

MAHARASHTRA STATE POWER GENERATION CO. LTD.

1X660MW BHUSAWAL TPS-UNIT: 6

VOLUME – II B

**TECHNICAL SPECIFICATION
FOR
OZONE GENERATION PLANT**

SPECIFICATION NO. PE-TS-415-174-A001, R0



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA**

80363/2020/PS-DEM-MAX

	TITLE : 1X660 MW BHUSAWAL TPS, UNIT # 6	SPECIFICATION NO. PE-TS-415-174-A001	
		SECTION :	
	TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT		
		REV. NO. 00	15/09/2020 (Typical)

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TECHNICAL SPECIFICATION FOR OZONE
GENERATION PLANT

SPECIFICATION NO. PE-TS-415-174-A001

SECTION :

SUB-SECTION:

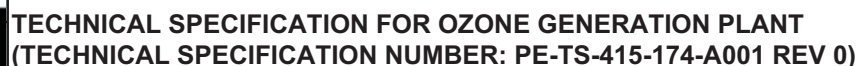
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PROJECT INFORMATION

	TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)
1.0	<u>INTRODUCTION</u> The proposed 1x 660 MW Bhusawal Thermal Power Project will be set up by Maharashtra State Power Generation Co. Ltd. (MAHAGENCO) in Dipnagar near Bhusawal, Maharashtra, India. The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given herein under is for general guidance and shall not be contractually binding on the Owner. All relevant site data/information as may be necessary shall have to be obtained /collected by the Bidder. 2.0 <u>APPROACH TO SITE</u> Deepnagar is well connected by rail and road. By road, it is about 8 Km from Bhusawal city. Nearest railway station is at Bhusawal. The nearest Airport is at Aurangabad. The nearest sea port is at Mumbai. The site is located on the Mumbai-Nagpur Highway. 3.0 <u>LAND</u> Bhusawal Thermal Power Plant is already having 1x62.5 MW + 2x210 MW Units and Two (2) Units of 500 MW each are under execution stage. About 108.94 Hectares of land is acquired by MAHAGENCO near existing TPS. It is proposed to install 1x 660 MW unit on this land. 4.0 <u>SOURCE OF COAL</u> Indian coal would be sourced from Machaakata coal blocks in Orissa state. The Coal will be received at Plant site directly by rail. The coal from the railway wagons would be unloaded by means of wagon tipplers and will be either bunkered or stacked in the stock pile at site. 5.0 <u>SOURCE OF WATER</u> The main source of water is considered Ozerkheda Reservoir which is located at around 18 km from plant site.

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6.0	<u>ASH DISPOSAL AREA</u>	
	The ash generated from 1 x 660 MW unit shall be disposed off in slurry form to the existing Ash Pond located at Velhala, approx. 12 Km from the site.	
7.0	<u>PROJECT INFORMATION</u>	
7.1	Client / Owner	: Maharashtra State Power Generation Co. Ltd.
7.2	Consultant	: DCPL
7.3	Project Title	: BHUSAWAL T.P.S. UNIT – 6 : 1X660 MW
7.4	Location	: Dipnagar, Near Bhusawal, Maharashtra, India
7.5	Nearest railway station	: Bhusawal
7.6	Nearest Airport	: Aurangabad
7.7	Nearest Harbour	: Mumbai
7.8	Access Roads	: NH 6 (Mumbai-Nagpur Highway)
7.9	Elevation above MSL	: 210 M
7.10	Longitude/latitude	: 75° 51' 10" East / 21° 02' 30" North
7.11	Seismic Zone	: Zone III as per IS:1893
7.12	<u>AMBIENT TEMPERATURE</u>	
7.12.1	Mean of daily maximum temperature	: 48.25 °C (during May)
7.12.2	Mean of daily minimum temperature	: 18 °C (during January)
7.12.3	Highest recorded temperature	: 48.7°C

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7.12.4 7.13 7.14 7.15 7.16	Lowest temperature recorded : 13°C Wet bulb temperature : 27°C (Maximum) Rainfall : 112 mm average annually Wind Speed : 0 to 39 Km/hr Wind direction : East North East to West South West
	<u>ELECTRICAL</u>
7.17	<u>MAIN POWER SOURCE FROM GRID</u>
7.17.1	Rated Voltage : 400kV
7.17.2	Voltage variation : $\pm 10\%$
7.17.3	Frequency Variation : $\pm 5\%$
7.17.4	Rated Short Circuit : 50 kA, Three Phase Symmetrical Level
7.18	<u>AUXILIARY POWER SUPPLY</u>
	Auxiliary electrical equipment shall be suitable for operation on the following supply system:
7.18.1	Motors above 1000 kW & other Power devices : 11kV, 3Ph, 3wire, 50Hz system
7.18.2	Motors below 1000 kW & above 160kW & other power devices : 3.3kV, 3 ph, 3 wire 50 Hz, Non Effectively earthed
7.18.3	Motors upto 160 kW & other power devices : 415V, 3 ph, 4 wire 50 Hz
7.18.4	Motor Starting Methods : Direct on Line
7.18.5	(a) Lighting fixtures : 240V, 1 phase, 50 Hz Space heaters, and : Supply through suitably rated transformers single Phase : to limit the short circuit level to 9kA – 1 sec. motors



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7.18.9	UPS power supply
	(a) Purpose : (i) Vital process loads (ii) Critical lighting (iii) Control and Instrumentation (iv) Office for LAN power supply/Server etc. (b) Rated Voltage : 415V, 3 ph, neutral/240V single phase, 50Hz
7.19	The variation in voltage and frequency may be $\pm 10\%$ and $\pm 5\%$ respectively. The combined voltage and frequency variation may be $\pm 10\%$. All devices shall be suitable for continuous operation over the entire range of voltage variation without any change in their performance
7.20	Power socket shall be 415V AC, 50 Hz, 4 pin 32/63 Amps. Power socket outlets for portable tools, hand lamps etc shall be 240 volts, single phase, 3 pin, metal clad industrial type
7.21	All electrical equipment shall be designed for the following ambient conditions (a) Maximum ambient temperature : 50°C (b) Minimum Ambient temperature : 13°C

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SECTION – I
SPECIFIC TECHNICAL REQUIREMENTS
SUB-SECTION IA - Specific Technical Requirements (Mech.)
SUB-SECTION IB - Specific Technical Requirements (Electrical)
SUB-SECTION IC - Specific Technical Requirements (C & I)

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1.0 INTENT OF SPECIFICATION

The intent of specification is to cover supply, design (i.e. Preparation and submission of drawing/ documents including " As Built " drawings and O&M Manuals) , engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles, fill of lubricants & consumables (excluding chemicals), mandatory spares along with spares for erection ,start up and commissioning, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in site transportation, assembly, minor civil works, erection & commissioning, trial run at site, and carrying out performance guarantee tests at site, obtaining all statutory clearances, training of customer/ client O&M staff, operation and maintenance for one year & final handing over to end customer in flawless condition for **OZONE GENERATION PLANT** for **1X660 MW BHUSAWAL THERMAL POWER STATION**.

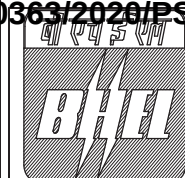
- 1.1 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the contractor of the responsibility of providing such facilities to complete the supply, erection and commissioning, performance and guarantee of **OZONE GENERATION PLANT**.
- 1.2 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to highest standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith. Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be included in the specification unless otherwise specifically excluded.
- 1.3 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing. Similarly, the extent of supply also includes all terms required for completion of the system and not withstanding that they may have been omitted in drawings / specifications or schedules.
- 1.4 The general term and conditions, instructions to tenderers and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 1.5 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under section-III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser / Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication. The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions. Pre-bid clarification if any must be asked at least ten days before the date of bid opening.
- 1.6 Deviations, if any, should be very clearly brought out clause by clause along with cost of withdrawal in the enclosed schedule (in section – III); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.

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- 1.7 In the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, more stringent requirement as per the interpretation of the BHEL / owner shall apply.
- 1.8 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.9 For definition of word like Contractor, bidder, supplier, vendor, Customer/ consultant, please referred relevant clause(s) of GCC.
- 1.10 The omission of specific reference to any component/accessory necessary for the proper performance of Ozone Generation Plant shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of equipment at quoted prices.
- 1.11 BHEL's / Customer's representative shall be given full access to the shop in which the equipment is being manufactured or tested and all test records shall be made available to him.
- 1.12 General terms & conditions instructions to the bidder and other attachments referred to elsewhere, make part of tender specification. The bidder shall be responsible for all governed by requirements stipulated hereinafter.
- 1.13 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and shipping release issued by BHEL/Customer.

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SUB-SECTION – IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

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1.0 SCOPE OF SUPPLY:

A) Scope of Supply by Bidder: -

Broad scope of work of this package includes all equipment and accessories as listed under. Please refer Electrical and C&I sections also for respective scopes.

The Ozone generation plant, as specified in Technical specification, Data sheets, P&ID shall consist of at least the followings and shall be in the scope of the bidder:

- i) Ozone shall be dosed at the following points of CW system and condenser: -
 - a) cooling tower riser.
 - b) Cooling tower basin with diffusing grid.
 - c) Condenser Inlet.
 - d) Condenser Make-up water.
- ii) 3X50 % Screw type oil free Air cooled compressors complete with drive motors, silencer, and Intake filters, inter coolers, after coolers, and step up gear box, moisture separator, ducting arrangement (if required) and all other accessories to complete the system requirement.
- iii) 1 no. Air receiver with all accessories of adequate capacity.
- iv) Twin tower Air drier-1 with all accessories and twin tower Air drier -2 with all accessories
- v) Oxygen generator-1 with all accessories and Oxygen generator-2 with all accessories.
- vi) One number Oxygen receiver for Ozonisation system with all accessories as required for the complete system requirement of the ozone generation plant.
- vii) Ozone generator for Ozonisation system at CW system and condenser with all accessories along with transformers, rectifiers, VFD etc. as required for the complete system requirement of the ozone generation plant.
- viii) Ozone generator for Ozonisation system for PT Plant with all accessories along with transformers, rectifiers, VFD etc. as required for the complete system requirement of the ozone generation plant.
- ix) 2X100 % Chilled water re circulation pumps for Ozonisation system complete with drive motors along with strainers, instruments, isolation valves, piping, flanges, pipe fittings etc. to meet the complete system requirement of all ozone generators.
- x) 2X100 % air cooled chillers for Ozonisation system along with associated piping, valves, instruments, equipment like cooling water, water softener etc. to meet the complete system requirement of all ozone generators.
- xi) One no. Water storage tank for cooling water of Ozonisation system equipment along with piping, valves, fittings, instrumentation and accessories associated with the same.
- xii) (2 X 100 %) Ozone dosing pumps along with 2X100 % venture injector for Ozonisation system at CW system and condenser complete with drive motors along with strainers, instruments, isolation valves, injector, Ozone static mixers, piping, flanges, pipe fittings etc. as required for the system.
- xiii) (2 X 100 %) Ozone dosing pumps along with 2X100 % venture injector for Ozonisation system for PT Plant complete with drive motors along with strainers, instruments, isolation valves, injector, Ozone static mixers, piping, flanges, pipe fittings etc. as required for the system.
- xiv) Two nos. booster pumps (if required) for motive water for PT Plant ozone dosing system.
- xv) Standalone Packaged type ozone generation plant of minimum capacity of 400g/hr for dosing at outlet of potable water storage tank with all accessories.
- xvi) Necessary number of ozone leak detectors as per the requirement of statutory norms or proven/established guidelines and shall be subjected to customer approval during detail engineering.
- xvii) Bidder to include all the ventilation requirement including toilets and MCC room in his scope for the Ozone Generation Plant building as per the requirement specified in the technical specification.
- xviii) Bidder shall also include in his scope split Air-conditioners for control room etc.
- xix) Bidder shall include in his scope necessary support/platform /ladder/hanger /anchor bolts as required for satisfactory erection / commissioning & operation of plant shall be provided by bidder.
- xx) Bidder shall include in his scope all ozone generation plant pipes and conduit support. All drains shall be terminated at point in ozone generation plant building.
- xxi) Bidder shall include in his scope one lot of mandatory spares as per list enclosed as Annexure-VI of technical specification.
- xxii) Required number of diffusers and all dosing/mixing arrangements.
- xxiii) The equipment offered must meet the rating and performance requirements for successful running of ozone generation plant.
- xxiv) Start-up & Commissioning spares.

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- xxv) Counter flanges, blank flanges, isolation valves at all the terminal points as required as per system requirements.
- xxvi) All special tools necessary for proper maintenance or adjustment of the equipment packed in permanent box.
- xxvii) All necessary structural steel for pipe supporting structure, platforms, walkways / pathways and access stairs, mechanical plant and equipment, mechanical services and pipe work associated with ozone generation plant.
- xxviii) Permanent ladder (not rungs) for approaching the top of tanks, valves for All steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc. as required to grout in civil works and to support/hold the equipment being supplied under this specification for opening/maintenance purpose.
- xxix) All auxiliary steel structures (U-clamps, nuts, bolts, channels etc.) for fixing the pipe on the pedestal or trestles.
- xxx) Wrapping, coating and protection of all the buried pipe shall be as per IS 10221 or AWWA C 203.
- xxxi) Finish paint for touch-up painting of equipment after erection at site in sealed containers.
- xxxii) Set of special tools and tackles if required for maintenance and erection of equipment supplied.
- xxxiii) All insert plates, puddle pipes, nuts and bolts, counter flanges, grouting material wherever applicable shall be in the scope of bidder.
- xxxiv) Embedment plates with lugs shall also be provided by bidder as per system requirement.
- xxxv) Monitoring gadgets, instruments and equipment required for commissioning & maintenance (till PG test and plant handover).
- xxxvi) Instrument hook up material shall be in bidder's scope.
- xxxvii) Packaged type water softener along with complete regeneration system. Further, for water softener any pump required shall also be part of bidder's scope.
- xxxviii) All Motorized valves with integral starter as per requirement and as indicated in the P&ID.
- xxxix) All Instrumentation (minimum) as per the enclosed P&ID (PE-DG-415-174-A001 Rev00) including the electronic on line dew point transmitter, Ozone analyser, Oxygen purity analyser, Ozone leak detector, residual ozone analyser etc. with suitable sampling connection and isolation valve.
- xl) Bidder shall provide extra capacity and dosing point if deemed and felt by the bidder necessary to maintain 0.02 ppm residual level of ozone in the system without any commercial implication to BHEL/customer.

2.0 SCOPE OF SUPPLY (ELECTRICAL)

Complete electrical scope shall be as per specification / details indicated in Section IB (Specific Technical Requirement Electrical) and IIB (General Technical Requirement Electrical).

3.0 SCOPE OF SUPPLY (C&I)

Complete C&I scope shall be as per specification / details indicated in Section IC (Specific Technical Requirement C&I) and IIC (General Technical Requirement C&I).

4.0 SCOPE OF SUPPLY (CIVIL)

- i) Total Civil construction work at site is in BHEL's Scope of work, however complete grouting for equipment, pumps, blowers, compressors etc. fixing of equipment, pumps, blowers etc. as required shall be in bidder's scope.
- ii) Civil pedestals for pipe supports is by BHEL, however, auxiliary structure, supports components for piping is in bidder's scope.
- iii) Also detailed Civil Input drawing shall be provided by bidder. Successful bidder shall furnish civil assignment drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence.
- iv) Minor Civil work including chipping of foundation, grouting below base plate for all structures, equipment, grouting of anchor bolts wherever these are not placed in the foundation during casting of foundation itself etc. To the extent possible, vendor shall ensure to supply all foundation bolts timely so as to facilitate placement of these bolts while casting the foundation. Wrapping, coating and protection of all the buried pipe shall be as per IS 10221.

5.0 SCOPE OF SERVICE:

The bidder's scope includes the following services:

- i) Design and engineering of entire ozone generation Plant
- ii) Erection and commissioning, unloading, storage and handling at site.
- iii) Arrangement of all instruments and lab facilities to carry out trail run, commissioning and PG test.

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- iv) The complete operation & Maintenance of Ozone Generation Plant for One (1) year after PG test is in bidder's scope.
- v) In site transportation.
- vi) Pre- Commissioning work such as flushing, hydraulic testing etc. Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities shall be arranged by the successful bidder at their own cost.
- vii) Monitoring gadgets, instruments and equipment required for maintenance (till PG test and plant handed over).
- viii) All personal required during commissioning and PG test. Also, all the personal for O&M of the plant as per tender specification.
- ix) Complete grouting for equipment including grouting material, fixing and any concreting inside the plant.
- x) Trail run for requisite period.
- xi) Performance guarantee testing.
- xii) Painting as per enclosed painting schedule. However, any variation in the painting schedule as finally approved by customer shall be taken care by the bidder without any commercial and delivery implication. Colour coding scheme shall be intimated to vendor during detailed engineering.
- xiii) Final touch up painting at site.
- xiv) Preparation of civil assignment drawings i.e. pedestals details; insert plates / embedment's plates required for supporting pipes and equipment etc. and review of civil drawing prepared by BHEL based on civil assignment drawing of bidder. In case any modification is required in the civil work already done based on civil inputs given by vendor, rework shall be done at the cost and risk of the vendor.
- xv) Obtaining all statutory clearance for ozone generation plant system as applicable as per govt. rules/equipment shall be in scope of bidder.
- xvi) Bidder shall include all necessary safety accessories as required for ozonisation system.
- xvii) All consumables and spares as required during the stipulated O&M (i.e. one year after successful PG Test. The spares supplied as part of contract shall not be used for O&M services.

6.0 TERMINAL POINTS AND BIDDER'S SCOPE:

TP1: - Motive water connection of 200 NB shall be terminated at 10-meter distance from Ozone generation plant Building area for Ozonisation at CW system and condenser. Further distribution of motive water shall be in bidder's scope.

TP2:- Ozonated water dosing line from dosing pump in Ozone generation plant Building area up to Condenser inlet dosing points is in bidder' scope. The pipe size of the condenser inlet is 2300 NB each. The piping distance from Ozone generation building to dosing point in the Condenser inlet dosing point is 650 meters & in bidder's scope. Further all the piping as per system requirement shall be in bidder's scope also.

TP3:- Ozonated water dosing line from dosing pump in Ozone generation plant Building area upto Cooling tower basin dosing point is in bidder' scope. The piping distance from Ozone generation building to Cooling tower basin dosing point is 100 meters & in bidder's scope. Further all the piping as per system requirement shall be in bidder's scope also. Bidder shall provide diffusing grid for proper distribution of the ozone.

