

**1X800 MW APPDCL KRISHNAPATNAM
STAGE-II**

**TECHNICAL SPECIFICATION
FOR
CHEMICAL DOSING SYSTEM**

SPECIFICATION NO: PE -TS-420-154-A001



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

	TITLE:	SPECIFICATION NO. PE-TS-420-154-A001
	1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION - I A REV.NO. 0 DATE : 29/03/2017

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		SUB SECTION:
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PROJECT INFORMATION

VOLUME : IIA

SECTION-II

PROJECT SYNOPSIS AND GENERAL INFORMATION

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SECTION-II

PROJECT SYNOPSIS AND GENERAL INFORMATION

1.00.00 INTRODUCTION

The proposed 1x800 MW Sri Damodaram Sanjeevaiah Thermal Power Station (SDSTPS), Stage-II, Unit-3 would be set up by Andhra Pradesh Power Development Company Limited (APPDCL) at Krishnapatnam of Andhra Pradesh. The proposed project is an extension unit within the boundary of the ongoing 2x800 MW, Stage-I project of SDSTPS.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on the Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

2.00.00 APPROACH TO SITE

The proposed site is located at Krishnapatnam near Nellore town. Nellore town is situated on National Highway NH-5 connecting Kolkata and Chennai. The nearest broad gauge railway station Venkatachalam is located about 23 km from plant site. Venkatachalam railway station is located on Vijaywada-Chennai main broad gauge line of Southern Railway.

Nearby Air Port is Chennai at a distance of about 170 km from the site.

Since Nellore town is located on east coast of Bay of Bengal, it has close proximity to sea.

3.00.00 LAND

The main plant & auxiliaries and balance of plant (BOP) require about 51 acres of land which is available within the existing plant boundary.

Existing coal storage and handling facilities for Stage-I will also be used for 1x800MW, Stage-II extension project.

Land acquired for the staff colony for Stage-I is sufficient to accommodate the staff colony for Stage-II also.

4.00.00 SOURCE OF COAL

Imported coal shall be used for this project. Imported coal will be sourced from Indonesia or other available source of good quality coal.

5.00.00 SOURCE OF WATER

Nellore is located on east coast of Bay of Bengal. So sea water from Bay of Bengal will be used as raw water for Stage-II operation.

6.00.00 ASH DISPOSAL AREA

Ash shall be dumped in the ash dump area adjacent to the existing ash pond which is adequate for 1x800 MW extension unit also as per MOEF norms.

7.00.00 SALIENT DESIGN DATA

7.01.00 Meteorological data of site is given below:-

Elevation above MSL : 2.1 to 3.0 m

Finished Grade level of Plant : 3.5 m

Annual mean ambient temperature
Max. : 42.2 °C
Min. : 18.3 °C

Highest temperature in a day : 33°C

Lowest temperature in a day : 24.4°C

Relative Humidity.
Max. : 84%
Min. : 46%

Rainfall
Average.: 1032 mm
Max. : 100 mm/ hr.

Basic Wind speed : 50 m/ sec.

Seismic Zone : Zone-III as per IS- 1893 (Part-IV)

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SECTION 1

SPECIFIC TECHNICAL REQUIREMENTS

SECTION I A : SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

SECTION I B : SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

SECTION I C : SPECIFIC TECHNICAL REQUIREMENTS (C&I)

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SECTION 1 A

SPECIFIC TECHNICAL REQUIREMENTS - MECHANICAL

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1. SCOPE:

Design, engineering, manufacturing, fabrication, assembly, inspection & testing at manufacturer's works, packing, supply and dispatch to power station site of skid mounted Chemical Dosing Systems along with startup, commissioning spares, and mandatory spares as specified hereinafter for the **1X800 MW APPDCL KRISHNAPATNAM STAGE-II** for following systems:-

- HYDRAZINE DOSING SYSTEM– One number skid.
- AMMONIA DOSING SYSTEM– One number skid.
- NaOH DOSING SYSTEM– One number skid.

The following drawings/ data sheets are enclosed:

- P&ID for Hydrazine Dosing System (PE-DG-420-154-A001). Rev 1
- P&ID for Ammonia Dosing System (PE-DG-420-154-A002). Rev 1
- P&ID for NaOH Dosing System (PE-DG-420-154-A003). Rev 1
- DATA SHEET - A - For above systems

2. DESIGN PHILOSOPHY:

Chemical dosing systems are 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.

3. SCOPE OF SUPPLY FOR BIDDER FOR CHEMICAL DOSING SYSTEM:

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

The Chemical dosing system consists of, hydrazine dosing system, ammonia dosing system for boiler feed water and NaOH dosing skids for DMCW system. The details of each dosing system are given below:

4.1 HYDRAZINE DOSING SYSTEM: (NO. OF SKID= 1 NO.)

(Refer drg no. PE-DG-420-154-A001. Rev. 1)

Residual dissolved 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 outlet of Deaerator (suction of Boiler Feed Pumps). Though provision has been kept to dose hydrazine at Condensate Polisher outlet as well as discharge of Boiler Fill Pumps dosing shall be done at one place at a time. For this purpose one (1) no. skid mounted Hydrazine dosing system shall be provided. Each Skid of Hydrazine Dosing system shall mainly comprise of the following:

4.1.1 CONCENTRATED HYDRAZINE STORAGE TANK (2 Nos.)

Two (2) numbers Concentrated Hydrazine Storage Tanks are provided for storing & measuring the technical grade concentrated Hydrazine liquor. Each tank is provided with accessories like level gauge, level transmitter, breather with vent, drain and overflow (with seal arrangement). A filling connection is provided to fill the tanks with concentrated solution by electrically operated Barrel Pump (to be mounted on Hydrazine Barrel). Concentrated solution shall be transferred to Hydrazine Solution Preparation Tanks by gravity flow when solution is to be prepared.

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4.1.2 HYDRAZINE SOLUTION PREPARATION TANK (2 Nos.)

A dilute solution is prepared in a two (2) numbers Hydrazine Solution Preparation Tanks using condensate and is uniformly mixed by a motorized stirrer (below 150 rpm). Each tank is provided with accessories like motorized stirrer, level gauge, level transmitter, breather with vent, drain and overflow (with seal arrangement). The solution is then dosed to the required points by means of Hydrazine Dosing Pumps.

4.1.3 HYDRAZINE DOSING PUMPS (6 Nos.)

Three nos. (3 X 100%) for dosing at outlet of Deaerator. & Three nos. (3 X 100%) for dosing at outlet of Condensate Polishers as well as Boiler Fill Pumps discharge, Positive displacement plunger type Dosing pumps (electrically operated, auto adjusted) with motor, relief valves, Y-type strainers shall be provided.

Dosing pumps shall be capable of adjustment from 0 to 100% capacity and locking shall be possible while the pumps are in operation. A calibrated scale of stainless steel construction shall be provided for the above purpose. Pumps shall be capable of operation either intermittently or continuously. Pumps shall have remote stroke control with ratio adjustment wherever specified. The control shall be of a proven quality and possess sufficient accuracy to maintain positive and stable control of the pump. A pulsation dampener shall be provided each set of pumps to provide even flows and reduce vibration wear on piping components.

4.1.4 HYDRAZINE BARREL PUMP (1 No.)

One no. (1 X 100 %) hydrazine barrel of suitable capacity with one motor operated barrel pump (1 X 100 %) complete with flexible hose and couplings for transferring hydrazine from barrel at ground level to preparation cum metering tank shall be provided.

4.1.5 ASSOCIATED PIPING, VALVES ETC:

As indicated in the drawing enclosed, to make the system complete, all associated piping & valves shall be provided. All piping in the skid shall be ASTM 312 Gr. TP 304 (seamless), pipe size: 40/25/15 Nb. Valve material shall be SS-304, ASA 800 rating. All valves shall be manually operated. Drains from tanks & pipes shall be inter-connected to a common drain header and terminated at the dosing skid itself. Level gauge drain shall not be connected to main drain header since quantity of liquid is very small and occurrence of such cases is rare. The same may be manually disposed of. As flow in drains is not continuous & of very small quantity the same shall be led to local storm water drain.

4.1.6 FLUSHING

Condensate shall be used for chemical dilution and flushing (shown in P & I drawing).

4.1.7 PARAMETERS FOR HYDRAZINE DOSING:

Major parameters of the equipment as calculated & provided in the system are mentioned in enclosed Datasheet A.

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4.2 AMMONIA DOSING SYSTEM: (NO. OF SKID= 1 NO.)

(Refer drg no. PE-DG-420-154-A002. Rev. 1)

Boiler feed water/Condensate water should have proper pH in order to protect the system from corrosion. In order to control the same, continuous dosing of dilute solution of Ammonia is done at outlet of Condensate Polisher in order to neutralize CO₂ in feed water and increase feed water pH value. Though provision has been kept to dose ammonia at outlet of Deaerator as well as discharge of Boiler Fill Pumps, but dosing shall be done at one place at a time only. For this purpose one (1) no. skid mounted ammonia dosing system shall be provided. Each Skid of Ammonia Dosing system shall mainly comprise of the following:

4.2.1 CONCENTRATED AMMONIA STORAGE TANK (2 Nos.)

Two (2) numbers Concentrated Ammonia Storage Tanks is provided for storing & measuring the technical grade concentrated Ammonia liquor. Each tank is provided with accessories like level gauge, level transmitter, breather with vent, drain and overflow (with seal arrangement). A filling connection is provided to fill the tank with concentrated solution by electrically operated Barrel Pump (to be mounted on Ammonia Barrel). 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 a two (2) numbers Ammonia Solution Preparation Tanks using condensate and is uniformly mixed by a motorized stirrer (below 150 rpm). Each tank is also provided with accessories like motorized stirrer, level gauge, level transmitter, breather with vent, drain and overflow (with seal arrangement). The solution is then dosed to the required points by means of Ammonia Dosing Pumps.

4.2.3 AMMONIA DOSING PUMPS (6 Nos.)

Three nos. (3 X 100%) for dosing at outlet of Condensate Polishers & Three nos. (3 X 100%) for dosing at outlet of Deaerator as well as Boiler Fill Pumps, Positive displacement plunger type Dosing pumps (electrically operated, auto adjusted) with motor, relief valves, Y-type strainers shall be provided.

Dosing pumps shall be capable of adjustment from 0 to 100% capacity and locking shall be possible while the pumps are in operation. A calibrated scale of stainless steel construction shall be provided for the above purpose. Pumps shall be capable of operation either intermittently or continuously. Pumps shall have remote stroke control with ratio adjustment wherever specified. The control shall be of a proven quality and possess sufficient accuracy to maintain positive and stable control of the pump. A pulsation dampener shall be provided each set of pumps to provide even flows and reduce vibration wear on piping components.

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 (1 X 100 %) complete with flexible hose and couplings for transferring Ammonia from barrel at ground level to preparation cum metering tank shall be provided.

4.2.5 ASSOCIATED PIPING, VALVES ETC:

As indicated in the drawing enclosed, to make the system complete, all associated piping & valves shall be provided. All piping in the skid shall be ASTM 312 Gr. TP 304 (seamless), pipe size: 40/25/15 Nb. Valve material shall be SS-304, ASA 800 rating. All valves shall be manually

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operated. Drains from tanks & pipes shall be inter-connected to a common drain header and terminated at the dosing skid itself. Level gauge drain shall not be connected to main drain header since quantity of liquid is very small and occurrence of such cases is rare. The same may be manually disposed of. As flow in drains is not continuous & of very small quantity the same shall be led to local storm water drain.

4.2.6 FLUSHING

Condensate shall be used for chemical dilution and flushing (shown in P & I drawing).

4.2.7 PARAMETERS FOR AMMONIA DOSING:

Major parameters of the equipment as calculated & provided in the system are mentioned in enclosed Datasheet A.

4.3 NAOH DOSING SYSTEM FOR DMCW SYSTEM: (NO. OF SKID= 1 NO.)

(Refer drg. No. PE-DG-420-154-A003, Rev. 1

Sodium Hydroxide Dosing System shall be provided to dose Sodium Hydroxide Solution to Equipment Cooling Water lines to increase pH around 9.5. Provision for Dosing of Sodium Hydroxide shall be kept to the following points:

- (a) DMCW O/H Tanks.
- (b) DMCW Pumps.

