319035/2021/PS-PEM-MAX

TELANGANA STATE POWER GENERATION CORPORATION LTD
5X800 MW YADADRI TPS

VOLUME: II B & III

TECHNICAL SPECIFICATIONS
FOR
OXYGEN DOSING SYSTEM

SPECIFICATION NO.: PE-TS-417-154-A101,R01

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 This specification is intended to cover design, engineering, manufacturing, fabrication, assembly, painting, packing, inspection & testing at manufacturer's works, mandatory spares, supply and dispatch to power station site of skid mounted **OXYGEN DOSING SYSTEM** , complete with all accessories/items including supervision of commissioning by experience/capable engineers as specified in different sections / volumes of this specification hereinafter for the **5X800 MW YADADRI TPS.** The bidder's scope shall also include any other services, etc. if called for in the succeeding sections of the specification.

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 Bidder shall be required to depute his qualified/capable personnel at any stage to supervise, Commissioning of Oxygen dosing skids for Two (2) Visit for station for Ten Days [i,e. One (1) Visit of Five (5) days for Stage -I & One (1) Visit of Five (5) days for Stage -II]. This will include supervision of commissioning of Oxygen Dosing system in totality.

The Ten (10) days are to be considered as Ten (10) working days at site. (i.e. 5 days per Stage, excluding the travel time.)

1.4 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.

1.5 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.

1.6 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.

1.7 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(TSGENCO) 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(TSGENCO) as and when brought to their notice either by the bidder or by purchaser/ customer (TSGENCO) themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

1.8 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 and there is no deviation.(Price to be given in sealed envelope only).

1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder / vendor and Customer (TSGENCO) / BHEL / Employer will mean BHEL and /or TSGENCO.

1.11 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and shipping release issue by BHEL/Customer (TSGENCO).

1.12 BHEL's/Customer's (TSGENCO) representative shall be given full access to the shop in which the equipment are being manufactured or tested and all test records shall be made available to him.

SECTION – B
PROJECT INFORMATION

YADADRI THERMAL POWER STATION

PROJECT INFORMATION

1	Name of the Project	YADADRI Thermal Power Station
2	Station Capacity	5X800 MW (Coal based)
3	Owner	Telangana State Power Generation Corporation Limited (TSGENCO)
4	Site Location	Site is located 7 km from the NH5.
5	Latitude	16° 42'20.40 N
6	Longitude	79° 34'41.56 E
7	Nearest Town	30 Km Miryalaguda
8	Nearest Railway Station	6.5 Km Damercherla
9	Nearest Airport	130 Kms (Vijayawada)
10	Site Conditions	
	Ambient Temperature	
	Daily minimum (average)	10°C
	Daily maximum (average)	47°C
	Design Ambient Temperature	50°C
	Ambient temperature (performance)	38°C
	Relative Humidity for design / efficiency	48-84 %
	Annual rainfall, mm	600 mm
	Plant Elevation above MSL	85 m above MSL
	Mean Wind Speed	8 km/h
	Wind Pressure	As per the latest revision of IS 875/1987
	Seismic co-efficient	Zone-II as per IS- 1893 (Part-IV)

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 **5X800 MW YADADRI TPS**.The above system shall be skid mounted. Two numbers skid 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), total Ten (10) Nos. for complete station.

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 C2) for respective scopes.

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

- **i.** Entire Oxygen dosing system mounted on skid (including Two bank of cylinders (containing four cylinders in each bank) as per P&ID and Data Sheet-A instrumentation (minimum) as per the enclosed P&ID.
- **ii.** Rack Five (5) no. each to hold 21 Nos. cylinder.
- **iii.** Oxygen cylinders (105 Nos.).
- **iv.** Injector assemblies (20 nos.).
- **v.** Tees (50 nos.) & Elbows (50 nos.).
- **vi.** Loose tubing (1000 meter).
- **vii.** Compression fittings (200 nos.) for loose tubing.
- **viii.** Foundation nuts & bolts to fix each skid on the floor, as required.

1.2 SCOPE OF SERVICE.

The bidder's scope also includes following service for scope under this specification:

- **i.** Supervision of Commissioning.

Bidder shall be required to depute his qualified/capable personnel at any stage to supervise, Commissioning of Oxygen dosing skids for Two (2) Visit for station for Ten Days [i,e. One (1) Visit of Five (5) days for Stage -I & One (1) Visit of Five (5) days for Stage -II]. This will include supervision of commissioning of Oxygen Dosing system in totality.

The Ten (10) days are to be considered as Ten (10) working days at site. (i.e. 5 days per Stage, excluding the travel time.)

1.3 CIVIL SCOPE.

Nil.

1.4 OXYGEN DOSING SYSTEM: (2 SKIDS FOR EACH UNIT /TOTAL 10 NOS FOR STATION)

(Refer drg no. PE-DG-417-154-12000A-A501)

Each skid of Oxygen Dosing System consists of the following:

- **i.** Two bank of oxygen cylinder with four cylinders in each bank for dosing at downstream of deaerator /CPU outlet.
- **ii.** Two (2) number of Pressure Regulator as per section D1 and data sheet - A
- **iii.** 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.
- **iv.** Control & instrumentation as per P&ID of oxygen dosing system, data sheet-A, Section C2,D1 and D2.

1.5 MANDATORY SPARES

Mandatory spares. .(Refer attached, Annexure-IV/Section-C1).

1.6 TERMINAL POINTS (ALSO REFER P & I DIAGRAM ENCLOSED)

i. All field instruments (pressure transmitters), solenoid actuated valves and mass flow controller (MFC) shall be terminated at JB by the oxygen dosing vendor for further connection to DCS by BHEL. BHEL shall provide 230 VAC UPS supply feeder at a single point. Further distribution to various instruments shall be in Bidder's scope. Bidder to include necessary power distribution board in his scope. Any power supply other than the above, if required by any instrument/device, has to be derived by the Bidder and all necessary hardware/software for the same shall be in bidder's scope. Bidder to furnish UPS power requirement along with the bid".

ii. The JB termination drawing (PE-DC-417-154-A004) is enclosed elsewhere in this specification. The bidder to comply the same.

iii. All vent connections shall be connected via vent header and terminated at one point of the skid by bidder for further connection to atmosphere by BHEL.

iv. 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.

v. 24V DC connection to SV-3, SV-4, SV-5 for Dearator o/l & SV-3 for CPU discharge provided on injector assembly shall be directly connected by BHEL.

1.7 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.

1.8 PACKING:

To prevent damage to the equipment of the skid during transit, wooden / angle iron / steel frame supports to be provided.Special attention shall be provided while packing and loading for overhead equipment. Packing and transport instructions are enclosed in section D1. Necessary packing procedure/drawing shall be submitted by successful bidder during detailed engineering for BHEL/Customer (TSGENCO) approval.

1.9 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-65 minimum. Other tech. requirements of this enclosure shall be in line with JB details indicated elsewhere in the specification.

m) All solenoid actuated valve shall be mounted in pneumatic junction boxes.

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

o) 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.

1.10 QUALITY PLAN AND SUB VENDOR APPROVAL

a) Quality plant is attached as Annexure-I. However, requirement of detailed QP, inspection checklist, certificate of conformance etc. for each equipment and sub-vendor shall be finalized during detailed engineering stage, if required. Decision of BHEL/customer shall be binding on vendor in this regard. Any changes/additional tests insisted upon by Owner during detailed engineering stage shall be accepted by bidder without any commercial and delivery implication to BHEL/Customer. All inspection & testing etc. shall be carried out based on Customer & BHEL approved documents.

b) Sub vendor list is attached as Annexure-II. The sub vendor list enclosed is indicative only and is subject to approval / acceptance by customer (TSGENCO). 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.

1.11 DRAWINGS/DOCUMENTATION

1.11.1 DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID:-

a) Deviations (if any) in given format only.
b) Compliance Cum Confirmation Certificate.(Stamped & Signed)
c) 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.

1.11.2 LIST OF DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT :-

After award of PO, following (Ref. MDL) 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-III**. The bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only.

Bidder to 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.

Ref. MDL			
SNO	**BHEL DRG NO**	**DRG TITLE**	**DRG SCH FOR VENDORS**
1.	PE-DG-417-154-12000A-A501	P&ID FOR OXYGEN DOSING SYSTEM	R-00 within 14 days from PO & subsequent revisions within10 days of comments received from BHEL. BHEL shall furnish comments / approval on each submission within 18days from receipt.
2.	PE-V0-417-154-A102	GA DRAWING AND FOUNDATAION DETAILS OF OXYGEN DOSING SYSTEM.	
3.	PE-V0-417-154-A103	QAP FOR OXYGEN DOSING SYSTEM	
4.	PE-V0-417-154-A105	SUB VENDOR LIST	
5.	PE-V0-417-154-A104	TECHNICAL DATA SHEET FOR OXYGEN DOSING SYSTEM	R-00 within 28 days from PO & subsequent revisions within10 days of comments received from BHEL. BHEL shall furnish comments / approval on each submission within 18days from receipt.
6.	PE-DC-417-154-A004	JUNCTION BOX TERMINATION DRAWINGS FOR OXYGEN DOSING SYSTEM	
7.	PE-DC-417-154-A102	PAINTING SCHEDULE FOR OXYGEN DOSING SYSTEM	
8.	PE-DC-417-154-A103	MANDATORY SPARE LIST FOR OXYGEN DOSING SYSTEM	
9.	PE-V0-417-154-A106	O&M MANUAL FOR OXYGEN DOSING SYSTEM	within 30 days of issuance of MDCC

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/login.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) 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.

b) 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.

1.12 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.

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

ANNEXURE-I

QAP

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-417-154-A101,R01	DATE:
	CUSTOMER :TSGENCO		QP NO.: PE-V0-417-154-A103	DATE:
	PROJECT: 5X8OO MW TSGENCO YADADRI TPS		PO NO.:	DATE:
	ITEM: OXYGEN DOSING SYSTEM	SYSTEM: DEAERATOR & CEP DISCHARGE DOSING SYSTEM	SECTION:	SHEET 1 OF 3

S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	D*				10
					M	C/N					M	C	N	
1.0	**WELDER'S QUALIFICATION**													
1.1	WELDING PROCEDURE SPECIFICATION (WPS)	CORRECTNESS	MA	VERIFICATION	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	REFER NOTE-2
2	EMPTY OXYGEN CYLINDER	MTC, HYDRO TEST & RELEVANT TESTS AS PER IS 7285	MA	VISUAL	100%		BHEL APPROVED DATASHEET/IS 7285	AS PER APPROVED DATASHEET//IS 7285	MTC	√	P	V	V	
3	VALVES (BODY & BONNET)	MATERIAL	MA	VISUAL	100%		BHEL 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		BHEL APPROVED DATASHEET	AS PER APPROVED DATASHEET	CALIBARATION REPORT, MTC		P	V	V	
4.B	PRESSURE TRANSMITTER	CALIBRATION, OVER LOAD PROTECTION & TYPE TEST CERTIFICATE	MA	VISUAL	100%		BHEL APPROVED DATASHEET	AS PER APPROVED DATASHEET	CALIBARATION REPORT, MANUFACTURERS COC	√	P	V	V	
5	SOLENOID VALVES	MATERIAL	MA	VISUAL	100%		BHEL APPROVED DATASHEET	AS PER MODEL DECODIFICATION MENTIONED IN MFRS CATALOGUE	MANUFACTURERS COC	√	P	V	V	
6	CYLINDER PRESSURE REGULATOR	MATERIAL	MA	VISUAL	100%		BHEL APPROVED DATASHEET	AS PER MANUFACTURERS CATALOGUE	MANUFACTURERS COC	√	P	V	V	-
7	TERMINATION BOX	COUNTUNITY,IR-HV-IR & DEGREE OF	MA	ELECTRICAL	100%		BHEL APPROVED DATASHEET	AS PER APPROVED DATASHEET	MANUFACTURERS COC &	√	P	V	V	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:			Checked by:		
Reviewed by:			Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-417-154-A101,R01	DATE:
	CUSTOMER :TSGENCO		QP NO.: PE-V0-417-154-A103	DATE:
	PROJECT: 5X8OO MW TSGENCO YADADRI TPS		PO NO.:	DATE:
	ITEM: OXYGEN DOSING SYSTEM	SYSTEM: DEAERATOR & CEP DISCHARGE DOSING SYSTEM	SECTION:	SHEET 2 OF 3

S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	D*				10
					M	C/N					M	C	N	
		PROTECTION							INSPECTION REPORT					
8	TUBING	CHEMICAL & PHYSICAL	MA	CHEMICAL & PHYSICAL TEST	100%		BHEL APPROVED DATASHEET	APPROVED DRAWING DATASHEET	LAB REPORT	√	P	V	V	
9	MASS FLOW CONTROLLER	CALIBRATION REPORT	MA	ELECTRICAL	100%		BHEL APPROVED DRAWING & DATASHEET	APPROVED DRAWING & DATASHEET	CALIBRATION REPORT	√	P	V	V	
10	FITTING	MATERIAL	MA	VISUAL	100%		BHEL APPROVED DRAWING	AS PER MODEL DECODIFICATION MENTIONED IN MFRS CATALOGUE	MANUFACTURERS COC	√	P	V	V	
11	FINAL ASSAMBLY	DIMENSION, ORIENTATION & COMPLETENESS.	MA	MEASUREMENT	100%		BHEL APPROVED DRAWING	APPROVED DRAWING	INSPECTION REPORT	√	P	W	V	
	FAT	LEAKAGE	MA	N2 FILL FOR 2HR	100%		BHEL APPROVED DRAWING / FACTORY ACCEPTANCE TEST	NO LEAKAGE	INSPECTION REPORT	√	P	W	V	-
	PACKING	PACKING	MA	VISUAL AND MEASUREMENT.	100%		BHEL APPROVED DRAWING/SPEC	BHEL APPROVED DRAWING/SPEC	INSPECTION REPORT	√	P	W	V	REF. NOTE-5
12	POWDER COATING STAMPING	DFT MEASUREMENT	MI	VISUAL	100%		BHEL APPROVED DRAWING/SPEC	BHEL APPROVED DRAWING/SPEC	INSPECTION REPORT	√	P	W	V	

NOTES:

1. ALL INSTRUMENTS/VALVES ETC. SHALL BE OXYGEN CLEANED AND SUITABLE FOR OXYGEN SERVICE. MANUFACTURERS COC CERTIFYING THE SAME REGARDING OXYGEN CLEANED SHALL BE SUBMITTED FOR REVIEW DURING FINAL INSPECTION.
2. WELDER PERFORMANCE IS AS PER QW 484 & PROCEDURE QUALIFICATION RECORD IS AS PER QW 483 TO BE FURNISHED.
3. THE LATEST REVISIONS/YEAR OF ISSUE OF ALL THE STANDARD INDICATED IN THE QP SHALL BE REFERRED.
4. BHEL RESERVES THE RIGHT FOR CONDUCTING REPEAT TEST, IF REQUIRED.
5. PHOTOGRAPHS OF THE PACKING JUST BEFORE DISPATCH FOR ISSUING MDCC.
6. MATERIAL SHALL BE PACKED SUITABLY IN ORDER TO AVOID DAMAGE OF PAINT AND OTHER ITEMS DURING TRANSIT AND ALSO DURING STORAGE AT SITE IN TROPICAL CLIMATE CONDITIONS FOR A PERIOD OF 15-18 MONTHS.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: TSGENCO,
P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR, **CR:** CRITICAL

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:			Checked by:		
Reviewed by:			Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC. NO : PE-TS-417-154-A101,R01	DATE:
		CUSTOMER :TSGENCO		QP NO.: PE-V0-417-154-A103	DATE:
		PROJECT: 5X8OO MW TSGENCO YADADRI TPS		PO NO.:	DATE:
		ITEM: OXYGEN DOSING SYSTEM	SYSTEM: DEAERATOR & CEP DISCHARGE DOSING SYSTEM	SECTION:	SHEET 3 OF 3

Test Procedure (Factory Acceptance Test)

- 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 conducted at supplier's factory.
- FAT will be carried out using only the Inert gas such as Nitrogen. Following will be FAT protocol,

1. Checking the completeness of the system. This will include visual inspection of equipment and instruments as per the P&IDs & GA along with skid after assembling on skid.
2. Soap Leak test (Refer Annexure M of ASME B31.8) of tubing/fitting/valves using nitrogen at 1.25 times of maximum operating pressure (table 841.3.2.1 in ASME B31.8-2012) i.e. **26.25 Kg/cm2 (g)** for skid dosing at De-aerator outlet and **55.0 Kg/cm2 (g)** for skid dosing at CPU outlet for 2 hours. The allowable pressure drop would be up to 0.5 bar over 2 hours.
3. 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.
4. Testing of assembly of skid, instruments, termination box will be done as per approved Quality Assurance Plan along with final inspection during FAT (Test Procedure).
5. Inert test run using nitrogen to demonstrate flow.
6. Function of the manual valves to be checked out by opening & closing.
7. Factory Acceptance Test will be offered for witness to BHEL and reports shall be furnish to TSGENCO for review.

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:			Checked by:		
Reviewed by:			Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

ANNEXURE-II

SECTION – C1
SUB-VENDOR LIST

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	FILLING OF OXYGEN CYLINDER	FILLING OF EMPTY CYLINDERS MAY BE DONE FROM ANY CCE LICENSED OXYGEN GAS FILLER	AS APPLICABLE	
2.	EMPTY OXYGEN CYLINDERS	BPCL	ALLAHABAD	
		EVEREST KANTO	BOMBAY	
		MARUTI KOATSU CYLINDER LTD	HALOL, GUJARAT	
3.	CHECK VALVE/BALL VALVE/	HAMLET	USA	
		SWAGELOK	USA	
		PARKER	USA	
4.	VALVE MANIFOLD	HAMLET	USA	
		EXCEL HYDRO	MUMBAI	
		SCHNEIDER	GERMANY	
		HY LOK	KOREA	
		DK TECH	KOREA	
		ANDERSON GREENWOOD	USA	
		ASLACH	MUMBAI	
		HP VALVE AND FITTING	CHENNAI	
		HYD AIR	LONAVLA	
		FLUID CONTROL	MUMBAI	
		MICRO PRECISION	FARIDABAD	
		PARKER	USA	
		SWAGELOK	USA	
		BALDOTA	MUMBAI	
5.	PRESSURE REDUCING VALVE	TESCOM	USA	
		SWAGELOK	USA	
6.	TUBING	SWAGELOK	USA	
		HAMLET	USA	
		PARKER	USA	
		SANDVIK	USA	
		VIKAS INDUSTRIAL PRODUCTS	NOIDA	
7.	NEEDLE VALVE & PRESSURE SAFETY VALVE	SWAGELOK	USA	
		HAMLET	USA	
		PARKER	USA	
8.	SOLENOID VALVE	ROTEX	BARODA	
		AVCON	MUMBAI	
		ASCO	CHENNAI	
		SMC	NOIDA	
		NUCON	HYDERABAD	
9.	3 WAY VALVE	HI TECH	AHMEDABAD	
		ADVANCE VALVES PVT.LTD	NOIDA	
		BDK	HUBLI	
		FOURESS ENGG.INDIA LTD.	MUMBAI	
		FLUIDLINEVALVES COMPANY PRIVATE LTD.,	MUMBAI	
		INSTRUMENTATION LTD.	PALAKAD	
		KIRLOSKAR BROTHERS LTD.	PUNE	
		VENUS PUMP & ENGG. WORKS	KOLKATA	
		SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY	CHENNAI	
		STAFFORD CONTROLS LIMITED	PUNE	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
10.	PAINT	ASIAN PAINTS (I) LTD.		
		BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		

		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		JOTUN PAINTS		
11.	STRUCTURE STEEL	SAIL		
		TISCO		
		JINDAL		
		BHUSWAL		
12	MASS FLOW CONTROLLER	BROOK'S (EMERSON)		

SUB-VENDOR LIST FOR C&I ITEMS

Sl No	Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address	Tech Limit	Fin Limit
1	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode : 600050 Email : sales@switzerprocess.co.in	Works-1->C S Shankar 127, Sidco North Phase, Ambattur Estates, - CHENNAI-TAMIL NADU INDIA Phone- 8754491904 FAX : 044-26248849 Pincode : 600050 Email : cservice@switzerinstrument.com		
2	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com			
3	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Barksdale GmbH, Germany	Michael Weileder Dorn Assenheimer, Strasse 27 Reichelsheim Phone- +91-9999107840 Pincode : D-61203 Email : msingh@barksdale.de			
4	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com			
5	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, - Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com		
6	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS INDUSTRIES LIMITED	B-20-21, INDUSTRIAL AREA, MEERUT ROAD, GHAZIABAD Phone- 0120-2712016 Pincode : Email : mktg@indfos.com			

7	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	INDFOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com			
8	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,	Works-1->LARRY DEGARMO/ ROY STUMBOUGH 14685 W. 105TH STREET, LENEXA -KANSAS-USA Phone- 913-888-0767 FAX : 913-888-0767 Pincode : 66215 Email : rstumbough@sorinc.com		
9	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	Kaustubha Udyog,	S.No. 36/1/1, Sinhgad Road, Vadgaon Khurd, Near Lokmat Press, Pune, Phone- 020-24393577, Pincode : Email : pressure@vsnl.com,			
10	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net	Works-1->NA NA -- Phone- FAX : Pincode : Email :		OVERALL PENDING ORDER VALUE (EXCLUDING VALUE OF ORDERS ALREADY EXECUTED) FOR ALL PACKAGES FOR WHICH VENDOR IS REGISTERED SHALL NOT EXCEED RS. 1.0 CRORE
11	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in	Works-1->Mr. Gautam Mukherjee Kusumba,Sonarpur Station Road,P.O. - Narendrapur, - Kolkata-WEST		

				BENGAL INDIA Phone- 9836878855 FAX : 033-24342748 Pincode : 700103 Email : gkm_ani@hotmail.com		
12	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, Kolkata Phone- +91 33 2548 7220 Pincode : 700074 Email : parthabosebpi@gmail.com; bosepanda@vsnl.net	Works-1->Mr. Partha Bose 44, Saheed Hemanta Kumar Bose,Sarani, -Kolkata-WEST BENGAL India Phone- +91 33 2548 7220 FAX : +91 33 2548 0429, Pincode : 700074 Email : parthabosebpi@gmail.com bosepanda@vsnl.net		
13	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com		
14	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com	Works-1->Shikha Hazra/ Shyamal Hazra 32, Industrial Suburb,Yeshwanthpur -BANGALORE-KARNATAKA INDIA Phone- 080-23370300 FAX : 080-23379890 Pincode : 560022 Email : shikhahazra@hgurusouth.com		
15	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 À GIDC À Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com		

16	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com	Works-1->MR G.SRINIVASAN/MR ANUJ MALPANI PLOT NO:A-19/2 & T-4/2,I.DA. NACHARAM , -HYDERABAD-TELANGANA INDIA Phone- 09866550762 FAX : 040 27152193 Pincode : 560076 Email : gshrinivasan@forbesmarshall.com		
17	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, -Kalamboli Taluka Panvel-MAHARASHTRA India Phone- 022-27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-gauges.com		
18	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in	Works-1-> Others 26/2, G Type, Global Ind. Park Near Nahuli Railway Crossing, -Vapi-GUJARAT INDIA Phone- 9920576002 FAX : Pincode : 396105 Email : sales@nesstech.co.in , bkapadia@nesstech.co.in		
19	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com	Works-1->Scientific Center, Others By-Pass Junction,Near Kalsekar College kausa, mumbra,Thane -Mumbai-MAHARASHTRA INDIA Phone- 022-25491409,9892230623 FAX : Pincode : 400612 Email : sdbpl@vsnl.com		

20	TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com ,	Works-1-> PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, -BANGALORE-KARNATAKA INDIA Phone- 080-41586000, FAX : 080-28521442, Pincode : Email : uday.shankar@in.yokogawa.com		
21	TRANSMITTERS	ABB INDIA LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone-09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com		PRESSURE TRANSMITTER, DP TRANSMITTER and TEMP TRANSMITTER	
22	TRANSMITTERS	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone-9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1->Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA,PHASE-I -NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com	a)DISPLACEMENT TYPE TRANSMITTERS. b)PRESSURE AND DP TRANSMITTERS	
23	TRANSMITTERS	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone-9850560042 Pincode : 411 026 Email : ho@punetechtrol.com		Only for capacitance Type Level Transmitter	
24	TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	Works-1-> Khasra No.: 218-230& 235, Industrial Estate,Makhupura, -Ajmer-RAJASTHAN India Phone-9887865856, FAX : 0145-2695174, Pincode : 305002, Email : rajeev.gupta@tipl.com		
25	TRANSMITTERS	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in	Works-1->MR. MOHAN PADWAL 691/A/2,BIBWEWADI INDL ESTATE -PUNE-MAHARASHTRA INDIA Phone-918600042374 FAX : 912024215670 Pincode : 411037	FOR CAPACITANCE TYPE.	

