NEYVELI LIGNITE CORPORATION (NLC)
2X500 MW NEW NEYVELI TPP(SG PACKAGE)

VOLUME: II B & III

TECHNICAL SPECIFICATIONS
FOR
OXYGEN DOSING SYSTEM

SPECIFICATION NO.: PE-TS-400-154-12000A-A001

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

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VOLUME-IIB & III

VOLUME-IIB

SECTION – A

SCOPE OF ENQUIRY

1.0 SCOPE OF INQUIRY/ INTENT OF SPECIFICATION

1.1 The specification is intended to cover design, engineering, manufacture, inspection and testing at vendor's/ sub-vendor's works, painting, proper packing and supply and dispatch to power station site of skid mounted **OXYGEN DOSING SYSTEM** along with erection and commissioning spares(as required),specified in different sections / volumes of this specification hereinafter for the **2X500 MW NEW NEYVELI TPP(SG PACKAGE)**

1.2 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 vendor from the responsibility of providing such facilities to complete the supply of **OXYGEN DOSING SYSTEM** within quoted price.

1.3 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.

1.4 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.

1.5 The general term 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 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.

1.6 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 Vol-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.

1.7 Deviations along with cost of withdrawal (positive or negative), if any, should be very clearly brought out clause by clause in the enclosed schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.

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 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 NLC including their consultant as interpreted by BHEL in the relevant context.

1.10 The equipment covered under this specification shall not dispatch unless the same have been finally inspected, accepted and shipping release issue by BHEL/NLC.

1.11 BHEL's/NLC's representative shall be given full access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to him.

SECTION – B

PROJECT INFORMATION

2 GENERAL PROJECT INFORMATION

2.1 Introduction

The project site at Neyveli has distinct location advantages, being at pit-head distance from the source of lignite supply from Mines, making it convenient for transportation of lignite by belt conveyor. Water source is readily available from the nearby mines lake. Besides, other infrastructure such as access road, railway connection etc. already exist.

2.2 Power Plant Site

The power plant site is located at Neyveli, opposite to the now defunct Fertilizer and Briquetting & Carbonization Plant, near TPS-1 Expansion and TPS-II.

2.3 Project & Site Information

(i).	Owner / Purchaser	:	Neyveli Lignite Corporation Limited (NLC Ltd), Neyveli, Cuddalore District, Tamil Nadu State, India
(ii).	Consultant	:	Lahmeyer International (India) Pvt. Ltd (LII), Gurgaon, NCR, India.
(iii).	Project Title	:	2x500 MW Neyveli New Thermal Power Project (NNTPP)
(iv).	Location	:	200 kms south of Chennai and 50 kms south-west of Cuddalore
(v).	Latitude	:	11° 34' 00" N to 11° 35' 00" N
(vi).	Longitude	:	79° 26' 00" E to 79° 27' 00" E
(vii).	Elevation above MSL	:	(+) 67 m
(viii).	Nearest Railway Station	:	Neyveli.
(ix).	Nearest Sea Port	:	Chennai, at a distance of 200 km
(x).	Nearest Airport	:	Chennai, at a distance of 200 km
(xi).	Road Access/Approach to Site	:	Connected by Chennai-Thanjavur NH 45C road and state highway connecting Cuddalore – Virudhachalam via Neyveli. Both NH and state high way roads are well connected to NLC township roads. The approach road is approximately 15 kms from Chennai–Thanjavur NH – 45C road
(xii).	**Site Meteorological Data**		
	• Max ambient temperature	:	42.8° C
	• Min Ambient Temperature	:	26.9° C
	• Wet bulb temp	:	29° C
	• Max. Relative Humidity	:	92 % in the month of September
	• Min. Relative Humidity		23 % in the month of May
	• Rainfall		About 1265.7 mm annually (average)
	• Wind direction		South West to North East direction
	• Wind Speed		97.2 km/hr (maximum recorded) 4.3 km/hr (average wind speed)
	• Seismicity		As per IS: 1893 (part 4) (Zone-II) Importance factor: 1.75

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SECTION – C1

SPECIFIC TECHNICAL REQUIREMENT - MECHANICAL

1. SCOPE:

The scope of this specification covers the basis of design, system description, equipment selection aspects and control philosophy for Oxygen dosing system for 2X500 MW NEW NEYVELI TPP (SG PACKAGE).The above system shall be skid mounted. Two numbers skid per unit shall be provided for oxygen dosing system for each unit (one skid for dosing at CPU outlet and one skid for dosing at deaerator outlet).

1.1 SCOPE OF SUPPLY FOR BIDDER

Broad scope of work of bidder for this package includes all equipment and accessories. Please also refer C&I sections (Section C3) for respective scopes.

The scope of supply for Oxygen dosing system consists of the followings:

i. Entire Oxygen dosing system mounted on skid (including one bank of cylinders (containing two cylinders) as per P&ID and Data Sheet-A instrumentation (minimum) as per the enclosed P&ID.
ii. Start-up and commissioning spares as required.
iii. All flanges & counter flanges to interconnect the pipes.
iv. Racks (2 Nos.) each to hold 10 cylinders.
v. Oxygen cylinders (20 Nos.).
vi. Injector assemblies (8 nos.).
vii. Tees (20 nos.) & Elbows (20 nos.).
viii. Loose tubing (400 meter).
ix. Compression fittings (74 nos.) for loose tubing.
x. Foundation nuts & bolts to fix each skid on the floor, as required.

1.2 SCOPE OF SERVICE.

Nil.

1.3 CIVIL SCOPE.

Nil.

2. OXYGEN DOSING SYSTEM: (2 SKIDS PER UNIT, TOTAL= 4 SKIDS)

(Refer drg no. PE-DG-400-154-12000A-A501)

Each skid of Oxygen Dosing System consists of the following:

a) One bank of oxygen cylinder with two cylinders in bank for dosing at downstream of deaerator/CPU outlet.
b) Two number of Pressure Regulator as per section D1 and data sheet - A
c) Associated Piping, valves, fitting as indicated in the P&ID of oxygen dosing system and data sheet-A enclosed and as required to make the system complete.
d) Control & instrumentation as per P&ID of oxygen dosing system, data sheet-A, Section D1, C3 and D3.

3. COMMISSIONING SPARES

Commissioning spares if deemed necessary by the bidder for commissioning of the skids shall be supplied by the bidder as a part of base offer. List of commissioning spares quoted for and individual price break up of the same shall be submitted separately.

4. TERMINAL POINTS (ALSO REFER P & I DIAGRAM ENCLOSED)

i. All field instruments (pressure transmitters), solenoid valves and mass flow controller (MFC) shall be terminated at JB by the oxygen dosing vendor for further connection to DCS by Customer (NLC).
ii. All vent connections shall be connected via vent header and terminated at one point of the skid by bidder for further connection to atmosphere, if required, by BHEL.
iii. Dosing termination point shall be after MFC and terminated at one point by the oxygen dosing vendor for further interconnection till dosing locations by BHEL.
iv. 24 VDC connection to SV-3, SV-4, SV-5 for Dearator o/l & SV-3 for CPU discharge and Mass flow controller shall be directly connected by Customer (NLC)..

5. PAINTING:

Bidder to note that painting shall be as per approved painting requirement to be finalized during detailed engineering. However the same shall be prepared in line with the painting requirement enclosed in section D1 of technical specification.

6. PACKING:

To prevent damage to the equipment of the skid during transit, wooden / angle iron / steel frame supports to be provided wherever required. Special attention shall be provided while packing and loading for overhead equipment. Packing and transport instructions are enclosed in section D1.

7. DESIGN/CONSTRUCTION:

a) In addition to the requirements of Section-C & D the following shall also be complied under scope of this specification: The P&ID is enclosed herein in this section for bidder's compliance.

b) The material of construction specified in Data Sheet-A 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.

c) All instrument-wetted parts will be suitable for requested application.

d) All high points on any, piping or instrumentation will be vented and provided with valve. All low points on any, tanks, pumps, piping or instruments will be drained and provided with valve.

e) All valves and instruments will be located such that they are easily accessible during normal operation and maintenance.

f) All the terminal points shall be easily accessible and towards one side of skid.

g) All equipments shall have name plate clearly indicating the equipment name.

h) Pipe fittings of the system shall be done using elbows and tees. Pipe bending is not acceptable.

i) All the terminal points where flange joints are involved, bidder shall terminate it along with matching counter flange, nuts, bolts, gaskets etc.

j) KKS codes for all drives and instruments for the project have to be followed.

k) All JBs shall be mounted in their respective dosing skids only.

l) MFC shall also be mounted in an enclosure. Material of construction of enclosure shall be identical to MOC of junction box. DOP of enclosure shall be IP-55 minimum. Other tech. requirements of this enclosure shall be in line with JB details indicated elsewhere in the specification.

m) All cylinders supplied should conform to "Gas Cylinder Rules, 2004" and CCE license for the same shall be arranged by the bidder.

n) All the equipments, instruments, valves and tubing etc. coming in contact directly with oxygen shall be oxygen cleaned and certified to be fit for use in oxygen application.

8. QUALITY PLAN AND SUB VENDOR APPROVAL

a. Requirement of detailed QP, inspection checklist, certificate of conformance etc. for each equipment and sub-vendor shall be finalized during detailed engineering stage; decision of BHEL/customer shall be binding on vendor in this regard. Any changes/additional tests insisted upon by Owner during approval of QAP's shall be accepted by bidder without any commercial and delivery implication to BHEL/Customer. Bidder shall submit the quality plans in BHEL format during detailed engineering stage. Bidder to note further that during detailed engineering all the QAP's/check lists etc. shall be submitted to Customer/BHEL for approval. All inspection & testing etc. shall be carried out accordingly.

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

9. DRAWINGS/DOCUMENTATION

10.1 DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID(PI refer electrical & C&I portion also):-

a) Deviations (if any) in given format only.
b) Un Price Schedule duly filled.(Stamped & Signed)
c) Compliance certificate.(Stamped & Signed)
d) Schedule of Declaration. (Stamped & Signed)

Bidder to note that if bidder has taken any deviation from the technical specification requirements, the same shall be clearly mentioned in the bid in the BHEL prescribed format of Schedule of Deviations with cost of withdrawal attached as Volume - III of this technical specification.

In case of no deviation, Bidder to furnish signed and stamped copy of "Schedule of Deviations with cost of withdrawal" stating **"No Deviation"**.

No other technical document is required along with bidder's offer. Any other document submitted by bidder shall not be evaluated by BHEL and shall be considered as withdrawn.

Bidder to note that any un-declared deviation mentioned in bidder offer other than specified in the scheduled of Deviations with cost of withdrawal shall be considered as null and void.

10.2 LIST OF DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT (PI refer electrical & C&I portion also):-

After award of LOI, following minimum drawing/documents shall be submitted by the bidder for BHEL and Customer approval. However any additional drawing/document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial & delivery implication to BHEL.

For the Drawings/Documents Submission Procedure, please refer **Annexure-I**. 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 confirmed drawings submission schedule as follows:

a) Drawing/documents submission schedule: First submission of basic drawings/ documents – (P&ID, GA drawings and foundation details and Quality plan) shall be within 3 weeks from the date of LOI.

b) Every revised submission incorporating comments – within 7 days.

c) BHEL shall provide observation / approval within 03 weeks from the date of document submission by bidder.

Bidder to note that drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account.

