operate his tools and plants in such a way that major breakdowns are avoided. In the event of major breakdown, contractor shall make alternative arrangements expeditiously so that the progress of work is not hampered.

12.13

In the event of contractor failing to arrange the required tools, plants, machinery, equipment, material or non-availability of the same owing to breakdown, BHEL will make the alternative arrangement at the risk and cost of the contractor.

12.14

The T&P to be arranged by the contractor shall be in proper working condition and their operation shall not lead to unsafe condition. Contractor shall obtain prior approval of BHEL for

all the T&P before deploying in actual work. The movement of cranes and other equipment should be such that no damage / breakage occur to foundations, other equipments, material, property and men. All arrangements for the movement of the T&P etc shall be the contractor's responsibility.

12.15

Technical Conditions of Contract (TCC) for Electromechanical Works

Normally, use of welding generators only is permitted for welding. The use of welding transformers will be subject to prior approval of BHEL.

12.16

The contractor at his cost shall carry out periodical testing of his construction equipments and calibration of measuring & monitoring devices (MMD). Test / calibration certificates shall be furnished to BHEL. MMD shall be calibrated only at accredited laboratory as per the list available with BHEL or any other laboratory approved by BHEL. All calibration shall be traceable to national or international standards

Chapter-XIII PRESERVATIVE PAINTING

13 WELD FIT-UP AND WELD JOINT PROTECTIVE PAINT, COMPONENT PRESERVATIVE PAINTING ETC.

- 13.1) All protective paints for the protection of weld joint fit-ups, application of primers on finished weld joints are in the scope of contractor.
- 13.12) Two coats of steam washable paints shall be applied on steam side of LP turbine and condenser components, as advised by BHEL. The steam washable paints, primer and thinner will be provided by contractor as part of scope of work along with other like arrangements for surface preparation and paint application like sand/shot-blasting, consumables like surface cleaning agents, paint brush, brush cleanser, labour and necessary tools and plants as required for completion of work.
- 13.3) The water boxes shall be sandblasted to remove all traces of primer applied at the works. Thereafter apply two coats of primer paint followed by two/three coats of alloyed resin machinery enamel paints as approved by BHEL. Contractor shall submit manufacturer's batch test certificate / test certificate from BHEL approved laboratory for the primers and paints. Prior approval of BHEL for each and every batch of the primer & paints shall be mandatory. In order to achieve a desired minimum paint dry film thickness (DFT) as specified in BHEL drawing, number of coats may be applied and method of application shall be as recommended by the paint manufacturer. Required paints & primers and other consumables shall be arranged by contractor.
- 13.4) All site weld joints falling in steam side shall be painted with two coats of steam washable paint.
- 13.5) All water side surfaces of water chambers including tube plate shall be thoroughly surface prepared and painted. Required primer & paints and other consumables for condenser water box and tube plates shall be provided by Contractor.
- 13.6) After the successful completion of hydraulic testing, the interior surfaces of the water boxes, main tube plates shall be painted with suitable anticorrosive paints as per special procedures laid down by BHEL. Required necessary paints along with primers and other consumables shall be arranged by Contractor.
- 13.17) Prior to hydraulic testing of water side of condenser, interior surfaces of water boxes shall be painted.
- 13.8) After completion of tubing and tube side hydro test, all water side surfaces of water chambers including tube plate shall be painted.
- 13.9) Preservation of all components/equipments during various stages of erection, commissioning till handing over is in the contractor's scope. All prescribed methods of surface cleaning prior to application of preservative paint shall be followed by the contractor. **Contractor has to**

arrange all primer and paints, and other consumables like wire brush, painting brush required for this work.

- 13.10) Condenser internal components/parts/surfaces have to be surface protected with steam washable paint as per BHEL standards.

