

2 X 800 MW YERMARUS STPP

VOLUME: II B


**TECHNICAL SPECIFICATIONS
FOR
OXYGEN DOSING SYSTEM**

SPECIFICATION NO.: PE-TS-362-154-12000A-A001




BHARAT HEAVY ELECTRICALS LIMITED

**POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA**


	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION	
		REV. NO. 0	DATE:
		SHEET	OF

CONTENTS
VOLUME – II (TECHNICAL SPECIFICATION)

SECTION	SPECIFICATION NUMBER	REV.NO.	TITLE	PAGE NO
A	PE-TS-362-154-12000-A-A001	00	Scope of enquiry	1-2
B	PE-TS-362-154-12000-A-A001	00	Project information	3-6
C1	PE-TS-362-154-12000-A-A001	00	Specific technical requirements	7-16
C2	PE-TS-362-154-12000-A-A001	00	Annexures	
	ANNEXURE - 1	00	Sub vendor list	17-19
	ANNEXURE – 2	00	Electrical scope matrix	20-20
	ANNEXURE - 3	00	List of documents to be furnished by the vendor after award of contract	21-21
	ANNEXURE - 4	00	Schedule of clarifications	22-22
	ANNEXURE - 5	00	Specific Confirmation required from the bidders	23-23
	ANNEXURE - 6	00	Painting Requirements	24-24
C3	PE-TS-362-154-12000-A-A001	00	Specific requirements:- Control valves	25-28
C4	PE-TS-362-154-12000-A-A001	00	Data sheet – A	29-33
D	PE-TS-362-154-12000-A-A001	00	BHEL inspection requirement	34-36
	PE-TS-362-154-12000-A-A001	00	P&ID for Oxygen Dosing System	37-39
	PE-TS-362-154-12000-A-A001	00	Junction Box termination details	40-47

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-A	
		REV. NO. 0	DATE:
		SHEET	OF


**SECTION - A
SCOPE OF ENQUIRY**

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-A	
		REV. NO. 0	DATE:
		SHEET	OF

1.0 SCOPE OF ENQUIRY


This specification is intended to cover design, engineering, manufacture, fabrication, assembly, inspection and testing at suppliers works, packing and forwarding to power station site skid mounted oxygen dosing system along with accessories and commissioning spares for **2X800 MW YERMARUS STPP.**

- a) **OXYGEN DOSING SKIDS**
(Including 2 cylinders mounted on each skid) -- 4 Nos.
- b) **Accessories:-**
 - i. **Injector Assembly--** -- 8 Nos.
 - ii. **15 NB, SS 316, Schedule 80 tubing for oxygen dosing** --400 m
 - iii. **SS 316 Tube fittings (tees & 90° elbows)** --10 nos. each.
 - iv. **Filled oxygen cylinders (Each of 50 lt water
Volume filled at 204 Kg/cm2 pressure)** --TOTAL 32 NOS (16 NOS PER UNIT).
 - v. **Rack to hold 16 filled oxygen cylinders** --2 NOS
- 1.2 Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded.
- 1.3 It is not the intent to specify all the details of the design & manufacturer. However, the equipment shall conform in all respect to high standard of design, engineering & workmanship and shall be capable of performing the required duties in a manner acceptable to Engineer / Owner, who will interpret the meaning of drawing & the specification & shall be entitled to reject any work or material, which is not in full accordance herewith.
- 1.4 In case of any deviation, the Bidder shall indicate the same clause by clause in the deviation schedule. In the absence of the same it will be construed that the bid conform strictly to the specification.
- 1.5 General terms & conditions instructions to the bidder and other attachments referred to elsewhere, made part of tender specification. The bidder shall be responsible for all governed by requirements stipulated hereinafter.
- 1.6 In case of any data/requirement stipulated in the drawings but not in the specification and vice-versa, such data /requirement shall be deemed to be contained in the both. Contradictions between drawings and specifications, if any, shall be brought to the attention of the purchaser/consultant by the bidder and the correct requirement shall be obtained in writing.
- 1.7 In the event of any conflict between the various sections of the specification, bidder shall obtain necessary confirmation in writing from the purchaser. Else, purchaser's decision in this regard shall be deemed binding.

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-B	
		REV. NO. 0	DATE:
		SHEET	OF

SECTION – B

PROJECT INFORMATION

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-B	
		REV. NO. 0	DATE:
		SHEET	OF

Brief Information of Project

- | | | | |
|------|--------------------------------|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.0 | Owner | : | Raichur Power Corporation Ltd
22/23, Sudarshan Complex,
IInd floor, Sheshadri Road,
Bangalore-560 009
Karnataka, India |
| 2.0 | Consultant | : | M/s Evonik Energy Services (I) Pvt. Ltd., A-29, Sector 16
Noida-201301(UP), India |
| 3.0 | Project Title | : | 2x800 MW Yermarus Thermal Power Station |
| 4.0 | Location | : | Yermarus
Raichur Dist
Karnataka State, INDIA
It is situated at about 8 Kms from Raichur on the
Raichur-Hyderabad State Highway-13 and 12 kms
away from Bank of river Krishna and about 5 kms from
Raichur Thermal Power Station |
| 5.0 | Nearest Railway | : | Chicksugur Railway Station which is about 2 kms from
site. |
| 6.0 | Nearest Airport | : | Hyderabad around 200 kms |
| 7.0 | Nearest Port | : | Chennai around at about 470.kms from site. |
| 8.0 | Latitude and Longitude | : | Latitude – 16° 16' 55.9"N
Longitude – 77° 20' 38.6"E |
| 9.0 | Elevation above mean sea level | : | 350-375 meters |
| 10.0 | | | |

Climatic Conditions

(a) Ambient Temperature

- | | | | |
|------|-------------------------------------------------------------------|---|---------------|
| i. | maximum temperature | : | 45° C |
| ii. | minimum temperature | : | 6° C |
| iii. | Design Temperature for all
Electrical/ Mechanical
Equipment | : | 50° C Ambient |


(b) Relative Humidity

- | | | | |
|------|------------------------|---|-----|
| i. | Maximum during monsoon | : | 85% |
| ii. | Minimum | : | 20% |
| iii. | Average | : | 65% |

(c)

Rainfall

- | | | |
|---------------------|---|-------------------|
| | : | 720 mm |
| Annual average rain | : | 115 mm |
| | : | 38 mm/hr |
| Max. for one day | : | June to September |
| Max. intensity | | |
| Period | | |

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-B	
		REV. NO. 0	DATE:
		SHEET	OF

(d)

Wind Speed

- | | | | |
|------|---------------------------|---|---------------------------------------------|
| i. | Prevailing wind direction | : | West, South-East, North-West,
South-West |
| ii. | Maximum mean wind speed | : | 15.9 Kms / hr
(4.42 m/s) |
| iii. | Average | : | 9.61 Km/hr
(2.67 m/s) |

11.0 Wind Load

Calculations for wind effect shall be in accordance with IS:875- (Part-3) latest revision taking into account the following :

- (a) Basic wind speed of 39 m/sec as given in Fig.1 of the code.
- (b) Factor K1 shall be taken as 1.06
- (c) Terrain category shall be 2 and corresponding values shall be taken for K2
Factor K3 shall be taken as 1.0

(d)

12.0 Wind Loading for Stack

For wind pressure as per clause 11.0 above

(a)

- (b) For RC stacks as per IS: 4998

13.0


Seismic data (as per IS:1893 latest issue)

- | | | | |
|-----|-----------------------|---|------------------------------------|
| (a) | Zone | : | Zone III (as per IS:1893- latest) |
| (b) | Importance factor (I) | : | 1.75 |

14.0

Auxiliary power supply : Auxiliary electrical equipment to be supplied against this specification shall be suitable for operation on the following supply system.


- | | | | |
|-----|----------------------------------------------------|---|-------------------------------------------------|
| (a) | For motors rated above 1500 kW | : | 11000V, 3 phase, 3 wire, 50Hz medium earthed AC |
| (b) | For motors rated 175KW and above and below 1499KW. | : | 3300V, 3 phase, 3 wire, 50Hz medium earthed AC |
| (c) | For motor rated 174 kW and below | : | 415, 3 phase, 3 wire solidly earthed AC |
| (d) | For motor control centre | : | 415V, 3 phase, 3 wire solidly earthed AC |

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-B	
		REV. NO. 0	DATE:
		SHEET	OF

- (e) DC. motor starters, DC solenoids, DC alarm, control and protections : 220 V DC, 2 wire, unearthed DC
- (f) AC control & protective devices : 110 V 1 phase, 50Hz, 2 wire AC supply. The single-phase 110V AC supply shall be derived by Contractor by providing 415V/110V control transformers of adequate rating with MCCB /MCB on both the primary and secondary sides.
- (g) Uninterrupted power supply : 240 V, 1 phase, 50Hz, 2 wire AC supply from UPS system for I&C (including indicator recorders) and UCMS only
- (h) AC solenoids, indicators/recorders, space heaters (for motors rated 30KW and above) : 240V 1 phase, 2 wire, 50Hz AC system with effectively earthed neutral. The power supply shall be derived by CONTRACTOR by providing 415V/ 240V transformer of adequate rating with MCCB/MCB on primary/secondary sides.
- (i) Winding heating of motors below 30kW : 24 V 1 phase, 50Hz, AC with one point earthed. This shall be derived by CONTRACTOR by providing 415V 3 phase, 3 wire, AC supply through an adequately rated step-down transformer of adequate rating with MCCB / MCB on primary/secondary sides.
- (j) Solid state controls (including solenoid valves) : 24 V DC, 2 wire, supply from Battery chargers for instrumentation system only.
- (k) Lighting fixtures : 240 V, 1 phase, 2 wire, 50Hz system.
- (l) Lighting fixtures and space heaters in panels : 240 V, 1 phase, 2 wire, 50Hz system.
- (m) Construction supply : 415 V, 3 phase, 4 wire, 50 Hz AC supply with neutral lead solidly earthed.
- (n) The above voltages may vary as follows :


All devices shall be suitable for continuous operation over the entire range of voltage and frequency indicated below without any change in their performance.

- i. AC supply : Voltage variation $\pm 10\%$ Frequency variation $\pm 5\%$
Combined voltage & frequency variation $\pm 10\%$
- ii. DC supply : Voltage variation +10%
-20%

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

SECTION – C1

SPECIFIC TECHNICAL REQUIREMENT

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

1.0

SCOPE:

The scope of this section covers the basis of design, system description, equipment selection aspects and control philosophy for Oxygen dosing system for 2X800 MW YERMARUS STPP. The above system shall be skid mounted. Two numbers skid (one number for dosing at CPU outlet and one number for dosing at deaerator outlet) per unit shall be provided for oxygen dosing system for each unit.

2.0

DESIGN BASIS:

- Customer specification
- Design Calculation for the systems
- BHEL (TRICHY) feed water recommendations

The following drawings/documents shall be used for the reference:

- P&I diagram for Oxygen dosing system (part of this document)
- DATA SHEET – A for Oxygen dosing system (part of this document)

3.0

DESIGN PHILOSOPHY:

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

The chemical feed for Combined Water Treatment (CWT) involves the feed of only aqueous ammonia and gaseous oxygen. The principles, equipment selection and control philosophy of ammonia feed system has been covered separately in the design philosophy and P&ID for LP Chemical dosing system.

It is emphasized that CWT will be operated only with boilers which have deep-bed condensate polishers, a copper-free condensate / feed water, a copper-alloy free metallurgy downstream of condensate polisher for good water chemistry control.

The following philosophy of chemical feed system is considered:-

Shut down sequence:-


- Oxygen feed needs to be stopped one hour before shut down and deaerator and LP heater vents needs to be opened.
- Ammonia dosing rate needs to be increased to achieve pH in the range of 9.2-9.5.

Start up sequence:-

- Deaerator vent is kept open.
- Ammonia is dosed at CPU outlet to achieve a pH of 9.2-9.5.
- Cation conductivity reaches below 0.15 $\mu\text{S}/\text{cm}$ (at 25°C) and the trend is downwards.
- Deaerator vents are closed.
- Oxygen feed is manually started from DCS.