ANNEXURE-I

SNO	BHEL DRG NO	DRG TITLE	No. of weeks for document submission after placing LOI/PO	Document size
1	PE-VO-391-154-12000A-A001	P&ID for Oxygen Dosing System	3	A3
2	PE-VO-391-154-12000A-A002	GA drawing and foundation detail for Oxygen Dosing System	3	A3
3	PE-VO-391-154-12000A-A003	Technical Data sheet for Oxygen Dosing System	4	A4
4	PE-VO-391-154-12000A-A004	QAP for Oxygen Dosing System along with sub vendor list	3	A4
5	PE-VO-391-154-12000A-A005	Junction Box Termination drawings for Oxygen Dosing System	5	A3
6	PE-VO-391-154-12000A-A006	Erection procedure	6	A4
7	PE-VO-391-154-12000A-A007	Engineering BOQ	10	A4
8	PE-VO-391-154-12000A-A008	O&M Manual along with catalogue for Oxygen Dosing System	20	As applicable

In addition of above following documents shall also be submitted by bidder during detail engineering:-

a) Storage instructions

Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System in addition to hard copies to be submitted as per dwg/ document distribution schedule. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

a) Internet explorer version – Minimum Internet Explorer 7

b) Internet speed – 2 mbps (Minimum preferred)

c) Pop ups from our external DMS IP (124.124.36.198) should not be blocked

d) Vendor's Internal proxy setting should not block DMS application's link (http://124.124.36.198/wrenchwebaccess/bgin.aspx)"

e) DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.

f) For quick access bidder may refer the link http://bhelpem.com/DMSManuals/DMSManuals.html

NOTE:-

a) Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier

b) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

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

11.0 SPARES

a. 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.

b. The quality plan and the inspection requirement finalised for the main equipment will also be applicable to the corresponding spares.

c. All spares supplied will be new and in accordance with the contract document and will be free from defects in design, material and workmanship.

d. In case of any failure in the original component/equipments due to faulty designs, materials and workmanship, the corresponding spare parts if any, supplied will be replaced without any extra cost to the BHEL and customer unless a joint examination and analysis by BHEL and/or customer of such spare parts prove that the defect found in the original part that failed can safely be assured not to be present in spare parts.

e. The long term availability of spares to the BHEL and the customer for the full life of the equipment covered under the contract and that before going out of production of spare parts of the equipment covered under the contract, vendor and his sub-vendors shall give the BHEL and the customer at least 24 (Twenty Four) months advance notice so that the latter may order his bulk requirements of spares, if he so desires. The same provision will also be applicable to the sub-vendors. Further, in case of discontinuance of manufacture of any spares by the vendors or his sub-vendors the vendors and his sub-vendors, will provide the BHEL and the customer, 2 (two) years in advance, with full manufacturing drawings, material specifications and technical information required by the BHEL and the customer for the purpose of manufacture of such items and also the right to manufacture such spares for their own requirements.

f. Further in case of discontinuance of supply of spares by the vendors or his sub-vendors, the vendor will provide the BHEL and the customer with full information for replacement of such spares with other equivalent makes, if so required by the BHEL and the customer.

g. Notwithstanding the above, the vendor shall be responsible for supply of spares for the lifetime of the package at reasonable prices. The prices of all future requirements of spares shall be derived from the corresponding ex-works price at which the orders for such spares have been placed by the BHEL and the customer as a part of the mandatory or long term or any other kind of spares. The base indices for calculating ex-works price shall be commissioning of last equipment under main contract.

h. The vendor will indicate the delivery period of the spares, which the BHEL and the customer may procure in accordance with this clause.

i. In case of emergency requirements of spares, the vendor would make every effort to expedite the manufacture and delivery of such spares on the basis of mutually agreed time schedule.

j. In case the vendor fails to supply the mandatory or long term or any other kind of spares on the terms stipulated above, the BHEL and the customer shall be entitled to purchase the same from the alternate sources at the risk and the cost of the vendor and recover from the vendor, the excess amount paid by the BHEL and the customer over the rates as per the contract. In the event of such risk purchase by the BHEL or the customer, the purchases will be as per the works and procurement policy of the BHEL and the customer prevalent at the time of such purchases and BHEL & the customer at his option may include a representative from the vendor in finalizing the purchases.

k. It is expressly understood that the final settlement between the parties in terms of relevant clauses of the tender document shall not relieve the vendor of any of his obligations under the provision of long term availability of spares and such provisions shall continue to be enforced till the expiry of 30 (thirty) years period reckoned from the scheduled date of completion of trial operation of the last equipment unless otherwise discharged expressly in writing by the BHEL or the customer.

12.0 MISCELLENEOUS REQUIREMENTS

a) Vendor to attend regular engineering meeting with BHEL and customer fortnightly in BHEL or customer office as decided during detail engineering. Vendor will depute his entire concerned engineering representatives along with the project manager for discussion and approval. Meeting can be held at site also.

b) In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.

c) Latest version of all codes and standards to be followed.

d) Bidder to follow KKS numbering for this project.

e) Skid El 0.0 should be equal to 0.1 m plus TG hall FFL. This should be taken care in GA drawing.

f) Billing break up (BBU) of Oxygen Dosing System should be equal to Bill of Quantity (BOQ) of the same.

g) For detailed dispatch instructions, Bidder to refer special condition of contract (SCC) of the project.

ANNEXURE II

DRAWING DOCUMENTS SUBMISSION PROCEDURE

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

DRAWING/DOCUMENT DISTRIBUTION LIST

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

SI		LII	NLC (HQ)	NLC-SITE	BHEL SITE	PMG BHEL	PEM/ UNITS/ PSSR	REMARKS
1	Master list of drawings / document (duly indicating schedule of submission)	Soft copy	Soft copy	Soft copy		Soft copy	Soft copy (S)	
2	Drawings / document for Approval/Information (First Submission)	Soft copy + 2 prints	Soft copy + 3 prints	Soft copy + 1 print		Soft copy	Soft copy (S)	
3	Return with comments/approval	Soft copy (S)	Soft copy	Soft copy		Soft copy	Soft copy	
4	Drawings / Documents for approval (second & subsequent submissions till approval)	Soft copy	Soft copy	Soft copy		Soft copy	Soft copy (S)	
5	Drawings / documents for distribution (Approved by NLC, in cat. 1 or Received for Information)	Soft copy + 2 print (HQ+ Site)	Soft copy + 3 prints	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
6	Erection Drawings documents		Soft copy + 1 print	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
7	As built Drawings documents	Soft copy + 1 print	Soft copy + 1 print	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
8	Operation & Maintenance Manual	-	Soft copy + 1 print	Soft copy + 10 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	
9	Type Test Certificate	Soft copy	Soft copy + 1 print	Soft copy + 3 prints	Soft copy + 5 prints	Soft copy	Soft copy (S)	

NOTES:

1. The above schedule of submission does not include Docs Drgs. of quality assurance inspection and delivery dispatches. QAP documents to be submitted as per distribution schedule.
2. Date of submitting soft copy is to be taken as date of submission.
3. S – Source for generation of document.

Quantity of prints may change during detailed engineering stage based on BHEL / Customer requirement. However the same will be adhered by the bidder without any delivery/commercial implication to BHEL.

DATA SHEET-A

Sl. No	Description	Parameter
Mechanical Items		
1.0	No. of skid(s)for project	FOUR (Two per units)
2.0	**Cylinders:**	
2.1	Quantity mounted on skid	Two per skid (Total eight)
2.2	Loose supply of filled Oxygen cylinders	10 loose on a rack per unit.
2.3	Design Standard of empty oxygen cylinder	IS-7285
2.4	MOC of cylinder	Chrome Moly Steel
2.5	Water Capacity	50 liters
2.6	Gas Capacity	10 m3
2.7	Max Working pressure at 15^{o}C	204 Kgf/cm2
2.8	Painting of oxygen cylinder	As per IS 4379
2.9	Accessories	Two numbers (one per unit) Cylinder storing rack (MS), each with capacity to hold 10 cylinders.
3.0	**All Tubing:**	
3.1	Material	ASTM A213/269 GR TP 316 SCH 40 (seamless)
3.2	Diameter	15 NB (1/2" OD)
4.0	**Ball valves**	
4.1	Body, Bonnet, stem	ASTM A182 Gr. TP 316
4.2	Trim Material	SS 316
4.3	Design standard	MSS-99-2010 / equivalent
4.4	Test standard	MSS-99-2010 / equivalent
4.5	Size	15 NB
4.6	End Connections	FERRULED ANSI B 16.11
4.7	Rating	----Class ASA 800 ----
4.8	Valve operation	Manual
5.0	**Check valves/ NRV**	
5.1	Body, cover, disc/piston & seat	ASTM A182 Gr. TP 316
5.2	Design standard	MSS-99-2010 / equivalent
5.3	Test standard	MSS-99-2010 / equivalent
5.4	Size	15 NB
5.5	End Connections	FERRULED ANSI B 16.11
5.6	Rating	----Class ASA class ASA 800----
5.7	Valve operation	Manual
6.0	**Pressure relief valve**	
6.1	Type	Spring loaded, angle type
6.2	Body, bonnet, disc & nozzle	SS 316
6.3	Valve discharges to	Atmosphere (vent)
6.4	Back pressure	Constant
6.5	Set pressure	60 Kg/cm2 (g) for skid 1 and 35 Kg/cm2 (g) for skid 2
6.6	Inlet Connections	15 NB, Flanged/threaded, ANSI B16.5, 400# for skid at CPU outlet and 300# for skid at de aerator outlet
6.7	Outlet Connections	15 NB, Flanged/threaded, ANSI B16.5, 150#
7.0	**Fittings**	Stainless steel to A276 or A479 F316, Dimension to ANSI B 16.11 FERRULED ends.
8.0	**Pressure Regulator**	
8.1	Quantity	Two per skid (total 8), each mounted to an oxygen cylinder
8.2	Body & trim	SS 316/Brass
8.3	Inlet connection	1/2 "
8.4	Outlet connection	1/2 "
8.5	Operating pressure	204 Kg/cm2(g)
8.6	Set outlet Pressure	55 Kg/cm2(g) for skid dosing at CPU outlet and 30 Kg/cm2(g) for skid dosing at deaerator outlet
9.0	**Flanges**	SS 316, ANSI B 16.5 400# for skid at CPU outlet and 300# for skid at de aerator outlet
10.0	**Structural steel**	IS 2062
11.0	**Nuts & bolts**	SS 304
12.0	**Mass Flow Controller (MFC)**	
12.1	Expected flow of oxygen in process	50-250 GM/hr (for skid dosing at deaerator outlet) & 40-200 GM/hr. (for skid dosing at CPU outlet)
12.2	MOC-Wetted part	SS 316, ANSI B 16.5 CL 400
12.3	Operating Pressure	Pressure reducing valve set pressure (refer PID)

13.0	**Compression fittings**	
13.1	Quantity	74 Nos.
13.2	MOC	SS-316

Note:-

1. All the equipments, instruments, hoses, valves, fittings and tubing coming in contact directly with oxygen shall be oxygen cleaned and certified to be fit for use in oxygen application.
2. All cylinders supplied should conform to "Gas Cylinder Rules, 2004" and CCE license for the same shall be arranged by the bidder.

QAP

		MANUFACTURER'S NAME & ADDRESS :		MANUFACTURING QUALITY PLAN				PROJECT PACKAGE	: 2X500 MW NEW NEYVELI TPP (SG PACKAGE) : OXYGEN DOSING SYSTEM			
				ITEM: OXYGEN DOSING SYSTEM SUB - SYSTEM : DEAERATOR & CEP DISCHARGE DOSING SYSTEM		QP. NO : REV. : DATE : PAGE :	1 2 OF 3	CONTRACT NO. MAIN SUPPLIER BHEL QP. NO	: BHEL/PEM/NOIDA : PE-V0-400- 154-12000A-A005			
S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY**			REMARKS
									M	C	N	
1	2	3	4	5	6	7	8	9	D*	10		11
1.0	**WELDER'S QUALIFICATION**											
1 1	WELDING PROCEDURE SPECIFICATION (WPS)	CORRECTNESS	MA	SCRUTINY	100%	ASME IX	ASME IX	QW 482		P	V	V	
1 2	WELDER PERFORMANCE & PROCEDURE QUALIFICATION RECORD	WELD SOUNDNESS & WELDING PERFORMANCE	MA	PHYSICAL TEST	100%	ASME IX	ASME IX	QW 483 & QW 484		P	V	V	
2	EMPTY OXYGEN CYLINDER	MTC, HYDRO TEST & RELEVANT TESTS AS PER IS 7285	MA	IS 7285	100%	APPROVED DATA SHEET	AS PER APPROVED DATASHEET	MFRS CERTIFICATE		P	V	V	
3	VALVES (BODY & BONNET)	MATERIAL	MA	–	100%	APPROVED DATASHEET	AS PER MODEL DECODIFICATION MENTIONED IN MFRS CATALOGUE	MANUFACTURERS COC		P	V	V	
4	INSTRUMENTS												
4.A	PRESSURE GAUGE	MOC FOR WETTED PARTS, CALIBRATION & BOURDON OVER PRESSURE PROTECTION & TYPE TEST CERTIFICATE	MA	MEASUREMENT	1/TYPE	APPROVED DATASHEET	AS PER APPROVED DATASHEET	MFRS CERTIFICATE		P	V	V	
4.B	PRESSURE TRANSMITTER	CALIBRATION, OVER LOAD PROTECTION & TYPE TEST CERTIFICATE	MA	MEASUREMENT	100%	APPROVED DATASHEET	AS PER APPROVED DATASHEET	MANUFACTURERS COC		P	V	V	
5	SOLENOID VALVES	MATERIAL	MA	VISUAL	100%	APPROVED DATASHEET	AS PER MODEL DECODIFICATION MENTIONED IN MFRS CATALOGUE	MANUFACTURERS COC		P	V	V	
6	CYLINDER PRESSURE REGULATOR	MATERIAL	MA	VISUAL	100%	APPROVED DATASHEET	AS PER MANUFACTURERS CATALOGUE	MANUFACTURERS COC		P	V	V	
7	TERMINATION BOX	CIDUNTUNITY,IR-HV-IR & DEGREE OF PROTECTION	MA	ELECTRICAL	100%	APPROVED DATASHEET	AS PER APPROVED DATASHEET	MFRS COC & INSPECTION REPORT		P	V	V	
8	TUBING	CHEMICAL & PHY SICAL	MA	CHEMICAL & PHY SICAL TEST	100%	APPROVED DRAWING DATASHEET	APPROVED DRAWING DATASHEET	LAB REPORT		P	V	V	
9	MASS FLOW CONTROLLER	CALIBRATION REPORT	MA	ELECTRICAL	100%	APPROVED DRAWING & DATASHEET	APPROVED DRAWING & DATASHEET	CALIBRATION REPORT		P	V	V	
10	FITTING	MATERIAL	MA	VISUAL	100%	APPROVED DRAWING	AS PER MODEL DECODIFICATION MENTIONED IN MFRS CATALOGUE	MANUFACTURERS COC		P	V	V	
11	FINAL ASSAMBLY	DIMENSION, ORIENTATION & COMPLETENESS.	MA	MEASUREMENT	100%	APPROVED DRAWING	APPROVED DRAWING	INSPECTION		P	W	W	
	FAT	LEAKAGE		N2 FILL FOR 2HR	100%	APPROVED DRAWING / FACTORY ACCEPTANCE TEST	NO LEAKAGE	INSPECTION REPORT		P	W	W	
12	POWDER COATING STAMPING	DFT MEASUREMENT	MI	VISUAL	100%	APPROVED PAINTING SCHEME				P	W	V	

