

PROJECT:

5X800 MW TSGENCO YADADRI TPS

CUSTOMER:

**TELANGANA STATE POWER GENERATION CORPORATION LIMITED
(TSGENCO). HYDERABAD.**

**TECHNICAL SPECIFICATION
FOR
CHEMICAL DOSING SYSTEM**

SPECIFICATION NO: PE-TS-417-154-A001



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



TITLE:

**TECHNICAL SPECIFICATION
FOR CHEMICAL DOSING SYSTEM.
PROJECT: 5X800 MW TSGENCO YADADRI TPS**

BHEL DOCUMENTS NO.: PE-TS-417-154-A001

REV NO: 00

DATE:

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SECTION - A
INTENT OF SPECIFICATION

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1.0 **SCOPE OF INQUIRY/ INTENT OF SPECIFICATION:**

This specification is intended to cover design, engineering, manufacturing, fabrication, assembly, painting, packing, inspection & testing at manufacturer's works, **mandatory spares, start up and commissioning spares**, special tools & tackles, supply and dispatch to power station site of skid mounted **CHEMICAL DOSING SYSTEM** including supervision of commissioning by experience/capable engineer, as specified in different sections / volumes of this specification hereinafter for the **5X800 MW TSGENCO YADADRI TPS** for following systems:-

- **Hydrazine Dosing System (1 No per unit, Total= 5 Nos).**
- **Ammonia Dosing System (1 No per unit, Total= 5 Nos).**
- **NaOH Dosing System (1 No per unit, Total= 5 Nos).**

- 1.1 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve them of the responsibility of providing such facilities to complete the supply, erection and commissioning of **CHEMICAL DOSING SYSTEM**.
- 1.2 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to 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.
- 1.3 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- 1.4 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.
- 1.5 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification are subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of BHEL/Customer shall prevail and shall be complied by the bidder without any commercial and delivery implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by BHEL/ Customer as and when brought to their notice either by the bidder or by BHEL/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.
- 1.7 Deviations, if any, should be very clearly brought out clause by clause along with cost of withdrawal in the enclosed schedule (in Vol – III); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.
- 1.8 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

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- 1.9 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer as interpreted by BHEL in the relevant context. Please refer GCC/SCC for better clarity.
- 1.10 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.
- 1.11 BHEL's/Customer's 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.
- 1.12 Pre-bid meeting shall be held before bid submission. Bidder to ask all their queries in Prebid clarifications format only.



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SECTION – B
PROJECT INFORMATION



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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)



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SECTION – C1
SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

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1.0 INTRODUCTION

The Chemical dosing systems have been designed to dose required quantity of chemicals to maintain the quality of boiler feed water. Chemicals are dosed both in low-pressure side of feed water cycle as well as in DMCW system.

2.0 SYSTEM DESCRIPTION

2.1 HYDRAZINE DOSING SYSTEM (1 No. per Unit):

(Refer drg no. PE-DG-417-154-A001)

Residual oxygen present in feed water can be detrimental to feed cycle equipment. In order to control the same continuous dosing of dilute solution of hydrazine is done at deaerator outlet (BFP suction) only. Though provision has been kept to dose hydrazine at CEP discharge after CPU and boiler fill pumps also, but dosing shall be done at one place at a time. For this purpose one (1) no. skid mounted Hydrazine dosing system per unit shall be provided.

2.2 AMMONIA DOSING SYSTEM (1 No. per Unit):

(Refer drg no. PE-DG-417-154-A002)

Boiler feed water/Condensate water should have proper pH (8-8.5) in order to protect the system from corrosion. In order to control the same, continuous dosing of dilute solution of Ammonia is done at CEP discharge after CPU. Though provision has been kept to dose ammonia at deaerator outlet and boiler fill pumps also, but dosing shall be done at one place at a time only. For this purpose one (1) no. skid mounted ammonia dosing system for each unit shall be provided.

2.3 NaOH DOSING SYSTEM (1 No. per Unit):

(Refer drg. No. PE-DG-417-154-A003)

Sodium Hydroxide (NaOH) dosing system is provided to dose NaOH solution in Equipment cooling water lines & DMCW O/H Tank to increase pH upto 9.5. The sodium hydroxide dosing is done in the DMCW cycle during the initial fill and for the compensation of cooling water for any leakage during normal run. The dilute solution of NaOH in NaOH Dosing tank is prepared manually by opening the inlet valve of DM water and adding NaOH lye in basket. The NaOH is being dissolved by locally starting the motorized agitator. The dosing is done as per requirements of desired pH in DMCW line judged by trial basis. Normally the leakage is occasionally and of small quantity. At the low level of solution in tank the solution is to be prepared again.

3.0 DESIGN INPUTS/CRITERION

The following drawings/data sheets are enclosed:

- | | |
|----------------------|------------------------------------|
| ▪ DATASHEET – A | For the above system. |
| ▪ PE-DG-417-154-A001 | P & ID of Hydrazine dosing system. |
| ▪ PE-DG-417-154-A002 | P & ID of Ammonia dosing system. |
| ▪ PE-DG-417-154-A003 | P & ID of NaOH dosing system. |

4.0 BRIEF SCOPE (Refer Datasheet-A also).

4.1 HYDRAZINE DOSING SYSTEM:

Dosing system shall mainly comprises of the following:

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4.1.1 CONCENTRATED HYDRAZINE STORAGE TANK (2 Nos.)

Concentrated hydrazine storage tanks are provided for storing & measuring the technical grade concentrated hydrazine liquor. Each tanks are provided with breather with vent, level gauge, level transmitter & overflow drain with sealing arrangement. Concentrated solution shall be transferred to Hydrazine Solution Preparation Tanks by gravity flow when solution is to be prepared.

4.1.2 HYDRAZINE SOLUTION PREPARATION TANK (2 Nos.)

A dilute solution of 0.6% concentration is prepared in the hydrazine solution preparation tanks using condensate/DM water and is uniformly mixed by a motorized stirrer. The tanks are provided with breather with vent, motorized agitator, level gauge, level transmitter & overflow drain with sealing arrangement. The solution is then dosed to the required point with the help of dosing pumps.

4.1.3 HYDRAZINE DOSING PUMPS (6 Nos.)

Three nos. (3 X 50%) for dosing at CEP discharge & boiler fill pump discharge (Boiler Filling Line) ,Three nos. (3 X 50%) for dosing at D/A outlet point, Positive displacement plunger type Dosing pumps (electrically operated, auto stroke adjusted) with motor, relief valves shall be provided. A Y-type strainer set (3 x 100%) common for three pumps each for CEP discharge & D/A outlet shall be provided.

4.1.4 HYDRAZINE BARREL (1 no.) & BARREL PUMP (1 Nos.)

One no.(1) hydrazine barrel of suitable capacity with one motor operated barrel pump complete with flexible hose and couplings for transferring concentrated hydrazine from drum at ground level to preparation cum metering tank shall be provided.

4.1.5 FLUSHING

DM Water shall be used for flushing the tank shown in P & I drawing.

4.2 AMMONIA DOSING SYSTEM:

Dosing system shall mainly comprises of the following:

4.2.1 CONCENTRATED AMMONIA STORAGE TANK (2 Nos.)

Concentrated ammonia storage tanks are provided for storing & measuring the technical grade concentrated ammonia liquor. Each tank is provided with breather with vent, level gauge, level transmitter & overflow drain with sealing arrangement. Concentrated solution shall be transferred to Ammonia Solution Preparation Tanks by gravity flow when solution is to be prepared.

4.2.2 AMMONIA SOLUTION PREPARATION TANK (2 Nos.)

A dilute solution is prepared in the ammonia solution preparation tanks using condensate and is uniformly mixed by a motorized stirrer. The tanks are provided with breather with vent, motorized agitator, level gauge, level transmitter & overflow drain with sealing arrangement. The solution is then dosed to the required point with the help of dosing pumps.

4.2.3 AMMONIA DOSING PUMPS (6 Nos.)

Three nos. (3 X 50%) for CEP discharge & Three nos. (3 X 50%) for D/A outlet & Boiler Fill Pump Discharge (Boiler Filling Line) point, Positive displacement plunger type Dosing pumps (electrically operated, auto stroke adjusted) with motor, relief valves shall be provided. A Y-type strainer set (3 x 100%) common for three pumps each for CEP discharge & D/A outlet shall be provided.

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4.2.4 AMMONIA BARREL (1 no.) & BARREL PUMP (1 Nos.)

One no.(1) ammonia barrel of suitable capacity with one motor operated barrel pump complete with flexible hose and couplings for transferring concentration Ammonia from drum at ground level to preparation cum metering tank shall be provided.

4.2.5 FLUSHING

DM Water shall be used for flushing the tank shown in P & I drawing.

4.3 NaOH DOSING SYSTEM :

Dosing system shall mainly comprises of the following:

4.3.1 NaOH SOLUTION PREPARATION CUM STORAGE TANK (1 No.)

One (1) no NaOH solution preparation cum storage Tank complete with motorized agitator, CO₂ absorber, dissolving basket, level gauge, level transmitter ,vent, overflow with water seal & drain shall be provided. This tank will be located at the level of DMCW overhead tanks.

4.3.2 NaOH DOSING PUMPS (2 Nos.)

Two nos. (2 X 100%), Positive displacement plunger type Dosing pumps (electrically operated, auto stroke adjusted) with motor, relief valves shall be provided. A Y-type strainer set (2 x 100%) common for two pumps shall be provided.



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SUB VENDOR LIST (TABLE-1)

SL NO.	ITEM	APPROVED SUPPLIERS	PLACE	REMARKS
	MECHANICAL:			
1	TANK/DISSOLVING BASKET/WATER SEAL POT/ CO₂ ABSORBER/BREATHAR	SELF-MAKE OF MAIN VENDOR	AS APPLICABLE	
2	AGITATOR/STIRRER	REMI (REFER NOTE 1)	MUMBAI	
		MILTON ROY INDIA	CHENNAI	
		CEECON	CHENNAI	
		FIBRE & FIBRE		
		POWER PIPING	CHENNAI	
		SWELORE	AHMEDABAD	
		VK PUMPS	NASIK	
3	GATE/GLOBE/NON-RETURN (CHECK) VALVES	PRECISION ENGG.	MUMBAI	
		CRESENT VALVE	MUMBAI	
		BDK	HUBLI	
		LEADER	JALANDHAR	
		CHEMTECH	MUMBAI	
		TECHNO VALVE	MUMBAI	
		FOURESS	MUMBAI	
		FLUIDLINE	MUMBAI	
		STEELSTRONG	MUMBAI	
		L&T AUDCO		
		GM ENGINEEIRNG		
		A.V. VALVES		
		ATAM VALVES	JALANDHAR	
4	2/3 WAY VALVE MANIFOLDS	TECHNO VALVE	MUMBAI	
		HI TECH	AHMEDABAD	
		CHEMTROL		
		BLISS ANAND	GURGAON	
		APPROVED ORIGINAL SUPPLIER FOR THE RESPECTIVE INSTRUMENT	AS APPLICABLE	
5	METERING PUMP WITH PRV			
		MILTON ROY		
		VK PUMP		
		SWELORE		
		METACHEM		
		DENCIL		
		POSITIVE METERING		
		EXCEL HYDRO		
6	PIPES	CHOKSHI TUBES	AHMEDABAD	
		REMI	MUMBAI	
		RATNAMANI	AHMEDABAD	
		PRAKASH STEELAGE	SILVASA	
		KALYANI		
		PRAKASH		
		SAW		
7	FITTINGS	BHARAT FORGE	PUNE	
		RELIANCE FORGE	MUMBAI	



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		EBY	MUMBAI	
		SIDDARTH & GAUTAM	FARIDABAD	
		MS FITTINGS	KOLKATA	
		PRADEEP METALS LTD	MUMBAI	
		TUBE PRODUCT INCOROPORATION	BARODA	
		CSA FITTINGS		
8	FLANGES	PRADEEP METALS LTD	MUMBAI	
		TUBE PRODUCT INCOROPORATION	BARODA	
		RELIANCE FORGE	MUMBAI	
		CD INDUSTRIES		
9	PAINT	BERGER PAINTS	KOLKATA	
		ASIAN PAINTS	MUMBAI	
		SHALIMAR PAINTS	KOLKATA	
		JENSON & NICOLSON	KOLKATA	
		GUNJAN PAINT	MUMBAI	
	ELECTRICAL:			
10	LT MOTORS	KEC	BANGALORE	
		SIEMENS	MUMBAI	
		ABB	FARIDABAD	
		CROMPTON GREAVES LTD	MUMBAI	
		BHARAT BIJLEE	MUMBAI	
		NGEF	BANGALORE	
		MARATHON	KOLKATA	
		JYOTI	VADODARA	
		LHP	SOLAPUR	
	C&I:			
11	LOCAL CONTROL PANEL	INDSUSTRIAL SWITCHGEAR & APPS	MUMBAI	BOM OF THE LCP SHALL BE SUBJECT TO BHEL/ CUSTOMER APPROVAL DURING DETAILED ENGINEERING.
		PROCON	CHENNAI	
		CONTROL & SWITCHGEAR		
		PYROTECH	UDAIPUR	
		DELTA CONTROL	MUMBAI	
		PSI ENGINEERING	CHENNAI	
		MILTON ROY INDIA	KOLKATA	
		RITTAL		
		SUCHITRA		
		INDUSTRIAL CONTROLS & APPLIANCES LTD.		
12	INST CABLES (SCREENED)	RELIANCE	BANGLORE	
		DELTON	FARIDABAD / NEW DELHI	
		NICCO	KOLKATA	
		CHORDS CABLE	BHIWADI	
		UNIVERSAL	SATNA	
		INCAB	PUNE	
		POLYCAB	DAMAN	
13	LT CONTORL CABLES	DELTON	FARIDABAD/N EW DELHI	
		FINOLEX	PUNE	
		NICCO	KOLKATA	



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		PARAMOUNT CABLES	ALWAR	
		FGI	KOLKATA	
		POLYCAB WIRES	DAMAN	
		TORRENT CABLES	NADIAD	
		FINOLEX	PUNE	
		INDUSTRIAL CABLE	RAJPURA	
		THERMOCABLES	HYDERABAD	
		ADVANCE CABLE TECHNOLOGIES	BANGALORE	
		APAR INDUSTRIES	MUMBAI	
		CMI LTD.	FARIDABAD	
		CRYSTAL CABLE INDUSTRIES	KOLKATA	
		DIAMOND POWER	VADODARA	
		ELKEY TELELINKS	NEW DELHI	
		GOVIND CABLES	KOLKATA	
		HAVELLS INDIA	NOIDA	
		KEI INDUSTRIES	DELHI	

14	LEVEL GAUGE	BLISS ANAND PVT. LTD.	
		TOSHNIWAL BROTHERS PVT.LTD.	MAKE:NIVO CONTROLS
		SIGMA INSTRUMENTS CO.	
15	TRANSMITTERS	ABB LIMITED	PRESSURE TRANSMITTER, DP TRANSMITTER and TEMP TRANSMITTER
		Pune Techtrol Pvt. Ltd.	Only for capacitance Type Level Transmitter
		V. AUTOMAT & INSTRUMENTS (P) LTD.	a)DISPLACEMENT TYPE TRANSMITTERS. b)PRESSURE AND DP TRANSMITTERS
		Moore Industries International Inc.	
		PANAM ENGINEERS	For Pressure and Diff. Pressure transmitter
		TOSHNIWAL INDUSTRIES PVT. LTD.,	
		Endress + Hauser (India) Pvt. Ltd.,	
		YOKOGAWA INDIA LIMITED,	
		SBEM PVT. LTD.	FOR CAPACITANCE TYPE.
		SIEMENS LIMITED	
		EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	
		SMART INSTRUMENTS LTD, BRAZIL	LD-301 & T-301 TRANSMITTER FROM M/S SMART EQUIPMENTS BRAZIL.
		NIVO CONTROLS PVT. LTD.	For Capacitance type only
		Honeywell Automation India Limited	
16	JUNCTION BOX	Shrenik & Company,	
	JUNCTION BOX	SUCHITRA INDUSTRIES	
	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Metal type junction box only



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	JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	
	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	
17	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	
	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	
	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	
	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	
17	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	
	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	
	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	
	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	
	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	
	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	
	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	
	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	
	INSTRUMENT FITTINGS	AURA INCORPORATED	
	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	
	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	
	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	
	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	
	INSTRUMENT FITTINGS	PANAM ENGINEERS	
19	Pressure gauge and differential Pressure gauge	SWITZER, CHENNAI. AN INSTRUMENTS, KOLKATA, H GURU, NEW DELHI. MANOMETER INDIA, MUMBAI. GIC, MUMBAI/GOA. GLUCK INDIA, MUMBAI. BUDENBERG GAUGE. DRESSER IND. FORBES MARSHALL. WAREE.	