TP4:- Ozonated water dosing line from dosing pump in Ozone generation plant Building area up to cooling tower riser dosing point is in bidder' scope. The piping distance from Ozone generation building to cooling tower riser dosing point is 130 meters & in bidder's scope. Further all the piping as per system requirement shall be in bidder's scope also

TP5:- Ozonated water dosing line from dosing pump in Ozone generation plant Building area up to Condenser Make-up water pipe is in bidder' scope. The pipe size of the Condenser Make-up is 500 NB. The piping distance from Ozone generation building to Condenser Make-up water dosing point is 100 meters & in bidder's scope. Further all the piping as per system requirement shall be in bidder's scope also.

TP6: - Tap off for Motive water shall be taken by the bidder from stub provided in RW line of 600 NB in PT Plant Area which is at a distance of 150 m from Ozone generation plant Building. All the necessary Tees, elbows etc. as required shall also be in bidder's scope.

TP7:- Ozonated water dosing line from dosing pump in Ozone generation plant Building up to PT Plant stilling chamber is in bidder' scope. The piping distance from Ozone generation building to dosing point is 150 meters is in bidder's scope.

TP8: - Tap off for Motive water shall be taken by the bidder from stub provided at the outlet of Potable water storage tank which is at a distance of 50 m from potable water ozone dosing system. All the necessary Tees, elbows etc. as required shall also be in bidder's scope.

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TP9: - Ozonated water dosing line from dosing pump in potable water ozone dosing system up to potable water tank discharge header dosing point is also in bidder' scope. The piping distance from potable water ozone dosing system to potable water tank discharge header is 50 meters is in bidder's scope.

TP10: - Bidder to note that Instrument air shall be provided for at 10-meter distance from Ozone generation plant Building.

TP11: - Potable and service water connection of 40 NB at 10-meter distance from Ozone generation plant Building area. Further distribution of Potable and service water shall be in bidder's scope.

TP 12: - Drains: - All drains shall be terminated at one point by bidder.

7.0 BIDDER TO FURNISH FOLLOWING DOCUMENT/INFORMATION ALONG WITH THE BID.

- Deviation schedule duly fill for deviation along with cost of withdrawal, if any.
- Schedule of Declaration.

8.0 EXCLUSIONS

- Motive water, Service water and potable water up to the terminal point.
- All civil construction Works at site.
- Instrument Air up to the terminal point.

9.0 QP AND SUB VENDOR APPROVAL

Bidder to note the QP requirement shall be in line with the Annexure-I of technical specification. However, detailed QP, inspection checklist, certificate of conformance etc. for each sub-vendor shall be decided during detailed engineering. All inspection & testing etc. shall be carried out accordingly. Any changes/additional tests insisted upon by Owner during detailed engineering shall be accepted by bidder without any commercial implication to BHEL/Owner.

10.0 SUB VENDOR

The sub vendor list (Annexure- II) enclosed is indicative only and is subject to approval / acceptance by customer. Bidder to propose his sub vendor list with back up documents (experience list, end user performance certificate as applicable) etc. The same shall subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.

11.0 DESIGN/CONSTRUCTION

- The P&IDs (Dwg.No.-PE-DG-415-174-A001) is enclosed herein in this section for bidder's compliance.
- The material of construction specified in specification are minimum requirements and material of construction for other components not specified shall be similarly selected by the bidder for intended duty which shall be subjects to customer approval during detailed engineering without any delivery and price implication to BHEL.
- The technical specification requirement for items which are not included shall be subject to customer/BHEL approval during detailed engineering stage. Vendor will submit all the backup documents for provenances of the technical details selected.

12.0 DRAWING/DOCUMENTS REQUIREMENT

For the Drawings/Documents submission schedule, please refer ANNEXURE-VII.

For the Drawings/Documents distribution Procedure, please refer ANNEXURE-IV. The bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. Bidder to comply with the observations of the BHEL and CUSTOMER without price & delivery implication.

13.0 SPARES

All the spares for the equipment under the contract provided by the vendor will strictly conform to the specifications and documents and will be identical to the corresponding main equipment/components supplied under the contract.

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A) MANDATORY SPARES

- The list of mandatory spares which is to be considered by bidder in their scope are indicated in Annexure VI.
- All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipment.
- Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.
- Inspection of mandatory spares shall be in line with the approved quality plans for the respective items/equipment. The inspection categorization of mandatory spares shall also be in line with the approved Categorization plan for the respective items/equipment.

B) START-UP & COMMISSIONING SPARES

Start-up and commissioning spares are those spares which are required during the start-up and commissioning of the equipment/system. All spares used till the plant is handed over to the Customer shall come under this category. The Bidder shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipment are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Bidder.

Notes: -

- The Bidder shall indicate the service expectancy period for the spares under normal operating conditions before replacement is necessary.
- All spares supplied under this contract shall be strictly inter changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary.
- All the spares (mandatory) shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.
- Each spares part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spares part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.
- All cases, containers or other packages are to be opened for such examination as may be considered necessary by BHEL / Customer.
- The Bidder will provide the BHEL/Customer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/components/equipment covered under the contract and will further ensure with his vendors that the BHEL/Customer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.
- The Bidder shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship.
- The bidder to provide datasheets/assembly drawings of the manufacturer/ any other relevant document showing Bill of Material(s), Make, Model Number, Part Number etc. through which the mandatory spares to be supplied can be uniquely identified.

14.0 ADDITIONAL REQUIREMENT

- Online analyser for measurement of residual ozone shall be provided by the bidder. The location of the analyser must be at certain distance from the dosing point.
- Bidder to submit BBU during detailed engineering after approval of Basic documents. BBU shall be equal to BOQ for the package and there shall be no price and delivery implication is applicable to BHEL / customer for the same. None of the items supplied for the project as non-billable. Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule.

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- Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads. Incomplete BBU shall not be review by BHEL.
- Any statutory requirement / clearance required for the package from government / local body shall be in bidder's scope.
 - The vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor with valid reason in writing and require written approval shall be taken from BHEL. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
 - KKS numbering if required, as per BHEL/Customer requirement shall be provided by the Bidder during detailed engineering stage without any commercial/delivery implication to BHEL.
 - Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.
 - Buried piping shall be protected as under (as per IS-10221).
 - Surface cleaning by wire brush, power tool cleaning etc.
 - Apply one coat of coal tar/primer/enamel.
 - Apply one layer of tape comprising of coal tar. Application of tape shall conform to AWWA C- 203/IS 10221 (Appendix-B) with Minimum thickness of tape as 4MM +10%
 - Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads.
 - In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.
 - Bidders should make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t. existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.
 - Wherever local instruments for measurement of Flow, Pressure, Level is indicated in the P&ID, Bidder to provide Diaphragm seal type instrument for Chemical (all type and concentration), corrosive, viscous fluids application.
 - All the vertical pumps shall be considered as self-lubricating type unless specifically mentioned.
 - Bidder to take utmost care w.r.t the safety requirement of the system while designing the system.
 - Every fortnightly there shall be a meeting at Site/ BHEL /customer office for approval of engineering document of ozone generation plant. Bidder will attend the same without any cost implication to BHEL/customer.

15.0 INSTRUCTIONS TO BIDDER

- a) The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve them of the responsibility of providing such facilities to complete the supply, erection and commissioning of Complete Ozone Generation Plant.
- b) It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgment is not in full accordance herewith.
- c) The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.

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- d) The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification are subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- e) While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under section-III of the specification **within 10 days of receipt of tender documents**. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of BHEL/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by BHEL/ Customer as and when brought to their notice either by the bidder or by BHEL/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.
- f) The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.
- g) Deviations, if any, should be very clearly brought out clause by clause along with cost of withdrawal in the enclosed schedule (in Sec – III); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.
- h) In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- i) Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer.
- j) The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer as per approved QAP.
- k) BHEL's/Customer's representative shall be given full access to the shop in which the equipment is being manufactured or tested and all test records shall be made available to him.
- l) Pre-bid meeting shall be held before bid submission. Bidder to ask all their queries in pre-bid meeting.

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TITLE :

1X660 MW BHUSAWAL TPS, UNIT # 6

SPECIFICATION NO. PE-TS-415-174-A001

SECTION : I

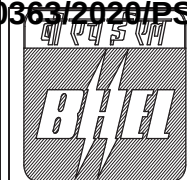
TECHNICAL SPECIFICATION FOR OZONE
GENERATION PLANT

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ANNEXURES

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TITLE :

1X660 MW BHUSAWAL TPS, UNIT # 6

SPECIFICATION NO. PE-TS-415-174-A001

SECTION : I

TECHNICAL SPECIFICATION FOR OZONE
GENERATION PLANT

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ANNEXURE-I: QUALITY PLAN

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT 1X660 MW BHUSAWAL TPS, UNIT # 6 BHEL DOCUMENTS NO.: PE-TS-415-174-A001 SECTION - IA												
QUALITY ASSURANCE PLAN FOR PRESSURE VESSELS												
Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Reference Document	Acceptance Standard	Format of Record	Scope of Check			Remarks
									BIDDER	BHEL	CUSTOMER	
I) Initial Procedure Qualifications :												
a	Welding Procedure Qualification Tests	Procedure Qualification	Major	Visual & Mech Checks on Test Piece	100%	ASME SEC IX	ASME SEC IX	WPS - QW 482 & PQR - QW 483	P	V	V	Note 1
b	Welder Performance Qualification Tests	Performance Qualification	Major	Visual & Mech Checks on Test Piece	100%	ASME SEC IX	ASME SEC IX	WPQ - QW 484	P	V	V	Note 1
II) Raw Material Inspection :												
a	Raw Material Identification for Shell, D/Ends, Pipes & Flanges	Verification of MTC & Chemical, Mechanical Properties	Major	Chemical & Mechanical Check	1 Per Heat / Lot	App.Drg. / Relevant code	ASME SEC II Part A for D/ends & IS 2062 for Shell	Mfr TC / Check Test Report	P	V	V	Note 2 & 3
b	Surface Defects	Verification of Surface	Major	Visual	100%	No Pitting / Corrosion	No Pitting & Corrosion	SIR	P	V	V	
III) Inspection of Dished Ends :												
a	Dimension & Visual Check	Dimensional Conformance, Thinning after forming & Visual	Major	Measurement & Visual	100%	App.Drg.	ASME SEC VIII / IS 4049	SIR	P	V	V	Thickness Check by De meter
b	DP Check on KR, SF & Edge	NDT	Major	Visual	100%	ASME SEC V	ASME SEC VIII Appendix 8	DP Report	P	V	V	
c	RT on D/end cordial seam	RT	Major	Visual	100%	ASME SEC V	ASME SEC VIII DIV I	RT Report	V	V	V	Review of RT Films by BHEL & CUSTOMER.
IV) In Process Inspection :												
a	Shell Fabrication	Marking, Edge Preparation, rolling & Fit up	Major	Dimensional Conformance & Root Gap	100%	App.Drg.	App.Drg.	SIR	P	V	V	
b	Joint Preparation, Weld set-ups & Nozzles fittings	Alignment & Dimensions	Major	Measurement & Visual	100%	App.Drg.	App.Drg.	SIR	P	V	V	
c	Welding of shells, shell to D/ends & nozzles	Weld Parameter	Major	Visual	100%	AWPS & ASME SEC IX	AWPS & ASME SEC IX	Log Book	P	V	V	
d	DP Check on Butt Joints & Fillet Joints	NDT	Major	Visual	100% on Butt Joints & 10% on Fillet Joints	ASME SEC V	ASME SEC VIII Appendix 8	DP Report	P	V	V	
e	RT on T Joints & Butt Joints	RT	Major	Visual	As per Spec. / Drg	ASME SEC V	ASME SEC VIII ADIV I	RT Report	V	V	V	Review of RT Films by BHEL & CUSTOMER.
f	Air Leak Test (Soap Bubble Test) for Nozzle RF Pads	Weld Soundness	Major	Visual	100%	App.Drg. / Relevant code	No Leakage / Bubbles	FIR	W	V	V	Bubble Test @ 1.05 kg/cm2 (g)
Contd...2												

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT 1X660 MW BHUSAWAL TPS, UNIT # 6 BHEL DOCUMENTS NO.: PE-TS-415-174-A001 SECTION - IA												
QUALITY ASSURANCE PLAN FOR PRESSURE VESSELS												
Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Ref.Document	Acceptance Standard	Format of Record	Bidder	BHEL	CUSTOMER	Remarks
V) Stage Inspection												
a	Dimension Check	Dimensional	Major	Measurement	100%	App.Drg.	App.Drg.	FIR	P	W	V	
b	Visual Check	Visual	Major	Visual Inspection	100%	App.Drg.	App.Drg.	FIR	P	W	V	
c	Hydro Static Pressure Test / Water Fill Test (As Applicable)	With stand of Hydro Test / Water Fill Test	Critical	Visual Inspection	100%	App.Drg.	No Leakage or Seepage	FIR	P	W	W	
d	Painting	DFT	Major	Visual Inspection	100%	App.Drg.	App.Drg.	FIR	P	V	V	
e	Stamping / Stenciling	To identify the Equipment	Major	Visual Inspection	100%	App.Drg.	App.Drg.	FIR	P	V	V	
f	Review of Testing and Measuring Instruments	To ensure the accuracy	Minor	Verification	100%	Calibration Certificate	National & International	TC	V	V	V	

NOTE 1: Only qualified welders & WPS to be used. In case welders are already qualified by customer / BHEL / LRIS / BVQI / DNV & doing similar jobs re-qualification is not required.

NOTE 2: Check Test shall be carried out on plates where ever corelation of TC with material is not available. Sample shall be identified & test Certificates shall be Verified by BHEL & CUSTOMER.

NOTE 3: All plates of pressure vessels shall be ultrasonically tested as follows:

- (a) For nominal thickness 20 mm and higher when used for fabrication of dished ends
 - (b) For nominal thickness 40 mm and higher when used for fabrication of shells
 - (c) For nominal thickness 50 mm and higher when used for blind flanges
- All thicknesses, when used for body flanges

NOTE 4: All test reports / Inspection reports related to the tank shall be furnished for BHEL / CUSTOMER review.

NOTE 5: Hydro test duration shall be 1hr at 1.5 times of design pressure or 2 times of working pressure whichever is higher & No Leakage will be permitted.

NOTE 6: The above mentioned quality inspection requirement are bare minimum. However any other test of any item as required by BHEL/Customer the same shall be provided by the bidder without and commercial and delivery implication to BHEL.

ABBREVIATIONS:

TC: Test Certificate
DFT: Dry Film Thickness
W: Witness

SIR: Stage Inspection Report
App.Drg. Approved Drawing
V: Verify Documents

FIR: Final Inspection Report
P: Perform

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT												
1X660 MW BHUSAWAL TPS, UNIT # 6												
BHEL DOCUMENTS NO.: PE-TS-415-174-A001												
SECTION - IA												
QUALITY ASSURANCE PLAN FOR ATMOSPHERIC TANKS												
Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Reference Document	Acceptance Standard	Format of Record	Scope of Check			Remarks
									BIDDER	BHEL	CUSTOMER	
I) Initial Procedure Qualifications :												
a	Welding Procedure Qualification Tests	Procedure Qualification	Major	Visual & Mech Checks on Test Piece	100%	ASME SEC IX	ASME SEC IX	WPS - QW 482 & PQR - QW 483	P	V	V	Note 1
b	Welder Performance Qualification Tests	Performance Qualification	Major	Visual & Mech Checks on Test Piece	100%	ASME SEC IX	ASME SEC IX	WPQ - QW 484	P	V	V	Note 1
II) Raw Material Inspection :												
a	Raw Material Identification for Shell, D/Ends, Pipes & Flanges	Verification of MTC & Chemical, Mechanical Properties	Major	Chemical & Mechanical Check	1 Per Heat / Lot	App.Drg. / Relevant code	ASME SEC II Part A for D/ends & IS 2062 for Shell	Mfr TC / Check Test Report	P	V	V	Note 2 & 3
III) Inspection of Dished Ends :												
a	Dimension & Visual Check	Dimensional Conformance, Thinning after forming & Visual	Major	Measurement & Visual	100%	App.Drg.	ASME SEC VIII / IS 4049	SIR	P	V	V	Thickness Check by De meter
b	DP Check on KR, SF & Edge	NDT	Major	Visual	100%	ASME SEC V	ASME SEC VIII Appendix 8	DP Report	P	V	V	
c	RT on D/end cordial seam	NDT	Major	Visual	As per Appd. Drg	ASME SEC V	ASME SEC VIII DIV I	RT Report	V	V	V	Review of RT Films by BHEL & CUSTOMER.
IV) In Process Inspection :												
a	Shell Fabrication	Marking, Edge Preparation, rolling & Fit up	Major	Dimensional Conformance & Root Gap	100%	App.Drg.	App.Drg.	SIR	P	V	V	
b	Joint Preparation, Weld set-ups & Nozzles fittings	Alignment & Dimensions	Major	Measurement & Visual	100%	App.Drg.	App.Drg.	SIR	P	V	V	
c	Welding of shells, shell to D/ends & nozzles	Weld Parameter	Major	Visual	100%	AWPS & ASME SEC IX	AWPS & ASME SEC IX	Log Book	P	V	V	
d	DP Check on Butt Joints & Fillet Joints	NDT	Major	Visual	100% on Butt Joints & 10% on Fillet Joints	ASME SEC V	ASME SEC VIII Appendix 8	DP Report	P	V	V	
e	RT on T Joints & Butt Joints	NDT	Major	Visual	As per Spec. / Drg	ASME SEC V	ASME SEC VIII DIV I	RT Report	V	V	V	Review of RT Films by BHEL & CUSTOMER.
f	Air Leak Test (Soap Bubble Test) for Nozzle RF Pads	Weld Soundness	Major	Visual	100%	App.Drg. / Relevant code	No Leakage / Bubbles	FIR	W	V	V	Bubble Test @ 1.05 kg/cm2 (g)
Contd...2												

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT 1X660 MW BHUSAWAL TPS, UNIT # 6 BHEL DOCUMENTS NO.: PE-TS-415-174-A001 SECTION - IA											
QUALITY ASSURANCE PLAN FOR ATMOSPHERIC TANKS											
Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Ref.Document	Acceptance Standard	Format of Record	Scope of Check		Remarks
									BIDDER	BHEL	CUSTOMER
V) Stage Inspection before Rubber Lining :											
a	Dimension Check	Dimensional	Major	Measurement	100%	App.Drg.	App.Drg.	FIR	P	W	V
b	Visual Check	Visual	Major	Visual Inspection	100%	App.Drg.	App.Drg.	FIR	P	W	V
c	Hydro Static Pressure Test / Water Fill Test (As Applicable)	With stand of Hydro Test / Water Fill Test	Critical	Visual Inspection	100%	App.Drg.	No Leakage or Seepage	FIR	P	W	W
f	Painting	DFT	Major	Visual Inspection	100%	App.Drg.	App.Drg.	FIR	P	V	V
g	Stamping / Stenciling	To identify the Equipment	Major	Visual Inspection	100%	App.Drg.	App.Drg.	FIR	P	V	V
h	Review of Testing and Measuring Instruments	To ensure the accuracy	Minor	Verification	100%	Calibration Certificate	National & International Standards	TC	V	V	V

- NOTE 1: Only qualified welders & WPS to be used. In case welders are already qualified by customer / BHEL / LRIS / BVQI / DNV & doing similar jobs re-qualification is not required.
- NOTE 2: Check Test shall be carried out on plates where ever correlation of TC with material is not available. Sample shall be identified & test Certificates shall be Verified by BHEL/CUSTOMER.
- NOTE 3: All test reports / Inspection reports related to the tank shall be furnished for BHEL / CUSTOMER review.
- NOTE 4: Hydro test duration shall be 1hr at 1.5 times of design pressure or 2 times of working pressure whichever is higher & No Leak shall be permitted.
- NOTE 5: For Rubber Lining refer separate QAP. Rubber Lining shall be carried out after Hydro Test and clearance from BHEL.
- NOTE 6: Hydro test will be conducted before Rubber Lining.
- NOTE 7: The above mentioned quality inspection requirement are bare minimum. However any other test of any item as required by BHEL/Customer the same shall be provided by the bidder without and commercial and delivery implication to BHEL.