				Email : wm@sbem.co.in		
26	TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,	Works-1-> M-171 to 173, MIDC, Waluj, -Aurangabad- MAHARASHTRA India Phone- 9881000474, FAX : 0240-2555179, Pincode : 431136, Email : Narendra.Kulkarni@wetzer.endress.com	"Except Displacement Type Level Transmitters"	
27	TRANSMITTERS	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com	Works-1->Matt Moren/Gina Cruz 16650 Schoenborn St., North Hills - CALIFORNIA- USA Phone- +1 818 894 7111, ext FAX : +1 818 830 5588 Pincode : 91343 Email : gcruz@miinet.com		
28	TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	Works-1->Mr. Santosh Shukla Others R-628,TTC Industrial Area, MIDC Rabale, -Navi Mumbai- MAHARASHTRA India Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com	For Pressure and Diff. Pressure transmitter	
29	TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com	Works-1->Mr.Kedar Tillu 53, 54, 56 & 57,Hadapsar Industrial Estate - PUNE- MAHARASHTRA INDIA Phone- 9665034625 FAX : 020 66039905 Pincode : 411013 Email : kedar.tillu@honeywell.com		

30	TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone-9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com	Works-1->Kalpesh Chandan/Hrishikesh Aghor Plot No. A 145/4 TTC IND AREA,MIDC, PAWANE, -NAVI MUMBAI-MAHARASHTRA INDIA Phone-9619688001 FAX : 022-66736000 Pincode : 400 705 Email : Kalpesh.chandan@emerson.com		
31	TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone-28208477 Pincode : 400093 Email : corp@delbby.rpgms.ems.vsnl.net.in		LD-301 & T-301 TRANSMITTER FROM M/S SMART EQUIPMENTS BRAZIL.	
32	TRANSMITTERS	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone-0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com	Works-1->Ankit Varshney Kalwa Works, Thane-Belapur Road, Thane, -MUMBAI-MAHARASHTRA INDIA Phone- FAX : Pincode : 400708 Email :		
33	TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com	Works-1->Mr. Praveen Toshniwal 104-115, Electronic Complex, -Indore-MADHYA PRADESH India Phone- 0731-4081305 FAX : 0731-255075 Pincode : 452010 Email : sales@nivocontrols.com	For Capacitance type only	
34	DIFFERENTIAL PRESSURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone-09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,			
35	JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net			

36	JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com	Works-1->B. Srinivas Suchitra Industries, Opp No 53, Muneshwara Black Devinagar, Lottagal hal - BANGALORE-KARNATAKA INDIA Phone- 080-23511247 FAX : Pincode : 560094 Email : suchitra_industries@yahoo.com		
37	JUNCTION BOX	Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com	Works-1->Mr.Pulin Shah/ Mr. Kaloesh Parmar 39 A/3 ,Panchratna Industrial Est,Sarkhej-Bavla Road, Changodhar - Ahmedabad-GUJARAT INDIA Phone- 98250 803391 FAX : 079-26932424 Pincode : 382213 Email : sales@sumip.com		
38	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com	Works-1->Mr. Dineshbhai Zaveri CEO C-1/ 27&37, GIDC, Kabilpore, -Navsari-GUJARAT INDIA Phone- 02637-265140,265003 FAX : 02637-265308 Pincode : 396424 Email : flexpro@flexproltd.com	Metal type junction box only	
39	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	JIGNESH MAHENDRA AJMERA DENA BANK BLDG.,SHREE NAGESH INDL. ESTATE,STATION ROAD, MUMBAI Phone- 022 67973578 Pincode : 400 088 Email : ajmera@ajmera.net, jmajmera@yahoo.com	Works-1->JIGNESH MAHENDRA AJMERA DENA BANK BLDG., SHREE NAGESHINDL. ESTATE,STATION ROAD, -MUMBAI-MAHARASHTRA INDIA Phone- 022 67973578 FAX : Pincode : 400 088 Email : ajmera@ajmera.net		

40	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com		Over all financial limit for ordering as Rs.30 lacs (Rs.Thirty Lacs). The registration category & the financial limit may be reviewed after survey in March 2009 and approval thereof. Registered w.e.f. 22.01.2009.
41	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd,Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone-9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com		
42	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259		

				Pincode : 400 062 Email : srinivas@precision-engg.com		
43	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com			
44	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com		Over all financial limit for ordering as Rs.30 lacs (Rs.Thirty Lacs).
45	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd,Nagargaon, -Lonavla-MAHARASHTRA INDIA Phone-9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com		
46	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com			
47	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com		

48	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com	Works-1->S. Harichandran/ P.S. Pandi B-11, Mugappair Industrial Estate, -CHENNAI-TAMIL NADU INDIA Phone- 044-25252537 FAX : 044-26252538 Pincode : 600037 Email : sales@hpvalvesindia.com		
49	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com	Works-1->Shahanawaz Khan Vishweshwar Ind. Premises Co-op Soc. Ltd,F-18/19, Pradhikaran,Bhosadi MIDC -PUNE-MAHARASHTRA INDIA Phone- 020-30694134 FAX : 022-23013010 Pincode : 411026 Email : shahanawaz.khan@perfectinstrumentation.com		
50	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone- +91-250-2392246 Pincode : 401210 Email : arya@aryaengg.com			
51	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	Works-1->ALEX BAPTIST/ K. SRINIVAS 7. SIDHAPURA INDUSTRIAL ESTATE,SV ROAD, GOREGAON(WEST) -MUMBAI-MAHARASHTRA INDIA Phone- 022-42631700 FAX : 022-40035259 Pincode : 400 062 Email : srinivas@precision-engg.com		
52	INSTRUMENT FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com			

53	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasan Phone- 02764-267036/37 Pincode : 382705 Email : marketing@com-fit.com	Works-1->Miss Sonal Pithadia/Miss Pavan Chavda Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway, Laxmipura - Nandasan-GUJARAT INDIA Phone- 8460848087 FAX : 2764-267036/37 Pincode : 382705 Email : domestic@com-fit.com		
54	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com	Works-1->Mr. Abbas Bhola Unit No. 16, Supreme Industrial Estate,Kaman Bhiwandi Road,Devdal, -Vasai East-MAHARASHTRA India Phone- 9920044113 FAX : 07303178243 Pincode : 401208 Email : ab@fluidfitengg.com		
55	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	Works-1->S.R.SINGH/ NAVEEN SINGH B - 2, SECTOR - 6, -NOIDA-UTTAR PRADESH INDIA Phone- 0120-4352940 FAX : 0120-4352940 Pincode : 201301 Email : naveensingh@vsnl.com		Over all financial limit for ordering as Rs.30 lacs (Rs.Thirty Lacs).
56	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Works-1->Mr. Tansen Choudhari/Mr. Mahesh Darekar Shed No.8, Lonavla Indl.Co-op.Estate Ltd,Nagargaon, - Lonavla-MAHARASHTRA INDIA Phone- 9823951347 FAX : (02114) 271132 Pincode : 410 401 Email : factory@hyd-air.com		

57	INSTRUMENT FITTINGS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	Works-1->Mr. Santosh Shukla Others R-628,TTC Industrial Area, MIDC Rabale, -Navi Mumbai-MAHARASHTRA India Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com		

Note-

- The sub vendor list above is indicative only and is subject to BHEL and customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.
- Bidder to propose sub vendor within 2 weeks of placement of PO. Thereafter no request for additional sub-vendor shall be entertained.
- The inspection category will be intimated after award of contract by BHEL/customer. However the same will be adhered by the bidder without any commercial and delivery implication to BHEL/ customer.

ANNEXURE III

DRAWING DOCUMNTS 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 copes 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

Other requirements

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

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

TITLE:

TECHNICAL SPECIFICATION FOR
OXYGEN DOSING SYSTEM
TELANGANA STATE POWER GENERATION CORPORATION LTD
5X800 MW YADADRI TPS

SPEC NO: PE-TS-417-154-A101	
VOLUME: II B	
SECTION: C1	
REV NO: 01	DATE:

DISTRIBUTION SCHEDULE

S. No	Description	TSGENCO								M/S DCPL, KOLKATA			Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/ KTPS	SE/ Civil KTPS	SE/E&M / KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS		
A	**Letter Of Intent or Contract Documents**	1	1	1	S	1	2	2	1	1	1	1	2	
B	**Vendor Drawings**													
1.	Preliminary	1	1	1	2	1	1	2	2	12	1	-	S	
2.	Return preliminary with comments	-	-	1	2	1	1	1	1	S	1	-	1	
3.	Final and any revision thereof													
	a. Civil	1	1	6+1T	1	1	6+1T	1	-	2+1T	1	1	S	
	b. E&M	1	1	1	6+1T	1	1	6+1T	1	2+1T	1	1	S	
C.	**Design Drawings**													
1.	Preliminary													
	a. Civil	1	1	2	1	1	2	1	1	4	1	1	S	
	b. E&M	1	1	1	2	1	1	2	1	4	1	1	S	
2.	Released for construction													
	a. Civil	1	1	2	1	1	6	1	1	1	1	2	S	
	b. E&M	1	1	1	1	2	1	6	1	1	1	2	S	
3.	Return marked 'As built'													
	a. Civil	-	-	1	-	-	1	-	-	1	1	S	1	
	b. E&M	-	-	-	1	-	-	1	1	1	1	S	1	
4.	As built drawings													
	a. Civil	-	-	1+1T	-	2+1T	5+1T	-	1	1+1T	-	1	S	
	b. E&M	-	-	1	2+1T	2+1T	-	5+1T	1+1T	1+1T	-	1	S	

S. No	Description	TSGENCO								M/S DCPL, KOLKATA			Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/ KTPS	SE/ Civil KTPS	SE/E&M / KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS		
D	Progress Report Monthly													
1.	Equipment vendor	1	1	1	2	1	1	2	1	1	1	1	S	
2.	M/s DCPL, Kolkata	1	1	2	2	1	1	2	1	S	1	1	Nil	
E	Test & Inspection Reports													
1.	Equipment manufacturer													
	a. Civil	1	1	1	2	1	1	1	-	11	1	1	S	
s	b. E&M	1	1	-	2	1	-	1	1	11	1	1	S	
2.	M/s DCPL, Kolkata	1	1	-	2	1	-	1	1	S	-	1	-	
F	Instruction Manuals/Data Books													
1.	Equipment manufacturer													
	a. Civil	1	1	1+1T	1	1	6+1T	1	1	2+1T	1	1	S	
	b. E&M	1	1	-	3+1T	1	-	6+1T	2	3+1T	1	1	S	
2.	M/s DCPL, Kolkata	1	1	-	10+1T	1	-	15+1T	-	S	1	1	Nil	
G	M/s DCPL, Kolkata Criteria	1	1	1	8+1T	1	1	2	1	1	1	1	S	
H	Design Calculations	1	1	1	8+1T	1	1	2	1	1	1	1	S	
I	Final consulting Engineering Report	1	1	1	10	1	1	2	1	S	1	1	Nil	

S – Source, T – Transparency & Soft Copy on CD,

TSGENCO : Telangana State Power Generation Corporation Limited

Director, Projects, Hyd : Director/ Projects, TSGENCO, Vidyut Soudha, Hyderabad – 500 082

NOTES:

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

ANNEXURE-IV
LIST OF MANDATORY SPARES

	Description	Quantity (For Complete Station)
A	**Electronic Transmitters**	
(i)	Transmitters/ Gauges/Switches/MFC etc. along with relevant accessories	20% of one Unit or at least four (whichever is maximum) for Each type along with accessories.
B	**Valves**	20% of one Unit used for each type, class,size and model or two (2) number for each type ,class size and model whichever is maximum.
C	**Solenoid Valves**	
i	Solenoid Valve Coil	4 nos. of each rating & insulation
ii	Plunger	2 nos. of each type
iii	Seat	4 nos. of each type & size
iv	Gaskets	4 sets of each type & size
v	O-Ring set	10 sets of each type & size
D	**Process Connection Piping (Impulse piping/tubing, sampling piping / tubing & air supply piping as applicable)**	
i	Valve Manifolds (2 way/3 way/5 way)	20% of one unit for each type, class, size & model
ii	Fittings	20% of one unit for each type, class, size & model
iii	Filter Regulators	40% of one unit for each model
E	**Junction Box**	
i	Junction box	20% of one Unit for each size or minimum 2 nos.(whichever is maximum)
ii	Terminals in Terminal blocks	20 nos. of each type

NOTE-The bidder shall offer mandatory spares of the same make, model and type for items which are offered in the main offer. further, offered spare parts shall be of the same grade and shall have same performance as the instruments which they are to replace.

SECTION – C1
DATA SHEET-A

Sl. No	Description	Parameter
Mechanical Items		
1.0	No. of skid(s) for One Unit / Station	Two (2) / Ten (10) Nos.
2.0	**Cylinders:**	
2.1	Quantity mounted on each skid	Eight per skid (Total sixteen) for each unit
2.2	Loose supply of filled oxygen cylinders	21 nos for each unit (Total 105 Nos.)
2.3	Design Standard of empty oxygen cylinder	IS-7285 Part 1
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	Five numbers (one per unit) Cylinder storing rack (MS), each with capacity to hold 21 cylinders.
3.0	**All Tubing:**	
3.1	Material	ASTM A213/269 GR TP 316 (seamless)
3.2	Diameter	15 NB (1/2" OD),18 BWG
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	2000 psig
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	2000 psig
5.7	Valve operation	Self-actuated.
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	46 Kg/cm2 (g) for skid 1 and 23 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 20), each mounted to on each oxygen cylinder bank
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	45 Kg/cm2(a) for skid dosing at CPU outlet and 22 Kg/cm2(a) 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	50-400 gm/ hr. (for skid dosing at deaerator outlet); 50-350 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	200 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.

P&ID & JB TERMINATION DRAWING FOR OXYGEN DOSING SYSTEM

CONDENSATE LINE
P&ID-CONDENSATE SYSTEM
(PE-DG-417-100-N106)-[ZONE-15-D][

"DETAIL AA "

DOSING AFTER CPU

MFC BV-31 BV-32 QCL12AA203
MFC BV-22 BV-21 QCL12AA204
BV-24 NV-1

15NB F1

SET POINT:-
LOW-40 KG/CM2(g)
ADEQUATE-42 KG/CM2(g)
HIGH-44 KG/CM2(g)

QCL12CP501 PG
QCL12CP002 PT
QCL12CP001 PT 02

MVM-5 MVM-6 MVM-7
BV-19 BV-20
BV-17 BV-18
BV-25 BV-26
15NB

EXHAUST

SET POINT:-
LOW-41 KG/CM2(g)
HIGH-46 KG/CM2(g)

QCL10CP501 PG
QCL10CP001 PT

SET POINT:- 46 KG/CM2(g)
PRV-1 15NB
BV-7
BV-4 BV-3
BV-6 BV-5
MVM-1 MVM-2
BV-14 BV-16
BV-13 BV-15
QCL12AA201 QCL12AA202
SET POINT:-
42 KG/CM2(g)
15NB
SV-1
BV-29 BV-30 QCL10AA201
BV-1 CV-1
MVM-9 02
PT QCL10CP002
15NB

SET POINT:-
LOW-41 KG/CM2(g)
HIGH-46 KG/CM2(g)

QCL11CP501 PG
QCL11CP001 PT
MVM-3 MVM-4 BV-12
BV-9 BV-8
BV-11 BV-10
15NB
SV-2
QCL11AA201
BV-27 BV-28
BV-2 CV-2
02 MVM-8
PT QCL11CP002
15NB
SET POINT:- 46 KG/CM2(g)
PRV-2 15NB

SET POINT:-
44 KG/CM2(g)
15NB

SET POINT:-
44 KG/CM2(g)
15NB

QCL10CP501
MVM-10 BV-34 BV-33 PG 02

QCL11CP501
MVM-11 BV-36 BV-35 PG 02

15NB BV-37 CV-4 OXYGEN CYLINDER#1
15NB BV-38 CV-5 OXYGEN CYLINDER#2
15NB BV-39 CV-6 OXYGEN CYLINDER#3
15NB BV-40 CV-7 OXYGEN CYLINDER#4 03

15NB BV-41 CV-8 OXYGEN CYLINDER#5
15NB BV-42 CV-9 OXYGEN CYLINDER#6
15NB BV-43 CV-10 OXYGEN CYLINDER#7 03
15NB BV-44 CV-11 OXYGEN CYLINDER#8 02

18"ø PIPE FLOW
1" NPT PLUG
1/8" DIA HOLES (3 Nos.)
SV-3 CV-3 1/2ø"TUBING
PLUG END OF INJECTOR
BV-23 QCL13AA201
1/4 PIPE DIA
1" NPT COUPLING DRILLED TO SUPPORT INJECTION PIPE.
1/2" SOCKOLET DRILLED TO ALLOW INJECTION TUBE TO PENETRATE. (WELD INJECTION TUBE TO SOCKOLET).

"INJECTOR ASSEMBLY DETAIL - AA"

LIST OF EQUIPMENTS & INSTRUMENTS:- 02

SR. NO.	DESCRIPTION	QTY.
1	OXYGEN CYLINDERS FILLED	8
2	NON RETURN VALVE MAIN SKID	10
3	NON RETURN VALVE INJECTION ASSEMBLY	1
4	BALL VALVE MAIN SKID	43
5	BALL VALVE INJECTION ASSEMBLY	1
6	PRESSURE SAFETY VALVE	2
7	PRESSURE TRANSMITTERS	6
8	PRESSURE GAUGES	3
9	SOLENOID VALVE MAIN SKID	2
10	SOLENOID VALVE INJECTION ASSEMBLY	1
11	PRESSURE REDUCING VALVE	2
12	MASS FLOW CONTROLLER	2
13	METERING VALVE	1
14	FILTER	1
15	PRESSURE REGULATOR (CYLINDER)	2
16	INJECTOR ASSEMBLY (LOOSE)	1
17	CYLINDER BLOCK	8

03 03

L E G E N D:-

	PRESSURE REDUCING CUM REGULATING VALVE (MANUAL)
	NEEDLE VALVE
PT	PRESSURE TRANSMITTER
	SOLENOID ACTUATED VALVE
PG	PRESSURE GAUGE
	NON RETURN VALVE/CHECK VALVE
MFC	MASS FLOW CONTROLLER
	BALL VALVE
	BALL VALVE(NORMALLY CLOSED)
	PRESSURE REGULATOR
	PRESSURE SAFETY VALVE
	DISCHARGE TO ATMOSPHERE
	MULTI-VALVE MANIFOLD(SEE NOTES)
	CHEMICAL SEAL DIAPHRAGM
	CYLINDER VALVE (WHEEL OPERATED)
	AIR FILTER
	FLEXIBLE HOSE

NOTES:-

1. THE ENTIRE SYSTEM INCLUDING THE JUNCTION BOX SHALL BE SKID MOUNTED.
2. ONE NUMBER SKID PER UNIT SHALL BE PROVIDED FOR DOSING AT CPU OUTLET.
3. ONE NUMBER INJECTION ASSEMBLY (SHOWN IN P&ID) FOR EACH SKID SHALL BE SUPPLIED LOOSE.
4. ALL THE VALVES SHALL BE OF SS 316.
5. ALL TUBING SHALL BE OF SS 316, 1/2" OD 18 BWG.
6. ALL THE MULTI VALVE MANIFOLD SHALL BE 3-WAY VALVE MANIFOLDS.
7. ALL INSTRUMENTS INCLUDING MFC 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 BHEL.
8. ALL INSTRUMENTS, PIPING,FITTINGS,SHALL BE TOTALLY MADE OIL/GREASE FREE BEFORE OXYGEN IS TAKEN IN TO SERVICE.
9. ALL SOLENOID VALVES (SOV) SHALL BE PLACED IN PNEUMATIC JUNCTION BOX ONLY. AIR DISTRIBUTION FOR SOVs SHALL BE THROUGH SS MANIFOLD AND SS ISOLATION VALVES ONLY AND SS TUBING FROM SOV TO VALVE SHALL NOT BE MORE THAN 6 METERS.
10. MFCs SHALL BE MOUNTED IN AN ENCLOSURE.

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

REV.	DATE	ALTD	CHD	APPD
03	30.06.19	-SD-	-SD-	-SD-
2.0		INJECTOR DETAILS UPDATED.		
3.0		CYLINDER CONNECTION UPDATED. REVISION MARKED AS 03.		

REV.	DATE	ALTD	CHD	APPD
1.0		REVISED AS PER MOM DTD.		
02	08.02.2019	-SD-	-SD-	-SD-
2.0		09.01.2019 TO 10.01.2019. REVISION MARKED AS 02.		

REV.	DATE	ALTD	CHD	APPD
01	13.12.2018	-SD-	-SD-	-SD-
2.0		REVISED AS PER COMMENTS DTD. 14.11.18. REVISION MARKED AS 01.		