Notes:-

1. Bidder to note that geared motor of REMI make for stirrers (for stirrers of REMI make ONLY) is acceptable to BHEL.
 2. All the finally selected sub vendors shall be subject to customer approval during detailed engineering without any delivery/ commercial implications to BHEL/ Customer.
 3. Calibration column may be purchased from sources as per pump manufacturer's recommendation.
 4. The sub vendor list enclosed is indicative only and is subject to approval / acceptance by customer.
- Bidder to propose his sub vendor list with back up documents (experience list, end user certificate as applicable) etc. The same shall subject to BHEL and Customer approval during detailed engineering stage without any technical, commercial & delivery implication to BHEL or customer.



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DRAWING DOCUMENTS DISTRIBUTION SCHEDULE

TABLE-2

Sl No	Drg/Doc/MDL	TCE	TSGENC O -HQ	TSGENCO- SITE /TCE SITE	BHEL SITE	PMG BHEL	PEM/ MUs /TBG/ISG PSSR
1	Master list of drawings / doc (duly indicating sch of submission)	Soft copy	Soft copy	Soft Copy	-	Soft copy	*S
2	Drawings / doc for Approval/Information (First Submission)	Soft copy	Soft copy +1 print	Soft copy	-	Soft copy	S
3	Return with comments/approval	S	Soft copy	Soft copy	-	Soft copy	Soft copy
4	Drawings / Documents for approval (2 nd & subsequent submissions till approval)	Soft copy	Soft copy	Soft copy	-	Soft copy	S
5	Drawings /documents for distribution (Approved by TSGENCO)	Soft copy	Soft copy +1 print	Soft copy +2 prints	Soft copy +2 prints	Soft copy	S
6	Erection Drawings / documents	-	1 print	3 prints	6 prints	-	S
7	As built Drawings / documents	-	Soft copy +1 print	Soft copy +3 prints	Soft copy +2 prints	Soft copy	S As applicable
8	Operation & Maintenance Manual	-	Soft copy +1 print	Soft copy +3 prints	Soft copy +2 prints	Soft copy	S
9	Performance & functional Guarantee test reports	-	Soft copy +1 print	Soft copy +3 prints	Soft copy +2 prints	Soft copy	S
10	Type Test Certificate	Soft copy	Soft copy	Soft copy	Soft copy	Soft copy	S
11	Commissioning & Performance Test Protocols	-	Soft copy +1 print	Soft copy +3 prints	Soft copy +2 prints	Soft copy	S
12	Monthly Progress Report	-	Soft copy	Soft copy	Soft copy	S	Soft copy

Note: *S Indicated against 'Agency responsible' for submission of respective document **as per distribution Schedule:**

- Monthly progress report in Soft form shall be sent by BHEL PMG to ED/TPC TSGENCO, CE/TPC, CE (Construction)/Site, CE (Civil/Thermal) and Director (Projects) /TSGENCO .
- Quantity of prints may change during detailed engineering stage based on BHEL / Customer requirement. However the same will be adhered by the bidder without any delivery/commercial implication to BHEL.
- 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 approval.
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copies whichever is later.
- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.
- Bidder has 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-word (as applicable)/MS-Excel (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 / customer will also be submitted by the bidder without any delivery/commercial implication to BHEL.
 - P&IDs., GA & LCP.



TITLE:
TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM.

PROJECT: 5X800 MW TSGENCO YADADRI TPS

BHEL DOCUMENTS NO.: PE-TS-417-154-A001

VOLUME II-B

SECTION -C1

REV. NO. 00

DATE:

TABLE -3

LIST OF COMMISSIONING SPARES

Sl.No.	Description	Quantity per unit	Quantity (Total) for station
A	FOR HYDRAZINE DOSING SYSTEM		
1.1	Oil Seals for drive end for motor	4 Nos.	20 Nos.
1.2	Gaskets for drive end for motor	4 Nos.	20 Nos.
1.3	Guide ring for plunger.	4 Nos.	20 Nos.
1.4	Teflon rings for valve/s.	4 Nos.	20 Nos.
1.5	Level gauge glass	4 Nos.	20 Nos.
1.6	Back up fuse	4 Nos.	20 Nos.
1.7	Pilot lamp	4 Nos.	20 Nos.
1.8	Push Button	4 Nos.	20 Nos.
1.9	Control fuse	4 Nos.	20 Nos.
1.10	Bulb for Annunciation	4 Nos.	20 Nos.
B	FOR AMMONIA DOSING SYSTEM		
1.1	Oil Seals for drive end for motor	4 Nos.	20 Nos.
1.2	Gaskets for drive end for motor	4 Nos.	20 Nos.
1.3	Guide ring for plunger.	4 Nos.	20 Nos.
1.4	Teflon rings for valve/s.	4 Nos.	20 Nos.
1.5	Level gauge glass	4 Nos.	20 Nos.
1.6	Back up fuse	4 Nos.	20 Nos.
1.7	Pilot lamp	4 Nos.	20 Nos.
1.8	Push Button	4 Nos.	20 Nos.
1.9	Control fuse	4 Nos.	20 Nos.
1.10	Bulb for Annunciation	4 Nos.	20 Nos.
C	FOR NaOH DOSING SYSTEM		
1.1	Oil Seals for drive end for motor	4 Nos.	20 Nos.
1.2	Gaskets for drive end for motor	4 Nos.	20 Nos.
1.3	Guide ring for plunger.	4 Nos.	20 Nos.
1.4	Teflon rings for valve/s.	4 Nos.	20 Nos.
1.5	Level gauge glass	4 Nos.	20 Nos.
1.6	Back up fuse	4 Nos.	20 Nos.
1.7	Pilot lamp	4 Nos.	20 Nos.
1.8	Push Button	4 Nos.	20 Nos.
1.9	Control fuse	4 Nos.	20 Nos.
1.10	Bulb for Annunciation	4 Nos.	20 Nos.



TITLE:
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PROJECT: 5X800 MW TSGENCO YADADRI TPS

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DATE:

TABLE -4

LIST OF MANDATORY SPARES

Sl.No.	Description	Quantity
A)	Mechanical Items	
1.1	Piston Ring (Guide Ring)	4 Sets for each type and Duty of Pump
1.2	Piston (Plunger)	4 Sets for each type and Duty of Pump
1.3	Seals and other Wear out Part	2 Sets for each type and Duty of Pump
1.4	Complete Set of Bearings	2 Sets for each type and Duty of Pump
1.5	Crank Shaft	2 Sets for each type and Duty of Pump
1.6	Cross Head Assembly	2 Sets for each type and Duty of Pump
1.7	Connecting Rod Plate	2 Sets for each type and Duty of Pump
1.8	Complete Set of Valves	20% of the total quantity used for each unit for each type and Size or Minimum 2 Nos whichever is higher
1.9	Strainer	2 Nos. for each type, size and duty.
B)	Electrical Items	
1.1	Complete Set of Motor	2 Nos. for each type, Duty and application
1.2	Driving End & Non-Driving End Bearing	6 Set for each type and rating of Motor
1.3	Cooling Fan	4 No. for each type and rating of Motor
1.4	Motor Terminal Block	10 No. for each type and rating of Motor
1.5	Complete Set of Coupling	2 Set for each Application
C)	C&I Spares	
1.1	Transmitters/ Gauges/Switches etc. along with relevant accessories	20% of total or at least 2 Nos (whichever is higher) for Each type along with accessories.
1.2	Solenoid Valves	
1.2.1	Solenoid Valve Coil	4 nos. of each rating & insulation
1.2.2	Plunger	2 nos. of each type
1.2.3	Seat	4 nos. of each type & size
1.2.4	Gaskets	4 sets of each type & size
1.2.5	O-Ring set	10 sets of each type & size



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PAINTING SPECIFICATION (ANNEXURE-I)

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

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

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- 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.

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- 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.

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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

TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM.

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- 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 :

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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.

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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 than 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

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- 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 $\pm 20\%$ 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

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- 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)
- $$\text{Testing Voltage } V = 7900 \sqrt{T} \pm 10 \text{ percent where } T \text{ is the average coating thickness in mm.}$$
- 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 ASTM D 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) :

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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.

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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.

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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.



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QUALITY PLAN

		MANUFACTURER'S NAME & ADDRESS :		QUALITY PLAN				PROJECT 5X800 MW TSGENCO YADADRI TPS				
				ITEM: CHEMICAL DOSING SYSTEM SUB - SYSTEM : CHEMICAL DOSING SYSTEM		QP.NO : REV. : 0 DATE : PAGE : 1 OF 4		PACKAGE CONTRACT NO. MAIN SUPPLIER BHEL/PEM, NOIDA				
S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY**			REMARKS
1	2	3	4	5	6	7	8	9	M	B	R	11
1.0	WELDER'S QUALIFICATION											
1.1	WELDING PROCEDURE SPECIFICATION (WPS)	CORRECTNESS	MA	SCRUTINY	100%	ASME IX	ASME IX	QW 482	P	V	V	
1.2	WELDER PERFORMANCE & PROCEDURE QUALIFICATION RECORD	WELD SOUNDNESS & WELDING PERFORMANCE	MA	PHYSICAL TEST	ASME IX	ASME IX	ASME IX	QW 483 & QW 484	P	V	V	
2.0	TANKS											
2.1	RAW MATERIAL :											
2.1.1	PLATE	CHEMICAL.& PHY. PROPERTIES	MA	CHEM & PHY TEST	1/PLATE/HT BATCH	ASTM A 240 GR.TP 304	ASTM A 240 GR.TP 304	MFG.TC/LAB REPORT	P	V	V	IDENTIFICATION BY BHEL
		IGC TEST	MI	IGC TEST	1/PLATE/HT BATCH	ASTM A 262 PR.'E'	ASTM A 262 PR.'E'					
2.1.2	PIPE FOR NOZZLE	CHEMICAL.& PHY. PROPERTIES	MA	CHEM.& PHY.TEST	1/HT BATCH/SIZE	ASTM A 312 GR.TP 304	ASTM A 312 GR.TP 304	MFG.TC/LAB REPORT	P	V	V	
		MICRO STRUCTURE	MI	GRAIN STRUCTURE	1/HT BATCH/SIZE	FOR HEAT TREATMENT	FOR HEAT TREATMENT	MFG.TC/LAB REPORT	P	V	V	
		IGC TEST	MI	IGC TEST	1/HT BATCH/SIZE	ASTM A 262 PR.'E'	ASTM A 262 PR.'E'	MFG.TC/LAB REPORT	P	V	V	
		HYDRO TEST	NA	LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE	MFG. TC/IR	P	V/W	V	REFER NOTE 4
2.1.3	FLANGES FOR TANKS	CHEMICAL & PHY PROPERTIES	MA	CHEM & PHY TEST	1/HT BATCH	ASTM A 182 GR. F 304	ASTM A 182 GR. F 304	MFG.TC/LAB REPORT	P	V	V	
2.2	IN PROCESS											
2.2.1	DISHED ENDS	DIMENSIONS	MA	MEASUREMENT WITH TEMPLATE	100%	APPD.DWG.(BY BHEL)	APPD.DWG.(BY BHEL)	MFG.TC./LAB REPORT	P	V	V	
		SURFACE DEFECTS ON WELDMENTS		DP TEST	100%	ASTM E 165	NO SURFACE DEFECTS	MFG.TC	P	V	V	
2.3	FINAL ASSEMBLY FOR TANKS:	DIMENSIONS & ORIENTATION	MA	MEASUREMENT	100%	APPD.DWG.(BY BHEL)	APPD.DWG.(BY BHEL)	MFG.TC/INSP REPORT	P	W	W	TO BE OFFERED ALONG WITH FINAL SKID ASSEMBLY INSPECTION.
			MA	VISUAL		APPD.DWG.(BY BHEL)	APPD.DWG.(BY BHEL)	MFG.TC/INSP REPORT	P	W	W	
2.3.1		LEAKAGE	MA	WATER FILL FOR 2 HR	100%	N.A.	NO LEAKAGE	MFG.TC/INSP. REPORT	P	W	W	
3.0	STIRRER :											
3.1	RAW MATERIAL FOR SHAFT	CHEM.& PHY. PROPERTIES	MA	CHEM & PHY TEST	1/BAR	ASTM A 479 GR.TP 304	ASTM A 479 GR.TP 304	MFG.TC/LAB REPORT	P	V	V	
		IGC TEST	MA	IGC TEST	1/HT BATCH	ASTM A 262 PR.'E'	ASTM A 262 PR.'E'	MFG.TC/LAB REPORT				
3.2	IMPELLER	CHEMICAL PROP.	MA	CHEMICAL TEST	1/PLATE	ASTM A 240 GR.TP 316	ASTM A 240 GR.TP 316	MFG.TC/LAB REPORT	P	V	V	
3.3	COMPLETE STIRRER UNIT WITH MOTOR	PERFORMANCE IN WATER FILLED TANK										
		- VIBRATION	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V	
		- WOBBLING	MA	VISUAL	100%	NO WOBBLING	NO WOBBLING	MFG.TC	P	V	V	
		- POWER CONSUMPTION/ CURRENT DRAWN	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V	
4.0	MOTORS:	ROUTINE TEST	MA	MFG. TC	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V	
		TYPE TEST	MA	MFG. TC	1/ SIMILAR FRAME SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V	
		DEGREE OF PROTECTION	MA	MFG. TC	1/ SIMILAR FRAME SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V	
				** LEGEND : M : MANUFACUTRER/SUB-CONTRACTOR/SUB-VENDOR B : BHEL/ NOMINATED INSPECTION AGENCY "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION								
MANUFACTURER/ SUB CONTRACTOR		MAIN SUPPLIER--BHEL		R: CUSTOMER								
SIGNATURE						SIGNATURE OF APPROVAL BY CUSTOMER						
THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-417-154-A001												

		MANUFACTURER'S NAME & ADDRESS :		QUALITY PLAN				PROJECT 5X800 MW TSGENCO YADADRI TPS				
				ITEM: CHEMICAL DOSING SYSTEM		QP.NO : REV. : DATE :		PACKAGE CONTRACT NO.				
				SUB - SYSTEM : 		0		CHEMICAL DOSING SYSTEM				
				CHEMICAL DOSING SYSTEM		PAGE : 2 OF 4		MAIN SUPPLIER BHEL/PEM, NOIDA				
S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY**			REMARKS
1	2	3	4	5	6	7	8	9	M	B	R	11
5.0	METERING PUMP:											
5.1	RAW MATERIAL :											
5.1.1	WETTED PARTS	CHEM & PHY. PROPERTIES	MA	CHEM. & PHY. TEST	1/BAR	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V	
		SURFACE TEST	MI	UT ON BAR>25 MM DIA	100%	ASTM A 388	REF. NOTE # 1	MFG.TC/LAB REPORT	P	V	V	
				DP ON M/C SURFACE	100%	ASME - E - 165	NO SURFACE DEFECTS	MFG.TC/LAB REPORT	P	V	V	
5.2	FINAL INSPECTION											
5.2.1	PUMP WITH MOTOR	LINEARITY	MA	PERFORMANCE	100%	API 675	API 675	INSPECTION REPORT	P	W	V	SHALL BE TESTED WITH EITHER JOB MOTOR OR SHOP MOTOR OF SIMILAR FRAME SIZE
		STEADY STATE ACCURACY	MA	SHOP TEST	100%	API 675	API 675	INSPECTION REPORT	P	W	V	
		REPEATABILITY	MA	SHOP TEST	100%	API 675	API 675	INSPECTION REPORT	P	W	V	
		POWER DRAWN @ 100% STROKE	MA	MEASURED AT WORK	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	INSPECTION REPORT	P	W	V	
		LEAKAGE	MA	HYDRO TEST	100%	@1.5X DESIGN PRESSURE	NO LEAKAGE	INSPECTION REPORT	P	W	V	
		DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	V	
		NOISE	MA	MEASUREMENT	100%	--	< 85 dbA AT 1 M RADIUS	INSPECTION REPORT	P	W	V	
		VIBRATION	MA	MEASUREMENT	100%	--	≤45 MICRONS (PEAK TO PEAK)	INSPECTION REPORT	P	W	V	
7.0	PRESSURE RELIEF VALVE	SET & RESET PRESSURE.	MA	PERFORMANCE	100%	BHEL APPD.DATA SHEET & API RP-520	BHEL APPD.DATA SHEET & API RP-520	MFG. TC	P	V	V	
		DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG. TC	P	V	V	
		LEAKAGE DURING PERFORMANCE TEST	MA	VISUAL	100%	NO LEAKAGE	NO LEAKAGE	MFG. TC	P	V	V	
8	VALVES (GATE, GLOBE & NRV)											
8.1	RAW MATERIAL :											
8.1.1	BODY, BONNET COVER	CHEM. & PHY PROPERTIES	MA	CHEM. & PHY TEST	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG. TC/LAB REPORT	P	V	V	
		HEAT TREATMENT	MA	HEAT TREATMENT	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG. TC/LAB REPORT	P	V	V	
8.1.2	TRIM MATERIAL	CHEM. & PHY PROPERTIES	MA	CHEM. & PHY TEST	1/BAR/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG. TC/LAB REPORT	P	V	V	
8.2	ASSEMBLY											
		LEAKAGE (BODY & SEAT)		HYDRO TEST	100%	BHEL APPD.DATA SHEET	NO LEAKAGE	MFG TC	P	V	V	
		LEAKAGE (SEAT)		PNEUMATIC TEST	100%	BHEL APPD.DATA SHEET	NO LEAKAGE	MFG TC	P	V	V	
		DIMENSIONS		MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG TC	P	V	V	
MANUFACTURER/ SUB CONTRACTOR		MAIN SUPPLIER--BHEL		** LEGEND : M : MANUFACTURER/SUB-CONTRACTOR/SUB-VENDOR B : BHEL/NOMINATED INSPECTION AGENCY R: CUSTOMER "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION								
SIGNATURE								SIGNATURE OF APPROVAL BY CUSTOMER				
THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-417-154-A001												