NOTES: ALL INSTRUMENTS/VALVES ETC. SHALL BE O XYGEN CLEANED AND SUITABLE FOR OXYGEN SERVICE MANUFACTURERS COC CERTIFYING THE SAME REGARDING OXYGEN CLEANED SHALL BE SUBMITTED FOR REVIEW DURING FINAL INSPECTION.

		LEGEND :		DOC NO.	REV :	CAT :
MANUFACTURER/ SUB SUPPLIER	MAIN SUPPLIER	* RECORDS IDENTIFIED WITH "TICKS" SHALL BE ESSENTIALLY INCLUDED BY CONTACTION IN QA DOCUMENTATION. ** M : MANUFACTURER/SUB-CONTRACTOR C . BHEL, N NLC	FOR CUSTOMER USE			
SIGNATURE		INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION AS APPROPRIATE, "CHP" SHALL BE IDENTIFIED IN COLUMN "N".		REVIEWED BY	APPROVED BY	APPROVAL SEAL

TEST PROCEDURE FOR OXYGEN DOSING SYSTEM			
JOB NO		EQUIPMENT	: OXYGEN DOSING SYSTEM
PROJECT	2X500 MW NEW NEYVELI TPP (SG ACKAGE)	PAGE	: 03 of 03

TEST PROCEDURE FOR OXYGEN DOSING SYSTEM

- A Factory Acceptance Testing will be conducted at vendor's Factory. This will be for verification of the functional performance of critical equipment/instruments and hardware design when run at design pressure, temperature and flow.
- FAT will be carried out using **only the inert gas** such as **Nitrogen.** Following will be the FAT protocol.
- Checking the completeness of the system. This will include visual inspection of equipment and instruments as per the P & ID s & GA along with skid after assembling on skid.
- Soap joint leak test of tubing/fittings/valves using nitrogen at 1.25 times of maximum operating pressure **(ANSI B31.8),** for 2 hours. The allowable pressure drop would be up to 0.5 bar over 2 hours.
- Functional testing of calibrated components (equipments/ instruments) using nitrogen. The test controller will be connected to Mass flow controller. The set point will be given from test controller & this will be monitored.
- Testing of Assembly of skid , instruments , termination box will be done by BHEL as per approved Quality Assurance Plan.
- Inert test run using nitrogen to demonstrate flow.
- Final Assembly & Factory Acceptance Test will be witnessed by BHEL & NLC.

SUBMITTED TO	: BHEL/PEM/NOIDA
SUPPLIED BY	:
CLIENT	: BHARAT HEAVY ELECTRICALS LIMITED

REV	DATE	DESCRIPTION	PREPARED BY	CHECKED BY	APPROVED BY
00		Items for approval			

INDICATIVE LIST OF SUB VENDOR

LIST OF BHEL APPROVED SUB VENDORS

S. No.	ITEM	APPROVED SUPPLIERS	REMARKS
1.	EMPTY OXYGEN CYLINDER	KANTO EVEREST / MARUTI KOATSU CYLINDERS	
2.	CHECK VALVE	SWAGELOK / HAMLET / PARKER	
3.	BALL VALVE	SWAGELOK / HAMLET / PARKER	
4.	3 WAY VALVE MANIFOLD	EXCEL HYDRO / BY ORIGINAL MANUFACTURER	
5.	TUBING	SWAGELOK / HAMLET / PARKER / SANDVIK	
6.	FITTINGS	SWAGELOK / HAMLET / PARKER / SANDVIK	
7.	SOLENOID VALVE	ROTEX / HERION / ASCO	
8.	PRESSURE REDUCING cum REGULATING VALVE/PRESSURE REGULATOR	TESCOM, SWAGELOK	
9.	NEEDLE VALVE	SWAGELOK / HAMLET / PARKER	
10.	PRESSURE GAUGE	WIKA / GIC / WAREE / H GURU	
11.	PRESSURE SAFETY VALVE	SWAGELOK / HAMLET / PARKER	
12.	PRESSURE TRANSMITTER	HONYWELL / EMERSON / YOKOGAWA	
13.	MASS FLOW CONTROLLER	BROOK'S (EMERSON)	
14.	CYLINDER REGULATOR	TESCOM, SWAGELOK	
15.	STRUCTURAL SKID	SELF-MAKE OF MAIN VENDOR	AS APPLICABLE
16.	ENCLOSURE FOR JB	RITTAL	
17.	LUGS	DOWELL / 3D / CHETNA	
18.	CABLES	TORENT / ICL / UCL / POLYCAB	
19.	PAINT	BERGER PAINTS / ASIAN PAINTS / SHALIMAR PAINTS / JENSON & NICOLSON / GUNJAN PAINT	
20.	FILLING OF OXYGEN CLINDER	FILLING OF EMPTY CYLINDERS MAY BE DONE FROM ANY CCE LICENSED OXYGEN GAS FILLER	AS APPLICABLE
21.	FLOW METER CUM TRANSMITTER	EMERSON PROCESS MANGEMENT (I) LTD	MICRO MOTION LFM SERIES
		GE RHEONIK	
22.	CONTROL VALVE WITH ACTUATOR	IL / DRESSER MASONILAN / CCI / NIPPON FISHER / FISHER CONTROLS (EMERSON) / COPES VULCAN / MIL CONTROLS / DRESSER VALVES INDIA PVT LTD	
23.	JUNCTION BOX	AJMERA INDUSTRIAL & ENGIN / BALIGA LIGHTING EQUIPMENT / DEVI POLYMERS / ELECTROMAC INDUSTRIES / KS INSTRUMENTS PVT LTD / MANISHA ENTERPRISE / SHRENIK & COMPANY / SUCHITRA INDUSTRIES	

PRESSURE TRANSMITTER	ABB E + H EMERSON PROCESS MANAGEMENT HONEYWELL YOKOGAWA SIEMENS FUJI EMERSON PROCESS ENDRESS + HAUSER
INSTRUMENT SIGNAL CABLE	CORDS CABLES ,RAJASTHAN TCL KEI POLYCAB THERMO CABLES DELTON CORDS CABLES, RAJASTHAN DELTON CABLES, FARIDABAD INCAB, PUNE KEI INDUSTRIES LTD, CHENNAI PARAMOUNT CABLES, ALWAR POLYCAB, DAMAN THERMO CABLES, HYDERABAD

JUNCTION BOX	BALIGA LIGHT INSTRUMENTS LTD, INDIA FCG FLAME PROOF CONTROLS, INDIA BALIGA LIGHTING, CHENNAI DEVI POLYMERS, CHENNAI. PYROTECH, UDAIPUR SAJAS ELECTRICALS, India
LIE/LIR	CHEMIN CONTROLS PYROTECH CHEMIN CONTROLS, PONIDCHERRY FORBES MARSHAL, PUNE INSTRUMENTATION LIMITED, KOTA PRAMMEN INDUSTRIES PYROTECH, UDAIPUR PYROTECH ELECTRONICS P.LTD

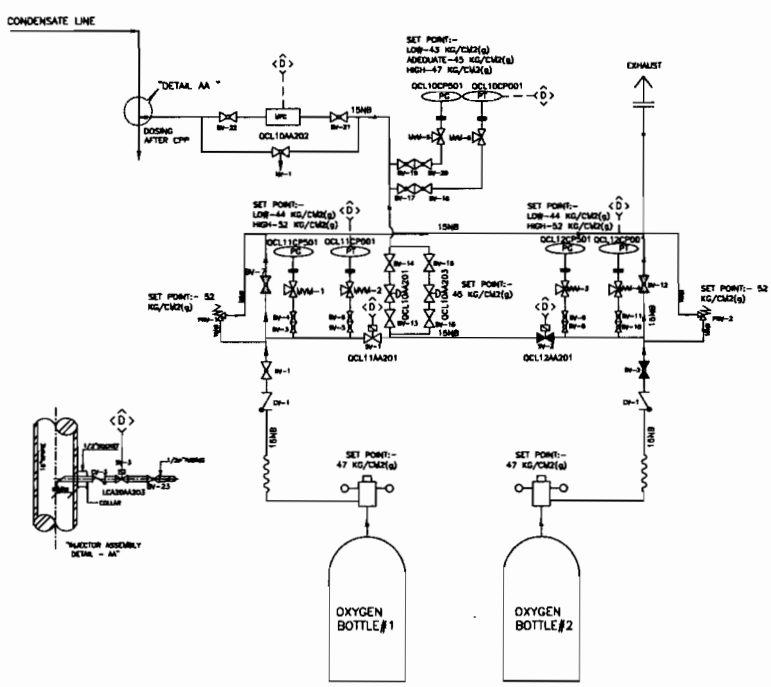
TERMINAL BLOCK	PHOENIX WAGO ELMAX CONNECTWELL
PANELS/CABINETS	RITTAL PYROTECH PYROTECH ELECTRONICS P LTD
SOLENOID VALVES	ASCO ROTEX AUTOMATION INDIA AVCON CONTROLS, MUMBAI NORGREN,INDIA ASCO NUMATICS (INDIA) PRIVATE LTD. CHENNAI IMI NORGREN HERION PVT.LTD NOIDA ROTEX AUTOMATION LIMITED VADODRA U.V.INTERNATIONAL CHENNAI

PRESSURE GAUGE/DRAFT GAUGE	GENERAL INSTRUMENTS CONSORTIUM IND. AN INSTRUMENTS PVT. LTD., INDIA WIKA INSTRUMENTS, INDIA WAREE H GURU A N INSTRUMENTS PVT LTD, KOLKOTTA, ASHCROFT INDIA (earlier PRECISION INDUSTRIES, AHMADABAD) FORBES MARSHALL LTD, HYDERABAD GENERAL INSTRUMENTS CONSORTIUM, GOA/MUMBAI GOA THERMOSTATIC INSTRUMENTS, GOA H.GURU INSTRUMENTS MANOMETER, MUMBAI WAAREE INDUSTRIES, MUMBAI WIKA, INDIA BUDENBERG GAUGE CO LTD.UK MANOMETER (INDIA) PVT LTD., India WIKA INSTRUMENTS INDIA PVT.LTD, India