Chapter-XIV

LINING AND INSULATION

14 LINING AND INSULATION

14.1

Application of thermal insulation/ spray insulation, finishing, cladding and outer casing etc of the following:

1. TG integral piping and tanks & vessels
2. Other equipments not listed above but required for completion
3. ST-TG auxiliaries including, but not limited, to heat exchangers, pumps, tanks and vessels and other equipments
4. condensate and extraction system piping

14.2

The work shall conform to dimension and tolerances specified in the various drawing and documents that will be provided during the execution. If any portion of the work is found to be defective in workmanship or not conforming to drawings or other specifications, the contractor shall dismantle and re-do the work duly replacing the defective materials at his cost. Failing which the work will be got done by engaging other agencies or departmentally and recoveries will be deducted from contractor's bills towards expenditure incurred including 30% departmental charges.

14.3

The terminal points as decided by BHEL shall be final and binding on the contractor.

14.4

All insulation and refractory materials including iron components and outer sheet casing materials, cladding sheets etc required will be supplied by BHEL and the same have to be erected/ applied as per the drawings and specifications of BHEL by the contractor.

14.5

The contractor shall provide the required quantity of wire, nails, and planks for formwork and other materials for shuttering and curing works.

14.6

Contractor shall observe all precaution for laying, curing etc of pourable insulation. The contractor at his own cost shall redo any defective works found.

14.7

Wool insulation is received at site as loose bonded mattresses in standard sizes. These are to be dressed/cut to suite the equipments. Multiple layers of wool have to be applied as directed and as per drawings and specifications for all equipments/ systems covered under the scope of work.

Technical Conditions of Contract (TCC) for Electromechanical Works

- 14.8 Cutting & dressing of insulation bricks to suit the site area of application is incidental to work.
- 14.9 Removable type of insulation has to be provided for valves fittings, expansion joints etc as per drawing or as directed by BHEL engineer.
- 14.10 The cladding and outer casing are aluminums sheets. All relevant specifications and procedures with regards to beading, sealing etc. for aluminum sheets have to be adhered to.
- 14.11 Cladding/outer casing shall be fixed expeditiously, so as to avoid damage to the insulation from the weather.
- 14.12 The overlapping surface of outer casing/cladding sheet shall be coated with sealing compound, which will be supplied by BHEL free of cost.
- 14.13 To take care of bimetal corrosion due to variety of metals in contact of each other viz retainer to support, support to outer casing/cladding, cladding-to-cladding etc, suitable paints specified by BHEL, to be applied and/or neoprene rubber packing/strips or any other insert may have to be fixed as required.
- 14.14 The contractor shall leave certain gaps and openings while doing the work as per the instructions of BHEL engineer to facilitate inspection or during commissioning to fix gauges, fittings, instruments etc. These gaps will have to be finished as per drawings at later date by the contractor at his cost.
- Contractor shall cut open works in needed as per BHEL engineer's instructions during commissioning for inspection, checking and make good the works after inspection is over without any extra payment.
- 14.15 A log book shall be maintained by the contractor for the clearance of the area for application of refractory and insulation where the contractor does the work on his own accord without prior permission. The work should be re-done, at his own cost, where necessitated.
- 14.16 Wastage allowances for the material issued are envisaged as follows:

Technical Conditions of Contract (TCC) for Electromechanical Works

A	Pourable & castable insulation	-	2%
B	Insulation bricks and mortar	-	2%
C	Wool mattresses	-	2%
D	Cladding sheets	-	2%

The wastage allowance will be applicable on the net issued quantity i.e. Total quantity issued reduced by the quantity returned to stores as unused/fresh item. Contractor shall reconcile the material issues periodically as prescribed by BHEL site. Payment for the done will be regulated as per relevant section

14.17

The following works are also included in the scope of this contract:

- Cutting of cladding sheets as per the profile of the equipment and painting on inner surface two coats of bituminous paint. Paint shall be arranged by contractor.
- Cutting of the wool mattresses to the required shape and application of finishing cement of required thickness wherever required.

14.18

Insulation work of temporary piping for alkali boil out, steam blowing and chemical cleaning has to be carried out at site. The same have to be removed and returned to the BHEL stores after the completion of activity. Rates quoted for application of wool for boiler and auxiliaries will be applicable for this work also. No separate payment will be made for removal of temporary insulation and return of the same to BHEL stores/yard.

14.19

In certain instances, co-ordinated/ phased application of castable refractory/ insulation on pressure parts etc may be necessitated in consideration of sequence of activities of other erection agencies. Contractor shall do such phased work as may be directed by BHEL.