		MANUFACTURER'S NAME & ADDRESS :		QUALITY PLAN				PROJECT 5X800 MW TSGENCO YADADRI TPS					
				ITEM: CHEMICAL DOSING SYSTEM		QP.NO :		PACKAGE CHEMICAL DOSING SYSTEM		CONTRACT NO.			
				SUB - SYSTEM :		REV. : 0		DATE :		MAIN SUPPLIER BHEL/PEM, NOIDA			
				CHEMICAL DOSING SYSTEM		PAGE : 3 OF 4							
S.NO	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY**				
1	2	3	4	5	6	7	8	9	M	B	R	11	
9.0	FITTING/FLANGES FOR PIPING:												
9.1	RAW MATERIAL	CHEM. & PHY PRPERTIES	MA	CHEM. & PHY TEST	1/HT BATCH	ASTM A 182 GR.TP 304	ASTM A 182 GR.TP 304	MFG.TC/LAB REPORT	P	V	V		
		HEAT TREATMENT	MA	HEAT TREATMENT	100%	ASTM A 182 GR.TP 304	ASTM A 182 GR.TP 304	MFG.TC/LAB REPORT	P	V	V		
		IGC TEST	MI	IGC TEST	1/HT BATCH	ASTM A 262 PR. 'E'	ASTM A 262 PR. 'E'	MFG.TC/LAB REPORT	P	V	V		
9.2	FINAL INSPECTION	DIMENSIONS	NA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG/ ANSI B 16.11/16.5	BHEL APPD.DATA SHEET/DWG/ ANSI B 16.11/16.5	MFG.TC	P	V	V		
10.0	STRAINERS :												
10.1	RAW MATERIAL FOR BODY	PHY. & CHEM. PROPERTIES	MA	PHY. & CHEM.TEST	1/BAR/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TCLAB REPORT	P	V	V		
10.2	SCREEN	CHEMICAL	MA	CHEMICAL	1/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V		
		MESH SIZE	MA	MEASUREMENT	1/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V		
10.3	FINAL INSPECTION	DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V		
		LEAKAGE		HYDRO TEST	1	BHEL APPD.DATA SHEET	NO LEAKAGE	MFG.TC	P	V	V		
11.0	PIPE (SEAMLESS)												
11.1	MATERIAL	CHEMICAL	MA	CHEMICAL	1/HT BATCH/SIZE	ASTM A 312 GR.TP 304	ASTM A 312 GR.TP 304	MFG.TC/LAB REPORT	P	V	V		
		MECHANICAL TEST	MA	MECHANICAL TEST	1/HT BATCH/SIZE	ASTM A 312 GR.TP 304	ASTM A 312 GR.TP 304	MFG.TC/LAB REPORT	P	V	V		
		MICRO STRUCTURE	MI	GRAINS STRUCTURE	1/HT BATCH/SIZE	FOR HEAT TREATMENT	FOR HEAT TREATMENT	MFG.TC/LAB REPORT	P	V	V	IDENTIFICATION BY BHEL. REFER NOTE 4.	
		IGC TEST	MI	IGC TEST	1/HT BATCH/SIZE	ASTM A 262 PR 'E'	ASTM A 262 PR 'E'	MFG.TC/LAB REPORT	P	V	V		
		HYDRO TEST	MA	LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE	MFG.TC/IR	P	V/W	V		
12.0	LEVEL GAUGE :												
12.1	RAW MATERIAL	CHEM.PROPERTIES	MA	CHEM.TEST	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V		
12.2	FINAL INSPECTION	DIMENSION	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V		
		LEAKAGE	MA	HYDRO TEST	100%	BHEL APPD.DATA SHEET	NO LEAKAGE	MFG.TC	P	V	V		
13.0	PRESSURE & DP GAUGE												
13.1	MAT. FOR WETTED PARTS & BOU	CHEM.PROPERTIES	MA	CHEM.TEST	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V		
13.2	FINAL INSPECTION	DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG.TC/LAB REPORT					
13.3	PERFORMANCE	ACCURACY & OVERLOAD PROTECTION	MA	CALIBRATION	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG. TC	P	V	V		
14.0	SWITCHES(LEVEL, PRESURE & DP) & TRANSMITTERS (LEVEL, PRESSURE & DP):												
14.1	MAT. FOR WETTED PARTS	CHEM.PROPERTIES	MA	CHEM.TEST	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V		
14.2	PERFORMANCE	FUNCTIONAL	MA	CALIBRATION & VISUAL	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V		
		IR-HV-IR		ELECTRICAL	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V		
		DIMENSIONS		MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG.TC	P	V	V		
		DEGREE OF PROTECTION	MI	VERIFICATION OF TYPE TEST CER	TYPE TEST	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V		
				** LEGEND : M : MANUFACUTRER/SUB-CONTRACTOR/SUB-VENDOR B : BHEL/NOMINATED INSPECTION AGENCY "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION									
MANUFACTURER/ SUB CONTRACTOR		MAIN SUPPLIER--BHEL		R: CUSTOMER									
SIGNATURE									SIGNATURE OF APPROVAL BY CUSTOMER				

THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-417-154-A001

		MANUFACTURER'S NAME & ADDRESS :		QUALITY PLAN				PROJECT : 5X800 MW TSGENCO YADADRI TPS				
				ITEM: CHEMICAL DOSING SYSTEM		QP.NO : REV. : 0 DATE :		PACKAGE : CONTRACT NO. :		CHEMICAL DOSING SYSTEM		
				SUB - SYSTEM :		PAGE : 4 OF 4		MAIN SUPPLIER : BHEL/PEM, NOIDA				
				CHEMICAL DOSING SYSTEM								
S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY**			REMARKS
1	2	3	4	5	6	7	8	9	M	B	R	10
15.0	CONTROL PANEL :	DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	CONTOL PANEL TEST TO BE OFFERED ALONG WITH FINAL SKID ASSEMBLY.
		CONTINUITY, IR-HV-IR	MA	ELECTRICAL	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		VERIFICATION OF MAKE	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		RATING OF COMPONENTS	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		PAINT SHADES, THICKNESS	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		ADHESION	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		DEGREE OF PROTECTION	MI	VERIFICATION OF TYPE TEST CERTIFICATE	TYPE TEST	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG.TC/LAB REPORT	P	V	W	
16.0	COMPLETE SKID ASSEMBLY:	DIMENSIONS & ORIENTATION	CR	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		LEAKAGE, CHECK ON WELDMENTS		VISUAL & HYDRO TEST	100%	DISCH.PIPING - 1.5 x DISCH PR. OF PUMP	NO LEAKAGE	INSPECTION REPORT	P	W	W	
		FUNCTIONAL TEST FOR INTERLOCKS	MA	VISUAL	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
	PMI Test for SS	GRADE CONFIRMATION	MA	CHEM.TEST	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		PAINTING	MA	VISUAL & MEASUREMENT	100%	BHEL APPD PAINTING SCHEME	APPD DWG/PAINTING	INSPECTION REPORT	P	W	W	
NOTE-1) WHEN BACK WALL ECHO IS SET TO 100% OF FSH IN SOUND AREA, DEFECT ECHO SHALL NOT EXCEED 20% OF FSH. MAX BACH WALL ECHO IS 20% OF FSH. TOTAL NO OF DEFECTS SHALL BE MAX. 5 NO IN ONE METER LENGTH. MIN DISTANCE BETWEEN TWO DEFECTS SHALL BE 3 TIMES THE DIA OF BAR.												
NOTE-2) CHEMICAL DOSING SKID VENDOR SHALL BE SELECTED FROM CUSTOMER APPROVED SOURCES. ALL THE BOUGHT OUT ITEMS OF THE CHEMICAL DOSING VENDOR SHALL BE PROCURED FROM BHEL APPROVED SOURCES.												
NOTE- 3) ALL VENDOR DRAWINGS/DATASHEETS SHALL BE APPROVED BY BHEL. ONLY MANUFACTURING QP(PREPARED IN LINE WITH THIS STANDARD QP) OF THE VENDOR SHALL BE FORWARDED FOR CUSTOMER APPROVAL. ALL THE BHEL APPROVED DOCUMENTS SHALL BE FURNISHED TO CUSTOMER FOR INFORMATION/RECORDS ALONG WITH O&M MANUAL. COPY OF THE SAME SHALL ALSO BE FURNISHED TO INSPECTION AGENCY DURING INSPECTION.												
NOTE 4) FOR PIPES PURCHASED DIRECTLY FROM MANUFACTURER'S OR AUTHORIZED DEALERS, APART FROM TC REVIEW, CHECK WILL BE AS PER CLAUSE 2.1.2 AND 10.0; HOWEVER FOR HYDRAULIC TEST, MANUFACTURER TC SHALL BE REVIEWED . IN CASE ON IMPORTED PIPES PURCHASED FROM OPEN MARKET, TEST SHALL BE PERFORMED AS PER CLAUSE 2.1.2 AND 10.0 (INCLUDING HYDRAULIC TEST).												
NOTE 5) FOR RAW MATERIAL (BARS/PIPES/CASTINGS/FORGINGS) WHERE HEAT TREATMENT ARE CARRIED OUT BY MATERIAL PRODUCERS ON BULK QUANTITIES, THEIR TEST CERTIFICATE SHALL BE REVIEWED (EXCEPT TIME TEMPERATURE CHART)												
NOTE 6) NDT REQUIREMENT ON WELDING (TANK, PIPE, BREATHER/WATER SEAL/CO2 ABSORBER) SHALL BE AS -- A) ON BUTT WELD-- 25% DP & 25% RT FOR PUMP SUCTION SIDE & 100% DP & 100% RT FOR PUMP DISCHARGE SIDE. B) ON FILLET WELD--100% DP TEST												
		** LEGEND :										
MANUFACTURER/ SUB CONTRACTOR		MAIN SUPPLIER--BHEL		M : MANUFACUTRER/SUB-CONTRACTOR/SUB-VENDOR B : BHEL/NOMINATED INSPECTION AGENCY R: CUSTOMER								
SIGNATURE				"P" PERFORM, "W" WITNESS, AND "V" VERIFICATION								
THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-417-154-A001												



TITLE:
**TECHNICAL SPECIFICATION FOR CHEMICAL
DOSING SYSTEM.**

PROJECT: 5X800 MW TSGENCO YADADRI TPS

BHEL DOCUMENTS NO.: PE-TS-417-154-A001

VOLUME II-B

SECTION –C1

REV. NO. 00

DATE:

DATA SHEET-A



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

BHEL DOCUMENTS NO.: PE-TS-417-154-A001

VOLUME II-B

SECTION –C1

SECTION –C1

DATA SHEET-A

SL.No.	Description	Hydrazine		Ammonia		NaOH
1.0	Total No. of skid for each Unit/ entire	One (1)/Five (5)		One (1)/Five (5)		One (1)/Five (5)
2.0	Barrel pump (Motor Operated)	One (1)		One (1)		Not Applicable
3.0	Concentrated Solution Storage Tanks					
3.1	No. of tanks per Skid	Two (2)		Two (2)		Not Applicable
3.2	Capacity in litres	50		100		Not Applicable
3.3	Type	-----Vertical cylindrical, Dished end-----				
3.4	Minimum free board	300 mm		300 mm		Not Applicable
3.5	Material of the tank	SS-316		SS-316		Not Applicable
3.6	Fluid Handled	Concentration of Hydrazine -80 % max		Concentration of Ammonia -25 %		Not Applicable
3.7	Design Code	IS 803 or Equiv.		IS 803 or Equiv.		Not Applicable
3.8	Design Temperature	60 Deg C.		60 Deg C.		Not Applicable
3.9	Thickness	6 mm		6 mm		Not Applicable
3.10	Motorised Stirrer	Not Applicable		Not Applicable		Not Applicable
4.0	Solution Preparation Tanks					
4.1	No. of tanks per Skid	Two (2)		Two (2)		One (1)
4.2	Capacity in litres	2000		800		500
4.3	Type	-----Vertical cylindrical, Dished end-----				
4.4	Minimum free board	300 mm		300 mm		300 mm
4.5	Material of the tank	SS-304		SS-304		SS-304
4.6	Fluid Handled	Dilute Hydrazine solution – 0.6 % (for normal operation)		Ammonia solution – 3.0 % (for normal operation)		Dilute Sodium Hydroxide solution
4.7	Design Code	IS 803 or Equiv.		IS 803 or Equiv.		IS 803 or Equiv.
4.8	Design Temperature	60 Deg C.		60 Deg C.		60 Deg C.
4.9	Thickness	6 mm		6 mm		6 mm
4.10	Motorised Stirrer	Provided		Provided		Provided
4.11	MOC of stirrer	SS-304		SS-304		SS-304
4.12	Dissolving basket	Not Applicable		Not Applicable		Provided (30
4.13	Type of agitator	Motor operated (Propeller type with slow speed reduction gear unit)				
4.14	Speed	Not to exceed 100 RPM.				
5.0	Injection pump:					
5.1	Medium to be handled	0.6-35 % Hydrazine solution		3-15 % Ammonia solution		3% NaOH solution
5.2	Type of pump	Electromechanical, positive displacement, constant speed variable stroke & plunger type				
5.3	No. of pump-motor assembly (each Skid)	3 Nos. (For CPU O/L)	3 Nos. (For D/A O/L)	3 Nos. (For CPU	3 Nos. (For D/A	2 Nos.
5.4	Capacity	100 LPH	100 LPH	100 LPH	100 LPH	10 LPH
5.5	Discharge pressure	45 Kg/cm2 (g)	20 Kg/cm2 (g)	45 Kg/cm2 (g)	20 Kg/cm2 (g)	10 Kg/cm2 (g)
5.6	Material of construction					
A)	Housing	2 % Ni Cast Iron.				
B)	Pump head	SS 316				



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

BHEL DOCUMENTS NO.: PE-TS-417-154-A001

VOLUME II-B

SECTION –C1

SECTION –C1

C)	Valve and valve housing	SS316		
D)	Worm	Manganese Bronze / Cast Iron.		
E)	Worm Wheel	Manganese Bronze / Cast Iron.		
F)	Shafts (worm)	Hardened Steel (EN 19 / ASTM A 276 Gr. 410).		
G)	Base plate	MS		
H)	Foundation bolts	SS304		
5.7	Design standard	API 675.		
5.8	Service temperature	60 Deg C		
5.9	Range of Capacity Adjustment	0-100%		
5.10	Pulsation dampner	Provided	Provided	Provided
5.11	Pressure relief valves	Provided	Provided	Provided
6.0	Barrel Pump (Motor Operated)			
6.1	Quantity (For each Skid)	One (1)	One (1)	Not Applicable
6.2	Service	To transfer Chemical from Barrel to the respective Concentrated Storage Tank		Not Applicable
6.3	Type of pump	Dispensing type.		Not Applicable
6.4	Type of Casing	Foot mounted.		Not Applicable
6.5	Service temperature	60 Deg C		Not Applicable
6.6	Rated Capacity, in LPH	Not less than 500		Not Applicable
6.7	Range of Capacity Adjustment	10 % - 100 %.		Not Applicable
6.8	Material of construction			
A)	Liquid end	SS316		Not Applicable
B)	Diaphragm	PTFE		Not Applicable
C)	Foundation bolts	SS304		Not Applicable
7.0	Strainers:			
7.1	No. of strainers	Two (2 X100%) at CPU outlet and Boiler fill line dosing pump suction. Two (2 X100%) at D/A outlet dosing pump suction.		Two (2X100%)
7.2	Type	Y-Type	Y-Type	Y-Type
7.3	Material of screen	SS-316	SS-316	SS-316
7.4	Mesh Size	30(BS)	30(BS)	30(BS)
8.0	Piping:			
8.1	Material	ASTM A 312 TP 304 (Seamless)		
8.2	Diameter	25 NB/15 NB	25 NB/15 NB	25 NB/15 NB
9.0	Valves:			
9.1	Body Material	SS 304	SS 304	SS 304
9.2	Weld ends	Socket weld ends	Socket weld ends	Socket weld
10.0	Access ladder and platform	Provided with chequered plate all over the skid.		