The dilute solution of NaOH 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. 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, drive motor and other accessories

4.3.2 NaOH DOSING PUMPS (2 Nos.)

Two nos. (2 X 100%), Positive displacement plunger type Dosing pumps (electrically operated, auto adjusted) with motor, relief valves shall be provided. A Y-type strainer set (2 x 100%) common for two pumps shall be provided. Dosing pump shall be capable of adjustment from 0 to 100 % capacity and locking shall be possible while the pumps are in operation. A calibrated scale of stainless steel construction shall be provided for this purpose.

4. 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 Plant DDCIMS including ON/OFF command of the individual pumps and stirrers. All controls, fault indicators/alarms, interlocks, logics shall be implemented

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in Plant DDCIMS.

For each system skid mounted relay based Local Control Panel (LCP) comprising of 'START' push button and 'EMERGENCY STOP' push button along with 'ON/OFF/DISTURBANCE' indication, stroke position indicator, raise/ lower push button for stroke position and local annunciation shall also be provided for local operation. The 'EMERGENCY STOP' Push Button (lockable type) shall be wired directly to MCC whereas START push button shall be routed to DDCMIS. The auto stroke controllers of each pump shall be provided in the local panel. The stroke position & adjustment will be done from DDCMIS as well as LCP 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 with 4-20 mA DC indication of stroke position in DDCMIS & LCP. The ON/OFF operation facility for motorized stirrer shall be provided in Plant DDCMIS with local ON, OFF facility.

The facility of local/remote selection along with remote control shall be provided in DDCMIS and its indication shall be provided in LCP. The starter of all the motors shall be clubbed with 415V main plant MCC. 415 V supply system shall be 3 phase 3 wire system. DDCMIS commands shall extend to MCC. All controls, fault indications, alarms, interlocks, logics shall be implemented in DDCMIS only. All motorised valves shall be provided with integral starters.

The basic features for control of Chemical Dosing System are highlighted below:

To maintain residual Hydrazine in feed water at the desired pre-set value, dosing rate of Hydrazine shall be adjusted from remote DDCMIS through 4-20 mA signals. The respective feed controller (DDCMIS based) shall receive the inputs with reference to the measured values at feed water flow transmitter as well as residual Hydrazine analyser (Customer scope) and compare these with the pre-set desired value. The resultant output shall be used for adjustment of the stroke of the Hydrazine Dosing Pump under service. However provisions for local manual stroke adjustment of the Dosing Pumps will also be made available.

The pH of condensate at discharge of Condenser shall be maintained at the desired pre-set value by adjustment of dosing of ammonia. This shall be achieved by adjustment of the stroke of Ammonia Dosing Pumps from remote DDCMIS through 4-20 mA signals based on the measurement of pH of feed water. The respective feed controller (DDCMIS based) shall receive the inputs with reference to the measured values at condensate water flow transmitter as well as pH analyser (customer scope) and compare these with the pre-set desired value. The resultant output shall be used for adjustment of the stroke of the Ammonia Dosing Pump under service. However provisions for local manual stroke adjustment of the Dosing Pumps will also be made available.

The pH of CCW System shall be maintained at the desired pre-set value by manual adjustment of Dosing of Sodium Hydroxide.

The control philosophies for Dosing system are as follows:

- i) At low-low level in the solution preparation tank:
 - a) Running Dosing pump shall be tripped.
 - b) Stirrer motor of the respective tank shall be tripped.
- ii) Following fault indications with alarm annunciations shall be provided on LCP & in Plant DCS:
 - a) Low level & Low-low level in respective concentrated storage & solution preparation tank
 - b) Dosing Pump & Agitator trip due to low level in the tank.
 - c) Pump trip due to over load.
 - d) High pressure at pump discharge header
 - e) Low pressure at pump discharge header.
 - f) High level in the concentrated storage & solution preparation tank

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- iv) Following conditions (as minimum) to be ensured before starting a stirrer
 - a) Level in the tank adequate (NOT LOW).
 - b) MCC not disturbed
- v) Following conditions (as minimum) to be ensured before starting a pump
 - a) Level in the tank adequate (NOT LOW).
 - b) MCC not disturbed.
 - c) Motorized discharge valve of selected pump open

5. Following shall be provided on LCP:

- vi) Following shall be provided on LCP
 - d) ON/OFF/DISTURBANCE- Lamp Indications for all drives (pumps & agitator)
 - e) Operation 'Local selected' / operation 'remote selected'- Lamp Indication, common for all drives.
 - f) Pump - Start/Emergency Stop & Agitator & Start/Emergency Stop –Push Buttons & Motorized valve Open/Close –Push Buttons.
 - g) Auto stroke controller
 - h) Stoke position indicator (may be a part of controller)
 - i) Local LED based annunciation driven by Plant DDCIMS
 - j) Raise/lower push button for stroke position & local annunciation
- vii) Manual starting & stopping of dosing pumps is envisaged through the LCP.

SIGNAL EXCHANGE

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).

- a) Operation local selected
- b) Operation remote selected
- c) Pump & stirrer (ON/OFF/DISTURBANCE)
- d) Process conditions (as per clause (5 III) above)
- e) Pump stroke length demand signal (4-20 mA)
- f) Motorized valve Open/Close

Following signals (as minimum) shall be wired from LCP to DDCMIS. Binary signals shall be P.F. contacts.

- a) All field signals
- b) START–PB commands for all drives (pumps & agitator)
- c) Pump stroke length feedback signal (4-20 mA)
- d) Motorized valve Open/Close signal

Following signals shall be wired from DDCMIS to MCC

- a) START/ STOP command from Plant DDCMIS to MCC.

Following signals shall be wired from MCC to DDCMIS

- a) ON/OFF/MCC Disturbed feedback from MCC to Main plant DCS.

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Following signals shall be wired between LCP & MCC

- a) EMERGENCY STOP-PB for all drives (pumps & agitator).

All the field instruments i.e. level transmitter, pressure transmitter etc. & stroke actuator shall be interfaced with DDCMIS through LCP.

5. SCOPE OF SERVICE

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

- Design and engineering.
- Fabrication of the skid mounted chemical dosing system.
- Inspection and testing of the skid as per the approved quality assurance plan.
- Supply of the skid mounted chemical dosing system up to the power plant site along with all accessories as defined in the technical specification.
- Painting as per approved painting requirement to be finalized during detailed engineering. However the same shall be prepared in line with the painting requirement enclosed in ANNEXURE IV of technical specification.

6. CIVIL SCOPE

Nil.

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

- All piping beyond battery limit of skid as indicated in P&ID's enclosed with the technical specification is excluded from bidder's scope.
- Electrical scope shall be as per Electrical scope matrix attached in Section I B of the technical specification.
- All drains shall be brought at one point on the skid by the bidder via a drain header and further connection to the nearest plant drain shall be done by BHEL/Customer.
- Counter flanges for all the piping terminal points (as per P&ID) and for the terminal point of drain header shall be in bidder's scope.

8. QUALITY PLAN AND SUB VENDOR APPROVAL

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

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9. DRAWINGS/DOCUMENTATION REQUIREMENT ALONG WITH BID

Bidder to furnish the following documents/information (**For Electrical and C&I please refer the respective section of the specification**).

- Deviation if any in the enclosed Schedule of deviation with cost of withdrawal only with mention of specification clause for which deviation is being asked. (Stamped & Signed)
- Compliance cum confirmation schedule.(Stamped & Signed)
- Schedule of Declaration. (Stamped & Signed)
- Un Price Schedule duly filled in. (Stamped & Signed).

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

In case of no deviation, Bidder to furnish signed and stamped copy of "Schedule of Deviations with cost of withdrawal" stating "**No Deviation**". No other technical document is required along with bidder's offer. Any other document submitted by bidder shall not be evaluated by BHEL and shall be considered as withdrawn. Bidder to note that any un-declared deviation mentioned in bidder offer other than specified in the scheduled of Deviations shall be considered as null and void.

10. DRAWING/DOCUMENTS REQUIREMENT (PI refer electrical & C&I portion also):-

For the Drawings/Documents requirement, please refer **Annexure-III**.

For the Drawings/Documents Submission Procedure, please refer **Annexure-VII**. 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.

11. SPARES

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

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

12.1 MANDATORY SPARES

- The list of mandatory spares is indicated in Annexure V.
- The bidder shall indicate the prices in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the BHEL & Customer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.
- The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes.

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- All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the unit. However, spares shall not be dispatched before dispatch of corresponding main equipment.
- Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.
- The Bidder shall note that if there is any change/ variation in equipment / system during detail engineering which causes any change/ variation in the essential spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the purpose of evaluation.

12.2 START-UP AND COMMISSIONING SPARES

Start-up and Commissioning spares are those which would be required during equipment or system testing, start up and commissioning. All spares used until the plant is finally handed over by the bidder to the Customer come under this category. All start-up and commissioning spares as required shall be provided by the bidder without any additional cost to the BHEL and Customer. The list of minimum start-up and commissioning spares are attached in Annexure-VI. However bidder to provide additional spares as per their system requirement without any commercial and delivery implication to BHEL/Customer during detailed engineering List of spares shall be furnished by BIDDER along with the offer.

Bidder shall be responsible for the ready and timely availability for all the start up and commissioning spares as required during various stages of testing, cleaning and commissioning up to handing over of each unit of the total plant.

An adequate stock of start-up spares shall be available at the site such that the start-up and commissioning of the equipment/systems, Performance guarantee test and handing over the equipment/ systems to the Customer will be carried out without hindrance and delay. All start-up spares which remain unused after the taking over of the plant shall remain the property of the Customer.

12.3 MAINTENANCE TOOLS AND TACKLES

- One set of all special tools shall be furnished and shipped with each piece of equipment for dismantling, maintenance, adjustment, and calibration of the equipment. The tools shall be shipped in separate heavily constructed wooden boxes provided with hinged covers and padlock hasps.
- The Contractor shall supply under this contract all maintenance tools for each piece of equipment / system and it shall be boxed separately and the boxes shall be appropriately marked for shipment and identification of contents.
- A weather-proof itemized list of the contents shall also be attached to the outside of each container.
- The maintenance tools shall include all special handling rigs, bars, slings, cable and all specialised equipment for control system maintenance such as extender boards, scopes, and all software and hardware. Further, Bidder shall also include a full set of regular maintenance tools and tackles required. Bidder shall also include all maintenance tools and tackles in their scope. Total price of all the maintenance tools and tackles shall be included in the quoted lump sum price.