14.20

Prior to application of refractory bituminous painting on the pressure parts and other area is under contractor scope. The bituminous paint shall be arranged by contractor. No separate payment will be made for application of paint.

Chapter-XV

FINAL PAINTING

15.1 All exposed metal parts of the equipment (In case received in not painted condition) including piping, structures, railings etc. wherever applicable, after installation unless otherwise surface protected, shall be first painted with at least one coat of suitable primer which matches the shop primer paint used, after thoroughly cleaning all such parts of all dirt, rust, scales, greases, oils and other foreign materials by wire brushing, scraping or sand blasting, and the same being inspected and approved by BHEL engineer for painting. Afterwards, the above parts shall be finished with two coats of alloyed resin machinery enamel paints.

15.2 Touch-up painting on damaged areas –

a) For coatings damaged up to metal surface

Surface preparation shall be carried out by manual cleaning. Minimum 6 inches adjoining area with existing coating shall be roughened by wire brushing, emery paper rubbing etc., for best adhesion of patch primer. Primer coat of touch-up primer has to be applied by brush immediately after the surface preparation.

Over this primer coat, finish coat and final finish coat shall be applied as covered above by brush within maximum seven (7) days of application of touch up primer.

Painting scheme is enclosed for information at relevant annexure. However, for execution only the latest document shall be applicable and no claim whatsoever shall be entertained in case of any variance between such documents. Similarly, documents as provided progressively during the execution of work for all other products/ equipment etc. shall be applicable.

15.3

Painting of welded areas / painting of areas exposed after removal of temporary supports / touch-up painting on damaged areas of employer's structures, where inter-connection, welding / modification etc. has been carried out by the bidder.

(a.) Clean the surface to remove flux spatters and loose rust, loose coatings in the adjoining areas of weld seams by wire brush and emery paper.

(b.) Painting procedure to be followed as mentioned above for touch-up painting on damaged areas.

15.4

The scope of work includes painting of color bands, lettering, marking and signs for direction of flow/rotation, names etc of approved colours as per the standard colour codes and specifications specified in tender specification or as advised by BHEL/customer engineer at site for the equipment/ components covered in these specifications.

15.5

All exposed metal parts of the equipment including piping, structures, hand railing, grating etc. shall be thoroughly cleaned off dust, rust, scales and other foreign materials by manual or mechanized wire brushing, scrapping, sand blasting etc. and the same being inspected and approved by BHEL/customer engineer before application of primer. Afterwards, the above parts shall be finish painted with specified number of coats as per specification.

15.6

In certain isolated instances where it is not possible to clean the equipment as explained above, cleaning by grinding might have to be resorted to. No damage to the equipment/components should be caused.

15.7

Surface to be painted should be free of oil and grease. It should be removed by using suitable cleaning agents including permitted solvents. Surface cleaned by chemical agent, if required, shall be treated further as prescribed in use of such cleaning agents. The contractor at his own cost shall provide all the consumables and application implements.

15.8

During the preparation of surface, if the shop coat is damage by chemical cleaning or by mechanical means, contractor shall repair the same free of cost to BHEL.

15.9

Specified drying time shall be permitted from one to another coat.

15.10

This work requires working at higher altitudes. The work spread is also substantial involving substantial run of structures and piping.

Contractor shall take sufficient precautions to avoid any accident and hazard in all respects. The ropes, ladders, scaffolding materials, clamps etc. and climber used should be of standard quality for safe and smooth execution of work.

15.11

Contractor shall carry out the work in such a way that other erected equipment, structure, civil foundations and other property are not damaged. For damages in any of such cases due to lapses by contractor, BHEL shall have the right to recover the cost of such damages from the contractor.

15.12

Contractor shall take due care to cover/protect the equipment which are already painted while carrying out the painting of other adjacent equipment. If so happens, it shall be cleaned and repainted by the contractor without any extra charges.

15.13

In general, painting of structural parts and colour bands, lettering, marking of direction of flow/rotation etc will be carried out by brush painting. However, areas/equipment inaccessible for manual painting has to be painted by spray painting. The decision of BHEL engineer, in this regard, shall be final and binding on the contractor. For the purpose of spray painting, air at one point will be made available by BHEL free. Laying of air hose pipe and any other line required shall be done by contractor at his cost. The contractor shall provide spray equipment set.