During normal operation:-

- pH is maintained at 8.2-8.5 by dosing aqueous ammonia solution.
- Oxygen dosing rate recommended by BHEL TRICHY is 30-150 ppb. Exact dosing rate shall be decided by the operator. For sizing of oxygen dosing system, 150 ppb continuous dosing of

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

99% pure oxygen has been considered.

- Dosing shall normally be done at CPU outlet. However provision shall be given for dosing at deaerator outlet also. For this purpose two separate skid based oxygen dosing systems shall be supplied for each unit. However, dosing shall be done at one place at a time only.
- Dosing rate shall be controlled from DCS (Customer scope) by regulating pneumatic flow control valve (PCV) provided on each O₂ dosing skid under full load conditions based on dissolved oxygen level at economizer inlet. Oxygen dosing rate can be adjusted in the range of 30-150 ppb from DDCMIS. 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 pneumatic control valve (PCV) if cation conductivity in the cycle goes above 0.3 us/cm.

4.0 **Equipment for Oxygen Dosing (2 skids per unit/Total= 4 skids)**

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

4.1 Cylinder banks

Each oxygen dosing skid shall consist of a bank of two oxygen cylinders, dosing at downstream of deaerator/CPU outlet. Oxygen cylinder bank is provided to cater daily requirement. The automatic change-over of cylinder takes place on the basis of pressure i.e. the cylinder banks dosing at CPU outlet will switch over at 47 kg/cm²(g) and the cylinder banks dosing at deaerator outlet at 20 kg/cm²(g). Separate storage rack for 16 cylinders and 16 filled oxygen cylinders per unit shall be supplied to cater 1/2 month's oxygen requirement.

4.2 Pressure Regulator:

The line pressure regulator is used for reducing a high supply pressure (204 bars cylinder pressure) to 50 kg/cm²(g) pressure in skid dosing at CPU outlet and to 20 kg/cm²(g) pressure in skid dosing at deaerator outlet.


4.3 Valves, tubing, vents and instrumentation shall be as per the attached P&ID and the data sheet. The MOC and specification of all the equipment shall be as per the attached data sheet.

5.0 **Control and Instrumentation:-**

The mode of operation of the oxygen dosing system shall be from BOP DDCMIS (customer scope) only. All the logics, controls and interlocks shall be implemented in BOP DDCMIS. Local manual intervention is not envisaged. Both manual/automatic controls may be implemented in the BOP C&I DDCMIS. The provision to select "Auto" or "Manual" mode shall be provided in the BOP DDCMIS OWS (BHEL scope) 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 50 Kgf/cm² for skid dosing at CPU outlet and set pressure of 20 Kgf/cm² for skid dosing at deaerator outlet) attached with each cylinder.

Each of the two oxygen cylinders in the skid shall have a dedicated set of solenoid valve, pressure gauge and pressure transmitter. Two cylinders provided on skid are connected and one cylinder will serve at a time based on the pressure at the inlet of solenoid valve. In case the pressure at the inlet of SV1 reaches at the set point, the solenoid valve SV1 will close and solenoid vale SV2 will open and other cylinder is taken in to service provided the pressure at the inlet of SV2 is not low and vice

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

versa. Alarm for pressure low at the inlet of solenoid valves shall be provided in DCS.

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

The pressure of the oxygen shall be further reduced by pressure reducing valve in the skid based on the feedback received from pressure transmitter (set point –“ADEQUATE”–(Set points–45 kgf/cm² for skid dosing at CPU outlet & 15 kgf/cm² for skid dosing at deaerator outlet) downstream. The flow and pressure of oxygen can be monitored from BOP DDCMIS by the signal from flow meter (coriolis type) cum transmitter and from pressure transmitter provided at the downstream of pressure reducing regulating valve. The flow of oxygen dosing will be controlled manually/automatically from DDCMIS by adjusting pneumatic flow control valve (PCV) (air to open type) provided on skid based on the feedback from the dissolved oxygen analyzer (BHEL scope) located in the economizer inlet. The PCV shall have a position feedback transmitter that shall transmit the feedback signal to BOP DDCMIS.

All solenoid valves mounted in the oxygen dosing skid shall be 24 VDC powered from DDCMIS and routed through the local skid mounted junction box. All the field instruments, pneumatically controlled PCV and solenoid valves (SV 1 & SV 2) shall be terminated at a junction box in the skid by BHEL's oxygen dosing vendor for further connection to BOP DDCMIS (customer scope) by customer. At each dosing point, viz. CPU outlet and deaerator outlet, an injection assembly containing 15 NB tubing, fixing collar, solenoid valve and NRV shall be supplied loose by oxygen dosing vendor. 24 VDC power for these solenoid valves shall be given by BHEL. Instrument air supply for the pneumatically controlled PCV shall be given by BHEL through its IA distribution network. BHEL 'S oxygen dosing vendor will terminate all instruments/devices as per BHEL tender drawings/BHEL provided termination diagrams given in section F & to be finalized during detailed engineering and will provide JB's and cables from field instruments, pneumatically controlled PCV and solenoid valves (SV 1 & SV 2) up to JB accordingly.

Bidder to note that the set points indicated below for operation of pressure reducing valve are tentative. Final value of the same may be decided by bidder during detailed engineering as per the requirement of the flow meter-cum-transmitter manufacturer.

Bidder to further note in case the manufacturer of flow meter cum transmitter recommends gas filters for proper functioning of the instrument, the same shall be deemed included in bidder scope.

Considering the safety aspects of the oxygen dosing skid, bidder to provide a flame arrestor in the vent header of each of oxygen dosing skids.

1. 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 DDCMIS	Remarks
<u>During Normal Operation:-</u>					
Pressure transmitter	QCL11CP001	55 Kg/cm ² (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 1 outlet)	Manual checking of pressure regulator reqd.



TITLE:
**TECHNICAL SPECIFICATION FOR
OXYGEN DOSING SYSTEM
FOR 2X800 MW YERMARUS STPP.**

SPEC. NO. PE-TS-362-154-12000-A-A001

VOLUME II-B

SECTION-C


REV. NO. 0

DATE:

SHEET


OF

Pressure transmitter	QCL11CP001	47 Kg/cm ² (LOW)	Close SV-1 (QCL11AA201) & Open SV-2 (QCL12AA201)	Yes (LOW pressure at cylinder 1 outlet)	Auto-changeover of cylinders. Manually replace cylinder 1 with filled cylinder.
Pressure transmitter	QCL12CP001	55 Kg/cm ² (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 2 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	QCL12CP001	47 Kg/cm ² (LOW)	Close SV-2 (QCL12AA201) & Open SV-1 (QCL11AA201)	Yes (LOW pressure at cylinder 2 outlet)	Auto-changeover of cylinders. Manually replace cylinder 1 with filled cylinder.
Pressure transmitter	QCL10CP001	43 Kg/cm ² (LOW)	Close PCV (QCL10AA202)	Yes (Oxygen dosing stopped due to low pressure)	
Pressure transmitter	QCL10CP001	55 Kg/cm ² (HIGH)	Not applicable	Yes (HIGH dosing pressure)	Manual checking of pressure reducing valve reqd.
Cation Conductivity analyzer		0.3 μ S/cm (at 25°C), increasing (HIGH)	Close PCV (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		30 ppb (LOW), decreasing	Gradually open PCV(QCL10AA202) to increase DO provided signal from QCL10CP001 is "NOT LOW" (i.e < 43 Kg/cm ²)	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		150 ppb, increasing (HIGH)	Close PCV(QCL10AA202) to decrease DO	Yes (Oxygen dosing stopped due to high DO level in feed water cycle)	
During Start up:-					
Cation Conductivity analyzer		0.15 μ S/cm (at 25°C), decreasing (ADEQUATE)	Open PCV (QCL10AA202), provided signal from QCL10CP001 is "NOT LOW" (i.e < 43 Kg/cm ²) & signal from DO analyzer is "NOT HIGH" (i.e > 150 ppb)	Yes (Oxygen dosing started)	

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

For Skid dosing at deaerator Outlet

Source of signal	Tag Number	Set Point (suggested)	Interlock	Alarm in DDCMIS	Remarks
During Normal Operation:-					
Pressure transmitter	QCL21CP001	22 Kg/cm2 (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 1 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	QCL21CP001	17 Kg/cm2 (LOW)	Close SV-1 (QCL21AA201) & Open SV-2 (QCL22AA201)	Yes (LOW pressure at cylinder 1 outlet)	Auto-changeover of cylinders. Manually replace cylinder 1 with filled cylinder.
Pressure transmitter	QCL22CP001	22 Kg/cm2 (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 2 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	QCL22CP001	17 Kg/cm2 (LOW)	Close SV-2 (QCL22AA201) & Open SV-1 (QCL21AA201)	Yes (LOW pressure at cylinder 2 outlet)	Auto-changeover of cylinders. Manually replace cylinder 1 with filled cylinder.
Pressure transmitter	QCL10CP001	13 Kg/cm2 (LOW)	Close PCV (QCL20AA202)	Yes (Oxygen dosing stopped due to low pressure)	
Pressure transmitter	QCL10CP001	22 Kg/cm2 (HIGH)	Not applicable	Yes (HIGH dosing pressure)	Manual checking of pressure reducing regulating valve reqd.
Cation Conductivity analyzer		0.3 µs/cm (at 25°C), increasing (HIGH)	Close PCV (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		30 ppb (LOW), decreasing	Gradually open PCV(QCL20AA202) to increase DO provided signal from QCL20CP001 is "NOT LOW" (i.e < 13 Kg/cm2)	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

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.		SPEC. NO. PE-TS-362-154-12000-A-A001	
			VOLUME II-B	
			SECTION-C	
			REV. NO. 0	DATE:
			SHEET	OF

Dissolved oxygen analyzer		150 ppb, increasing (HIGH)	Close PCV(QCL20AA202) to decrease DO	Yes (Oxygen dosing stopped due to high DO level in feed water cycle)	point for operation by operator's plant chemist during commissioning within the range of 30-150 ppb.
During Start up:-					
Cation Conductivity analyzer		0.15 $\mu\text{S}/\text{cm}$ (at 25°C), decreasing (ADEQUATE)	Open PCV (QCL20AA202), provided signal from QCL10CP001 is "NOT LOW" (i.e < 43 Kg/cm ²) & signal from DO analyzer is "NOT HIGH" (i.e > 150 ppb)	Yes (Oxygen dosing started)	

6.0 COMMISSIONING SPARES

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

7.0 ACCESSORIES


Accessories as described below shall be supplied loose with the oxygen dosing skids:-

- Injector Assembly:** - Eight numbers injector assemblies as described in the P&ID of this specification shall be supplied loose, to be fitted by BHEL at the dosing locations.
- SS tubing:** - 400 m of 15 NB (1/2 in) SS 316 tubing (Sch 80) tubing shall be supplied loose to interconnect dosing skids with injector assemblies. The specification of tubing shall be as per data sheet A.
- SS 316 Tube fittings (tees & 90° elbows):** - 10 numbers tees and 10 numbers 90° elbows shall be supplied loose to help connect injector assemblies to pipe header. The specification of fittings shall be as per data sheet A.
- Filled oxygen cylinders (Each of 50 lt water volume filled at 204 Kg/cm² pressure):** - 60 filled oxygen cylinders shall be supplied loose to cater one month oxygen requirement of two units. These cylinders are in addition to the eight cylinders (two per skid) already mounted on skids.
- Rack to hold 30 filled oxygen cylinders:** - Two numbers of MS racks shall be supplied loose, each having adequate provision to hold at least 30 filled oxygen cylinders.

8.0 QUALITY ASSURANCE PLANS

Bidder to note that all inspection & testing shall be carried out as per approved manufacturing QP to be submitted by the bidder during detailed engineering for the project. However the same shall be in line with the requirements mentioned in BHEL Inspection requirement mentioned in the section D of technical specification.

Any changes/additional tests insisted upon by Customer during detailed engineering shall be accepted by bidder without any commercial implication to BHEL/Customer.