ABBREVIATIONS:

TC: Test Certificate

DFT: Dry Film Thickness

W: Witness

SIR: Stage Inspection Report

App.Drg. Approved Drawing

V: Verify Documents

FIR: Final Inspection Report

P: Perform

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT 1X660 MW BHUSAWAL TPS, UNIT # 6 BHEL DOCUMENTS NO.: PE-TS-415-174-A001 SECTION - IA												
QUALITY ASSURANCE PLAN FOR RUBBER LINNING												
Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of	Reference Document	Acceptance Standard	Format of Record	Scope of Check			Remarks
									BIDDER	BHEL	CUSTOMER	
I) RUBBER SHEET :												
a	Rubber Sheet Inspection	Surface and Thickness check	Major	Visual & Measurement	100%	App.Drg.	App.Drg	SIR	P	V	V	
b	Tensile Strength & % Elongation	Strength	Major	Mechanical Test	1 Sample per Batch	IS 3400 Part 1	TS > 120 kg/cm2 & Elongation > 350%	TC	P	V	V	
c	Resistance to Bleeding Test	Resistivity	Major	Chemical Test	1 Sample per Batch	IS 3400 Part 1	No Discoloration & Weight gain limit -0% to +2%	TC	P	V	V	Note 1
II) IN PROCESS INSPECTION												
a	Surface Preparation	Blast Clean Surface free from foreign matls.	Major	Visual Inspection	100%	App.Drg. / IS4682	App.Drg / IS4682	SIR	P	V	V	
b	Adhesive Coat I	--	Major	Visual Inspection	100%	App.Drg. / IS4682	App.Drg / IS4682	SIR	P	V	V	
c	Adhesive Coat II	--	Major	Visual Inspection	100%	App.Drg. / IS4682	App.Drg / IS4682	SIR	P	V	V	
d	Continuity of Lining	Spark Test	Major	Visual Inspection	100%	App.Drg. / IS4682	No spark at 5KV / mm of lining thk	FIR	P	V	V	
e	Curing of Rubber Lining	Control of Pressure / Temperature / Time of Steam / Water	Major	Measurement & visual	100%	IS4682	IS4682 Part 1	Log book	P	V	V	
III) FINAL INSPECTION FOR LINED VESSELS												
a	Visual Check	Visual	Major	Visual Inspection	100%	App.Drg.	App.Drg / IS4682	FIR	P	V	W	
b	Adhesion Test	Adhesion Strength*	Critical	Measurement & visual	100%	App.Drg. / IS4682	IS 4682 Part 1	FIR	P	V	W	*1 test piece per lot
c	Thickness Verification	Thickness	Major	Measurement	Random	App.Drg.	Thk Tolerance = -10% to +15%	FIR	P	V	W	
d	Hardness Check	Hardness Shore A	Major	Visual Inspection	100%	App.Drg. / IS4682	App.Drg	FIR	P	V	W	
e	Continuity of Lining	Spark Test	Major	Visual Inspection	100%	App.Drg. / IS4682	No spark at 5KV / mm of lining thk	FIR	P	V	W	
f	Review of Testing and Measuring	To ensure the accuracy	Minor	Verification	100%	Calibration Certificate	National & Intl. Standards	TC	V	V	W	

NOTE 1: Sample to be kept in 33% HCl, 48% NaOH & DM Water for 72Hrs at 50 Deg C and shall pass as per Acceptance standard.
The above mentioned quality inspection requirement are bare minimum. However any other test of any item as required by BHEL/Customer the same shall be provided by the bidder without and commercial and delivery implication to BHEL.

NOTE 2:

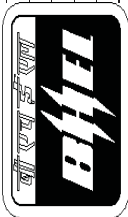
ABBREVIATIONS:
TC: Test Certificate
DFT: Dry Film Thickness
W: Witness

SIR: Stage Inspection Report
App.Drg. Approved Drawing
V : Verify Documents

FIR: Final Inspection Report
RW: Random Witness

P: Perform
R: Review

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT									
1X680 MW BHUSAWAL TPS, UNIT # 6									
BHEL DOCUMENTS NO.: PE-TS-415-174-A001									
SECTION - IA									
QUALITY ASSURANCE PLAN FOR CENTRIFUGAL PUMPS									



Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Ref.Document	Acceptance Standard	Format of Record	Scope of Check			Remarks
									BIDDER	BHEL	CUSTOMER	
I) Raw Material Inspection :												
a	Raw Material Identification for Casing, Impeller, Shaft, Casing Wearing ring & Shaft sleeve.	Chemical Analysis & Mechanical Tests	Major	Chemical Analysis & Mechanical Tests	1 Per Heat / Lot	App.Drg. / Relevant code	App.Drg. / Relevant code	Mfr TC / IR	P	V	V	Note 1 & 3
b	Check for Surface defects and Dimensional conformity of the Raw materials.	Dimensional & Visual	Major	Visual & Measurement	100%	App.Drg. / Relevant code	App.Drg. / Relevant code	Mfr TC / IR	P	V	V	
c	Motors	Speed, Power, IP, Mounting Type	Major	Visual	100%	As Per IS 325	Relevant code	Routine Test Report	R	V	V	
II) In Process Inspection :												
a	Machining of Casings, Impeller	Dimensions & Alignment	Major	Visual & Measurement	100%	Appd. Drg & Data Sheet	Appd. Drg	SIR	P	V	V	
b	DP Check on Machined Surface	NDT	Major	Visual	100%	ASME SEC V	ASME SEC VIII & Appendix 8	SIR	P	V	V	
c	Hydro test for casings	With stand of Hydro Static	Critical	Hydro	100%	Appd. Drg & Data Sheet / IS 5120	Appd. Drg & Data Sheet / IS 5120 & No Leakage	SIR	P	W	V	
d	Dynamic Balancing of Impeller	Dynamic / Static Balancing	Critical	Visual & Measurement	100%	ISO 1940 Gr.6.3	Relevant code	SIR	P	V	V	
e	Assembly of Pump	Alignment, Fitment	Major	Visual & Measurement	100%	Appd. Drg & Data Sheet	Appd. Drg	-	P	V	V	
III) Final Inspection :												
a	Dimension Check	Dimensions Capacity vs Head, Capacity vs Power and Capacity vs Efficiency	Major	Measurement	100%	Appd. Drg & Data Sheet	Appd. Drg	FIR	P	W	V	
b	Performance Test (With Job Motor)	Temperature raise in Oil & Bearing Hsg.	Major	Measurement	100%	Appd. Drg & Data Sheet / HIS	Appd. Drg & Data Sheet / HIS	PTR	P	W	W	NOTE 5
			Critical	Measurement	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet		P	W	W	
			Major	Measurement	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet		P	W	W	
c	Strip Down Test	Wear & Tear	Major	Visual / Strip test	100%	IS 5120	As per IS 5120	FIR	P	W	V	
d	Rotor Run out Test	Alignment	Major	Visual & Measurement	100%	IS 5120	As per IS 5120	FIR	P	W	V	

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT											
1X680 MW BHUSAWAL TPS, UNIT # 6											
BHEL DOCUMENTS NO.: PE-TS-415-174-A001											
SECTION - IA											
QUALITY ASSURANCE PLAN FOR CENTRIFUGAL PUMPS											
SI.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Ref.Document	Acceptance Standard	Format of Record	Scope of Check		
									BIDDER	BHEL	CUSTOMER
IV) Painting :											
a	Surface Preparation	Roughness / Free from foreign matts.	Major	Visual	100%	Approved Drg. & Data Sheet	Approved Drg. & Data Sheet	SIR	P	V	V
V) Stamping / Stenciling :											
a	Identification	To identify the Equipment	Major	Visual	100%	Approved Drg. & Data Sheet	Approved Drg. & Data Sheet	SIR	P	V	V
VI) Testing and Measuring Equipment :											
a	Calibration status of equipments	To ensure the accuracy	Major	Verification	100%	National & Intl Standards	National & Intl Standards	Calibration Certificates	P	V	V
NOTE 1: UT shall be carried out for plates thickness 20mm and above & Forgings 50mm dia and above.											
NOTE 3: MTC shall be provided for metallic parts.											
NOTE 4: Hydro Test on casings shall be carried out at 2 times of rated head which ever is higher and the test pressure shall be maintained for 30 minutes & No Leakage shall be permitted.											
NOTE 5: The duration of performance test shall be minimum 1 hour.											
NOTE 6: The above mentioned quality inspection requirement are bare minimum. However any other test of any item as required by BHEL/Customer the same shall be provided by the bidder without and commercial and delivery implication to BHEL.											
ABBREVIATIONS:											
TC: Test Certificate			SIR: Stage Inspection Report			FIR: Final Inspection Report			P: Perform		
PTR: Performance Test Report			Appd. Drg. Approved Drawing			RW: Random Witness			R: Review		
W: Witness			V: Verify Documents			Mft's Std. Manufacturer's Standard					



TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT

1X660 MW BHUSAWAL TPS, UNIT # 6

BHEL DOCUMENTS NO.: PE-TS-415-174-A001

SECTION - IA

QUALITY ASSURANCE PLAN FOR CHECK VALVES

Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Ref.Document	Acceptance Standard	Format of Record	SCOPE OF CHECK			Remarks
									BIDDER	BHEL	CUSTOMER	
I) Raw Material Inspection :												
a	Material Identification for Body, Plate Castings	Material Properties	Major	Chemical & Mechanical	100%	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	FOUNDARY TC/COC	P	V	V	
			Major	Physical	100%	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	FOUNDARY TC/COC	P	V	V	
			Major	Dimension & Surface Check	100%	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	Inspection Reports	P	V	V	
b	Hinge/ Stop Pin	Material Properties	Major	Chemaical Analysis	1 sampel per Heat number	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	MTC/COC	P	V	V	
			Major	Visual Inspection	100%	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	Inspection Report	P	V	V	
c	Spring	Material Properties	Major	Chemaical Analysis	1 sampel per Heat number	Relevant Mtrl.specs	Relevant Mtrl.specs	MTC/COC	P	V	V	
II) In Process Inspection :												
a	Body & Plate Machining	Dimensions	Major	Measurement	Sample	Manufacturing drng	Manufacturing drng	SIR	P	V	V	
		Finish	Major	Visual	100%	Manufacturing drng	Manufacturing drng	-	P	V	V	
		DPT	Major	Visual	100%	As per ASME Sec V.	As per ASME Sec V.	DPT Report	P	V	V	
b	Rubber Lining on body	Vulcanising Soundness	Major	Visual Spark leak Test & Hardness	100%	As per Procedure for Rubber Lignin	As per Procedure for Rubber Lignin	Inspection Report	P	V	V	
III) Final Inspection :												
a	Assembly of Valve	Dimensions & Overall Finishing	Major	Measurement	100%	Appd.Drg./Datas sheet.	Appd.Drg./Dtas sheet.	FIR	W	V	V	
b	Hydrostatic Test	Body Hydro Test	Major	Pr.Test Hydro	100%	Appd.Drg./Datas sheet/No Leakage. API 598	Appd.Drg./Datas sheet/No Leakage. API 598	FIR	W	W	W	
		Seat Hydro Test	Major	Pr.Test Hydro	100%	Appd.Drg./Datas sheet/No Leakage. API 598	Appd.Drg./Datas sheet/No Leakage. API 598	FIR	W	W	W	
c	Performance Test	Smooth Operation of Plates	Critical	Operational(open-close)	100%	Appd. Drg & Data Sheet, API 594 / API 598	Appd. Drg & Data Sheet, API 594 / API 598	FIR	W	W	W	
d	Surface Preparation	Painting	Major	Visual	100%	Appd.Drg./Data sheet.	Appd.Drg./Data sheet.	Test Certificate	W	V	V	
IV) Documents Review & Release Note												
a	Document Review & Issue of Release note	Final document review	Critical	Document Review	100%	-	-	Inspection Reports, Test certificates, Issue of Release note	V	V	V	
NOTE 1: The above mentioned quality inspection requirement are bare minimum. However any other test of any item as required by BHEL/Customer the same shall be provided by the bidder without and commercial and delivery implication to BHEL.												
ABBREVIATIONS:												
TC: Test Certificate				SIR: Stage Inspection Report				FIR: Final Inspection Report				P: Perform COC: Certificate of Compliance
W: Witness				Appd. Drg. Approved Drawing				V: Verify Documents				
NOTE 1: The above mentioned quality inspection requirement are bare minimum. However any other test of any item as required by BHEL/Customer the same shall be provided by the bidder without and commercial and delivery implication to BHEL.												
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		TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT	
		1X660 MW BHUSAWAL TPS, UNIT # 6	
		BHEL DOCUMENTS NO.: PE-TS-415-174-A001	
		SECTION - IA	
		QUALITY ASSURANCE PLAN FOR BUTTERFLY VALVES (MANUAL / ACTUATED)	

Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Ref.Document	Acceptance Standard	Format of Record	SCOPE OF CHECK		Remarks
									BIDDER	CUSTOMER	
I) Raw Material Inspection :											
a	Material identification for Body, Disc & Wetted Parts	Mechanical & chemical Property Check	Major	Verification with respect stds	100%	Appd. drg., Appd. Data Sheet & Relevant code	Appd. drg., Appd. Data Sheet & Relevant code	Mfr. TC or Check Test Report	P	V	V
b	Receiving Inspection of Bought outs	Visual Defects	Major	Verification with respect stds & Visual Check	100%	Appd. drg. & Relevant code	Appd. drg. & Relevant code	Receiving Inspection	P	V	V
II) In Process Inspection :											
a	Machining of Body, Disc ,Components & Actuators.	Dimensions & Alignment	Major	Visual & Measurement	100%	App.Drg.	App.Drg.	SIR	P	V	V
b	DP Check on Machined Surface & Actuators	Surface Defects	Major	Visual	100%	ASME SEC V	ASME SEC VIII	DP Report	P	V	V
III B) Assembly Check :											
a	Assembly of Valves	Verification of all stages	Major	Verification with equipment drg	100%	Assy. Procedure, Equip. drg & Appd. Data Sheet	Assy. Procedure, Equip. drg & Appd. Data Sheet	--	P	V	V
b	Assembly of Actuators	Verification of all stages	Major	Verification with Appd. Drg	100%	Assy. Procedure, Appd. drg & Appd. Data Sheet	Assy. Procedure, Appd. drg & Appd. Data Sheet	--	P	V	V
IV) Final Inspection :											
a	Dimension Check	Dimensions	Major	Measurement	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	FIR	P	V	V
b	Operational Check	Smooth Movement	Major	Visual	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	FIR	P	W	W
c	Pneumatic Test for Valve	Leakage Proof	Major	Visual	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	FIR	P	V	V
d	Hydro Static Pressure Test on Seat & Body	With stand of Hydro Static & Leak Proof	Critical	Visual	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	FIR	P	W	W
e	Actuator performance (Job Actuator)	Leak tightness,Accuracy& simulation(Air to open/close)	Major	Visual	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	FIR	P	W	W
V) Painting :											
a	Surface Preparation	Roughness / Free from foreign matls.	Major	Visual	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	SIR	P	V	V
VI) Stamping / Stenciling :											
a	Identification	To identify the Equipment	Major	Visual	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	SIR	P	V	V
VII) Testing and Measuring Equipment :											
a	Calibration status of equipments	To ensure the accuracy	Major	Verification	100%	National & Intl Standards	National & Intl Standards	Calibration Certificates	P	V	V
NOTE 1 : UT shall be carried out for plates thickness 20mm and above & Forgings 50mm dia and above (Only for Metallic).											
NOTE 2 : MTC shall be provided for metallic parts.											
Note 3 : Hydrostatic test for seat and body-1.1 X Maximum working pressure for seat and 1.5 X Maximum working pressure for shell& No Leakage will be permitted.											
Note 4 : Seat Leakage Test should be done in both the directions											
Note 5 : Proof of Design and Disc strength as per AWWAC-504 requirements needs to be conducted.											