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The vendor warrants:

1. That all spares supplied will be new and in accordance with the contract document and will be free from defects in design, material and workmanship and shall further guarantee as under:
 - a. In case of any failure in the original component/equipment due to faulty designs, materials and workmanship, the corresponding spare parts if any, supplied will be replaced without any extra cost to the BHEL and Customer unless a joint examination and analysis by BHEL and/or Customer of such spare parts prove that the defect found in the original part that failed can safely be assured not to be present in spare parts.
 - b. The long term availability of spares to the BHEL and the Customer for the full life of the equipment covered under the contract and that before going out of production of spare parts of the equipment covered under the contract, vendor and his sub-vendors shall give the BHEL and the Customer at least 24 (Twenty Four) months advance notice so that the latter may order his bulk requirements of spares, if he so desires. The same provision will also be applicable to the sub-vendors. Further, in case of discontinuance of manufacture of any spares by the vendors or his sub-vendors the vendors and his sub vendors, will provide the BHEL and the Customer, 2 (two) years in advance, with full manufacturing drawings, material specifications and technical information required by the BHEL and the Customer for the purpose of manufacture of such items and also the right to manufacture such spares for their own requirements.
 - c. Further in case of discontinuance of supply of spares by the vendors or his sub-vendors, the vendor will provide the BHEL and the customer with full information for replacement of such spares with other equivalent makes, if so required by the BHEL and the customer.
 - d. Notwithstanding the above, the vendor shall be responsible for supply of spares for the lifetime of the package at reasonable prices. The prices of all future requirements of spares shall be derived from the corresponding ex-works price at which the orders for such spares have been placed by the BHEL and the customer as a part of the mandatory or long term or any other kind of spares. The base indices for calculating ex-works price shall be commissioning of last equipment under main contract.
2. The vendor will indicate the delivery period of the spares, which the BHEL and the Customer may procure in accordance with this clause.
3. In case of emergency requirements of spares, the vendor would make every effort to expedite the manufacture and delivery of such spares on the basis of mutually agreed time schedule.
4. In case the vendor fails to supply the mandatory or long term or any other kind of spares on the terms stipulated above, the BHEL and the customer shall be entitled to purchase the same from the alternate sources at the risk and the cost of the vendor and recover from the vendor, the excess amount paid by the BHEL and the customer over the rates as per the contract. In the event of such risk purchase by the BHEL or the customer, the purchases will be as per the works and procurement policy of the BHEL and the customer prevalent at the time of such purchases and BHEL & the customer at his option may include a representative from the vendor in finalizing the purchases.
5. It is expressly understood that the final settlement between the parties in terms of relevant clauses of the tender document shall not relieve the vendor of any of his obligations under the provision of long term availability of spares and such provisions shall continue to be enforced till the expiry of 30 (thirty) years period reckoned from the scheduled date of completion of trial

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operation of the last equipment unless otherwise discharged expressly in writing by the BHEL or the Customer.

12. PACKING:

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

THE ACTUATOR OF THE PUMP SHALL BE PACKED IN AIR TIGHT PACKING ALONG WITH THE PUMP IN INSTALLED CONDITION FOR PREVENTING DAMAGE OF ACTUATOR.

Bidder shall submit the packing details during detailed engineering for approval. Any changes required in packing details shall be complied by the bidder without any price and delivery implication.

13. DESIGN REQUIREMENTS

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

- a. In addition to the requirements of Section-I & II the following shall also be complied under scope of this specification: The P&ID is enclosed herein in this section for bidder's compliance.
- b. The material of construction specified in Data Sheet-A are minimum requirements and material of construction for other components not specified shall be similarly selected by the bidder for intended duty which shall be subjects to Customer/BHEL approval during detailed engineering.
- c. All instrument-wetted parts will be suitable for requested application.
- d. All high points on any, tanks, pumps, piping or instrumentation will be vented and provided with valve. All low points on any, tanks, pumps, piping or instruments will be drained and provided with valve.
- e. All valves and instruments will be located such that they are easily accessible during normal operation and maintenance.
- f. 5mm thick IS 2062 Checker plate shall be provided covering the skid frame and for elevated platform for the preparation/measuring tank, wherever applicable. The tanks supports, pumps and pipe supports and LCP/LCP supports shall be welded to the checker plate.
- g. Stuffing box shall be provided for mounting the agitator to avoid air ingress.
- h. Vent/overflow pipe from tank shall at least reach the bottom half of the breather/water seal/CO2 absorber.
- i. SS pad shall be provided for welding MS structural supports to SS tanks.
- j. Step ladder and chemical charging platform shall be provided for easy access to top of tank.
- k. All the terminal points shall be easily accessible and towards one side of skid.
- l. All valves shall be easily accessible for the operator.
- m. All tanks/pumps shall have name plate clearly indicating the equipment name.
- n. Pipe fittings of the system shall be done using elbows and tees. Pipe bending is not acceptable.
- o. All equipment shall have SS name plate.
- p. All LCP shall be mounted in their respective dosing skids only.
- q. All the terminal points where flange joints are involved, bidder shall terminate it along with matching counter flange, nuts, bolts, gaskets etc.
- r. KKS codes for all drives and instruments for the project have to be followed.

14.0 MISCELLANEOUS REQUIREMENTS

- a. Initial charge of all lubricants & grease.
- b. All special tools necessary for proper maintenance or adjustment of the equipment packaged in permanent box.
- c. Finish paints for touch-up painting of equipment after erection at site in sealed container.
- d. All the first fill and one Year's topping requirements or 10 % of first fill quantity, whichever is more of consumable such as greases, oil, lubricants, servo fluids/control fluids, gases and etc. which

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will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be furnished by the bidder. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.

- e. Document approval by Customer/ BHEL under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval.
- f. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to Customer and BHEL for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
- g. In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion. However, in case changes are necessitated due to any constraints at Customer/BHEL end, delay in review/ approval of drawing beyond one month will be to Customer/BHEL account.
- h. Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the BHEL's switch gear /MCC on account of changed loads.
- i. Wherever CIVIL works is excluded from the bidder's scope, successful bidder shall furnish civil assignment / scope drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by vendor, BHEL reserves the right to debit cost of such rework to vendor".
- j. Bidder to submit BBU during detailed engineering after approval of Basic documents. BBU shall be equal to BOQ for the package and there shall be no price and delivery implication is applicable to BHEL / CUSTOMER for the same. None of the items supplied for the project as non-billable. Incomplete BBU shall not be review by BHEL.
- k. Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.
- l. Relevant requirements as per GTR, GCC, ECC & SCC. Any statutory requirement / clearance required for the packages from government / local body shall be in bidder's scope.
- m. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- n. Vendor to attend regular engineering meeting with BHEL and Customer fortnightly in BHEL or Customer office as decided during detail engineering. Vendor will depute his entire concerned engineering representatives along with the project manager for discussion and approval. Meeting can be held at site also.
- o. Latest version of all codes and standards to be followed.
- p. For detailed dispatch instructions, Bidder to refer special condition of contract (SCC) of the project.

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ANNEXURES

ANNEXURE I: QUALITY PLAN
ANNEXURE II: SUB VENDORS LIST
ANNEXURE III: DRAWING DOCUMENTS DISTRIBUTION
PROCEDURE
ANNEXURE IV: PAINTING SPECIFICATION
ANNEXURE V: MANDATORY SPARES LIST
ANNEXURE VI: LIST OF ERECTION & COMMISSIONING SPARES
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ANNEXURE VIII: FORMAT FOR OPERATION AND MAINTENANCE
MANUAL

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ANNEXURE I:

QUALITY PLAN

		MANUFACTURER'S NAME & ADDRESS :		QUALITY PLAN ITEM: CHEMICAL DOSING SYSTEM SUB - SYSTEM :				OP NO : PE - VE-420-154A-006 REV : 0 DATE :		PROJECT PACKAGE CONTRACT NO.		1X800 MW APPDCL KRISHNAPATNAM STAGE-II. CHEMICAL DOSING SYSTEM	
				CHEMICAL DOSING SYSTEM				PAGE : 2 OF 4		MAIN SUPPLIER		BHEL/PBM, 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	10	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		
		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/BATCH/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		SIGNATURE		MAIN SUPPLIER--BHEL		R:APPDCL		SIGNATURE OF APPROVAL BY CUSTOMER					

THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-420-154-A001

		MANUFACTURER'S NAME & ADDRESS :		CATEGORY		CHARACTERISTICS CHECKED		QUALITY PLAN				PROJECT PACKAGE CONTRACT NO.		1X800 MW APPDCL KRISHNAPATNAM STAGE-II.	
								ITEM: CHEMICAL DOSING SYSTEM	OP.NO : PE - VE-420-154A-3006	REV. : 0	DATE :				
SUB - SYSTEM :		CHEMICAL DOSING SYSTEM		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORMS		FORMAT OF RECORDS		BHEL/PEM, NOIDA			
S.NO	COMPONENTS/ OPERATION	3	4	5	6	7	8	9	AGENCY**		10				
									M	B	R				
1	2	3	4	5	6	7	8	9	10		11				
9.0	FITTING/FLANGES FOR PIPING:														
9.1	RAW MATERIAL		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				
			MA	HEAT TREATMENT	100%	ASTM A 182 GR.TP 304	ASTM A 182 GR.TP 304	MFG.TC/LAB REPORT	P	V	V				
9.2	FINAL INSPECTION		MI	IGC TEST	1/HT BATCH	ASTM A 262 PR 'E'	ASTM A 262 PR 'E'	MFG.TC/LAB REPORT	P	V	V				
			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		MA	PHY & CHEM. TEST	1/BAR/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V				
10.2	SCREEN		MA	CHEMICAL	1/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V				
			MA	MEASUREMENT	1/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V				
10.3	FINAL INSPECTION		MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V				
				HYDRO TEST	100%	1 BHEL APPD.DATA SHEET	NO LEAKAGE	MFG.TC	P	V	V				
11.0	PIPE (SEAMLESS)														
11.1	MATERIAL		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				
			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				
			MI	GRAINS STRUCTURE	1/HT BATCH/SIZE	FOR HEAT TREATMENT	FOR HEAT TREATMENT	MFG.TC/LAB REPORT	P	V	V				
			MI	IGC TEST	1/HT BATCH/SIZE	ASTM A 262 PR 'E'	ASTM A 262 PR 'E'	MFG.TC/LAB REPORT	P	V	V				
			MA	LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE	MFG.TC/R	P	V/W	V				
12.0	LEVEL GAUGE:														
12.1	RAW MATERIAL		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		MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V				
			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 & BOLU		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		MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG.TC/LAB REPORT							
13.3	PERFORMANCE														
14.0	SWITCHES(LEVEL, PRESSURE & DP) & TRANSMITTERS (LEVEL, PRESSURE & DP):		MA	CALIBRATION	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG. TC	P	V	V				
14.1	MAT. FOR WETTED PARTS		MA	CHEM. TEST	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V				
14.2	PERFORMANCE		MA	CALIBRATION & VISUAL	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V				
				ELECTRICAL	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V				
				MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG.TC	P	V	V				
			MI	VERIFICATION OF TYPE TEST CERT TYPE TEST		BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V				
** LEGEND : M : MANUFACTURER/SUB-CONTRACTOR/SUB-VENDOR B : BHEL/NOMINATED INSPECTION AGENCY "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION															
MANUFACTURER/ SUB CONTRACTOR		MAIN SUPPLIER--BHEL		SIGNATURE OF APPROVAL BY CUSTOMER											
SIGNATURE															

THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-420-154-A001

		MANUFACTURER'S NAME & ADDRESS :		QUALITY PLAN ITEM: CHEMICAL DOSING SYSTEM SUB - SYSTEM :				OP.NO : PE - VE-420-154A-006 REV : 0 DATE :		PROJECT PACKAGE CONTRACT NO.		1X800 MW APPDCL KRISHNAPATNAM STAGE-II. CHEMICAL DOSING SYSTEM	
				CHEMICAL DOSING SYSTEM		PAGE : 4 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	10	11			
15.0	CONTROL PANEL:	DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	CONTROL 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 : MANUFACTURER/SUB-CONTRACTOR/SUB-VENDOR B : BHEL/NOMINATED INSPECTION AGENCY P: PERFORM, W: WITNESS, AND "V" VERIFICATION									
SIGNATURE				SIGNATURE OF APPROVAL BY CUSTOMER									
THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-420-154-A001													

	TITLE:	SPECIFICATION NO. PE-TS-420-154-A001
	1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SECTION I
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ANNEXURE II:

SUB VENDORS LIST

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SUB VENDOR LIST - MECHANICAL