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

9.0 SUB VENDORS:-

Bidder to note that all the sub-vendors shall be selected from the BHEL approved sub vendor list enclosed as annexure – 1, section – C2 of this technical specification.

10.0 TERMINAL POINTS (Also refer P & I Diagram enclosed)

- i. All field instruments, solenoid valves and PCV shall be terminated at JB by the oxygen dosing vendor for further connection to DCS by BHEL.
- ii. All vent connections shall be connected via vent header and terminated at one point of the skid for further piping (if required) by BHEL.
- iii. Dosing termination point shall be suitably terminated by dosing vendor after PCV at one point at the skid for further connection till dosing locations by BHEL.
- iv. 15 NB instrument air connections up to the PCV in each individual skid shall be supplied by BHEL.

11.0 Painting:

Bidder to note that painting shall be as per approved painting schedule to be finalized during detailed engineering. However the same shall be prepared in line with the schedule enclosed as Annexure 6 of section C2 of technical specification.

12.0 DRAWINGS/DOCUMENTATION

12.1 Documents to be submitted along with the bid:-

Bidder to note that the only technical document required with the bid is the duly filled, stamped and signed copy of the Confirmation Sheet attached as Annexure 5 Section C2 of this Technical Specification.

In case, 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 clarifications attached as Annexure 4 Section C2 of this technical specification and this document shall be submitted along with the confirmation sheet mentioned above.

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 shall be considered as null and void.

12.2 Documents to be submitted after award of contract:-


Successful bidder on award of the project shall prepare drawings/documents as per Annexure 4 Section C3 in project specific title blocks and submit the same for formal approval by BHEL/customer.

12.3 Documents to be submitted after dispatch of skids:-

Bidder shall submit soft copy/hard copy/CD ROMs of all the finally approved drawings and O&M Manuals as required by Customer/consultant/BHEL-site/BHEL-PEM. The exact number of copies 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.

13.0 PACKING:

To prevent damage to the equipment of the skid during transit, wooden / angle iron / steel frame supports to be provided wherever required. Special attention shall be provided while packing and

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF


loading for overhead equipment.

14.0

DESIGN REQUIREMENTS


Bidder to note that design requirement of the chemical dosing skids shall be as below: -

1. All the terminal points shall be easily accessible and towards one side of skid.
2. All valves shall be easily accessible for the operator.
3. All equipment shall have SS name plate.
4. Cabling between individual equipment and JB shall be routed via cable trays/conduits.
5. All JB shall be skid mounted.

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

SECTION – C2


ANNEXURE

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF


ANNEXURE – 1

List of BHEL approved sub vendors

SL NO.	ITEM	APPROVED SUPPLIERS	PLACE	REMARKS
	MECHANICAL:			
1	STRUCTURE FOR THE SKID/ RACK FOR CYLINDER STORAGE	SELF-MAKE OF MAIN VENDOR	AS APPLICABLE	
2	FILLING OF OXYGEN CYLINDER	FILLING OF EMPTY CYLINDERS MAY BE DONE FROM ANY CCE LICENSED OXYGEN GAS FILLER	AS APPLICABLE	
3	EMPTY OXYGEN CYLINDERS	BPCL	NAINI	
		EVEREST KANTO	TARAPUR/AURA NGABAD	
		MARUTI KOATSU CYLINDER LTD	HALOL, GUJARAT	
3	CHECK VALVE	PRECISION ENGG.	MUMBAI	
		CRESENT VALVE	MUMBAI	
		BDK	HUBLI	
		LEADER	JALANDHAR	
		CHEMTECH	MUMBAI	
		FOURESS	MUMBAI	
		STEELSTRONG	MUMBAI	
4	BALL VALVE	AV VALVES LTD	AGRA	
		AKAY VALVES	MUMBAI	
		FLOW CHEM INDUSTRIES	AHMEDABAD	
		KSB PUMPS LTD	MUMBAI	
		BDK	HUBLI	
		AUDCO	CHENNAI	
5	3- WAY VALVE MANIFOLD FOR PG & PT	HI TECH	AHMEDABAD	
		CHEMTROL		
		BLISS ANAND	GURGAON	
		EXCEL HYDRO	MUMBAI	
		BY ORIGINAL INSTRUMENT MANUFACTURER	AS APPLICABLE	
6	PRESSURE REDUCING VALVE	TESCOM	USA	(PART OF EMERSON PROCESS)
7	TUBING	RATNAMANI	AHMEDABAD	
		REMI	MUMBAI	
8	FITTINGS	SWAGELOK	USA	
		PARKER	USA	
		HAMLET	ISRAEL	
9	NEEDLE VALVE	BY ORIGINAL INSTRUMENT MANUFACTURER	AS APPLICABLE	
10	PAINT	BERGER PAINTS	KOLKATA	
		ASIAN PAINTS	MUMBAI	
		SHALIMAR PAINTS	KOLKATA	
		JENSON & NICOLSON	KOLKATA	
		GUNJAN PAINT	MUMBAI	
	C&I:			

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF


11	PRESSURE GAUGE	A N INSTRUMENTS	KOLKATA	
		H GURU	NEW DELHI	
		MANOMETER INDIA	MUMBAI	
		GIC	MUMBAI/GOA	
		GLUCK INDIA	MUMBAI	
		BUDENBERG GAUGE		
		DRESSER IND		
		FORBES MARSHALL		
		WAREE INSTRUMENTS		
12	PRESSURE TRANSMITTER	BLISS ANAND	GURGAON	
		BRISTOL BABCOCK		
		FISHER-ROSEMOUNT		
		SMART INST		
		EMERSON PROCESS MANGEMENT (I) LTD	MUMBAI	
		SIEMENS	MUMBAI/BANGALORE	
		SBEM	PUNE	
		TATA HONEYWELL	PUNE	
		V AUTOMAT	NEW DELHI	
		BIRLA-KENT TAYLOR LTD. (A GROUP COMPANY OF ABB)	FARIDABAD	
		FUJI ELECTRIC	JAPAN	
		YOKOGAWA	JAPAN	
13	FLOW METER CUM TRANSMITTER	EMERSON PROCESS MANGEMENT (I) LTD	USA/MUMBAI	MICRO MOTION LFM SERIES
		GE RHEONIK	USA/INDIA	
14	CONTROL VALVE WITH ACTUATOR	IL	PALGHAT	
		DRESSER MASONILAN	FRANCE	
		CCI	USA/KOREA	
		NIPPON FISHER	JAPAN	
		FISHER CONTROLS (EMERSON)	UK/USA/FRANCE	
		COPE'S VULCAN	UK	
		MIL CONTROLS	ALWAYE	
		DRESSER VALVES INDIA PVT LTD	COIMBATORE	
		WEIR	UK	
		FISHER XOMOX	CHENNAI	
15	SOLENOID VALVE	JEFFERSON	ARGENTINA	
		HERION	GERMANY/ITALY	
		ROTEX AUTOMATION LTD	VV NAGAR/BARODA	
		ASCO	USA/INDIA/UK	
16	JUNCTION BOX			
		AJMERA INDUSTRIAL & ENGIN		
		BALIGA LIGHTING		

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

		EQUIPMENT		
		DEVI POLYMERS		
		ELECTROMAC INDUSTRIES		
		KS INSTRUMENTS PVT.LTD.		
		MANISHA ENTERPRISE		
		SHRENIK & COMPANY,		
		SUCHITRA INDUSTRIES		
17	INST CABLES (SCREENED)	RELIANCE	BANGLORE	
		DELTON	FARIDABAD / NEW DELHI	
		NICCO	KOLKATA	
		CHORDS CABLE	BHIWADI	
		UNIVERSAL	SATNA	
		INCAB	PUNE	
		POLYCAB	DAMAN	
18	PVC INSULATED LT CONTORL CABLES	DELTON CABLES	FARIDABAD	
		HVPL	FARIDABAD	
		ELKAY TEELINKS	FARIDABAD	
		GEMSCAB	BHIWADI	
		KEI	BHIWADI	
		CORDS CABLE	BHIWADI	
		UCL	SATNA	
		RADIANT CABLES	HYDERABAD	
		INCAB	PUNE	
		NICCO	KOLKATA	
		PARAMOUNT CABLES	ALWAR	
		FGI	KOLKATA	
		POLYCAB WIRES	DAMAN	
		TORRENT CABLES	NADIAD	
		ICL	RAJPURA	

Notes:-


- Any other sub-vendors not listed in above list shall be subject BHEL/Customer approval during detailed engineering without any price/delivery implication.

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

ANNEXURE – 2

Electrical Scope Matrix

<u>SI.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	Junction Box	Vendor	Vendor	JB shall be mounted on respective skid. Termination of all field instruments, solenoid valves and PCV up to JB shall be done as per BHEL termination drawing by bidder. Connection between JB and BOP-DDCMIS shall be in BHEL scope.
2	Ordinary control cables, screened control cables & special control cable	Vendor	Vendor	Within the skid, between instrument and JB.
3	Cable glands and lugs for equipment supplied by vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass glands. 2. Solder less crimping type tinned copper heavy-duty lugs for Power cables. 3. Solder less crimping type heavy duty copper lugs for control Cables.
4	Equipment grounding	Vendor	Vendor	Within the skid

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

ANNEXURE - 3

List of documents to be submitted by the bidder after award of contract

Sl. No.	BHEL Document No.	Drawing name
A	Basic Engineering Documents	
1	PE-V0-362-154-A401	P&I Diagram for oxygen dosing system for deaerator outlet
2	PE-V0-362-154-A402	P&I Diagram for oxygen dosing system for CPU outlet
3	PE-V0-362-154-A403	GA Diagram for oxygen dosing system for deaerator outlet
4	PE-V0-362-154-A404	GA Diagram for oxygen dosing system for CPU outlet
B	Datasheets and item GA	
B1	Mechanical	
5	PE-V0-362-154-A405	Datasheet for ball valves
6	PE-V0-362-154-A406	Datasheet for check/non-return valves
7	PE-V0-362-154-A407	Datasheet for pressure reducing valve (pressure regulator)
8	PE-V0-362-154-A408	Datasheet for pressure relief valve
9	PE-V0-362-154-A409	Data sheet & GA drawing of empty oxygen cylinder
10	PE-V0-362-154-A410	GA drawing of cylinder rack
11	PE-V0-362-154-A411	GA drawing of injection assembly
B2	Control and instrumentation	
12	PE-V0-362-154-A412	Datasheet for solenoid valve
13	PE-V0-362-154-A413	Datasheet for pneumatic control valve
14	PE-V0-362-154-A414	Datasheet for pressure gauge
15	PE-V0-362-154-A415	Datasheet for pressure transmitter
16	PE-V0-362-154-A416	JB grouping & termination drawing
C	Quality	
17	PE-V0-362-154-A417	Manufacturing Quality plan with sub vendor list


DRAWING DOCUMENTS DISTRIBUTION SCHEDULE

Documents:	Customer	Consultant	PS-ER	PEM
Documents for approval	5+1S	2+1S	2+1S	3+1S
Documents for information	5	2	2	3
Schedules, diagrams, lists, tables, calculation, specifications and other documents	5	2	2	2
Final as-built drawings	5	2	2	
CD-ROMs of final as-built drawings	5+2S	2+1S	2+1S	2+1S
Final as-built drawings (hard copy)	5	2	2	2
Final O&M manuals	5+2S	2+2S	2+1S	3+2S
CD-ROMs of Final O&M Manuals	5	2	2	2
Detailed project time schedules	5	2	2	1

NOTE:

"S" for Soft Copy (CD).

All drawing to be submitted in Autocad format and all calculation in Excel file in CD for approval.