TITLE:
**TECHNICAL SPECIFICATION FOR CHEMICAL
DOSING SYSTEM.**

PROJECT: 5X800 MW TSGENCO YADADRI TPS

BHEL DOCUMENTS NO.: PE-TS-417-154-A001

VOLUME II-B

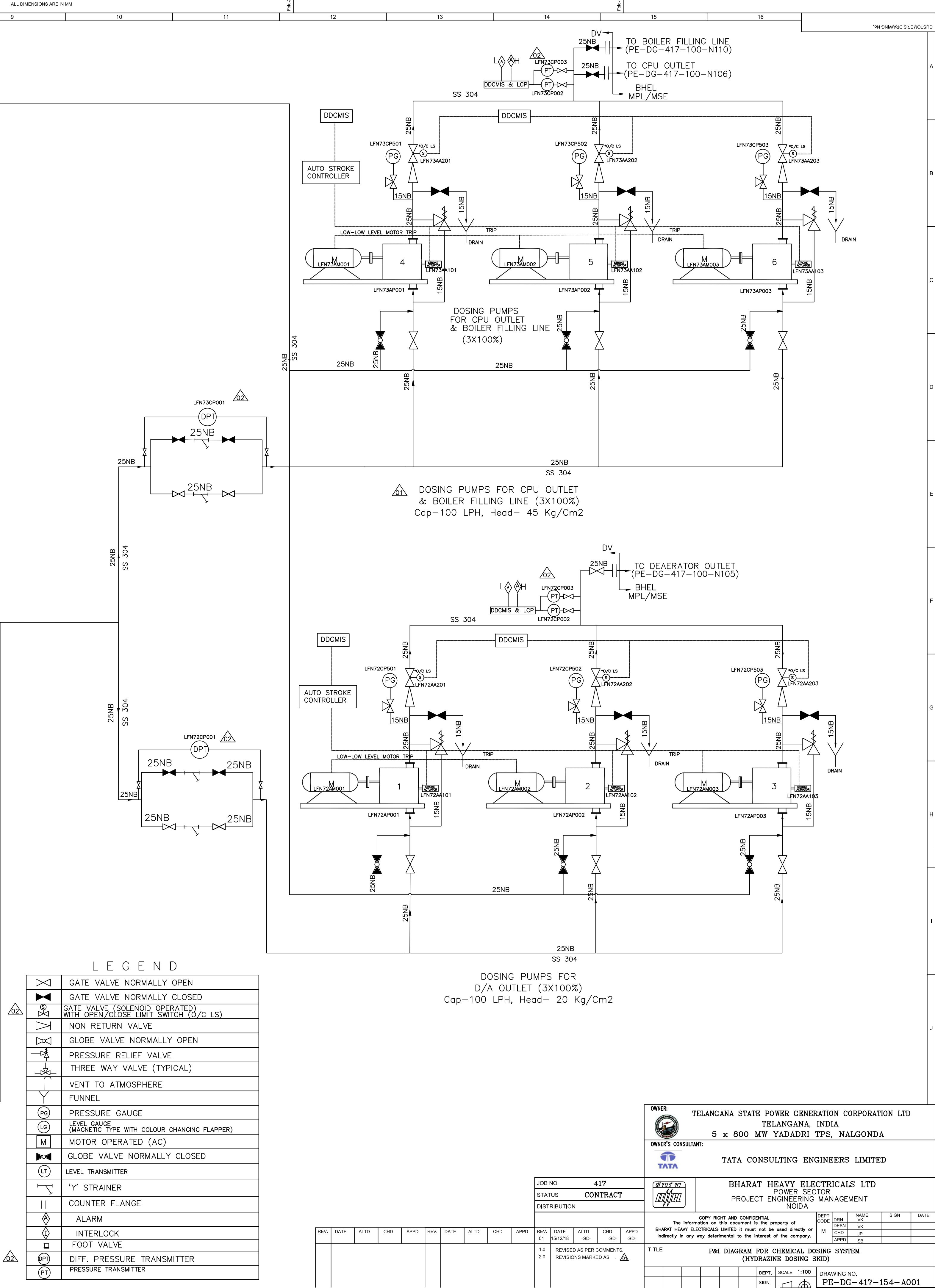
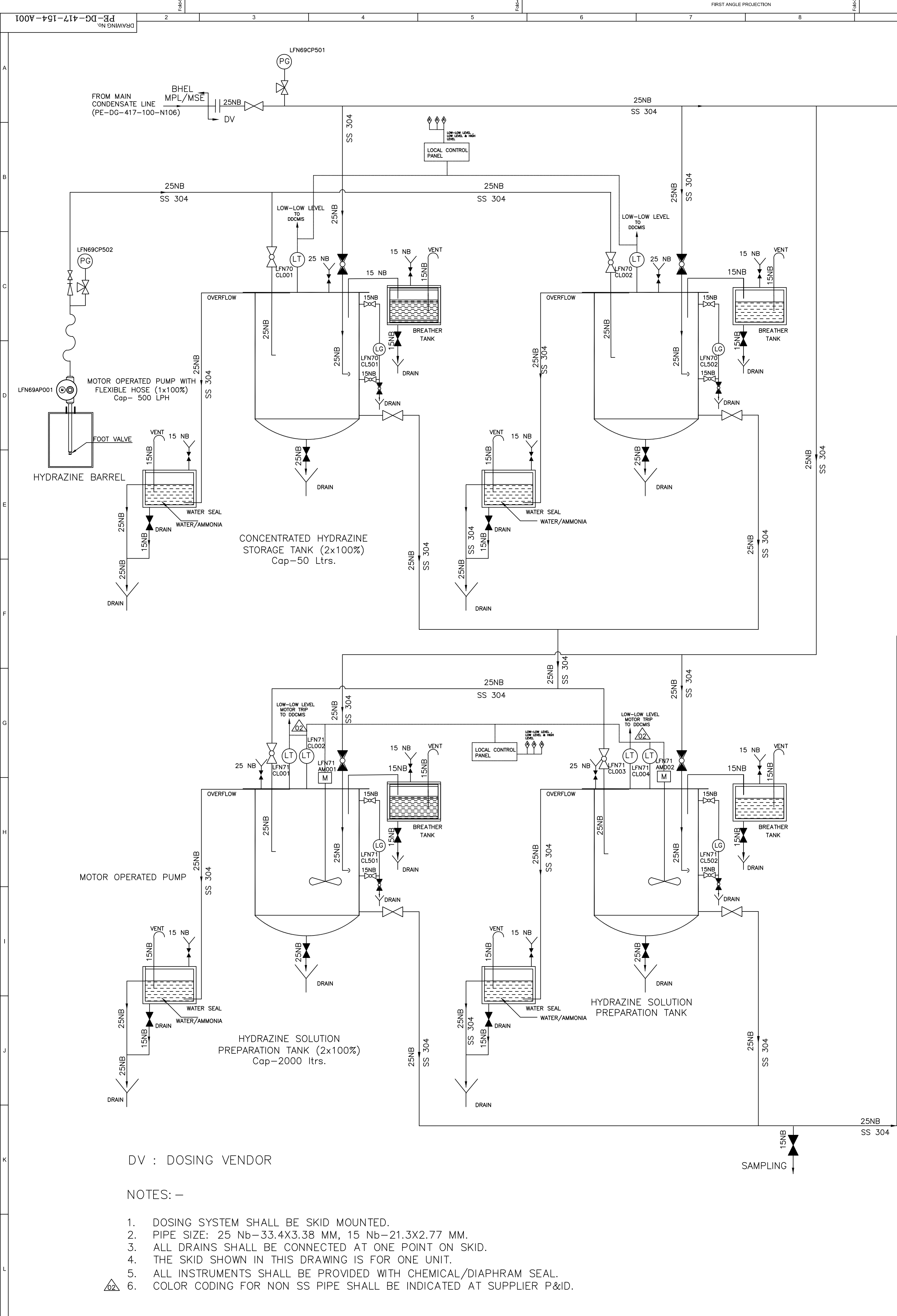
SECTION –C1

REV. NO. 00

DATE:

DRAWING

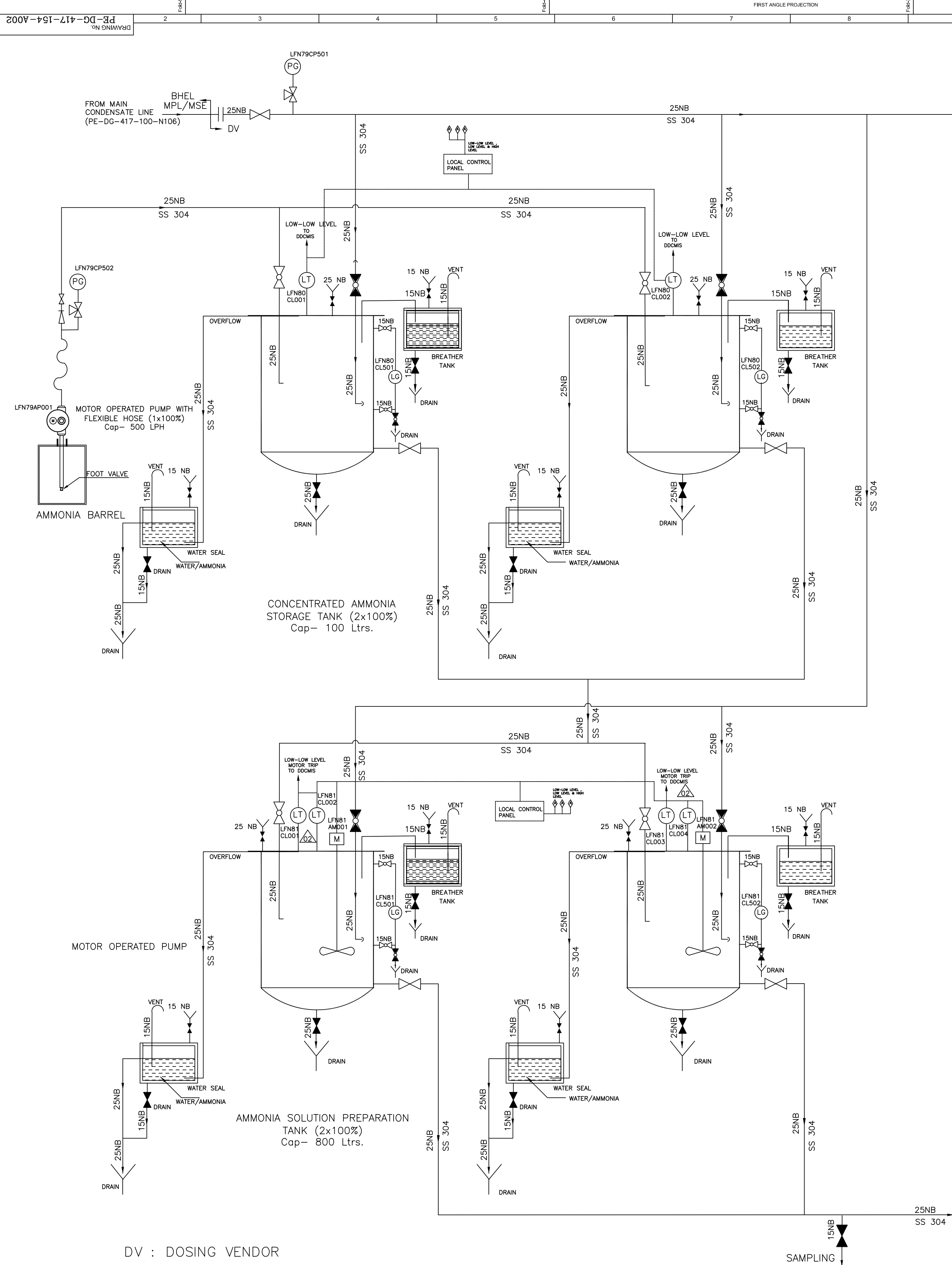
(P&ID FOR DOSING SYSTEM)