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SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	TANKS/DISSOLVING BASKETS/WATER SEAL/CO2 ABSORBER/BREATHER	SELF MAKE OF MAIN VENDOR		
2.	METERING PUMPS	VK PUMPS	NASIK	
		MILTON ROY INDIA	CHENNAI	
		SWELLORE	AHMEDABAD	
		POSITIVE METERING PUMPS	NASIK	
		METACHEM	MUMBAI	
3.	AGITATOR	REMI PEOCESS PLANT & M/C	MUMBAI	
		FIBRE & FIBRE	MUMBAI / SILVASA	
		CEECONS	CHENNAI	
		STANDARD ENGINEERS	MUMBAI	
4.	BALL VALVE (MANUAL /PNEUMATIC/ ELECTRIC) CLASS 150	A.V. VALVES LTD	AGRA	
		AKAY INDUSTRIES PVT.LTD.	DHARWAD	
		BELGAUM AQUA VALVES PVT. LTD.	BELGAUN	
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS.	CHENNAI	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		DEMBLA VALVES LTD.	THANE	
		M/S GM ENGINEERING	RAJKOT	
		HAWA VALVES (INDIA) PVT. LTD.	NAVI MUMBAI	
		INTERVALVE (INDIA) LTD.	PUNE	
		LEADER VALVES LTD.	JALANDHAR	
		MICROFINISH VALVES PVT LTD.	HUBLI	
		NILON VALVES PRIVATE LIMITED	AHMEDABAD	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		UNIFLOW	CHENNAI	
		VALTECH INDUSTRIES	MUMBAI	
		VAAS AUTOMATION PVT. LTD.	NEW DELHI	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
5.	DIAPHRAGM VALVE (MANUAL / PNEUMATIC) CLASS 150	WEIR BDK	HUBLI	
		CRANE FLOW PROCESS	SATARA	
		PROCON	MUMBAI	
		MAJESTIC VALVES (LABLINE)	-	
		HAWA ENGINEERS	AHMEDABAD	
6.	DUAL PLATE CHECK	ADVANCE VALVES PVT. LTD.	NOIDA	

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	VALVES	FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	1. DUAL PLATE CHECK VALVE CI - CLASS 150 & UP TO 600NB, 2. DUAL PLATE CHECK VALVE CCS - CLASS 150 & UP TO 500NB
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CI ,CCS & STAINLESS STEEL SPRING ASSISTED DUAL PLATE CHECK VALVES UPTO 700 NB AND 150 CLASS RATING.
7.	Y-TYPE STRAINER / STRAINER (WATER SERVICE)	OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		GRAND PRIX	NEW DELHI	
		JAYPEE	NEW DELHI	
		GREAVES COTTON	MUMBAI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI / NOIDA	
		FILTRATION ENGINEERS (I) PVT. LTD	MUMBAI	
		FLUIDNYE	-	
		SUNGOV ENGINEERING PVT. LTD.	DELHI	
		GRAND PRIX	FARIDABAD	
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
		BHATIA ENGINEERING CO.	DELHI	
8.	SS PIPES / TUBES	APEX TUBES	BEHROR (ALWAR)	
		RATNAMANI	CHATTRAL	
		REMI	TARAPUR	
		PRAKASH STEELAGE	-	
9.	SAFETY SHOWER	UNICARE	-	
		MOHAN INDUSTRIES	-	
		SUPER SAFETY SERVICES	-	
10.	STROKE CONTROLLER	V K PUMPS	NASIK	
		METACHEM	MUMBAI	
		SWELORE	AHMEDABAD	
		MILTON ROY INDIA	CHENNAI	
11.	SAFETY VALVES/RELIEF VALVES	METACHEM	MUMBAI	
		KEYSTONE	BARODA	
		V K PUMPS	NASIK	
		MILTON ROY	CHENNAI	
12.	STEEL GATE/GLOBE/NR	A.V. VALVES LTD	AGRA	



TITLE:
**1X800 MW APPDCL KRISHNAPATNAM
STAGE-II**

**TECHNICAL SPECIFICATION FOR
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VALVES	ATAM VALVES PVT. LTD.	JALANDHAR	(1) CARBON STEEL GATE VALVES & NON RETURN VALVES: 15 NB TO 50 NB (#800) & 65 NB TO 300 NB (#150) (2) CARBON STEEL GLOBE VALVES: 15 NB TO 50 NB (#800) & 65 NB TO 200 NB (#150)
	FLUIDLINE VALVES COMPANY PVT.LTD.	KAUSHAMBI	
	M/S GM ENGINEERING	RAJKOT	
	INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C) SUPPLIER NOT REGISTERED FOR NR VALVES
	LEADER VALVES LTD.	JALANDHAR	
	NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
	NSSL LIMITED.	NAGPUR	
	STEEL STRONG VALVES (I) PVT.LTD.,	NAVI MUMBAI	LIMITED TO RANGES & CLASSES AS AVAILABE IN VD FILE.
	VENUS PUMPS AND ENGG. WORKS	KOLKATA	CC/CSS-GATE-BBT- UPTO600NB CL UPTO300,GATE-PSBT UPTO250NB CL 1500,GLV-BBT- UPTO300NB CL UPTO600,SCNRV- BBT-UPTO600NB CL UPTO150,SCNRV- BBT-UPTO300NB CL 300,SCNRV-PSBT- UPTO150NB CL UPTO900



TITLE:
**1X800 MW APPDCL KRISHNAPATNAM
STAGE-II**

**TECHNICAL SPECIFICATION FOR
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		VALTECH INDUSTRIES	MUMBAI	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE- GV/150/900,GV/300/40 0, GV/600/300 , GV/GLV/NRV/900/250 , GLV/300/300,GLV/150/ 350/ , SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.
		V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
13. FITTINGS (CS/SS)		M.S. FITTINGS	KOLKATA	
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
		TUBE PRODUCTS	BARODA	
		NL HAZRA	KOLKATA	
		GUJRAT INFRA PIPES	BARODA	
		EDWARDS	USA	
		PIPEFIT ENGINEERS	BARODA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
14. FLANGES (SS/CS)		PRADEEP METALS LTD	MUMBAI	
		TUBE PRODUCT INCORPORATION	BARODA	
		MS FITTINGS	KOLKATA	
		HAWA ENGINEERING	-	
		ALIANCE PIPE & PLANGES	KOLKATA	
		JAI AMBE	MUMBAI	
15. PAINT				
		BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
16. MOTORISED ACTUATOR		JOTUN PAINTS		
		ROTARK	-	
		AUMA	-	

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		LIMITORK	-	
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NOTE:

1. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL.

BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.

2. DEALERS ARE NOT ACCEPTABLE FOR ANY ITEM OF THE PACKAGE. BIDDER SHALL PROCURE ALL ITEMS INCLUDING PLATES, STRUCTURAL, FLANGES; COUNTER FLANGES ETC. FROM APPROVED SUB VENDOR ONLY.
3. THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ CUSTOMER.

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SUB VENDOR LIST ELECTRICAL

COMPREHENSIVE & UPDATED LIST OF MAIN VENDORS FOR BoIs PROCURED BY ELECTRICAL, C&I, MPL & MSE TO BE USED AS APPROVED SUB-VENDORS FOR BoP/ BoI PACKAGES					
S. No.	Deptt.	Package	PMD Vendor/ Sub Vendor	Vendor Address	Remarks
1	Electrical	LV MOTORS (NON FLAME PROOF)	ABB	14, MATHURA ROAD, FARIDABAD, HARYANA-121003	Sub vendor
2	Electrical	LV MOTORS (NON FLAME PROOF)	BHARAT BIJLEE LTD.	BHARAT BIJLEE LIMITED, 1ST FLOOR, 7-B, RAJINDRA PARK, PUSA ROAD, NEW DELHI - 110 060.	Sub vendor
2	Electrical	LV MOTORS (NON FLAME PROOF)	CROMPTON GREAVES	3RD FLOOR, EXPRESS BUILDING,9-10, BAHADUR SHAH ZAFAR MARG, NEAR ITO CROSSING,NEW DELHI-110002, INDIA	Sub vendor
3	Electrical	LV MOTORS (NON FLAME PROOF)	GE-POWER	KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032	Sub vendor
3	Electrical	LV MOTORS (NON FLAME PROOF)	KIRLOSKAR ELECTRIC CO LTD.	P.O. BOX 5555 , MALLESWARAM WEST ,BANGALORE 560055	Sub vendor
4	Electrical	LV MOTORS (NON FLAME PROOF)	LAXMI HYDRAULICS PVT. LTD	129/130, INDUSTRIAL ESTATE PATIL NAGAR, HOTGI ROAD SOLAPUR-413003, MAHARASHTRA	Sub vendor
4	Electrical	LV MOTORS (NON FLAME PROOF)	MARATHON	MARATHON ELECTRIC INDIA PRIVATE LTD.SECTOR - 11, MODEL TOWN, FARIDABAD - 121006	Sub vendor
5	Electrical	LV MOTORS (NON FLAME PROOF)	NGEF	POCKET NO.10, FLAT NO. 37 & 38, EXPANDABLE DDA FLATS, NASIRPUR DWARKA, PHASE-I NEW DELHI-110 045	Sub vendor
5	Electrical	LV MOTORS (NON FLAME PROOF)	RAJINDRA ELECT INDUSTRIES	14 SHAH IND.ESTATE VEERA DESAI RD,ANDHERI(W) MUMBAI-400053	Sub vendor
6	Electrical	LV MOTORS (NON FLAME PROOF)	SIEMENS	RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA	Sub vendor
6	Electrical	LV MOTORS (FLAME PROOF)	RAJINDRA ELECT INDUSTRIES	14 SHAH IND.ESTATE VEERA DESAI RD,ANDHERI(W) MUMBAI-400053	Sub vendor
7	Electrical	JUNCTION BOXES (NON FLAME PROOF)	JASPER ENGNIREES PVT. LTD.	A-23, SECTOR - 8, NOIDA-201301	Sub vendor
7	Electrical	JUNCTION BOXES (NON FLAME PROOF)	Electro Controls & Devices	M/S ELECTRO CONTROLS & DEVICES, F-41, SITE-C, SURAJPUR INDUSTRIAL AREA GREATER NOIDA, UTTAR PRADESH :201308	Sub vendor
8	Electrical	JUNCTION BOXES (NON FLAME PROOF)	M/s Shrenik & Co.	39A/3, PANCHRATNA INDUSTRIAL ESTATE, SARKHEJ-BAVLA ROAD, CHANGODAR, AHMEDABAD – 382 213	Sub vendor
8	Electrical	JUNCTION BOXES (NON FLAME PROOF)	M/s PHOENIX MECANO LTD.,	388 BHARE, TALUKA MULSHI, POST GHOTAWADE, PIRANGOOT, INDUSTRIAL AREA, PUNE-412115	Sub vendor

9	Electrical	JUNCTION BOXES (NON FLAME PROOF)	Adroit Control Engineers Pvt.Ltd.	M/S ADROIT CONTROL ENGINEERS PVT.LTD. PLOT-3, KRISHNA INDL. AREA, SECTOR-25 FARIDABAD – 121004	Sub vendor
9	Electrical	JUNCTION BOXES (NON FLAME PROOF)	M/s PHOENIX MECANO LTD.,	388 BHARE, TALUKA MULSHI, POST GHOTAWADE, PIRANGOOT, INDUSTRIAL AREA, PUNE-412115	Sub vendor
10	Electrical	JUNCTION BOXES (NON FLAME PROOF)	MIKA ENGINEERS	BRANCH OFFICE : 'D'-101, DHEERAJ HERITAGE RESIDENCY II, SHASTRI NAGAR, SANTACRUZ (W), MUMBAI 400 054.	Sub vendor
10	Electrical	JUNCTION BOXES (NON FLAME PROOF)	M/s PHOENIX MECANO LTD.,	388 BHARE, TALUKA MULSHI, POST GHOTAWADE, PIRANGOOT, INDUSTRIAL AREA, PUNE-412115	Sub vendor
11	Electrical	JUNCTION BOXES (NON FLAME PROOF)	BAJAJ ELECTRICALS	BAJAJ ELECTRICALS LTD. ENGINEERING & PROJECTS BU (NORTH) 3rd FLOOR, GULMOHARHOUSE, COMMUNITY CENTRE 161/B-4, GAUTAM NAGAR, YUSUF SARAI NEW DELHI – 110049	Sub vendor
11	Electrical	JUNCTION BOXES (NON FLAME PROOF)	AJMERA INDUSTRIES & ENGG. WORKS	AJMERA INDL. AND ENGG. WORKS. AJMERA HOUSE, A-61 / KHAIRANE MIDC. , TTC INDL. AREA, NAVI MUMBAI – 400705.	Sub vendor
12	Electrical	JUNCTION BOXES (NON FLAME PROOF)	S.B. ELECTRICAL ENGINEERING CORPORATION	03, SARDAR GRIHA BUILDING, LOHAR CHAWAL, MUMBAI-400002	Sub vendor
12	Electrical	JUNCTION BOXES (FLAME PROOF)	SUDHIR SWITCHGEAR	305/6, APEEJAY HOUSE, 130, BOMBAY SAMACHAR MARG, MUMBAI - 400 023. INDIA	Sub vendor
13	Electrical	CABLE TRAYS & ACC.	ADVANCE POWER PRODUCTS	Mr. Manmohan Damani 24A, Rabindra Sarani, Kolkata-West Bengal-INDIA Phone- 033-22252463 Pincode : 700073 Email : advancepowerproducts@vsnl.net	PMD
13	Electrical	CABLE TRAYS & ACC.	EROS METAL WORKS (P) LTD.	Mr. Amit N. Pande G-5, MIDC Industrial area Hingna Road Nagpur-Maharashtra-India Phone- 9371490163 Pincode : 440028 Email : emwpl ngp@sancharnet.in	PMD
14	Electrical	CABLE TRAYS & ACC.	INDUSTRIAL PERFORATION (I) PVT.LTD.	MR. A. K. SAHA 327, R.N.GUHA ROAD, DUM DUM KOLKATA-West Bengal-India Phone- 9830241788 Pincode : 700028 Email : ipipl@cal2.vsnl.net.in	PMD
14	Electrical	CABLE TRAYS & ACC.	INDIANA GRATINGS PVT. LTD.	Sri D. M. Bhatia, M.D. Indiana House, Makeana Road, Marol Naka, Andheri (East), MUMBAI-MAHARASHTRA-INDIA Phone- 02228504743 Pincode : 400059 Email : dhanji.bhimani@indianagroup.com	PMD
15	Electrical	CABLE TRAYS & ACC.	INDIA ELECTRICALS SYNDICATE	Mr. Suresh Kumar Agarwal 55, Ezra Street, Kolkata-West Bengal-India Phone- 033-22354047 Pincode : 700001 Email : cabletray@vsnl.com	PMD