	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

ANNEXURE - 4

SCHEDULE OF CLARIFICATIONS

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

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

ANNEXURE - 5

Specific confirmation required from the bidders

Sl. No.	Description	Reply/Comments by bidder	Remarks, if any
1	Bidder to confirm that the scope of supply shall be as per BHEL technical specification PE-TS-362-154-12000-A-A001, Rev 00 and subsequent correspondences, agreements till the award of order.	Confirmed/Not Confirmed	
2	In case of any deviation/clarification, the same has been furnished in the separate Clarification schedule attached along with the Technical Specification.	Confirmed/ No clarification	
3	Bidder to note that un-declared deviation mentioned elsewhere in the bidder offer shall be treated as null and void and shall be automatically considered as withdrawn. Bidder to confirm the same.	Confirmed/Not Confirmed	
4	Bidder to confirm that list of commissioning spares if required has been submitted with the offer.	Confirmed/Not Confirmed/ Not required	
5	Bidder to confirm that all the items and instruments shall be supplied as per data sheet A and P&ID enclosed with this technical specification.	Confirmed/Not Confirmed	
6	Bidder to confirm that all the sub vendors shall be selected from the list of BHEL approved sub vendors enclosed as Annexure 1 Section C2 of this technical specification.	Confirmed/Not Confirmed	
7	Bidder to confirm that electrical scope of the vendor shall be as per Annexure 2 Section C2 of this technical specification.	Confirmed/Not Confirmed	
8	Bidder to confirm that painting of all the items shall be as per Annexure 6 Section C2 enclosed with this technical specification.	Confirmed/Not Confirmed	
9	Bidder to confirm that all the documents listed in Annexure 4 of this technical specification shall be submitted for approval of BHEL/customer.	Confirmed/Not Confirmed	


	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

ANNEXURE - 6
PAINTING REQUIREMENTS


Sl. No.	Items	Surface preparation	Primer coat	Intermediate coat	Finish coat
1	All structural steel components + cylinder racks	Shot blast cleaning/abrasive blast cleaning to SA 2 ½ (near white metal)	Minimum 1 coat of 35 DFT thickness of inorganic ethyl zinc silicate	Minimum 1 coat of 50 DFT thickness of epoxy based TiO ₂ pigmented paint	Minimum 2 coats of 35 DFT thickness each of epoxy paint followed by one coat (minimum 35 DFT thickness) of aliphatic acrylic polyurethane CDE134, %V=40.0 (min)
2	Instruments	As per manufacturer's standard practice.			
3	All SS & GS components	No painting is required.			
4	Junction Box	As per section data sheet A			

Notes:-

1. Surface preparation shown is as per Swedish Standards SIS 05-5900. Degreasing will be as per standard SSPC-SP1.
2. Method of paint application shall be as per paint manufacturer's recommendations.
3. All equipment shall be finish painted at shop. Loose paint (for structural steel) for touch up shall be supplied along with skid.
4. The painting scheme mentioned above is the minimum requirement and is indicative. However any minor changes in the painting scheme or any special painting for some projects due to customer insistence shall be carried out by the bidder without any commercial/delivery implications to BHEL.

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

SECTION – C3
SPECIFIC TECHNICAL REQUIREMENT: - CONTROL VALVE


	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

SPECIFIC TECHNICAL REQUIREMENTS

The requirements in this section are specific for this project for control valves.

[A] GENERAL TECHNICAL REQUIREMENTS FOR CONTROL VALVE WITH PNEUMATIC ACTUATOR ALONGWITH ACCESSORIES ARE:

1. THE CONTROL VALVES' ACTUATORS TO BE SIZED FOR SHUT OFF DIFFERENTIAL PRESSURE.
2. CONTROL VALVES SHALL BE SIZED TO HAVE AN OPENING OF 10% MIN. AND 80% AT MAX. FLOW CONDITION. FURTHER, THE VALVE STEM TRAVEL RANGE FROM MINIMUM FLOW CONDITION TO MAXIMUM FLOW CONDITION SHALL NOT BE LESS THAN 50% OF THE TOTAL VALVE STEM TRAVEL.
3. ALL THE VALVES SHALL BE CAPABLE OF HANDLING AT LEAST 120% OF THE REQUIRED MAXIMUM FLOW.
4. ANTICAVITATION TRIMS SHALL BE PROVIDED FOR VALVES WITH CAVITATION SERVICES AND HARDENED TRIMS FOR FLASHING SERVICES.
5. CONTROL VALVE ACCESSORIES SHALL BE FITTED ON THE VALVE BODY. INTEGRAL PNEUMATIC TUBING SHALL BE PVC COATED COPPER AND FITTINGS SHALL BE OF BRASS. APPLICABLE ACCESSORIES SHALL BE TERMINATED AT THE JUNCTION BOX (MOUNTED ON THE SKID).
6. TYPE OF FLOW ACTION ("UNDER THE SEAT" OR "OVER THE SEAT") WILL BE SELECTED BY THE VENDOR, HOWEVER WHEREVER DOWNSTREAM SIDE IS SUBJECTED TO VACUUM, FLOW ACTION SHALL BE "FLOW TO CLOSE" (OVER THE SEAT). SEPARATE INDICATION FOR THE SAME HAS NOT BEEN PROVIDED.
7. TRIM SUPPLIED SHALL BE SUITABLE FOR QUICK CHANGING AND TRIM VELOCITY SHALL NOT EXCEED 30 M/SEC.
8. CONTROL VALVES SHALL UNDERGO QUALITY ASSURANCE PROGRAM AS PER APPROVED QUALITY PLAN.
9. THE MULTIPLE STAGES SHALL BE SUCH THAT THE CONTROLLED PRESSURE DROP ACROSS EACH STAGE SHALL ENSURE THAT THE VALVE DOES NOT CAVITATE IN ANY OF THE STAGES.
10. THE SIZING PROCEDURE FOLLOWED SHALL BE AS PER LATEST EDITION OF ANSI/ISA OR EQUIVALENT STANDARD.
11. TOLERANCE ON END TO END, CENTER TO CENTER, CENTER TO FACE SHALL BE IN ACCORDANCE WITH ANSI B16.10
12. FACILITY TO ADJUST THE MAXIMUM TRAVEL OF THE STEM SHALL BE INCORPORATED.
13. THE END CONNECTIONS SHALL BE SOCKET WELDED FOR SIZES BELOW 50NB. FLANGED CONNECTION SHALL BE PROVIDED FOR DM WATER SERVICES WITH SUITABLE RUBBER LINED INTERFACES.
14. SMART POSITIONER SHALL BE PROVIDED WITH ADVANCED DIAGNOSTIC SOFTWARE WITH FEATURES LIKE STROKE COUNTER OR TRAVEL COUNTER, LEAKAGE IN ACTUATOR, ON LINE PARTIAL CLOSURE TEST, VALVE SIGNATURE ANALYSIS, VALVE RESPONSE TEST, VALVE FIXTION/ JAMMING DETECTION ETC TO BE PROVIDED.
15. UNIVERSAL HART CALIBRATOR (ONE PER UNIT) SHALL BE PROVIDED, COMMON TO ALL SMART POSITIONERS.
16. TRAVEL TIME FOR ALL THE CONTROL VALVES SHALL BE WITH IN 10 SEC.
17. NOISE ABATEMENT SHALL BE ACHIEVED BY VALVE BODY AND TRIM DESIGN AND NOT BY USE OF SILENCER.

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

[B] Specifications of SMART Positioners of Control Valves:-

The electronic positioner shall meet the following requirements:

1. Electrical

- | | |
|----------------------------|----------------------------------------------------------------------------------------------------------|
| (A) Input Signal | 4-20 mA-from Control System |
| (B) Power Supply | Loop Powered from the output card of control system. |
| (C) HART Protocol | Compatibility for remote calibration & Diagnostics (Super-imposed HART Signal on Input Signal) (4-20 mA) |
| (D) Valve Position Sensing | Position sensing (Non-contact type), 4-20 mA
O/P Signal for control system to be provided |

2. Environment

- | | |
|----------------------|--------------------|
| (A) Operating Temp. | (-) 30 to 80 Deg.C |
| (B) Humidity | 0-95% |
| (C) Protection Class | IP-65 Minimum |

3. Software for Configuration and Diagnostic

- | | |
|-----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (A) Software | Windows Based Software, Software shall meet the requirement for configuration, diagnostics, calibration and testing of the actuator |
| (B) Diagnostic/Test features | Advanced Diagnostic Features like Stroke Counter or Travel Counter, Leakage in actuators, online partial closure test, valve signature analysis, step response test, valve friction/jamming detection etc. to be provided. |
| (C) Factory Valve Signature Tests Reports (PR VS Valve Travel and Travel VS I/P Signal) | To be Provided |

4. Configuration/ Operating Modes

- | | |
|---------------------------|-------------------------------------------------------------------------|
| (A) Calibration | Remote Calibration, Auto & Manual Calibration shall be possible |
| (B) Operating Range | Full Range & Split Range Signal Range |
| (C) Valve Action | Direct & Reverse Valve Action |
| (D) Flow Characterization | Possible to Fit Valve
Characteristic curve linear & equal percentage |

5. Fail Safe/Fail Freeze


- | | |
|-----------------------------------------------|-----|
| Fail Safe/Fail Freeze Features to be provided | Yes |
|-----------------------------------------------|-----|

6. Pneumatic

- | | |
|-------------------------|-------------------------------------------------------------------------------|
| (A) Air Capacity | Sufficient to Handle the Valves Selected/Boosters to be supplied if required. |
| (B) Air Supply Pressure | To suit the Air Supply Pressure |
| (C) Process Connection | 1/2 Inch NPT |

7. Performance

- | | |
|------------------------------|--------------------------|
| (A) Characteristic Deviation | <= 0.5% of SPAN |
| (B) AMB Temp. Effect | <=0.01% deg.C. or Better |

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

8. EMC & CE Compliance

Required to inter- national standard like EN (IEC)

EN50081 - 2 & EN50082 Or Equivalent

9. Accessories


- | | |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| (A) In Built Operator panel | Display with push buttons for configuration |
| | Display on the positioned itself (password protected/hardware Lock) |
| (B) Hand Held Hart Calibrator | Universal Hart Calibrator to be provided, one per unit |
| (C) Press Gauge block | For Supply & output pressure, filter regulator other accessories shall be provided as on required basis for making system complete. |
| (D)Electrical Cable Entry | ½ NPT, side or bottom entry to avoid water ingress |
| (E) Valves Mounting Assembly | for Sliding Stem/Rotary/Single acting/ double acting on required basis. |

[C] END PREPARATION

Valve body ends shall be socket welded, flanged or screwed as finalized during detailed engineering and as per Employer's approval. For valves size 50 mm and below, the welded ends wherever required shall be socket welded as per ANSI B 16.11. Flanged ends wherever required shall be of ANSI pressure-temperature class equal to or greater than that of the control valve body.

[D] VALVE ACTUATORS

All control valves shall be furnished with pneumatic actuators. The Bidder shall be responsible for proper selection and sizing of valve actuators in accordance with the pressure drop and maximum shut off pressure and leakage class requirements. The valve actuators shall be capable of operating at 60 deg.C continuously. Valve actuators and stems shall be adequate to handle the unbalanced forces occurring under the specified flow conditions or the maximum differential pressure specified. An adequate allowance for stem force (at least 0.15 Kg/sq.cm. per linear mm of seating surface) shall be provided in the selection of the actuator to ensure tight seating unless otherwise specified. The travel time of the pneumatic actuators shall not exceed 10 seconds.

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

SECTION – C4
DATA SHEET –A



TITLE:
TECHNICAL SPECIFICATION FOR
OXYGEN DOSING SYSTEM
FOR 2X800 MW YERMARUS STPP.

SPEC. NO. PE-TS-362-154-12000-A-A001

VOLUME II-B

SECTION-C

REV. NO. 0

DATE:

SHEET

OF

DATA SHEET – A

(All the equipment & instruments coming in contact directly with oxygen shall be oxygen cleaned and certified fit to be used for oxygen application both in the data sheet and in the respective test certificates.)