5.4 P&ID.DWG
COMPUTED FILE NAME: 5.4 P&ID.DWG

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PE-DG-417-154-A002

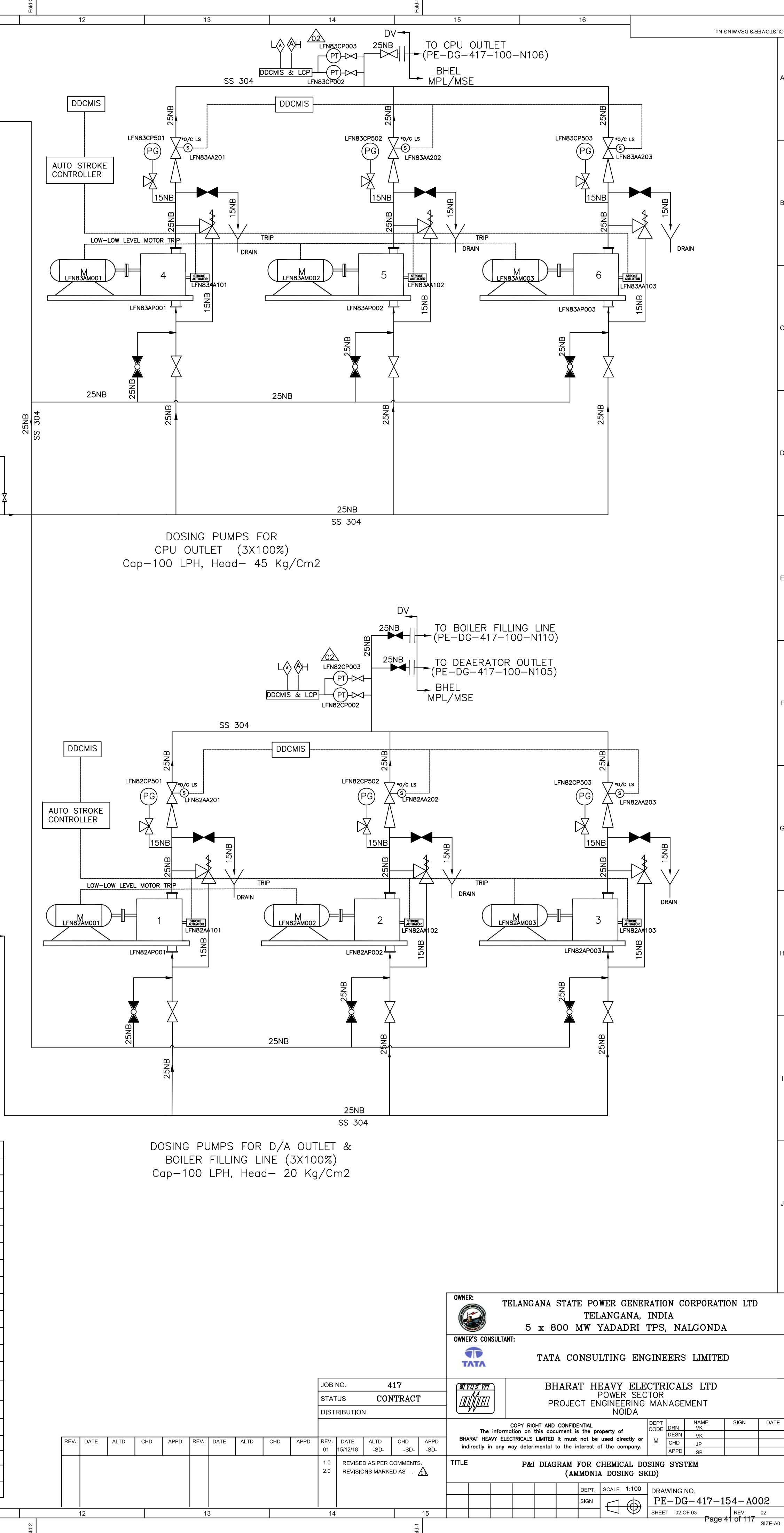


DV : DOSING VENDOR

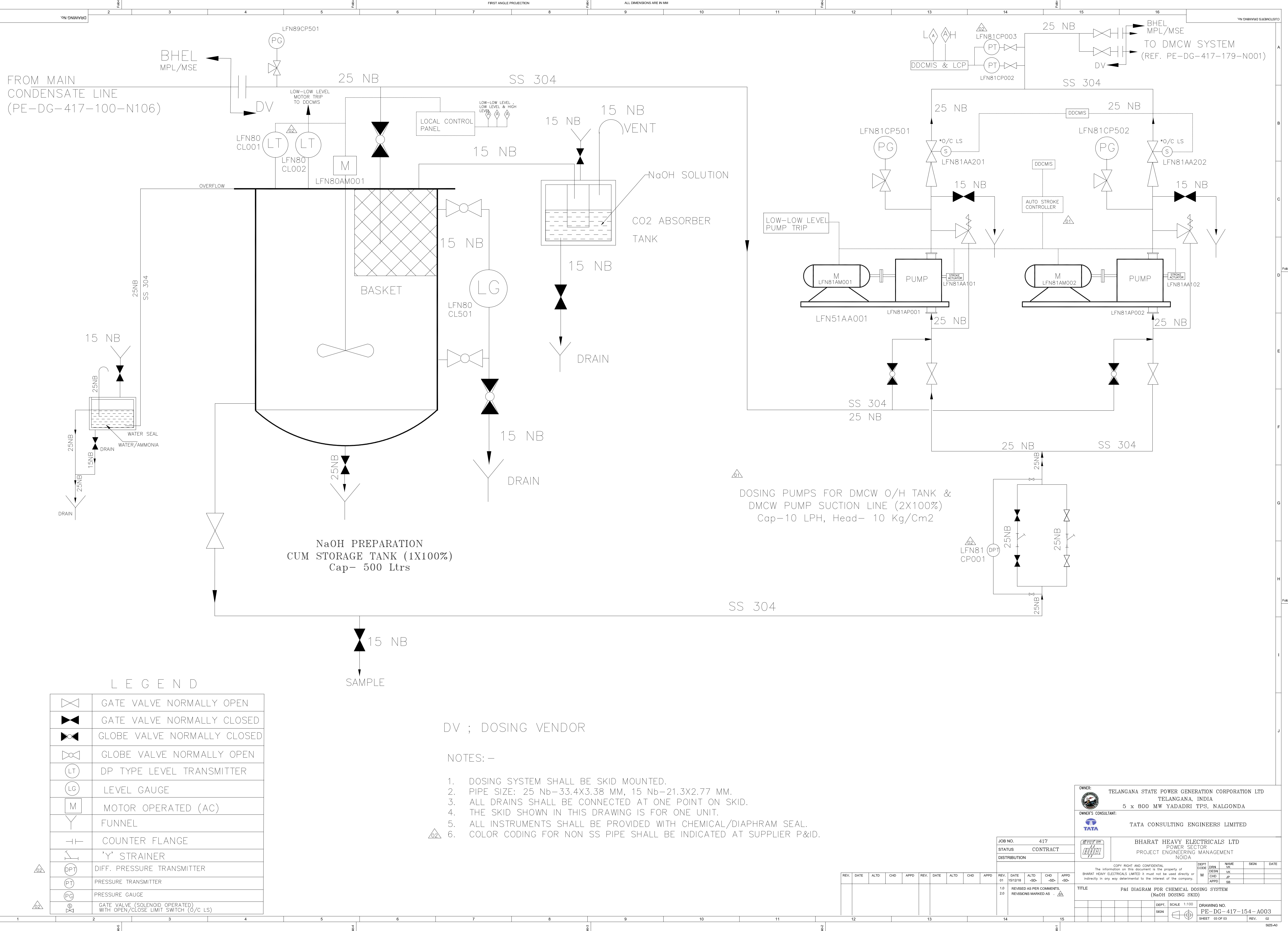
NOTES: -

- DOSING SYSTEM SHALL BE SKID MOUNTED.
- PIPE SIZE: 25 Nb-33.4x3.38 MM, 15 Nb-21.3x2.77 MM.
- ALL DRAINS SHALL BE CONNECTED AT ONE POINT ON SKID.
- THE SKID SHOWN IN THIS DRAWING IS FOR ONE UNIT.
- ALL INSTRUMENTS SHALL BE PROVIDED WITH CHEMICAL/DIAPHRAM SEAL.
- COLOR CODING FOR NON SS PIPE SHALL BE INDICATED AT SUPPLIER P&ID.

LEGEND	
	GATE VALVE NORMALLY OPEN
	GATE VALVE NORMALLY CLOSED
	GATE VALVE (SOLENOID OPERATED) WITH OPEN/CLOSE LIMIT SWITCH (O/C LS)
	NON RETURN VALVE
	GLOBE VALVE NORMALLY OPEN
	PRESSURE RELIEF VALVE
	THREE WAY VALVE (TYPICAL)
	VENT TO ATMOSPHERE
	FUNNEL
	PRESSURE GAUGE
	LEVEL GAUGE (MAGNETIC TYPE WITH COLOUR CHANGING FLAPPER)
	MOTOR OPERATED (AC)
	GLOBE VALVE NORMALLY CLOSED
	LEVEL TRANSMITTER
	'Y' STRAINER
	COUNTER FLANGE
	ALARM
	INTERLOCK
	FOOT VALVE
	DIFF. PRESSURE TRANSMITTER
	PRESSURE TRANSMITTER



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																																																	
																																																			
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TITLE		P&ID DIAGRAM FOR CHEMICAL DOSING SYSTEM (AMMONIA DOSING SKID)																																																	
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		Page 41 of 117		SIZE-A0																																															





TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM.

PROJECT: 5X800 MW TSGENCO YADADRI TPS

BHEL DOCUMENTS NO.: PE-TS-417-154-A001

VOLUME II-B

SECTION –C2

REV. NO. 00

DATE:

SECTION – C2

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR FOR SKID MOUNTED SYSTEM (FOR EPC PROJECTS)**PACKAGE : CHEMICAL DOSING SYSTEM****SCOPE OF VENDOR: SUPPLY****PROJECT :**

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V, 3 phase, 4 wire AC supply shall be provided by BHEL. based on the load data provided by the vendor at contract stage for all equipment supplied by the vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local control panel	Vendor	Vendor*	Refer C & I specification for details
3	Local push buttons	Vendor	Vendor*	
4	Power cables, ordinary control cables and screened control cables	Vendor	Vendor*	Within the skid. If starters are in MCC, then outside skid, cables scope shall be as per note no. 1.
5	Junction box for control & instrumentation cable (if applicable)	Vendor	Vendor*	
6	Any special type of cable like compensating, co-axial, prefab, MICC & fibre optical	Vendor	Vendor*	Within the skid
7	Equipment grounding	Vendor	Vendor*	Within the skid. All equipment metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL.
8	Motors with base frame and fixing hardware for motors.	Vendor	Vendor*	Makes shall be subject to customer/ BHEL approval at contract stage.

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR FOR SKID MOUNTED SYSTEM (FOR EPC PROJECTS)**PACKAGE : CHEMICAL DOSING SYSTEM****SCOPE OF VENDOR: SUPPLY**

9	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor*	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
10	Below grade grounding	BHEL	BHEL	
11	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
12	Electrical Equipment GA drawing & skid GA drawing	Vendor	-	For necessary interface review.

NOTES :- 1. If motor starters are provided in main MCC then BHEL will provide power & control cable including supply, laying & termination.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.

*E & C by vendor during factory assembling of the skid.

[illegible]

NOTES:

1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (dc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTOR CONTROLLED)



LOAD DATA (ELECTRICAL)

JOB NO.	417	ORIGINATING AGENCY		PEM (ELECTRICAL)	
PROJECT TITLE	5 X 800 MW YADADRI TPS	NAME		DATA FILLED UP ON	
SYSTEM / S	CHEMICAL DOSING SYSTEM	SIGN.		DATA ENTERED ON	
DEPTT. / SECTION	MAUX	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE	Page 46 of 117



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**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM.
PROJECT: 5X800 MW TSGENCO YADADRI TPS**

BHEL DOCUMENTS NO.: PE-TS-417-154-A001

VOLUME II-B

SECTION –C3

REV. NO. 00

DATE:

**SECTION – C3
SPECIFIC TECHNICAL REQUIREMENTS (CONTOL AND
INSTRUMENTATION)**



1.0 CONTROL PHILOSOPHY

This control write-up is applicable for the following LP dosing systems:

- i) Hydrazine dosing system.
- ii) Ammonia dosing system.
- iii) NaOH dosing system.

The control of all dosing systems shall be realized in DDCMIS including ON/OFF command of the individual pumps and stirrers. All controls, fault indicators/alarms, interlocks, Trip logics shall be implemented in DDCMIS. Separate local panel shall be provided for each of the above said system.

The starter of all the motors shall be clubbed with main plant MCC. Power to all pumps, agitators etc. shall be fed from MCC. DCS commands shall be routed through respective MCC.

A local panel comprising of 'START' push button, 'STOP' push button along with 'ON/OFF/TRIP' indication, local/ remote indication, stroke position indicator, raise/ lower push button for stroke position and local annunciation shall be provided for local operation. The 'STOP' push button shall be wired directly to MCC whereas 'START' push button shall be routed to DDCMIS.

The ON/OFF operation of all motorized stirrers and pumps shall also be provided in DDCMIS with local ON, OFF facility.

The auto stroke controllers of each pump shall be provided in the local panel. The stroke position & adjustment will be done from Plant DCS & Local panel and the stroke controller shall be suitable for accepting 4-20 mA DC signals. The pumps shall be provided with 24 V DC, 2- wire LVDT Type Position feedback transmitter to generate 4-20 mA DC signals to indicate stroke position in DDCMIS & Local panel.

The Local/ Remote selection switch (soft) shall be provided in DDCMIS and its indication shall be provided in LCP. LCP shall be located on the dosing skid.

1. Following interlocks shall be provided at high Level in the concentrated solution storage tanks:
 - i) Barrel pump shall be tripped.
2. Following interlocks shall be provided at low-low Level in the solution preparation tanks:
 - ii) Running Dosing pump shall be tripped.
 - iii) Stirrer motor of the respective tank shall be tripped.
3. Following conditions to be ensured before starting a stirrer:
 - i) Level in the solution preparation tank adequate.
 - ii) Motor not overload.
4. Following conditions to be ensured before starting a pump:
 - i) Level in the solution preparation tank adequate.
 - ii) Motor not overload.
 - iii) Solenoid discharge valve of selected pump open.
5. Following shall be provided on LCP:
 - i) ON/ OFF/ Fault- Lamp Indications for all drives (pumps & agitator)
 - ii) Operation 'Local selected' / operation 'Remote selected'- Lamp Indication, common for all drives.
 - iii) Pump- Start/ Stop, Agitator-Start/ Stop & Solenoid valve Open/Close –Push Buttons.
 - iv) Auto stroke controller



TITLE:
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CHEMICAL DOSING SYSTEM.**
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DATE:

- v) Stoke position indicator (may be a part of controller) & Raise/lower Push button
- vi) Local LED based annunciation driven by DDCMIS.

6. Following fault indications with alarm annunciations shall be provided on LCP & in DDCMIS:

- i) Low level in the solution preparation tanks.
- ii) Low-low level in the solution preparation tanks.
- iii) High level in the concentrated solution storage tanks.
- iv) High level in the solution preparation tanks.
- v) High pressure at pump discharge header.
- vi) Low pressure at pump discharge header.
- vii) Dosing pump tripped.
- viii) Barrel pump tripped.
- ix) Stirrer motor tripped.
- x) Low Level in solution preparation tanks.
- xi) Low –Low Level in solution preparation tanks.
- xii) Running dosing motor & stirrer motor tripped due to low-low level in solution preparation tanks.

SIGNAL EXCHANGE

1. Following signals shall be wired from DDCMIS **to LCP**. These shall be 24V DC powered signals. (PF contacts are not used to avoid the higher voltage LCP power supply reaching DDCMIS while contact interrogation).

- i) Operation local selected
- ii) Operation remote selected
- iii) Dosing Pump & stirrer (ON/OFF/FAULT)
- iv) Process conditions (as per clause 5 above)
- v) Dosing Pumps stroke length demand signal (4-20 mA).
- vi) Solenoid valve Open/Close

2. Following signals shall be wired from **LCP to DDCMIS**. Binary signals shall be P.F. contacts.

- i) All field signals
- ii) START commands for all drives (pumps & agitator)
- iii) Dosing Pumps stroke length feedback signal (4-20 mA).
- iv) Solenoid valve Open/Close signal.

All the field instruments & stroke actuator shall be terminated at local panel by the vendor, for taking further to DDCMIS.

	5 X 800 MW YADADRI TPS, NALGONDA	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CHEMICAL DOSING SYSTEM	
Specific Technical Requirements (C&I): 1.0 The Contractor shall provide complete Instrumentation for control, monitoring and operation of entire Chemical 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. 2.0 Chemical Dosing System shall be operated from plant DCS (DCS-BHEL Scope of supply) through operator work stations located in CCR. 3.0 Bidder to provide local control panel for each dosing systems for local operation. LCP shall have the provision of command (start/stop, load/unload) & feedback interface with plant DCS. Local control panel shall have provision for hardwired annunciation facia, push buttons, digital indicators, lamps, etc. Bidder shall connect the same up to terminal box (panel itself). Further cabling with DCS panel shall be in BHEL scope. This local panel will act as interface between the DCS and the field devices for commands & feedbacks. 4.0 Bidder to supply all the instruments (PT, LT, DPG, LG and DPS etc.) 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. 5.0 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.		

	5 X 800 MW YADADRI TPS, NALGONDA	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CHEMICAL DOSING SYSTEM	
6.0	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. (ii) 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.	
7.0	All Instruments must have separate tapping lines. Sharing of the same tapping pipe for redundant instruments or various different instruments is not acceptable.	
8.0	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.	
9.0	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.	
10.0	The junction boxes/LIEs for termination of instruments are in bidder's scope.	
11.0	415 V, 3 phase, 4 wire AC supply shall be provided by BHEL based on the load data provided by the bidder at contract stage for all equipment supplied by the bidder as part of contract. Any other voltage level (AC/DC) required will be derived by the bidder. Bidder to include necessary power distribution board in his scope and all necessary hardware/software for the same shall be in bidder's scope.	
12.0	Power supply derived for Transmitters, contact interrogation, interposing relay and solenoid shall generally be ungrounded 24V D.C only.	
13.0	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.	
14.0	MOVs (Motorized Valves) shall be integral type, if applicable.	

	5 X 800 MW YADADRI TPS, NALGONDA	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CHEMICAL DOSING SYSTEM	
15.0	Mandatory spares has to be supplied by bidder.	
16.0	The scope of cable shall be referred in Electrical scope split sheet in Electrical portion of the specification.	
17.0	Bidder to provide erection hardware including junction boxes, canopies, structural steel as required.	
18.0	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.	
19.0	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.	
20.0	Provision for separate Terminal block/wiring diagram for power and control blocks of control panel to be ensured.	
21.0	The make of all the items shall be from approved sub-vendor list.	
22.0	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.	
23.0	Editable & pdf copy of Drawings/Documents and data to be furnished after award of the contract: • GA & wiring diagram of local panel. • Local control panel & instruments data sheet. • Instrument schedule. • Drive List and I/O List. • Instrument hook-up diagram. • 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.		

	5 X 800 MW YADADRI TPS, NALGONDA	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) CHEMICAL DOSING SYSTEM	
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-C and Section-D of the specification, Section-C shall prevail.		



TITLE:

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM.
PROJECT: 5X800 MW TSGENCO YADADRI TPS**

BHEL DOCUMENTS NO.: PE-TS-417-154-A001

VOLUME II-B

SECTION –D1

REV. NO. 00

DATE:

**SECTION – D1
GENERAL TECHNICAL REQUIREMENTS (MECHANICAL)**

VOID



TITLE:

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM.
PROJECT: 5X800 MW TSGENCO YADADRI TPS**

BHEL DOCUMENTS NO.: PE-TS-417-154-A001

VOLUME II-B

SECTION –D2

REV. NO. 00

DATE:

SECTION – D2 GENERAL TECHNICAL REQUIREMENTS (ELECTRICAL)



**5 x 800 MW YADRADRI TPS
BASIC TECHNICAL FEATURES
FOR LT MOTORS
(FOR BHEL-PEM SCOPE PACKAGES)**

Doc. No.	PE-DC-417-565-E003
Rev. No.	02
Dated	16-08-2018
Page	2 of 7

1.0 This document covers the basic technical features of low tension (LT) squirrel cage induction AC motors employed for driving auxiliaries of BHEL-PEM scope packages in **5 x 800 MW YADRADRI TPS**.

2.0 **CODES AND STANDARDS**

All motors shall conform to the latest applicable standards as listed below;

- 1) Three phase induction motors: IS: 12615, IEC: 60034
- 2) Single phase AC motors: IS: 996, IEC: 60034
- 3) Crane duty motors: IS: 3177, IEC: 60034
- 4) Energy Efficient motors: IS 12615 or IEC: 60034-30 with Efficiency class IE3

3.0 **DESIGN REQUIREMENTS**

3.1 **Service Conditions**

The motors will be installed in hot, humid and tropical atmosphere highly polluted at places with coal dust and/or fly ash. For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature.

The design ambient temperature shall be 50 deg C.

3.2 **Supply system and rated voltage of motors**

KW rating	Supply system	Rated voltage of motor
Upto 0.2 kW	240V/415 V	240V/415 V
Above 0.2 kW & up to 175kW	415 V	415 V

3.2.1 **Supply voltage & variations shall be as follows:-**

Voltage variation (AC Supply): (+/-) 10%
 Frequency variation : (+) 3% to (-) 5%
 Combined V & F variation : 10% (sum of absolute values)

During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance.

3.2.2 **Motors shall be capable of running continuously at rated output for each of the conditions specified.**

3.3 **Motor Rating**

All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity. LT motor rating at 50 degree C shall have at least 15% margin over the input power requirement of the driven equipment at rated duty point unless stated otherwise in driven equipment specification. The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.