15	Electrical	CABLE TRAYS & ACC.	INDMARK FORMTECH PVT. LTD.	Mr. Narendra R. Meher J Block, Plot No.- 375, MIDC BHOSARI PUNE- MAHARASHTRA-INDIA Phone- 020- 27130546 Pincode : 411026 Email : indmarkformtech@vsnl.net	PMD
16	Electrical	CABLE TRAYS & ACC.	Maheshwari Electrical Mfrs. Pvt. Ltd.,	A-59, Sector-5, Noida,-UP,-India, Phone- 9811027324, Pincode : 201301, Email : memindia@gmail.com,	PMD
16	Electrical	CABLE TRAYS & ACC.	NAMDHARI INDUSTRIAL TRADERS PVT. LTD	Mr. Gurdeep Singh 515/5, Industrial Area- B, Overlock Road, Ludhiana-Punjab- India Phone- 0161-2531398 Pincode : 141003 Email : namdhari_ind_traders@yahoo.com	PMD
17	Electrical	CABLE TRAYS & ACC.	PREMIER POWER PRODUCTS (CAL) PVT. LTD.	Chatterjee International Centre, 33A, Jawaharlal Nehru Road, 6th Floor, Suit No. - 11A, Kolkata,-West Bengal-India Phone- 9331008739 Pincode : 700071 Email : hemantdaga@dagaventures.com	PMD
17	Electrical	CABLE TRAYS & ACC.	PATNY SYSTEMS (P) LTD	PATNY PLAZA 160 , SARDAR PATEL ROAD SEUNDRABAD SECUNDRABAD-TELANGANA-INDIA Phone- 040-27902451 Pincode : 500003 Email : mr.mkt@patnysystems.com	PMD
18	Electrical	CABLE TRAYS & ACC.	PARMAR METALS PVT.LTD.	MR. KIRIT PARMAR 28-A, BHAKTINAGAR INDL ESTATE RAJKOT- GUJARAT-INDIA Phone- 9925019998 Pincode : 360 002 Email : info@parmarmetal.com	PMD
18	Electrical	CABLE TRAYS & ACC.	PASSIVE INFRA PROJECTS PVT. LTD.	MR. VARUN AGRAWAL 182, VAISHALI, PITAMPURA Delhi-DELHI-INDIA Phone- 9871183059 Pincode : 110088 Email : ATANU.SAHA@PASSIVEINFRA.COM	PMD
19	Electrical	CABLE TRAYS & ACC.	PENTAX FERRO INCORPORATE	Mr. Rajeev Kandhari 801, 8th Floor, Palm Springs, Link road, Malad (W) Mumbai- Maharashtra-India Phone- 09820088400 Pincode : 400064 Email : rajeev@jencogalva.com	PMD
19	Electrical	CABLE TRAYS & ACC.	RUKMANI ELECTRICAL & COMPONENTS PVT LTD	11A , MAHARISHI DEBENDRA ROAD 1ST FL , ROOM NO.4 KOLKATA- WEST BENGAL-INDIA Phone- Pincode : 700007 Email : maruthikabra@gmail.com	PMD
20	Electrical	CABLE TRAYS & ACC.	RATAN PROJECTS & ENGINEERING CO. PVT.LTD.	MR. G.D. SINGHEE/MR. MAHESH SINGHEE 26, P.K. TAGORE STREET, MAIN BUILDING KOLKATA-WEST BENGAL-INDIA Phone- 9830177331 Pincode : 700006 Email : mahesh@ratans.com	PMD
20	Electrical	CABLE TRAYS & ACC.	RABI ENGINEERING WORKS PVT. LTD.	MR. TAPAN KUMAR SEN/MR. SIDDHARTHA 327, R.N. GUHA ROAD, DUM DUM, KOLKATA-WEST BENGAL- INDIA Phone- 9748753002 Pincode : 700028 Email : rabiengineering@gmail.com	PMD
21	Electrical	CABLE TRAYS & ACC.	Saral Industries	Mr. Y.K. Gupta L-1, L-2, Industrial Area-1 Sultanpur Road Rae Bareli-Uttar Pradesh-India Phone- 0535-2702474 Pincode : 229010 Email : saralindustries@gmail.com	PMD

21	Electrical	CABLE TRAYS & ACC.	UNITECH FABRICATORS and ENGINEERS PVT LTD	INDRAPRASHTHA APARTMENT 24 , M.B.RAOD , BIRATI KALABAGAN KOLKATA KOLKATA-WEST BENGAL-INDIA Phone- Pincode : 700051 Email : ufepl@vsnl.net; ufepl@rediffmail.com	PMD
22	Electrical	CABLE TRAYS & ACC.	VINFAB ENGINEERS INDIA PVT. LTD.	Mr. Vinay Deepak Kandhari 510-Sanjar Enclave, S.V. Road, Opp. Milad Cinema,Kandivali (West), Mumbai-Maharashtra-India Phone- 09833513350 Pincode : 400067 Email : vinay.kandhari@vkindia.com	PMD
22	Electrical	CABLE TRAY SUPPORT SYSTEM-WELDED(GALV)	EROS INFRASTRUCTURES PVT. LTD.	Mr. Amit Pande MIDC Industrial Area, Butibori, G-97, Nagpur-Maharashtra-India Phone- 0712-3205305 Pincode : 441103 Email : amitp@erosgroup.co.in	PMD
23	Electrical	CABLE TRAY SUPPORT SYSTEM-WELDED(GALV)	INDUSTRIAL PERFORATION (I) PVT.LTD.	MR. A. K. SAHA 327, R.N.GUHA ROAD, DUM DUM KOLKATA-West Bengal-India Phone- 9830241788 Pincode : 700028 Email : ipipl@cal2.vsnl.net.in	PMD
23	Electrical	CABLE TRAY SUPPORT SYSTEM-WELDED(GALV)	INDMARK FORMTECH PVT. LTD.	Mr. Narendra R. Meher J Block, Plot No.- 375, MIDC BHOSARI PUNE-MAHARASHTRA-INDIA Phone- 020-27130546 Pincode : 411026 Email : indmarkformtech@vsnl.net	PMD
24	Electrical	CABLE TRAY SUPPORT SYSTEM-WELDED(GALV)	JAGANNATHAN ENGINEERING WORKS	Mr. S. Narayanan SF NO 22/2A-3G, Attikudi Village Vengur Post, Thiruverumbur Trichy-Tamil Nadu-India Phone- 0431-2404012 Pincode : 620013 Email : jewengg7@gmail.com	PMD
24	Electrical	CABLE TRAY SUPPORT SYSTEM-WELDED(GALV)	PREMIER POWER PRODUCTS (CAL) PVT. LTD.	Chatterjee International Centre, 33A, Jawaharlal Nehru Road, 6th Floor, Suit No. - 11A, Kolkata,-West Bengal-India Phone- 9331008739 Pincode : 700071 Email : hemantdaga@dagaventures.com	PMD
25	Electrical	CABLE TRAY SUPPORT SYSTEM-WELDED(GALV)	PATNY SYSTEMS (P) LTD	PATNY PLAZA 160 , SARDAR PATEL ROAD SEUNDRABAD SECUNDRABAD-TELANGANA-INDIA Phone- 040-27902451 Pincode : 500003 Email : mr.mkt@patnysystems.com	PMD
25	Electrical	CABLE TRAY SUPPORT SYSTEM-WELDED(GALV)	RUKMANI ELECTRICAL & COMPONENTS PVT LTD	11A , MAHARISHI DEBENDRA ROAD 1ST FL , ROOM NO.4 KOLKATA-WEST BENGAL-INDIA Phone- Pincode : 700007 Email : maruthikabra@gmail.com	PMD
26	Electrical	CABLE TRAY SUPPORT SYSTEM-WELDED(GALV)	RATAN PROJECTS & ENGINEERING CO. PVT.LTD.	MR. G.D. SINGHEE/MR. MAHESH SINGHEE 26, P.K. TAGORE STREET, MAIN BUILDING KOLKATA-WEST BENGAL-INDIA Phone- 9830177331 Pincode : 700006 Email : mahesh@ratans.com	PMD
26	Electrical	CABLE TRAY SUPPORT SYSTEM-WELDED(GALV)	RABI ENGINEERING WORKS PVT. LTD.	MR. TAPAN KUMAR SEN/MR. SIDDHARTHA 327, R.N. GUHA ROAD, DUM DUM, KOLKATA-WEST BENGAL-INDIA Phone- 9748753002 Pincode : 700028 Email : rabiengineering@gmail.com	PMD

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27	Electrical	CABLE TRAY SUPPORT SYSTEM- WELDED(GALV)	Saral Industries	Mr. Y.K. Gupta L-1, L-2, Industrial Area-1 Sultanpur Road Rae Bareilly-Uttar Pradesh-India Phone- 0535-2702474 Pincode : 229010 Email : saralindustries@gmail.com	PMD
27	Electrical	CABLE TRAY SUPPORT SYSTEM- WELDED(GALV)	TJSV Steel Fabrication & Galvanizing (India) Limited	Mr. N. Sreekumar Vasavanaickenpatti, Kondampatti Post, Gudimangalam, No. 83, Udumalpet,-Tamil Nadu-India Phone- 0425-2249481 Pincode : 642201 Email : nsreekumar1949@gmail.com	PMD
28	Electrical	CABLE TRAY SUPPORT SYSTEM- WELDED(GALV)	UNITECH FABRICATORS and ENGINEERS PVT LTD	INDRAPRASHNTHA APARTMENT 24 , M.B.RAOD , BIRATI KALABAGAN KOLKATA KOLKATA-WEST BENGAL- INDIA Phone- Pincode : 700051 Email : ufepl@vsnl.net; ufepl@rediffmail.com	PMD
28	Electrical	CABLE GLANDS	ALLIED TRADERS & EXPORTERS	C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA	Sub vendor
29	Electrical	CABLE GLANDS	ARUP ENGG & FOUNDRY WORKS	391/119,PRINCE ANWAR SHAH ROAD, CALCUTTA-700068	Sub vendor
29	Electrical	CABLE GLANDS	BALIGA LIGHTING EQPT.PVT.LTD.	63A,CP RAMASWAMY ROAD, ALWARPET,P.B.No 6910, CHENNAI- 600018	Sub vendor
30	Electrical	CABLE GLANDS	COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI- 400063	Sub vendor
30	Electrical	CABLE GLANDS	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	Sub vendor
31	Electrical	CABLE GLANDS	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059	Sub vendor
31	Electrical	CABLE GLANDS	INCAB	HARE STREET,KOLKATA, WEST BENGAL- 700001	Sub vendor
32	Electrical	CABLE LUGS	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	Sub vendor
32	Electrical	CABLE LUGS	UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001	Sub vendor
33	Electrical	GI CONDUITS	BIS APPROVED MAKE		Sub vendor