Sl. No.	Description	Parameter
<u>Mechanical Items</u>		
1.0	No. of skid(s) for project	Four (two per unit)
2.0	Cylinders:	
2.1	Quantity mounted on skid	Two per skid (Total eight)
2.2	Loose supply of filled Oxygen cylinders	16 loose on a rack for each unit (total 32)
2.3	Total quantity of filled oxygen cylinders to be supplied for the project	32+8 (connected)=40 nos
2.4	Design Standard of empty oxygen cylinder	IS-7285
2.5	Design standard for valve fittings to cylinder	IS-3224
2.6	Water Capacity	50 liters
2.7	Gas Capacity	10 m ³
2.8	Max Working pressure at 15C	204 Kg/cm ²
2.9	Painting of oxygen cylinder	As per IS 4379
2.10	Additional requirement	All cylinders supplied should conform to "Gas Cylinder Rules, 2004" and CCE license if required for the same shall be arranged by the bidder
2.11	Accessories	Two numbers (one per unit) Cylinder storing rack (MS), each with capacity to hold 30 cylinders
3.0	All Tubing:	
3.1	Material	ASTM A213/269 GR TP 316 SCH 80 (seamless)
3.2	Diameter	15 NB (1/2" OD)
4.0	Ball valves	
4.1	Body, Bonnet, stem	ASTM A182 Gr. TP 316
4.2	Trim Material	SS 316
4.3	Design standard	BS 5351 & 5159/equivalent
4.4	Test standard	EN-12266-1
4.5	Size	15 NB
4.6	End Connections	SW ANSI B 16.11
4.7	Rating	----Class ASA 800 ----
4.8	Valve operation	Manual
5.0	Check valves/ NRV	
5.1	Body, cover, disc/piston & seat	ASTM A182 Gr. TP 316
5.2	Design standard	ANSI B 16.34/API 602
5.3	Test standard	API 598
5.4	Size	15 NB
5.5	End Connections	SW ANSI B 16.11
5.6	Rating	----Class ASA class ASA 800 ----
5.7	Valve operation	Manual



TITLE:
**TECHNICAL SPECIFICATION FOR
OXYGEN DOSING SYSTEM
FOR 2X800 MW YERMARUS STPP.**

SPEC. NO. PE-TS-362-154-12000-A-A001

VOLUME **II-B**

SECTION-C

REV. NO. 0

DATE:

SHEET OF

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	55 Kg/cm ² for skid 1 and 22 Kg/cm ² for skid 2
6.6	Inlet Connections	15 NB, Flanged/threaded, ANSI B16.5, 300#
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 socket weld ends.
8.0	Pressure Regulator	
8.1	Quantity	Two per skid (total 8), each mounted to an oxygen cylinder
8.2	Body & trim	SS 316/Brass
8.3	Inlet connection	1/2 "
8.4	Outlet connection	1/2 "
8.5	Operating pressure	204 Kg/cm ² (g)
8.6	Set outlet Pressure	50 Kg/cm ² (g) for skid dosing at CPU outlet and 20 Kg/cm ² (g) for skid dosing at deaerator outlet
9.0	Flanges	-----SS 316, ANSI B 16.5 CL 300 -----
10.0	Structural steel	IS 2062
11.0	Nuts & bolts	SS 304

C & I items		
12.0	Pressure Gauge	
12.1	Sensing element	Bourdon with chemical seal diaphragm
12.2	MOC-Sensing element	SS 316
12.3	MOC-Movement	SS 304
12.4	MOC-Casing	Die cast AL, stove enameled, black finish, threaded bezel ring, clear glass cover conforming to NEMA-4
12.5	Paint	Epoxy
12.6	Colour of case	Black
12.7	Span/zero adjustment	INT. Micro screw
12.8	Dial size	150 mm
12.9	Range selection	130% of operating parameter
12.10	Over range protection	150% of FSD
12.11	Colour of dial	White
12.12	Colour of numerals	Black
12.13	Scale	Linear, 270° arc graduated in metric units
12.14	Blow out disc	Required
12.15	Accuracy	±1% Of FSD
12.16	Process connection/ location	½" NPT (M)/ Bottom
12.17	Name plate/metal tag	SS
12.18	3-way manifold valves for PG	½" NPT (F) of SS 316
13.0	Pressure/differential pressure transmitter	
13.1	Type	2 wire , microprocessor based



TITLE:
**TECHNICAL SPECIFICATION FOR
OXYGEN DOSING SYSTEM
FOR 2X800 MW YERMARUS STPP.**

SPEC. NO. PE-TS-362-154-12000-A-A001

VOLUME II-B

SECTION-C


REV. NO. 0

DATE:


SHEET

OF


13.2	Working principle	Smart—Inductive/Capacitance/Resonant(HART protocol compatible)
13.3	Output Signal	4-20 mA DC(Analog) along with superimposed digital signal (based on HART protocol)
13.4	Signal processing unit	Silicon solid state electronic circuitry
13.5	Measuring element	Capsule/diaphragm
13.6	Measuring diaphragm	AISI-316
13.7	Static pressure/Overload pressure	150% of maximum span continuously, without affecting calibration
13.8	Turndown ratio	100:1
13.9	Span and zero	Locally adjustable non-interacting. Facility for elevation and suppression.
13.10	Enclosure class	IP 67
13.11	Output indicator	Yes, digital LCD type
13.12	Name plate	Tag number and service engraved in SS tag plate
13.13	Body	Forged Stainless steel Rating: At least 1.5 times the maximum fluid pressure
13.14	Operating voltage	16-48 Volts DC
13.15	Load	600 ohm(min) at 24 V D.C.
13.16	Design Ambient temperature	65 degree Celsius
13.17	DOP of enclosure	IP 65
13.18	Accuracy	±0.075% of span or better
13.19	Repeatability	±0.05% of span or better
13.20	Sealing/Isolation	Extended diaphragm with 10 meters SS armoured capillary. MOC of diaphragm—SS 316
13.21	Accessories	Universal mounting bracket suitable for pipe mounting, high tensile SS U-bolts, companion flanges with nuts, bolts and gaskets(as required), 3 valve manifold of SS 316 for PT and held interface kit for calibration of SMART transmitter
14.0	Solenoid Valve	
14.1	Type	Double coil type, corrosion resistant type
14.2	Body	SS 316/Brass
14.3	Internals	SS 316/Brass
14.4	Spring	SS 316
14.5	Size	½ inch
14.6	Class of insulation	F
14.7	Electrical connection	24 VDC from BOP-DDCMIS
14.8	Connectivity	Connectivity with BOP-DDCMIS required for operation
15.0	Flow meter cum transmitter	Bidder to select appropriate model subject to approval during detailed engineering
15.1	Expected flow of oxygen in process	50-400 GM/hr (for skid dosing at deaerator outlet) & 40-300 GM/hr (for skid dosing at CPU outlet)
15.2	MOC-Wetted part	SS 316
15.3	Operating Pressure	Pressure reducing valve set pressure (refer PID)
15.4	Transmitter	Field mounted HART protocol compatible transmitter compatible with the sensor

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-C	
		REV. NO. 0	DATE:
		SHEET	OF

15.5	Mass flow accuracy at max flow	±1%
16.0	Control Valve with actuator	Refer Section C3
17.0	Junction Box	
17.1	No. of ways	12/24/36/48/64/72/96/128 with 20% spare terminals
	Material & Thickness	4 mm thick Fiberglass reinforced polyester (FRP)
	Mounting	Mounted on respective Oxygen dosing skid
	Mounting clamps & accessories	CR Sheet (250mmx335 + 2x2 mm thick) shall be used on mounting. The brackets, bolts, nuts, screws and lugs required shall be of brass.
	Locking Mechanism	Industrial Type
	Handle	Stainless Steel
	Terminal blocks	Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm ² . A M6 earthing stud shall be provided.
	TB channels	Painted in RAL 9002 color
	Grounding	To be provided
	Protection Class	IP 55
	Bus bar	Copper, nickel plated
	Gasket	Neoprene
	Cable gland	Nickel plated brass (single compression type) ¾" and 1"
	Cable entry	Bottom with gland plates suitable for cables used along with blanking facility.

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-D	
		REV. NO. 0	DATE:
		SHEET	OF

SECTION – D
INSPECTION REQUIREMENT OF BHEL

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-D	
		REV. NO. 0	DATE:
		SHEET	OF

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

1. Welder Qualification

- a) Review of welder's qualification (WPS & PQR) shall be done by BHEL during final inspection.

2. Empty oxygen cylinder

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

3. Valves (Ball, Check, PRV, solenoid, needle)

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

4. Instruments (Pressure Gauge, Pressure Transmitter, Mass flow meter, pressure reducing valve)


- a) Material Test certificate for wetted part as per approved data sheet shall be furnished for review by BHEL during final inspection.
- b) Calibration report shall be furnished for review by BHEL during final inspection.
- c) Manufacturer's COC for degree of protection of enclosure (1/similar frame size) shall be for review by BHEL during final inspection.
- d) All instruments shall be oxygen cleaned and suitable for oxygen service. Manufacturer's COC certifying the same shall be submitted for review by BHEL during final inspection.

5. Control valve

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

6. Junction Box

- a) Check of make & rating of components as per approved drawing shall be done by BHEL
- b) Visual check of dimensions and orientation as per approved drawing shall be done by BHEL

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-D	
		REV. NO. 0	DATE:
		SHEET	OF

- c) IR-HV-IR test shall be witnessed by BHEL
- d) Test certificate for degree of protection of the enclosure (1 per similar frame size) shall be submitted by bidder for review by BHEL.

7. Tubing

- a) Material test Certificate/lab report and hydro test report shall be furnished for review by BHEL during final inspection.

8. Fittings


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

9. Final skid assembly (Inspection witness by BHEL except point g)

- a) Measurement of skid dimensions and elevation of terminal point
- b) Visual checking of skid orientation as per BHEL/BHEL approved GA drawing
- c) Visual checking of welding soundness, cleanliness at weld joints
- d) Hydro test of the complete interconnected tubing
- e) Pneumatic test of the complete interconnected tubing
- f) Verification of painting thickness by elcometer and paint shade with respect to color shade chart
- g) DP test for all socket weld joints may be witnessed by any renowned TPI at bidder's cost and review of their report shall be done by BHEL during final inspection. Alternatively, bidder may also offer DP test for BHEL witness.

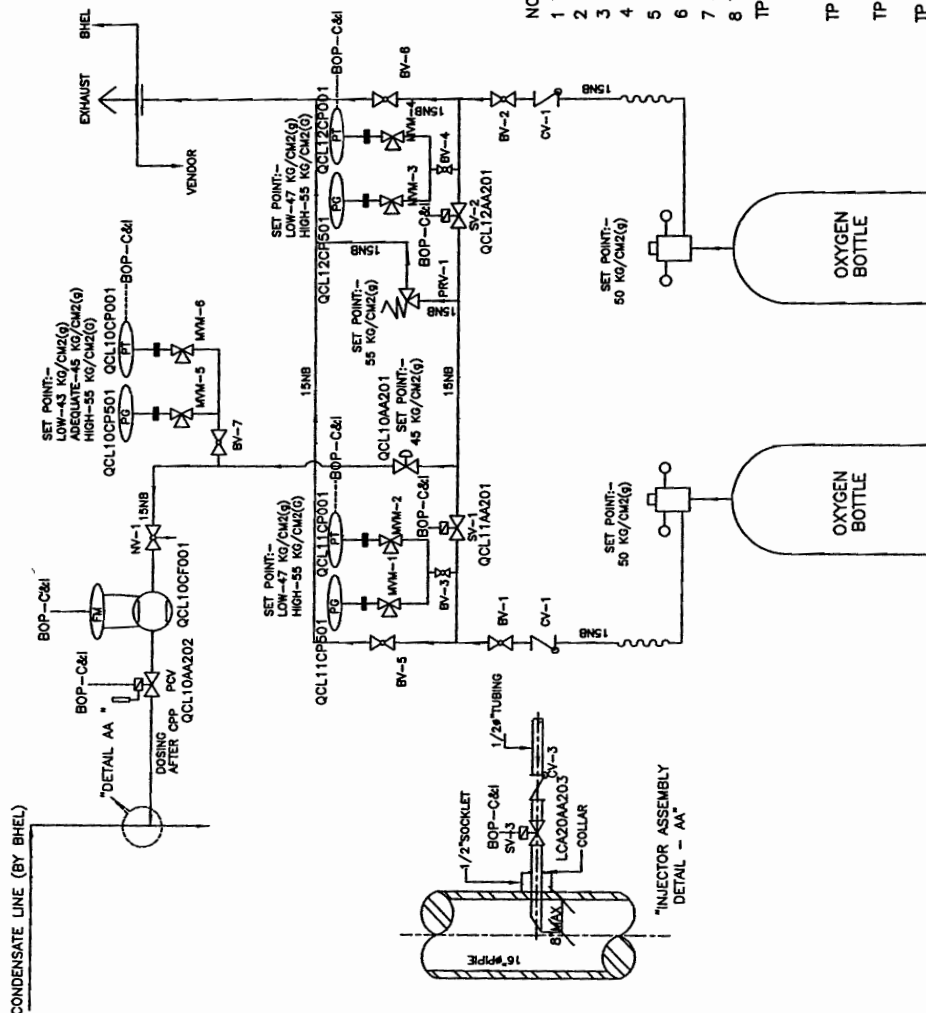
Note: -

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

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-D	
		REV. NO. 0	DATE:
		SHEET	OF