ABBREVIATIONS:

TC: Test Certificate
W: Witness

SIR: Stage Inspection Report
Appd. Drg. Approved Drawing

FIR: Final Inspection Report
V : Verify Documents

P: Perform
UT: Ultrasonic Testing

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT 1X660 MW BHUSAWAL TPS, UNIT # 6 BHEL DOCUMENTS NO.: PE-TS-415-174-A001 SECTION - IA											
QUALITY ASSURANCE PLAN FOR CHILLER											
Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Reference Document	Acceptance Standard	Format of Record	Scope of Check		Remarks
									BIDDER	CUSTOMER	
I) Initial Procedure Qualifications :											
a	Welding Procedure Qualification Tests	Procedure Qualification	Major	Visual & Mech Checks on Test Piece	100%	ASME SEC IX	ASME SEC IX	WPS - QW 482 & PQR - QW 483	P	V	Note 1
b	Welder Performance Qualification Tests	Performance Qualification	Major	Visual & Mech Checks on Test Piece	100%	ASME SEC IX	ASME SEC IX	WPQ - QW 484	P	V	Note 1
II) Raw Material Inspection :											
a	Raw Material Identification for tubes,tube sheet Shell etc.	Verification of MTC & Chemical, Mechanical Properties	Major	Chemical & Mechanical Check	1 Per Heat / Lot	App.Drg. / Relevant code	App.Drg. / Relevant code	Mfr TC / Check Test Report	P	V	Note 2 & 3
b	Surface Defects	Verification of Surface	Major	Visual	100%	No Pitting / Corrosion	No Pitting & Corrosion	SIR	P	V	
III) In Process Inspection :											
a	Condenser Assembly	i. Pressure Test (Shell side)	Major	Pneumatic under water	100%	App.Drg.	No leakage	SIR	P	V	
		i. Pressure Test (Tube side)	Major	Hydraulic	100%	App.Drg.	No leakage	SIR	P	V	
b	Cooler Assembly	i. Pressure Test (Shell side)	Major	Pneumatic under water	100%	App.Drg.	No leakage	SIR	P	V	
		i. Pressure Test (Tube side)	Major	Hydraulic	100%	App.Drg.	No leakage	SIR	P	V	
IV) Stage Inspection											
a	Dimension Check	Dimensional	Major	Measurement	100%	App.Drg.	App.Drg.	FIR	P	W	V
b	Visual Check	Visual	Major	Visual Inspection	100%	App.Drg.	App.Drg.	FIR	P	W	V
c	Pressure Test of Refrigerant System	Pneumatic	Critical	Pneumatic	100%	App.Drg.	No Leakage	FIR	P	W	W
NOTE 1: Only qualified welders & WPS to be used. In case welders are already qualified by customer / BHEL / LRIS / DNV & doing similar jobs re-qualification is not required.											
NOTE 2: Check Test shall be carried out on plates where ever correlation of TC with material is not available. Sample shall be identified & test Certificates shall be Verified by BHEL & CUSTOMER.											
NOTE 3: All plates of pressure vessels shall be ultrasonically tested as follows: (a) For nominal thickness 20 mm and higher when used for fabrication of dished ends (b) For nominal thickness 40 mm and higher when used for fabrication of shells (c) For nominal thickness 50 mm and higher when used for blind flanges All thicknesses, when used for body flanges											
NOTE 4: All test reports / Inspection reports related to the tank shall be furnished for BHEL / CUSTOMER review.											
NOTE 5: Hydro test duration shall be 1hr at 1.5 times of design pressure or 2 times of working pressure whichever is higher & No Leakage will be permitted.											
NOTE 6: The above mentioned quality inspection requirement are bare minimum. However any other test of any item as required by BHEL /Customer, the same shall be provided by the bidder without and											

QAP OF AIR COMPRESSORS TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)													
SR. NO. 1	COMPONENT / OPERATION 2	CHARACTERISTICS 3	CLASS 4	TYPE OF CHECK 5	QNTM. OF CHECK 6	REFERENCE DOCUMENT 7	ACCEPTANCE NORMS 8	FORMAT OF RECORD 9	AGENCY 10				REMARKS 11
									S	M	C	E	
I	MATERIAL INSPECTION / SUB-VENDOR ITEMS												
1.1	Rotor	Surface Defects Chemical Mechanical Hardness Internal Defects	MA	Visual Chemical Mechanical Hardness UT. > 50mm. Dia.	COC from ELGI 100%	Approved Drawing / Datasheet / AISI / SAE 1046	Approved Drawing / Datasheet / AISI / SAE 1046	-- Conc. Cert Conc. Cert Conc. Cert	P	R	R	COC from ELGI	
1.2	Gear Case	Chemical Mechanical	MA	Chemical Mechanical	1/lot	Approved Drawing / Datasheet / IS210	Approved Drawing / Datasheet / IS210	Manufacturers report	P	R	R		
1.3	Air block Casing	Surface Defect Mechanical Hardness	MA	Visual Mechanical Hardness	100% 1/lot 1/lot	Approved Drawing / Datasheet / IS 210	Approved Drawing / Datasheet / IS 210	-- Conc. Cert Conc. Cert	P P P	R R R	...	COC from ELGI	
1.4	Bull Gear and Pinion	Surface Defect Mechanical Hardness Chemical	MA	Visual Mechanical Hardness Chemical	100% 1/lot 1/lot 1/lot	Approved Drawing / Datasheet	Approved Drawing / Datasheet	-- Conc. Cert Conc. Cert Conc. Cert	P P P	R R R	R	COC from ELGI	
1.5	Intercooler & After cooler Assy	Mechanical Dimensional.	MA	Mechanical	1/lot	Approved Drawing / Datasheet	Approved Drawing / Datasheet	Manufacturer Report. / IR	P	R	R		
I	INPROCESS INSPECTION												
2.1	Pressure Relief valve	Functional test	MA	Verification	100%	Approved Drawing / Datasheet	Approved Drawing / Datasheet	IR	P	R	R		
2.2	Oil cooler	Tightness	MA	Hydro test	100%	Approved Drawing / Datasheet	Approved Drawing / Datasheet	Test/Guarantee certificate	P	R	R		
2.3	Rotor	Surface finish Coating Quality Dynamic Balacing	MA	Visual Measurement Balacing	100%	As per ELGI STD As per ELGI STD ISO 1940 Gr.6.3 or better	As per ELGI STD As per ELGI STD ISO 1940 Gr.6.3 or better	Conc. Cert	P	R	R	COC from ELGI	
2.4	Control Panel	Functional ,Continuity, HV,IR	MA	Measurement	100%	Approved Drawing / Datasheet / Mfg Drg.	Approved Drawing	Conc. Cert	P	R	R		
2.5	Intercooler & After cooler	Tightness	MA	Hydro test (1.5 times of working pr.) duration 30 min.	100%	Approved Data Sheet	Approved Data Sheet	IR	P	R	R		
III	FINAL INSPECTION												
3.1	Compressor outer dimensions. With motor and control panel.	Completeness Dimensional	MA	Visual Measurement	100% 100%	Approved Drawing / Datasheet	Approved Drawing / Datasheet	Dim. Record	P	R	W	W	

3.2	Performance Test [with motor]	Free Air Delivery (Flow)	MA	Verification	100%	Approved Drawing / Datasheet / ISO 1217 / IS 10431 Vibration VDI 3836 (10.0MM/SEC.)	Approved Drawing / Datasheet / ISO 1217 / IS 10431 Vibration VDI 3836 (10.0MM/SEC.)	Report	P	P	W	W
		Specific Power Consumption	MA	Power	100%			Report	P	P	W	W
		Delivery Pressure	MA	Measurement	100%			Report	P	P	W	W
		Loading =Working pressure+0.3 bar and Unloading =Working pressure+0.2	MA	Measurement	100%			Report	P	P	W	W
		Vibration and Noise	MA	Measurement	100%			Report	P	P	W	Noise to be checked at shop floor condition
		All interlock testing like Pressure cut in/cutoff, Safety valve opening, Main motor Over load relay	MA	Measurement	100%			Report	P	P	W	W
3.3	Painting	Final Finish.	MA	Visual	100%		As per ELGI STD	Report	P	W	R	R
NOTES : 1 In case of any dispute between Technical Specifications and QAP, former shall prevail. 2 Instruments used for testing shall have valid calibration with traceability to National Standards. 3 Leakages can be checked during performance testing of compressors. LEGENDS : S – SUB VENDOR , M– MANUFACTURER , C- BHEL , E- CUSTOMER P – PERFORM, R - REVIEW, W – WITNESS, MTC - MFR'S TEST CERTIFICATE, IR - INSPECTION REPORT, RT/UT/MT/PT - NON-DESTRUCTIVE TESTING METHODS DR - DOCUMENT/ RECORDS TICKED SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION, COC from ELGI / Conc. Cert : COMPLIANCE CERTIFICATE.												

QAP OF OZONE GENERATOR MODULE TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)												
SR. NO.	COMPONENT / OPERATION	CHARACTERISTICS	CLASS of check	TYPE OF CHECK	QNTM. OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE Standard	FORMAT OF RECORD	SCOPE OF CHECK			REMARKS
									ORAIPL/ Sub-vendor	BHEL	CUSTOMER	
I)	Raw Material Identification for Shell, D/Ends, Pipes & Flanges	Verification of MTC & Chemical, Mechanical Properties	Major	Chemical & Mechanical Check	1 Per Heat / Lot	App.Drg. / Relevant code	SS316Ti	Mfr TC / Inspection report	P	V	V	
II)	Ozone Generator Module	Surface Defects, Mechanical, Workmanship	Major	Visual	100%	App.Drg. / Relevant code	Conformance to applicable drawings & ASME SEC VIII	Mfr TC / Inspection report	P	V	V	
III)	Ozone Generator Module outer dimension	Dimensions	Major	Visual, Measurement	100%	App. dwg.	App. dwg.	Mfr TC / Inspection report	P	W	W	
IV)	Heat exchanger	With stand of Hydro Test	Critical	Measurement	100%	Mfg. standard	No Leakage	Mfr TC / Inspection report	P	W	W	
V)	Ozone Generator Module	Pneumatic test	Critical	Measurement	100%	Mfg. standard	No Leakage	Mfr TC / Inspection report	P	W	W	Bubble Test @1.05KG/Cm2 Checking with soap solution
VI)	Ozone Generator Assembly	General	Major	Visual	100%	App. dwg.	App. dwg.	Mfr TC / Inspection report	P	W	W	
ABBREVIATIONS:												
TC: Test Certificate		SIR: Stage Inspection Report		1 - ORAIPL/ SUB-VENDOR		2 - BHEL		3 - CUSTOMER				
		App.Drg.: Approved Drawing										
W: Witness		V: Verify Documents		P: Perform								
Note -												
1. All test reports / inspection reports related to the heat exchanger shall be furnished fro BHEL/ CUSTOMER review.												
2. Hydro test duration for water side shall be 1Hr at 1.5 times of design pressure or 2 times of working pressure whichever is higher & No leakage will be permitted.												

		CUSTOMER :		PROJECT		1X660 MW BHUSAWAL TPP		SPECIFICATION :											
		MAHAGENCO		TITLE		QUALITY PLAN		NUMBER :											
		BIDDER/ :		VENDOR		NUMBER PED-506-00-Q-006, REV-01		SPECIFICATION											
		SYSTEM		CAT.		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		TITLE											
SHEET 1 OF 2		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD		SECTION		VOLUME III		REMARKS			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	4	5	6	7	8	9	AGENCY		P		W		V		REMARKS		
1	2	3	4	5	6	7	8	9	10		11		12		13		14		
1.0	ASSEMBLY	1.WORKMANSHIP 2.DIMENSIONS 3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE 1.SHADE	MA MA MA	VISUAL -DO- VISUAL	100% -DO- 100%	MANUF'S SPEC MFG. DRG./ MFG. SPEC. MFG.SPEC./ RELEVANT IS	MANUF'S SPEC MFG. DRG./ MFG. SPEC. MFG.SPEC. RELEVANT IS	-DO- -DO- -DO-	2 2 2	- - -									
2.0	PAINTING		MA	VISUAL	SAMPLE	MANUF'S SPEC SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-									
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC. 2.OVERALL DIMENSIONS & ORIENTATION	MA MA	-DO- MEASUREMENT & VISUAL	100% 100%	IS-325/ BHEL SPEC./ DATA SHEET APPROVED DRG/DATA SHEET	SAME AS COL.7 APPROVED DRG/DATA SHEET & RELEVANT IS	TEST REPORT INSPN. REPORT	2 2	1 1							NOTE -1 & NOTE-3 NOTE -1 & NOTE-3		
BHEL		PARTICULARS		BIDDER/VENDOR															
		NAME																	
		SIGNATURE																	

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
(TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT TITLE		1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN				SPECIFICATION : TITLE :			
		SHEET 2 OF 2		SYSTEM		NUMBER PED-506-00-Q-006, REV-01							
SL. NO.		COMPONENT/OPERATION CHARACTERISTICS CHECK		CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS		
										P	W	V	
1		2		3	4	5	6	7	8	9	10	11	
				3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-
				NOTES:									
				1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON									
				2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.									
				3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.									
				<u>Legends for Inspection agency</u>									
				1. BHEL/CUSTOMER									
				2. VENDOR (MOTOR MANUFACTURER)									
				3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)									
				P. PERFORM									
				W. WITNESS									
				V. VERIFY									

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
(TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)

			CUSTOMER : MAHAGENCO		PROJECT TITLE 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :						
QUALITY PLAN			BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE						
SL. NO.	COMPONENT/OPERATION	SHEET 1 OF 9	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION			VOLUME III REMARKS
										P	W	V	
1	2	3	4	5	6	7	8	9	10			11	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL												
1.1	SHEET STEEL PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-		FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-		3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	INSPEC. REPORT			3	-	2	
		1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-		3	-	-	
1.2	HARDWARES												
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	MANFR'S DRG./SPEC	RELEVENT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING												
		1.SURFACE CONDITION	MA	VISUAL	100%			FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%		MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH												
		1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
BHEL			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE										
			BIDDER'S/VENDORS COMPANY SEAL										

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
(TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)

			CUSTOMER : MAHAGENCO		PROJECT TITLE		1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :		
QUALITY PLAN			BIDDER/ VENDOR		QUALITY PLAN		NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE		
SHEET 2 OF 9			SYSTEM		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	6	7	8	9	10	11
1											
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%		-	FREE FROM VISUAL DEFECTS	-DO-	3 -	-
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO		MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3 -	2
		3. DIMENSIONS	MA	MEASUREMENT	100%		-DO-	MANUF'R'S DRG.	LOG BOOK	3 -	2
		4.INTERNAL FLAWS	CR	UT	-DO-		ASTM-A388	MANUF'R'S SPEC. BHEL SPEC.	-DO-	3	2
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-		MANUF'R'S DRG. SPEC.	MANUF'R'S DRG. SPEC.	-DO-	3 -	2
		2. PHYSICAL COND.	MA	-DO-	-DO-		-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3 -	2
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE		MANUF'R'S DRG/ SPEC.	MANUF'R'S DRG. / SPEC.	-DO-	3 -	2
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%		-DO-	-DO-	INSP. REPORT	3 -	2
BHEL			PARTICULARS			BIDDER/VENDOR					
			NAME								
			SIGNATURE								
			DATE						BIDDER'S/VENDORS COMPANY SEAL		

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
(TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)

		CUSTOMER : MAHAGENCO		PROJECT TITLE		1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :															
		BIDDER/ : VENDOR :		QUALITY PLAN		QUALITY PLAN		SPECIFICATION : TITLE															
		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		NUMBER PED-506-Q-007, REV-03		SECTION															
		CAT.		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD		VOLUME III REMARKS													
SHEET 3 OF 9		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		7		8		9		10		11									
SL. NO.		CHARACTERISTIC CHECK		3		4		5		6		7		8		9		10		11			
1		COMPONENT/OPERATION		2		3		4		5		6		7		8		9		10		11	
1.7		OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.		1. SURFACE COND. ETC.		MA		VISUAL		100%		-		NO VISUAL DEFECTS		INSPT. REPORT		3		-		2	
1.8		SHEET STAMPING (PUNCHED)		2. OTHER CHARACTERISTICS		MA		TEST		SAMPLE		MANUF'S SPEC.		LOG BOOK AND OR SUPPLIER'S TC		3		-		2		2	
1.9		CONDUCTORS		1. SURFACE FINISH		MA		VISUAL		100%		-		FREE FROM VISUAL DEFECTS		LOG BOOK		3*		-		2*	
				2. ELECT. PROP. & MECH. PROP		MA		ELECT. & MECH. TEST		SAMPLES		RELEVANT IS/ BS OR OTHER STANDARDS		RELEVANT IS/ BS OR OTHER STANDARDS		SUPPLIERS TC & VENDOR'S INSPN. REPORTS		3		-		2	

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
(TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)

新恒丰 		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT TITLE		SPECIFICATION : NUMBER :			
		SHEET 4 OF 9		BIDDER/ : VENDOR		QUALITY PLAN		SPECIFICATION : TITLE			
				SYSTEM		NUMBER PED-506-Q0-Q-007, REV-03		VOLUME III			
				CAT.		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		REMARKS			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION	REMARKS	
								P	W	V	
1	2	3	4	5	6	7	8	9	10	11	
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-
		3.TEMP. WITH-STAND CAPACITY	MA	ELECT. TEST	-DO-	MANUF'S SPEC. / BHEL SPEC.	MANUF'S SPEC / BHEL SPEC.	-DO-	3	-	2
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-
BHEL		PARTICULARS		BIDDER/VENDOR							
		NAME									
		SIGNATURE									
		DATE									
							BIDDER'S/VENDORS COMPANY SEAL				

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
(TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)

80363/2020/PS-PEM-MAX 80363/2020/PS-PEM-MAX		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT TITLE		SPECIFICATION : NUMBER :				
		SHEET 5 OF 9		BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION	VOLUME III REMARKS	
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ASTM-E165	MANUF'S SPEC./BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ SAME AS RELEVANT STAND	BHEL SPEC./	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	
BHEL												
			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE									
BIDDER'S/VENDORS COMPANY SEAL												

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
(TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)

QUALITY PLAN SHEET 6 OF 9		CUSTOMER : MAHAGENCO		PROJECT TITLE		1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-Q-007, REV-03		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SPECIFICATION : TITLE		SECTION VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT. SYSTEM	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUF'R'S SPEC.	MANUF'R'S SPEC.	Log Book	2	-	-	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUF'R'S SPEC./BHEL SPEC.	MANUF'R'S SPEC./BHEL SPEC.	Log Book	2	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.6	IMPREGNATION	4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	FOR MV MOTOR
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		1.VISCOSITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
BHEL												
BIDDER'S/VENDORS COMPANY SEAL												

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
(TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)