Notes:-

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

P&ID OF
OXYGEN DOSING SYSTEM



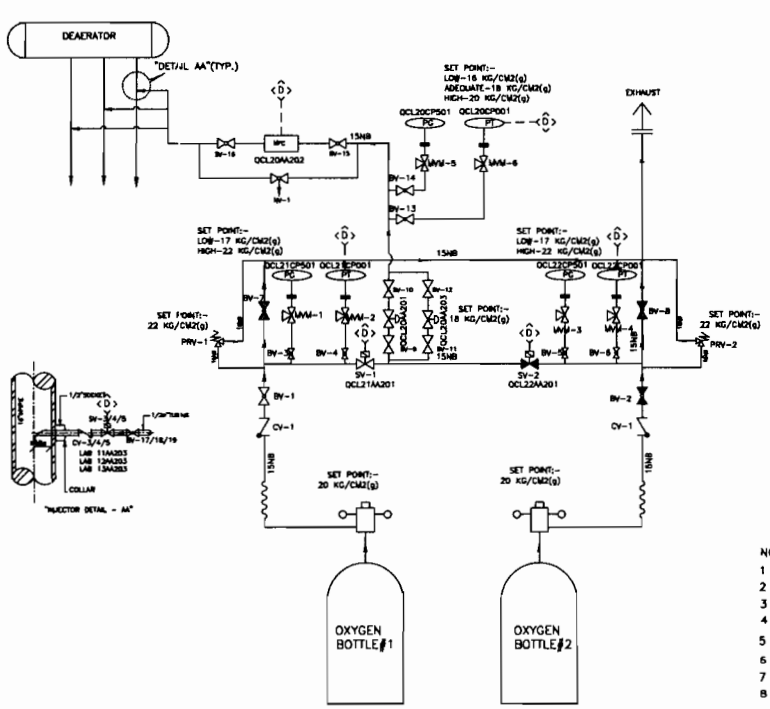
LEGEND

	PRESSURE REDUCING CUM REGULATING VALVE
	NEEDLE VALVE
PT	PRESSURE TRANSMITTER
	SOLENOID ACTUATED VALVE
PG	PRESSURE GAUGE
	NON RETURN VALVE/CHECK VALVE
	MASS FLOW CONTROLLER
	BALL VALVE
	PRESSURE REGULATOR
	PRESSURE SAFETY VALVE
	DISCHARGE TO ATMOSPHERE
	MULTI-VALVE MANIFOLD(SEE NOTES)
	CHEMICAL SEAL DIAPHRAGM

NOTES:-

1 THE ENTIRE SYSTEM INCLUDING THE JUNCTION BOX SHALL BE SKID MOUNTED.
2 ONE NUMBER SKID FOR ENTIRE STATION SHALL BE PROVIDED FOR DOSING AT CPU OUTLET.
3 ONE NUMBER INJECTION ASSEMBLY FOR ENTIRE STATION SHALL BE SUPPLIED LOOSE.
4 ALL THE VALVES SHALL BE OF SS 316, 800 CLASS SW.
5 ALL TUBING SHALL BE OF SS 316, 15 NB AND SCH 80.
6 30 M OF TUBING FOR ENTIRE STATION OF SAME SPECIFICATION SHALL BE LOOSE WITH THE SKID.
7 ALL THE MULTI VALVE MANIFOLD SHALL BE 3-WAY VALVE MANIFOLDS.
8 ALL FIELD INSTRUMENTS(PRESSURE AND FLOW TRANSMITTERS), AND SOLENOID VALVES(SV1 & 2 ONLY) SHALL BE TERMINATED AT THE JB BY VENDOR AND CABLING FROM JB TO DCS SHALL BE IN THE SCOPE OF CUSTOMER.

P&ID FOR OXYGEN DOSING SYSTEM
(FOR DOSING AT CPU OUTLET)



LEGEND

	PRESSURE REDUCING CUM REGULATING VALVE
	NEEDLE VALVE
PT	PRESSURE TRANSMITTER
	SOLENOID ACTUATED VALVE
PG	PRESSURE GAUGE
	NON RETURN VALVE/CHECK VALVE
	MASS FLOW CONTROLLER
	BALL VALVE
	PRESSURE REGULATOR
	PRESSURE SAFETY VALVE
	DISCHARGE TO ATMOSPHERE
	MULTI-VALVE MANIFOLD(SEE NOTES)
	CHEMICAL SEAL DIAPHRAGM

NOTES:-

1 THE ENTIRE SYSTEM INCLUDING THE JUNCTION BOX SHALL BE SKID MOUNTED.
2 ONE NUMBER SKID FOR ENTIRE STATION SHALL BE PROVIDED FOR DOSING AT DEAERATOR OUTLET.
3 THREE NUMBERS INJECTION ASSEMBLY FOR ENTIRE STATION SHALL BE SUPPLIED LOOSE.
4 ALL THE VALVES SHALL BE OF SS 316, 800 CLASS SW.
5 ALL TUBING SHALL BE OF SS 316, 15 NB AND SCH 80.
6 80 M OF TUBING FOR ENTIRE STATION OF SAME SPECIFICATION SHALL BE LOOSE WITH THE SKID.
7 ALL THE MULTI VALVE MANIFOLD SHALL BE 3-WAY VALVE MANIFOLDS.
8 ALL FIELD INSTRUMENTS(PRESSURE AND FLOW TRANSMITTERS), AND SOLENOID VALVES(SV1 & 2 ONLY) SHALL BE TERMINATED AT THE JB BY VENDOR AND CABLING FROM JB TO DCS SHALL BE IN THE SCOPE OF CUSTOMER.

P&ID FOR OXYGEN DOSING SYSTEM
(FOR DOSING AT DEAERATOR OUTLET)

SECTION – C3

SPECIFIC TECHNICAL REQUIREMENT (CONTROL & INSTRUMENTATION)

SPECIFIC TECHNICAL REQUIREMENTS (C&I)

1.1 **Oxygen Dosing System** shall be controlled from Plant DCS (NLC - SCOPE).

1.2 Bidder to supply the field instrumentation as required / shown in the P&ID.

1.3 The detailed specification of instruments, JB etc. are given in detail as below.

1.4 The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements shall prevail.

1.5 Drawings/Documents and data to be furnished after award of the contract:

- Field instruments data sheet.
- JB grouping document.
- Cable schedule and cable interconnection drawing.
- Instrument schedule.
- Drive List and Analog / Binary Input / output List
- Recommended Control write-up
- Any other document decided during detailed engineering.

SECTION – D1

SPECIFIC TECHNICAL SPECIFICATION - MECHANICAL

SCOPE:

The scope of this design philosophy covers the basis of design, system description, equipment *selection* aspects and control philosophy for Oxygen dosing system for **2X500 MW NEW NEYVELI TPP (SG PACKAGE).** The above system shall be skid mounted. Two numbers skid for each unit shall be provided for oxygen dosing system (one number for dosing at CPU outlet and one number for dosing at deaerator outlet).

2.0 DESIGN BASIS:

- Design Calculation for the systems.
- P&I diagram for Oxygen dosing system (part of this document)
- DATA SHEET – A for Oxygen dosing system (part of this document)

3.0 DESIGN PHILOSOPHY:

The objective of providing the dosing systems is to maintain the chemistry of the boiler feed water and also to comply with different modes of operation i.e."Combined Water Treatment mode" during continuous plant operation and "Ammoniacal mode or AVT(O) mode" during start-up & shutdown conditions.
The chemical feed for Combined Water Treatment (CWT) involves the feed of only aqueous ammonia and gaseous oxygen.

The following philosophy of chemical feed system is considered:-

a) During normal operation:-

- pH is maintained at 8.2-8.5 by dosing aqueous ammonia solution.
- Oxygen dosing rate recommended by BHEL is 30-150 ppb. Exact dosing rate shall be decided by the operator. For sizing of oxygen dosing system, 150 ppb continuous dosing of 99% pure oxygen has been considered.
- Dosing shall normally be done at CPU outlet. However provision shall be given for dosing at deaerator outlet also. For this purpose two separate skid based oxygen dosing systems shall be supplied for each unit. However, dosing shall be done at one place at a time only.
- Dosing rate shall be controlled from Plant DCS (Customer Scope) by regulating mass flow controller (MFC) provided on each O2 dosing skid under full load conditions based on dissolved oxygen level at economizer inlet. Oxygen dosing rate can be adjusted in the range of 30-150 ppb from Plant DCS (Customer Scope). However, customer may also chose to manually feed a particular set point within this range and operate the oxygen dosing automatically based on this set point.
- The oxygen dosing shall automatically turn off by closing the mass flow controller (MFC) if cation conductivity in the cycle goes above 0.3 us/cm.

b) Start up sequence:-

- Deaerator vent is kept open.
- Ammonia is dosed at CPU outlet to achieve a pH of 9.2.
- Cation conductivity reaches below 0.15 µs/cm (at 25°C) and the trend is downwards.
- Deaerator vents are closed.
- Oxygen feed is manually started from DCS.

c) Shut down sequence:-

- Oxygen feed needs to be stopped one hour before shut down and deaerator and LP heater vents needs to be opened.
- Ammonia dosing rate needs to be increased to achieve pH in the range of 9.2.

4.0 **Equipment for Oxygen Dosing (Two skids per unit, Total 4 Nos. for station)**

As mentioned, four oxygen dosing skids shall be supplied for entire station. Each skid shall be identical unless specifically mentioned otherwise. Since per unit only one skid of the two shall be under operation at a time, the cylinder storage for the all the skids shall be common located at the vicinity of the oxygen dosing skids. Each skid shall consist of the following components:-

4.1 **Cylinder banks**

Each oxygen dosing skid shall consist of a bank of two oxygen cylinders, dosing at downstream of deaerator/CPU outlet. Oxygen cylinder bank is provided to cater daily requirement. The automatic change-over of cylinder takes place on the basis of pressure i.e. the cylinder banks dosing at Condensate Polishing Unit (CPU) outlet will switch over at 44 kg/cm2(g) and the cylinder banks dosing at deaerator outlet at 17 kg/cm2(g). Separate storage rack for 10 cylinders per unit shall be supplied to cater 15 days oxygen requirement.

4.2 **Pressure Regulator:**

The line pressure regulator is used for reducing a high supply pressure (204 bars cylinder pressure) to 47 kg/cm2(g) pressure in skid dosing at CPU outlet and to 20 kg/cm2(g) pressure in skid dosing at deaerator outlet.

4.3 Valves, tubing, vents and instrumentation shall be as per the attached P&ID (PE-DG-400-154-12000A-A501) and the data sheet. The MOC and specification of the equipments shall be as per the attached data sheet.

5.0 **Control and Instrumentation:-**

The mode of operation of the oxygen dosing system shall be from Plant DCS (Customer Scope) only. All the logics, controls and interlocks shall be implemented in Plant DCS (Customer Scope). Local manual intervention is not envisaged. Both manual/automatic controls shall be implemented in DCS. The provision to select "Auto" or "Manual" mode shall be provided in Plant DCS (Customer Scope) OWS only.

The oxygen gas shall be at high pressure (204 Kgf/cm2) in the cylinders. The same shall be brought to a lower pressure by the Pressure Regulator (set pressure of 47 Kg/cm2 for skid dosing at CPU outlet and set pressure of 20 Kg/cm2 for skid dosing at deaerator outlet attached with each cylinder.

Each of the two oxygen cylinders in the skid shall have a dedicated set of solenoid valve [SV-1(QCL11AA201) & SV-2(QCL12AA201)] , pressure gauges (QCL11CP501 & QCL12CP501) and pressure transmitters(QCL11CP001 & QCL12CP001) for the CPU out let and solenoid valve [SV-1(QCL21AA201) & SV-2(QCL22AA201)] , pressure gauges(QCL21CP501 & QCL22CP501) and pressure transmitters (QCL21CP001 & QCL22CP001) for the Dearator out let .

Two cylinders provided on skid are connected and one cylinder will serve at a time, based on the pressure at the inlet of solenoid valve. In case the pressure at the inlet of SV1(QCL11AA201, QCL21AA201 for the CPU outlet and dearator outlet respectively), reaches at the set point, the solenoid valve SV1(QCL11AA201,QCL21AA201 for the CPU outlet and dearator outlet respectively) will close and solenoid valve SV2(QCL12AA201,QCL22AA201for the CPU outlet and dearator outlet respectively) will open and other cylinder shall be taken in to service provided the pressure at the inlet of SV2 (QCL12AA201,QCL22AA201for the CPU outlet and dearator outlet respectively) is not low and vice versa. Alarm for pressure low at the inlet of solenoid valves shall be provided in Plant DCS (Customer Scope).

A pressure relief valve shall be fitted at the downstream of solenoid valve to relieve system pressure if the system pressure goes above set pressure.

The pressure of the oxygen shall be further reduced by pressure reducing valves (QCL10AA201 for skid dosing at CPU outlet and QCL20AA201 for skid dosing at dearator outlet) in the skid, based on the feedback received from pressure transmitter (QCL10CP001) {set point –"ADEQUATE--(Set points–45 kg/cm2 for skid dosing at CPU outlet & pressure transmitter (QCL20CP001) {set point – "ADEQUATE--(18 kg/cm2 for skid dosing at deaerator outlet) provided at the downstream of pressure reducing regulating valve. The flow and pressure of oxygen can be monitored from DCS by the signal from mass flow controller (QCL10CF001for skid dosing at CPU outlet and QCL20CF001 for skid dosing at dearator outlet) and from pressure transmitters (QCL10CP001 for skid dosing at CPU

outlet & QCL20CP001 for skid dosing at deaerator outlet) provided at the downstream of pressure reducing regulating valve. The flow of oxygen dosing will be controlled manually/automatically from DCS by adjusting flow MFC (QCL10AA202 for skid dosing at CPU outlet & QCL20AA202 for skid dosing at deaerator outlet)provided on skid, based on the feedback from the dissolved oxygen analyzer located in the economizer inlet. The MFC shall have a position feedback transmitter that shall transmit the feedback signal to Plant DCS (Customer Scope).