P&ID FOR OXYGEN DOSING SYSTEM

DRAWING NO.
PE-DC-362-154-A003



LEGEND

	PRESSURE REDUCING CUM REGULATING VALVE
	NEEDLE VALVE
	PRESSURE TRANSMITTER
	SOLENOID ACTUATED VALVE
	PRESSURE GAUGE
	NON RETURN VALVE
	FLOW METER WITH TRANSMITTER
	BALL VALVE
	PRESSURE REGULATOR
	PRESSURE SAFETY VALVE
	DISCHARGE TO ATMOSPHERE FOR GAS/SYSTEM
	PNEUMATIC CONTROL VALVE
	MULTI-VALVE MANIFOLD(SEE NOTES)
	CHEMICAL SEAL DIAPHRAGM

NOTES:-

- 1 THE ENTIRE SYSTEM INCLUDING THE JUNCTION BOX SHALL BE SKID MOUNTED.
- 2 ONE NUMBER SKID PER UNIT SHALL BE PROVIDED FOR DOSING AT DEAERATOR OUTLET(TOTAL=2 NOS).
- 3 THREE NUMBERS INJECTION ASSEMBLY PER UNIT SHALL BE SUPPLIED LOOSE(TOTAL = 6 NOS).
- 4 ALL THE VALVES SHALL BE OF SS 316, 800 CLASS SW.
- 5 ALL TUBING SHALL BE OF SS 316, 15 NB AND SCH 80.
- 6 30 M OF TUBING PER UNIT (TOTAL 60M) OF SAME SPECIFICATION SHALL BE LOOSE WITH THE SKID.
- 7 ALL THE MULTI VALVE MANIFOLD SHALL BE 3-WAY VALVE MANIFOLDS.
- 8 THE FOLLOWING SHALL BE THE TERMINAL POINT DETAILS:-
TP 1:- ALL FIELD INSTRUMENTS(PRESSURE AND FLOW TRANSMITTERS), AND SOLENOID VALVES(SV1 & 2 ONLY) SHALL BE TERMINATED AT THE JB BY OXYGEN DOSING VENDOR FOR FURTHER CONNECTION TO DCS BY NTPC.
- TP 2:- ALL VENT CONNECTIONS SHALL BE TERMINATED AT ONE POINT BY OXYGEN DOSING VENDOR FOR FURTHER CONNECTION TO ATMOSPHERE, IF REQUIRED, BY BHEL.
- TP 3:- DOSING TERMINAL POINT SHALL BE AFTER PCV AND TERMINATED BY THE OXYGEN DOSING SUPPLIER FOR FURTHER INTERCONNECTION TILL DOSING LOCATIONS BY BHEL.
- TP 4:- INSTRUMENT AIR CONNECTION TO PCV SHALL BE DIRECTLY CONNECTED BY BHEL.
- TP 5:- 24 VDC CONNECTION TO SV-3 SHALL BE DIRECTLY CONNECTED BY NTPC.
9. BHEL SHALL TERMINATE ALL INSTRUMENTS/DEVICES AS PER NTPC PROVIDED TERMINATION DRAWINGS & WILL PROVIDE JBS AND CABLES ACCORDINGLY.

2X800 MW YERMARUS STPP - UNIT 1&2



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE	NAME	SIGN	DATE
DRN	GJ		12-10-11
DESIGN	FS		12-10-11
CHD	SB		12-10-11
APPD	S. BALAJI		12-10-11

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

DRAWING NO.
PE-DC-362-154-A003

SHEET	1	DF	2	REV	02
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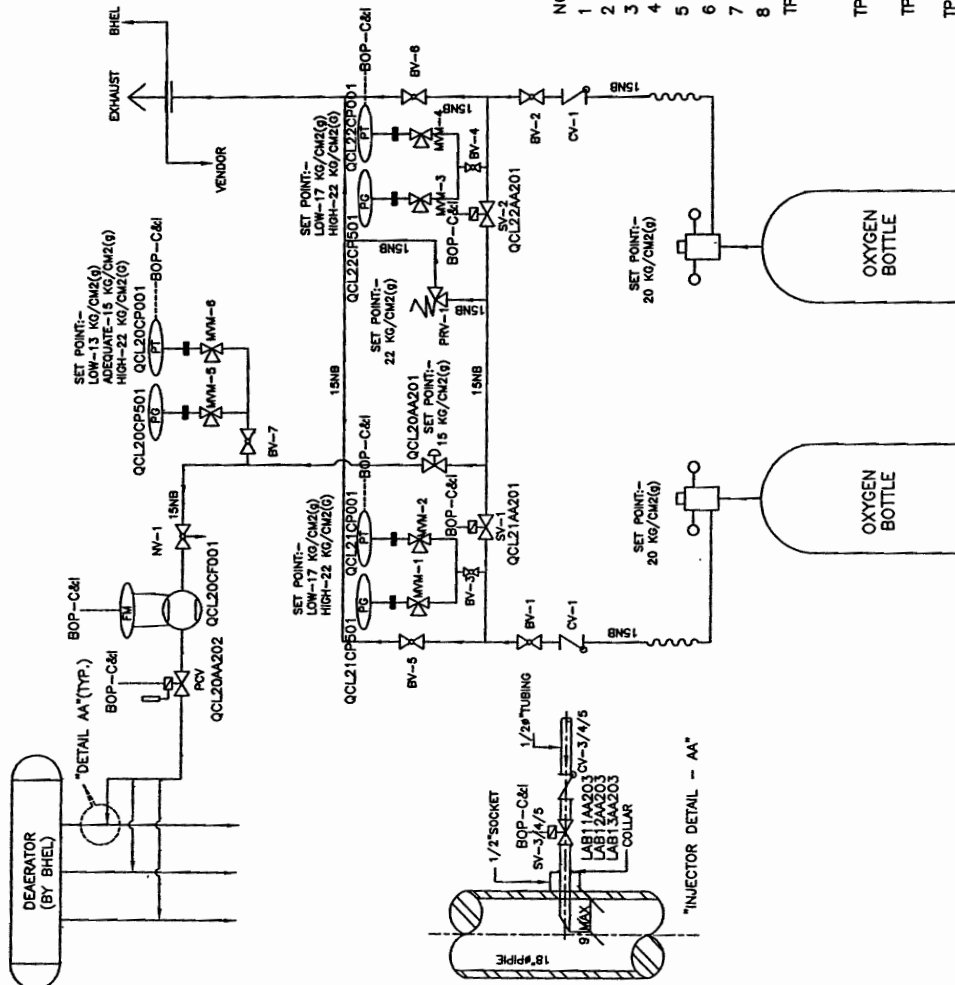
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FIRST ANGLE PROJECTION

DRAWING NO.
PE-DC-362-154-A003

LEGEND

	PRESSURE REDUCING CUM REGULATING VALVE
	NEEDLE VALVE
	PRESSURE TRANSMITTER
	SOLENOID ACTUATED VALVE
	PRESSURE GAUGE
	NON RETURN VALVE
	FLOW METER WITH TRANSMITTER
	BALL VALVE
	PRESSURE REGULATOR
	PRESSURE SAFETY VALVE
	DISCHARGE TO ATMOSPHERE FOR GAS/SYSTEM
	PNEUMATIC CONTROL VALVE
	MULTI-VALVE MANIFOLD(SEE NOTES)
	CHEMICAL SEAL DIAPHRAGM



NOTES:-

- 1 THE ENTIRE SYSTEM INCLUDING THE JUNCTION BOX SHALL BE SKID MOUNTED.
 - 2 ONE NUMBER SKID PER UNIT SHALL BE PROVIDED FOR DOSING AT DEAERATOR OUTLET(TOTAL=2 NOS).
 - 3 THREE NUMBERS INJECTION ASSEMBLY PER UNIT SHALL BE SUPPLIED LOOSE(TOTAL = 6 NOS).
 - 4 ALL THE VALVES SHALL BE OF SS 316, 800 CLASS SW.
 - 5 ALL TUBING SHALL BE OF SS 316, 15 NB AND SCH 80.
 - 6 100 M OF TUBING PER UNIT (TOTAL 200M) OF SAME SPECIFICATION SHALL BE LOOSE WITH THE SKID.
 - 7 ALL THE MULTI VALVE MANIFOLD SHALL BE 3-WAY VALVE MANIFOLDS.
 - 8 THE FOLLOWING SHALL BE THE TERMINAL POINT DETAILS:-
- TP 1:- ALL FIELD INSTRUMENTS(PRESSURE AND FLOW TRANSMITTERS), AND SOLENOID VALVES(SV1 & 2 ONLY) SHALL BE TERMINATED AT THE JB BY OXYGEN DOSING VENDOR FOR FURTHER CONNECTION TO DCS BY NTPC.
- TP 2:- ALL VENT CONNECTIONS SHALL BE TERMINATED AT ONE POINT BY OXYGEN DOSING VENDOR FOR FURTHER CONNECTION TO ATMOSPHERE, IF REQUIRED, BY BHEL.
- TP 3:- DOSING TERMINAL POINT SHALL BE AFTER PCV AND TERMINATED BY THE OXYGEN DOSING SUPPLIER FOR FURTHER INTERCONNECTION TILL DOSING LOCATIONS BY BHEL.
- TP 4:- INSTRUMENT AIR CONNECTION TO PCV SHALL BE DIRECTLY CONNECTED BY BHEL.
- TP 5:- 24 VDC CONNECTION TO SV-3, SV-4 AND SV-5 SHALL BE DIRECTLY CONNECTED BY NTPC.
9. BHEL SHALL TERMINATE ALL INSTRUMENTS/DEVICES AS PER NTPC PROVIDED TERMINATION DRAWINGS & WILL PROVIDE JBS AND CABLES ACCORDINGLY.