		QUALITY PLAN		CUSTOMER :		PROJECT		1X660 MW BHUSAWAL TPP		SPECIFICATION :											
				MAHAGENCO		TITLE				NUMBER :											
				BIDDER/ VENDOR																	
SHEET 7 OF 9				SYSTEM		QUALITY PLAN		NUMBER PED-506-00-Q-007, REV-03		TITLE											
COMPONENT/OPERATION		CHARACTERISTIC CHECK		CAT.		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD		SECTION		VOLUME III		REMARKS	
SL. NO.																					
1	2	3	4	5	6	7	8	9	10	11											
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1										
			MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-										
2.8	BRAZING/COMPRESSION JOINT	1.COMPACTNESS & CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-										
			CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2	-	1										
2.9	COMPLETE ROTOR ASSEMBLY	3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1										
			CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2	-	1	VERIFICATION FOR MV MOTOR ONLY									
2.10	ASSEMBLY	2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	-DO-	MFG. SPEC.	Log Book	2	-	1										
			MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-										
			MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-										
			MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1										
			MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-										
			MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-										
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	1										
BHEL		PARTICULARS		BIDDER/VENDOR																	
		NAME																			
		SIGNATURE																			
		DATE																			
				BIDDER'S/VENDORS COMPANY SEAL																	

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
(TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)

SL. NO.	COMPONENT/OPERATION	QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :	
				MAHAGENCO		TITLE		NUMBER :	
				BIDDER/ VENDOR		QUALITY PLAN		SPECIFICATION :	
				SYSTEM	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	VOLUME III REMARKS
SHEET 8 OF 9		CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	
1	2	3	4	5	6	7	8	9	10
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC CLAUSE 8.1.2	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	1 \$ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	1 \$ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	1 -
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	1 * REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	1 \$ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	1 \$ NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	1 \$ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	- 1 TC FROM AN INDEPENDENT LABORATORY ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR.
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	1 SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY \$ NOTE - 2
BHEL		PARTICULARS			BIDDER/VENDOR				
		NAME							
		SIGNATURE							
		DATE							
					BIDDER/S VENDORS COMPANY SEAL				

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
(TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT TITLE		1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :									
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03				SPECIFICATION : TITLE									
SHEET 9 OF 9				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)				VOLUME III									
COMPONENT/OPERATION		CHARACTERISTIC (CHECK		CAT.		REFERENCE DOCUMENT		ACCEPTANCE NORM		SECTION AGENCY									
				TYPE/ METHOD OF CHECK		EXTENT OF CHECK		FORMAT OF RECORD		P W V									
SL. NO.		3		4		5		6		7									
2		3		4		5		6		7									
1		3		4		5		6		7									
										10									
										11									
NOTES: 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE. THESE TEST MAY NOT BE REPEATED FOR FIRST NUMERAL OF IP-XX. SECOND NUMERAL TEST SHALL BE CARRIED OUT ON ONE MOTOR OF EACH TYPE & RATING. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY																			
BHEL <table><tr><td>PARTICULARS</td><td>BIDDER/VENDOR</td></tr><tr><td>NAME</td><td></td></tr><tr><td>SIGNATURE</td><td></td></tr><tr><td>DATE</td><td></td></tr></table> BIDDER'S/VENDORS COMPANY SEAL												PARTICULARS	BIDDER/VENDOR	NAME		SIGNATURE		DATE	
PARTICULARS	BIDDER/VENDOR																		
NAME																			
SIGNATURE																			
DATE																			

PEM :: C&I भारतीय भेल		STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER										QUALITY PLAN NO.: PE-QP-999-145-1036				
												VOLUME IIB				
												SECTION D				
												REV. NO. 01		DATE: 24.08.2007		
												SHEET 1		OF 8		
Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks				
									P	W	V					
1.0	Materials /Components															
1.1	Panels & Control Desks	Physical Inspection for Dimensions, Painting, Cutouts, Lifting / Locking Arrangements, Components, Drawing Pocket, Mounting accessories, Plinth & AV Pads, Cable Gland Plates, Hardwares, Hinges, Louvers & Filters, Fans & Panel Lamps	MA	Visual	100%	Contract specifications, Approved GA Drawings, BOQ	As per ref documents. No physical damage.	BHEL Quality Inspection Report.	3/2	2	1					
1.2	Power Supply/Packs, Battery charger, Transformer, UPS.	Physical Inspection Physical Damages Dimensions Mounting Accessories	MA	Visual	100%	Contract specifications, BOQ.	As per reference documents, Test Report	BHEL Quality Inspection Report.	3/2	2	1					
1.3	Indicating Lamp, Annunciator, Meters, Transducers, Signal Converters, Instruments, Single Loop Controllers	Physical Verification Physical Damages Dimensions Accessories	MA	Visual	100%	Contract specifications, BOQ.	As per ref documents No physical damage. Test/ Calibration report.	BHEL Quality Inspection Report	3/2	2	1					
1.4	PLC processors, I/O modules, Power Supply modules, Communication modules, Mounting Racks, Ethernet	Physical Inspection - Identification Labels - Physical Damages - Quantity - Spare Capacity	MA	Visual	100%	Product Catalogue, Data sheets, Approved Configuration diagram, BOQ	As per ref documents. Test Certificates	BHEL Quality Inspection Report.	3/2	2	1					

LEGEND: * CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

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

1 - BHEL
2 - Vendor
3 - Sub-vendor

भेल PEM :: C&I		STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER										QUALITY PLAN NO.: PE-QP-999-145-1036 _____						
												VOLUME IIB						
												SECTION D						
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												SHEET 2		OF 8				
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks						
									P	W	V							
1.5	CPU, Monitor, Keyboard, Mouse, CD Drives, Printers, OS, System Software, Engineering software in the form of Licensed CD.	Physical Inspection Identification Labels, Tech. Specification Physical Damages Accessories Installation arrangements for Computers & Printers	MA	Visual	100%	Contract specifications, Product Catalogue, Approved GA / Configuration drawing, BOQ.	As per reference documents.	BHEL Quality Inspection Report.	3/2	2	1							

LEGEND: * CR		- Critical characteristics		\$		P		- Agency Performing the Test.		1		- BHEL	
MA		- Major characteristics		W		W		- Agency Witnessing the Test.		2		- Vendor	
MI		- Minor characteristics		V		V		- Agency Verifying the Test.		3		- Sub-vendor	

STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER

PEM :: C&I

QUALITY PLAN NO: PE-QP-999-145-1036

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[illegible][illegible]

LEGEND:

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

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

1 - BHEL
2 - Vendor
3 - Sub-vendor

80363/2020/PS-PEM-MAX

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
(TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)

03/2020/PS-PEM-MAX

PEM :: C&I STANDARD QUALITY PLAN FOR PROGRAMMABLE LOGIC CONTROLLER QUALITY PLAN NO.: PE-QP-999-145-1036															
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		SHEET		4		OF		8							
		Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
											P	W	V		
3.0	Factory Acceptance Test (FAT)														
3.1	Input Output Functional Verification	I/O configuration, I/O operation	MA	Visual/ Eletrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2	1	1				
3.2	Processor Verification	Processor configuration, Powering up, standby operation (as applicable) and Loading	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2	1	1				
3.3	Power Supply Module Verification	Redundancy Operation	MA	Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2	1	1				
3.4	Communication System Verification	Redundancy operation of Communication System, Measurement of Response Time, Communication with third party system	MA	Electrical	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2	1	1				
3.5	Diagnostic Verification	Self Diagnostic features of PLC system	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2	1	1				
3.6	Control Panel/Desk Verification	Operation of PLC driven annunciation system, Mosaic, Push buttons & selector switches, Indicating lamps	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2	1	1				
3.7	Software Verification	(i) Control Logics (ii) Engineering Features (iii) HMI Features	MA	Visual	100%	FAT Procedure	AS per FAT	BHEL Quality Inspection Report.	2	1	1				

LEGEND: * CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

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

1 - BHEL
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FACTORY ACCEPTANCE TEST (FAT) PROCEDURE

This document covers procedure to conduct/witness PLC system functional tests in order to demonstrate conformity to purchase specifications and related engineering documents. The test shall be conducted at the system suppliers works. The system supplier shall conduct all functional tests before commencing FAT and test results shall be made available during FAT. Vendor must furnish following relevant drawings, duly approved by BHEL Engineering, for reference during FAT.

- a) Technical Specification of PLC.
- b) PLC System Configuration
- c) General Assembly Drawings.
- d) Panel Wiring Diagrams.
- e) Bill of Quantity for PLC System.
- f) Logic Diagram.
- g) HMI Schematics.
- h) Input / Output List.

Further the vendor shall furnish applicable product specification, datasheets, catalogues, test-certificates, and internal inspection records to enable FAT. Vendor shall also submit, [to the inspecting agency](#), his standard test procedure, for clauses given below; where vendor's standard practice has been referred.

APPLICABLE TEST PROCEDURE:

1. Input/Output Functional Verification.

Check for correctness of addressing of racks, slots and I/O modules as per applicable PLC configuration diagram. Appropriate signal generators shall be used to simulate Inputs and outputs to check operation and SCAN time. [Check online replacement of cards, processors, power supply etc.](#)

2. Processor Verification

PLC Configuration drawing to be referred for ascertaining

- i) Redundancy

80363/2020/PS-PEM-MAX**TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT****(TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)**

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ii) Type (Hot or Cold)

Both the processors are to be checked for healthiness in case of redundant configuration as per vendor's standard practice. In case of hot redundancy, switchover of control from primary processor to standby processor shall be demonstrated for uninterrupted control and data processing as per vendor's standard practice. Switchover shall be witnessed, by manual power off or resetting the Primary CPU or simulating failure of primary processor. Checking should be by witnessing the lighting up of Processor's LEDs as per manufacturer's product standard.

Vendor shall demonstrate, as per Vendor's standard practice, adequate Loading (Spare Capacity) of Processors, as mentioned in contract specs. This shall be done, by simulating worst load operation of fully integrated PLC system.

3. Power Supply Module Verification

Check if PSM is in redundant mode as per specification. Check the healthiness of power supply from both the modules' lamp indication/measurement. Simulate failure of one PSM and verify that standby PSM has taken over without any interruption.

4. Communication System Verification

Communication system has to be in line with approved PLC Configuration Diagram. Verify that both the communication buses are intact and connected. Communication between PLC processors, I/O rack, OWS etc. is to be checked through simulation of input data. Simulate the bus failure by disconnection of working bus. Check that the communication continues without interruption or loss of data.

Following response times are to be demonstrated as per vendor's standard practice for conformance to contract specifications:

1. Screen update time
2. I/O scan time
3. SOE resolution time
4. Data transfer time with third party system using Communication Protocol as per Contract specification and as per quantum of data as per approved signal exchange list.

5. Diagnostic Verification

Product Catalogue/Literature shall be referred for checking of all diagnostic features. Hardware failure to be simulated by removing an I/O

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6. Control Panel /Desk Verification

- i) PLC driven annunciation system should be checked by alarm signal simulation.
- ii) Push Button and selector switch operation should be checked by verification of corresponding change of status of Data Base point.
- iii) Indicating lamp / MIMIC should be checked by corresponding Data Base point simulation.

7. Software Verification

- i). Control Logics:– Software switches, lamps and Analog sources shall be used for simulation of field conditions .Control logics shall be checked for its correct functionality as per approved logic schemes
- ii). Engineering features:-
 - a) Online changing of parameters, set points.
 - b) Online modification in Control Logic Diagrams.
 - c) Online configuration of Graphics, Trends, Logs, HSR.
- iii). HMI features:-
Check for configuration & operation of Graphics, Trends, Logs, HSR and Alarms, in the form of Displays and Printouts, by simulation of Inputs as per approved documents.

8. Burn in Elevated Temperature test

Electronic equipments shall be subjected to Burn in elevated temperature test as per the procedure detailed below:

- a) (i) PLC modules are kept at 50 Deg c under continuous energized condition for 48 hours.

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ii) 48 hours test period shall be divided into 4 equal time segment of 12 hours duration each. For every 12 hours duration segment, after lapse of first 11 hours 110% of nominal voltage shall be applied to the panel under test for a period of 30 minutes followed by application of 90% of nominal voltage for the next 30 minutes.

b) Assembled Panels with complete wiring shall be kept under continuous energized condition for 120 hours at ambient temperature. Temperature rise in panels should be below 10 Deg C above ambient.

**TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
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Checklist for Serial Communication between maxDNA Systems and Foreign Device :BHEL

A Device Specific :

SN	Parameters	Options available	Remarks if any
1	Modle No.& Make of Device		
2	Communications Link Options	☐ Multidrop ☐ Peer to Peer ☐ N/w topology attached	
3	Protocol Mode (Device is a)	☐ Master ☐ Slave ☐ Master/Slave	
4	Protocol	☐ RTU ☐ ASCII ☐ Other -----	
5	Master	☐ System maxDNA ☐ Other -----	
6	Dist.bet.maxDNA System & Device*	☐ ----- Feet ☐ ----- Meters	

B Electrical Specific :

1	Interface Type	☐ RS232 ☐ RS422 ☐ RS485	
2	Wiring at Device end	☐ 2 Wire ☐ 4 Wire	
3	Transmission Channel	☐ Half Duplex ☐ Full Duplex	
4	Baud Rates (bps)	☐ 1200 ☐ 2400 ☐ 4800 ☐ 9600 ☐ 19200	
5	Databits	☐ 8 ☐ 7	
6	Stopbits	☐ 1 ☐ 2	
7	Parity	☐ None ☐ Odd ☐ Even	
8	H/w & Software Handshake	☐ Yes ☐ No	
9	Response Timeout time (Sec)	☐ ----- ☐ Configurable timeout	
10	Data Formats Supported	☐ Boolean ☐ Real ☐ Char ☐ Sn.Int ☐ UnSn.Int	
11	Transmission mode	☐ Asynchronous ☐ Synchronous	

C Application Specific : *

1	Primary Function*	☐ Data Acquisition ☐ Data Acquisition & Control	
		☐ Download parameter sets	
2	Analog Points to read	-----Nos. ☐ Details attached ☐ Details not attached	
3	Analog Points to write	-----Nos. ☐ Details attached ☐ Details not attached	
4	Digital Points to read	-----Nos. ☐ Details attached ☐ Details not attached	
5	Digital Points to write	-----Nos. ☐ Details attached ☐ Details not attached	
6	Memory / Flag Points to read	-----Nos. ☐ Details attached ☐ Details not attached	
7	Memory / Flag Points to write	-----Nos. ☐ Details attached ☐ Details not attached	

D Hardware Specific :

1	Cable type	☐ Boolean cable ☐ Twisted pair cable	
2	Cable Details Enclosed	☐ Yes ☐ No	
3	Any specific Converter required	☐ Yes ☐ No ☐ Details enclosed	

E Device Documents :

1	Manufacturer's Documents*	☐ Tech., Spec. ☐ Operating Manual	

***Notes:**

A6 To identify converter requirement and cable length.

C The sr.no.1 to 7 are reqd.to be furnished for interface impl. :such as Tagname,Description,point type, modbus(Register) address,EU,range & device (slave) address

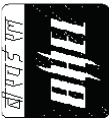
C1 What is the primary purpose of the communications link?

E1 Reqd. Contents : This document must provide an overview of the device including its intended use(a general technical,communication & electrical details)

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
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Format for vendor to furnish signal
Exchange list between DCS-PLC

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												SHEET		1		OF	
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks					
1.0	INCOMING Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	3	---	2						
		2. Bend Test	CR	Mech. test	Sample	IS:1079 IS:513	IS:1079 IS:513	Log Book	2	---	---						
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---						
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---						
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	---						
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	---	1					
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	IS:2062	IS:2062	Log Book	2	---	---						
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---						
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	---	---						
		4. Mill marking	MA	Visual	100%	IS:2062	IS:2062	Log Book	2	---	---	1					
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---						
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---						
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics \$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor																	

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-1056							
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks					
									P	W	V						
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc.	3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Electrical Measurement Visual	100% 100% 100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---	---					
		4. Type / Routine Test Certificates	MA	Verification	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	3	---	---	2					
		1. Verification at make and Type	CR	Visual	Sample	BHEL Spec. and BOM	BHEL Spec. and BOM	Log Book	2	---	---	---					
		2. Verification of Test Certificates	CR	Scrutiny of Type / Routine T.Cs.	100%	Relevant IS	Relevant IS	Log Book	2	---	---	---					
		3. Operation / Functional check	CR	Electrical	Sample+ 100%@	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	---	+ for relay & contactors only				
		4. I.R.	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	---	@ for all components except relays & contactors.				
		5. H.V.	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	---					
		6. Calibration	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	1					
		7. Pick up / Drop off Voltage	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	---					
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									P	W	V				
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make 2. Surface defects 3. IR / HV on Terminal Blocks	MA MA MA	Visual Visual Electrical	Sample Sample Sample	BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue	Log Book Log Book Log Book	2 2 2	--- --- ---	--- --- ---				
6.0	IN PROCESS Blanking / Bending / Forming	1. Dimensions 2. Surface defects after bending	MI MA	Measurement Visual	100% 100%	Approved Mfr. drgs. Factory Standard	Approved Mfr. drgs. Factory Standard	Log Book Log Book	2 2	--- ---	--- ---				
7.0	Nibbling / Punching	1. Cutout Sizes 2. Deburring	MI MA	Measurement Visual	100% 100%	Approved Mfr. drgs. Approved Mfr. drgs.	Approved Mfr. drgs. Approved Mfr. drgs.	Log Book Log Book	2 2	--- ---	--- ---				
8.0	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions 2. Alignment 3. Welding Quality 4. Surface defects	MA MA MA MA	Measurement Measurement Visual Visual	100% 100% 100% 100%	Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards	Log Book Log Book Log Book Log Book	2 2 2 2	--- --- --- ---	2 2 2 2				
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks					
									P	W	V						
9.0	Pre-treatment and Painting	1. Pretreatment Process 2. Process parameters like bath temp. concentration etc. 3. Dipping / Removal Time 4. Surface quality after every dip 5. Primer after phosphating 6. Putty Application & Rubbing after primer 7. Paint first coat 8. Putty Application and Rubbing after first coat of paint 9. Paint second coat	MA MA MA MA MA MA MA	Visual Measurement Measurement Visual Visual, Thickness Visual Visual, Thickness Visual Visual, Thickness, Scratch test Colour adhesion	100% Periodic 100% 100% 100% 100% 100% 100%	Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005	Log Book Log Book Log Book Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2 2 2 2	--- --- --- --- --- --- --- ---	1 1 1 1 1 1 1 1							
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TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
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प्री प्रो. सं. १११ BHEL PEM :: C&I STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL		STD QUALITY PLAN NO.: PE-QP-999-145-1056										
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
10.	Panel Wiring	1. Wiring Layout 2. Wiring Termination (Crimped Lugs) 3. Ferrule numbers 4. Colour of wiring 5. Size of Conductor	MA MA MA MA MA	Visual Visual Visual Visual Measurement	100% 100% 100% 100% 100%	Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs.	Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs.	Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2	--- --- --- --- ---	--- --- --- 1 1	
11.	Component Mounting	1. Correct components 2. Fixing	MA MA	Visual Visual	100% 100%	Approved drgs., Specs. & BOM Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM Approved drgs., Specs. & BOM	Log Book Log Book	2 2	--- ---	--- ---	
12.	FINAL Final Inspection	1. Workmanship 2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components 3. Components identification Marking / Name plates	MA MA MA	Visual Visual Visual	100% 100% 100%	Factory Standard BHEL approved drg. / Spec. BHEL approved drg. / Spec.	Factory Standard BHEL approved drg. / Spec. BHEL approved drg. / Spec.	Inspection Report Inspection Report Inspection Report	2 2 2	1 1 1	1 1 1	At Random by BHEL, based on 100 % internal test reports by Mfr.
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									P	W	V						
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.					
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1						
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1						
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1						
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1						
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1						
		11. Wire Termination	MA	Pulling manually	Sample	----	Firm termination	Inspection Report	2	1	1						
		12. Continuity	MA	Electrical	100%	----	Continuity OK	Inspection Report	2	1	1						
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics												\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.				1 - BHEL 2 - Vendor 3 - Sub-vendor	