OWNER: TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA, INDIA
5 x 800 MW YADADRI TPS, NALGONDA

OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

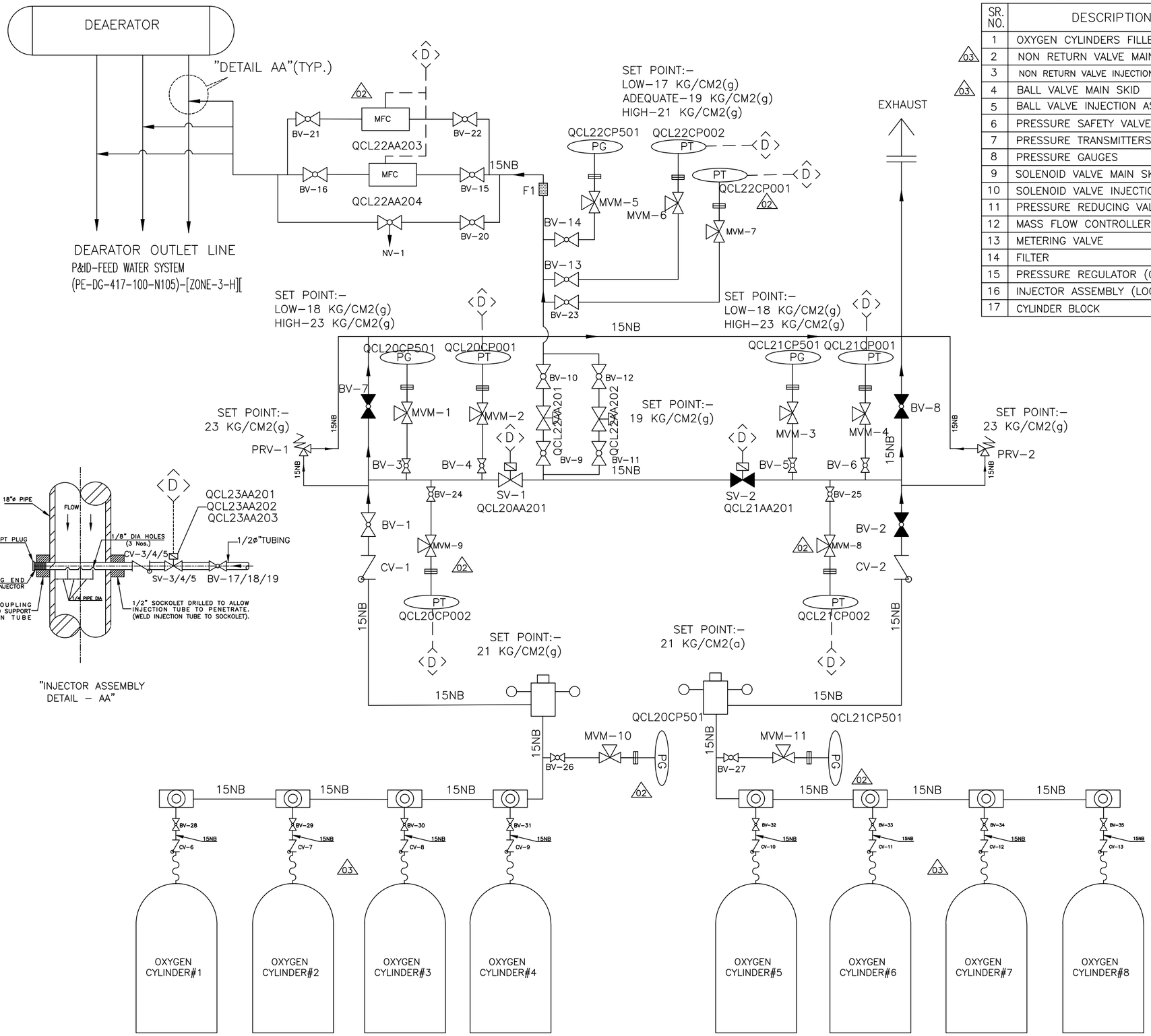
JOB NO. 417
STATUS CONTRACT
DISTRIBUTION

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

DEPT CODE	DRN.	NAME	SIGN	DATE
M	DESN	VK		
	CHD	JP		
	APPD	SB		

TITLE: P & ID FOR OXYGEN DOSING SYSTEM (FOR CPU OUTLET)

DEPT. SCALE 1:100
SIGN
DRAWING NO. PE-DG-417-154-12000A-A501
SHEET 01 OF 02 REV. 03
SIZE-A0



LIST OF EQUIPMENTS & INSTRUMENTS:- 02

SR. NO.	DESCRIPTION	QTY.
1	OXYGEN CYLINDERS FILLED	8
2	NON RETURN VALVE MAIN SKID	10
3	NON RETURN VALVE INJECTION ASSEMBLY	3
4	BALL VALVE MAIN SKID	32
5	BALL VALVE INJECTION ASSEMBLY	3
6	PRESSURE SAFETY VALVE	2
7	PRESSURE TRANSMITTERS	6
8	PRESSURE GAUGES	3
9	SOLENOID VALVE MAIN SKID	2
10	SOLENOID VALVE INJECTION ASSEMBLY	3
11	PRESSURE REDUCING VALVE	2
12	MASS FLOW CONTROLLER	2
13	METERING VALVE	1
14	FILTER	1
15	PRESSURE REGULATOR (CYLINDER)	2
16	INJECTOR ASSEMBLY (LOOSE)	3
17	CYLINDER BLOCK	8

03 against SR. NO. 2 and 4

L E G E N D:-

	PRESSURE REDUCING CUM REGULATING VALVE (MANUAL)
	NEEDLE VALVE
PT	PRESSURE TRANSMITTER
	SOLENOID ACTUATED VALVE
PG	PRESSURE GAUGE
	NON RETURN VALVE/CHECK VALVE
MFC	MASS FLOW CONTROLLER
	BALL VALVE
	BALL VALVE(NORMALLY CLOSED)
	PRESSURE REGULATOR
	PRESSURE SAFETY VALVE
	DISCHARGE TO ATMOSPHERE
	MULTI-VALVE MANIFOLD(SEE NOTES)
	CHEMICAL SEAL DIAPHRAGM
	CYLINDER VALVE (WHEEL OPERATED)
	AIR FILTER
	FLEXIBLE HOSE

NOTES:-
1. THE ENTIRE SYSTEM INCLUDING THE JUNCTION BOX SHALL BE SKID MOUNTED.
2. ONE NUMBER SKID PER UNIT SHALL BE PROVIDED FOR DOSING AT DEAERATOR OUTLET.
3. THREE NUMBERS INJECTION ASSEMBLY FOR EACH SKID SHALL BE SUPPLIED LOOSE.
4. ALL THE VALVES SHALL BE OF SS 316.
5. ALL TUBING SHALL BE OF SS 316, 1/2" OD 18 BWG.
6. ALL THE MULTI VALVE MANIFOLD SHALL BE 3-WAY VALVE MANIFOLDS.
7. ALL INSTRUMENTS INCLUDING MFC, 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 BHEL.
8. ALL INSTRUMENTS, PIPING,FITTINGS,SHALL BE TOTALLY MADE OIL/GREASE FREE BEFORE OXYGEN IS TAKEN IN TO SERVICE.
9. ALL SOLENOID VALVES (SOV) SHALL BE PLACED IN PNEUMATIC JUNCTION BOX ONLY. AIR DISTRIBUTION FOR SOVs SHALL BE THROUGH SS MANIFOLD AND SS ISOLATION VALVES ONLY AND SS TUBING FROM SOV TO VALVE SHALL NOT BE MORE THAN 6 METERS. 02
10. MFCs SHALL BE MOUNTED IN AN ENCLOSURE.

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

OWNER: TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA, INDIA
5 x 800 MW YADADRI TPS, NALGONDA

OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

JOB NO. 417
STATUS CONTRACT
DISTRIBUTION

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

DEPT CODE		NAME	SIGN	DATE
M	DRN	VK		
	DESN	VK		
	CHD	JP		
	APPD	SB		

TITLE: P & ID FOR OXYGEN DOSING SYSTEM (FOR DEARATOR OUTLET)

DRAWING NO. PE-DG-417-154-12000A-A501
SCALE 1:100
SHEET 02 OF 02 REV. 03
SIZE-A0

REV.	DATE	ALTD	CHD	APPD
03	30.06.19	-SD-	-SD-	-SD-
1.0	INJECTOR DETAILS UPDATED.			
2.0	CYLINDER CONNECTION UPDATED.			
3.0	REVISION MARKED AS 03.			

REV.	DATE	ALTD	CHD	APPD
02	08.02.2019	-SD-	-SD-	-SD-
1.0	REVISED AS PER MOM DTD. 09.01.2019 TO 10.01.2019.			
2.0	REVISION MARKED AS 02.			

REV.	DATE	ALTD	CHD	APPD
01	13.12.2018	-SD-	-SD-	-SD-
1.0	REVISED AS PER COMMENTS DTD. 14.11.18.			
2.0	REVISION MARKED AS 01.			

319035/2021/PS-PEM-MAX

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV	DATE	CHD	-SD-
01	12.06.19	APPD	-SD-

1.0. REVISION MARKED AS 01.

REV	DATE	CHD	-SD-
01	23.05.20	APPD	-SD-

1.0. REVISION MARKED AS 02.

417

REV	DATE	CHD
		APPD

TATA CONSULTING ENGINEERS LIMITED

VENDOR DOCUMENT REVIEW STATUS

- ☑ A Drawing/Document approved as submitted. Proceed with fabrication/construction.
- ☐ B Drawing/Document approved subjected to comments noted. Proceed with fabrication/ construction considering our commnets.
- ☐ C Our comments are noted on this marked up print.
- ☐ D Our commnets are noted in memo attached to the forwarding transmittal letter No. TCE.11005A-IC-VDT-370 Dated 04-06-2020
- ☐ E Correct original of this drawing/document to reflect our comments and resubmit for approval.
- ☐ F Correct original of this drawing/document to reflect our comments and resubmit for records.
- ☐ G Drawings/Documents of this category are for information only and not for approval. Information furnished on the drawing/document is noted.
- ☑ H Drawing/Document reviewed against our previous comments and other revisions highlighted and identified by the vendor.
- ☐ I Drawing/Document returned without review.
- ☐ J Print not enclosed.

Approval conveyed herein neither relieves the Vendor/Contractor of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, performance requirements and conformity of the supplies with the Indian Statutory Laws as may be applicable, nor does it limit the purchaser's rights under the contract.

Reviewed by NM Date 04-06-2020

OWNER:

TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA, INDIA
5 x 800 MW YADADRI TPS, NALGONDA

OWNER'S CONSULTANT:

TATA CONSULTING ENGINEERS LIMITED

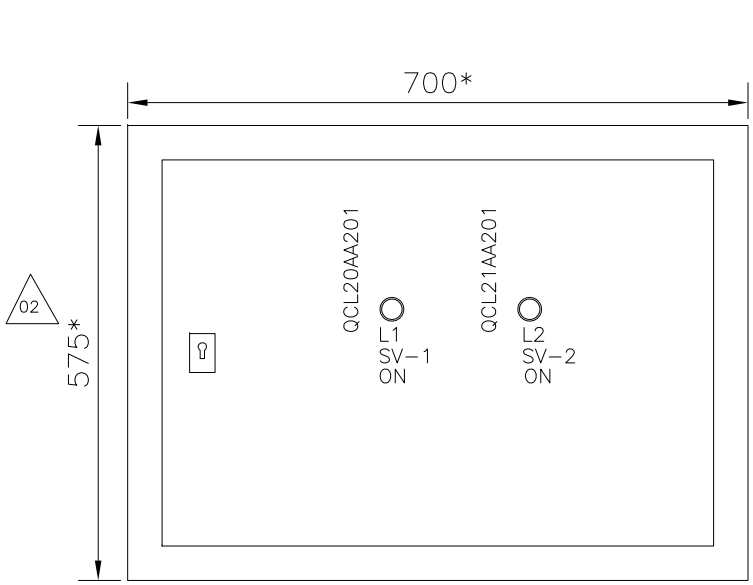
BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

	NAME	SIGN	DATE
PRPD	VK/RKR	-SD-	30.04.2019
CHD	RKR	-SD	30.04.2019
APPD	SB	-SD-	30.04.2019

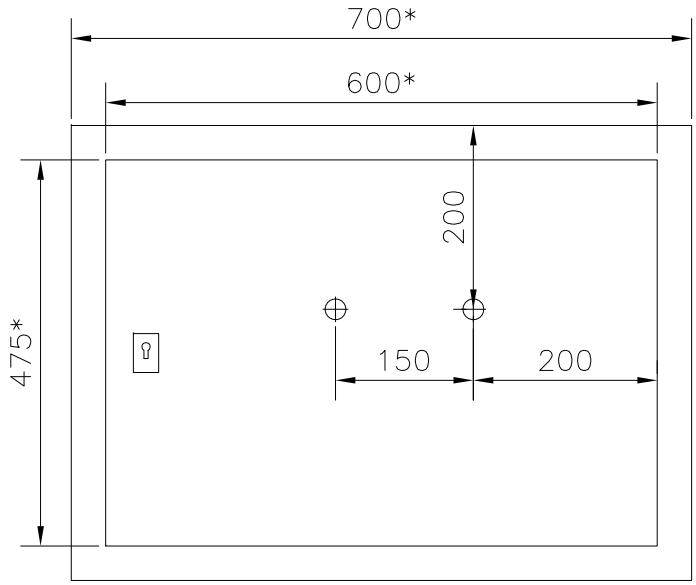
TITLE:
JUNCTION BOX TERMINATION DRAWINGS FOR OXYGEN DOSING SYSTEM

BHEL DRAWING No.
PE-DC-417-154-A004

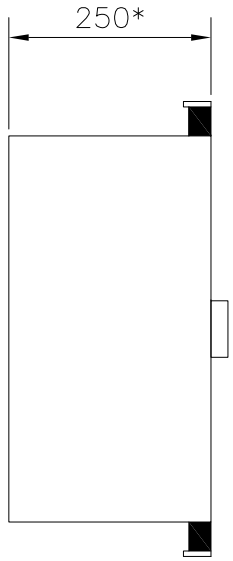
Rev No. 02



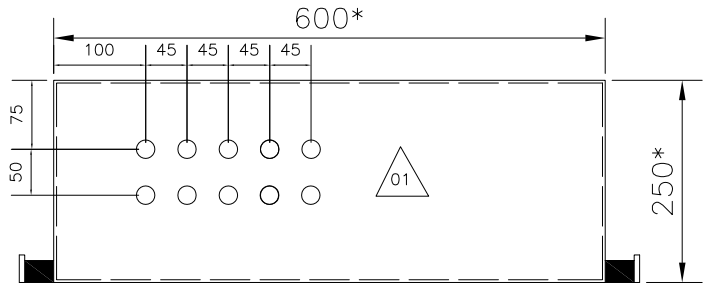
FRONT VIEW
JUNCTION BOX LAYOUT
02 SIZE : 700(W)x575(H)x250(D)



FRONT VIEW
CUTOUT DETAILS
SHEET THICKNESS : 4 mm
MOC-FRP



SIDE VIEW



BOTTOM VIEW

02
NOTE:–
1. ALL DIMENSIONS ARE IN MM.
2. DIMENSIONS MARKED AS (*) ARE MINIMUM DIMENSION. FINAL DIMENSIONS CAN BE INCREASED TO MEET SYSTEM REQUIREMENT.

02
REF. DOCS.
1.0 DESIGN MEMO OF OXYGEN DOSING SYSTEM – PE–DC–417–154–A101
2.0 P&ID FOR OXYGEN DOSING SYSTEM – PE–DG–417–154–12000A–A501

CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA, INDIA
5 x 800 MW YADADRI TPS, NALGONDA

OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

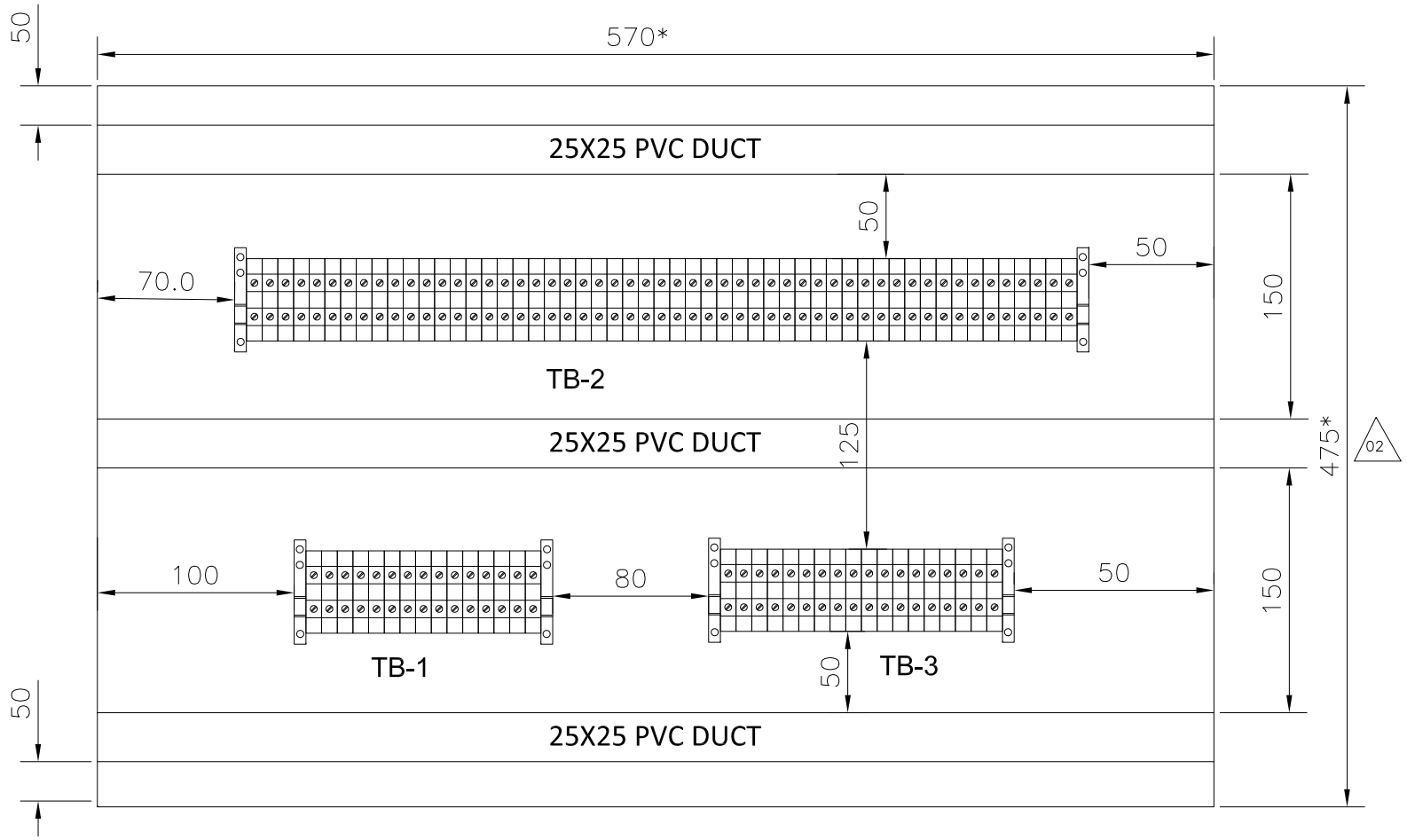
JOB NO. 417
STATUS CONTRACT
DISTRIBUTION

REV.	DATE	ALTD	CHD	APPD
02	23.05.20	–sd–	–sd–	–sd–
1.0	REVISION MARKED AS 02			
01	12.06.19	–sd–	–sd–	–sd–
1.0	REVISION MARKED AS 01			

DEPT CODE		NAME	SIGN	DATE
M	DRN	VK	–SD–	30.04.19
	CHD	JP	–SD–	30.04.19
	APPD	SB	–SD–	30.04.19

TITLE: JUNCTION BOX– OXYGEN DOSING SYSTEM (DEARATOR OUTLET)

DEPT. SCALE 1:100 DWG. DRAWING NO. PE-YD-417-154-A004
SIGN SHEET 1 OF 10 REV. 02
SIZE–A0



INSTRUMENT MOUNTING PLATE
570(W)x475(H)x 2 mm Thk.

02

REF. DOCS.

1.0 DESIGN MEMO OF OXYGEN DOSING SYSTEM – PE-DC-417-154-A101

2.0 P&ID FOR OXYGEN DOSING SYSTEM – PE-DG-417-154-12000A-A501

02

NOTE:-

1. ALL DIMENSIONS ARE IN MM.
2. DIMENSIONS MARKED AS (*) ARE MINIMUM DIMENSION. FINAL DIMENSIONS CAN BE INCREASED TO MEET SYSTEM REQUIREMENT.

REV.	DATE	ALTD	CHD	APPD
02	23.05.20	-sd-	-sd-	-sd-
1.0	REVISION MARKED AS 02			
01	12.06.19	-sd-	-sd-	-sd-
1.0	REVISION MARKED AS 02			

CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA, INDIA
5 x 800 MW YADADRI TPS, NALGONDA

OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

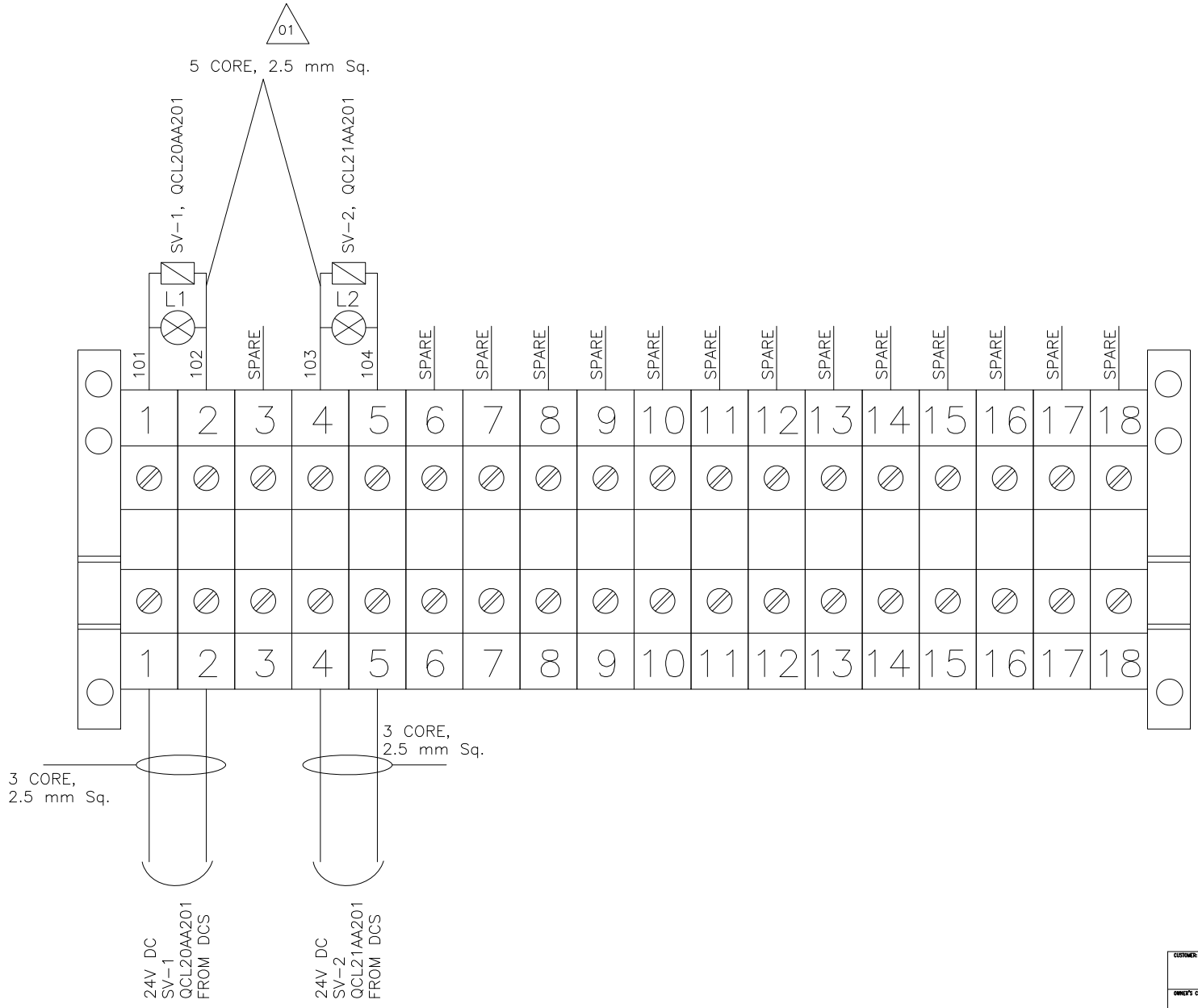
BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

JOB NO. 417
STATUS CONTRACT
DISTRIBUTION

DEPT CODE		NAME	SIGN	DATE
M	DRN	VK	-SD-	30.04.19
	CHD	JP	-SD-	30.04.19
	APPD	SB	-SD-	30.04.19

TITLE: JUNCTION BOX- OXYGEN DOSING SYSTEM (DEARATOR OUTLET)

DEPT. SCALE 1:100 DMS DRAWING NO. PE-VD-417-154-A004
SIGN SHEET 2 OF 10 REV. 02
SIZE-A0



TB-1

02

REF. DOCS.