3.4 **Starting Requirements**

3.4.1 **Motor shall start smoothly and rapidly. Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The**

	5 x 800 MW YADRADRI TPS BASIC TECHNICAL FEATURES FOR LT MOTORS (FOR BHEL-PEM SCOPE PACKAGES)	Doc. No.	PE-DC-417-565-E003
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		Page	3 of 7

accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

- 3.4.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value of 85 (eighty five) percent rated voltage.

- 3.4.3 Continuous duty LT motors up to 175 KW Output rating (at 50 deg. C ambient temperature), shall be Premium efficiency (IE3) as per IEC: 60034-30/ IS: 12615 and the locked rotor current of motors shall as per IS 12615.

However, as per system requirement drives rated in the range of 160-210 KW may be considered in either 415V or 3.3 KV

- 3.4.4 Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction.

- 3.4.5 The following frequency of starts shall apply

- i) Three cold starts in succession with the motor being initially at a temperature not exceeding the ambient temperature.
- ii) Two hot starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- iii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature (not to be repeated in the second successive hour)

- 3.4.6 Locked motor withstand time of hot motors at 110% rated voltage shall be as follows:

- a) For motors with starting time upto 20 sec.
- at least 3 sec. more than starting time.
- b) For motor with starting time above 20 secs but not exceeding 45 secs.
- at least 5.0 sec. more than starting time.
- c) For motors with starting time above 45 secs.
- at least 10%. more than starting time.

The starting time of the motor referred above is at minimum permissible voltage. Wherever the above requirements are not complied with, speed switches of approved make & type shall be provided to bypass the locked rotor protection for a pre-selected time during starting of motors. The speed switches shall have one NO & one NC contacts having maximum interrupting capacity of 5 Amps at 240V AC and 0.25 amps at 220 V DC.

Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilising motor rated capacity.



**5 x 800 MW YADRADRI TPS
BASIC TECHNICAL FEATURES
FOR LT MOTORS
(FOR BHEL-PEM SCOPE PACKAGES)**

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3.5 Running Requirements

- 3.5.1 Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given above.
- 3.5.2 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.
- 3.5.3 The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.

3.6 Stress during bus Transfer

- 3.6.1 The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.
- 3.6.2 The motor shall be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.

4.0 SPECIFIC REQUIREMENTS

4.1 Enclosure

All motor enclosures for outdoor, semi-outdoor & indoor application shall conform to the degree of protection IP-55 unless otherwise specified. Motor for outdoor or semi-outdoor service shall be of weather-proof construction with canopy. For hazardous area approved type of increased safety enclosure shall be furnished.

4.2 Cooling

- 4.2.1 The motor shall be self-ventilated type, either totally enclosed fan cooled IC 411(TEFC), totally enclosed tube ventilated IC 511(TETV) or closed air circuit air- cooled IC 611(CACA).

4.3 Winding and Insulation

All insulated winding shall be of copper. All motors shall have class F insulation but limited to class B temperature rise. Windings shall be impregnated to make them non-hygroscopic and oil resistant.

Tropical Protection

All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

All fittings and hardware shall be corrosion resistant.

4.4 Bearings

- 4.4.1 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be rated for minimum service life of 40,000Hrs.
- 4.4.2 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.



**5 x 800 MW YADRADRI TPS
BASIC TECHNICAL FEATURES
FOR LT MOTORS
(FOR BHEL-PEM SCOPE PACKAGES)**

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- 4.4.3 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.
- 4.4.4 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.
- 4.4.5 Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication. LT motors 15kW and above shall be provided with external greasing arrangement.
- 4.4.6 Oiled bearing shall have an integral self-cooled oil reservoir with oil ring inspection ports, oil sight glass with oil level marked for standstill and running conditions and oil fill and drain plugs.
- 4.4.7 Forced lubricated or water cooled bearing shall be used as per requirement.
- 4.4.8 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.
- 4.4.9 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.

4.5 Noise & Vibration

- 4.5.1 For 415V motors, maximum double amplitude vibrations upto 1500 rpm shall be 40 microns and 15 microns upto 3000 rpm.
- 4.5.2 The noise level shall not exceed 85db (A) at 1.5 meters from the motor.

4.6 Motor Terminal Box

- 4.6.1 Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation
- 4.6.2 Terminal box shall be capable of being turned 360 deg in steps of 90 Deg. for LT motors unless otherwise approved.
- 4.6.3 The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.
- 4.6.4 The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.
- 4.6.5 Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.
- 4.6.6 The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
- 4.6.7 The terminal box shall be capable of withstanding maximum system fault current for a duration of 0.25 sec.
- 4.6.8 Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.
- 4.6.9 The gland plate for single core cable shall be non-magnetic type. A suitable cable adopter box shall be provided if the cable size does not allow the direct termination in the main TB.

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4.6.10 Minimum clearances to be provided between phase to phase and phase to earth shall be as under-

Voltage Rating of Motor Minimum Ph-Ph & Ph-Earth clearance
0.415 kV : 25 mm

Note: In case it is not possible to maintain these clearances, the live parts shall be totally insulated from earth and other Phases. Adequate clearances shall be provided for cable connections.

4.7 Grounding

The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer.

The cable terminal box shall have a separate grounding pad.

4.8 Rating Plate

In addition to the minimum information required by IS, the following information shall be shown on motor rating plate:

- Temperature rise in Deg.C under rated condition and method of measurement.
- Degree of protection.
- Bearing identification no. and Type of lubrication, Quantity and frequency/ time interval
- Location of insulated bearings.

5.0 ACCESSORIES

5.1 SPACE HEATERS

Motor of rating 30 kW and above shall be provided with space heaters, suitably located for easy removal or replacement. The space heater shall be rated 240 V, 1 Phase, 50Hz and sized to maintain the motor internal temperature above dew point when the motor is idle. The minimum cable size for space heater shall be 2.5 sq.mm copper cable.

5.2 DELETED

5.3 INDICATOR/ SWITCH

5.3.1 Dial type local indicator with alarm contacts shall be provided for the following:

Hot and cold air temperature of the closed air circuit for CACA motor.

5.3.2 Alarm switch contact rating shall be minimum 2.0 A at 220V D.C. and 10A at 240V A.C.

5.4 ACCESSORY TERMINAL BOX

5.4.1 All accessory equipment such as space heater, temperature detector, current transformers etc., shall be wired to and terminated in terminal boxes, separate from and independent of motor (power) terminal box.

5.4.2 Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit owner's cable connections.

DRAIN PLUG



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Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.

5.5 LIFTING PROVISIONS

Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.

5.6 DOWEL PINS

The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.

7.0 PAINTING

Colour scheme for motors shall be shade 631 of IS-5.

8.0 TESTING

8.1 Type Tests

For LT Motors, type test reports for type tests as per IS: 12615/ IEC: 60034 conducted on equipment similar to those proposed to be supplied shall be submitted. The type Test should have been conducted within last 5 years from enquiry date.

8.2 Routine Tests

All motors shall be subjected to routine tests as per IS: 12615/ IEC: 60034 in the presence of customer or customer representative.

9.0 Variable Frequency Drive motor details:

- i) The motor shall be suitable for operation with a solid-state power supply consisting of an adjustable frequency inverter for speed control.
- ii) The motor shall be suitable for the current waveforms produced by the power supply including the harmonics generated by the drive.
- iii) The Motor shall be designed to operate continuously at any speed over the range 20-100 % of rated speed.
- iv) The permitted voltage variation should take into account the steady state voltage drop across the AC drive and all other system components upstream of the motor.
- v) Motors required to be transferred to DOL, by-pass mode shall be rated for specified variations in system line voltage and frequency. Starting current of motor in DOL, bypass mode shall be limited to value in motor specifications.
- vi) The motor shall be constructed to withstand torque pulsations resulting from harmonics generated by the solid-state power supply.
- vii) The motor insulation shall be designed to accept the applied voltage waveform, within the V_{peak} and dv/dt limits as per IEC-61800-4.
- viii) The drive manufacturer shall be solely responsible for proper selection of the motor for the given load application and the output characteristics of the drive.

	TITLE LV MOTORS <u>DATA SHEET-A</u>	SPECIFICATION NO.	
		VOLUME	II B
		SECTION	C
		REV NO. 00	DATE 19.01.2018
		SHEET 1	OF 1

1.0	Design ambient temperature	:	50 °C
2.0	Maximum acceptable kW rating of LV motor	:	175 KW
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Degree Of Protection	:	IP55
5.0	Details of supply system		
	a) Rated voltage (with variation)	:	240V, 415V ± 10%
	b) Rated frequency (with variation)	:	50 Hz (Variation: +3% TO –5%)
	c) Combined voltage & freq. variation	:	10% (sum of absolute values)
	d) System fault level at rated voltage	:	50 kA for 1 sec
	e) Short time rating for terminal box	:	50 kA for 0.25 sec
	f) LV System grounding	:	Solidly
6.0	Class of insulation	:	Class ‘F’,with temp rise limited to class B.
7.0	Minimum voltage for starting (As percentage of rated voltage)	:	80% of rated voltage
8.0	Power cables data	:	Shall be given during detailed engg.
9.0	Earth Conductor Size & Material	:	Shall be given during detailed engg.
10.0	Space heater supply (30KW & ABOVE)	:	240 V, 1Φ , 50 Hz
11.0	Rating up to which Single phase motor	:	Acceptable below 0.20 Kw
12.0	TYPE OF STARTER PROVIDED IN MCC	:	DOL
13.0	Locked rotor current		
	a) Limit as percentage of FLC	:	As per IS-12615
	b) Permissible tolerance, if any	:	As per IS-12615
14.0	Terminal box	:	Suitable to rotate at 90 degrees
15.0	Paint shade	:	Shade 631 of IS-5

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	TITLE MOTOR DATA SHEET – C 5 X 800 MW YADADRI TPS	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE
		SHEET 1 OF 2

S. No.	Description		Data to be filled by successful bidder
A.	General		
1	Manufacturer & country of origin		
2	Motor type		
3	Type of starting		
4	Name of the equipment driven by motor & Quantity		
5	Maximum Power requirement of driven equipment		
6	Rated speed of Driven Equipment		
7	Design ambient temperature		
B.	Design and Performance Data		
1	Frame size & type designation		
2	Type of duty		
3	Rated Voltage		
4	Permissible variation for		
5	a	Voltage	
6	b	Frequency	
7	c)	Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)		
9	Synchronous speed & Rated slip		
10	Minimum permissible starting voltage		
11	Starting time in sec with mechanism coupled		
12	a) At rated voltage		
13	b) At min starting voltage		
14	Locked rotor current as percentage of FLC (including IS tolerance)		
15	Torque		
	a) Starting		
	b) Maximum		
16	Permissible temp rise at rated output over ambient temp & method		
17	Noise level at 1.0 m (dB		
18	Amplitude of vibration		
19	Efficiency & P.F. at rated voltage & frequency		
	a) At 100% load		
	c) At 75% load		

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	MOTOR DATA SHEET – C 5 X 800 MW YADADRI TPS	SPECIFICATION NO.	
			VOLUME	II B
			SECTION D	
			REV NO. 00	DATE
			SHEET 2	OF 2

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	Constructional Features	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	Characteristic curves/ drawings (To be enclosed for motors of rating $\geq 55\text{KW}$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	Design Calculations For LT Cable Sizing & Selection		Doc. No. PE-DC-410-507-E002	
	5X800 YADRADRI TPS, NALGONDA		Rev No.:	2
			Date:	5-Dec-18

3.0 CONSTRUCTIONAL DETAILS OF CABLES SELECTED

(A) LV POWER CABLES [1.1KV (XLPE TYPE)] & CONTROL CABLES

S.NO.	PARTICULARS	DETAILS	
		LT POWER CABLES	LT CONTROL CABLES
1	REFERENCE STANDARD	IS: 7098 -PART -1	IS -1554 PART -1
2	SYSTEM	415 V AC , 240 V AC & 220V DC	220V DC & 110 V AC
3	VOLTAGE GRADE	1.1 KV	1.1 KV
4	CONDUCTOR		
	MATERIAL	For Al cables Stranded and compacted plain aluminium of grade H2 and for Cu cables class 2 stranded, high conductivity annealed plain copper conforming to IS:8130.	Stranded, non-compacted & circular, high conductivity annealed plain copper, generally conforming to IS: 8130.
	STANDARD	IS 8130	IS 8130
	SHAPE	CIRCULAR/ SHAPED	CIRCULAR
	MINIMUM SIZE	ALUMINIUM- 10 SQ.MM.	2.5 SQ.MM.
		COPPER- 2.5 SQ. MM.	
5	NO. OF CORES	1C,2C,3C, 3.5C, 4C	AS PER CLAUSE 4.2.1
	CORE IDENTIFICATION	BY COLOR CODING	By color coding and numbering
6	INSULATION	Extruded cross-linked polyethylene (XLPE) conforming to IS: 7098 (Part 1)	Extruded HRPVC type-C compound conforming to IS: 5831. The minimum volume resistivity of insulation shall be 3.5 x 10 ¹⁴ ohm-cm at 27°C and 3.5 x 10 ¹¹ OHM-CM at 85°C.
	STANDARD	IS: 7098 -PART -1	IS -5831 & IS-1554 PART-I
7	INNER SHEATH	Extruded HRPVC FRLS compound conforming to type ST2 of IS: 5831 for multicore cable. Single core cables shall have no inner sheath. Filler shall be of same material as of inner sheath i.e. ST2	Extruded HRPVC compound conforming to type ST2 FRLS of IS: 5831 for multicore cables. Single core cables shall have no inner sheath. Filler shall be of same material as of inner sheath i.e. ST2.
	STANDARD	IS: 5831 & IS-7098 PART-I	IS: 5831 & IS-1554 PART I
8	ARMOUR	NON-MAGNETIC HARD DRAWN ALUMINIUM ROUND WIRE ARMOUR OF H4 GRADE FOR SINGLE CORE CABLES AND GS ROUND WIRE ARMOUR FOR MUTI- CORE CABLES	Galvanised single round steel wire for twin and multicore cables.
	STANDARD	IS:3975 & IS 7098 PART I	IS 3975 & IS-1554 PART I
9	OUTER SHEATH	Extruded FRLSH HRPVC compound conforming to type ST2 of IS: 5831.	Extruded FRLSH HRPVC compound conforming to type ST2 of IS: 5831.
	STANDARD	IS: 5831 & IS-7098 PART-I	IS: 5831

	Design Memorandum For Screened Control Cable	Doc. No:	PE-DC-417-507-E003
	5X800 YADADRI TPS, NALGONDA	Rev. No:	0
		Date:	7-Jan-19

5	FILLERS	
(a)	TYPE	NON -HYGROSCOPIC FRLS (AS REQUIRED FOR MAINTAINING CABLE CIRCULARITY)
6	INNER SHEATH	Extruded FRLS PVC (With anti rodent, anti termite & moisture resistant properties)
(a)	MATERIAL	HR PVC Type ST2 of IS-5831,1984 Thickness as per IS-1554, Part-I 1976
(b)	COLOR	BLACK
(c)	Rip Cord	Non metallic under sheath
7	ARMOUR	GI wire / strip as per IS 3975
8	OUTER SHEATH	Extruded FRLS PVC (With anti rodent, anti termite & moisture resistant properties)
(a)	MATERIAL	HR PVC Type ST2 of IS-5831,1984 Thickness 1.8mm (Min)
(b)	COLOR	GREY

9	CORE IDENTIFICATION		
	PAIR	CORE	COLOR
	1ST	1ST	BLUE
	1ST	2ND	RED
	2ND	1ST	GREY
	2ND	2ND	YELLOW
	3RD	1ST	GREEN
	3RD	2ND	BROWN
	4TH	1ST	WHITE
	4TH	2ND	BLACK

Above 4 Pairs, 4 Pairs making a unit shall have indelible printed colour coded bands like Pink for 1st unit, Orange for 2nd unit and Violet for 3rd unit and so on. In addition band marking, for example single band for 1st. unit, double band for 2nd. unit and so on, shall be provided on each conductor for identification of unit. Band marking on individual core shall be provided at regular intervals not exceeding 50 mm.

	Design Memorandum For Screened Control Cable	Doc. No.	PE-DC-417-507-E003
	5X800 YADADRI TPS, NALGONDA	Rev No.:	0
		Date:	7-Jan-19

SCREENED CONTROL CABLE SIZES FINALISED FOR THE PROJECT

TYPE F (INDIVIDUAL & OVERALL SCREENED CABLES)	TYPE G (OVERALL SCREENED CABLES)
2P	2P
4P	4P
8P	8P
12P	12P
20P	---

NOTES:

1. Screened Control cable sizes shall be selected from above as per requirement. All sizes may not be used.



TITLE:

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM.
PROJECT: 5X800 MW TSGENCO YADADRI TPS**

BHEL DOCUMENTS NO.: PE-TS-417-154-A001

VOLUME II-B

SECTION –D3

REV. NO. 00

DATE:

**SECTION – D3
GENERAL TECHNICAL REQUIREMENTS (CONTROL AND
INSTRUMENTATION)**



Technical specification
for
5 X 800 MW YADADRI TPS, NALGONDA

REV. NO. 00 DATE : 28.01.2019

INSTRUMENTS DATASHEET

TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM.