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
(TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)

प्री एंड ई BHEL PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL							STD QUALITY PLAN NO.: PE-QP-999-145-I056				
									VOLUME IIB				
									SECTION D				
									REV. NO. 01 DATE: 22-02-2008				
									SHEET 7 OF 7				
Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
									P	W	V		
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	Type Test Certificate	3	---	1		
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant IS.	BHEL approved spec., drg., BOM & relevant IS.	Test Report	2	1	1		
15	FUNCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1		
		2. Instrument Calibration	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1		
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant IS.	BHEL approved spec/drg & relevant IS.	Inspection Report	2	1	1		

LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics		\$	P W V	- Agency Performing the Test. - Agency Witnessing the Test. - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor
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80363/2020/PS-PEM-MAX



TITLE :

1X660 MW BHUSAWAL TPS, UNIT # 6

SPECIFICATION NO. PE-TS-415-174-A001

SECTION : I

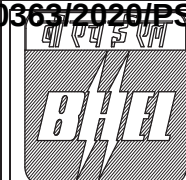
TECHNICAL SPECIFICATION FOR OZONE
GENERATION PLANT

SUB-SECTION: IA

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ANNEXURE II: SUB VENDORS

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TITLE :

1X660 MW BHUSAWAL TPS, UNIT # 6

SPECIFICATION NO. PE-TS-415-174-A001

SECTION : I

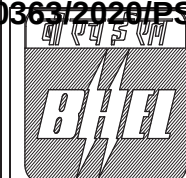
TECHNICAL SPECIFICATION FOR OZONE
GENERATION PLANT

SUB-SECTION: IA

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SL NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	OIL FREE SCREW COMPRESSOR	ATLAS COPCO	PUNE	
		KOBELCO (KPC)	PUNE	
		ELGI	COIMBTORRE	
		INGERSOLL RAND	AHMADABAD	
2.	AIR RELEASE VALVES	H.SARKER & COMPANY		
		LEADER VALVES LTD.		
		R&D MULTIPLES (METAL CAST) PVT. LTD.		
		A.V. VALVES LIMITED		
		G.M.DALUI & SONS PVT.LTD.		
3.	MS ROD FOR BELOW GROUND EARTHING	STEEL AUTHORITY OF INDIA LIMITED		
		RASHTRIYA ISPAT NIGAM LIMITED		
4.	CHAIN PULLEY BLOCK	BRADY & MORRIS ENGINEERING CO. LTD.	AHMEDABAD	
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 10 TONNE.
		TRACTEL TIRFOR INDIA PVT. LTD.	FARIDABAD	
		TECHNO INDUSTRIES	AHMEDABAD	
		UNIVERSAL HOIST-O-FABRIK	THANE	
5.	ELECTRIC HOISTS	ALPHA SERVICES	BHIWADI	
		BRADY & MORRIS ENGINEERING CO. LTD.	AHMEDABAD	
		CONSOLIDATED HOISTS PVT LTD	PUNE	
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		EDDY CRANES PVT. LTD.	MUMBAI	
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD	
		GLOBAL TECHNOLOGIES	HYDERABAD	
		MANGLA HOISTS PVT LTD	NEW DELHI	
		MEEKA MACHINERY PVT. LTD.	AHMEDABAD	
		REVA INDUSTRIES LTD.	FARIDABAD	UPTO 25.0 T CAPACITY.
		ROCKWELL HOISTO CRANES PVT. LTD.	BAHADURGAR H	
		SAFEX ENERGY PVT. LTD.	AHMEDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 15 TONNES.
		TECHNO INDUSTRIES	AHMEDABAD	
		UNIVERSAL HOIST-O-FABRIK	THANE	
6.	BALL VALVES	AKAY INDUSTRIES PVT.LTD.		
		FLOW CHEM INDUSTRIES		
		FISHER SANMAR LIMITED		
		KIRLOSKAR BROS. LTD.		

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TITLE :

1X660 MW BHUSAWAL TPS, UNIT # 6

SPECIFICATION NO. PE-TS-415-174-A001

SECTION : I

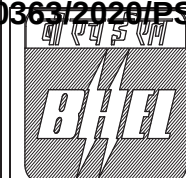
TECHNICAL SPECIFICATION FOR OZONE
GENERATION PLANT

SUB-SECTION: IA

REV. NO. 00

SL NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		LEADER VALVES LTD.		
		KSB PUMPS LTD.		
		MICROFINISH VALVES PVT LTD.		
		MICON VALVES (INDIA) PVT.LTD		
		PEC VALVES PVT.LTD.		
		VIRGO ENGINEERS LTD.		
		A.V. VALVES LIMITED		
		FLUIDLINE VALVES COMPANY PRIVATE MUMBAI		
		STEELSTRONG VALVES (I) PVT.LTD.,MUMBAI		
		B.D.K. ENGINEERING INDUSTRIES LTD.		
		SURYA VALVES &INSTRUMENTS MANUFACTURING COMPANY, CHENNAI		
		VAL TECH INDUSTRIES ,MUMBAI		
		FEDERAL HARDWARE ENGINEERING CO PTE LTD., SINGAPORE		
		CRESCENT VALVES MFG. CO. PVT. LTD.		
7.	CONTROL VALVE	DEZURIK -COPES VULCAN LTD., U.K		
		CONTROL COMPONENT INC., USA		
		DRESSER VALVE INDIA PVT. LTD UP TO 45KSC ONLY		
		FOURESS ENGG.INDIA LTD.UP TO 45KSC ONLY		
		FISHER SANMAR LTD		
		INSTRUMENTATION LTD. UP TO 45KSC ONLY		
		MIL. CONTROLS LTD.		
8.	STEEL GATE /GLOBE/NRV VALVES	A.V. VALVES LTD		
		NITON VALVE INDUSTRIES PRIVATE LTD		
		WEIR VALVES & CONTROLS M.E.		
		BABCOCK BORSIG ESPANA, S.A.		
		B.D.K. ENGINEERING INDUSTRIES LTD.		
		KIRLOSKAR BROTHERS LTD.		
		LEADER VALVES LTD.		
		KSB PUMPS LTD.		
		MICON VALVES (INDIA) PVT. LTD		
		OSWAL INDUSTRIES LTD.		
		PETROL VALVES S.R.L. ITALY		
		FOURESS ENGG. INDIA LTD.		
		FLUIDLINE VALVES COMPANY PRIVATE LTD., MUMBAI		
		STEEL STRONG VALVES (I) PVT. LTD., MUMBAI		
		VALTECH INDUSTRIES ,MUMBAI		
		SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY, CHENNAI		
		FEDERAL HARDWARE ENGINEERING CO PTE LTD.,SINGAPORE		
		CRESCENT VALVES MFG. CO. PVT.		

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1X660 MW BHUSAWAL TPS, UNIT # 6

SPECIFICATION NO. PE-TS-415-174-A001

SECTION : I

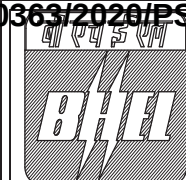
TECHNICAL SPECIFICATION FOR OZONE
GENERATION PLANT

SUB-SECTION: IA

REV. NO. 00

SL NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		LTD.		
9.	CAST IRON/ GATE/GLOBE/NRV/SAFE TY RELIEF VALVES	A.V. VALVES LTD H.SARKER & COMPANY G.M. DALUI & SONS PVT. LTD. KIRLOSKAR BROS. LTD. LEADER VALVES LTD. MICON VALVES (INDIA) PVT. LTD FLUIDLINE VALVES COMPANY PRIVATE FEDERAL HARDWARE ENGINEERING CO PTE LTD., SINGAPORE CRESCENT VALVES MFG. CO. PVT. LTD. SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY, CHENNAI		
10.	BF VALVES (WATER SERVICE)	ADVANCE VALVES PVT. LTD B.D.K. ENGINEERING INDUSTRIES LTD. INTER VALVE (INDIA) LTD. FOURESS ENGG. INDIA LTD. INSTRUMENTATION LTD. LARSEN & TOUBRO LTD. KIRLOSKAR BROS. LTD. MICON VALVES (INDIA) PVT. LTD R&D MULTIPLES (METAL CAST) PVT. LTD. SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY, CHENNAI STAFFORD CONTROLS LIMITED, PUNE FLUIDLINE VALVES COMPANY PRIVATE LTD., MUMBAI TYCO VALVES & CONTROLS INDIA PVT.LTD.,HALOL		
11.	A/C SYSTEM	ABB,LTD. BLUE STAR LTD. VOLTAS LTD.		
12.	VENTILATION SYSTEM	ASEA BROWN BOVERI LTD. ALSTOM LTD. BLUE STAR LTD. HYDERABAD POLLUTION CONTROLS LTD. VOLTAS LTD. C. DOCTOR & CO. PVT. LTD.		
13.	FLOW ELEMENT	ENGINEERING SPECIALTIES PRIVATE LTD INSTRUMENTATION LTD. MICRO PRECISION PRODUCTS STAR-MECH CONTROLS (I) PVT.LTD		

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1X660 MW BHUSAWAL TPS, UNIT # 6

SPECIFICATION NO. PE-TS-415-174-A001

SECTION : I

TECHNICAL SPECIFICATION FOR OZONE
GENERATION PLANT

SUB-SECTION: IA

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SL NO.	ITEM	SUPPLIERS	PLACE	REMARKS
14.	PUMPS (HORIZONTAL)	BEST & CROMPTON ENGG. LTD.		
		FLOWMORE LTD.		
		JYOTI LTD.		
		KIRLOSKAR BROS. LTD.		
		MATHER & PLAN PUMPS LTD.		
		KSB PUMPS LTD.		
		SULZER PUMPS INDIA LTD.		
		WPIL LIMITED		
		SAM TURBO INDUSTRY LTD.		
15.	ROTAMETER	CHEMTROLS SAMIL (INDIA) PVT. LTD., MUMBAI		
16.	DIAPHRAGM VALVE	BDK VALVES –HUBLI		
		CRANE FLOW PROCESS-SATARA		
17.	CHECK VALVES (FLAT TYPE SIZE UPTO 50 NB)	B BDK VALVES –HUBLI		
		H SARKAR-HOWRAH		
		LEADER-JALANDHAR		
		MAJESTIC WORKS, MUMBAI		
18.	DUAL PLATE NON RETURN VALVES (SS & CI UPTO 100 NB CLASS 150)	ADVANCE VALVES-NOIDA		
		R&D MULTIPLES-VALSAD		
		B BDK VALVES –HUBLI		
19.	SOLENOID VALVES	ROTEX AUTOMATION-BARODA		
		ASCO - CHENNAI		
20.	Y-TYPE STRAINER	OTOKLIN-MUMBAI		
		GRAND PRIX-NEW DELHI		
		JAYPEE-NEW DELHI		
		GREAVES COTTON-MUMBAI		
		MULTITEX- NEW DELHI		
21.	MS PIPES (IS: 1239 & 3589)	SAIL-ROUR KELA		
		JINDAL (UPTO 350 NB)-GHAZIABAD		
		TISCO (UPTO 150 NB)-JAMSHEDPUR		
		MSL (FOR IS 3589-200 NB TO 500 NB)-RAIGAD		
22.	MS PLATES	SAIL		
23.	AGITATOR/STIRRER	FIBRE & FIBRE	MUMBAI	
24.	FITTINGS	BHARAT FORGE	PUNE	
		RELIANCE FORGE	PUNE	
25.	FLANGES	BHARAT FORGE	PUNE	
		RELIANCE FORGE	PUNE	
26.	220V DC LEAD ACID BATTERIES (TUBULAR AND PLANTE)	EXIDE INDUSTRIES LTD		
		HBL NIFE POWER SYSTEMS LTD.		

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SPECIFICATION NO. PE-TS-415-174-A001

SECTION : I

TECHNICAL SPECIFICATION FOR OZONE
GENERATION PLANT

SUB-SECTION: IA

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SL NO.	ITEM	SUPPLIERS	PLACE	REMARKS
27.	PAINT	ASIAN PAINTS (I) LTD.		
		BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
		(b)	FLUID TECHNOLOGIES, NAGPUR
3.7	DEBRIS FILTER	(a)	M/S. TAPROGGE, GERMANY
		(b)	M/S. EIMCO WATER TECHNOLOGIES, USA
		(c)	M/S. CLUMPS & KOLLER, GERMANY
		(d)	M/S. BGR ENERGY LTD., CHENNAI
4.0	ETP ITEMS, a. TPI & API Separators, b. Filter Press	(a)	K-PACK SYSTEMS
		(b)	ISHA ENGINEERS & CO.
5.0	OIL HANDLING PLANT	(a)	RAUNAK INTERNATIONAL
		(b)	TECHNO ELECTRIC
		(c)	UNITECH MACHINES
		(d)	BRIDGE & ROOF
6.0	VERTICAL TURBINE PUMPS	(a)	KIRLOSKAR BROTHERS LTD. (KBL)
		(b)	MATHER & PLATT
		(c)	WPIL
		(d)	JYOTI PUMPS
		(e)	FLOWMORE
		(f)	SAM
7.0	HORIZONTAL CENTRIFUGAL PUMPS	(a)	KBL
		(b)	KSB PUMPS
		(c)	MATHER & PLATT
		(d)	SAM TURBO
		(e)	WPIL
		(f)	JYOTI PUMPS
		(g)	FLOWMORE

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
		(h)	SULZER
		(i)	KISHOR PUMPS
8.0	METERING/DOSING PUMPS	(a)	MILTON ROY INDIA (P) LTD.
		(b)	V.K. PUMPS
		(c)	SHAPO TOOLS
9.0	SUMP PUMP	(a)	KIRLOSKAR BROTHERS LTD. (KBL)
		(b)	SAM
		(c)	KISHOR PUMPS
		(d)	FLOW MORE
		(e)	KSB
		(f)	VARTAK PUMPS
		(g)	MAXFLOW
10.0	FUEL OIL PUMPS	(a)	TUSHACO
		(b)	ALKETON, MADRAS
		(c)	PSI ENGINEERING
		(d)	ROTO PUMPS
		(e)	BOURNMEN, GERMANY
		(f)	DELTA CORPORATION
		(g)	ALL WEILER, GERMANY
		(h)	TMO, SWEDEN
11.0	AIR BLOWER (LOBE TYPE)	(a)	EVEREST TRANSMISSION
		(b)	KAY ENGG. WORKS
		(c)	SWAMP PNEUMATICS
		(d)	ROOTS
12.0	BUTTERFLY VALVES	(a)	KIRLOSKAR BROTHERS LTD.