All solenoid valves mounted in the oxygen dosing skid shall be 24 VDC powered from Plant DCS (Customer Scope) and routed through the local skid mounted junction box. All the field instruments, MFC and solenoid valves (SV 1 (QCL11AA201/QCL21AA201) & SV 2 (QCL12AA201/QCL22AA201)) shall be terminated at a junction box in the skid by BHEL's oxygen dosing vendor for further connection to Plant DCS (Customer Scope). The cabling from JB to plant DCS shall be in Customer scope.

At each dosing point, viz. CPU outlet and deaerator outlet, an injection assembly containing 15 NB tubing, fixing collar, solenoid valve and NRV shall be supplied loose by oxygen dosing vendor.

The set points indicated below for operation of pressure reducing valve are tentative. Final value of the same shall be decided by oxygen dosing vendor during detailed engineering as per the requirement of the flow meter-cum-transmitter manufacturer.

Note:-

i. 24 V DC to MFCs shall be provided by Customer.

ii. All analyzers (conductivity analyzer, dissolved oxygen analyzer) shall be in customer's scope.

Following interlocks/alarm annunciation facility shall be provided.

For Skid dosing at CPU Outlet

Source of signal	Tag Number	Set Point (suggested)	Interlock	Alarm in DCS	Remarks
During Normal Operation:-					
Pressure transmitter	PT (QCL11CP001)	52 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 1 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	PT (QCL11CP001)	44 Kg/cm2 (g) (LOW)	Close SV-1(QCL11AA201) & Open SV-2 (QCL12AA201)	Yes (LOW pressure at cylinder 1 outlet)	Auto-changeover of cylinders. Manually replace cylinder 1 with filled cylinder.
Pressure transmitter	PT (QCL12CP001)	52 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 2 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	PT (QCL12CP001)	44 Kg/cm2 (g) (LOW)	Close SV-2(QCL12AA201) & Open SV-1(QCL11AA201)	Yes (LOW pressure at cylinder 2 outlet)	Auto-changeover of cylinders. Manually replace cylinder 2 with filled cylinder.
Pressure transmitter	PT (QCL10CP001)	43 Kg/cm2 (g) (LOW)	Close MFC (QCL10AA202)	Yes (Oxygen dosing stopped due to low pressure)	
Pressure transmitter	PT (QCL10CP001)	47 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH dosing pressure)	Manual checking of pressure reducing valve reqd.
Pressure transmitter	PT (QCL10CP001)	45 Kg/cm2 (g) (Adequate)	Open Permissive pressure of MFC(QCL10AA202),	Not applicable	
Cation Conductivity analyzer	(CUSTOMER SCOPE)	0.3 µs/cm (at 25°C), increasing (HIGH)	Close MFC (QCL10AA202)	Yes (Oxygen dosing stopped due to high cation conductivity in feed water cycle)	Increase ammonia pH set point to raise pH to 9.2-9.5 range
Dissolved oxygen analyzer	(CUSTOMER SCOPE)	30 ppb (LOW), decreasing	Gradually open MFC (QCL10AA202) to increase DO provided signal from PT (QCL10CP001) is "NOT LOW" (i.e < 45 Kg/cm2 (g))	Yes (Low DO level in feed water cycle)	Initial set point may be chosen as 90 ppb. However, provision may be kept to choose exact set point for operation by operator's plant chemist during commissioning within the range of 30-150 ppb.
Dissolved oxygen analyzer	(CUSTOMER SCOPE)	150 ppb, increasing (HIGH)	Close MFC (QCL10AA202) to decrease DO	Yes (Oxygen dosing stopped due to high DO level in feed water cycle)	
During Start up:-					
Cation Conductivity analyzer	(CUSTOMER SCOPE)	0.15 µs/cm (at 25°C), decreasing (ADEQUATE)	Open MFC (QCL10AA202) , provided signal from PT-3 is "NOT LOW" (i.e < 48 Kg/cm2 (g)) & signal from DO analyzer is "NOT HIGH" (i.e > 150 ppb)	Yes (Oxygen dosing started)	

For Skid dosing at deaerator Outlet

Source of signal	Tag Number	Set Point (suggested)	Interlock	Alarm in DCS	Remarks
During Normal Operation:-					
Pressure transmitter	PT (QCL21CP001)	22 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 1 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	PT (QCL21CP001)	17 Kg/cm2 (g) (LOW)	Close SV-1(QCL21AA201) & Open SV-2 (QCL22AA201)	Yes (LOW pressure at cylinder 1 outlet)	Auto-changeover of cylinders. Manually replace cylinder 1 with filled cylinder.
Pressure transmitter	PT (QCL22CP001)	22 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 2 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	PT (QCL22CP001)	17 Kg/cm2 (g) (LOW)	Close SV-2 (QCL22AA201) & Open SV-1 (QCL21AA201)	Yes (LOW pressure at cylinder 2 outlet)	Auto-changeover of cylinders. Manually replace cylinder 2 with filled cylinder.
Pressure transmitter	PT (QCL20CP001)	16 Kg/cm2 (g) (LOW)	Close MFC (QCL20AA202)	Yes (Oxygen dosing stopped due to low pressure)	
Pressure transmitter	PT (QCL20CP001)	20 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH dosing pressure)	Manual checking of pressure reducing regulating valve reqd.
Pressure transmitter	PT (QCL20CP001)	18 Kg/cm2 (g) (Adequate)	Open Permissive pressure of MFC (QCL20AA202).	Not applicable	
Cation Conductivity analyzer	(CUSTOMER SCOPE)	0.3 µs/cm (at 25°C), increasing (HIGH)	Close MFC (QCL20AA202)	Yes (Oxygen dosing stopped due to high cation conductivity in feed water cycle)	Increase ammonia pH set point to raise pH to 9.2-9.5 range
Dissolved oxygen analyzer	(CUSTOMER SCOPE)	30 ppb (LOW), decreasing	Gradually open MFC (QCL20AA202) to increase DO provided signal from PT(QCL20CP001) is "NOT LOW" (i.e < 18 Kg/cm2 (g))	Yes (Low DO level in feed water cycle)	Initial set point may be chosen as 90 ppb. However, provision may be kept to choose exact set point for operation by operator's plant chemist during commissioning within the range of 30-150 ppb.
Dissolved oxygen analyzer	(SWAS PANEL SCOPE)	150 ppb, increasing (HIGH)	Close MFC (QCL20AA202) to decrease DO	Yes (Oxygen dosing stopped due to high DO level in feed water cycle)	
During Start up:-					
Cation Conductivity analyzer	(CUSTOMER SCOPE)	0.15 µs/cm (at 25°C), decreasing (ADEQUATE)	Open MFC (QCL20AA202), provided signal from PT-3 is "NOT LOW" (i.e < 22 Kg/cm2 (g)) & signal from DO analyzer is "NOT HIGH" (i.e > 150 ppb)	Yes (Oxygen dosing started)	

Sl. No	Description	Parameter
Mechanical Items		
1.0	No. of skid(s)for project	FOUR (Two per units)
2.0	**Cylinders:**	
2.1	Quantity mounted on skid	Two per skid (Total eight)
2.2	Loose supply of filled Oxygen cylinders	10 loose on a rack per unit.
2.3	Design Standard of empty oxygen cylinder	IS-7285
2.4	MOC of cylinder	Chrome Moly Steel
2.5	Water Capacity	50 liters
2.6	Gas Capacity	10 m3
2.7	Max Working pressure at $15^{O}C$	204 Kgf/cm2
2.8	Painting of oxygen cylinder	As per IS 4379
2.9	Accessories	Two numbers (one per unit) Cylinder storing rack (MS), each with capacity to hold 10 cylinders.
3.0	**All Tubing:**	
3.1	Material	ASTM A213/269 GR TP 316 SCH 40 (seamless)
3.2	Diameter	15 NB (1/2" OD)
4.0	**Ball valves**	
4.1	Body, Bonnet, stem	ASTM A182 Gr. TP 316
4.2	Trim Material	SS 316
4.3	Design standard	MSS-99-2010 / equivalent
4.4	Test standard	MSS-99-2010 / equivalent
4.5	Size	15 NB
4.6	End Connections	FERRULED ANSI B 16.11
4.7	Rating	----Class ASA 800 ----
4.8	Valve operation	Manual
5.0	**Check valves/ NRV**	
5.1	Body, cover, disc/piston & seat	ASTM A182 Gr. TP 316
5.2	Design standard	MSS-99-2010 / equivalent
5.3	Test standard	MSS-99-2010 / equivalent
5.4	Size	15 NB
5.5	End Connections	FERRULED ANSI B 16.11
5.6	Rating	----Class ASA class ASA 800----
5.7	Valve operation	Manual
6.0	**Pressure relief valve**	
6.1	Type	Spring loaded, angle type
6.2	Body, bonnet, disc & nozzle	SS 316
6.3	Valve discharges to	Atmosphere (vent)
6.4	Back pressure	Constant
6.5	Set pressure	60 Kg/cm2 (g) for skid 1 and 35 Kg/cm2 (g) for skid 2
6.6	Inlet Connections	15 NB, Flanged/threaded, ANSI B16.5, 400# for skid at CPU outlet and 300# for skid at de aerator outlet
6.7	Outlet Connections	15 NB, Flanged/threaded, ANSI B16.5, 150#
7.0	**Fittings**	Stainless steel to A276 or A479 F316, Dimension to ANSI B 16.11 FERRULED ends.
8.0	**Pressure Regulator**	
8.1	Quantity	Two per skid (total 8), each mounted to an oxygen cylinder
8.2	Body & trim	SS 316/Brass
8.3	Inlet connection	1/2 "
8.4	Outlet connection	1/2 "
8.5	Operating pressure	204 Kg/cm2(g)
8.6	Set outlet Pressure	55 Kg/cm2(g) for skid dosing at CPU outlet and 30 Kg/cm2(g) for skid dosing at deaerator outlet
9.0	**Flanges**	SS 316, ANSI B 16.5 400# for skid at CPU outlet and 300# for skid at de aerator outlet
10.0	**Structural steel**	IS 2062
11.0	**Nuts & bolts**	SS 304
12.0	**Mass Flow Controller (MFC)**	
12.1	Expected flow of oxygen in process	50-250 GM/hr (for skid dosing at deaerator outlet) & 40-200 GM/hr. (for skid dosing at CPU outlet)
12.2	MOC-Wetted part	SS 316, ANSI B 16.5 CL 400
12.3	Operating Pressure	Pressure reducing valve set pressure (refer PID)
13.0	**Compression fittings**	
13.1	Quantity	74 Nos.
13.2	MOC	SS-316

INSPECTION REQUIREMENT OF BHEL

The inspection of oxygen dosing system shall be done as per the manufacturing Quality Plan which shall be subject to approval by BHEL & CUSTOMER during detailed engineering. Any changes insisted upon by BHEL shall be taken care of by bidder. However the minimum inspection requirement of BHEL shall be as given below.

1. **Welder Qualification**
   a) Review of welder's qualification (WPS & PQR) shall be done by BHEL & CUSTOMER during final inspection.

2. **Empty oxygen cylinder**
   a) Inspection report of BIS approved inspection agency for all the tests performed as per IS 7285 shall be submitted for review by BHEL & CUSTOMER during final inspection.
   b) Approval certificate from CCE, Nagpur shall also be furnished if applicable as per statutory norms for review by BHEL & CUSTOMER during final inspection.

3. **Valves (Ball, Check, PRV, solenoid, needle)**
   a) Material test Certificate/lab report for both physical & chemical test (physical test for trim material is not required) for body, bonnet, cover, trim material, ball shall be furnished for review by BHEL & CUSTOMER during final inspection.
   b) Hydro test, pneumatic test, dimensions of valve assembly shall be as per BHEL approved data sheet. Manufacturer's test certificate shall be submitted for the same for review by BHEL & CUSTOMER during final inspection.
   c) All valves shall be oxygen cleaned and suitable for oxygen service. Manufacturer's COC certifying the same shall be submitted for review by BHEL & CUSTOMER during final inspection.