PROJECT: 5X800 MW TSGENCO YADADRI TPS

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 °C
16. Performance: :
 - i. Accuracy : $\pm 0.075\%$ of Span or better

TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM. **PROJECT: 5X800 MW TSGENCO YADADRI TPS**

- | | | |
|-----|-------------------------------------|--|
| | ii. Repeatability | ± 0.05% of Span or better |
| 17. | Sealing/Isolation | : Extended diaphragm (Silicon oil/ Fluorolub filled) with 5 meters SS armoured capillary for corrosive/viscous/solid bearing or slurry type fluid applications |
| 18. | Accessories | : <ul style="list-style-type: none"> 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 |

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

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 °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/ Fluorolub 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

TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM.

PROJECT: 5X800 MW TSGENCO YADADRI TPS

- 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

TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM.

PROJECT: 5X800 MW TSGENCO YADADRI TPS

	pressure		permanent deformation or loss of accuracy
14.	Turn-down ratio	:	10 : 1 or better
15.	Zero & Span	:	Continuous, tamper proof, remote as well locally adjustable with zero elevation and suppression by 100% of span
16.	Enclosure Class	:	IP-65
17.	Output Indicator	:	LCD type (Integral indicator of 5 digit display)
18.	Nameplate	:	Tag number and Service engraved in stainless steel tag plate
19.	Ambient Temperature	:	0 - 50 °C
20.	Load Impedance	:	600 Ohms at 24 Volts (minimum)
21.	Process Connection	:	2" Flanged
22.	Performance - Accuracy	:	± 0.075 % of span or better
23.	Accessories	:	a) Counter Flange, nuts, bolts, gaskets etc b) Weights for 5 point calibration of instruments c) Vent and drain plugs d) ½" NPT Glands e) Handheld calibrator
24.	Preferred Features	:	a) Test plug connection and cutout terminals physically separated from other electronics b) Electronic Damping facility (adjustable)
25.	Adjustment/Calibration/ Maintenance	:	From handheld calibrator or HART management system

TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM.

PROJECT: 5X800 MW TSGENCO YADADRI TPS

- ~~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) ~~1/2"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 °C
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

TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM. **PROJECT: 5X800 MW TSGENCO YADADRI TPS**

		alloy
10. Antenna / Flange assembly	:	316 SS or Hest alloy (as required)
11. Power supply	:	24 V DC
12. Output Indicator	:	LCD
13. Accuracy	:	5 mm or 0.1% of probe length
14. Accessories	:	a) Handheld calibrator
	:	b) Counter Flange, nuts, bolts, gaskets etc
	:	c) ½"NPT cable gland
	:	d) SS Nameplate
15. Adjustment/Calibration/ /Maintenance	:	From handheld calibrator/ HART management system
16. Applications	:	Vessels under vacuum or low pressure applications, solid levels

1.06.00 ULTRASONIC LEVEL TRANSMITTER

1. Type	:	Microprocessor based, 2-wire, Smart (HART Compatible)
2. Operating Principle	:	Detection of reflected ultrasonic pulse
3. Output Signal	:	4-20 mA DC along with superimposed digital signal
4. Operating frequency	:	10 KHz to 50 KHz (typical)
5. Display	:	LCD
6. Temperature Compensation	:	Built in –Programmable
7. Power supply	:	24 V DC
8. Enclosure	:	SS, IP-65 (Explosion proof for NEC Class-1, Division 1 area)

TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM.**PROJECT: 5X800 MW TSGENCO YADADRI TPS**

- | | | | |
|-----|--------------------------------------|---|--|
| 9. | Zero & Span | : | Continuous, tamper proof, remote as well locally adjustable. It shall be possible to calibrate the instrument without any level in the sump/ tank |
| 10. | Accuracy & Repeatability | : | 0.15 % of span or better |
| 11. | Resolution | : | 0.1 % of span |
| 12. | Operating temp. | : | Transmitter- 500 C and Sensor - 800 C |
| 13. | MOC Sensor | : | SS-316/Body- PVC and Face – Polyurethane |
| 14. | Mounting | : | 4" Flanged/ 2" NPT for sensor and Transmitter on panel |
| 15. | Accessories | : | <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 40%;"> <p>a)</p> <p>b)</p> <p>c)</p> <p>d)</p> <p>e)</p> </div> <div style="width: 60%;"> <p>Handheld calibrator</p> <p>Weather canopy for protection from direct sunlight and direct rain</p> <p>½"NPT cable gland</p> <p>All mounting hardware (SS-316), Prefab cable</p> <p>SS Nameplate</p> </div> </div> |
| 16. | Diagnosis | : | On-line |
| 17. | Status Indication | : | Power On, HI, HI-HI, Lo, LO-LO, Fault |
| 18. | Output Contacts | : | 2 SPDT, 230V, 5A |
| 19. | Adjustment/Calibration/ /Maintenance | : | From handheld calibrator/ HART management system |
| 20. | Applications | : | Coal Bunker, Water Service etc. |

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~~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 : SS-316.
material All other wetted part SS316
3. Case Material : SS~~t~~
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 $\pm 1.0\%$
 - b) Accuracy of Setting Indication of $\pm 1.5\%$
13. Ambient temperature : 0 – 50 Deg.C

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14. Nameplate : Tag number, service engraved in SS tag plate
15. Accessories :
a) Silicon oil/ Fluorolub 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) 1/2" 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 : SS-316.
material 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

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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 $\pm 1.0\%$
 - b) Accuracy of Setting Indication of $\pm 1.5\%$
13. Ambient temperature : 0 – 50 Deg.C
14. Nameplate : Tag number, service engraved in SS tag plate
15. Accessories :
 - a) Silicon oil/ Fluorolub 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) 1/2" NPT cable gland
16. Applications : During Detail Engineering on Owner's

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approval

3.03.00 LEVEL SWITCH

3.03.01 FLOAT OPERATED

1. Float material : SS-316
2. Wetted parts : SS-316
3. Float chamber : Stainless steel/Carbon steel, construction welded
4. Float chamber : Side mounted
mounting
5. Fluid connection : Side – Side
6. Fluid connection size : 1" ANSI RF Flange (rubber line, if required)
7. Drain : ½ inch NPT with Plug
8. Pressure rating of chamber : Minimum 1.5 times of design pressure
9. Repeatability : +/- 1.5 mm or better
10. Switch housing : Stainless Steel
11. Switch housing type : IP- 65
12. Type of switch : Snap acting magnetically operated hermetically sealed
13. Switch configuration : 2 SPDT (5A, 240 V AC, 0.5A, 220V DC)
14. Accessories :
 - a) Counter flange, nuts & bolts, suitable gasket etc.
 - b) Steel globe type drain valve
 - c) ½"NPT cable gland

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d) Stainless steel nameplate with alpha-numeric engraved for service and tag

15. Application : During Detail Engineering on Owner's approval

3.04.00 FLOW SWITCH

1. Type : Paddle /Piston/Disk
2. Wetted part material : Stainless steel or Hastelloy for acidic application
3. End connection :
 - a) Threaded upto 1" line size with integral Tee
 - b) Flanged for line size > 1 ½"
4. Enclosure material : Stainless Steel
5. Enclosure class : IP 65
6. Switch configuration : 2 SPDT (5A, 240 V AC, 0.5A, 220V DC)
7. Repeatability : 2%
8. Cable connection : ½"NPTF
9. Accessories :
 - a) Tee, Counter flange, nuts & bolts, suitable gasket etc
 - b) ½"NPT cable gland
 - c) Stainless steel nameplate with alpha-numeric engraved for service and tag

3.05.00 RF LEVEL SWITCH

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1. Type : RADIO FREQUENCY
Sensing probe
2. Material : SS-316
3. Mounting : Threaded
4. Application : 250°C (Max.)
Temperature
Electronic Controller
5. Input Supply Voltage : 240V AC $\pm 10\%$, 50 Hz.
6. Relay Output : 2 SPDT (240V AC, 5A)
7. Ambient Temperature : 50 °C
8. Enclosure Protection : IP-66
9. Enclosure Housing : SS
Normal Level
10. Local LED Indication : Power On
Alarm Level
Probe Healthy
11. Switching Repeatability : $\pm 0.5\%$
Co-axial cable for probe connection to controller
12. Accessories : SS Tag plate
 $\frac{1}{2}$ " NPT Cable Glands
13. Application : Solid level

3.06.00 CONDUCTIVITY TYPE LEVEL SWITCH

1. Type : Conductivity discrimination
2. Probe MOC : SS-316
3. Mounting : Flanged on external cage
4. Application : 250°C (Max.)
Temperature
5. Test Pressure : Two times rated pressure

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- | | | |
|--------------------------|---|--|
| 6. Input Supply Voltage | : | 240V AC $\pm$ 10%, 50 Hz. |
| 7. Input | : | Four independent channel with selectable switching threshold for water conductivity |
| 8. Relay Output | : | 2 SPDT (240V AC, 5A) |
| 9. Ambient Temperature | : | 50 °C |
| 10. Enclosure Protection | : | IP-65 (Explosion proof for NEC Class-1, Division-1 area) |
| 11. Enclosure Housing | : | SS
HI,LO, HIGH-HIGH, LOW-LOW |
| 12. Local LED Indication | : | Power
Fault |
| 13. Accessories | : | a) Interconnecting cable from probe to electronics
b) Mounting accessories
c) External cage
d) Washer & Gasket
e) ½" NPT Cable Glands
f) SS Tag Plate |
| 14. Application | : | During Detail Engineering on Owner's approval |

~~3.07.00~~

~~TEMPERATURE SWITCH~~

- | | | |
|-------------------------------|--------------|-------------------------------------|
| 1. Type | : | Bimetallic or gas filled |
| 2. Sensing Element | : | SS 316 |
| Material | | |
| 3. Bulb Material | : | SS 316 |
| 4. Capillary | : | Stainless Steel armored |

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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
For Zero adjustment (Micrometer screw external)
10. Adjustment : 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 ± 1.0 % of span or better
14. Operating ambient : 0 - 50 °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

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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

Anodized Aluminium with engraved marking (Minimum graduation 10mm),

7. Scale Board : 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

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gasket etc. as applicable, SS Tag plate

4.03.00

GAUGE GLASS

1. Type : Reflex /Transparent
2. Material :
 - Glass : Toughened borosilicate resistant to thermal shock
 - Body Material : ~~Carbon Steel~~ Stainless Steel
 - Enclosure : IP-65 (Explosion proof for NEC Class-1, Division 1 area)
3. Integral cocks & valves/Fittings :
 - i. SS 316
4. :
 - Rubber lined corrosion resistant
 - ii. stainless steel (for DM/RO service)
5. Vessel Connection : ANSI Flanged SS316
6. Accessories :
 - i. Integral cocks
 - ii. Drain Valves
 - iii. Companion Flanges, Bolts, nuts, gaskets, SS Tag plate
 - iv. Illuminating lamps, Mica shield as required
 - v. Calibrated scale
7. Pressure rating : Twice the maximum working pressure
8. Temperature : 300 ° C
9. Other details :
 - For larger lengths (greater than 1200mm), additional gauge glasses shall be provided with minimum of 50 mm overlap.

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4.04.00

SLIGHT GLASS

1. Type : Flap-type.
2. End connection : Screwed / Flanged
3. Material
 - a) Body : SS- 304
 - b) Cover plate : SS- 304
 - c) Indicator : SS- 316
4. Sight Glass : Toughened Borosilicate
5. Gasket : Neoprene
6. Bolts & Nuts : High tensile steel.
7. Hydraulic Test Pressure : 1.5 times maximum working pressure
8. Accessories : Companion Flanges, Bolts, nuts, gaskets as required, SS Tag plate.

~~4.05.00~~

~~ROTAMETER~~

- ~~1. Type : ON LINE for line upto and including 50 mm NB.
: Borosilicate BY PASS for line size above 50 NB~~
- ~~2. Metering tube : Toughened Borosilicate~~
- ~~3. Float : SS-316~~
- ~~4. End fittings : SS-316~~
- ~~5. Packing material : Teflon / PTFE~~
- ~~6. Casing : Stainless Steel~~
- ~~7. Gland Rings : Stainless Steel
/Followers/ Other :
wetted parts~~
- ~~8. Orifice Plate : Stainless Steel (for bypass type)~~
- ~~9. Operating Temperature : 0-50 Deg. c~~

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- | | | | |
|----|----------------|---|-----------------------------|
| 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 ° C |

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- | | | | |
|-----|-------------------|---|--|
| 9. | Fluid Temperature | : | 0-150 ° 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 |



Technical specification
for
5 X 800 MW YADADRI TPS, NALGONDA

REV. NO. 00 DATE : 28.01.2019

LCP and JUNCTION BOXES SPECIFICATION

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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.

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- 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.

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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.

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- 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 &

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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 with 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.

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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~~

TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM.

PROJECT: 5X800 MW TSGENCO YADADRI TPS

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 |

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- 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

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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 fixtures

- | | | |
|---------------------------------|---|--|
| 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~~

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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

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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

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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. |

TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM.

PROJECT: 5X800 MW TSGENCO YADADRI TPS

- | | | |
|-----|-----------------------|--|
| | | 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 | : <div style="margin-left: 20px;"> 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

 a) 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)

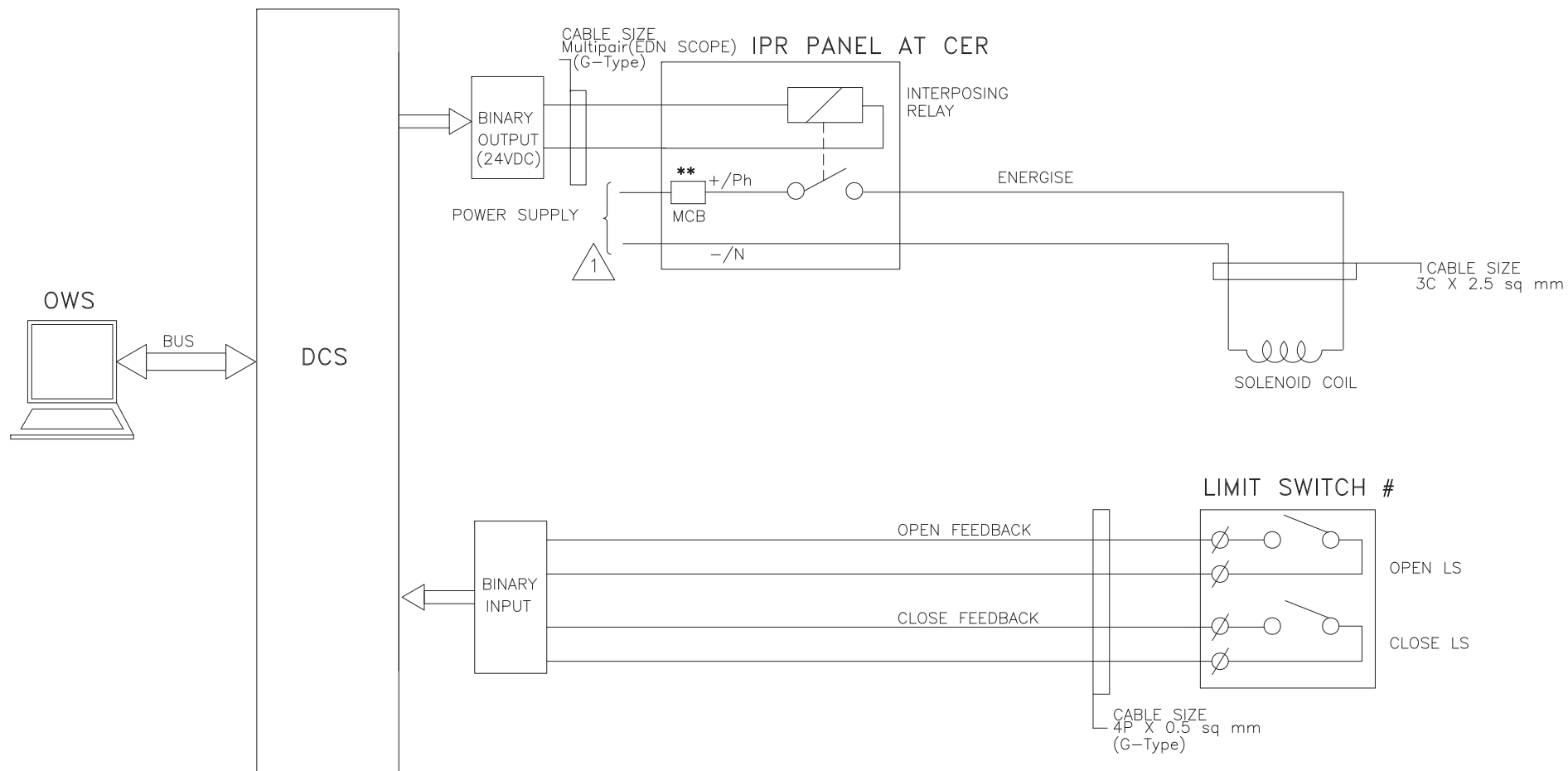
 d) Aluminum back panel

 e) Canopy at top

 f) Mounting brackets

 g) bolts and nuts made of brass etc. </div> |

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.