2X800 MW YERMARUS STPP - UNIT 1&2

DEPT CODE	IRN	NAME	SIGN	DATE
	DESIGN	GJ		12-10-11
	CHD	SB		12-10-11
DRAWING NO.	APPD	S. BALAJI		12-10-11
	PE-DC-362-154-A003			
SHEET 2 OF 2 REV 00				

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

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

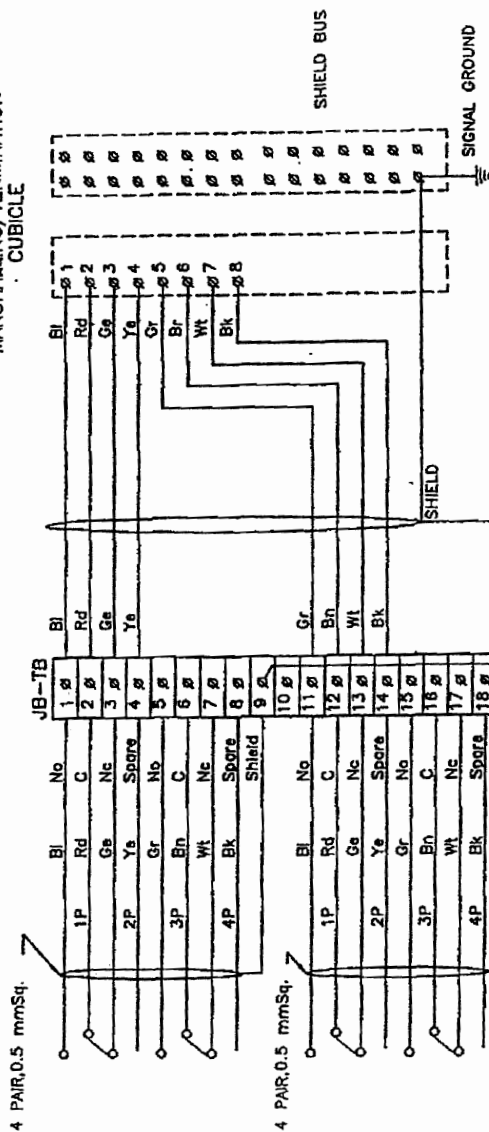
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STATUS						CONTRACT
DISTRIBUTION						

	TITLE: TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM FOR 2X800 MW YERMARUS STPP.	SPEC. NO. PE-TS-362-154-12000-A-A001	
		VOLUME II-B	
		SECTION-D	
		REV. NO. 0	DATE:
		SHEET	OF

JUNCTION BOX TERMINATION DETAILS

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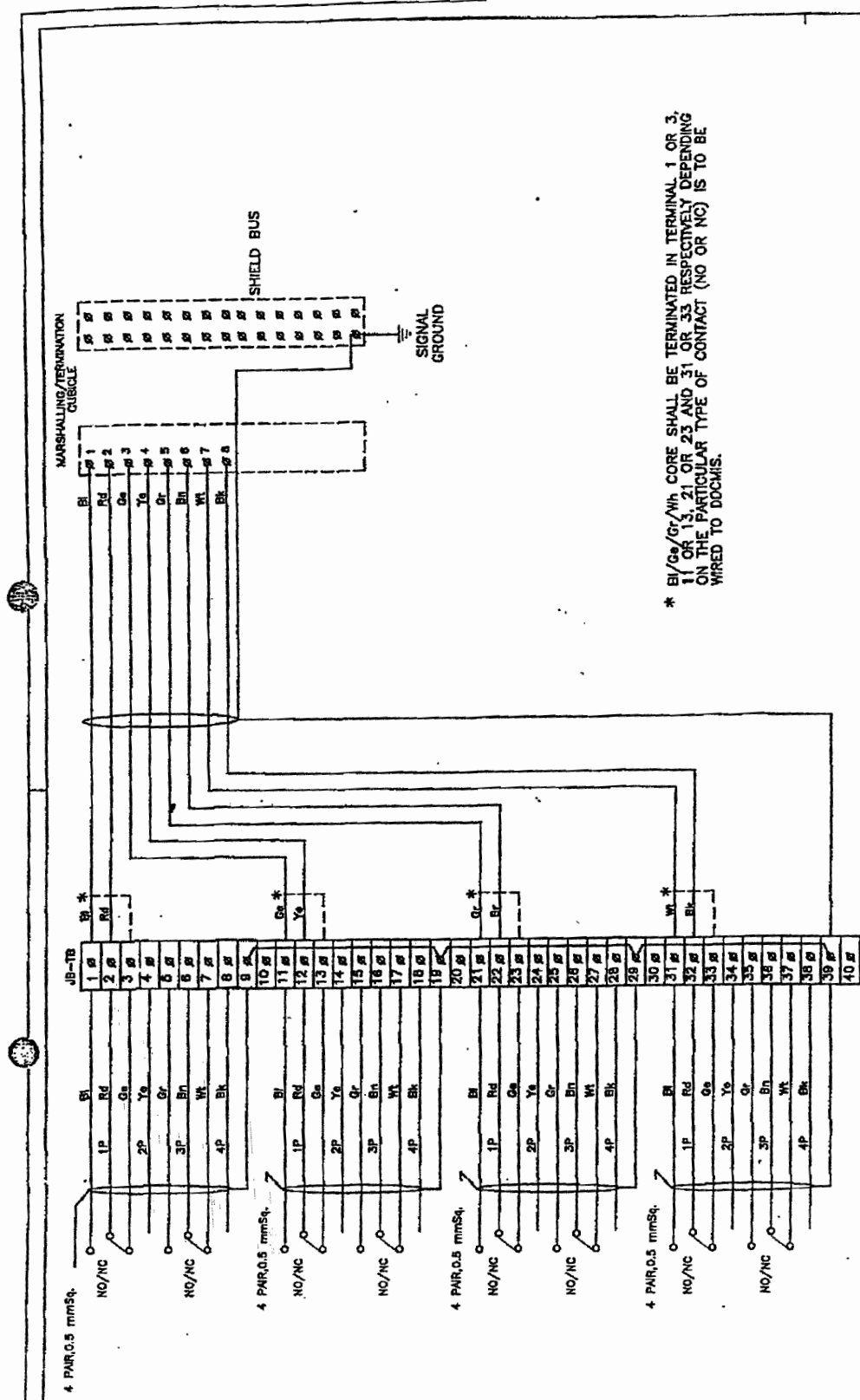
MARSHALLING/TERMINATION CUBICLE



TITLE

INTERFACING OF FIELD INSTRUMENTS/
SWGR SWITCH (COC) TERMINATION DETAILS

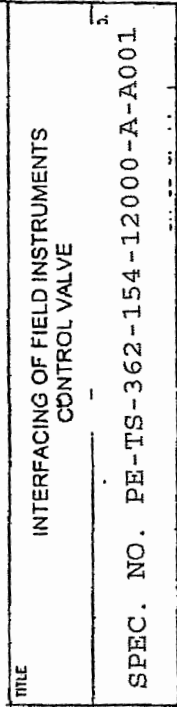
SPEC. NO. PE-TS-362-154-12000-A-A001



* Bl/Ce/Gr/Wl CORE SHALL BE TERMINATED IN TERMINAL 1 OR 3, 11 OR 13, 21 OR 23 AND 31 OR 33 RESPECTIVELY DEPENDING ON THE PARTICULAR TYPE OF CONTACT (NO OR NC) IS TO BE WIRED TO DOCMIS.

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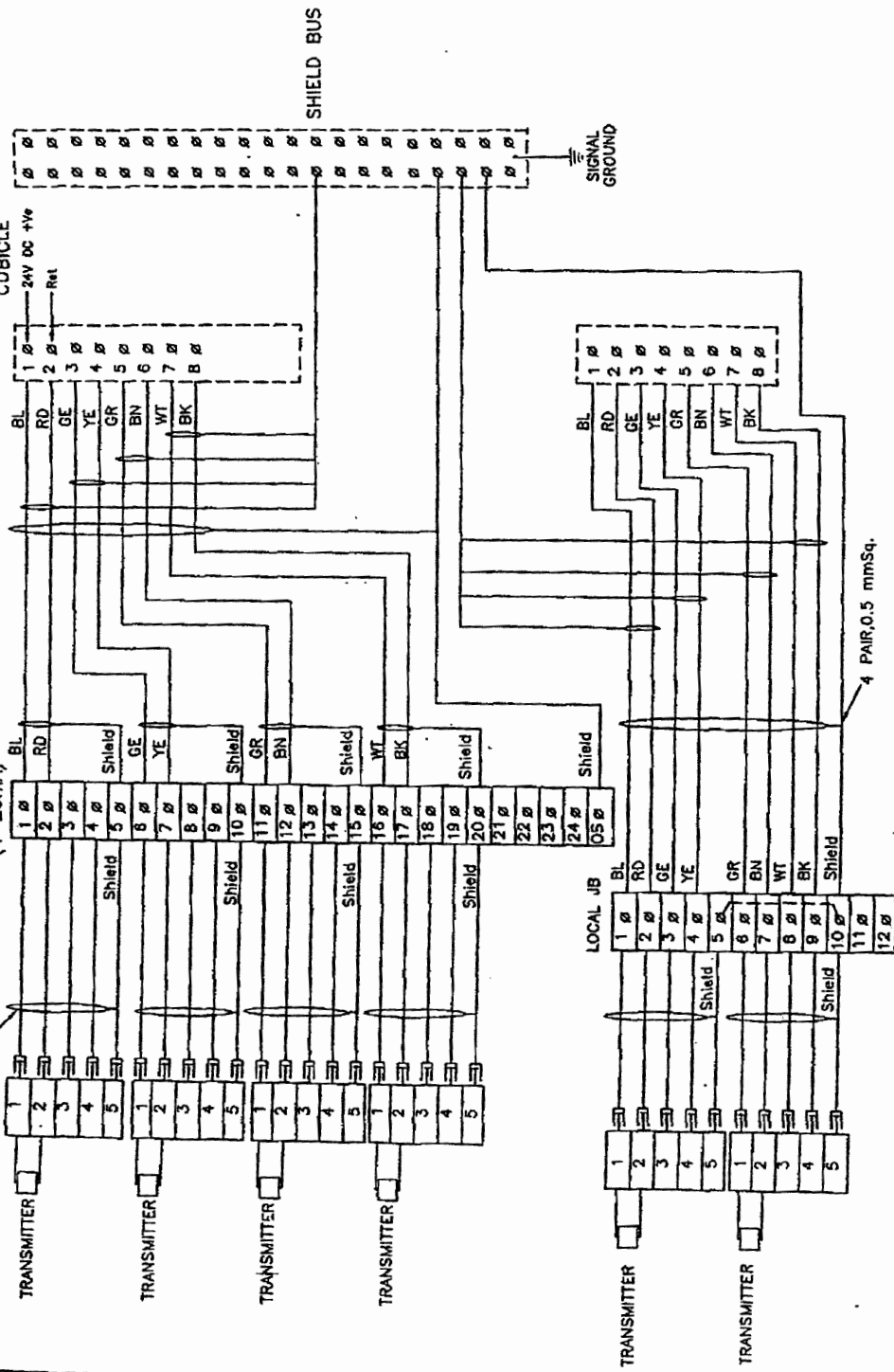
TITLE	INTERFACING OF FIELD INSTRUMENTS SWITCH TERMINATION DETAILS NO/NC
SPEC. NO.	PE-TS-362-154-12000-A-A001



INTERNAL WIRING/2 PAIR,0.5 mmSq.(TYP)