4. **Instruments (Pressure Gauge, Pressure Transmitter, Mass flow meter, pressure reducing valve)**
   a) Material Test certificate for wetted part as per approved data sheet shall be furnished for review by BHEL & CUSTOMER during final inspection.
   b) Calibration report shall be furnished for review by BHEL & CUSTOMER during final inspection.
   c) Manufacturer's COC for degree of protection of enclosure (1/similar frame size) shall be for review by BHEL & CUSTOMER during final inspection.
   d) All instruments shall be oxygen cleaned and suitable for oxygen service. Manufacturer's COC certifying the same shall be submitted for review by BHEL & CUSTOMER during final inspection.

5. **Control valve**
   a) Hydro test report for body and pneumatic test report of actuator chamber and seat shall be submitted for review by BHEL & CUSTOMER during final inspection.
   b) Manufacturer's test reports shall be submitted for 100 % control valves for overall dimensional checks (as per BHEL approved GA/data sheet) and functional tests (including valve travel, opening & closing time, linearity/CAM characteristics, hysteresis) as per BHEL approved data sheets for review by BHEL & CUSTOMER during final inspection.
   c) Manufacturer's test reports for CV test (including valve characteristics, PR vs discharge, PR vs opening 0 to 100% in steps of 10%) shall be submitted for 1/similar type of control valve for review by BHEL & CUSTOMER during final inspection.

6. **Junction Box**
   a) Check of make & rating of components as per approved drawing shall be done by BHEL
   b) Visual check of dimensions and orientation as per approved drawing shall be done by BHEL
   c) IR-HV-IR test shall be witnessed by BHEL
   d) Test certificate for degree of protection of the enclosure (1 per similar frame size) shall be submitted by bidder for review by BHEL.

7. **Tubing**
   a) Material test Certificate/lab report and hydro test report shall be furnished for review by BHEL & CUSTOMER during final inspection.

8. **Fittings**
   a) Material test Certificate/lab report, certificate for heat treatment and dimensions of fittings (as per BHEL approved data sheet) shall be submitted for review by BHEL & CUSTOMER during final inspection.

9. **Final skid assembly (Inspection witness by BHEL & CUSTOMER except point g)**
   a) Measurement of skid dimensions and elevation of terminal point

b) Leak test of tubing/fitting/ valves using nitrogen at 1.25 times of maximum operating pressure for skids for two hours.
c) Visual checking of skid orientation as per BHEL/ CUSTOMER approved GA drawing
d) Visual checking of welding soundness, cleanliness at weld joints
e) Hydro test of the complete interconnected tubing
f) Pneumatic test of the complete interconnected tubing
g) Verification of painting thickness by elcometer and paint shade with respect to color shade chart
h) DP test for all socket weld joints may be witnessed by any renowned TPI at bidder's cost and review of their report shall be done by BHEL & CUSTOMER during final inspection. Alternatively, bidder may also offer DP test for BHEL & CUSTOMER witness.

Note: -

i. For pressure transmitters and for imported components (imported either by bidder or by equipment manufacturer's authorized dealer/distributor), manufacturer's COC is also applicable in place of test certificate. However, the COC should contain all the desired relevant information.
ii. For type test reports such as degree of protection for enclosures and for CV test, reports generated on an equipment of similar frame size/design/model within 5 years preceding the date of final inspection is acceptable to BHEL.

TECHNICAL SPECIFICATION FOR

PAINTING

11.1 General

1. The term "Painting" referred herein covers rust preventive, preventive and decorative coating along with surface of the following areas.
   a) All Mechanical equipment, Technological structures, chutes, piping, ducts etc.
   b) Various types of static and rotary equipment inclusive of electric motors etc.
   c) Steel tanks and vessels
   d) Pipe work including trestles, supports, hangers, etc.
   e) Metallic duct work such as ventilation ducts, gas ducts including supoorts, hangers, etc.
2. Surfaces made of aluminium, brass, bronze, stainless steel, cast iron and other corrosion resistant alloys are not required to be painted unless specified except for identification bands or for aesthetic purposes.
3. All machined mating surfaces (e.g. flanges) will be properly cleaned, greased and protected before despatch
4. The complete paint system for any item includes the following basic activities:
   a) Proper surface preparation
   b) Application of primer coats
   c) Application of intermediate coats
   d) Application of finished coats

All the above coats will be of quality paint products and the scope of work will also include supply of all paint materials as per specification.

11.2 **Painting for mechanical & electrical equipment, mechanical structures, piping, ducts etc.**

1. This section covers the painting requirements for the equipments, structures, piping, duct etc. and any other surface required to be painted for all the equipments in the section-1 of this specification.
2. Codes and Standards

   Painting of equipment will be carried out as per the specifications indicated below and will conform to the relevant IS specification for the material and workmanship

   The following Indian Standards may be referred to for carrying out the painting job:

Table 11.1
Codes and Standards for Painting

S.No	Code	Description
1.	IS:5	Colours for ready mixed paints and enamels
2.	IS 1303	Glossary of terms relating to paints

S.No	Code	Description
3.	IS 2379	Colour code for identification of pipelines
4	IS 1477	Code of practice for painting of ferrous metals in buildings (Parts I & II)
5.	IS 2524	Code of practice for painting of non-ferrous metals in buildings (Part I & II)
6.	IS 2395	Code of practice for painting of concrete, masonry and plaster surfaces (Part I & II)
7.	IS 2338	Code of practice for finishing of wood based materials (Parts I & II)
8.	IS 6278	Code of practice for white washing and colour washing
9.	IS 3140	Code of practice for painting asbestos cement building products
10.	IS 158	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting
11.	IS 2074	Ready mixed paint, air drying, red oxide, Zinc Chrome, priming
12.	IS 104	Ready mixed paint, brushing, Zinc Chrome, priming
13.	IS 2932	Enamel, synthetic, exterior (a) undercoating (b) finishing specification.

3. Preparation Of Surfaces

a) Surface preparation being a pre requisite for any paint application, will be such as to clean the surface thoroughly of any materials which will be conducive to premature failure of the paint substrates and the surface preparation will be as per the painting scheme elaborated subsequently.

b) Solvent cleaning (SP 1)

The surface will be cleaned by wiping, immersion, spraying or vapour contacting of a suitable solvent or washing with an emulsion or alkaline solution to remove oil, grease, dirt, old paint, etc. Solvent cleaning will not remove rust, scales, mill scales or weld flux. Therefore, before application of paint, solvent cleaning will be followed by other cleaning procedures as stated below.

c) Hand tool cleaning(SP2)

The surface will be cleaned by vigorous wire brushing done manually to St-2 quality. This method effectively removes loosely adherent materials, but would not affect residues of rust or mill scales that are intact and firmly adherent.

d) Power tool cleaning(SP3)

The surface will be cleaned by electric or pneumatic tools to St-3 quality. The tools will be used carefully to prevent excessive roughing of surface and formation of ridges and burns. This method will remove

loosely adherent materials but would not affect residues of rust or mill scales that are firmly adherent.

e) Blast cleaning (SP4)

The surface will be cleaned by impingement of abrasive materials, at high velocity created by clean and dry compressed air blast. This method will remove loosely adherent materials as well as adherent scales and mill scales. Prior to application of blast, heavy deposit of oil and grease are removed by solvent cleaning and excessive surface scales are removed by hand tools or power tool cleaning. The surface will be cleaned to Sa-2 1/2 quality (SP 4) which means that to 95% of surface area is free from all rust, mill scales and visible residues, foreign materials, etc. The blast cleaning is not recommended for sheet metal work.

f) Blast cleaning (SP5): In this process the surface will be cleaned to 35 to 50 Microns.

4. Primer Paints (P)

After the surface is prepared in a manner acceptable to Owner/ consultant, two (2) coats of Primer paints will be applied only on dry and clean surfaces. Second coat of red oxide primer will be applied only after first coat has dried up completely. Coating of primer will in general conform to IS:2074-92 and will be applied by brushing to ensure a continuous film without "holidays".

a) Primer paint P1: (Epoxy based)

A two pack air drying epoxy polyamide resin based red oxide -zinc phosphate (primer):

Epoxy content (% wt)	15 to 18
Air drying time	About 30 minutes (touch dry) Over night (hard dry)
Dry film thickness (DFT/coat)	30 microns (min)
Temperature resistance	Upto 120°C dry heat

b) Primer paint P2 (Epoxy based)

A two pack air drying epoxy polyamide with zinc dust of at least 92% zinc dust on the dry film.

Epoxy content (% wt)	8 to 10
Air drying time	About 10 minutes (touch dry) 2 hours (hard dry)
Dry film thickness (DFT/coat)	40 microns (min)
Temperature resistance	Upto 300°C dry heat

c) Primer paint P3 (Ethyl zinc silicate, EZS, based)

A two pack heavy duty zinc dust rich silicate primer:

Total solids (% wt)	84 ± 2

Air drying time	16 hours
Density	3.07 ± 0.005
Dry film thickness (DFT/coat)	60 microns (min)
Temperature resistance	Upto 450°C dry heat

d) Primer paint P4 : Double boiled linseed oil as per IS – 77 : specification for linseed oil, boiled for paints

e) Primer paint P5: In organic Zinc silicate with suitable air drying time 40 microns per coat

f) Primer paint P6 : Red oxide Zinc phosphate as per IS 12744 with DFT 30 microns per coat

g) Primer paint P7 : Red oxide Zinc chrome primer(alkyd based) as per IS 2074 with DFT 40 microns per coat

5. **Intermediate paints (I)**

These paints will be applied over primer coats as an intermediate layer to provide weather proof seal of primer coats.

a) Intermediate paint (I1)

A two pack air drying high build epoxy resin based paint with MIC.

Air drying time	6 to 8 hours (touch dry) 7 days (full cure)
Dry film thickness (DFT/coat)	100 microns
Temperature resistance	Upto 180 deg.C dry heat
Compatible with	Primer P1 and P2

Intermediate Paint I2: Synthetic Enamel (long oil alkyd) to IS 2932. 1 coat = 20 Microns per coat.

6. Finish Paint (F)

Finish paint coats will be applied over primer coats and intermediate coats after proper cleaning and touch up of primed coats. Synthetic enamel paint comprising of IS: 2932:95 will be used for finish coats.

a) Finish paint (F1)

A two pack air drying epoxy polyamide enamel suitably pigmented.

Air drying time	2 to 3 hours (touch dry) 7 days (full cure)
Dry film thickness (DFT/coat)	40 microns
Temperature resistance	Upto 130°C dry heat
Compatible with	Primers Intermediate
Color	Generally all shades

b) Finish paint (F2)

A single pack synthetic rubber based enamel paint.

Air drying time	2 hours (touch dry)

	24 hours (hand dry)
Dry film thickness (DFT/coat)	25 microns
Temperature resistance	Upto 200°C dry heat
Compatible with	No primers
Color	Generally all shades

c) Finish Paint F3

A single pack heat resistant silicon resin based paint with leafing aluminium.

Air drying time	3 to 4 hours (touch dry) 24 hours (hard dry)
Dry film thickness (DFT/coat)	20 microns (min)
Temperature resistance	upto 400°C dry heat
Compatible with	no primer paint except F3
Colour	smooth aluminium

d) Finish Paint F4: Heat resistant Alumina Paint IS 13183 Gr II. DFT 20 microns per coat.

e) Finish Paint F5: Heat resistant Silicone Aluminium Paint with suitable air drying time as per IS 13183 Gr I, 25 microns per coat.

f) Finish Paint F6: Aliphatic acrylic polyurethane paint, DFT = 30 microns per coat.

g) After cleaning the dust on the dried up primer/ intermediate paint, first coat of synthetic enamel will be applied. After this first coat dries up hard, the surface is wet scrubbed cutting down to a smooth finish and ensuring that at no place the first coat is completely removed. After allowing the water to get evaporated completely, the second finish coat of synthetic enamel paint will be applied only after gently removing the gloss of first coat from entire surface and it is dusted off the surfaced. The requirement of workmanship will be as per IS: 1477-71.

h) Equipment No. and the name of the equipment will be painted on the surface of the equipment on visible locations. Service of the Pipe/Line designation with arrow identification for the direction of flow will be painted on all pipes at visible locations at an interval of 20 metres. Wherever pipelines are insulated, the service of the piping and arrow mark will be painted over the clad surface.

i) The color code to be followed during painting of piping will be in line with IS 9404:2002 (Identification of pipelines used in Thermal Power Plants – Color Code).

j) For painting of structure, equipment, tanks & vessels etc. suggested color code is given in Table 11.3.

k) For insulated pipeline the finish paint will be applied at that place where color band is to be painted on the aluminium sheeting. The finished paint (color band) will be of 2m length at that place.

l) Color band for piping will be applied at these following locations-

- At start and end point.
- At every 50m intervals.
- At every T joints and cross connection of piping.
- At every battery limit of pipeline.
- Near valves located at terminal points.

m) Width of band

Table 11.2

Width of band

S.No.	Size of pipe including insulated pipe line outside diameter	Width of band
1	80mm and below	25 mm
2	Above 80 mm upto 150 mm	50 mm
3	Above 200 mm upto 300 mm	75 mm
4	Above 350 mm	100 mm

n) Direction of flow will be indicated by black or white arrow in contrast to the base color on the pipeline. Length of the arrow will be minimum 125 mm and width will be minimum 65 mm. These will be put at an interval of 10 m.