15.14

The contractor shall provide all the necessary scaffolding materials, temporary structures and necessary safety devices etc., during execution of the work.

15.15

Final painting work shall be started after obtaining clearance from BHEL engineers and as per his instructions.

Chapter-XVI

PERFORMANCE GUARANTEES/ PERFORMANCE TESTS/ DEMONSTRATION TESTS

16.0 General Requirements

16.1. Performance requirements and ratings stipulated for the various equipment covered in these specifications.

16.2. The successful Bidder (Contractor) shall make the plant ready for the performance guarantee test and assist to conduct the same at site in the presence of Owner / Consultant. Such tests shall be commenced, within a period of three (3) months after the successful completion of Trial Operation. Any extension of time beyond the above three (3) months shall be mutually agreed upon between Owner/BHEL

16.3. The performance test shall be carried out as per the procedure mutually agreed upon between the Owner/Consultant/BHEL . The procedures for test shall be in line with the latest international codes / standards including correction curves and also meeting the specification requirement. The procedure shall be discussed, mutually agreed and finalized / approved by the Owner before commencement of PG test & demonstration tests.

16.4. Detailed test procedure shall broadly cover and include objective of the test, various guaranteed parameters & values agreed between JSW & BHEL as per contract, method of preparation & conductance of tests, instrument list, scheme(s) showing measuring points, duration of tests, frequency of readings, method of calculation including correction curves & calculations, sample calculation, acceptance criteria, etc.

16.5. Bid price quoted by the Bidder shall include all costs associated with the tests including the cost towards supply, calibration, installation and removal of the test instrumentation. Any special equipment, tools & tackles, matching flanges, impulse piping & valves, etc. required for successful completion of the tests shall be provided the Successful Bidder (Contractor) and the cost towards it shall be included in the Bid price quoted by the Bidder.

16.6. Tools & Tackles, thermo wells (screwed as well as welded), instruments / devices including flow devices, matching flanges, impulse piping & valves, etc. and any special equipment required for successful completion of the tests shall be provided by the Bidder free of cost.

16.7. Successful Bidder (Contractor) shall use only calibrated instruments for the performance guarantee test. It shall be ensured by the Bidder that the type, rating & accuracy of the instruments, their numbers & locations, protecting tubes, pressure connections and other test connections required to be used for carrying out performance guarantee / acceptance / demonstration tests meet the stipulations in the relevant codes. The Bidder shall get these instruments calibrated in an independent test lab / institute approved by the Owner. All calibration procedures and standards shall be subjected to the approval of the Owner. All test instrumentation

required for performance tests shall be supplied by the Bidder and the same upon satisfactory completion of performance guarantee test at site, shall be retained by the successful Bidder (Contractor).

16.8. Test Reports

16.8.1. Performance Guarantee Tests on the equipment's / systems not covered in this chapter shall be carried out as per the procedure / test code specified in respective detailed specifications.

16.8.2 Acceptance of Guarantee Test Results AND Category wise Guarantees

If equipment / system fails to meet the guarantees during the performance guarantee test, Bidder shall support for all possible modifications and / or replacements without any extra cost to the BHEL under the guidance of BHEL representative so that the equipment / system complies with the guaranteed requirements. After such modifications and / or replacements, the Bidder shall coordinate to conduct the Performance Guarantee Test(s) once again with JSW/BHEL consent within one month from the date the equipment is ready for retest.

Bidder shall support BHEL till the guaranteed parameter is achieved satisfactorily during the PG test of individual equipment /system without any extra cost to BHEL.

Chapter-XVII (Material Handling services)

2.0 SCOPE OF WORK

1.0 Material Handling services: The scope of work in general are receipt of project material, unloading, storing, preservation, issuing of material with proper documentation and providing & maintaining the site office set up materials at JSW Dolvi as on and when required basis for the period of Eighteen months.