1.0 DESIGN MEMO OF OXYGEN DOSING SYSTEM – PE-DC-417-154-A101

2.0 P&ID FOR OXYGEN DOSING SYSTEM – PE-DG-417-154-12000A-A501

REV.	DATE	ALTD	CHD	APPD

REV.	DATE	ALTD	CHD	APPD
02	23.05.20	-sd-	-sd-	-sd-
1.0	REVISION MARKED AS 02			

REV.	DATE	ALTD	CHD	APPD
01	12.06.19	-sd-	-sd-	-sd-
1.0	REVISION MARKED AS 01			

JOB NO. 417
STATUS CONTRACT
DISTRIBUTION

CUSTOMER:
TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA, INDIA
5 x 800 MW YADADRI TPS, NALGONDA

OWNER'S CONSULTANT:
TATA CONSULTING ENGINEERS LIMITED

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

DEPT CODE		NAME	SIGN	DATE
M	DRN	VK	-SD-	30.04.19
	CHD	JP	-SD-	30.04.19
	APPD	SB	-SD-	30.04.19

TITLE
JUNCTION BOX- OXYGEN DOSING SYSTEM
(DEARATOR OUTLET)

DEPT. | SCALE 1:100 | SHEET 3 OF 10 | REV. 02 | SIZE-A0

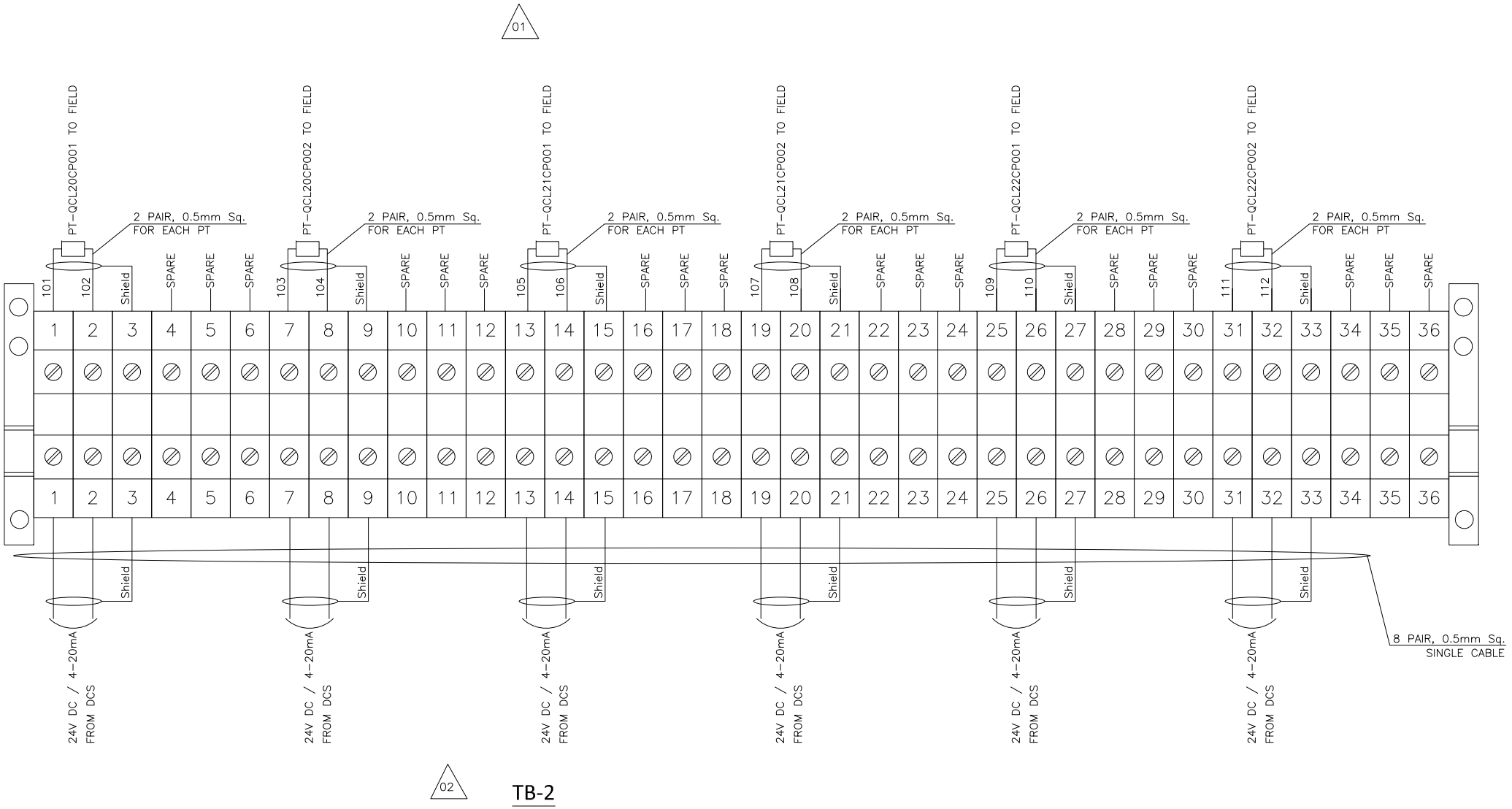
DRWG. NUMBER NO. PE-YD-417-154-A004

DRAWING No. PE-DC-410-154-A002

CUSTOMER'S DRAWING No.

FIRST ANGLE PROJECTION | ALL DIMENSIONS ARE IN MM

COMPUTER FILE NAME: JB DETAIL-YADADRI.DWG



02

REF. DOCS.

1.0 DESIGN MEMO OF OXYGEN DOSING SYSTEM – PE–DC–417–154–A101

2.0 P&ID FOR OXYGEN DOSING SYSTEM – PE–DG–417–154–12000A–A501

REV.	DATE	ALTD	CHD	APPD
02	23.05.20	–sd–	–sd–	–sd–
1.0	REVISION MARKED AS 02			
01	12.06.19	–sd–	–sd–	–sd–
1.0	REVISION MARKED AS 02			

JOB NO. 417
STATUS CONTRACT
DISTRIBUTION

CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA, INDIA
5 x 800 MW YADADRI TPS, NALGONDA

OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

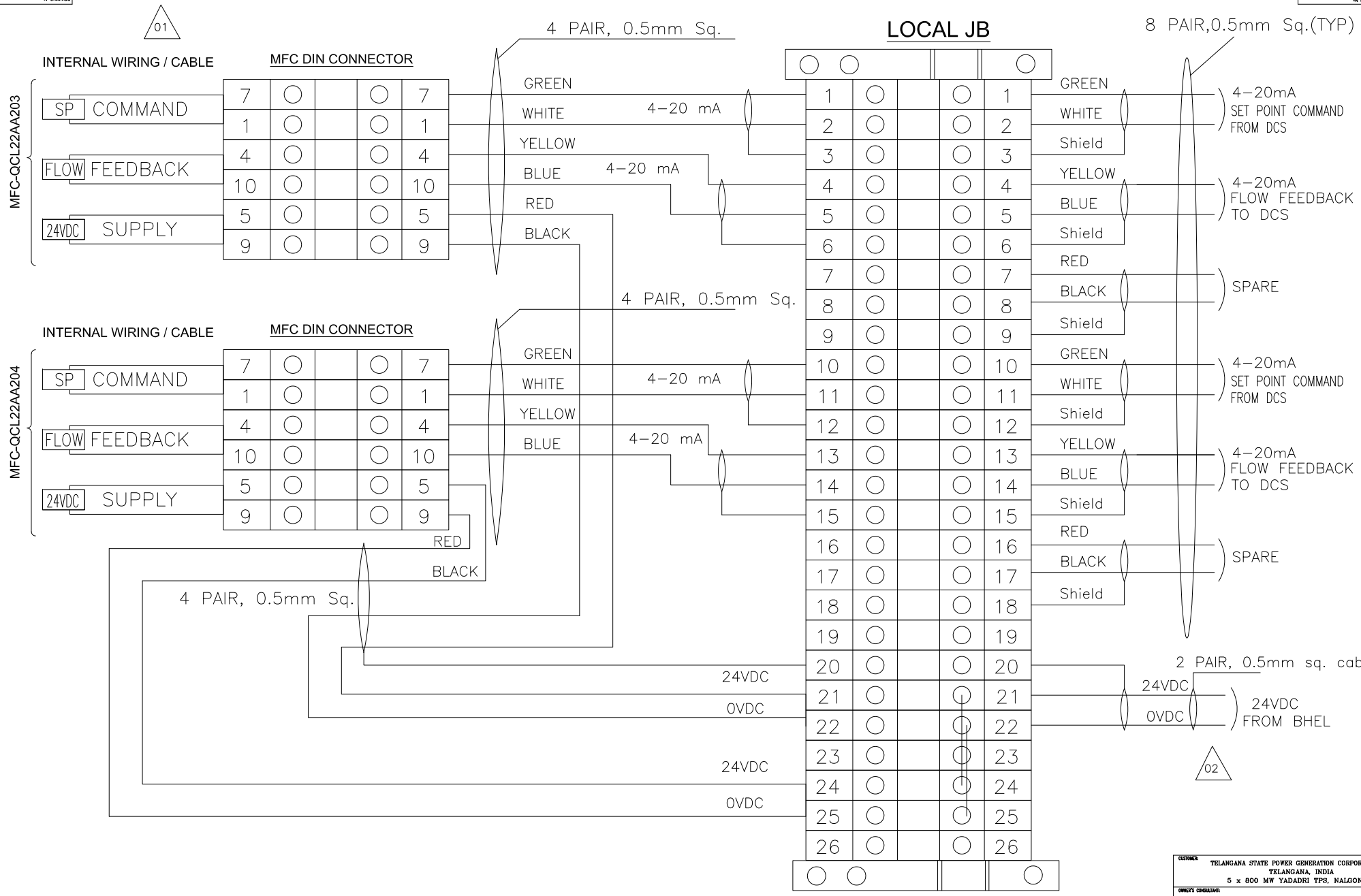
DEPT CODE		NAME	SIGN	DATE
M	DRN	VK	–SD–	30.04.19
	CHD	JP	–SD–	30.04.19
	APPD	SB	–SD–	30.04.19

TITLE: JUNCTION BOX– OXYGEN DOSING SYSTEM (DEARATOR OUTLET)

DEPT. | SCALE 1:100 | DWG. DRAWING NO. PE–YD–417–154–A004

SIGN | SHEET 4 OF 10 | REV. 02 | SIZE–A0

COMPUTER FILE NAME: JB DETAIL–YADADRI.DWG



REF. DOCS.

1.0 DESIGN MEMO OF OXYGEN DOSING SYSTEM – PE-DC-417-154-A101

2.0 P&ID FOR OXYGEN DOSING SYSTEM – PE-DG-417-154-12000A-A501

CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA, INDIA
5 x 800 MW YADADRI TPS, NALGONDA

OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

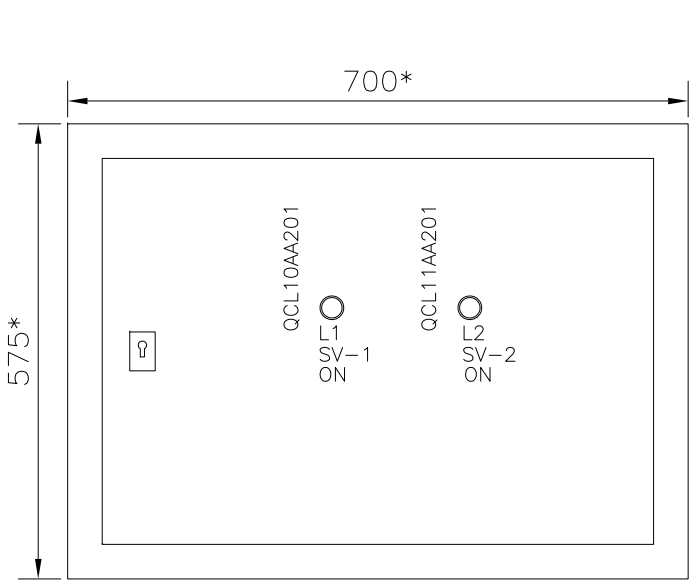
BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

JOB NO. 417
STATUS CONTRACT
DISTRIBUTION

TITLE: JUNCTION BOX– OXYGEN DOSING SYSTEM (DEARATOR OUTLET)

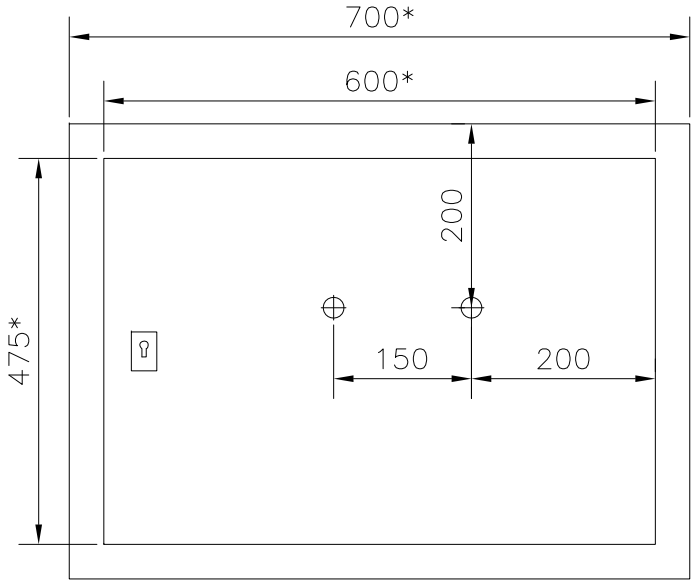
DRG. ENGINEER NO. PE-YD-417-154-A004

SCALE 1:100 | SHEET 5 OF 10 | REV. 02 | SIZE-A0

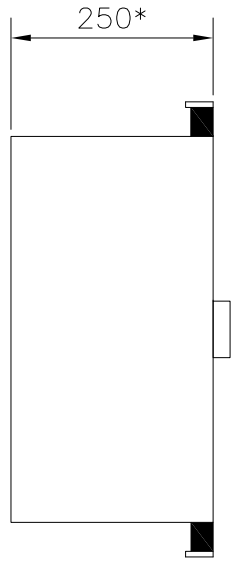


FRONT VIEW
JUNCTION BOX LAYOUT
SIZE : 700(W)x575(H)x250(D)

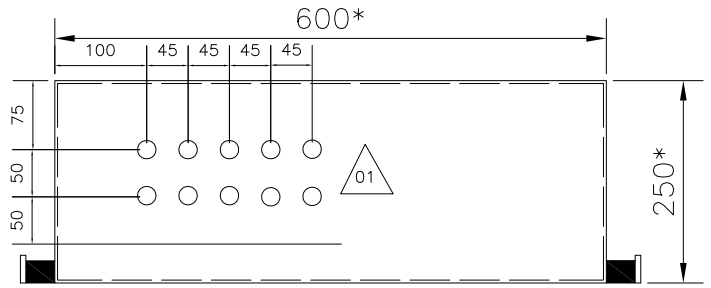
02



FRONT VIEW
CUTOUT DETAILS
SHEET THICKNESS : 4 mm
MOC-FRP



SIDE VIEW



BOTTOM VIEW

02

NOTE:–

1. ALL DIMENSIONS ARE IN MM.
2. DIMENSIONS MARKED AS (*) ARE MINIMUM DIMENSION. FINAL DIMENSIONS CAN BE INCREASED TO MEET SYSTEM REQUIREMENT.

02

REF. DOCS.

1.0 DESIGN MEMO OF OXYGEN DOSING SYSTEM – PE–DC–417–154–A101
2.0 P&ID FOR OXYGEN DOSING SYSTEM – PE–DG–417–154–12000A–A501

CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA, INDIA
5 x 800 MW YADADRI TPS, NALGONDA

OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

JOB NO. 417
STATUS CONTRACT
DISTRIBUTION

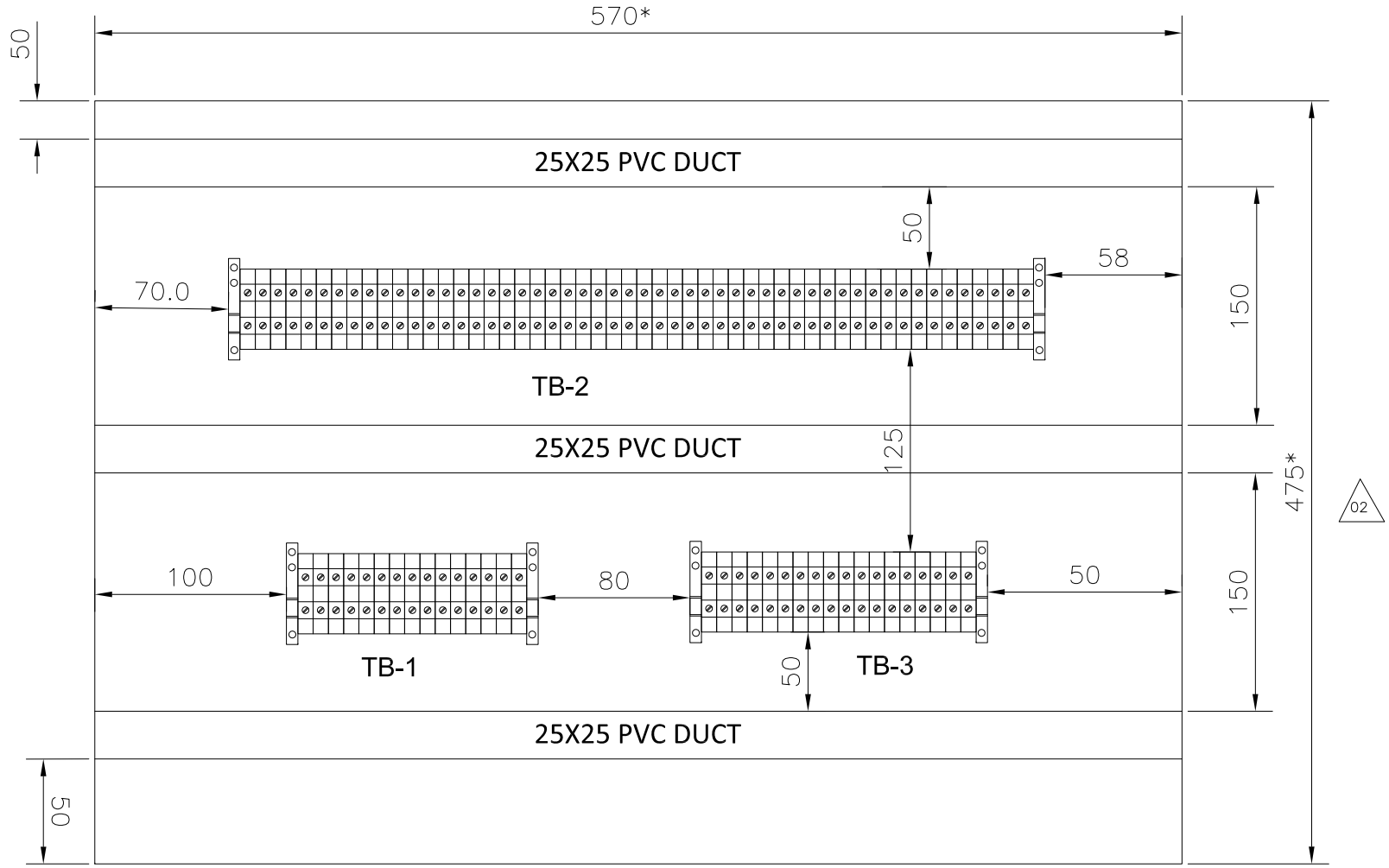
REV.	DATE	ALTD	CHD	APPD
02	23.05.20	–sd–	–sd–	–sd–
1.0	REVISION MARKED AS 02			
01	12.06.19	–sd–	–sd–	–sd–
1.0	REVISION MARKED AS 01			

DEPT CODE		NAME	SIGN	DATE
M	DRN	VK	–SD–	30.04.19
	CHD	JP	–SD–	30.04.19
	APPD	SB	–SD–	30.04.19

TITLE: JUNCTION BOX– OXYGEN DOSING SYSTEM (CPU OUTLET)

DEPT. SCALE 1:100
SIGN
SHEET 6 OF 10
DOC. NUMBER NO. PE–YD–417–154–A004
REV. 02
SIZE–A0

COMPUTER FILE NAME : JB DETAIL–YADADRI.DWG



INSTRUMENT MOUNTING PLATE
570(W)x475(H)x 2 mm Thk.

02

REF. DOCS.

1.0 DESIGN MEMO OF OXYGEN DOSING SYSTEM – PE-DC-417-154-A101

2.0 P&ID FOR OXYGEN DOSING SYSTEM – PE-DG-417-154-12000A-A501

02

NOTE:-

1. ALL DIMENSIONS ARE IN MM.
2. DIMENSIONS MARKED AS (*) ARE MINIMUM DIMENSION. FINAL DIMENSIONS CAN BE INCREASED TO MEET SYSTEM REQUIREMENT.

CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA, INDIA
5 x 800 MW YADADRI TPS, NALGONDA

OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

JOB NO. 417
STATUS CONTRACT
DISTRIBUTION

REV.	DATE	ALTD	CHD	APPD
02	23.05.20	-sd-	-sd-	-sd-
1.0	REVISION MARKED AS 02			
01	12.06.19	-sd-	-sd-	-sd-
1.0	REVISION MARKED AS 02			

DEPT CODE		NAME	SIGN	DATE
M	DRN	VK	-SD-	30.04.19
	CHD	JP	-SD-	30.04.19
	APPD	SB	-SD-	30.04.19

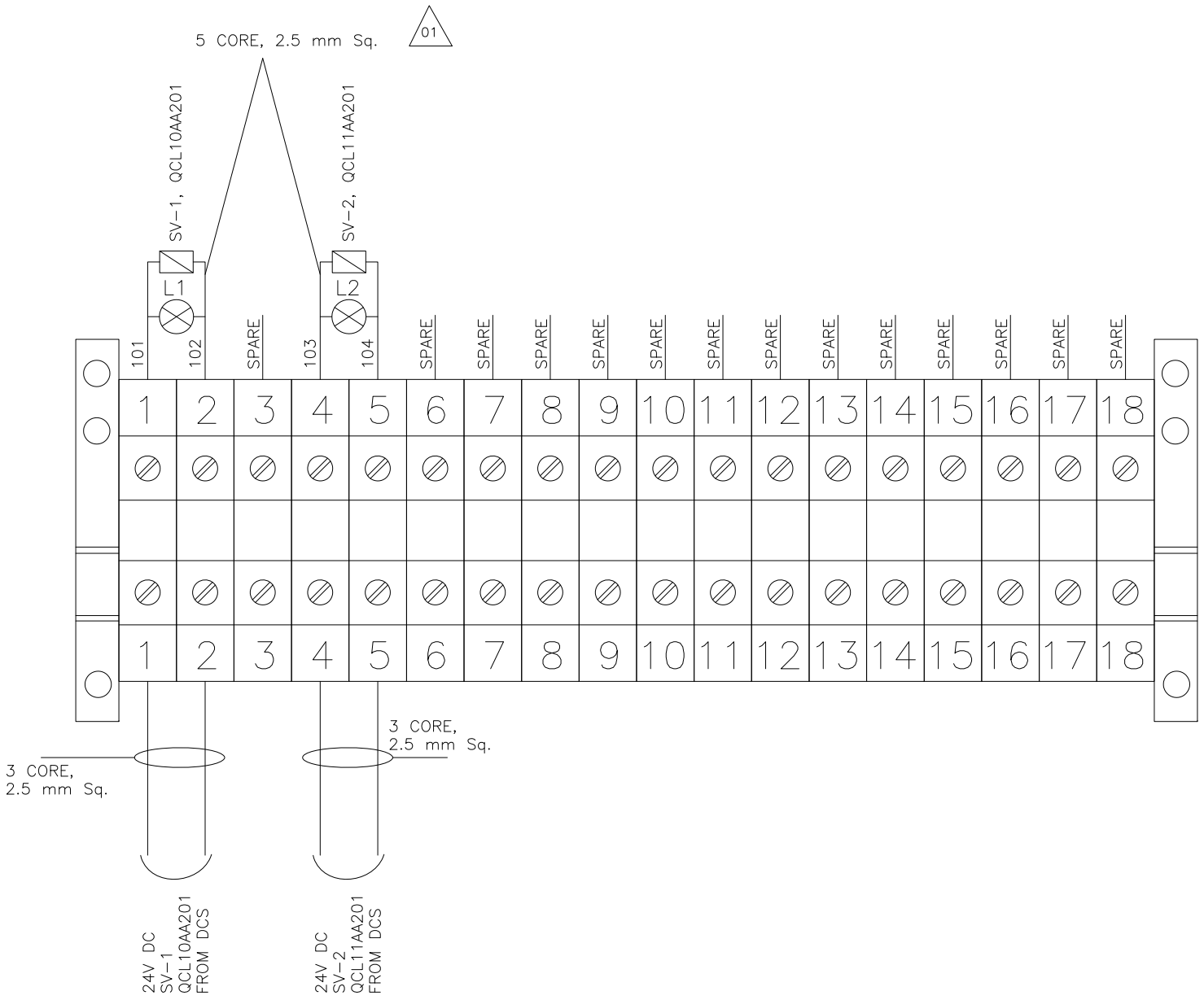
TITLE: JUNCTION BOX- OXYGEN DOSING SYSTEM (CPU OUTLET)

DEPT. SCALE 1:100 SIGN

DWG. DRAWING NO. PE-YD-417-154-A004

SHEET 7 OF 10 REV. 02

SIZE-A0



TB-1

02

REF. DOCS.

1.0 DESIGN MEMO OF OXYGEN DOSING SYSTEM – PE-DC-417-154-A101

2.0 P&ID FOR OXYGEN DOSING SYSTEM – PE-DG-417-154-12000A-A501

CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA, INDIA
5 x 800 MW YADADRI TPS, NALGONDA

OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

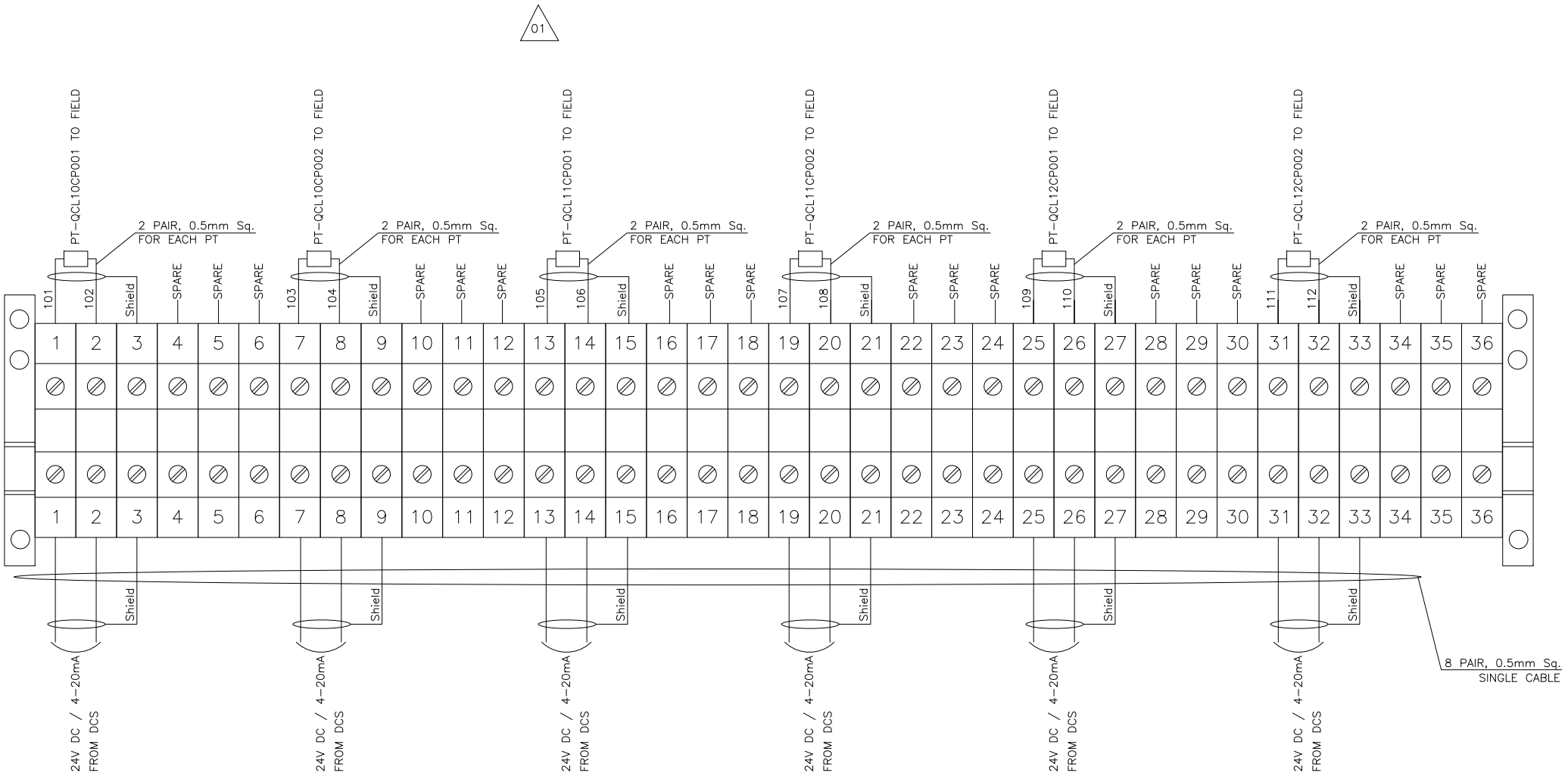
BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

JOB NO. 417
STATUS CONTRACT
DISTRIBUTION

TITLE: JUNCTION BOX- OXYGEN DOSING SYSTEM (CPU OUTLET)

DRG. NUMBER NO. PE-YD-417-154-A004

SHEET 8 OF 10 REV. 02



02

REF. DOCS.

1.0 DESIGN MEMO OF OXYGEN DOSING SYSTEM – PE-DC-417-154-A101

2.0 P&ID FOR OXYGEN DOSING SYSTEM – PE-DG-417-154-12000A-A501

REV.	DATE	ALTD	CHD	APPD
02	23.05.20	-sd-	-sd-	-sd-
1.0	REVISION MARKED AS 02			

REV.	DATE	ALTD	CHD	APPD
01	12.06.19	-sd-	-sd-	-sd-
1.0	REVISION MARKED AS 01			

JOB NO. 417
STATUS CONTRACT
DISTRIBUTION

CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA, INDIA
5 x 800 MW YADADRI TPS, NALGONDA

OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

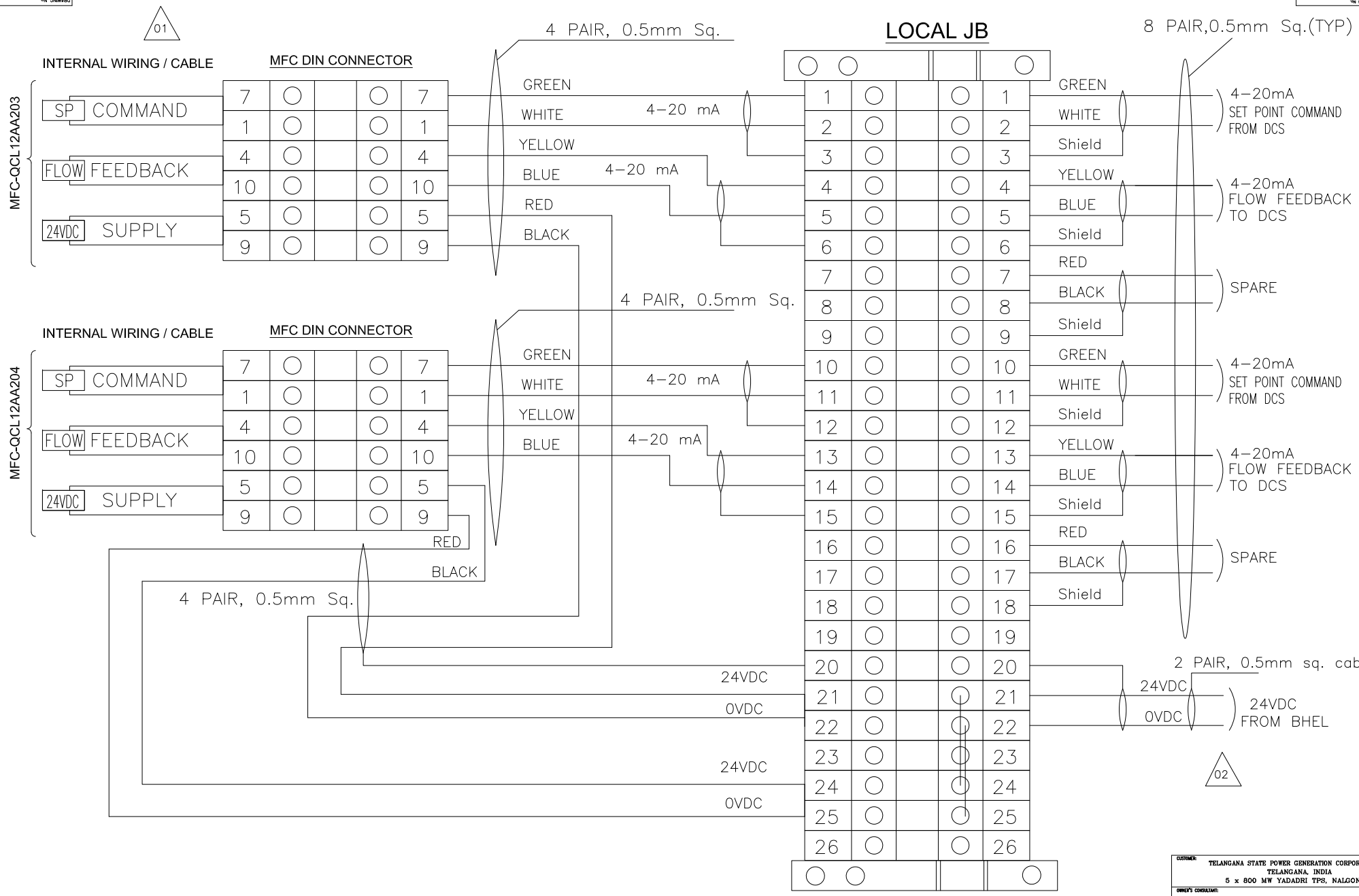
BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

DEPT CODE		NAME	SIGN	DATE
M	DRN	VK	-SD-	30.04.19
	CHD	JP	-SD-	30.04.19
	APPD	SB	-SD-	30.04.19

TITLE: JUNCTION BOX- OXYGEN DOSING SYSTEM (CPU OUTLET)

DEPT. | SCALE 1:100 | SHEET 9 OF 10 | REV. 02 | SIZE-A0

BHEL DRAWING NO. PE-YD-417-154-A004



REF. DOCS.

1.0 DESIGN MEMO OF OXYGEN DOSING SYSTEM – PE-DC-417-154-A101

2.0 P&ID FOR OXYGEN DOSING SYSTEM – PE-DG-417-154-12000A-A501

CUSTOMER: TELANGANA STATE POWER GENERATION CORPORATION LTD
TELANGANA, INDIA
5 x 800 MW YADADRI TPS, NALGONDA

OWNER'S CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
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NOIDA

JOB NO. 417
STATUS CONTRACT
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TITLE: JUNCTION BOX– OXYGEN DOSING SYSTEM (CPU OUTLET)

DRG. NUMBER NO. PE-YD-417-154-A004

SCALE 1:100 SHEET 10OF 10 REV. 02

SECTION – C2
SPECIFIC TECHNICAL REQUIREMENT - C&I

1. The Contractor shall provide complete Instrumentation for control,monitoring and operation of entire Oxygen Dosing System. The requirements given are to be read in conjunction with detailed Technical specification. Further in case of any discrepancy in the requirement within the same section noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre bid clarification. In absence of any pre bid clarification, the more stringent requirement as per interpretation of customer shall prevail without any commercial and time implication.
2. Oxygen Dosing System shall be operated from plant DCS (DCS-BHEL Scope of supply) through operator work stations located in CCR.
3. Bidder to provide local control panel, if required. This local panel will act as interface between the DCS and the field devices for commands & feed backs
4. Bidder to supply all the instruments (PT,PG & MFC) required for the package along with necessary fittings, accessories and valve manifold , chemical/diaphragm seal. etc. All instruments shall be provided with durable epoxy coating for housing and all exposed surfaces of the instruments.Instrument Installation along with hardware shall be in bidder scope.Double root valves shall be provided where pressure is above 40 Kg/cm2.
5. The quantity of instruments for the system shall be as per tender P &ID wherever provided of the respective system as a minimum, for bidding purpose. However,Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments & items are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.
6. **Redundancy of sensors/Instruments shall be provided,irrespective of instrumentation shown in the PID, by bidder as per following:**

I. Triple redundancy for all analog and binary inputs required for Trip/protection of system /drives.

II. For all other control functions (interlock/permissive) dual redundancy of the sensors/Instruments shall be provided.

III. For sensors/Instruments which are used for alarms/monitoring purpose shall be single (for transmitters only) and for switches which are used for alarms/monitoring purpose shall be dual.

7. All Instruments must have separate tapping lines. Sharing of the same tapping pipe for redundant instruments or various different instruments is not acceptable.
8. As a general rule, measuring points and measuring equipment for critical protection shall be separate from and not combined with measuring equipment for the automatic control equipment.
9. Electronic instruments shall not be located close to hot lines, vessels or other hot equipment. Ambient temperatures exceeding 80 °C shall not result in calibration difficulties or rapid deterioration of electronic components.
10. The junction boxes/LIEs for termination of instruments /solenoid actuated valves etc are in bidder's scope. 20% spare terminals shall be provided on JBs.
11. Mass flow controller along with its accessories shall be in bidder's scope. BHEL shall provide 24VDC supply for Mass Flow Controller.
12. Solenoid actuated valves shall be rated for 24 V DC only.

13. Power supply derived for Transmitters, contact interrogation, interposing relay and solenoid shall generally be ungrounded 24V D.C only.
14. The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial/ time implication in this regard shall be acceptable. In case of any conflict or repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
15. Mandatory spares has to be supplied by bidder.
16. Bidder to provide erection hardware including junction boxes, canopies,structural steel as required.
17. 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.
18. Each valve/instrument shall be fitted with a stainless steel or aluminum nameplate indicating the valve/instrument service and reference number in accordance with the approved equipment coding system.
19. Provision for separate Terminal block/wiring diagram for power and control blocks of control panel to be ensured.
20. The make of all the items shall be from approved sub-vendor list.
21. The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards eg. ANSI, ASME, IEEE, ISO, IEC, IGCI, AWS, NFPA, AISC,IGS, SAMA, UBC, UL, NESC, NEMA, ISA, DIN, VDE, IS etc.
22. Editable & pdf copy of Drawings/Documents and data to be furnished after award of the contract:
    - GA Drawing.
    - Field instruments data sheet.
    - JB grouping document.
    - Any other document decided during detailed engineering.

Note:

1. All equipment items shall be of latest design with proven on track record from reputed experienced manufacturers of specified type and range of equipment.The make/model of various instruments/items/systems and instrument sub-vendor shall be subject to approval of BHEL/Customer during detailed engineering stage.
2. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.
3. Documents of C&I System shall be submitted to end user/owner for approval during detail engineering. Changes, if any, shall be accommodated by the bidder without any price/time implication.
4. Uniformity of make and type of instruments and control components shall be followed throughout for rationalization of spares' inventory, except for certain proprietary items where this requirement cannot be met.
5. In case of any discrepancy in Section-C2 and Section-D2 of the specification,Section-C2 shall prevail.

SECTION – D1
GENERAL TECHNICAL REQUIREMENT – MECHANICAL

1.0 INTRODUCTION

The scope of this design philosophy covers the basis of design, system description, equipment selection aspects and control philosophy for Oxygen dosing system for **5X800 MW TSGENCO YADADRI TPS.** The above system shall be skid mounted. Two numbers skid per 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 SYSTEM DISCRIPTION

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 at CPU Outlet, recommended by BHEL is 30-150 ppb of continuous dosing. . Exact dosing rate shall be decided by the operator based on oxygen level at economizer inlet. The set point for dissolved oxygen at economizer inlet shall be maintained as 90 ppb.The dosing rate shall be varied to maintain the set point of 90 ppb. For sizing of oxygen dosing system, 200 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 station. However, dosing shall be done at one place at a time only.
- Dosing rate shall be controlled from Plant DCS 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 concentration can be adjusted in the range of 30-150 ppb from Plant DCS. 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 microsiemens.

b) Start up sequence:-

- Deaerator vent is kept open.
- LP Heater’s 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 vent is closed.
- LP Heater’s vent is 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. However in case of emergency trip the dosing needs to be stopped immediately.
- Ammonia dosing rate needs to be increased to achieve pH in the range of 9.2.

3.0 DESIGN INPUTS/CRITERION

The following drawings/data sheets are enclosed:

- P&I diagram for Oxygen dosing system- PE-DG-417-154-12000A-A501.
- Junction Box Termination details for Oxygen Dosing System- PE-DC-417-154-A004
- Design Calculation for the systems.(Part of this document).
- DATA SHEET – A for Oxygen dosing system (Part of this document)

4.0 BRIEF SCOPE

4.1 OXYGEN DOSING SYSTEM (TOTAL 10 NOS. FOR STATION):

As mentioned, Ten (10) Nos. oxygen dosing skids (Two (2) nos. Per unit) shall be supplied for entire Station. Each skid shall be identical unless specifically mentioned otherwise. One skid out of the two skid shall be under operation at a time.

Each skid shall consist of the following components:-

4.1.1 Cylinder banks

Each oxygen dosing skid shall consist of two banks, each of four (4) oxygen cylinders, dosing at downstream of deaerator/CPU outlet. The automatic change-over of cylinder banks take place on the basis of pressure i.e. the cylinder banks, dosing at Condensate Polishing Unit (CPU) outlet will switch over at 41 kg/cm2(g) and decreasing and the cylinder banks dosing at deaerator outlet at 18 kg/cm2(g) and decreasing.

4.1.2 Pressure Regulator:

The line pressure regulator is used for reducing a high supply pressure (204 bars cylinder pressure) to 45 kg/cm2(a) pressure in skid dosing at CPU outlet and to 22 kg/cm2(a) pressure in skid dosing at deaerator outlet.

4.1.3 Valves, tubing, vents and instrumentation shall be as per the attached P&ID (PE-DG-410-154-12000A-A501) and the data sheet. The MOC and specification of the equipment shall be as per the attached data sheet.

5.0 CONTROL PHILOSOPHY (OXYGEN DOSING SYSTEM)

The mode of operation of the oxygen dosing system shall be from Plant DCS only. All the logics, controls and interlocks shall be implemented in Plant DCS. 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 -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 44 Kg/cm2 for skid dosing at CPU outlet and set pressure of 21 Kg/cm2 for skid dosing at deaerator outlet attached with each cylinder bank.

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

Eight cylinders provided on skid are connected and four cylinders 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 actuated valve SV1(QCL11AA201,QCL21AA201 for the CPU outlet and dearator outlet respectively) will close and solenoid actuated valve SV2 (QCL12AA201, QCL22AA201for the CPU outlet and dearator outlet respectively) will open and other cylinder bank shall be taken in to service provided the pressure at the inlet of SV2 (QCL12AA201,QCL22AA201 for the CPU outlet and dearator outlet respectively) is not low and vice versa. Alarm for pressure low at the inlet of solenoid actuated valves shall be provided in Plant DCS.

A pressure relief valve shall be fitted at the downstream of solenoid actuated 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–43 kg/cm2 for skid dosing at CPU outlet & pressure transmitter (QCL20CP001) {set point –“ADEQUATE--(20 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 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.

All solenoid actuated valves mounted in the oxygen dosing skid shall be of 24 VDC rating. All the field instruments, MFC and solenoid actuated 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.The cabling from JB to plant DCS shall be in BHEL scope.

At each dosing point, viz. CPU outlet and deaerator outlet, an injection assembly containing 15 NB tubing, fixing collar, solenoid actuated 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.