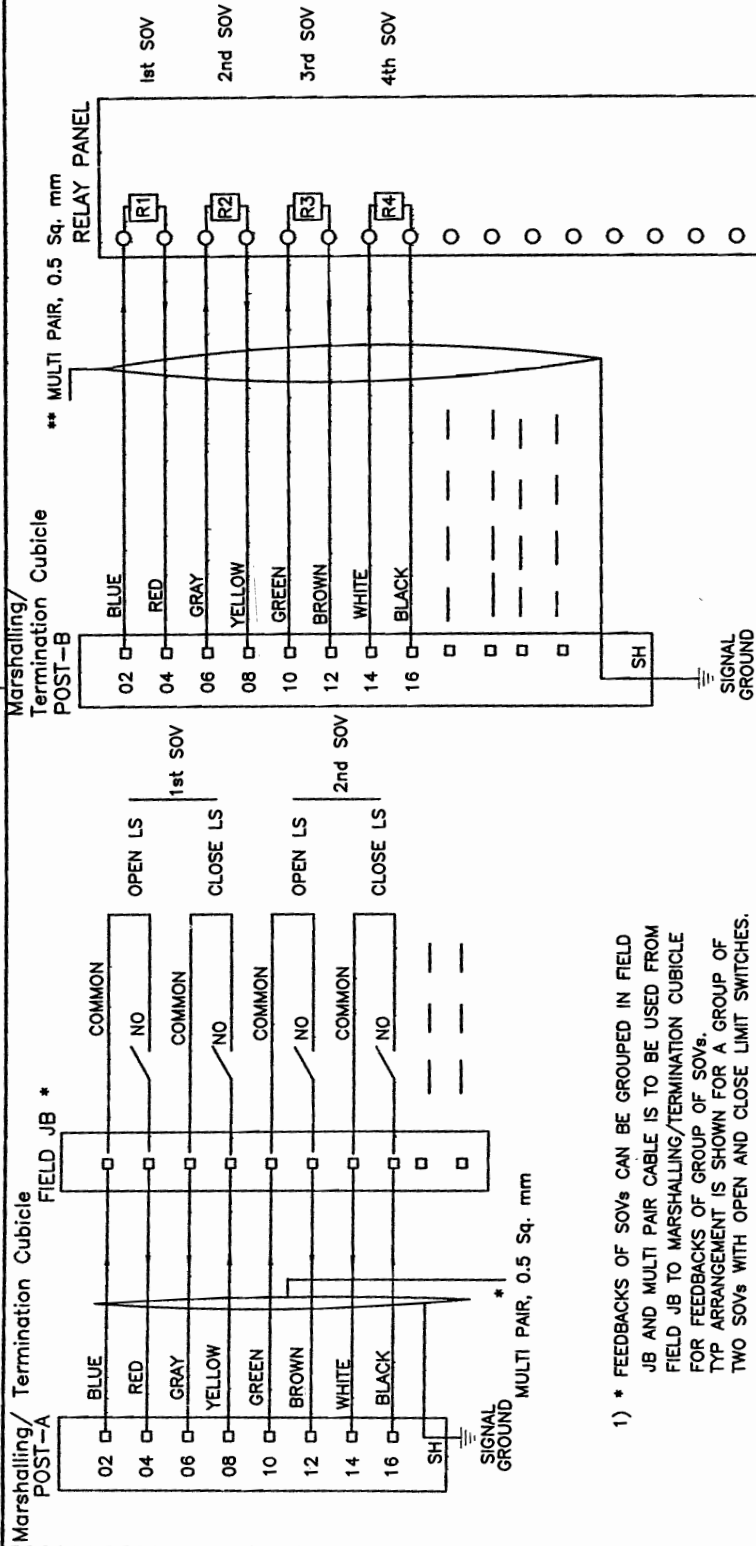
INTEGRAL JB OF LIE/LIR
(4-20mA)

MARSHALING/TERMINATION
CUBICLE



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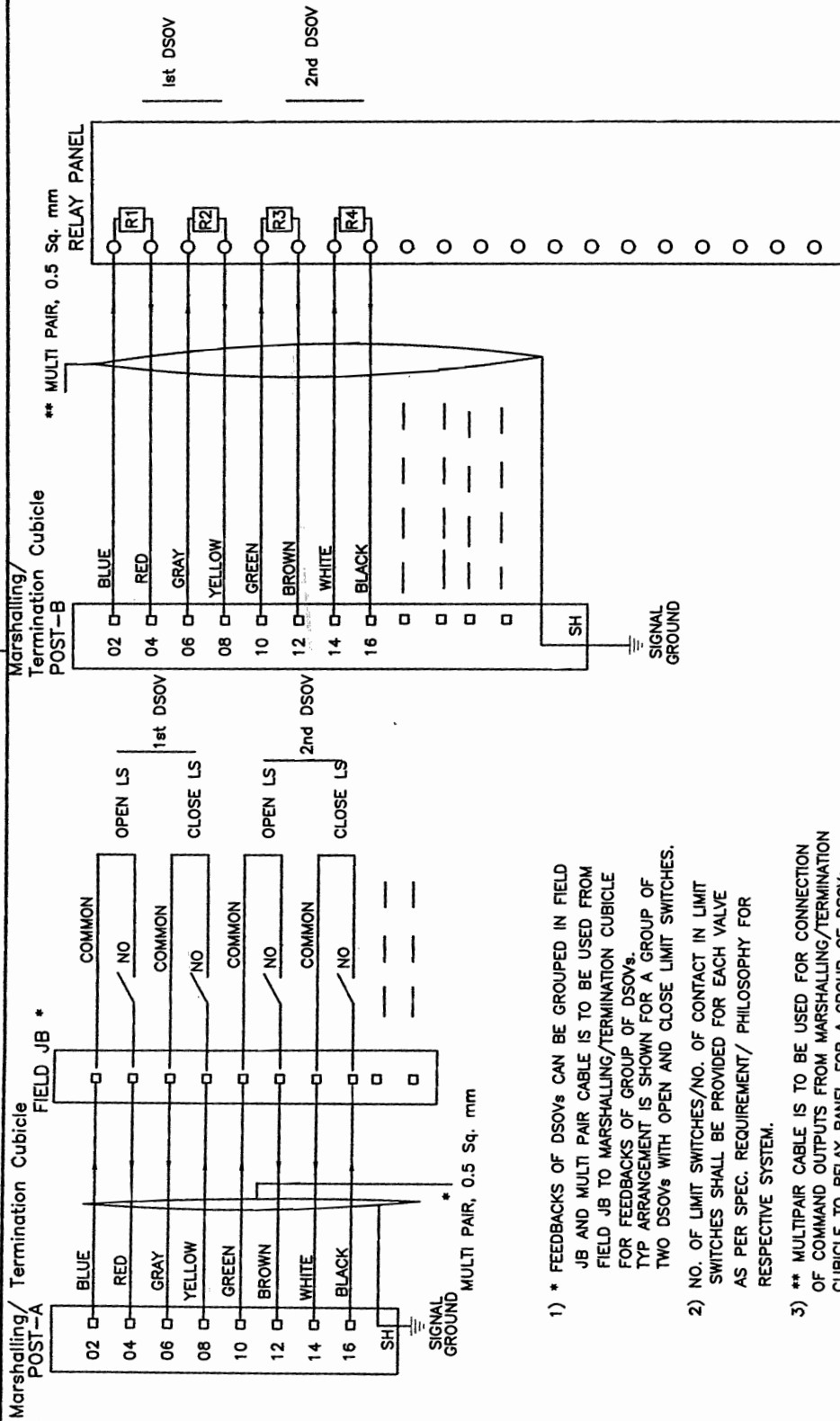
TITLE	INTERFACING OF FIELD INSTRUMENTS 4-20mA
SPEC. NO.	PE-TS-362-154-12000-A-A001



- 1) * FEEDBACKS OF SOVs CAN BE GROUPED IN FIELD JB AND MULTI PAIR CABLE IS TO BE USED FROM FIELD JB TO MARSHALLING/TERMINATION CUBICLE FOR FEEDBACKS OF GROUP OF SOVs. TYP ARRANGEMENT IS SHOWN FOR A GROUP OF TWO SOVs WITH OPEN AND CLOSE LIMIT SWITCHES.
- 2) NO. OF LIMIT SWITCHES/NO. OF CONTACT IN LIMIT SWITCHES SHALL BE PROVIDED FOR EACH VALVE AS PER SPEC. REQUIREMENT/ PHILOSOPHY FOR RESPECTIVE SYSTEM.
- 3) ** MULTIPAIR CABLE IS TO BE USED FOR CONNECTION OF COMMAND OUTPUTS FROM MARSHALLING/TERMINATION CUBICLE TO RELAY PANEL FOR A GROUP OF SOVs.

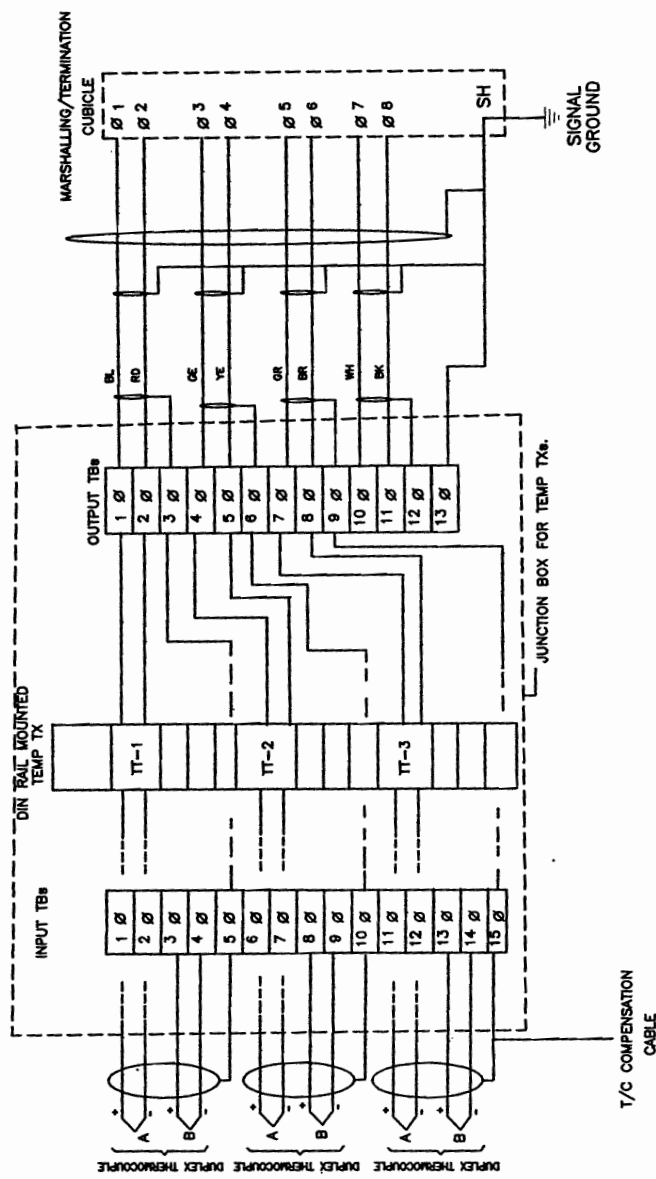
TITLE INTERFACING OF FIELD INSTRUMENTS
INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR
(SINGLE COIL SOLENOID)

SPEC. NO. PE-TS-362-154-1 Page 43 of 47 A001



- 1) * FEEDBACKS OF DSOVs CAN BE GROUPED IN FIELD JB AND MULTI PAIR CABLE IS TO BE USED FROM FIELD JB TO MARSHALLING/TERMINATION CUBICLE FOR FEEDBACKS OF GROUP OF DSOVs. TYP ARRANGEMENT IS SHOWN FOR A GROUP OF TWO DSOVs WITH OPEN AND CLOSE LIMIT SWITCHES.
- 2) NO. OF LIMIT SWITCHES/NO. OF CONTACT IN LIMIT SWITCHES SHALL BE PROVIDED FOR EACH VALVE AS PER SPEC. REQUIREMENT/ PHILOSOPHY FOR RESPECTIVE SYSTEM.
- 3) ** MULTIPAIR CABLE IS TO BE USED FOR CONNECTION OF COMMAND OUTPUTS FROM MARSHALLING/TERMINATION CUBICLE TO RELAY PANEL FOR A GROUP OF DSOVs.

PROJECT	TYPICAL THERMAL POWER PROJECT
TITLE	INTERFACING OF FIELD INSTRUMENTS INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR (DOUBLE COIL SOLENOID)
SPEC. NO.	PE-TS-362-154-12000-A-A001
Page 46 of 47	
CAD FILE NAME:	C:\PC_MS\TYTPPP_SG.TG.BOP\OCT.02\0000-999-POI-A-065SH09.rdw



- NOTE: 1) ABOVE IS THE TYP. DRG. FOR DIN RAIL MOUNTED TEMP TRANSMITTER FOR T/C APPLICATION. EXACT TYPE OF TEMP TRANSMITTERS SHALL BE AS PER PART-A OF SPECIFICATION.
- 2) THE EXACT GROUPING OF TEMP TXs SHALL BE FINALISED DURING DETAILED ENGG. STAGE.
- 3) AFTER GLANDING OF T/C CABLES ON JB, THE CABLE PAIR OF FIRST ELEMENT WILL BE DIRECTLY CONNECTED TO IT AND FOR CABLE PAIR OF SECOND ELEMENT LOOP SHALL BE KEPT, BEFORE TERMINATION AT INPUT TBs FOR FUTURE USE.