Identification of equipment at storage yard, technical assistance for checking and making the shortage/damage reports, taking delivery at storage yard and direct unloading at execution/Assembly site of work under the scope of this tender specification along with the supply of all consumables (slippers, wooden planks, supports, Tarpaulins) tools & tackles (Hydra/Crane, Slings etc.) and all type of manpower (Hydra operator, supervisor. Store keeper, Rigger, helper etc) required for Material handling.

- 1) It is not the intent to specify herein all details of material. Any item related to this work not covered, but necessary to complete the system will be deemed to have been included in the scope of the work.
- 2) Site testing wherever required shall be carried out for all standard T& P's
- 3) The contractor shall take full responsibility for satisfactory handling of Material & reconciliation under overall guidance of BHEL and shall locate any cause of malfunction and rectify the same for proper operation.
- 4) The work shall be executed under the usual conditions without affecting project work and in conjunction with other operations and contracting agencies at site. The contractor and his personnel shall cooperate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.
- 5) All the work shall be carried out as per instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the contractor.
- 6) All necessary certificates and licenses required to carry out this work are to be arranged by the contractor expeditiously at his cost.
- 7) The contractor shall note that whenever required items/materials shall be unloaded at erection site / assembly yard by the prescribed route without disturbing and causing damage to other works in the most professional manner. All items, Hardware, etc., shall be stored in appropriate manner as per instructions of BHEL engineer.
- 8) Contractor shall remove all scrap materials periodically generated from his working area in and collect the same at one place earmarked for the same. Load of scraps is to be shifted to a place earmarked by

Technical Conditions of Contract (TCC) for Electromechanical Works

BHEL. Failure to collect the scrap is likely to lead to accidents and as such BHEL reserves the right to collect and remove the scrap at contractor's risk and cost if there is any failure on the part of contractor in this respect.

- 9) The contractor shall ensure that his premises are always kept clean and tidy to the extent possible. Any untidiness noted on the part of the contractor shall be brought to the attention of the contractor's site representative who shall take immediate action to clean the surroundings to the satisfaction of the Engineer-in-Charge
- 10) The Contractor may have to execute work in such a place and condition where other agencies also will be under such circumstances.
- 11) If any item or equipment not covered but requires to be unloaded, same shall be carried out by the contractor. Unit rate shall be considered for payment purpose. The unit rates quoted by the contractor shall be uniform for all the items.
- 12) Scope of work covered under this specification requires quality workmanship & Material Management. The contractor shall ensure timely completion of work. The contractor shall have adequate tools, Consumables & etc in his possession. He shall also have adequate trained, qualified and experienced engineers, supervisory staff and skilled personnel.
- 13) The manpower deployed by contractor shall match with above scope of works
- 14) Contractor shall deploy adequate Manpower for Material Management to meet scope of works and Minimum manpower & T&P's shall be available at site on continuous basis to meet the daily site requirements.
- 15) The scope of various material to be handled, indicated in this contract is indicative only. Bidder shall unload all the material pertaining to this Project and site establishment materials as specified in chapter- VI
- 16) Maintenance: During hiring period, maintenance & cleaning of the Porta cabin and accessories shall be in the scope of bidder.
- 17) Exclusive person along with Laptop / Desktop PC shall be deployed for documenting the material receipt and issuing.
- 18) Wooden slippers other materials required for preservation of the equipment at the stores and at the site are in the scope of the contractor.

.2.0 List of minimum major Tools & Plants to be deployed by the contractor:

- a) All T&Ps & Consumables are to be arranged by the contractor at his cost.

T&P and Consumables

Technical Conditions of Contract (TCC) for Electromechanical Works

SI No	Description	Qty	Capacity
01	Farana Crane with Operator& Rigger	1 no per site	14MT/ As required
02	Diesel	As required	As required
03	Fork Lift-1 No with operator	As required	As required
03	Wire rope slings	4 sets minimum	2- 25MT Verities
04	Webbing Slings	4 Sets minimum	2-15MT Verities
05	Chain block pulley	2 sets minimum	Capacity - 3T/As required
06	D-Shackles	4 sets minimum	3-5MT Verities
07	CRANE/FARANA with operator & helper	01 NO	40/50MT

Note: Contractor shall bring all the T&Ps required to handle the material as mentioned in chapter XVII.