Notes:-

i. All analyzers (conductivity analyzer, dissolved oxygen analyzer) shall be in SWAS Panel (BHEL) 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)	46 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 1 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	PT (QCL11CP001)	41 Kg/cm2 (g) (LOW)	Close SV-1(QCL11AA201) & Open SV-2 (QCL12AA201)	Yes (LOW pressure at cylinder 1 outlet)	Auto-changeover of cylinders bank. Manually replace cylinders with filled cylinders.
Pressure transmitter	PT (QCL12CP001)	46 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 2 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	PT (QCL12CP001)	41 Kg/cm2 (g) (LOW)	Close SV-2(QCL12AA201) & Open SV-1(QCL11AA201)	Yes (LOW pressure at cylinder 2 outlet)	Auto-changeover of cylinders bank. Manually replace cylinders with filled cylinders.
Pressure transmitter	PT (QCL10CP001)	40 Kg/cm2 (g) (LOW)	Close MFC (QCL10AA202)	Yes (Oxygen dosing stopped due to low pressure)	
Pressure transmitter	PT (QCL10CP001)	44 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH dosing pressure)	Manual checking of pressure reducing valve reqd.
Pressure transmitter	PT (QCL10CP001)	42 Kg/cm2 (g) (Adequate)	Open Permissive pressure of MFC(QCL10AA202),	Not applicable	
Cation Conductivity analyzer	(SWAS PANEL 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	(SWAS PANEL 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	(SWAS PANEL 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	(SWAS PANEL 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)	23 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 1 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	PT (QCL21CP001)	18 Kg/cm2 (g) (LOW)	Close SV-1(QCL21AA201) & Open SV-2 (QCL22AA201)	Yes (LOW pressure at cylinder 1 outlet)	Auto-changeover of cylinders bank. Manually replace cylinders with filled cylinders.
Pressure transmitter	PT (QCL22CP001)	23 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 2 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	PT (QCL22CP001)	18 Kg/cm2 (g) (LOW)	Close SV-2 (QCL22AA201) & Open SV-1 (QCL21AA201)	Yes (LOW pressure at cylinder 2 outlet)	Auto-changeover of cylinders bank. Manually replace cylinders with filled cylinders.
Pressure transmitter	PT (QCL20CP001)	17 Kg/cm2 (g) (LOW)	Close FCV (QCL20AA202)	Yes (Oxygen dosing stopped due to low pressure)	
Pressure transmitter	PT (QCL20CP001)	21 Kg/cm2 (g) (HIGH)	Not applicable	Yes (HIGH dosing pressure)	Manual checking of pressure reducing regulating valve reqd.
Pressure transmitter	PT (QCL20CP001)	19 Kg/cm2 (g) (Adequate)	Open Permissive pressure of MFC (QCL20AA202).	Not applicable	
Cation Conductivity analyzer	(SWAS PANEL 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	(SWAS PANEL 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	(SWAS PANEL 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)	

VOLUME : III-C

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

C O N T E N T S

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

1.00.00 INTENT OF SPECIFICATION

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

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

2.00.00 CODES & STANDARDS

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

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

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

3.00.00 GENERAL REQUIREMENTS

3.01.00 The steel surface preparation prior to actual commencement of coating shall conform to SSPC SP 10 / NACE 2 / Sa2½ (near white metal) with sand blasting.

3.02.00 The contractor shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to Owner/Consultant for approval.

3.03.00 The contractor shall also provide copies of test reports from NABL approved laboratory (like National Test House, Kolkata) in support of the paint/primer materials to be used shall conform to the specification requirement.

3.04.00 The contractor shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) shall also be submitted prior to commencement of supply of material and field application.

3.05.00 Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.

3.06.00 Applied coating shall be tested for dry film thickness, holiday (electrical inspection for continuity) and adhesion as per relevant standard such as SSPC PA 2, NACE RP 0274 and ASTM D 4541.

3.07.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.

3.08.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.

3.09.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a Purchaser approved method shall be adopted.

3.10.00 The colour scheme of the entire Plant, covered under this specification shall be approved by the Purchaser in advance before application.

3.11.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by Purchaser.

3.12.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti corrosive painting.

3.13.00 For vessels / tanks requiring lining and epoxy painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.

3.14.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.

3.15.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).

3.16.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.

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

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

3.19.00 All insulated piping shall have aluminium sheet jacketing.

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

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

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

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

4.02.00 Surface Preparation

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

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

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

4.03.00 Painting

4.03.01 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc. to be installed indoor shall be as follows :

a) Surface preparation shall be done either manually or by any other approved method.

b) Primer Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based zinc phosphate.

c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based paint pigmented with Titanium Dioxide.

d) Top Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber paint of approved shade and colour with glossy finish.

e) Total DFT of paint system shall not be less than 150 microns.

4.03.02 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc to be installed **outdoor** shall be as follows :

a) Surface preparation shall be done by means of sand blasting, which shall conform to Sa 2-1/2 Swiss Standard.

b) Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer.

c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.

d) Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade and colour with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.

e) Total DFT of paint system shall not be less than 300 microns.

4.03.03 Specification for application of paints for external surfaces protection of steel pipes and fittings which are **buried underground / laid inside a hume pipe & or submerged Under Water and laid under Pipe Trenches** (in road/rail/pipe or trench crossings) shall be as follows :

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

4.03.04 Specification for application of paints for **internal surface protection of large diameter pipes** (sizes above 600 mm NB and above) if any, shall be as follows :

a) All Internal surfaces of steel pipes, fittings, specialties etc. buried underground or located within pipe trenches shall be given epoxy coating to protect them from (except for drinking water service, where the compatible painting shall be so selected to meet relevant quality standards) corrosion.

b) Internal surface of the pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT (dry film thickness) followed by two part polyamide cured solvent less epoxy.

c) The minimum dry film thickness (DFT) of internal lining shall be 600 micron.

4.03.05 Specification for application of paints for protection of **internal surfaces of DM Water Storage Tank(s)** shall be as follows :

a) Primer - One coat of epoxy primer containing high level of Zinc Phosphate anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.

b) Finish Paint - Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.

c) Total thickness of primer and paint should not be less than 500 microns.

4.03.06 All motors, local push button stations, cable racks, structures used for supports etc. are to be painted with acid proof paint.

4.03.07 The following surfaces shall not be painted - stainless steel, galvanized steel, aluminum, copper, brass, bronze and other nonferrous materials.

4.03.08 No painting or filler shall be applied until all repairs, hydrostatic tests and final shop inspection are completed.

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

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface Preparation :

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

a) The blast pattern or profile depth shall be 40 to 100 micron and shall be measured by dial micrometer.

b) Before sand blasting is started or during blasting or coating, temperature of the pipe surface should be more than 3°C above dew point temperature. Blast cleaned surface should be primed within 4 hours and shall be protected from rainfall or surface moisture and shall not be allowed to flash rust. If the rust occurs, the surface again to be prepared by sand blasting or wire brushing.

5.02.00 Application of Epoxy Coating

a) Coating shall be applied when

i) When the pipe surface temperature shall be atleast 3°C above dew point temperature.
ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater that 50°C.

b) Material preparation shall be in accordance with manufacturer's recommendations.

c) Application of epoxy coating system :

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

5.03.00 Application of PU Coating

a) PU coating shall be applied when the pipe surface temperature atleast 3°C above dew point temperature (when R.H is more than 85%).

b) Material preparation and application shall be done as per manufacturer recommendation.

6.00.00 TEST REQUIREMENTS :

6.01.00 Measurement of dry film thickness

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

6.01.01 Apparatus / Instrument:-

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

6.01.02 Procedures:-

a) Number of measurements:
For 100 square feet (9.29 square meters), five (5) spots per test area (each spot is 3.8 cm) in diameter. Three gauge readings per spot (average becomes the spot measurement).

b) If the structure is less than 300 square feet, each 100 square feet should be measured.

c) If the structure is between 300 and 1000 sq ft, select 3 random 100 square feet test areas and measure.

d) For structure exceeding 1000 square feet, select 3 random 100 square feet testing areas for the first 1000 sq ft and select 1 random 100 square feet testing area for each additional 1000 square feet

e) Coating thickness Tolerance: Individual reading taken to get a representative measurement for the spot are unrestricted (usually low or high readings are discarded). Spot measurements (the average of 3 gauge readings) must be within 80% of the minimum thickness and 120% of the maximum thickness. Area measurement must be within specified range.

6.02.00 Electrical Inspection (Holiday) Test

6.02.01 All the coated / lined pipes shall be tested with an approved high voltage holiday detector preferably equipped with an audio visual signaling device to indicate any faults, holes, breaks or conductive particles in the protective coating.

6.02.02 The applied output voltage of holiday detector shall have a spark discharge of thickness equal to at least twice the thickness of the coating to assure adequate inspection voltage and compensate for any variation in coating thickness. The electrode shall be passed over the coated surface at approximately half the spark discharge distance from the coated surface only one time at the rate of approximately 10 to 20m/min. The edge effect shall be ignored. Excessive voltage shall be avoided as it tends to induce holiday in the coated surface thereby giving erroneous readings.

6.02.03 While selecting test voltages, consideration should be given to the tolerance on coating thickness and voltage should be selected on the basis of maximum coating thickness likely to be encountered during testing of a particular pipe.

The testing voltage shall be calculated by using following formula. (as per NACE 0274 : 2004)

Testing Voltage V = 7900 $\sqrt{T}$ ± 10 percent where T is the average coating thickness in mm.

6.02.04 Any audio visual sound or spark leads to indicate pinhole, break or conductive particle.

6.03.00 Adhesion Pull off Test :

After holiday the coated surface is subjected to adhesion pull off test as per ASTMD 4541.

6.03.01 Apparatus / Instrument: Adhesion tester consists of three basic components:

A hand wheel, a black column containing a dragging indicator pin and scale in the middle and a base containing three legs and a pulling “Jaw” at the bottom and also dollies.

6.03.02 Prepare the test surface :

Once test area is selected, test area shall be free of grease, oil, dirt, water. The area should be flat surfaces and large enough to accommodate the specified number of replicate test.

6.03.03 Prepare Dolly (Test Pull Stub) :

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

6.03.04 Select an adhesive:

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

6.03.05 Attach the dolly to the surface.

a) Using a wooden stick, apply an even layer of adhesive to the entire contact surface area of the dolly.

b) Carefully remove the excessive adhesive by using a cotton swab. Allow the adhesive to fully cure before performing the adhesion test.

c) Attach the dolly to the coated surface and gently push downward to displace any excessive adhesive.

d) Push the dolly inward against the surface, then apply tape across the head of the dolly.

6.03.06 Adhesion Test Procedure

a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.

b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.

c) Slide the dragging indicator pin on the black column to zero by pushing it downward.

d) Firmly hold the base of the instrument in one hand and rotate the handwheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum PSI/MPa/Kg/cm² required by project specification is exceeded and the test is discontinued, (b) the maximum PSI/MPa/Kg/cm² of adhesion tester has been achieved and dolly is still attached, (c) The force applied by the adhesion tester causes the dolly to dislodge.

e) Read the scale and record the adhesion value.

6.04.00 Coating Repair

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

6.04.01 Surface Preparation:

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

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

6.04.03 Coating Application :

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

6.04.04 Repair Inspection :

Repaired portion shall be electrically inspected using a holiday detector.

6.05.00 Welded Field Joints

6.05.01 Preparation :

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

6.05.02 Electrical Inspection :

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

7.00.00 INFORMATION/DATA REQUIRED

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

SECTION – D2
GENERAL TECHNICAL REQUIREMENT – C&I

1. INSTUMENT DATASHEET
2. LCP AND JUNCTION BOX SPECIFICATION
3. CABLE TYPE
4. DRIVE CONTROL PHILOSOPHY
5. ERECTION HARDWARE

INSTRUMENTS DATASHEET

1.00.00 **SPECIFICATION FOR ELECTRONIC TRANSMITTERS**

1.01.00 PRESSURE TRANSMITTER

1.	Working Principle	:	Smart (HART Compatible)
2.	Type	:	Microprocessor based, 2 – Wire
3.	Output Signal	:	4-20 mA DC along with superimposed digital signal
4.	Measuring Element	:	Capsule / Diaphragm
5.	Element material	:	SS-316 (Stainless Steel) or better
6.	Static Pressure	:	150 % of maximum span continuously, without affecting the calibration
7.	Turn-down ratio	:	100: 1
8.	Span and Zero	:	Continuous, tamper proof, remote as well locally adjustable with zero elevation and suppression by 100% of span
9.	Enclosure Class	:	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
10.	Output Indicator	:	LCD (Integral indicator of 5 digit display)
11.	Nameplate	:	Tag number, service engraved in SS tag plate
12.	Body	:	SS
13.	Operating Voltage	:	24V DC
14.	Load	:	600 Ohms (min.) at 24 Volts D.C.
15.	Ambient Temperature	:	0 - 50 ^{O}C
16.	Performance:	:	
	i. Accuracy		$\pm$ 0.075% of Span or better

	ii. Repeatability		± 0.05% of Span or better
17.	Sealing/Isolation	:	Extended diaphragm (Silicon oil/ Flurolub filled) with 5 meters SS armoured capillary for corrosive/viscous/solid bearing or slurry type fluid applications
18.	Accessories	:	a. Universal mounting bracket suitable for 2" pipe mounting b. High tensile carbon steel U-bolts c. Siphon for steam and hot water services d. ½" NPT 2-valve stainless steel manifold, constructed from SS316 bar stock e. Companion flange with nuts, bolts and gaskets f. ½" NPT cable gland g. Handheld calibrator
19.	Adjustment/Calibration/ Maintenance	:	From handheld calibrator/ HART management system

Notes: For primary air/ secondary air/ flue gas applications, DP type transmitters shall be provided for pressure measurement.

LVDT type is not acceptable.

1.02.00 DIFFERENTIAL PRESSURE TRANSMITTER / FLOW TRANSMITTER

1.	Working Principle	:	Smart (HART Compatible)
2.	Type	:	Microprocessor based, 2 – Wire
3.	Output Signal	:	4-20 mA DC along with superimposed digital signal
4.	Measuring Element	:	Capsule / Diaphragm

5.	Element material	:	SS-316 (Stainless Steel) or better
6.	Static Pressure	:	150 % of maximum span continuously, without affecting the calibration
7.	Turn-down ratio	:	100: 1
8.	Span and Zero	:	Continuous, tamper proof, remote as well locally adjustable with zero elevation and suppression by 100% of span
9.	Enclosure Class	:	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
10.	Output Indicator	:	LCD (Integral indicator of 5 digit display)
11.	Nameplate	:	Tag number, service engraved in SS tag plate
12.	Body	:	SS
13.	Operating Voltage	:	24V DC
14.	Load	:	600 Ohms (min.) at 24 Volts D.C.
15.	Ambient Temperature	:	0 - 50 ^{O}C
16.	Performance:		
	i. Accuracy	:	$\pm$ 0.075% of Span or better
	ii. Repeatability	:	$\pm$ 0.05% of Span or better
17.	Sealing/Isolation	:	Extended diaphragm (Silicon oil/ Flurolub filled) with 5 meters SS armoured capillary for corrosive/viscous/solid bearing or slurry type fluid applications
18.	Accessories	:	a. Universal mounting bracket suitable for 2” pipe mounting b. High tensile carbon steel U-bolts

c. Siphon for steam and hot water services

d. ½" NPT 5-valve stainless steel manifold, constructed from SS316 bar stock

e. Companion flange with nuts, bolts and gaskets

f. ½" NPT cable gland

g. Handheld calibrator

19. Adjustment/Calibration/ Maintenance : From handheld calibrator/ HART management system

1.03.00 Displacer Type Level Transmitters

1.	Type	:	Smart (HART Compatible)
2.	Stages of operation	:	Continuous
3.	Material	:	
4.	i. Displacer		SS-316
5.	ii. Suspension wire		SS-316
6.	iii. Torque tube housing		SS
7.	iv. Torque tube		Inconel
8.	v. Displacer chamber		SS
9.	vi. Transmitter Housing		SS
10.	Operating Voltage	:	24 V DC
11.	Transmission	:	Microprocessor based, 2-wire
12.	Output Signal	:	4-20 mA DC along with superimposed digital signal
13.	Static / overload	:	Maximum static pressure without

26.	Applications	:	During detail engineering on Owner's approval

1.04.00 MASS FLOW METER

1.04.01 SENSOR

1.	Measuring Principle	:	Coriolis Mass flow
2.	Primary Element	:	Flow Tube of 316SS or better
3.	Heating Arrangement	:	Integral
4.	Temperature Control	:	For heavy fuel oil application
5.	Process Connection	:	Flanged of rating as per process requirement
6.	Drain	:	Self-draining facility
7.	Enclosure	:	Stainless steel
8.	Accessories	:	Counter flanges, Mounting nuts, bolts, gaskets etc.

1.04.02 TRANSMITTER

1.	Measured quantities	:	Mass Flow rate, Total Mass Flow, Density
2.	Input Signal Processing	:	Smart (HART compatible)
3.	Display	:	LCD
4.	Output	:	2 nos. isolated output of 4-20mA DC selectable from four measured quantities
5.	Load	:	< 750 ohms
6.	Power supply	:	240V AC, 50 Hz

7.	Turn Down	:	100:1
8.	Accuracy	:	± 0.2 % of measured value
9.	Housing	:	IP 65 (Explosion proof)
10.	Nameplate	:	Tag number, service engraved in stainless steel tag plate
11.	Accessories	:	a) Handheld calibrator b) Mounting U-bolts, nuts, bolts, prefab cable etc c) ½"NPT cable gland
12.	Adjustment/Calibration/ /Maintenance	:	From handheld calibrator/ HART management system
13.	Applications	:	Fuel Oil service

1.05.00 RADAR TYPE LEVEL MEASUREMENT

1.	Type	:	Smart (HART Compatible)
2.	Antenna	:	Co axial / guided wave radar / Overspill protection
3.	Principle	:	TDR (Time Domain Reflectometry)
4.	Communication	:	Two wire 4-20mA DC with HART
5.	Environmental temperature	:	0 – 50 ºC
6.	Enclosure	:	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
7.	Calibration	:	a) Self calibration with internal reference b) Zero & Span calibration
8.	Process Connection	:	External cage mounting Flanged /screwed
9.	Electronic Housing	:	Epoxy painted Die-Cast aluminium

transmitters. The hand held calibrator shall be suitable for all types of transmitters supplied in the package. If one type of hand held type calibrator is not suitable for communicating with all types of transmitters then separate hand held calibrator will be provided.

3.00.00 PROCESS ACTUATED SWITCHES

3.01.00 PRESSURE SWITCH

1.	Type	:	i. Piston for high pressure application ii. Bellow / Diaphragm for low pressure application
2.	Sensing element material	:	SS-316. All other wetted part SS316
3.	Case Material	:	SS
4.	Setter Scale	:	Black graduation on white linear scale. Graduation 0-100% with red pointer for set points
5.	Over range	:	150 % of maximum pressure
6.	Adjustments	: :	a) Internal Set Point b) Differential adjustment
7.	End Connection	:	1/2" NPT bottom connected
8.	Switch configuration	:	Two SPDT (240V, 5A AC/220V, 0.5A DC)
9.	Switch Type	:	Snap acting, shock & vibration proof
10.	Terminal Block	:	Suitable for full ring lugs
11.	Enclosure Class	:	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
12.	Performance	: :	a) Repeat accuracy ± 1.0% b) Accuracy of Setting Indication of ± 1.5%
13.	Ambient temperature	:	0 – 50 Deg.C

14.	Nameplate	:	Tag number, service engraved in SS tag plate
15.	Accessories	:	a) Silicon oil/ Flurolub filled Remote diaphragm seal with SS-316 capillary for corrosive/ viscous/ solid bearing or slurry type fluid applications b) Snubbers for pulsating fluid applications c) Siphons for steam and hot water services d) Retention ring and screws for surface mounting e) 1/2" NPT 2 Valve SS-316 barstock manifold f) ½" NPT cable gland
16.	Applications	:	During Detail Engineering on Owner's approval

3.02.00 DIFFERENTIAL PRESSURE SWITCH

1.	Type	:	i. Piston for high pressure application ii. Bellow / Diaphragm for low pressure application
2.	Sensing element material	:	SS-316. All other wetted part SS316
3.	Case Material	:	SS
4.	Setter Scale	:	Black graduation on white linear scale. Graduation 0-100% with red pointer for set points
5.	Over range	:	150 % of maximum pressure

6.	Adjustments	:	a) Internal Set Point
		:	b) Differential adjustment
7.	End Connection	:	1/2" NPT bottom/ back connected
8.	Switch configuration	:	Two SPDT (240V, 5A AC/220V, 0.5A DC)
9.	Switch Type	:	Snap acting, shock & vibration proof
10.	Terminal Block	:	Suitable for full ring lugs
11.	Enclosure Class	:	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
12.	Performance	:	a) Repeat accuracy ± 1.0% b) Accuracy of Setting Indication of ± 1.5%
13.	Ambient temperature	:	0 – 50 Deg.C
14.	Nameplate	:	Tag number, service engraved in SS tag plate
15.	Accessories	:	a) Silicon oil/ Flurolub filled Remote diaphragm seal with SS-316 capillary Diaphragm seals for corrosive/ viscous/ solid bearing or slurry type fluid applications b) Snubbers for pulsating fluid applications c) Siphons for steam and hot water services d) Retention ring and screws for surface mounting e) 1/2” NPT 5 Valve SS-316 barstock manifold f) ½” NPT cable gland
16.	Applications	:	During Detail Engineering on Owner’s

approval

4.00.00 **LOCAL INSTRUMENTS**

4.01.00 PRESSURE GAUGE AND DIFFERENTIAL PRESSURE GAUGE

1.	Type	:	Bourdon/Bellows/Diaphragm
2.	Sensing & Socket	:	SS-316
3.	Movement Material	:	SS-316
4.	Case Material	:	Stainless steel. IP-65 (Explosion proof for NEC Class-1, Division 1 area)
5.	Dial Size	:	Generally 150 mm
6.	Scale	:	Black lettering on white in 270 O arc.
7.	Window	:	Shatterproof glass
8.	Range Selection	:	Normal process pressure: 50~70 % of range
9.	Over-range Protection	:	125% of maximum range by internal stop. External stop at zero
10.	Adjustment	:	For Zero adjustment (Micrometer screw external) For Range adjustment (Micrometer screw internal).
11.	Element Connection	:	Argon welding
12.	Process Connection	:	1/2" NPT (M) Bottom for local, back for panel mounting
13.	Performance	:	Accuracy of $\pm$ 1.0 % of span or better
14.	Operating ambient	:	0 - 50 ^{O}C
15.	Safety Feature	:	Blow out disc /diaphragm at the back
16.	Accessories	:	a) Snubbers for pulsating fluid application.discharge b) Stainless steel Diaphragm seals

			for corrosive/ viscous/ solid bearing or slurry type fluid applications
		c)	3-Way SS316 Gauge cock for pressure gauges
		d)	5-valve SS316 manifold from barstock for differential pressure gauge
		e)	Siphons for steam and hot water services
	17. Nameplate	:	Tag number, service engraved in stainless steel tag plate

4.02.00 LEVEL INDICATOR (FLOAT & BOARD TYPE)

1.	Type	:	Float and Board
2.	Float Material	:	SS-316
3.	Float Cable	:	SS-316
4.	Indicator Assembly	:	Epoxy painted Aluminium
5.	Guide wire spring assembly	:	SS-316 (2 Nos.)
6.	Guide Wire Anchor	:	SS-316
7.	Scale Board	:	Anodized Aluminium with engraved marking (Minimum graduation 10mm), mounting brackets and suitable hardware required as per tank height
8.	Elbow Assembly	:	Anodized Aluminium
9.	Flanges	:	RF , ANSI 150 , SS (3 Nos.)
10.	Accuracy	:	± 10 mm or better
11.	Accessories	:	All mounting accessories including counter flange, nuts & bolts, suitable

1.	Type	:	Hydrometer Type
2.	Mounting	:	On line
3.	Accuracy	:	+/- 2% of range
4.	Scale	:	Black letter on white scale
5.	End connection	:	PVC flange

9.06.00 DENSITY/ CONCENTRATION METER

1.	Wetted Part		Stainless Steel
2.	Enclosure		Stainless Steel (IP-65)
3.	Power Supply		24 V DC
4.	Output signal	:	4-20 mA DC (isolated) into 600 ohms
5.	Accuracy		±0.001 g/cc
6.	Indication	:	LCD display
7.	Temp. Compensation	:	Integral
8.	Accessories		Mounting hardware, integral amplifier (if required), cable glands, tag plate etc.