TITLE:
**1X800 MW APPDCL KRISHNAPATNAM
STAGE-II**

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM**

SPECIFICATION NO. PE-TS-420-154-A001

SECTION I

SECTION - I A

REV.NO. 0 DATE : 29/03/2017

SUB VENDOR LIST C&I

LIST OF C&I VENDORS

Sl No	Package Name	Supplier Name	Supplier Communication Address	Supplier Works Address
1	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, Kolkata Phone- +91 33 2548 7220 Pincode : 700074 Email : parthabosebpi@gmail.com; bosepanda@vsnl.net	Works-1->Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, -Kolkata-WEST BENGAL India Phone- +91 33 2548 7220 FAX : +91 33 2548 0429, Pincode : 700074 Email : parthabosebpi@gmail.com bosepanda@vsnl.net
2	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in	Works-1->Mr. Gautam Mukherjee Kusumba, Sonarpur Station Road, P.O. -Narendrapur, -Kolkata-WEST BENGAL INDIA Phone- 9836878855 FAX : 033-24342748 Pincode : 700103 Email : gkm_ani@hotmail.com
3	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com	Works-1->Mr. Hitesh Parmar/Mr. Hitesh Parmar Plot No.2306, Phase II, GIDC Chhatral, -Kalol-GUJARAT INDIA Phone- 9327359227 FAX : 02764-233440 Pincode : 382729 Email : hitesh.parmar@ashcroftindia.com
4	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	Works-1->Mr. Shyam Warilani/Mr. V Suresh Babu Plot No 34 À GIDC À Phase 1, -VAPI-GUJARAT INDIA Phone- +91 11 4161 7111 FAX : 022 2687 3613 Pincode : 396 195 Email : pbajaj@baumer.com
5	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32, INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com	Works-1->Shikha Hazra/Shyamal Hazra 32, Industrial Suburb, Yeshwanthpur - BANGALORE-KARNATAKA INDIA Phone- 080-23370300 FAX : 080-23379890 Pincode : 560022 Email : shikhahazra@hgurusouth.com
6	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com	Works-1->MR G.SRINIVASAN/MR ANUJ MALPANI PLOT NO:A-19/2 & T-4/2, I.DA. NACHARAM, -HYDERABAD-TELANGANA INDIA Phone- 09866550762 FAX : 040 27152193 Pincode : 560076 Email : gshrinivasan@forbesmarshall.com

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7	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net	Works-1->NA NA -- Phone- FAX : Pincode : Email :
8	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011- 41607463, Pincode : 400016, Email : gicdelhi@general- gauges.com,	Works-1->Gauge Bourdon India Pvt. Ltd., Plot No-4, 5, 6,Jawahar Co-operative Industrial Estate, - Kalamboli Taluka Panvel- MAHARASHTRA India Phone- 022- 27421095, FAX : 022-27421901, Pincode : 410209, Email : info@general-gauges.com
9	LEVEL GAUGE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	Works-1->Mr. Bharat Kumar/ Mr. Sasi Kumar Plot No. 92B & 93B,Sec-V, IMTManesar - GURGAON-HARYANA INDIA Phone- 0124-4366000 TO 9 FAX : 0124-2290884 Pincode : 122002 Email : bharat@blissanand .com
10	LEVEL GAUGE	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com	
11	LEVEL GAUGE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in	Works-1->R Gopinath 27 Nahur Udyog Industrial Premises,M.M.Malviya Road, Mulund(-MUMBAI- MAHARASHTRA INDIA Phone- +912225918567 FAX : +912225918566 Pincode : 400080 Email : sales@sigmainstruments.co.in
12	TRANSMITTERS	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com	Works-1->Matt Moren/Gina Cruz 16650 Schoenborn St., North Hills -CALIFORNIA- USA Phone- +1 818 894 7111, ext FAX : +1 818 830 5588 Pincode : 91343 Email : gcruz@miinet.com

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13	TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,	Works-1-> Khasra No.: 218-230& 235, Industrial Estate, Makhupura, -Ajmer- RAJASTHAN India Phone- 9887865856, FAX : 0145-2695174, Pincode : 305002, Email : rajeev.gupta@tipl.com
14	TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,	Works-1-> M-171 to 173, MIDC, Waluj, -Aurangabad- MAHARASHTRA India Phone- 9881000474, FAX : 0240-2555179, Pincode : 431136, Email : Narendra.Kulkarni@wetzler.endress.com
15	TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business, Parsiwada, Sahar road, Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	Works-1-> Mr. Santosh Shukla Others R-628, TTC Industrial Area, MIDC Rabale, -Navi Mumbai- MAHARASHTRA India Phone- 9821350761, FAX : 022-27695559, Pincode : 400701, Email : sales@panamengineers.com
16	TRANSMITTERS	V. AUTOMAT & INSTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	Works-1-> Mr. BHAGWAN SINGH/ Mr. NANDAN SINGH F-61, OKHLA INDL.AREA, PHASE-I - NEW DELHI-DELHI INDIA Phone- 011-47627200 Extn. 3 FAX : 011- 26819440 Pincode : 110 020 Email : production@vautomat.com
17	TRANSMITTERS	ABB LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com	
18	TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,	Works-1-> PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, -BANGALORE- KARNATAKA INDIA Phone- 080-41586000, FAX : 080-28521442, Pincode : Email : uday.shankar@in.yokogawa.com

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19	TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com	Works-1->Mr.Kedar Tillu 53, 54, 56 & 57, Hadapsar Industrial Estate -PUNE-MAHARASHTRA INDIA Phone- 9665034625 FAX : 020 66039905 Pincode : 411013 Email : kedar.tillu@honeywell.com
20	TRANSMITTERS	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com	Works-1->Ankit Varshney Kalwa Works, Thane-Belapur Road, Thane, -MUMBAI- MAHARASHTRA INDIA Phone- FAX : Pincode : 400708 Email :
21	TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com	Works-1->Kalpesh Chandan/Hrishikesh Aghor Plot No. A 145/4 TTC IND AREA,MIDC, PAWANE, -NAVI MUMBAI-MAHARASHTRA INDIA Phone- 9619688001 FAX : 022- 66736000 Pincode : 400 705 Email : Kalpesh.chandan@emerson.com
22	TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delbby.rpgms.ems.vsnl.net.in	
23	LOCAL CONTROL PANELS	C and S ELECTRIC LTD.	222, OKHLA INDUSTRIAL ESTATE, PHASE-II, NEW DELHI Phone- 9871799447 Pincode : 110020 Email : panel.marketing@cselectric.co.in	
24	LOCAL CONTROL PANELS	PYROTECH ELECTRONICS PVT. LTD.	E-329, ROAD NO.12, MIA, UDAIPUR Phone- 2492122,31,34 Pincode : 313003 Email : pyrotech@pyrotechindia.com	

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25	LOCAL CONTROL PANELS	PROCON INSTRUMENTATION PVT. LTD.	1H, SHAKTI TOWERS, 766, ANNA SALAI, CHENNAI Phone- 28266041,2824142 Pincode : 600022 Email : procond1@nda.vsnl.net.in	
26	LOCAL CONTROL PANELS	INDUSTRIAL CONTROLS & APPLIANCES PVT LTD	47, CHAKALA ROAD, ANDHERI(EAST), MUMBAI Phone- 28344494,28221532 Pincode : 400099 Email : indconapp@vsnl.com	

	TITLE: 1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SPECIFICATION NO. PE-TS-420-154-A001
		SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION - I A
		REV.NO. 0 DATE : 29/03/2017

ANNEXURE III:

DRAWING DOCUMENTS DISTRIBUTION PROCEDURE

	TITLE:	SPECIFICATION NO. PE-TS-420-154-A001
	1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION - I A
		REV.NO. 0 DATE : 29/03/2017

Documents:	PEM-Engineering
Documents for approval	8
Documents for information	8
Schedules, diagrams, lists, tables, calculation, specifications and other documents	8
Final as-built drawings	
CD-ROMs of final as-built drawings	10
Final as-built drawings (hard copy)	14
Final O&M manuals	18
CD-ROMs of Final O&M Manuals	10
Detailed project time schedules	5

Note:

- Bidder shall submit soft copy/hard copy/CD ROMs of all the finally approved drawings and O&M Manuals as required by Customer/Customer consultant/BHEL-site/BHEL-PEM. The exact number of hard copies/CD ROMs of these documents to be submitted shall be notified to the bidder at the time of detailed engineering and bidder shall submit the same without any commercial/delivery implications to BHEL/Customer.
- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.
- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and 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 these requirements 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 (as applicable) in MS- Excel format during detailed engineering.
- Bidder to also furnish the auto cad copy/ MS-word (as applicable) of the following documents after award of contract. However any other auto cad copy/ MS-Excel/ MS-word of any other document as per the insistence of BHEL/ customer will also be submitted by the bidder without any delivery/ commercial implication to BHEL/ Customer.
 - P&IDs.
 - GA & Foundation Drawing
 - Local Control Panel/ Junction Box Wiring Diagram

	TITLE:	SPECIFICATION NO. PE-TS-420-154-A001
	1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SECTION I
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ANNEXURE IV :

PAINTING SPECIFICATION

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

1.00.00 INTENT OF SPECIFICATION

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

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

2.00.00 CODES & STANDARDS

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

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

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

3.00.00 GENERAL REQUIREMENTS

- 3.01.00** The steel surface preparation prior to actual commencement of coating shall conform to SSPC SP 10 / NACE 2 / Sa2½ (near white metal) with sand blasting.
- 3.02.00** The contractor shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to Owner/Consultant for approval.
- 3.03.00** The contractor shall also provide copies of test reports from NABL approved laboratory (like National Test House, Kolkata) in support of the paint/primer materials to be used shall conform to the specification requirement.
- 3.04.00** The contractor shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) shall also be submitted prior to commencement of supply of material and field application.
- 3.05.00** Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.

- 3.06.00 Applied coating shall be tested for dry film thickness, holiday (electrical inspection for continuity) and adhesion as per relevant standard such as SSPC PA 2, NACE RP 0274 and ASTM D 4541.
- 3.07.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.
- 3.08.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.
- 3.09.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a Purchaser approved method shall be adopted.
- 3.10.00 The colour scheme of the entire Plant, covered under this specification shall be approved by the Purchaser in advance before application.
- 3.11.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by Purchaser.
- 3.12.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti corrosive painting.
- 3.13.00 For vessels / tanks requiring lining and epoxy painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.
- 3.14.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.
- 3.15.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).
- 3.16.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.