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
	(MANUAL/PNEUMATIC)	(b)	FOURESS
		(c)	L & T
		(d)	INTERVALVE (INDIA) LTD
		(e)	R&D MULTIPLES
		(f)	AUDCO
		(g)	INSTRUMENTATION LTD
		(h)	HAWA VALVES
		(i)	VENUS PUMPS & ENGINEERING WORKS
		(j)	BHEL
		(k)	FLOW VEL
		(l)	LEADER VALVES
13.0	RUBBER EXPANSION JOINT	(a)	D'WAREN & CO
		(b)	S.L. MANEKLAL
		(c)	SRM EXOFLEX PVT LTD
		(d)	CORI ENGINEERS
14.0	STRAINERS	(a)	SPIRAX MARSHALL
		(b)	MICON VALVES (I) PVT. LTD.
		(c)	FLOWTECH ENGINEERS
		(d)	FOURESS LTD.
		(e)	KSB LTD.
		(f)	L & T
		(g)	LEADER
		(h)	PROCEDYNE ENGINEERS
15.0	CAST IRON VALVE (GATE /GLOBE/CHECK/AIR RELEASE VALVE)	(a)	LEADER VALVE
		(b)	VENUS PUMP

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
		(c)	FOURESS
		(d)	LEVCON
		(e)	DURGA ENGG CO.
		(f)	L & T
		(g)	R & D MULTIPLES
		(h)	FLUIDLINE VALVES CO PVT LTD
		(i)	INTER VALVE (INDIA) LTD
		(j)	NSSL LIMITED
16.0	CAST STEEL VALVES (GATE/GLOBE/CHECK/ BALL VALVE)	(a)	L & T
		(b)	KIRLOSKAR BROS. LTD
		(c)	CRESENT VALVES
		(d)	AUDCO
		(e)	KSB
		(f)	LEVCON
		(g)	FOURESS
		(h)	R & D MULTIPLES
		(i)	FLUIDLINE VALVES
		(j)	NSSL LIMITED
		(k)	VENUS PUMP
		(l)	DURGA ENGG CO.
		(m)	HAWA VALVES
		(n)	A.V.VALVES
17.0	STAINLESS STEEL (GATE/GLOBE/CHECK VALVE)	(a)	CRESCENT
		(b)	FOURESS
		(c)	R & D MULTIPLES

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
18.0	GUN METAL/BRASS/ BRONZE VALVES	(a)	LEADER VALVES
		(b)	SARKAR
		(c)	LEVCON
		(d)	BOMBAY METAL & ALLOYS
		(e)	SANT ENGG
		(f)	BANKIM & COMP.
		(g)	BDK
19.0	FORGED STEEL VALVE	(a)	FOURESS LIMITED
		(b)	KSB LIMITED
		(c)	L & T
		(d)	BANKIM
		(e)	BDK VALVES
		(f)	LEADER
		(g)	A.V.ENGG
		(h)	CRESCENT
		(i)	BHEL
20.0	L.D. PIPING	(a)	SETH & SURA ENGG. CO. LTD.
		(b)	IVCRL
		(c)	RAUNAQ
		(d)	ZUBERI
		(e)	INDIAN HUME PIPES LTD
		(f)	DYNAMIC SS ENGG PVT LTD
21.0	L.P.PIPING	(a)	UNITECH MACHINES, NEW DELHI
		(b)	AARTI INFRASTRUCTURE, NAGPUR
		(c)	ZUBERI, JAIPUR

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
		(d)	SETH & SURA ENGG.CO. LTD
22.0	DIESEL ENGINES	(a)	KIRLOSKAR CUMMINS
		(b)	GREAVES COTTON
		(c)	ASHOK LEYLAND
23.0	FLANGES & FITTINGS	(a)	ALLIANCE
		(b)	JYOTI
		(c)	EBY
24.0	AIR DRYING UNIT (Refrigerant Type)	(a)	DONALDSON
		(b)	SABRO
25.0	<u>EOT CRANE</u>		
25.1	EOT CRANE (More than 100 Ton)	(a)	UNIQUE IND. HANDLERS
		(b)	ANUPAM INDUSTRIES
		(c)	MUKAND
		(d)	WMI
		(e)	FAFECO
		(f)	CENTURY CRANE ENGINEERS (P) LTD.
25.2	EOT CRANE (Less than 100 T)	(a)	UNIQUE INDUSTRIAL HANDLERS
		(b)	ANUPAM INDUSTRIES
		(c)	MUKAND
		(d)	FAFECO
		(e)	TURBO FUEGUSON
		(f)	WMI
		(g)	CONSOLIDATED HOIST
		(h)	HERCULES
		(i)	ELECON

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
		(j)	HASK ENGINEERS
		(k)	BRADY & MORRIS ENGG. CO. LTD.
		(l)	McNALLY BHARAT KOLKATA
		(m)	SHREE ENGINEERS
		(n)	CENTURY CRANE ENGINEERS (P) LTD.
26.0	MANUAL HOIST & CHAIN PULLEY BLOCK	(a)	TRACTEL TRIFOR INDIA (P) LTD.
		(b)	LIFTING EQUIPMENT & ACCESSORIES
		(c)	INDEF (HERCULES)
		(d)	BATLIBOI
		(e)	UNIVERSAL
		(f)	ABHAY INDUSTRIES
27.0	ELECTRICAL HOIST	(a)	BATLIBOI
		(b)	PBL
		(c)	GREAVES
		(d)	HOISTOMECH
		(e)	SHREE ENGINEERS
		(f)	ABHAY INDUSTRIES
		(g)	INDEF
		(h)	UNIVERSAL
		(i)	SWIFT
		(j)	TRACTEL TRIFOR INDIA (P) LTD.
		(k)	CENTURY CRANE ENGINEERS (P) LTD.
		(l)	HERCULES HOISTS LIMITED
28.0	PAINTINGS	(a)	ASIAN PAINTS (I) LTD.
		(b)	BERGER PAINTS INDIA LTD.

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
		(c)	SHALIMAR PAINTS LTD.
		(d)	NEROLAC
		(e)	JHONSON & NICHOLSON
29.0	ANTI COROSSIVE COAL TAR COATING	(a)	IWL LTD
		(b)	A.R.LAMINATORS
30.0	FABRICATED MS STEEL TANK	(a)	SEAM INDUSTRIES
		(b)	ENESTEE ENGG LTD
		(c)	ERA BUILDING SYSTEM
		(d)	DIAMOND FABRICATORS (I) PVT LTD
		(e)	THERMO SYSTEMS PVT LTD
		(f)	TECHNOFAB ENGG LTD
		(g)	RATANMANI TUBES AND METALS
31.0	WELDING FLUX & FILLER WIRE	(a)	PRECISION WELD ARC LTD
		(b)	S. CHEM & ALLIED PRODUCTS PVT LTD.
32.0	<u>FIRE DETECTION & PROTECTION SYSTEM</u>		
		(a)	TYCO
		(b)	HITECH ENGINEERING SERVICES
33.0	<u>FIRE DETECTION & PROTECTION SYSTEM EQUIPMENTS</u>		
33.1	PUMPS	(a)	KBL
		(b)	MATHER & PLATT
		(c)	FLOW MORE
33.2	HIGH VELOCITY NOZZLES	(a)	PREUSSAGE (WEST JRMANY)
		(b)	H D FIRE
33.3	MEDIUM VELOCITY NOZZLES	(a)	PREUSSAGE (WEST JRMANY)
		(b)	GEM, USA

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
41.2	CONDENSER & CHILLER	(a)	NMW (I) PVT. LTD., HOWRAH (W.B)
		(b)	PATEL AIR TEMP, AHMEDABAD
		(c)	JAYPEE ENGG. WORKS,KOLKATA
		(d)	BLUE STAR,MUMBAI
		(e)	CARRIER,MUMBAI
		(f)	VOLTAS,MUMBAI
41.3	COOLING COILS	(a)	JAYPEE , AHMEDABAD
		(b)	BLUE STAR , MUMBAI
		(c)	CARRIER,MUMBAI
		(d)	COOL TECH,MUMBAI
		(e)	V.M. ENGG., PUNE
41.4	AIR HANDLING UNITS	(a)	FLAKT (ABB)
		(b)	BLUE STAR,MUMBAI
		(c)	CARRIER, MUMBAI
		(d)	COOL TECH, MUMBAI
		(e)	V.M. ENGG.,PUNE
		(f)	HYDERABAD POLLUTION CONTROLS PVT. LTD
41.5	CONDENSER CHILLED WATER PUMPS	(a)	KIRLOSKAR
		(b)	BEACONWEIR
		(c)	GREAVES LTD.
		(d)	JYOTI
		(e)	KSB
		(f)	CROMPTON GREAVES
41.6	FRESH AIR FANS	(a)	GEC

		TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)	
<u>SR. NO.</u>	<u>ITEM</u>		<u>VENDORS</u>
42.2	TRACTION MACHINE ASSEMBLY	(a)	HAISUNG, KOREA
42.3	ROPE	(a)	KISWIRE, KOREA
43.0	<u>AIR COMPRESSOR</u>		
		(a)	KIRLOSKAR PNEUMATICS
		(b)	ATLAS COPCO
		(c)	INGERSOL-RAND

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
3.0 LIST OF APPROVED VENDORS-ELECTRICAL			
<u>SR. NO.</u>	<u>ITEMS</u>		<u>VENDORS</u>
1.0	MOTOR ACTUATORS	(a)	ROTORK
		(b)	AUMA
		(c)	LIMITORQUE
		(d)	ANTIREB
2.0	DRY TYPE TRANSFORMERS	(a)	KIRLOSKAR
		(b)	VOLTAMP
		(c)	CROMPTON
		(d)	VIJAY ELECTRICALS, HYD.
		(e)	BHEL
		(f)	MEGAWIN SWITCHGEAR
3.0	(A) GENERATOR TRANSFORMER	(a)	TELK
		(b)	BHEL
		(c)	ABB
		(d)	AREVA
		(e)	CGL
		(f)	SIEMENS
	(B) UNIT & STATION TRANSFORMER	(a)	TELK
		(b)	BHEL
		(c)	ABB
		(d)	AREVA
		(e)	CGL
		(f)	SIEMENS
		(g)	VOLTAMP
	(C) AUXILIARY	(a)	AREVA

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>ITEMS</u>		<u>VENDORS</u>
11.0	ANNUNCIATOR	(a)	PROCON
		(b)	I/C
12.0	HOOTER	(a)	KHERAJ
		(b)	TULLU
		(c)	VAISHNO
13.0	CONTROL PANELS/(Relay Based) LIGHTING PANELS/JBS	(a)	POSITRONICS.
		(b)	CONTROL & SCHEMATIC
		(c)	VIMAC ELECTRIC
		(d)	PRITHVI TECHNOLOGY
		(e)	POWEROL PANEL & CONTROL
		(f)	L & T
		(g)	SIEMENS
		(h)	SCHNEIDER
14.0	LT BUS DUCT	(a)	STAR DRIVE
		(b)	ELEC MECH
		(c)	CONTROL SCHEMATIC
		(d)	REEP
		(e)	JASPER ENGINEERS
		(f)	C & S ELECTRIC LTD.
15.0	BATTERY	(a)	EXIDE
		(b)	AMARA RAJA
		(c)	HBL
		(d)	AMCO
16.0	BATTERY CHARGER	(a)	CHHABI
		(b)	AMARA RAJA

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>ITEMS</u>		<u>VENDORS</u>
22.0	PUSH BUTTONS/ INDICATING LAMP	(a)	SIEMENS
		(b)	L & T
		(c)	CANDS
		(d)	TEKNIC
		(e)	SCHNEIDER
23.0	ELECTRICAL PANEL METER/ INDICATING INSTRUMENTS (AMMETER/VOLTMETER)	(a)	AE
		(b)	IMP
		(c)	MECO
		(d)	RISHABH
24.0	CT(LT)	(a)	KAPPA
		(b)	SILCON
		(c)	PRAYOG
		(d)	PRAGATI
		(e)	CANDS
		(f)	PRECISE
25.0	PT(LT)	(a)	KAPPA
		(b)	SILCON
		(c)	PRAYOG
		(d)	PRAGATI
		(e)	CANDS
		(f)	PRECISE
26.0	CONTROL TRANSFORMERS	(a)	KAPPA
		(b)	SILCON
		(c)	POWER PACK
		(d)	PRAGATI

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>ITEMS</u>		<u>VENDORS</u>
		(d)	K.K. Industries Kolkata
40.0	CABLE LUGS	(a)	DOWEL
		(b)	CROWN
		(c)	NIKO
		(d)	FORWARD ENGG.
41.0	DIESEL GENERATOR	(a)	POWERICA
		(b)	JACKSON
		(c)	KIRLOSKAR
		(d)	AVK SEGC
		(e)	LERUY SOMER
		(f)	GD ANKLESARIA & CO.
42.0	LT MCC	(a)	L & T
		(b)	CONTROL SCHEMATIC
		(c)	SIEMENS
		(d)	ABB
		(e)	GE
		(f)	ALSTOM
		(g)	SCHNEIDER
		(h)	CROMPTON
43.0	H.DG.C.I. Pipe Electrode	(a)	HITESH
		(b)	DHATU UDYOG NGP
44.0	HT HEAT SHRINKABLE END TERMINATION & JOINTING KITS	(a)	RAYCHEM, RPG

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>ITEMS</u>		<u>VENDORS</u>
48.0	PRESSURE RELIEF VALVES	(a)	ATVUS, KOLKATA
		(b)	SUKRUT UDYOG,PUNE
49.0	HT SWITCHGEAR	(a)	SIEMENS *
		(b)	L&T *
		(c)	ALSTOM*
		(d)	ABB*
		(e)	CROMPTON GREAVES LTD*
		(f)	BHEL
		(g)	AREVA (* Subject to availability of type test certificates and performance certificates for 3 (Three) years along with bid document. HT Switchgear should have been type tested within last 3 years.)
50.0	MLDB	(a)	L&T
		(b)	POSITRONICS
		(c)	CONTROL & SCHEMATICS, HYDERABAD
		(d)	VIMAC
		(e)	PRITHVI TECHNOLOGY
51.0	BUS TRANSFER SCHEME (NUMERICAL)	(a)	AARTECH SOLENIC
52.0	HT MOTORS (3.3 kV/6.6 kV /11 kV)	(a)	ALSTOM
		(b)	BHEL
		(c)	CROMPTON GREAVES LTD
		(d)	KIRLOSKAR ELECTRIC CO. LTD.

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>ITEMS</u>		<u>VENDORS</u>
		(e)	SIEMENS
		(f)	MARATHON ELECTRIC
		(g)	ABB
		(h)	HHI
53.0	LT MOTORS(415V)	(a)	ALSTOM
		(b)	BHEL
		(c)	CROMPTON GREAVES LTD
		(d)	KIRLOSKAR ELECTRIC CO. LTD
		(e)	SIEMENS
		(f)	MARATHON ELECTRIC
		(g)	ABB
		(h)	BHARAT BIJLEE
54.0	DC MOTORS	(i)	LAXMI HYDRAULIC LTD
		(a)	ALSTOM
		(b)	BHEL
		(c)	CROMPTON GREAVES LTD.
		(d)	KIRLOSKAR ELECTRIC CO. LTD.
55.0	MV BUSDUCT	(e)	SIEMENS
		(a)	BHEL
		(b)	REEP
		(c)	POWER GEAR
56.0	RELAY CONTROL PANEL (PCR)	(d)	C & S ELECTRIC LTD.
		(a)	ABB
		(b)	AREVA
		(c)	BHEL

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>NAME OF EQUIPMENT / ITEM</u>		<u>APPROVED VENDORS</u>
		(d)	EMERSON
		(e)	ABB
		(f)	FUJI (AIC)
5.6	NOX / SO2 ANALYSER (IN SITU)	(a)	CODEL, UK
		(b)	FORBES MARSHALL
		(c)	LAND COMBUSTION, UK
5.7	OZONE ANALYSER	(a)	BMT MESSTECHNIK, GMBH
5.8	RESIDUAL OZONE ANALYSER	(a)	ECO SENSORS / KAUFFMANN UMWITTECHNIK .EK
5.9	OZONE LEAK DETECTOR	(a)	OTTPL
6.0	<u>CONTROL VALVES / ACTUATORS / SOLENOID VALVES:</u>		
6.1	ELECTRICAL ACTUATORS FOR REGULATING & OPEN / CLOSE VALVES	(a)	ROTORK CONTROL (INDIA) LTD.,
		(b)	AUMA (INDIA) LTD.,
		(c)	LIMITORQUE INDIA LTD.
6.2	PNEUMATIC ACTUATORS-REGULATING & OPEN / CLOSE	(d)	INSTRUMENTATION LTD., PALGHAT
		(e)	KELTRON CONTROLS, KERALA
6.3	SH/RH SPRAY CONTROL VALVES	(a)	MIL CONTROLS LTD.
	SH/RH SPRAY BLOCK VALVES	(b)	INSTRUMENTATION LTD. PALGHAT
	FEED CONTROL VALVES	(c)	FISHER SANMAR LTD.
		(d)	CONTROL COMPONENT INC., USA
		(e)	HORA (HOLTER REGELARMATUREN GMBH & CO.)
6.4	LEO/HFO CONTROL, AND TRIP VALVES, FLOW CONTROL, PRESSURE	(a)	MIL CONTROLS LTD.
		(b)	INSTRUMENTATION LTD. PALGHAT

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT
(TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)

4.0 LIST OF APPROVED VENDORS – CONTROL & INSTRUMENTATION

SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
1.0	<u>FIELD / PRIMARY INSTRUMENTS:</u>		
1.1	RTD & THERMOCOUPLES	(a)	PYRO ELECTRIC INSTRUMENTS GOA PVT. LTD.
		(b)	GENERAL INSTRUMENTS CONSORTIUM, MUMBAI
		(c)	DETRIVE, MUMBAI
		(d)	TEMSSENS INSTRUMENTS(I) PVT. LTD, UDAIPUR
1.2	SMART ELECTRONIC TRANSMITTERS (PRESSURE, DIFF. PRESSURE)	(a)	EMERSON PROCESS MANAGEMENT (I) LTD
		(b)	FUJI, JAPAN
		(c)	YOKOGAWA, JAPAN/ YOKOGAWA INDIA
		(d)	ABB, GERMANY / FARIDABAD
		(e)	HONEYWELL, USA / PUNE
1.3	DISPLACER TYPE LEVEL TRANSMITTER	(a)	CHEMTROL MIL
		(b)	DRESSER, COIMBTOR
		(c)	V-AUTOMAT, DELHI
		(d)	ECKARDT, GERMANY
1.4	LEVEL TRANSMITTERS (DISPLACEMENT TYPE)	(a)	DRESSER MASONIELAN, FRANCE (DRESSER VALVES INDIA LTD. COIMBATORE)
		(b)	CHEMTROLS, MUMBAI (ECKARDT, GERMANY)
		(c)	ECKARDT, GERMANY

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>NAME OF EQUIPMENT / ITEM</u>		<u>APPROVED VENDORS</u>
1.5	LEVEL TRANSMITTERS (ULTRASONIC TYPE)	(d)	ENDRESS+HAUSER, GERMANY/INDIA
		(e)	KROHNE, FRANCE
		(f)	PEPPERL+FUCHS, GERMANY/INDIA
		(g)	VEGA, GERMANY
		(h)	KAB INSTRUMENTS LTD.
1.6	RADAR TYPE LEVEL TRANSMITTERS	(a)	SIEMENS MILLTRONICS
		(b)	ENDRESS & HAUSER
		(c)	SBEM
		(d)	EMERSON
		(e)	AMETEKEDREXELBRROK (CHEMTROLS)
1.7	TEMPERATURE TRANSMITTERS	(a)	EMERSON PROCESS (FORMERLY FISHER ROSEMOUNT), USA/DAMAN
		(b)	ABB, GERMANY / FARIDABAD
		(c)	FUJI, JAPAN
		(d)	HONEYWELL, USA / PUNE
		(e)	YOKOGAWA, JAPAN/ YOKOGAWA INDIA
		(f)	MOORE, USA
1.8	MAGNETIC LEVEL SWITCHES	(a)	LEVCON INSTRUMENTS PVT. LTD., KOLKATA
		(b)	V.AUTOMAT, NEW DELHI
		(c)	ASIAN INDUSTRIAL VALVES, CHENNAI
1.9	LEVEL SWITCHES CONDUCTIVITY TYPE	(a)	BHARAT HEAVY ELECTRICALS LTD.
		(b)	YARWAY, USA

TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>NAME OF EQUIPMENT / ITEM</u>		<u>APPROVED VENDORS</u>
		(c)	LEVELSTATE, UK
		(d)	SOLARTON, UK (PRESENTLY CALLED AS MOBREY)
		(e)	CHEMTROL
		(f)	LEVEL STATE (HITECH SYSTEMS)
		(g)	MOBREY
1.10	FLOW SWITCHES	(a)	SWITZER, CHENNAI
		(b)	KRONHE MARSHALL
		(c)	GENERAL INSTRUMENTS MUMBAI
		(d)	CHEMTROL
1.11	BYPASS ROTAMETER	(a)	IEPL, HYDERABAD
		(b)	PLACKA INSTRUMENTS INDIA PVT. LTD., CHENNAI
		(c)	TRAC, HYDERABAD
		(d)	EUREKA, PUNE
1.12	ROTAMETER	(a)	INSTRUMENTATION ENGINEERS PVT. LTD.
		(b)	SIGMA INSTRUMENTS CO.
		(c)	EUREKA INDUSTRIAL EQPT. PVT. LTD.
		(d)	TELACE EQUIPMENT PVT. LTD.
1.13	FLOW INTEGRATOR (ELECTRONIC TYPE)	(a)	ABB, GERMANY / FARIDABAD
		(b)	MASIBUS, GANDHINAGAR
		(c)	YOKOGAWA, JAPAN/ YOKOGAWA INDIA
		(d)	LEKKTROTEK, PUNE
		(e)	EMERSON

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>NAME OF EQUIPMENT / ITEM</u>		<u>APPROVED VENDORS</u>
		(f)	ENDRESS & HAUSER
		(g)	FORBES MARSHALL
1.14	GAUGES (PRESSURE, DIFF. PRESSURE)	(a)	A N INSTRUMENTS PVT. LTD., KOLKATA
		(b)	GENERAL INSTRUMENTS CONSORTIUM, GOA/ MUMBAI
		(c)	GOA THERMOSTATIC INSTRUMENTS, GOA
		(d)	FORBES MARSHALL LTD., HYDERABAD
		(e)	WAAREE INDUSTRIES, MUMBAI
		(f)	H.GURU INSTRUMENTS (SOUTH INDIA), BANGALORE
		(g)	WIKA INSTRUMENTS INDIA PVT. LTD., PUNE
		(h)	GOA INSTRUMENTS PVT. LTD.,
		(i)	MONOMETER, MUMBAI
		(j)	BELLS CONTROLS LTD., KOLKATA
		(k)	SWITZER INSTRUMENTS LTD., CHENNAI
		(l)	WIKA ALEXANDER WIEGAND GMBH&CO., GERMANY
		(m)	BUDENBURG GUAGE CO. LTD
		(n)	INSTRUMENTATION PVT. LTD., BANGALORE
		(o)	INDOSONIC INSTRUMENT, MUMBAI
		(p)	PRECISION
		(q)	ASHCROFT

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>NAME OF EQUIPMENT / ITEM</u>		<u>APPROVED VENDORS</u>
1.15	TEMPERATURE GAUGE	(a)	GOA THERMOSTATIC INSTRUMENTS, GOA
		(b)	GENERAL INSTRUMENTS CONSORTIUM,
		(c)	A.N. INSTRUMENTS PVT. LTD., KOLKATA
		(d)	H. GURU INSTRUMENTS (SOUTH INDIA), BANGALORE
		(e)	FORBES MARSHALL, HYDERABAD
		(f)	WIKI INSTRUMENTS INDIA PVT. LTD., PUNE
		(g)	WAREE, DADRA GOA INSTRUMENTS PVT. LTD.,
		(h)	BELLS CONTROLS LTD., KOLKATA
		(i)	SWITZER INSTRUMENTS LTD., CHENNAI
		(j)	WIKI ALEXANDER WIEGAND GMBH&CO., GERMANY
		(k)	BUDENBURG GUAGE CO. LTD.
		(l)	INDOSONIC INSTRUMENT, MUMBAI
1.16	SWITCHES (PRESSURE, DIFF. PRESSURE)	(a)	INDFOSS INDUSTRIES LTD., GHAZIABAD
		(b)	SWITZER INSTRUMENTS COMPANY, CHENNAI
		(c)	SOR INC., USA
		(d)	PYROELECTRIC, GOA
		(e)	DRESSER INDUSTRIES INC, USA
		(f)	REGULATEURS GEORGIN, FRANCE

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>NAME OF EQUIPMENT / ITEM</u>		<u>APPROVED VENDORS</u>
		(g)	DELTA CONTROLS LTD., U.K.
		(h)	KDG INSTRUMENTS LTD. U.K.
		(i)	ASHCROFT
		(j)	DWAYER, USA
		(k)	GENERAL INSTRUMENTS CONSORTIUM
1.17	TEMPERATURE SWITCH	(a)	INDFOSS INDUSTRIES LTD., GHAZIABAD
		(b)	SWITZER INSTRUMENTS COMPANY, CHENNAI
		(c)	GENERAL INSTRUMENTS CONSORTIUM, MUMBAI
		(d)	SOR INC., USA
		(e)	PYROELECTRIC, GOA DRESSER INDUSTRIES INC, USA
		(f)	REGULATEURS GEORGIN, FRANCE
		(g)	DELTA CONTROLS LTD., U.K.
		(h)	KDG INSTRUMENTS LTD. U.K.
1.18	AIR FILTER REGULATOR	(a)	PLACKA, CHENNAI
		(b)	SHAVO NORGREN, INDIA
1.19	MASS FLOW METER (CORROLIOUS PRINCIPLE)	(a)	EMERSON PROCESS MANAGEMENT (I) LTD
		(b)	ABB
		(c)	YOKOGAWA
		(d)	ENDRESS+ HAUESER
		(e)	GE SENSING & INSPECTION TECHNOLOGIES
		(f)	FORBES MARSHALL

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
1.20	I/P CONVERTER	(a)	ECKHARDT, GERMANY
		(b)	MTL, CHENNAI
		(c)	ABB
		(d)	WATSON SMITH (PRESENTLY NORGREN)
		(e)	EMERSON PROCESS MGMT ASIA PACIFIC LTD.
		(f)	MOORE CONTROLS
1.21	FLOW ELEMENTS	(a)	INSTRUMENTATION LTD.
		(b)	MICRO PRECISION PRODUCTS
		(c)	ENGINEERING SPECIALITIES PVT. LTD.
		(d)	GENERAL INSTRUMENTS
1.22	LEVEL GAUGES (FLOAT TYPE)	(a)	SB ELECTRO
		(b)	SIGMA
		(c)	V AUTOMAT
		(d)	LEVCON
		(e)	CHEMTROLS
		(f)	ASIAN INDUSTRIAL VALVES
1.23	ORP TRANSMITTERS	(a)	FORBES MARSHALL
1.24	DENSITY METER (NUCLEONIC TYPE)	(a)	ENDRESS + HAUSER
		(b)	THERMO MEASURE TECH.
		(c)	CHEMTROL (THERMO FISHER)
1.25	DENSITY METER (NON-NUCLEONIC TYPE)	(a)	ENDRESS + HAUSER
		(b)	THERMO MEASURE TECH.
		(c)	CHEMTROL (THERMO FISHER)

 TECHNICAL SPECIFICATION FOR OZONE GENERATION PLANT (TECHNICAL SPECIFICATION NUMBER: PE-TS-415-174-A001 REV 0)			
<u>SR. NO.</u>	<u>NAME OF EQUIPMENT / ITEM</u>		<u>APPROVED VENDORS</u>
1.26	SOLID MASS FLOW METER	(a)	SIEMENS MILLTRONICS
		(b)	CHEMTROL (THERMO FISHER)
		(c)	SIEMENS INSTRUMENTS, CANADA
1.27	PULL CORD SWITCH	(a)	JAYASHREE ELECTRODEVICES PVT. LTD.
		(b)	A.G. SYSTEM CONTROLS, MUMBAI
1.28	BELT SWAY SWITCH	(a)	JAYASHREE ELECTRODEVICES PVT. LTD.
		(b)	A.G. SYSTEM CONTROLS, MUMBAI
1.29	ZERO SPEED SWITCH	(a)	A.G. ELECTRONICS
		(b)	JAYASHREE ELECTRODEVICES PVT. LTD.
1.30	PROXIMITY SWITCH	(a)	AW
		(b)	JAYASHREE ELECTRODEVICES PVT. LTD.
1.31	LEVEL SWITCH (RF TYPE)	(a)	EIP ENVIRO LEVEL CONTROLS
2.0	<u>DCS, HMI, MONITORING AND PLC SYSTEMS:</u>		
2.1	DDCMIS	(a)	ABB.
		(b)	YOKOGAWA
		(c)	SIEMENS.
		(d)	BHEL
		(e)	EMERSON PROCESS MANAGEMENT
		(f)	MHI
2.2	PLC	(a)	ALLEN BRADLEY.
		(b)	SCHNEIDER
		(c)	ROCKWELL

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		(d)	GE FANUC
2.3	MASTER SLAVE CLOCK	(a)	SYMMETRICOM INC., USA
		(b)	HOPF, GERMANY
		(c)	HATHWAY, USA
		(d)	SERTEL ELECTRONICS, CHENNAI
		(e)	ADVANCE MICRONIC
2.4	DOT MATRIX PRINTER	(a)	HP / EPSON / WIPRO / TVS / SAMSUNG
2.5	LASER & COLOUR INKJET PRINTERS	(b)	HP / EPSON / CANON / IBM / XEROX / SAMSUNG
2.6	COMPUTERS FOR OPERATOR / ENGINEER / HISTORY STATION, SHIFT SUPERVISOR, STORIAN, SOFT LINK STATION FOR INTERFACING WITH OTHER SYSTEMS, PERFORMANCE CALCULATION AND SER STATION	(a)	IBM
		(b)	DELL
		(c)	HP/COMPAQ
2.7	TFT MONITOR	(a)	LG / SAMSUNG / HP / COMPAQ / IBM / DELL
2.8	VIBRATION MONITORING SYSTEM & TURBO-SUPERVISORY INSTRUMENTS	(a)	ROCKWELL AUTOMATION, USA
		(b)	BENTLEY NEVADA, USA / INDIA
		(c)	SHINKAWA, JAPAN / FORBES MARSHALL,
		(d)	VIBROMETER, SWITZERLAND
2.9	LARGE VIDEO SCREENS	(a)	BARCO BELGIUM / BARCO, INDIA
		(b)	PLANAR, USA / PYROTECH, INDIA
		(c)	CHRISTIE, USA / CHRISTIE, INDIA

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		(d)	SYNELEC
		(e)	DELTA, THAILAND / DELTA POWER SYSTEMS, INDIA
2.10	HART COMMUNICATOR	(a)	HONEYWELL, USA/PUNE
		(b)	EMERSON PROCESS (FORMERLY FISHER ROSEMOUNT), USA / DAMAN
		(c)	YOKOGAWA, JAPAN / YOKOGAWA, INDIA
		(d)	MERIAM, USA / CHEMTROLS, MUMBAI
		(e)	ABB, GERMANY / INDIA
		(f)	FUJI, JAPAN
2.11	HART MANAGEMENT SYSTEM	(a)	PEPPERL+FUCKS, GERMANY / INDIA
		(b)	MTL, UK / INDIA
		(c)	EMERSON PROCESS, USA / DAMAN
2.12	ALARM ANNUNCIATION SYSTEM	(a)	PROCON, CHENNAI
		(b)	I I C, HYDERABAD
		(c)	MINILEC, PUNE
		(d)	IIC, MUMBAI
		(e)	PIRIE, MUMBAI
		(f)	PECON, VADODARA
		(g)	POSITRONICS
2.13	RMCMs (ROTATING MACHINE CONDITION MONITORING SYSTEM)	(a)	VIBROTECH (M/S MEGITT INDIA PVT. LTD.)
		(b)	M/S SKF INDIA LTD.
2.14	ACOUSTIC PYROMETER	(a)	BONNENBERG + DRESCHER GMBH, GERMANY

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SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
2.15	ACOUSTIC STEAM LEAK DETECTION SYSTEM (ASLD)	(a)	HI-TECH SYSTEM & SERVICES LTD, NEW DELHI (AMI MAKE)
		(b)	SARTECH INTL, CHENNAI (INSTROTECH MAKE INSPECTA FFT)
2.16	EPABX SYSTEM	(a)	SIEMENS
		(b)	BPL
2.17	FURNACE TV CAMERA SYSTEM	(c)	HITECH SYSTEM & SERVICES LTD. (M/S LENOX INSTRUMENT COMPANY INC., USA
3.0	ELECTRICAL & SECONDARY INSTRUMENTS:		
3.1	DIGITAL INDICATOR	(a)	ABB, GERMANY / FARIDABAD
		(b)	MASSIBUS, GANDHINAGAR PYROTECH, UDAIPUR
		(c)	LEKTROTEK, PUNE
		(d)	GOSSEN / CAMILLE BAUER / METRAWATT YOKOGAWA, JAPAN / INDIA
		(e)	SIEMENS
3.2	BARGRAPH INDICATORS	(a)	ABB, GERMANY / FARIDABAD
		(b)	MASSIBUS, GANDHINAGAR
		(c)	PYROTECH, UDAIPUR
		(d)	LEKTROTEK, PUNE
		(e)	GOSSEN / CAMILLE BAUER / METRAWATT
		(f)	M-SYSTEM, JAPAN (CHINO LAXSONS DAMAN)
		(g)	SIEMENS

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3.3	PEN, POINT AND CHARTLESS RECORDERS	(a)	EUROTHERM, UK
		(b)	TATA HONEYWELL
		(c)	YOKOGAWA, JAPAN (YOKOGAWA, INDIA)
		(d)	CHINO (LAXSON), JAPAN
		(e)	ABB, UK / GERMANY
		(f)	FUJI ELECTRIC, JAPAN
3.4	TRANSDUCERS	(a)	SEIMENS
		(b)	AUTOMATIC ELECTRIC LTD., MUMBAI
		(c)	PYROTECH, UDAIPUR
		(d)	SOUTHERN TRANSDUCERS, CHENNAI
		(e)	ACCORD, PUNE MECO, MUMBAI
		(f)	ABB
		(g)	SITU, MUMBAI
		(h)	RISHABH
		(i)	ADEPT, PUNE
3.5	ELECTRICAL ANALOG (PANEL) METERS	(a)	AUTOMATIC ELECTRIC LTD., MUMBAI
		(b)	MECO, MUMBAI
		(c)	RISHAB, NASIK
3.6	SELECTOR SWITCHES AND CONTROL SWITCHES	(a)	KAYCEE
		(b)	ALSTOM
		(c)	L & T
		(d)	SIEMENS

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<u>SR. NO.</u>	<u>NAME OF EQUIPMENT / ITEM</u>		<u>APPROVED VENDORS</u>
3.7	MOSAIC ANALOG (MOVING COIL) INDICATORS	(a)	GOSSEN, GERMANY
		(b)	WEIGEL, GERMANY
3.8	MOSAIC DIGITAL INDICATORS	(a)	GOSSEN, GERMANY
		(b)	WEIGEL, GERMANY
3.9	INTERPOSING RELAYS FOR COMMAND OUTPUT TO MCC	(a)	JYOTI
		(b)	H&B
		(c)	ALSTOM
		(d)	ELASTA
		(e)	OEN SIEMENS
		(f)	ABB
3.10	RELAYS / AUX. CONTACTORS	(a)	TELEMECANIQUE & CTRLS
		(b)	ABB
		(c)	SIEMENS
		(d)	GEC – ALSTOM
		(e)	L & T
3.11	LIMIT SWITCHES	(a)	BHARTIYA CUTLER & HAMMER, FARIDABAD
3.12	MINIATURIZED PUSH BUTTONS / ILPB (24X48MM) MOSAIC GRID COMPATIBLE	(a)	SIEMENS
		(b)	TEW, GERMANY (OLD NAME SUBKLEW)
4.0	<u>CONTROL DESKS & PANELS:</u>		
4.1	UNIT CONTROL PANELS (UCP)/ ELECTRICAL CONTROL PANEL (ECP)/ CONTROL DESK (MOSAIC GRID BASED)	(a)	BHEL EDN
		(b)	PYRO TECH, UDAIPUR
		(c)	INSTRUMENTATION LTD. KOTA
		(d)	KHODAY CONTROL SYSTEMS, BANGALORE

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SR. NO.	NAME OF EQUIPMENT / ITEM		APPROVED VENDORS
		(e)	CHEMIN CONTROLS, PONDICHERRY
4.2	CRT DESK / OPERATOR DESK	(a)	PYRO TECH, UDAIPUR
		(b)	INSTRUMENTATION LTD. KOTA
		(c)	KHODAY CONTROL SYSTEMS, BANGALORE
		(d)	CHEMIN CONTROLS, PONDICHERRY
4.3	MOSAIC GRID/ MOSAIC TILES & OTHER MOSAIC ITEMS	(a)	SYMO, SWITZERLAND
		(b)	TEW, GERMANY (OLD NAME SUBKLEW)
		(c)	PYROTECH
4.4	LOCAL PANELS / DISTRIBUTION BOARDS	(a)	CONTROL & SCHEMATICS
		(b)	PYROTECH
		(c)	RITTAL
		(d)	L&T
4.5	TERMINAL BLOCKS	(e)	ELMEX
		(f)	PHOENIX
		(g)	WAGO
5.0	ANALYSERS:		
5.1	SWAS ANALYSERS	(a)	POLYMETRON / ZELLWEGGER - ANALYTICALS
		(b)	ABB
		(c)	ORION, USA
		(d)	ROSEMOUNT ANALYTICAL-CHEMPURE,
		(e)	HACH ULTRA FRANCE,
		(f)	HACH USA

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		(g)	YOKOGAWA
		(h)	AMETECH
		(i)	FORBES MARSHALL
		(j)	EMERSON
5.2	SWAS (STEAM AND WATER ANALYSIS SYSTEM) PANELS	(a)	ABB KENT, U.K.
		(b)	ABB LTD. FARIDABAD
		(c)	FORBES MARSHAL
		(d)	EMERSON PROCESS MANAGEMENT INSTRUMENTATION LTD., KOTA
		(e)	YOKOGAWA
5.3	CO ANALYSER (IN SITU TYPE)	(a)	AMETEK, USA / SINGAPORE
		(b)	CODEL INTERNATIONAL LTD. UK
		(c)	LAND COMBUSTION UK
5.4	OXYGEN IN FLUE GAS ANALYSER (ZIRCONIA PROBE TYPE)	(a)	AMETEK, USA / SINGAPORE
		(b)	LAND INSTRUMENTS, UK
		(c)	EMERSON PROCESS MANAGEMENT (I) LTD
		(d)	YOKOGAWA, JAPAN
		(e)	ENOTECH, GERMANY
		(f)	ABB, UK
		(g)	TELEDYNE, USA
		(h)	FUJI (AIC)
5.5	SMOKE DENSITY ANALYSER / PARTICULATE EMISSION ANALYSER / OPACITY ANALYSER	(a)	DURAG, GERMANY
		(b)	CODEL, UK
		(c)	LAND COMBUSTION UK