10.00.00 **SOLENOID VALVES**

1.	Operating Principle	:	Electromagnetic (noiseless)
2.	Coil voltage rating	:	~~240 V AC~~ /24 V DC (as required)
3.	Ways	:	2/3/4 way
4.	Port size	:	1/4" NPT all ports
5.	Body	:	SS bar stock
	Trim	:	SS-316
6.	Duty	:	Suitable for continuous energization
7.	Sealing	:	Airtight and leak proof
8.	Ambient Temperature	:	0 - 50 ^{O} C

9.	Fluid Temperature	:	0-150 ^{O} C (approx.)
10.	Coil Enclosure	:	Stainless Steel
11.	Insulation	:	Class-H
12.	Coil Casing	:	IP-65 (Explosion proof for NEC Class-1, Division-1 area)
13.	Mounting	:	On pipe or on panel
14.	Cable Connection	:	½" NPT
15.	Accessories	:	Cable glands, SS Tag plate

LCP and JUNCTION BOXES SPECIFICATION

1.00.00 **GENERAL REQUIREMENT**

1.01.00 ENCLOSURES FOR INSTRUMENTS AND OTHER EQUIPMENT

1.01.01 All panels, cabinets, distribution boxes, junction boxes, terminal boxes and all other field mounted equipment / enclosures shall have suitable environmental protection as detailed in Section-I of this volume of the specification.

1.02.00 SURFACE PREPARATION & PAINTING

1.02.01 All sheet metal panel/ desk exterior steel surfaces shall be sand blasted, ground smooth and painted as specified below.

1.02.02 Suitable filler shall be applied to all pits, blemishes and voids in the surface. The filler shall be sanded so that surfaces are level and flat; corners are smooth and even. Exposed raw metal edges shall be ground burr-free. The entire surface shall be blast clean to remove rust and scale and all other residue due to the fabrication operation. Oil, grease and salts etc. shall be removed from the panels by one or more solvent cleaning methods prior to blasting.

1.02.03 Two spray coats of inhibitive epoxy primer surfacer shall be applied to all exterior and interior surfaces, each coat of primer surfacer shall be of dry film thickness of 1.5 mil. A minimum of two spray coats of final finish color (Catalyzed epoxy or polyurethane) shall be applied to all surface of dry film thickness 2.0 Mil. The finish colors for exterior and interior surfaces shall conform to the following shades:

- Exterior – Opaline green shade 275 of IS: 5 or equivalent international code..
- Interior - Brilliant White.

1.02.04 Paint films, which show sags, cheeks, blisters, teardrops, fat edges or other painting imperfections, shall not be acceptable.

1.03.00 WIRING

1.03.01 All spare contacts of relays, switches and push buttons shall be wired up to the terminal blocks. All intercommunications between sections of panels/desks shall be furnished.

1.03.02 Each wire shall be identified at both ends with wire designation as per approved wiring diagram. Heat shrinkable type ferrules with indelible computerized ink print shall be used with cross- identification.

1.03.03 All wire termination shall be made with insulated sleeve and crimping type lugs. Wire shall not be spliced or tapped between terminals. Open-ended terminal lugs will not be accepted. Wires shall not be looped around the terminal screws or studs.

1.03.04 Internal wiring should be terminated uniformly on one side of the terminal block leaving the other side available for termination of outgoing cables. Internal wiring shall be grouped so that all outgoing wiring to each particular remote location is terminated on adjacent terminal blocks. Interior wiring and jumperings shall be arranged so that external connections can be made from internal side of terminal blocks. Common connections shall be limited to two (2) wires per terminal.

1.03.05 Wiring shall be arranged to ensure free access to all instrument or devices for maintenance. No wire shall be routed across the face or rear of any device in a manner, which will impede the opening of covers or obstruct access to leads, terminals or devices

1.03.06 Wires shall be dressed and run in trays or troughs with clamp-on type covers. Wirings may be neatly bunched in groups by non-metallic cleats or bands. Each group shall be adequately supported along its run to prevent sagging or strain on termination.

1.03.07 Shield wires shall be terminated on separate terminal blocks. Common connections shall be limited to two wires per terminal. Signal circuit shields shall be grounded at the power supply end only or as recommended by manufacturer.

1.03.08 All low level signal cables shall be separately bundled to from control cable and maintained at 300 mm minimum spacing from control bundles.

1.03.09 Panel internal wiring shall follow distinct color-coding to segregate different voltage levels viz. 24V DC, 48V, 110V AC, 240V AC, 220V DC etc.

1.03.10 Thermocouple lead wires, analyzer measuring lead wires, or any other lead wires carrying measuring signal of the order of low milli volt or micro volt shall be electrically and physically isolated from other AC and DC wiring. Shielded wires used in such cases for panel internal wiring shall be continuous and ungrounded with the shield terminated individually and separately in panel terminal block.

1.03.11 Wiring to door mounted devices shall be provided with multi-strand wires of (49 strands minimum) adequate loop lengths of hinge-wire so that multiple door openings will not cause fatigue failure of the conductor.

1.03.12 Internal wiring in factory pre-wired electronic systems cabinets may be installed according to the Contractor's standard wire size, insulation, and method of termination on internal equipment. Insulation for all wiring, including circuit board wiring, back panel wiring, power supply wiring and interconnecting cables between devices shall pass the vertical flame test per IPCEAS-1981. Identification of conductors may be done by insulation color-coding identified on drawings or by printed wiring lists.

1.04.00 TERMINAL BLOCKS

1.04.01 All terminal blocks shall be rail mounted/ post mounted type, cage clamp type with high quality non-flammable insulating material of melamine suitable for working temperature of 105 Deg C. The terminal blocks in field mounted junction boxes, instrument enclosures racks etc. shall be suitable for cage clamp connections. The terminal blocks in Control Equipment Room termination/ marshalling cubicles shall be suitable for post mounted cage clamp connection at the field input end. The exact type of terminal blocks to be provided by Bidder shall be subject to Owner.

1.04.02 All terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, small partitions, transparent covers, support brackets, distance sleeves, warning level, marking etc. For RTDs ring - tong type lugs shall be used at Junction Boxes.

1.04.03 The characteristics of the terminal blocks shall be as follows.

i) High contact force, independent of conductor cross-section and large contact surface area.

ii) Integrated self-loosening protection to avoid shifting of contact surface that may allow contamination of connection point.

iii) Inspection and maintenance free (resistant to thermal aging and vibration)

iv) Low and constant voltage drop

1.04.04 The insulation of the terminal blocks shall be of suitable thermoplastic material.

1.04.05 The spacing between Terminal blocks channels in panels and cubicles shall be adequate for routing the cable troughs and to allow adequate free workspace for termination and removal of wires. The terminal blocks shall be arranged with atleast 100 mm clearance between two sets of terminal blocks and junction box walls.

1.04.06 Signals of different voltage levels shall be clearly segregated by providing separate rows to each type of signal and by using terminal blocks of different color for each type of signal and by providing barrier strips between them.

1.04.07 Terminal blocks shall be provided with white marking strips / self-adhesive marker cards and where permitted by the safety codes and standards, shall be without covers. Power terminals and high voltage (above 48 volts) terminals shall have protection covers. All terminals shall be provided with permanent terminal identification numbers on both sides.

1.04.08 At least 20% spare unused terminals shall be provided on each terminal block for circuit modifications and for termination of all conductors in a multi-conductor control cable.

1.04.09 The bottom of the terminal block shall be at least 200 mm above the cable gland for bottom entry type panels.

1.04.10 For extending 24 V DC supply to panels, the size of the terminals shall be decided based on voltage drop and not based on current.

1.04.11 Other requirements of the terminal blocks are as follows:

i) The last terminal in a rail-mounted assembly shall be closed with an end plate and end bracket.

ii) For visual and electrical separation of terminal groups, partition plates shall be provided, which can be push fitted after forming an assembly.

iii) Design shall permit testing of incoming and outgoing signals by using suitable test plug and socket without disconnecting the cable connections.

iv) It shall be possible to use jumper plugs through the above test plug socket to connect adjacent terminals. Adequate number of short circuit jumper plugs shall be provided for the purpose.

v) Where more than one connection to a terminal block is required, two tier terminals shall be used.

1.05.00 GROUNDING

1.05.01 Separate Protective and Electronic system ground as required shall be provided.

1.05.02 All panels, desks, cabinets shall be provided with a continuous bare copper ground bus (Frame ground), bolted to the panel structure at bottom on both sides and effectively ground the entire structure. The bolts shall face inside of panels.

1.05.03 For electronic system cabinets the electronic system ground bus (Electronic ground) shall be similar but insulated from the cabinet and shall be separately connected to the system ground .The same ground may be used to earth the shield of shielded signal cables, otherwise a separate ground bus shall be provided for connecting the signal cable shields. Cable shields shall be grounded at the panel end only and shall never be left open .The electronic ground between panels of a shipping section shall be firmly looped.

2.00.00 **CONTROL DESKS & PANELS**

2.01.00 GENERAL

2.01.01 All control desk, panels etc. shall be furnished fully wired with necessary provision for convenience outlets, internal lighting, utility receptacles, grounding, ventilation, space heating, anti-vibration pads, internal piping &

accessories as required for completeness of the system.

2.01.02 The design shall conform to the EN ISO 11064 (Ergonomical design of Control Room), Part 1, 2 and 3.

2.01.03 The exact dimensions, material, construction details, grounding, general arrangement etc. shall be as per actual requirement and shall be finalized during detail engineering and subjected to Owner's approval.

2.01.04 Incoming power supply feeders shall be duplicated. Alarm shall be provided for failure of a power supply feed.

2.01.05 For Control desk/ panel mounted instruments/ devices etc. which are to be powered from UPS, all required conversion of interface equipments/ accessories to make such devices compatible with UPS supply shall be provided. All necessary hardware like input switches/ fuse unit for each feeder as well as switch fuse unit for each instrument/ device on the power supply line shall be provided. From UPS redundant feeders shall be provided wih suitably rated MCB and provision of fast auto changeover of UPS feeders.

2.01.06 Crating of the panels and desks shall be suitable for protection against shock, vibration, inappropriate handling and inclement weather conditions during transportation and warehousing. Mounted equipment shall have adequate protection against damage during handling, transit and storage. Suitable desiccant shall be used inside the packing case.

2.01.07 Nameplate

a) Nameplate shall be provided for instrument or device mounted on the panel.

b) Nameplates for panels shall be provided both in front and rear.

2.02.00 CONTROL DESK

2.02.01 Control desk shall be free standing, floor mounting, table top type with doors at back and shall be constructed of 3 mm thick (minimum) CRCA steel or Aluminium extrusion. Aluminium structure shall be anodized or powder coated paint finish. The top surface of control desk shall be 30 mm (minimum) thick with the top 12 mm (minimum) of acrylic solid surface and the remaining 18 mm of laminated medium density fibre (MDF) board.

2.02.02 Monitors with retractable keyboard shall be provided on the desk. Desk shall be arranged in arc-like shape without any sharp edges. Edges shall be extruded PVC or rounded post-formed laminate.

2.02.03 Desks shall be of modular, scalable and industrially ruggedized design and shall have connections for PA system handsets & telephone sets.

2.02.04 Desks shall have concealed cable trays for wire dressing. Both Horizontal & Side Managers (2 separate horizontal cable routing wire baskets for power & data cables) shall be provided.

Each User station will be provided with 2 separate power distribution units (1 for Main line & 1 for UPS line). Each power distribution unit will have 6 points of 5/13 Amp sockets, Mains MCB On/Off Switch & Indicator.

Adequate heat management provision for Exhaust of heat from within the Console Desk Assembly shall be provided. There will be multiple fans provided in the Main Control Desk. Each Fan will be of 230 VAC 250 CFM Ball Bearing based. Ventilation louvers will be provided on both Front & Rear Modesty with special Air Filters. Adequate space for CPU & Other equipments placed with in the desk.

2.02.05 Design shall include Earthing bolts.

2.02.06 Back installed items shall be suitably concealed from front view.

2.02.07 All operator workstations for SG, TG, Auxiliaries & Off-site Plants shall be mounted on this Control Desk. The cabling / wiring between OWS & CPUs, power supply cables etc. shall be aesthetically routed and concealed from view.

2.02.08 HARDWIRED DEVICES ON CONTROL DESK (DRAW OUT SECTION)

Release and Lamp Test push buttons shall be provided for a set of push buttons (decided during detail engineering stage). Depending on the type of control/ function, required number of push buttons/ indicating LEDs & their color, push button stations shall be selected. The size of push button stations shall be 24 x 48 mm or 25 x 50 mm and shall have service inscription details at the front. Emergency push buttons (with cover) shall be mounted on top of Control Desk.

2.03.00 BACK UP PANEL

2.03.01 Construction shall be from CRCA steel of thickness not less than 3mm.

2.03.02 Upright back-up panel shall be provided where hardwired devices shall be mounted on a mosaic grid type console. The mosaic grid tiles shall be of 24 mm x 48 mm (or 25 mm x 50 mm) size, made of heat & flame retardant, self extinguishing and non-hygroscopic material with flat matt finish without glare and non reflecting type.

2.03.03 DDCMIS Back-up Panel (referred as Unit Control Panel-UCP) shall also mount annunciation fascia (minimum 500 nos.) and the flame monitoring cameras along with other hardwired devices as decided during detail engineering stage by Owner. Color coding shall also subject to Owner's approval.

2.03.04 Colored Mimic for different Off-site plant control systems (as enumerated elsewhere in this specification) and hardwired annunciation system shall also

be mounted on the back up panels.

2.04.00 PANELS/CABINETS

2.04.01 All DDCMIS system modules, power supply components and other Local Control panels (PLC/Relay based) shall be housed in cabinets as specified below.

2.04.02 The cabinet mounted equipments shall be fully assembled, installed in mounting racks, wired and fully tested as per specification requirements and Owner approved drawings prior to shipment to the project site.

2.04.03 The Bidder shall ensure that the cabinets are complete & ready for installation before dispatch from manufacturing works. The installation work at project site for these cabinets shall only involve connections through multi-pair cables from marshalling cabinets (wherever provided) to system cabinets and inter-cabinet/cabinet to Control Desk/ Back up Panel.

2.04.04 All electronic cards, network components, power supply modules etc. located shall be suitably housed in cabinets and shall be neatly arranged in sub-racks. Network components shall be visible in door closed condition (e.g. Glass doors etc.) as approved by Owner.

2.04.05 Bidder shall design the cabinet internal arrangement, floor cutout and cable gland plate such that all the cables entering or leaving the cabinet can be properly glanded in the gland plate.

2.04.06 The packaging density of panels shall be such that the temperature rise within the panels shall never exceed 10°C above ambient even under worst operating conditions. Cooling Fans shall be provided wherever required and this shall be of industrial grade.

2.04.07 TECHNICAL PARTICULARS

1.	Material of Construction	:	Cold Rolled Coal Annealed (CRCA) steel sheet	
2.	Thickness of Sheet	:	a)	2.0 mm for faces supporting instruments / terminals
		:	b)	1.6 mm for other sides and top
3.	Construction	:	Welded throughout as per approved National Standards	
4.	Post welding operation	:	a)	Grounding of all welds to smoothness
		:	b)	Rounding of corners

			:	c) Cleaning of weld spatters
5.	Panel height		:	2300 mm (approx)
6.	Corners		:	7 mm inner radius
7.	Dimensional Tolerances		:	a) In height & length - 3 mm
				b) In height between adjacent sections - 2 mm
				c) Total for a group - 6 mm
8.	Doors		:	Double, recessed, turned back edges, full height front & rear
	i)	Thickness of Sheet	:	2 mm
	ii)	Hinges	:	Stainless steel
	iii)	Door latches	:	Three point type
	iv)	Door gaskets	:	Neoprene rubber on fixed frame to result dust proof/weatherproof enclosure
	v)	Opening of the doors	:	Outward
	vi)	Louvers	:	With removable wire mesh to ensure dust and vermin proof
9.	Gland plates		:	Removable in sections 4 mm thick (bottom)
10.	Cable entry		:	Bottom
11.	Hardware		:	a) Anti vibration pad- 15 mm
				b) Predrilled base channel ISMC – 100 or equivalent for all sides
				c) Stainless steel buff- finished 2 mm thick kick plate for all sides
				d) Stainless steel scratch strips along desk edges fixed with pan-head recessed screws
				e) Rubber strips to ensure air

tightness between kick plate and finished floor

f) Lifting hook / Eye bolt

g) Drawing pocket

h) Door switch, lamps, thermostat, heaters and industrial grade cooling fans,, illumination fixures

12.	Name Plate	:	Both at front and back surface of the panel
13.	Fixing of name plate	:	Stainless steel pan head screws
14.	Name plate material	:	Laminated phenolic (3 layers)
15.	Lettering	:	Black with white engraved
16.	Mounting of terminal blocks	:	Vertical angle support bracket tack welded on sheet steel plate, screwed on internal wall of enclosure

2.05.00 FURNITURE

All the furnitures in the Central / Local control Room (s), Engineers' rooms, Instrument laboratory , SWAS Room & any other rooms with C&I equipments located in different plant buildings under Bidder's scope shall be included in Bidder's scope of supply. Bidder shall provide following industrial grade furniture items as a minimum from reputed manufacturers/suppliers meeting International Standards. The furniture shall be modular and latest with ease of operational features. The furniture shall be modern, aesthetically designed, modular, flexible, space saving and future safe.

2.05.01 WORK STATION FURNITURE

Modular work station furniture, suitable for mounting servers & historians, programmer stations, PC based systems, printers (A4/A3 color laserjet) etc. shall be provided.

2.05.02 PC RACK

PC Racks shall be provided to mount CPUs of workstations/PCs of OWS/LVS etc. in control room. For each PC / workstation / monitor at least one chair shall be included.

2.05.03 CHAIRS

clearly brought out by the Contractor in his offer, alongwith all relevant details/basis.

3.03.00 Any other requirement for proper LVS mounting & functioning & viewing shall also be specifically brought out by the Contractor in his offer, along with all relevant details.

4.00.00 **LOCAL INSTRUMENT RACK (LIR) & LOCAL INSTRUMENT ENCLOSURE (LIE)**

4.01.00 GENERAL

4.01.01 Devices (Transmitters/ Switches) located in the field shall be suitably grouped together to the extent possible and installed in the LIE (Closed Rack) and LIR (Open Rack) in Boiler/TG Building and Off-site plant areas.

4.01.02 Racks and enclosure shall be factory prefabricated & painted and shall complete with internal piping, tubing, manifold, isolation valves, blowdown valves, integral junction box, illumination etc.

4.01.03 No more than six instruments shall be grouped in a single rack / enclosure.

4.01.04 Racks shall be installed above the tapping points for air, flue gas and coal air mixture application whereas for applications such as for water and steam, racks to be installed below the source point.

4.01.05 Attention shall be paid in the layout to avoid air traps in liquid piping and water accumulation in air /gas piping.

4.01.06 Racks used for furnace, flue gas and air application shall be provided with intermittent & continuous air purging

4.01.07 Welding of impulse lines shall comply with the provisions of the latest applicable ANSI Code for Pressure Piping.

4.01.08 Earth stud shall be furnished at rack for safety grounding.

4.02.00 LOCAL INSTRUMENT ENCLOSURE (LIE)

4.02.01 Enclosure shall be free standing type. Racks shall be adequately reinforced to ensure true surfaces and to provide support. Major load - bearing posts shall be suitably supported by gusset plates or moment members.

4.02.02 Enclosure outer shall be constructed from at least 3 mm thick steel plate and epoxy painted to shade gray. Base frame shall be made of ISMC 100 and black colour finish.

4.02.03 2” NB galvanized pipes shall be laid horizontally and supported at two end channels to mount transmitters at accessible height. Center posts or any

member, which would reduce access, shall be avoided.

4.02.04 Double leaf interlocking front opening doors with three point locking shall be provided and shall be arranged for maximum possible access to the interior. Key shall be of identical for all enclosures.

4.02.05 Doors shall have concealed quick removal type pinned stainless steel hinges and locking handles. Gaskets shall be used between all mating sections to achieve dust and weather proof enclosure rated for IP-65 including the internal junction box. All enclosures shall have access doors on front side.

4.02.06 Removable type bulkhead plates of thickness not less than 6 mm shall be mounted at the racks with suitable high temperature gasket. Impulse lines within the enclosures shall be properly clamped.

4.02.07 All internal wirings between the instruments and junction box shall run through flexible conduits. No exposed wirings within transmitter racks both open and closed type, is admissible.

4.02.08 Racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Covered funnels shall be used for saturated liquid and steam service, whereas, open funnels may be used for cold liquid services. Header (2” NB ASTM A 106, Sch-80 Gr. C) shall be suitably sloped and shall have one end flanged and extending beyond the rack for connection to plant drain header..

4.02.09 Each rack shall be provided with one receptacle, light fixtures with wire guard and one lighting switch each at instrument & Junction box compartments with wire guard. Lighting switches may be door actuated & mounted inside the panel. Outlet box, switch box and device covers shall be of galvanized stamped steel. Light switches and receptacles shall be installed inside the enclosure on the wall near the latch side of the enclosure door. Light fixtures shall be installed on the ceilings of the enclosures.

4.02.10 Power supplies for miscellaneous devices shall be provided with MCB located within the enclosures. MCB shall be mounted in fuse blocks. Nameplates shall be furnished above the MCB blocks, identifying the devices being served.

4.02.11 Vibration dampeners shall be installed for supporting each enclosure. The loading at each corner of the enclosure shall be determined by actual test weighting when construction is complete to determine the correct length of each dampener for proper loading of the dampener in accordance with manufacturer's recommendations

4.03.00 LOCAL INSTRUMENT RACK (LIR)

4.03.01 Rack shall be free standing type constructed from 6 mm thick steel channel frame provided with a canopy to protect the instrument from dripping water or

falling objects and shall be epoxy painted. Canopy shall be of CRCA steel sheet of at least 3 mm thickness.

4.03.02 Rack Major load-bearing posts shall be suitably supported by gusset plates or moment members. Suitable fenders grill shall be welded to the end-posts of the rack to outline a boundary beyond which no mounted equipment shall project to protect instrument from accidental contact during personnel movement. Center posts or any member, which would reduce access, shall be avoided.

4.03.03 2" NB galvanized pipes laid horizontally and supported at two end channels shall be employed at working accessible height for mounting of instruments.

4.03.04 All internal wirings between the instruments and junction box shall run through flexible conduits. No exposed wirings are admissible.

4.03.05 Racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Covered funnels shall be used for saturated liquid and steam service, whereas, open funnels may be used for cold liquid services. Header (2" NB ASTM A 106, Sch-80 Gr. C) shall be suitably sloped and shall have one end flanged and extending beyond the rack for connection to plant drain header..

Each rack shall be provided with one receptacle, one light fixture with wire guard and one lighting switch. Outlet box, switch box and device covers shall be galvanized stamped steel. Light fixtures shall be installed on the canopy of the rack

4.03.06 Power supplies for miscellaneous devices shall be provided with MCB located within the enclosures. MCB shall be mounted in fuse blocks. Nameplates shall be furnished above the MCB blocks, identifying the devices being served.

4.04.00 JUNCTION BOX

1.	Type of Enclosure	:	Dust tight & weatherproof conforming to IP 65
2.	Material	:	3 mm sheet steel / fiberglass reinforced polyester(UV stabilized)
3.	Type of Cover	:	Solid unhinged with retention chain / Screwed at all four corners
4.	Paint	:	i) Exterior : Opaline green shade 275 of IS: 5 ii) Interior - Brilliant Glossy White.