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

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

3.19.00 All insulated piping shall have aluminium sheet jacketing.

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

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

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

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

4.02.00 Surface Preparation

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

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

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

4.03.00 Painting

- 4.03.01 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc. to be installed indoor shall be as follows :
- a) Surface preparation shall be done either manually or by any other approved method.
 - b) Primer Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based zinc phosphate.
 - c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based paint pigmented with Titanium Dioxide.
 - d) Top Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber paint of approved shade and colour with glossy finish.
 - e) Total DFT of paint system shall not be less than 150 microns.
- 4.03.02 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc to be installed **outdoor** shall be as follows :
- a) Surface preparation shall be done by means of sand blasting, which shall conform to Sa 2-1/2 Swiss Standard.
 - b) Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer.
 - c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.
 - d) Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade and colour with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.
 - e) Total DFT of paint system shall not be less than 300 microns.
- 4.03.03 Specification for application of paints for external surfaces protection of steel pipes and fittings which are **buried underground / laid inside a huge pipe & or submerged Under Water and laid under Pipe Trenches** (in road/rail/pipe or trench crossings) shall be as follows :

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

- 4.03.04 Specification for application of paints for **internal surface protection of large diameter pipes** (sizes above 600 mm NB and above) if any, shall be as follows :
- 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.
 - 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.
 - 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 :
- 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.
 - 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.
 - Total thickness of primer and paint should not be less than 500 microns.
- 4.03.06 All motors, local push button stations, cable racks, structures used for supports etc. are to be painted with acid proof paint.
- 4.03.07 The following surfaces shall not be painted - stainless steel, galvanized steel, aluminum, copper, brass, bronze and other nonferrous materials.
- 4.03.08 No painting or filler shall be applied until all repairs, hydrostatic tests and final shop inspection are completed.

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

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface Preparation :

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

- a) The blast pattern or profile depth shall be 40 to 100 micron and shall be measured by dial micrometer.
- b) Before sand blasting is started or during blasting or coating, temperature of the pipe surface should be more than 3°C above dew point temperature. Blast cleaned surface should be primed within 4 hours and shall be protected from rainfall or surface moisture and shall not be allowed to flash rust. If the rust occurs, the surface again to be prepared by sand blasting or wire brushing.

5.02.00 Application of Epoxy Coating

- a) Coating shall be applied when
 - i) When the pipe surface temperature shall be atleast 3°C above dew point temperature.
 - ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater that 50°C.
- b) Material preparation shall be in accordance with manufacturer's recommendations.
- c) Application of epoxy coating system :

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

5.03.00 Application of PU Coating

- a) PU coating shall be applied when the pipe surface temperature atleast 3°C above dew point temperature (when R.H is more than 85%).
- b) Material preparation and application shall be done as per manufacturer recommendation.

6.00.00 TEST REQUIREMENTS :

6.01.00 Measurement of dry film thickness

Measurement of dry film thickness of coating : Coating thickness shall be in the range of $\pm 20\%$ 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

- 6.02.01 All the coated / lined pipes shall be tested with an approved high voltage holiday detector preferably equipped with an audio visual signaling device to indicate any faults, holes, breaks or conductive particles in the protective coating.
- 6.02.02 The applied output voltage of holiday detector shall have a spark discharge of thickness equal to at least twice the thickness of the coating to assure adequate inspection voltage and compensate for any variation in coating thickness. The electrode shall be passed over the coated surface at approximately half the spark discharge distance from the coated surface only one time at the rate of approximately 10 to 20m/min. The edge effect shall be ignored. Excessive voltage shall be avoided as it tends to induce holiday in the coated surface thereby giving erroneous readings.
- 6.02.03 While selecting test voltages, consideration should be given to the tolerance on coating thickness and voltage should be selected on the basis of maximum coating thickness likely to be encountered during testing of a particular pipe.
- The testing voltage shall be calculated by using following formula. (as per NACE 0274 : 2004)
- Testing Voltage $V = 7900 \sqrt{T} \pm 10$ percent where T is the average coating thickness in mm.
- 6.02.04 Any audio visual sound or spark leads to indicate pinhole, break or conductive particle.
- 6.03.00 Adhesion Pull off Test :**
- After holiday the coated surface is subjected to adhesion pull off test as per 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) :

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

6.03.04 Select an adhesive:

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

6.03.05 Attach the dolly to the surface.

- a) Using a wooden stick, apply an even layer of adhesive to the entire contact surface area of the dolly.
- b) Carefully remove the excessive adhesive by using a cotton swab. Allow the adhesive to fully cure before performing the adhesion test.
- c) Attach the dolly to the coated surface and gently push downward to displace any excessive adhesive.
- d) Push the dolly inward against the surface, then apply tape across the head of the dolly.

6.03.06 Adhesion Test Procedure

- a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.
- b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.
- c) Slide the dragging indicator pin on the black column to zero by pushing it downward.
- d) Firmly hold the base of the instrument in one hand and rotate the handwheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum PSI/MPa/Kg/cm² required by project specification is exceeded and the test is discontinued, (b) the maximum PSI/MPa/Kg/cm² of adhesion tester has been achieved and dolly is still attached, (c) The force applied by the adhesion tester causes the dolly to dislodge.

e) Read the scale and record the adhesion value.

6.04.00 Coating Repair

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

6.04.01 Surface Preparation:

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

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

6.04.03 Coating Application :

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

6.04.04 Repair Inspection :

Repaired portion shall be electrically inspected using a holiday detector.

6.05.00 Welded Field Joints

6.05.01 Preparation :

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

6.05.02 Electrical Inspection :

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

7.00.00 INFORMATION/DATA REQUIRED

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

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ANNEXURE V :

MANDATORY SPARES LIST

	TITLE:	SPECIFICATION NO. PE-TS-420-154-A001
	1X800 MW APPDCL KRISHNAPATNAM	SECTION I
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S.No.	Equipment/Package Name	Quantity
1.0	Chemical Dosing Pumps (Each Type & Duty)	
1.1	Piston Ring (Guide Ring)	2 Sets for each type and Duty of Pump
1.2	Piston (Plunger)	2 Sets for each type and Duty of Pump
1.3	Seals and other Wear out Part	2 Set for each type and Duty of Pump
1.4	Complete Set of Bearings	1 Set for each type and Duty of Pump
1.5	Crank Shaft	2 Set for each type and Duty of Pump
1.6	Cross Head Assembly	2 Set for each type and Duty of Pump
1.7	Connecting Rod Plate	2 Set for each type and Duty of Pump
1.8	Complete Set of Valves	10% of the total quantity used for each unit for each type and Size or Minimum 2 No. whichever is higher
1.9	Strainer	1 No. for each type, size and duty.
2.0	Electrical Items	
2.1	Complete Set of Motor	1 No. for each application
3.0	C&I Spares	
3.1	Transmitters/ Gauges/Switches etc. along with relevant accessories	5 % of total or at least two (whichever is higher) for each type, size, model & instrument range along with accessories.

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ANNEXURE VI:

LIST OF ERECTION & COMMISSIONING SPARES

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LIST OF ERECTION & COMMISSIONING SPARES

SL. NO.	ITEM DESCRIPTION	Quantity per skid (No.)	TOTAL NOS.
1.0	AMMONIA DOSING SYSTEM		
1.1	Oil Seals for drive end.	12	12
1.2	Gaskets for drive end	12	12
1.3	Guide ring for plunger.	12	12
1.4	Teflon rings for valves.	24	24
1.5	Level gauge glass	4	4
1.6	Back up fuse	3	3
1.7	Pilot lamp	2	2
1.8	Push Button	2	2
1.9	Control fuse	2	2
1.10	Bulb for Annunciation	4	4
1.0	HYDRAZINE DOSING SYSTEM		
1.1	Oil Seals for drive end.	12	12
1.2	Gaskets for drive end	12	12
1.3	Guide ring for plunger.	12	12
1.4	Teflon rings for valves.	24	24
1.5	Level gauge glass	4	4
1.6	Back up fuse	3	3
1.7	Pilot lamp	2	2
1.8	Push Button	2	2
1.9	Control fuse	2	2
1.10	Bulb for Annunciation	4	4
1.0	NaOH DOSING SYSTEM		
1.1	Oil Seals for drive end.	4	4
1.2	Gaskets for drive end	4	4
1.3	Guide ring for plunger.	4	4
1.4	Teflon rings for valves.	8	8
1.5	Level gauge glass	1	1
1.6	Back up fuse	3	3
1.7	Pilot lamp	2	2
1.8	Push Button	2	2
1.9	Control fuse	2	2
1.10	Bulb for Annunciation	4	4

Note: -

- Any other commissioning spare/ special tools and tackles required for the commissioning of the bidder's chemical dosing skids shall be in bidder's scope and same shall be supplied by bidder as part of his base offer and the same shall be mentioned specifically by the bidder in the un-priced schedule.
- All the commissioning spares provided shall be strictly of the same make and specification of the items it shall replace and shall be perfectly interchangeable.
- All the commissioning spares shall be separately packed and properly marked for easy identification at site.

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ANNEXURE VII

DRAWING / DOCUMENTS SUBMISSION SCHEDULE

	TITLE:	SPECIFICATION NO. PE-TS-420-154-A001
	1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION - I A REV.NO. 0 DATE : 29/03/2017

DRAWING/DOCUMENTS SUBMISSION SCHEDULE

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 Distribution procedure, please refer Annexure-III. 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.

- Drawing/documents submission schedule: First submission of basic drawings/ documents – (P&ID, GA & Foundation details & QAP for CHEMICAL DOSING SYSTEM) shall be within 3 weeks from the date of LOI.
- Every revised submission incorporating comments – within 7 days.
- BHEL shall provide observation / approval within 3 weeks from the date of document submission.
- 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. . Engineering meeting shall be held fortnightly, for which the bidder shall depute his concerned engineer along with project manager to BHEL PEM office or at customer office. The meeting can also be held at site.

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

S.No	Drawing/Document No.	Drawing/Document Title	No. of weeks for drawing/document submission after placing LOI/PO
1.	PE-V2-420-154A-A001	P&I DIAGRAM FOR CHEMICAL DOSING SYSTEM	3
2.	PE-V2-420-154A-A002	TECHNICAL DATA SHEET--CHEMICAL DOSING SYSTEM	5
3.	PE-V2-420-154A-A003	GA DRAWING & FOUNDATION DETAILS	3
4.	PE-V2-420-154A-A004	LOCAL CONTROL PANEL (INCLUDING WIRING DIAGRAM, LOGIC DIAGRAM AND FIELD TERMINATION DETAILS)- CDS	5
5.	PE-V2-420-154A-A005	ELECTRICAL LOAD DATA	5
6.	PE-V2-420-154A-A006	QAP FOR CHEMICAL DOSING SYSTEM	3
7.	PE-V2-420-154A-A007	O&M MANUAL FOR CHEMICAL DOSING SYSTEM WITH CATALOGUE	8
8.	PE-V2-420-154A-A008	PACKING & FORWARDING DETAILS	8

NOTE:-

- Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any

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deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

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

(a) 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>

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ANNEXURE VIII :

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

Bidder to submit operation and Maintenance manual with minimum information as listed in below check list during contract stage.