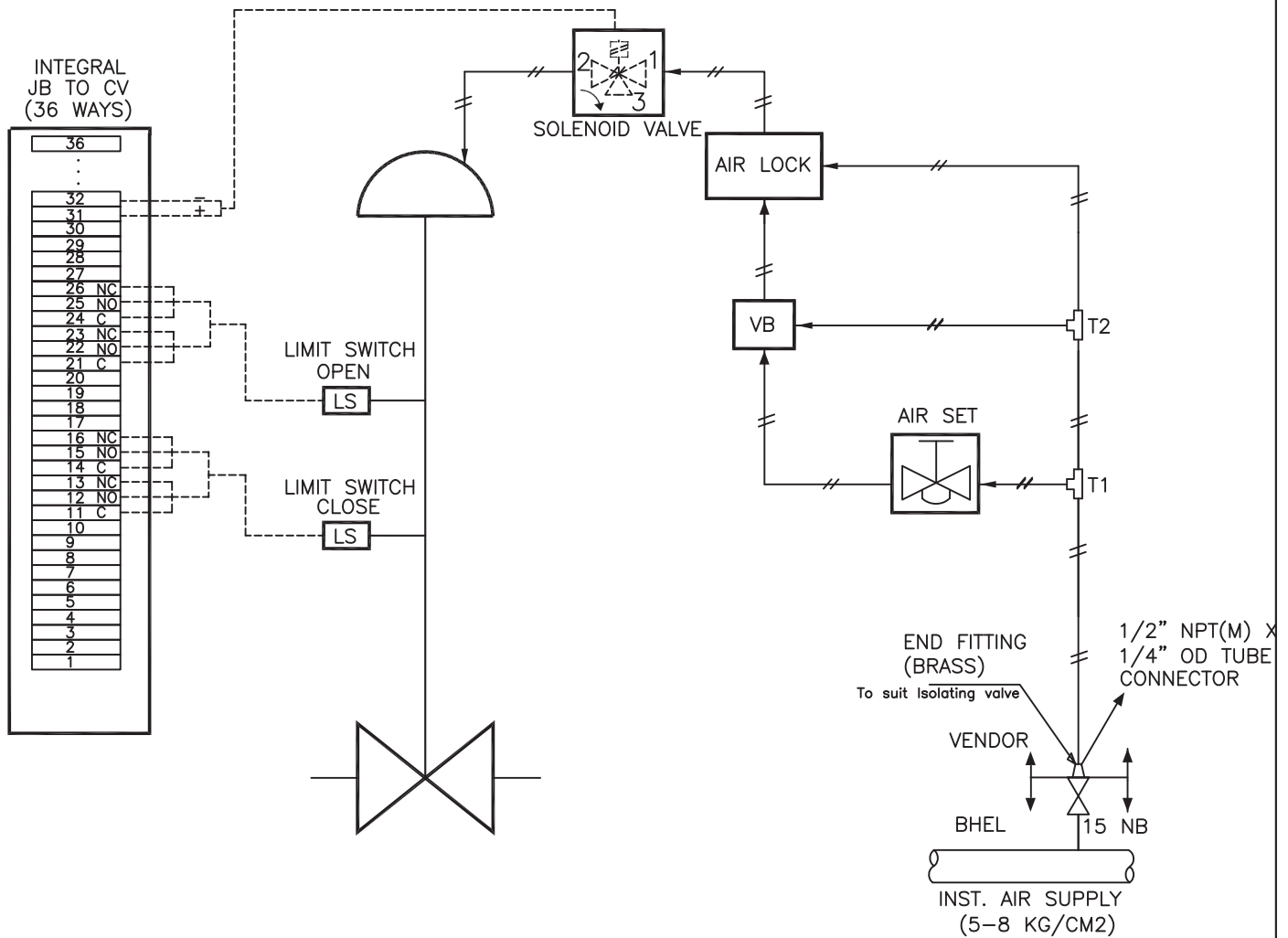


PROJECT:
5X800 YADADRI THERMAL POWER STATION
UNIT # 1 TO 5

TITLE:
DDCMIS INTERFACE FOR
SOLENOID DRIVE (SINGLE COIL)

DRG.NO.	PE-DM-417-145-I002
DATE	21.01.2019
REV.NO.	02
SHT	9 OF 11

STANDARD CONTROL VALVE HOOK-UP DIAGRAM (FOR ON / OFF TYPE)



NOTES :-

1. POSITION OF EACH VALVE ON SUPPLY AIR FAILURE / ELECTRIC SIGNAL FAILURE SHALL BE AS PER SPECIFICATION / DATA SHEET.
2. SOLENOID VALVES PORTS CONDITION:
PORT 1 AND 2 SHALL BE CONNECTED UNDER DE-ENERGISED CONDITION.
PORT 2 AND 3 SHALL BE CONNECTED UNDER ENERGISED CONDITION.
3. MOUNTING ACCESSORIES AS REQUIRED.
4. JB TERMINALS SHALL BE CAGE CLAMP TYPE SUITABLE FOR 2.5 SQ. MM COPPER WIRE. EXTERNAL CONNECTION, OF PLUG IN TYPE OR THROUGH CABLE GLAND, SHALL BE AS PER DATA SHEET.
5. ALL APPLICABLE ACCESSORIES SHALL BE PROVIDED AS INDICATED IN THE INDIVIDUAL CONTROL VALVE DATA SHEET / ACCESSORIES DATA SHEET.
6. 12 METERS 1/4" SS TUBING (AS PER ACCESSORIES DATA SHEET) & 1 SET OF FITTINGS TO BE SUPPLIED FOR EACH CONTROL VALVE FOR CONNECTION TO ISO VLV AT INST AIR HEADER ON ONE END AND TO AIR LOCK RELAY/AIR FILTER REGULATOR ON THE OTHER END. ALL THE BRASS / SS FITTINGS SHALL BE DOUBLE COMPRESSION TYPE.



STANDARD

TITLE:-

CONTROL VALVE HOOK-UP DIAGRAM

**DRG.
No.**

PES-145-06B

**REV.
No.**

01

DATE

24.03.15

SHEET

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



TITLE:

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM.
PROJECT: 5X800 MW TSGENCO YADADRI TPS**

BHEL DOCUMENTS NO.: PE-TS-417-154-A001

VOLUME III

REV. NO. 00

DATE:

VOLUME-III

DEVIATION SHEET (COST OF WITHDRAWL)



TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM.

PROJECT: 5X800 MW TSGENCO YADADRI TPS

TECH SPC NO: PE-TS-417-154-A001

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:

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

**TITLE:**

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM.
PROJECT: 5X800 MW TSGENCO YADADRI TPS**

BHEL DOCUMENTS NO.: PE-TS-417-154-A001

VOLUME III

REV. NO. 00

DATE:

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).
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/Customer.
11. Prices for recommended spares (if any) for three year operation shall be furnished separately and not to be included in the base price.

	TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM. PROJECT: 5X800 MW TSGENCO YADADRI TPS	BHEL DOCUMENTS NO.: PE-TS-417-154-A001	
		VOLUME III	
		REV. NO. 00	DATE:

DRAWING/DOCUMENTS SUBMISSION SCHEDULE FOR CHEMICAL DOSING SYSTEM

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

For the Drawings/Documents Submission Procedure, please refer **Sec-C1**. The submission of soft copy or hard copy of the drawing/document whichever is later will be considered as final date of submission of the drawing/document. The bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. Bidder to comply with the observations of the BHEL and CUSTOMER without price & delivery implication.

Bidder to note that the drawings to be submitted by bidder in the event of award of contract shall be as per the below given drawing/document list. Bidder to note that any additional drawings/documents requirement during detailed engineering shall be provided by bidder without any technical, commercial and delivery implications to BHEL. Bidder confirmed that every revised submission incorporating comments – within 7 days.

Bidder further confirmed 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. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

(a) List and schedule of drawings/documents to be submitted after award of contract:-

Sl. No.	BHEL Drg. No.	Title	CATEGORY	No. of weeks for document submission after placing LOI/LOA	SIZE OF DRAWING/ DOCUMENT
1	PE-V1-417-154-A001	P&I DIAGRAM	A	4	A1
2	PE-V1-417-154-A002	GA DRAWING	A	4	A1
3	PE-V1-417-154-A003	DATA SHEET FOR SYSTEM	A	6	A4
4	PE-V1-417-154-A004	LCP DRAWING	A	6	A4
5	PE-V1-417-154-A005	QAP	A	4	A1
6	PE-V1-417-154-A006	O& M MANUAL	A	8	A4

(b) Bidder to note that drawings/documents submission shall be through web based Document Management System. Bidder would be provided access to the DMS for drawings/documents approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

- Internet explorer version – Minimum Internet Explorer 7
- Internet speed – 2 mbps (Minimum preferred)
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- Vendor's internal proxy setting should not block DMS application's link
 - (<http://124.124.36.198/wrenchwebaccess/login.aspx>)
- 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.
- For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>

	TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM. PROJECT: 5X800 MW TSGENCO YADADRI TPS	BHEL DOCUMENTS NO.: PE-TS-417-154-A001	
		VOLUME III	
		REV. NO. 00	DATE:

NOTES:

1. A= APPROVAL. I = INFORMATION.
2. ANY ADDITIONAL DRAWINGS-DOCUMENTS REQUIRED DURING DETAILED ENGINEERING STAGE SHALL BE PROVIDED BY BIDDER WITHOUT ANY COMMERCIAL, TECHNICAL AND DELIVERY IMPLICATION TO BHEL AND CUSTOMER.
3. BIDDER TO SUBMIT REUSABLE DATABASE FORMATS IN BHEL/NTPC APPROVED FORMATS LIKE MS EXCEL, MS WORD OF DOCUMENTS LIKE INSTRUMENT SCHEDULE, I/O LIST, DRIVE LIST, FIELD JB TERMINATIONS, CABLE SCHEDULE & INTERCONNECTION, ETC. SOFT COPY OF FORMATS SHALL BE PROVIDED TO SUCCESSFUL BIDDERS.
4. DOCUMENTS PERTAINING TO PROVENNESS TO BE SUBMITTED BY THE BIDDER.
5. DWG. / DOCUMENT SHALL BE UPLOADED BY THE SUCCESSFUL BIDDER ON WRENCH /DMS. PROCEDURE FOR THE SAME WILL BE INFORMED AFTER AWARD OF CONTRACT.

SUGGESTED PRICE FORMAT		Doc No:	PE-PF-417-154-A001		
		Rev No:	0		
		Date of issue	06/03/2019		
SUGGESTED PRICE FORMAT					
NAME OF PROJECT: 5X800 MW TSGENCO YADADRI TPS					
NAME OF PACKAGE: CHEMICAL DOSING SYSTEM					
TECHNICAL SPECIFICATION:		PE-TS-417-154-A001			
S. No.	DESCRIPTION	UNIT	QTY	AMOUNT (Ex-Works)	
1.0	Total lump sum firm price inclusive of all prevailing taxes, duties and other levies for SUPPLY PART & MANDATORY SPARES , design (i.e. preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables (excluding chemicals), Mandatory spares, startup and commissioning spares , forwarding, proper packing, shipment and delivery at site for project and package specified above complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order.	Set	1		
2.0	MAJOR BREAK-UP OF PRICES GIVEN IN 1.0 ABOVE.				
2.1	Prices inclusive of all prevailing taxes, duties and other levies for SUPPLY PART comprising of design (i.e.preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables (excluding chemicals), alongwith spares for erection as required, startup and commissioning spares , forwarding, proper packing, shipment and delivery at site for project and package specified above complete with all accessories for following items for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order. (Break-up of prices as per Annexure I)	Set	1		
2.2	Total lumpsum firm price inclusive of all prevailing taxes, duties and other levies for Mandatory spares comprising of manufacture, fabrication, assembly, inspection / testing (as applicable) at vendor's & sub-vendor's works, painting, forwarding, proper packing, shipment, delivery at site & guarantee as per tender technical specification above, amendment & agreements till placement of order. (Price break up of Mandatory spares is to be furnished as per Annexure- II).	Lot	1		
Note: 1.) PG to consider and suitably incorporate taxes, duties and other commercial aspects. 2.) Bidder to quote the Prices in 'figures' along with corresponding 'words'.					
Particulars of bidder / authorised representative					
Name	Designation	Signature	Date	Company Seal	

SUGGESTED PRICE FORMAT ANNEXURE-I		Doc No:	PE-PF-417-154-A001	
		Rev No:	0	
		Date of issue	06/03/2019	
NAME OF PROJECT: 5X800 MW TSGENCO YADADRI TPS				
NAME OF PACKAGE: CHEMICAL DOSING SYSTEM				
TECHNICAL SPECIFICATION:		PE-TS-417-154-A001		
S. No.	DESCRIPTION	UNIT	QTY	AMOUNT (Ex-Works)
	BREAK-UP OF SUPPLY PRICES GIVEN IN 2.1 OF MAIN SHEET.			
2.1	Prices inclusive of all prevailing taxes, duties and other levies for SUPPLY PART comprising of design (i.e.preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables(excluding chemicals), alongwith spares for erection as required, startup and commissioning spares, forwarding, proper packing, shipment and delivery at site for project and package specified above complete with all accessories for following items for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order.	Set	1	
2.1.1	Hydrazine dosing skid	Nos	5	
2.1.2	Ammonia dosing skid	Nos	5	
2.1.3	NaOH dosing skid	Nos	5	
2.1.4	Supply of Startup and Commissioning spares inclusive of all prevailing taxes, duties and other levies etc. (As per BHEL NIT & tender technical specification, amendment & agreements till placement of order.)	Set	5	
Particulars of bidder / authorised representative				
Name	Designation	Signature	Date	Company Seal

SUGGESTED PRICE FORMAT (ANNEXURE-II)				
LIST OF MANDATORY SPARES				
NAME OF PROJECT: 5X800 MW TSGENCO YADADRI TPS			Doc No:	PE-PF-417-154-A001
NAME OF PACKAGE: CHEMICAL DOSING SYSTEM			Rev No:	0
TECHNICAL SPECIFICATION:		PE-TS-417-154-A001	Date:	06/03/2019
BREAK-UP OF SUPPLY PRICES GIVEN IN 2.2 OF MAIN SHEET.				
S. N.	DESCRIPTION	UNIT	QTY	AMOUNT (Ex-Works)
A)	Mechanical Items			
1.1	Piston Ring (Guide Ring)	Sets	4 Sets for each type and Duty of Pump	
1.2	Piston (Plunger)	Sets	4 Sets for each type and Duty of Pump	
1.3	Seals and other Wear out Part	Sets	2 Sets for each type and Duty of Pump	
1.4	Complete Set of Bearings	Sets	2 Sets for each type and Duty of Pump	
1.5	Crank Shaft	Sets	2 Sets for each type and Duty of Pump	
1.6	Cross Head Assembly	Sets	2 Sets for each type and Duty of Pump	
1.7	Connecting Rod Plate	Sets	2 Sets for each type and Duty of Pump	
1.8	Complete Set of Valves	Nos.	20% of the total quantity used for each unit for each type and Size or Minimum 2 Nos whichever is higher.	
1.9	Strainer	Nos.	2 Nos. for each type, size and duty.	
B)	Electrical Items			
1.1	Complete Set of Motor	Nos.	2 Nos. for each type, Duty and application	
1.2	Driving End & Non Driving End Bearing	Sets	6 Set for each type and rating of Motor	
1.3	Cooling Fan	Nos.	4 No. for each type and rating of Motor	
1.4	Motor Terminal Block	Nos.	10 No. for each type and rating of Motor	
1.5	Complete Set of Coupling	Sets	2 Set for each Application	
C)	C&I Spares			
1.1	Transmitters/ Gauges/Switches etc. along with relevant accessories	Nos.	20% of total or at least 2 Nos (whichever is higher) for Each type along with accessories.	
1.2	Solenoid Valves			
1.2.1	Solenoid Valve Coil	Nos.	4 nos. of each rating & insulation	
1.2.2	Plunger	Nos.	2 nos. of each type	
1.2.3	Seat	Nos.	4 nos. of each type & size	
1.2.4	Gaskets	Sets	4 sets of each type & size	
1.2.5	O-Ring set	Sets	10 sets of each type & size	
Particulars of bidder / authorised representative				
Name	Designation	Signature & Company Seal		Date



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

BHEL DOCUMENTS NO.: PE-TS-417-154-A001
VOLUME III

REV. NO. 00

DATE:

DECLARATIONS

Icertify 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