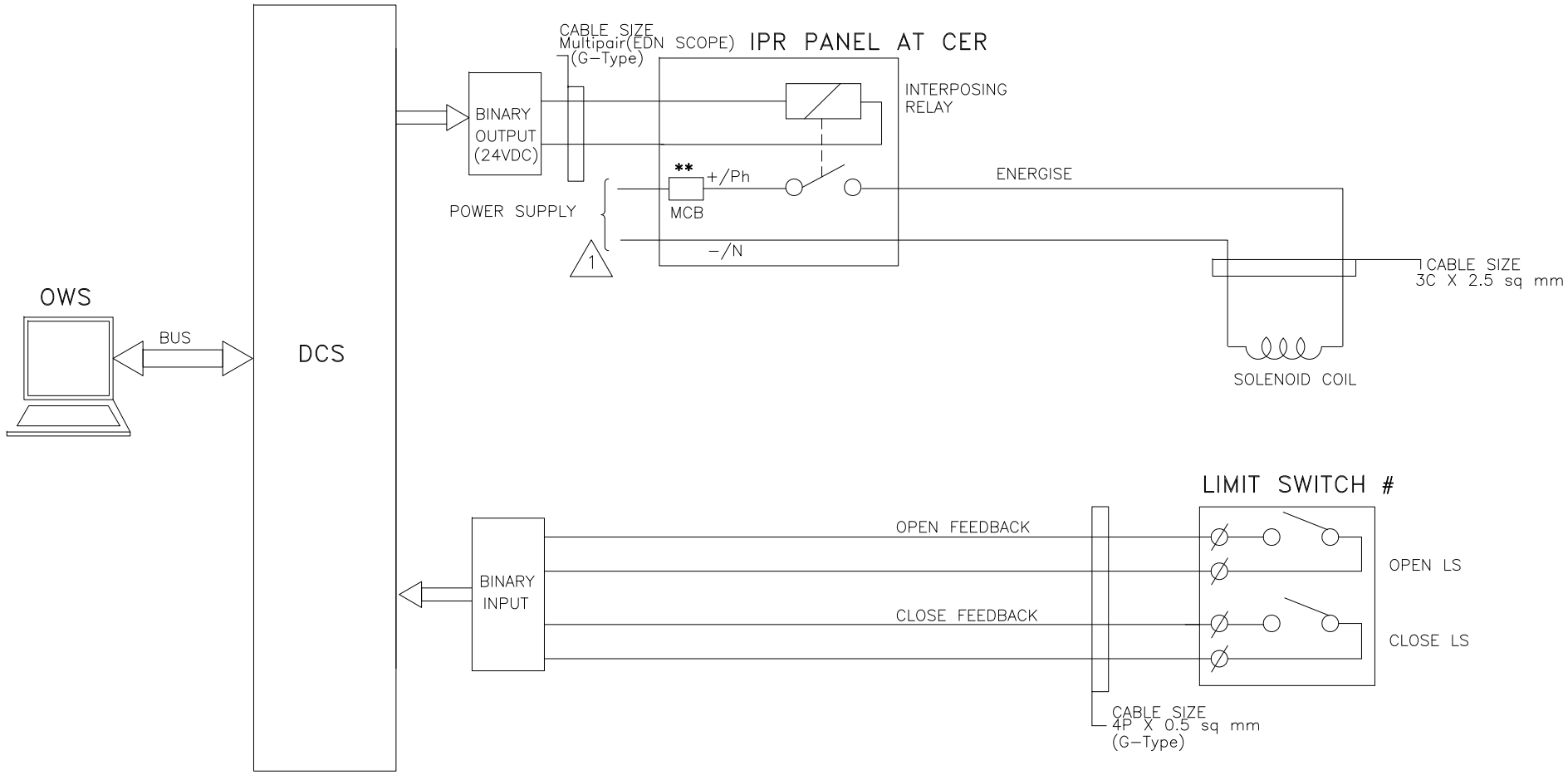
			Surface / Two (2) inch Pipe stanchion
5.	Mounting	:	(At a dry compartment at one side of the enclosure / rack with front opening type door)
6.	Cable Entry	:	3 mm (min) Bottom / side Gland plate
7.	Gasket	:	Neoprene
8.	Grounding	:	Brass earth lug with green screw head External-2 nos , Internal-1no. (M6)
9.	Number of Drain Holes	:	Two at bottom capped
10.	Identification	:	Label for JB and Tags for cable
11.	Accessories	:	a) Rail mounted cage clamp type screwless terminals (suitable for conductor size up to 2.5sq.mm of suitable voltage grade) with markers and 20% spare terminals b) Cable gland (Brass) & raceways c) Ferrules & lugs (Brass) d) Aluminum back panel e) Canopy at top f) Mounting brackets g) bolts and nuts made of brass etc.

CABLE TYPE

CABLE SIZES FOR 5X800 MW YADADRI TPS	
Sl no.	Cable Type
	G-TYPE
1	2P X 0.5 sqmm
2	4P X 0.5 sq mm
3	8P X 0.5 sqmm
4	12P X 0.5 sqmm
5	2P X 1.5 sqmm
	F-TYPE
1	4P X 0.5 sqmm
2	8P X 0.5 sqmm
3	12P X 0.5 sqmm
4	20P X 0.5 sqmm
	CONTROL CABLE
1	3C X 2.5 sqmm
2	5C x 2.5 sq mm
3	12C x 2.5 sqmm

Drive Control Philosophy

DCS INTERFACE FOR SOLENOID DRIVE
(24V DC / 240V AC UPS)



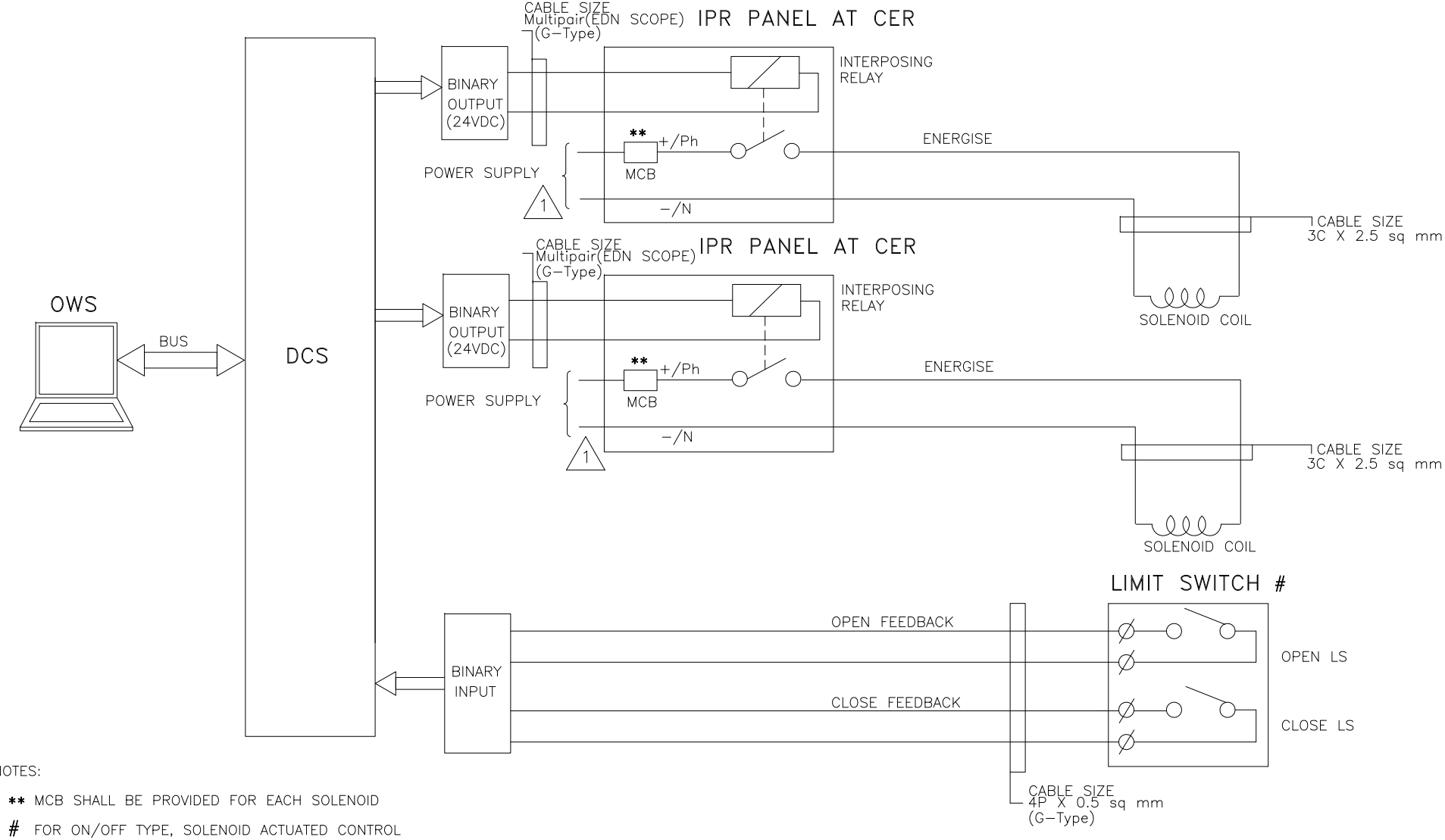
NOTES:

** MCB SHALL BE PROVIDED FOR EACH SOLENOID

FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.

BHEL	PROJECT: 5X800 YADADRI THERMAL POWER STATION UNIT # 1 TO 5	DRG.NO.	PE-DM-417-145-I002
		DATE	21.01.2019
	TITLE: DDCMIS INTERFACE FOR SOLENOID DRIVE (SINGLE COIL)	REV.NO.	02
		SHT	9 OF 11

DCS INTERFACE FOR SOLENOID DRIVE
(24V DC / 240V AC UPS)



NOTES:

** MCB SHALL BE PROVIDED FOR EACH SOLENOID

FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.

BHEL	PROJECT: 5X800 YADADRI THERMAL POWER STATION UNIT # 1 TO 5	DRG.NO.	PE-DM-417-145-I002
		DATE	21.01.2019
	TITLE: DDCMIS INTERFACE FOR SOLENOID DRIVE (DOUBLE COIL)	REV.NO.	02
		SHT	9a OF 11

VOLUME : VI
SECTION-VII
SUB SECTION - E
ERECTION HARDWARES

1.00.00 GENERAL TECHNICAL REQUIREMENTS

This section provides the general technical guidelines for the erection materials for instruments. All erection materials shall be of good quality and conform to the operating environment of the corresponding instrument.

However, any item required for erection of Bidder supplied system but not categorically indicated in this section, shall be supplied by the Bidder and all these items shall conform to International / National standards / codes.

1.01.00 Electrical Accessories

Electrical conduit and associated materials shall conform to the requirements of the articles which follow :

a) Rigid Steel Conduit

i) Conduits up to and including 25 mm shall be of 16 SWG and conduits above 25 mm shall be of 14 SWG. Minimum size of conduits shall be 19 mm.

ii) Each piece of conduit shall be straight, free from blister and other defects and covered with capped bushing at both ends.

iii) All rigid conduit couplings and elbows shall be hot dip galvanized rigid mild steel in accordance with IS:9537 Part-I (1980) and Part-II(1981).. The conduit interior and exterior surfaces shall have a continuous zinc coating with an over coat of transparent enamel lacker or zinc chromate. Conduits shall be furnished in standard length of 3 meters, threaded at both ends.

iv) All rigid conduit fittings shall conform to requirements of IS:2667,1976. Galvanised steel fittins shall be used wth steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fitting shall be compatiable with the flexible conduit supplied.

b) Flexible Conduit

i) Flexible conduit shall be of three layer construction of very high quality of lead coated steel. Outside and inside layer shall be reinforced with heat resistant material.

ii) Lead coating outside and inside of the conduit steel surface shall provide a non-corrosive characteristic particularly in acidic atmosphere. Besides flexibility, this shall be strong enough to stay at the desired profile without support and shall be durable and strong so as to offer sufficient mechanical protection. It shall also be fully liquid dust and air tight and shall withstand a continuous hydraulic pressure up to 2 Kg/Sq. cm and temperature up to 200 °C.

c) Special Fittings

i) Conduit sealing and fittings shall be provided as required and shall be consistent with the area and equipment with which they are installed.

ii) Double locknuts shall be provided on all conduit terminations not provided with threaded lugs and couplings. Locknuts shall be designed to securely bond the conduit to the enclosure when tightened. Locknuts shall not loosen due to vibration.

1.02.00 Electrical Junction Box:

Please refer to Section VII , Subsection – D of this volume of the Specification.

1.03.00 Cable Gland

1.	Type	: Double compression
2.	Entry Thread	: NPT / ET
3.	Material	: Brass
4.	Finish	: Cadmium Plated.
5.	Protection	: IP 54 or better
6.	Accessories	: Neoprene gasket, locknuts, reducers etc

1.04.00 Cable Tray

1.	Material	: Mild steel, slotted
2.	Thickness	: not less than 2.0 mm
3.	Finish	: Hot dip galvanized
4.	Perforation	: As per MFR standard
5.	Cover	: Suitable for tray

1.05.00 Process Hook Up Accessories & specification

Material and rating of the hook up items shall suit the piping and fluid condition. Hook up materials shall be IBR certified for applicable cases. Bidder shall furnish hook up drawings and the drawings for open racks & closed racks for owner's approval.

1.05.01 Seamless Stainless Steel Pipe

1.	Reference	: ASTM A-312 TP 316
2.	Material Grade	: TP 316
3.	Type	: Seamless /Plain end
4.	Size	: As applicable (e.g.½" NB etc)
5.	Schedule	: 40
6.	Standard Length	: 5 meter

1.05.02 Stainless Steel Pipe Fittings

	1.	Reference	: ASTM A-182 F 316 / ANSI B16.11
	2.	Type	: Forged
	3.	Rating	: 3000 lbs / 6000 lbs / 9000 lbs
	4.	Size	: To suit related SS pipe.
	5.	End connection	: Generally socket weld
	6.	Type of Fittings	: Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc.

1.05.03 Seamless Stainless Steel Tube

	1.	Reference	: ASTM A-213 , ASTM A-249 or ASTM A-269
	2.	Material Grade	: TP 316
	3.	Size	: As applicable (e.g.½" OD X 0.083" wall thickness / ¼" OD X 0.049" wall thickness etc.)
	4.	Type	: Cold drawn annealed, pickled, passivated, de-scaled, hydraulically cleaned seamless tube.
	5.	Properties	: The tube shall be free from scratches and suitable for bending and capable of being flared by hardened and tapered steel pin. The expanded tube shall show no crack or rupture. Hardness shall be RB 80.
	6.	Test Pressure	: 400 Kg/Sq. cm (minimum)
	7.	Tolerance	: ± 0.13 mm for outside diameter
			: ± 15 % for wall thickness
	8.	Standard Length	: 5 meter
	9.	Test	: Flare, Hardness, Ball and Bubble Test

1.05.04 Stainless Steel Tube Fittings

	1.	Reference	: ASTM-A-182
	2.	Type	: Double ferrule double compression
	3.	Material	: 316 Stainless steel forged
	4.	Ferrule	: 316 Stainless Steel

	5.	Type of Fittings	: Male / female connector, elbow, cross /equal tee, straight connector, bulkhead union, ferrule etc. as required to suit installation.
	6.	Size	: To suit SS tubing and NPT end connection

1.05.05 C.S. Pipe

	1.	Reference	: ASTM-A 106 Gr. C
	2.	Material	: Cold drawn seamless black C.S.
	3.	Type	: Seamless / Plain ends
	4.	Size	: As applicable (e.g. ½" NB etc)
	5.	Schedule	: 80, 160, XXS as required
	6.	Standard Length	: 5 meter

1.05.06 C.S. Pipe Fittings

	1.	Reference	: ASTM-A 105 / ANSI B16.11
	2.	Type	: Forged
	3.	Rating	: 3000 lbs / 6000 lbs / 9000 lbs
	4.	Size	: Suitable to related C.S.Pipe
	5.	End connection	: Generally socket weld
	6.	Type of Fittings	: Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc.

1.05.07 A.S. Pipe

	1.	Reference	: ASTM-A 335 P22 AS PER ANSI B 36.10
	2.	Material	: Cold drawn seamless A.S.
	3.	Type	: Seamless / Plain ends
	4.	Size	: As applicable (e.g. ½" NB etc)
	5.	Schedule	: XXS
	6.	Standard Length	: 5 meter

1.05.08 A.S. Pipe Fittings

1.	Reference	: ASTM-A 182 F22 AS PER ANSI B 16.11	
2.	Type	: Forged	
3.	Rating	: 9000 lbs	
4.	Size	: Suitable to related A.S.Pipe	
5.	End connection	: Generally socket weld	
6.	Type of Fittings	: Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc.	

1.05.09 G.I.Pipe

1.	Reference	:	IS-1239, Part-I
2.	Type	:	Medium grade, threaded at both ends protected with end caps
3.	Material	:	Continuous ERW galvanized MS pipe
4.	General	:	Pipe shall be galvanized both inside and outside
5.	Size	:	As applicable (e.g 1/2”/3/4”/1” etc.)

1.05.10 G.I.Pipe Fittings

1.	Reference	:	IS-1239, Part-II for material, dimension, thread etc.
2.	Style	:	Threaded
3.	Type of Fittings	:	Equal tee, three piece union, unequal tee, straight socket, 90 Deg. elbow, reducing socket cap. etc. to suit installation.
4.	Size	:	Suitable to related G.I.Pipe

1.05.11 Carbon Steel Globe Valve

1.	Reference	: ASTM A-105
2.	Type	: Globe
3.	Construction	: Forged Body Cadmium Plated
4.	End Connection	: As applicable (eg. ½” Socket Weld etc.)
5.	Rating	: Cl. 800 / CL. 2500

	6.	Material	: Body - Carbon steel
			: Stem - Hardened Steel
			: Plug - AISI 316 SS
			: Seat- Stainless steel stellited
	7.	Packing	: Teflon / Grafoil as required
	8.	Yoke	: ASTM A105
	9.	Hand wheel	: Carbon steel
	10.	Design standard	: As per ANSI B 16.34

1.05.12 Stainless Steel Globe Valve

	1.	Reference	: ASTM A-182 F316
	2.	Type	: Globe
	3.	Construction	: Forged Body
	4.	End Connection	: As applicable (eg. ½" Socket Weld etc.)
	5.	Proof Pressure	: 400 Kg/Cm2
	6.	Material	: Body - Stainless steel
			: Stem - Hardened Steel
			: Plug - AISI 316 SS
			: Seat- Stainless steel stellited
	7.	Packing	: Teflon as required
	8.	Yoke	: ASTM A182 F316
	9.	Handwheel	: Carbon steel
	10.	Design standard	: As per ANSI B 16.34

1.05.13 Alloy Steel Globe Valve

	1.	Reference	: ASTM A-182 F22
	2.	Type	: Globe
	3.	Construction	: Forged Body

4.	End Connection	: As applicable (eg. ½" Socket Weld etc.)
5.	Rating	: CL. 2500
6.	Material	: Body - Alloy steel
		: Stem - Hardened Steel
		: Plug - AISI 316 SS
		: Seat- Stainless steel stellited
7.	Packing	: Grafoil as required
8.	Yoke	: ASTM A182 F22
9.	Handwheel	: Carbon steel
10.	Design standard	: As per ANSI B 16.34

1.05.14 Structural Steel

Steel supports for JB's, trays; tubes and related equipments shall not be limited to the following:

a) MS Angle
b) MS Channel
c) I-Beam
d) Hexagonal head Bolt & Nut with washer
e) Foundation Bolt & Nut
f) Expansion Bolt
g) Steel Plates / Flats
h) CRCA sheet
i) 50 NB Pipe
j) Pipe clamps, U Bolts & Nuts
k) Checker plate

1.05.15 Condensate Pot

1.	Reference	: ASTM A182 F22 /ASTM A105
2.	Material	: Alloy steel / carbon steel as per application
3.	Construction	: Drilled from barstock
4.	End connection	: As applicable (e.g 3 nos. ½" socket weld end etc.)

	5.	Accessories	: Vent valves

1.05.16 Instrument Valve Manifold

1.	Type	: Two valve manifold
		: Five valve manifold
2.	Mounting	: Remote 2” Pipe Mounting / Transmitter Rack mounting
3.	Construction	: Single block (bar stock)
4.	Material	: Forged body and bonnet AISI 316 stainless steel
5.	Ports	: Mfg std. (e.g 1/2 " NPT (F) etc.)
6.	Rating	: 420 Kg/Sq. cm at ambient
7.	Operating Temperature	: (-)30 to (+)170 Deg C
8.	Packing	: PTFE Wafer
9.	Seat & Stem	: AISI 316 SS
10.	Plug	: AISI 316 SS free to turn on stem / 17-4 PH
11.	Handle Bar	: AISI 316 SS
12.	Connection	: Straight
13.	Accessories	: Plugs for all ports, Mounting Bracket , bolts , nuts

1.06.00 Pneumatic Hook Up Accessories

1.07.00 Air Header

Technical Particulars	**For Panel**	**For Field**
Material of Construction	: Stainless steel	: Stainless steel
Inlet Connection	: 2" NPT (M)	: 1" NPT (M)
Header Take-off Material	: Stainless steel	: Stainless steel
Take off connection	: 1 / 2” NPT (M)	: 1/ 2” NPT (M)
Take-off Valves Material	: stainless steel	: stainless steel

Tube Take-off	: Tube adapter on valve	: Tube adapter on valve
Drain	: SS drain valve at lowest point	: SS drain valves at lowest point

VOLUME-III

COMPLIANCE CUM CONFIRMATION 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.
3. 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.
4. 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.
5. There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.
6. 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.
7. 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 and Customer).
8. All sub vendors shall be subject to BHEL/CUSTOMER approval.
9. Any special tools & tackles, if required, shall be in bidder's scope.
10. Performance guarantee test parameters shall stand valid till the satisfactory completion of Performance guarantee test and its acceptance by BHEL and Customer.

PRE BID CLARIFICATION SCHEDULE

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 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.

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

Bidders Company Name …….

Authorized Representative's
Signature ……..

Name …….

Bidder's Name ……

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

DEVIATION SHEET (COST OF WITHDRAWL)

TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM.
PROJECT: 5X800 MW TSGENCO YADADRI TPS

TECH SPC NO: PE-TS-417-154-A101,R01

TENDER ENQUIRY REFERENCE:-

NAME OF BIDDER:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL 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. Cost of withdrawal of deviation will be applicable on the basic price (i.e, excluding taxes, duties & freight) only.
2. All the bidders has to list out all their Technical and Commercial Deviations (if any) in detail in the above format.
3. Any deviation not mentioned above and shown separately of found hidden in offer, will not be taken cognizance of.
4. 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. in the absence of same, such deviation(s) shall not be considered and offer shall be considered in total compliance to NIT
5. Bidder shall furnish price copy of above format along with price bid.
6. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
7. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
8. For deviations w.r.t. Credit Period, Liquidated damages, Firm prices if a bidder chooses not to give any cost of withdrawal of deviation loading as per **Annexure-VII of GCC, Rev-07** 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 withdrawal of deviation shall be taken as NIL.
9. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
10. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in un-priced copy of this format.
11. Cost of withdrawal is to be given separately 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.
12. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
13.In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.