7. **Suggested Colour Codes for Painting of Structures, equipments, tanks & vessels etc.**

Table 11.3

Colour of Specific Items

S.No.	Item / Service	Colour	IS-5	Colour Band	IS-5
1.	Structures, platforms, galleries, ladders and handrails	Dark admiralty grey	632	-	-
2.	Boiler casing, ESP and ducting	Nut Brown	413	-	-
3.	Fans, pumps, motors, compressors, Mills.	Light grey	631	-	-
a)	Outdoor ,Stand pipes, vent pipes	Aluminium	-	-	-
b)	Indoor Tanks	Aluminium	-	-	-
4.	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
5.	Switchgear	Light grey	631	-	-

S.No.	Item / Service	Colour	IS-5	Colour Band	IS-5
6	MCC/PDB, Local control panels, Bus Ducts	Light grey	631/7078 of IS:1660	-	-
7.	Transformers	Dark admiralty grey	632	-	-
8.	Machinery guards	Signal red	537	-	-
9	Water System				
a)	Boiler feed	Sea green	217	-	-
b)	Condensate	Sea green	217	Light brown	410
c)	D M Water	Sea Green	217	Light orange	557
d)	Soft water	Sea green	217	French blue	166
e)	Bearing cooling water	Sea green	217	French blue	166
f)	Potable & filtered water	Sea green	217	French blue	166
g)	Service & clarified water	Sea green	217	French blue	166
h)	Raw water(if applicable)	Sea green	217	White	-
i)	Cooling water	Sea green	217	French blue	166
10	Compressed Air System				
a)	Service air	Sky Blue	101	-	-
b)	Instrument air	blue	101	White	-
11	Oil system				
a)	Fuel oil	Light brown	410	French	166
b)	Light oil	Dark Brown	412	Brilliant green	221
c)	Lubricating oil	Light brown	410	Light grey	631
d)	Control oil	Light brown	410	Light orange	557
e)	Transformer oil	Light brown	410	Light orange	557
12	Fire services	Fire red	536	-	
a)	Ash slurry pipes	Black	-	-	-
b)	Vacuum pipes	Sky blue	101	Black	-
c)	Fuel pipes (Lignite)	Light brown	410	-	-
d)	Drainage	Black	-	-	
e)	Stand pipes and oil Vent pipes	Aluminum	-		
f)	Bottom Ash system	Light Grey	631	-	-

8. Paint Application

a) Paint will be applied in accordance with manufacturer's recommendations. The work will generally follow IS 1477 (Part II) for jobs carried out in India and SSPC-PA-I or DIN 55928 or equivalent for jobs carried out outside India. Touch up paint to be applied to cover scratches after erection and assembly of equipment at site.

b) Paint will not be applied when the ambient temperature is 5°C and below. Also paint will not be applied in rain, wind, fog or at relative humidity of 80% and above.

c) Each coat of paint will be continuous, free of pores and of even film thickness without thin spots. The first coat of finish paint at site will be applied preferably within three months of the shop paint.

d) Each coat of paint will be dry sufficiently before application of next coat.

e) Surface which cannot be painted but require protection will be given a coat of rust inhibitive grease according to IS:958-75 or solvent deposited compound according to IS:1153-75 or S:1674-60.

f) Surfaces which will be inaccessible after assembly will receive minimum coats of specified primer. Surfaces to be in contact with wood, brick or other masonry will be given one shop coat of the specified primer

g) Parts of steel structure to be embedded in concrete will be given a protective coat of Portland cement slurry immediately after fabrication and thoroughly cleaning the surfaces from grease, rust, mill scales etc. No paint will be applied on this part.

h) The Contractor will furnish paint manufacturer's test report or technical data sheet pertaining to the paint selected. The data sheet will indicate among other things the relevant standards, if any, composition in weight percent of pigments, vehicles, additives, drying time, viscosity, spreading rate, flash points, methods of application quality of surface preparation required, corrosion resistance properties and colour.

i) Rust preventive coating should be given to HSFG bolt and nut threads

j) Machined surfaces/weld edges are to be applied with a coating of temporary rust preventive oil.

k) All threaded and other surfaces of foundation bolts ands its materials, insulation pins, anchor channels, sleeves will be coated with temporary rust preventive fluid and during execution of civil works; the dried film of coating will be removed using organic solvents.

l) No painting is required for stainless steel components.

m) The temporary rust preventive coating that already been applied on any components, tubes, pipes etc. will be removed by suitable solvents/ heating to 350-400°C for an hour before primer paint application-but in case, it should be ensured that the minimum surface cleanliness required for primer paint application will be Sp2 (equivalent to hand tool cleaning).

n) In components, where ver plates/sheets of thickness less than or equal to 6mm, pipes, rods are used, power tool / hand tool cleaning to SP3/SP2 will be followed and the painting will be done as per the painting scheme adopted for components that are coming in the flue gas path.

o) All weld edge preparation for site welding will be applied with one coat of weldable primer.

p) For internal protection of pipes/tubes, VCI pellets will be used at both ends after sponge testing and ends capped. VCI pellets will not be used for SS components and composite assemblies.

q) Wherever inside surfaces of ducts need protection till erection, two coats of red oxide zinc phosphate primer (P1) paint to IS 12744 to a DFT of 60 microns will be applied after power tool cleaning.

9. Painting scheme

a) Type of paint products like P1, P2, P3,P4,P5,P6,P7, I1, I 2,F1, F2 and F3,F4,F5,F6 has been specified elsewhere in the specification.

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

10. Legends

Sa - 2 .5 – The quality of surface cleaning, i.e 95 % of the surface area is free from all rust, mill scales and visible residues, foreign materials etc.

SP1-Solvent Cleaning

SP2- Hand tool cleaning

SP3 – Power tool cleaning

SP 4- Blast cleaning (Sa 2.5)

SP 5: Blast cleaning (35 to 50 microns surface cleaning)

SP 6 – Phosphating

SP - surface preparation quality

2P1 - Two (2) coats of primer paint type P1

1I1 - One (1) coat of intermediate paint type I1

2F1 - Two (2) coats of finish paint type F1

DFT - Dry film thickness

CRT - Clean and retouch.

The painting scheme to be followed for various mechanical/ electrical equipment / structures is briefly given below for guidance to the Contractor.

Table 11.4

Painting Scheme and Total DFT in Microns

S.No.	Description	Painting scheme		Total DFT in Microns
		At shop	At site	
1.	Steel structures (for Boiler Proper, Lignite bunkers, Mills, mill maintenance building, Air heaters, aux. boiler, Fans, ESPs, etc)	SP-Sa 2 ½ 2P1 + 1I1	2 F1	240
2.	Separator and separator vessel	a) Surface preparation : Power tool cleaning to St-3 grade b) 2 coats of alkyd red oxide zinc phosphate primer to IS 12744 DFT 30 micron per coat c) 3 coats of long oil alkyd synthetic enamel finish paint (International Orange) to IS 2932 - DFT 20 microns / coat (min) d) Total DFT 120 microns (min)	-	120
3.	Separator internals	SP 1 or SP 3 Rust preventive fluid of DFT = 25 µ/coat		25
4.	Following insulated parts viz., Piping,fitting/components, Pipe clamps vessels/tanks, Equipments and ducts etc	SP 3 2P1, Total DFT - 60 microns P1 - pack of air drying alkyd red oxide zinc phosphate primer to IS 12744 - 2 coats, 30 microns per coat. Total DFT 60 microns (minimum)	-	60
5.	Following un insulated parts viz., Piping, fitting/ components, Pipe clamps, vessels/tanks, Equipments and ducts etc	a) Surface preparation : Power tool cleaning to St-3 grade b) 1 coat of alkyd red oxide zinc phosphate primer to IS 12744 DFT 30 micron per coat	1F2	70

S.No.	Description	Painting scheme		Total DFT in Microns
		At shop	At site	
		c) 2 coats of long oil alkyd synthetic enamel finish paint to IS 2932 – DFT 20 microns / coat (min) d) Total DFT 70 micron (min)		
6.	Constant load hangers (CLH) & Variable Load hanger(VLH)	SP:Sa 2 ½ 1P2 + 1 F6		70
7.	Hangers mentioned other than 6) above	a)Surface preparation : Power tool cleaning to St-3 grade b) 1 coat of alkyd red oxide zinc phosphate primer to IS 12744 DFT 30 micron per coat c) 2 coats of long oil alkyd synthetic enamel finish paint to IS 2932 – DFT 20 microns / coat (min) d) Total DFT 70 micron (min)	-	70
8.	Valves			
9.	Cast carbon steel valves Cast alloy steel valves, API valves, OCNRV, SV and SRV, Silencers and soot blower components	SP3 2F4	-	40
10	Forged valves	a)Surface preparation Solvent cleaning to SSPC-SP1 Grade. b) Phosphating to 16.15 g/sq.m.		
11.	Top covers of Soot blower	a)Surface preparation : Power tool cleaning to St-3 grade b) 1 coat of alkyd red oxide zinc phosphate primer to IS 12744 DFT 30 micron per		70

S.No.	Description	Painting scheme		Total DFT in Microns
		At shop	At site	
		coat c) 2 coats of long oil alkyd synthetic enamel finish paint to IS 2932 - DFT 20 microns / coat (min) d) Total DFT 70 micron (min)		
12	Floor grills, hand rails and posts, ladders / rungs	Hot dip galvanizing to 610 gms/sq.m	-	-
13.	(a)Components coming in the flue gas path like water walls	a)Power tool cleaning to St 2 / 3 b) One coat of dip - coat paint - Red oxide zinc phosphate primer (dip / brush) DFT = 30 microns		30
	(b)Components coming in the flue gas path, Surfaces in the flue gas path of ESP, Fans and APH	a) Power tool cleaning to St- 2 / 3 b) Two coats of dip - coat paint - Red oxide zinc PO4 to IS 12744DFT = 30 microns per coat		60

Note: For components not covered above, Contractor's standard practice will be followed with Owner's / Consultant's approval.

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SECTION – D3

GENERAL TECHNICAL REQUIREMENT (CONTROL & INSTRUMENTATION)

TECHINICAL SPECIFICATION
(FIELD INSTRUMENTS & FINAL CONTROL ELEMENTS)

FIELD INSTRUMENTS & FINAL CONTROL ELEMENTS

General Requirements

1. Measuring instruments/equipment and subsystems offered by the Contractor shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further, all instruments shall be of proven reliability, accuracy, repeatability requiring a minimum of maintenance. They shall comply with the acceptable international standards and shall be subject to owner's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specifications, ranges, make/ numbers as approved by the owner during detailed engineering.

2. Every panel mounted instrument requiring power supply shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.

3. All local gauges as well as transmitters, sensors, and switches for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance as well as for operator and management information (including all computation) of equipment under the scope of specification shall be provided.

4. The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapings where the pressure exceeds 40 kg/sq cm.

5. For protection purposes, transmitters can be considered in place of switches.

Pressure / Differential Pressure / Flow / Level Transmitter

Table 9.1

Specifications for Pressure / Differential Pressure / Flow / Level Transmitter

S.N	Features	Minimum Requirements
1	Type	Microprocessor based 2 wire type, HART protocol compatible
2	Sensor Type	Capacitive/ Piezo-electric
3	Output Signal	4-20 mA signals superimposed with HART signal.
4	Signal Processing Unit	Microprocessor based
5	Overpressure	150% of max. operating pressure. For vacuum service, the element shall have under – range protection to full vacuum
6	Turn-down Ratio	10:1 for vacuum / very low pressure applications. 100:1 for other applications.
7	Stability	± 0.1% of calibrated span for six months up to 70 Kg/cm² and ± 0.25% for range more than 70 Kg/cm²(g).
8	Span and Zero drift	± 0.015% per deg. C at max span & 0.11% per deg. C at min. span.
9	Enclosure Class	Weather proof as per IP 67 with corrosion resistance coating. For hazardous area explosion proof enclosure as described in NEC article 500
10	Zero & span adjustability	Continuous, tamper proof, remote as well as manual from instrument with zero suppression and elevation facility.
11	Local Indicator	To be provided
12	Display	Digital LCD Integral Display (minimum 5 digit) Engineering Unit
13	Process connection	½" NPT (F)
14	Electrical connection	½" NPT
15	MOC of Electrical Housing	Aluminum Alloy or better
16	Ambient Temperature	65 Deg. C
17	Operating Voltage	16 - 48 Volts DC
18	Load	600 Ohms (minimum) at 24 Volts DC
19	Accuracy	± 0.075% of span or better
20	Response Time	100 milli-second or better
21	Adjustment/ calibration/ maintenance	Centralised PC based system maintenance per clause.