Chapter-XVIII

Execution/Mobilization of special resources of manpower deployment for BHEL's Support

SL. NO	Item Description	Unit	Quantity	percentage weightage rate deduction in case of non deployment
1.0	Deployment of Requisite Manpower as mentioned below at site, within 15 days, as and when intimated by BHEL. This deployment shall be over and above the requirement as per Contractual clause. The deployed manpower shall report to BHEL (considering 26 working days in a month, with 8-hour regular duty and 4-hours overtime as per work exigencies, no separate overtime will be paid). BHEL may utilize this manpower in any area of work with in plant premises as per requirement. All statutory compliances, gate passes, food and accommodation of these manpower shall be arranged by contractor. Note: - a) In case the contractor does not deploy or delays deployment of above said manpower with reference to specific instructions from BHEL, BHEL will levy penalty of Rs. 100 per service day, for such delay. b) In case, the contractor fails to provide supervisors / Engineers as decided by BHEL for a continuous period of fifteen days or more, BHEL shall have the right to depute it on behalf of contractor, all statutory compliances, gate passes, food and accommodation of these manpower shall be arranged by contractor. In such case cost (if any) incurred by BHEL, the same shall be recovered from contractor's bill along with overhead of 5%. c) Execution/Mobilisation of special resources (PVC & ORC shall Not be applicable on above deployment).			

Technical Conditions of Contract (TCC) for Electromechanical Works

1.1	Engineer / Supervisor (Minimum Qualification Engineering (3-years' experience)/Diploma (7-years' experience) CV shall be approved by BHEL). Deployment shall be required during Pre-commissioning and commissioning work of STG.	Manmonth	15	1.457 % of total contract value per month
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Technical Conditions of Contract (TCC) for Electromechanical Works

3.0 Tentative Technical Staff Requirement to be stationed at site by the contractor:

2.1	• Project Manager posted – 01 Head with 12 Years’ relevant experience in Industrial Building & Power Plant (STG & its auxiliaries) Works etc. • Asst. Project Managers– 01 Heads with 7 Years’ relevant experience in Industrial Building & Power Plant (STG & its auxiliaries) Works etc. • Experienced Engineers: ○ Mechanical engineer – 02 nos. ○ Electrical engineer – 01 nos. ○ C&I engineer- 01 nos. • Experienced Foreman / Supervisors – 03 heads • Planning & Billing Engineers – 01 head • Stores, Gate Pass – 01 head • Accounts & Administration – 01 head • Human Recourse officers – 01 head • Quality Control Engineer – ○ Sr. Quality Control Engineer– 01 Head with minimum 5 Years’ relevant experience in quality control of STG & its auxiliaries. ○ Quality Control Engineer (QA/QC documentation) – 01 heads with minimum 03 years’ relevant experience in QA/QC of STG & its auxiliaries. • Safety Engineer – As per HSE Plan • Operator, Licensed Electrician, Mechanic - As per requirement • Experienced Helpers – lot for similar nature of work • Security Guards (Round the Clock) – As per requirement. Note: Above manpower requirement is tentative only. Contractor shall augment manpower to meet the project schedule/ milestones. Deployment of manpower shall be progressive to meet the project schedule.
2.2	Deputation of above man-power shall be jointly decided at site in line with construction Schedule.

Technical Conditions of Contract (TCC) for Electromechanical Works

2.3	Engineer/ supervisor for other functions like store & purchase, material management, planning, finance, administration etc. are to be provided as per site requirement and not considered in above list.
2.4	BHEL reserves the right to reject or approve the list of personnel proposed by the contractor. The persons whose bio-data have been approved by BHEL will have to be posted at site and deviation in this regard will not be permitted unless specific & reasonable justification is made.
2.5	In addition to above, a well experienced qualified engineer to be designated, as 'Project Co-coordinator', shall be deployed by the contractor. Such engineer shall have adequate exposure on the job and shall remain fully involved in all planning activities, guidance etc. to contractor's own team during the complete execution period of contract.
2.6	These manpower's shall be contractor's manpower to be deployed over and above deployment as per clause no.1 under heading "Execution/Mobilisation of special resources manpower deployment for BHEL's support".