1. All transmitters shall be equipped with all necessary accessories like valve manifolds, mounting bracket etc. Pulsation dampeners shall be used where the process media is unstable for measurement such as at the discharge of a pump. For absolute pressure transmitter, 2 valve manifold; for gauge / vacuum pressure transmitter, 3 valve manifold and

for DP / level / flow transmitter, 5 valve manifold shall be provided. In case if it becomes necessary to use a DP transmitter for pressure measurement then a 3 valve manifold shall be used in place of 2 valve manifold.

2. Pressure transmitter shall have easily accessible span, zero and time constant adjustments. A range suppression / elevation device shall be provided wherever required.

3. For pressure / differential pressure transmitter, proof pressure shall be 200% of maximum static process pressure.

4. All transmitter cases shall be dust – tight and rugged. Weather – proof and explosion – proof cases shall be used in outdoor and hazardous areas respectively. Protection clause shall be of IP 67 or better.

5. Transmitters for pressure / DP measurements of liquid and steam shall always be installed below the sampling point, preferably with the connection at the top.

6. Transmitters for pressure / DP measurements for gases and air shall always be installed above the sampling point, preferably with the connection at the bottom.

7. Transmitters with diaphragm seal system shall be considered when

   - The process temperature is outside of the normal operating ranges of the transmitter and cannot be brought into those limits with impulse piping or
   - The process is corrosive and would require frequent transmitter replacement or unusual materials of construction or
   - The process contains suspended solids or is viscous and may plug the impulse piping or
   - There is a need to make density or interface measurements or
   - The process medium may freeze or solidify in transmitter or impulse piping.

8. Diaphragm seal shall be either capillary type or direct mounted type depending upon the application. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

9. Differential pressure type level transmitters shall be used for range above 1219 mm, for services requiring purge or where liquid might boil in external portions.

10. Differential pressure type level transmitters for use on corrosive service shall generally be diaphragm wafer with extended filled capillary type. Flush or extended diaphragm type DP transmitter shall be considered for special application. Diaphragm material shall normally be stainless steel or any other special alloy.

Pressure Gauge/ Differential Pressure Gauge/Draft Gauge

Table 9.6

Specification for Pressure Gauge/ DP Gauge/ Draft Gauge

S.N	Feature	Minimum Requirement
1	Type	Bourdon / Bellows / Diaphragm
2	Sensing Element Material	AISI 316 SS
3	Movement Material	AISI 304 SS

S.N	Feature	Minimum Requirement
4	Case Material Protection Class	SS / IP 65
5	Dial Size	150 mm For Special application 250 mm shall be used
6	Scale	Black lettering on white background in 270 °C arc
7	Range Selection	Normally operate at 75% of its maximum pressure range. Instruments measuring varying pressures shall operate in a band of 60% of its maximum pressure range.
8	Over range Protection	150% of maximum range by internal stop. External stop below zero.
9	Adjustment	External Micrometer screw for zero adjustment. Internal micrometer screw for range adjustment.
10	Stop at Max. Reading	Shall be provided
11	Element Connection	Argon welding
12	Process Connection	½" NPT(M) bottom connection for local mounting, back connection for panel mounting
13	Accuracy	+/- 1.0 % of full scale or better
14	Operating Ambient Temperature	50 °C (Max. continuous)
15	Safety Feature	Neoprene Safety Diaphragm (Blowout disc) at the back
16	Window	Shatter-proof glass
17	Chemical Seal Unit	SS 316 Flange and Diaphragm, PTFE coated block, Silicon Oil filling fluid
18	Accessories	Snubbers for pulsating fluid applications, 3-way gauge cock, 2-valve manifold, Pigtail, Siphon for steam service, Gauge Saver, if maximum or Design Pressure is very high than the Operating Pressure Counter Flanges, Bolts, Nuts, Gaskets SS Tag Plate

1. Directly connected pressure measuring instruments shall be diaphragm, bourdon or bellow type elements depending upon the services conditions. In general, diaphragm elements shall be used in the range of 0 to 1000 mm water column pressure, bellow type element for ranges of 0 to1 Kg/cm2 and bourdon type element for ranges greater than 1 Kg/cm2.
2. Primary element material shall be corrosion resistant to process fluid or diaphragm seals shall be provided for protection.
3. For draft measurement Teflon coated beryllium copper diaphragm shall be used.
4. Snubbers shall be floating pin type, externally mounted and externally adjustable. It shall be used for all pulsating services.
5. Diaphragm seals, filled type or mechanical type shall be furnished where plugging of the element may occur or where suitable material is not available in highly corrosive services. When chemical seals are required, they shall be the clean out type with flushing connection.
6. Over-range protection shall be provided to at least 150 % of range. For vacuum service, the element shall have under-range protection to full vacuum
7. Ranges of the gauges shall be so selected that the gauge normally operates in the middle third of the scale and conform to IS 3624 standard dials, wherever necessary.
8. The sensing elements for all gauges shall be properly aged and factory tested to remove all residual stresses and shall be SS 316 with forged socket and tip of the same material. Elements above 70 Kg/sq. cm range shall be bored instead of drawn.
9. For low pressure application where long elements are used, well supported protecting tube shall be installed to prevent mechanical damage and erosion of the elements.

Specifications for Junction Box

S.N	Features	Minimum Requirements
1	No. of Ways	32 (2X16) with 20% spares terminals
2	Material & Thickness	3 mm thick Stainless steel
3	Protection class	IP-65 for outdoor/ IP 55 for Indoor
4	Cable entry	Bottom
5	Mounting	Suitable for Wall/column/structures mounting
6	Terminal Blocks	Rail mounted cage-clamp type suitable for conductor size up to 2.5 mm^2
7	Grounding	M6 earthing stud shall be provided
8	Gland plate	Removable type
9	Door	Single Lockable door with gasket, able to open sideways, turn able hinge based, latch type lock without handle with common key.
10	Accessories	Tag plate, clamps, fixtures, bolts (SS), nuts (SS), Gasket (Neoprene), cable glands (SS), Lugs (Brass), Fire proof compound for sealing.

1. All JB's for outdoor application shall be provided with individual canopies to prevent ingress of water.
2. All JB' shall have provision to add 10% additional TB's.
3. The marking on terminal strips shall correspond to the terminal numbering on wiring diagrams.
4. Separate Terminal blocks shall be used for Analog & Digital Signals & also for signals with different voltage levels.
5. The terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks and between terminal blocks and junction box walls.
6. Separate shield bus shall be provided with screw connection for terminating cable shields.
7. All spare cable entries shall be provided with plugs.
8. All wires in JB shall be neatly dressed & ferruled.
9. Double deck type terminal block shall not be used.

SPECIFICATION FOR SOLENOID VALVE

1.	Type	Single/Double coil type, corrosion resistant type
2.	Body	SS316
3.	Internals	SS316
4.	Spring	SS316
5.	Size	½ inch
6.	Class of insulation	H
7.	Electrical connection	24 V DC from BOP-DCS
8.	Connectivity	Connectivity with BOP-DCS required for operation
9.	Protection Class	IP-65

SPECIFICATION FOR MASS FLOW CONTROLLER (MFC)

1.	Mass Flow Controller	Bidder to select appropriate model subject to approval during detailed engineering
2.	Expected flow of oxygen in process	50-400 GM/hr (for skid dosing at deaerator outlet) & 40-300GM/hr (for skid dosing at CPU outlet)
3.	MOC-Wetted part	SS316
4.	Operating Pressure	Pressure reducing valve set pressure (refer PID)
5.	Transmitter	Field mounted HART protocol compatible transmitter compatible with the sensor
6.	Electrical connection	24 V DC from BOP-DCS
7.	Connectivity	Connectivity with BOP-DCS required for operation
8.	Protection Class	IP-65
9.	Mass flow accuracy at max flow	±1%

VOLUME-III

SCHEDULE OF PRE-BID CLARIFICATION

All clarification from the Technical Specification shall be filled in by the BIDDER clause by clause in this format only.

VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

SCHEDULE OF DEVIATIONS WITH COST OF WITHDRAWAL

PROJECT:-NEYVELI LIGNITE CORPORATION (NLC)
2X500 MW NEW NEYVELI TPP(SG PACKAGE)

PACKAGE:- OXYGEN DOSING SYSTEM

TENDER ENQUIRY REFERENCE:-

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWAL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	**DESIGNATIONS**	**SIGN & DATE**	

NOTES:

1. For self manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawl of deviation shall be taken as **NIL**.
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of withdrawl is to be given seperately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as **NIL**.
13. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
14. In case of descrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.

COMPLIANCE CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnishing same with the offer:

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.

2. QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.
   QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.
   The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.

3. All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.

4. There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.

5. The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.

6. The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).

7. All sub vendors shall be subject to BHEL/CUSTOMER approval.

8. Any special tools & tackles, if required, shall be in bidder's scope.

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

	TITLE * SCHEDULE OF DECLARATIONS	BHEL DOCUMENTS NO.: PE-TS-400-154-12000A-A001 VOL III SHEET..... OF.....

* **Bidder shall include this schedule both in technical and Price offers**

DECLARATION

I .....certify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated ..... and there is no deviation to the specification (except indicated in the deviation sheet (with cost of withdrawal).

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Biders Company Name .....

Authorised representative's Signature .....

Name .....

Bider's Name

The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

NEYVELI LIGNITE CORPORATION (NLC)
2X500 MW NEWNEYVELI TPP(SG PACKAGE)
PACKAGE:- OXYGEN DOSING SYSTEM
SUGGESTIVE UN-PRICED SCHEDULE

Sl. No.	DESCRIPTION OF EQUIPMENT / ITEM	QTY.	UNIT PRICE EX-WORKS (DULY PACKED)	TOTAL PRICE EX-WORKS (DULY PACKED)				
(1)	(2)	(3)	(4)	5)				
1.0	Total lump sum price on FOR site basis for design, engineering, manufacture, fabrication, assembly, inspection and testing at manufacturer's works, start up and commissioning spares,supply and dispatch to power station site of skid mounted **OXYGEN DOSING SYSTEM** alongwith other items,freight, all prevailing taxes, duties and other levies of as required for the total scope defined as per BHEL specification no. **PE-TS-400-154-12000A-A001** and subsequent clarifications confirmation, correspondences with the bidders till date.							
	NOTES:							
	a) Bidder to note that total price indicated above at**1.0** shall be considered for evaluation and hence should be complete in all respect for the full scope defined and considering all terms and conditions agreed.							
	b) In case, price indicated above does not match with total of item wise break-up given at**2.0**, the higher price so calculated shall be considered for evaluation but in case of order, the same shall be placed at the lowest price.							
2.0	**MAJOR BREAK-UP OF PRICES GIVEN IN 1.0 ABOVE**							
2.1	Total lump sum price on FOR site basis for design, engineering, manufacture, assembly, inspection and testing at manufacturer's works, packing, supply and delivery at site, including freight for **OXYGEN DOSING SYSTEM** complete with all accessories for the total scope defined as per BHEL specification no. **PE-TS-400-154-12000A-A001** and subsequent clarifications confirmation, correspondences with the bidders till date.							
2.1.1	**Oxygen dosing skid (including two cylinders mounted on each skid)**	4 nos.						
2.1.2	**Accessories (as described below)**							
2.1.2.a	**Injector Assembly**	8 nos						
2.1.2.b	**1/2" OD, 18 BWG, SS 316 tubing for oxygen dosing**	400 m						
2.1.2.c	**SS 316 Tube fittings –tees**	20 nos						
2.1.2.d	**SS-316 Compression fittings**	74 nos						
2.1.2.e	**SS 316 Tube fittings –90° elbows**	20 nos						
2.1.2.f	**Filled oxygen cylinders (Each of 50 lt water volume filled at 204 Kg/cm2 pressure)**	20 nos.						
2.1.2.g	**Rack to hold 10 filled oxygen cylinders**	2 nos.						
2.2	Supply of **Commissioning spares/special tools & tackles** inclusive of all taxes, duties etc. on "FOR" site basis (as and if deemed necessary by the bidder for commissioning of his skid) (in case quoted, bidder to furnish price break up separately.)							
	Total of 2.1.1, 2.1.2.a, 2.1.2.b, 2.1.2.c, 2.1.2.d, 2.1.2.e, 2.1.2.f, 2.1.2.g , and 2.2							