Check List for Operation & Maintenance Manual

Project name :
 Project number :
 Package Name :
 PO reference :
 Document number :
 Revision number :

Sl.no. & Sections	Description	Tick (√) if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	Cover page				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address, Emergency Contact number				
1.5	Name and sign of prepared by, checked by & approved by				
1.6	Revision history with approval Details				
2.0	Index				
2.1	Showing the sections & related page nos. All the pages should be numbered section wise				
3.0	Description of Plant/ System				
3.1	Description/ write up of operating principle of system equipment/ associated sub-systems & accessories/controls system, operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/ for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface/ terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings, Actual photograph of items/ system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/ wiring diagrams				
3.8	Control philosophy/ control write-ups				
4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	Handling of items at site				

4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/ user/ operator				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5.2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5.3	Do's & Don't of the equipments.				
5.4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5.5	Parameters to be monitored with normal values and limiting values				
5.6	Trouble shooting with causes and remedial measures				
5.7	Routine operational checks, recommended logs & records				
5.8	Changeover schedule if more than one auxiliary for the same purpose is given				
5.9	Painting requirement and schedule				
5.10	Inspection, repair, Testing and calibration procedures				
6.0	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/ calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				

6.7	List of vendors & Sub-vendors with their latest addresses, service centres, Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				
8.0	List of reference documents				
9.0	Binding as per requirement				



TITLE:
**1X800 MW APPDCL KRISHNAPATNAM
STAGE-II**

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM**

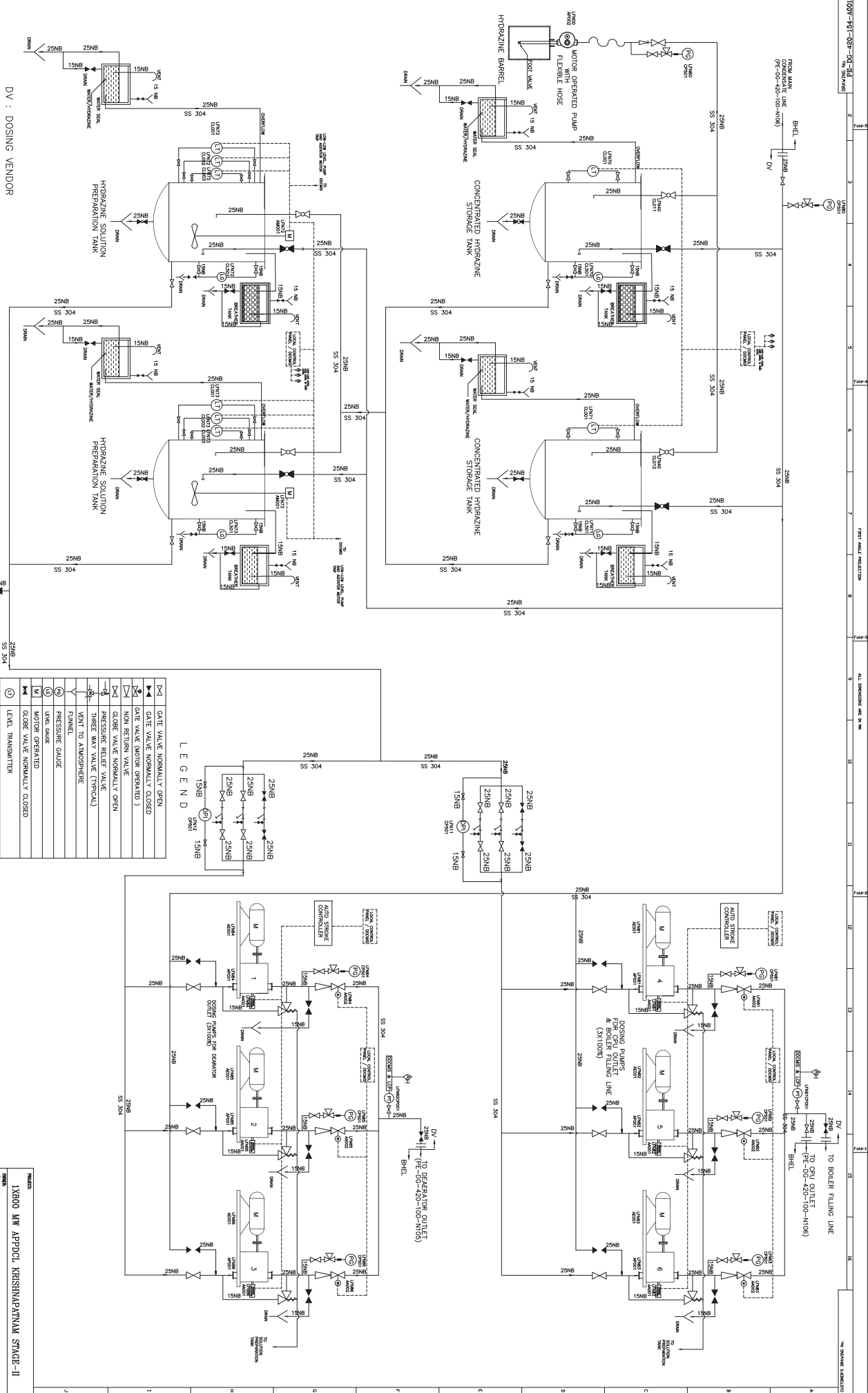
SPECIFICATION NO. PE-TS-420-154-A001

SECTION I

SECTION - I A

REV.NO. 0 DATE : 29/03/2017

P&ID



DV : DOSING VENDOR

NOTES:-

1. DOSING SYSTEM SHALL BE SKID MOUNTED.
2. PIPE SIZE: 25 NB-33.4X3.38 MM, 15 NB-21.3X2.77 MM.
3. ALL DRAINS SHALL BE CONNECTED AT ONE POINT ON SKID.
4. FOR CAPACITY OF THE TANKS AND PUMPS PLEASE REFER DATASHEET -A.
5. ONE NO. OF BARREL PUMP (MOTOR OPERATED) SHALL BE SUPPLIED WITH THE SKID.
6. ALL PIPES SHALL BE OF SS304 (S30403) INCLUDING DRAIN PIPES.
7. ALL VALVES SHALL BE OF SS304 (S30403).
8. EACH PUMP SHALL HAVE A PULSATION DAMPENER AT OUTLET.
9. ONE NO. SAFETY SHOWER AND EYE WASH STATION SHALL BE PROVIDED WITH EACH SKID.

LEGEND

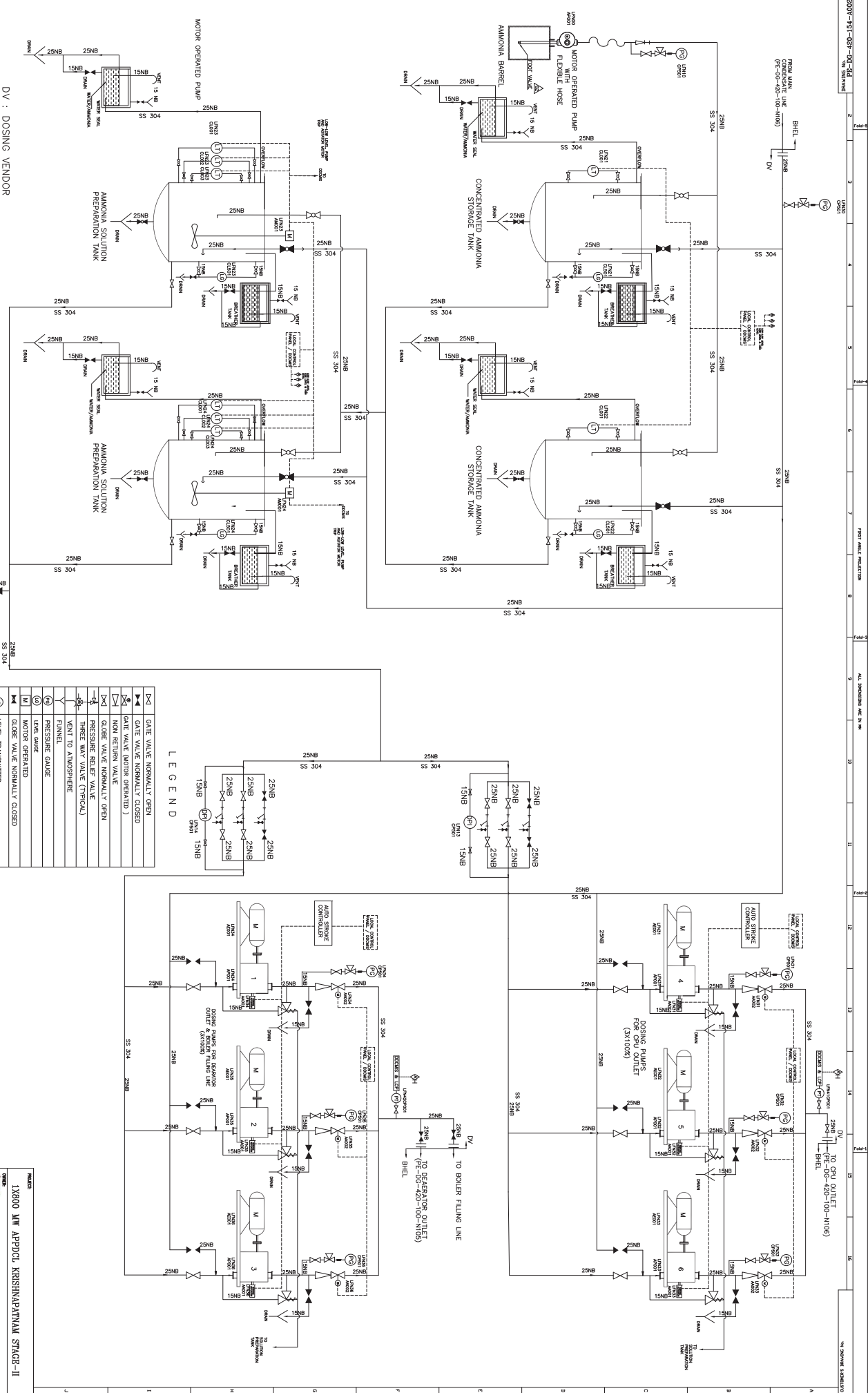
	GATE VALVE NORMALLY OPEN
	GATE VALVE NORMALLY CLOSED
	NON RETURN VALVE
	GLOBE VALVE NORMALLY OPEN
	PRESSURE RELIEF VALVE
	THREE WAY VALVE (TYPICAL)
	VENT TO ATMOSPHERE
	FLANGE
	PRESSURE GAUGE
	LEVEL GAUGE
	MOTOR OPERATED
	GLOBE VALVE NORMALLY CLOSED
	LEVEL TRANSMITTER
	Y-TYPE STRAINER
	COUNTER FLANGE
	ALARM
	INTER-LOCK
	FOOT VALVE
	PULSATING DAMPER
	DIFFERENTIAL PRESSURE TRANSMITTER
	DIFFERENTIAL PRESSURE INDICATOR

1X800 MW APPDC KRISHNAPATNAM STAGE-II

ANDHRA PRADESH POWER DEVELOPMENT CO. LTD (APPDC)
DEVELOPMENT CONSULTANTS PVT. LTD.
BRHADAT HEAVY ELECTRICALS LTD
PROJECT ENGINEERING

TITLE P & ID FOR HYDRAZINE DOSING SYSTEM

DATE 10/01/2023
DRAWN BY
CHECKED BY
APPROVED BY



DV : DOSING VENDOR

- NOTES:-
1. DOSING SYSTEM SHALL BE SKID MOUNTED.
 2. PIPE SIZE: 25 NB-33.4X3.8 MM, 15 NB-21.3X2.77 MM.
 3. ALL DRAINS SHALL BE CONNECTED AT ONE POINT ON SKID.
 4. FOR CAPACITY OF THE TANKS AND PUMPS PLEASE REFER DATASHEET - A.
 5. ONE NO. OF BARREL PUMP (MOTOR OPERATED) SHALL BE SUPPLIED WITH THE SKID.
 6. ALL VALVES SHALL BE OF SS304 (SCH 40S) INCLUDING DRAIN PIPES.
 7. ALL PIPES SHALL BE OF SS304 SOCKET WELD ENDS.
 8. EACH PUMP SHALL HAVE A POSITION DAMPENER AT OUTLET.
 9. ONE NO. SAFETY SHOWER AND EYE WASH STATION SHALL BE PROVIDED WITH EACH SKID.

LEGEND

▶▶	GATE VALVE NORMALLY OPEN
▶▶▶	GATE VALVE NORMALLY CLOSED
▶▶▶▶	GATE VALVE (MOTOR OPERATED)
▶▶▶▶▶	NON RETURN VALVE
▶▶▶▶▶▶	GLOBE VALVE NORMALLY OPEN
▶▶▶▶▶▶▶	PRESSURE RELIEF VALVE
▶▶▶▶▶▶▶▶	THREE WAY VALVE (TYPICAL)
▶▶▶▶▶▶▶▶▶	VENT TO ATMOSPHERE
▶▶▶▶▶▶▶▶▶▶	FLANGEL
▶▶▶▶▶▶▶▶▶▶▶	PRESSURE GAUGE
▶▶▶▶▶▶▶▶▶▶▶▶	LEVEL GAUGE
▶▶▶▶▶▶▶▶▶▶▶▶▶	GLOBE VALVE NORMALLY CLOSED
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▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶	ALARM
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▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶	PULSING DAMPER
▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶	DIFFERENTIAL PRESSURE TRANSMITTER
▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶▶	DIFFERENTIAL PRESSURE INDICATOR

1X800 MW APPDC, KRISHNAPATNAM STAGE-II

ANIRUPA PRADESH POWER DEVELOPMENT CO. LTD. (APPDC)
DEVELOPMENT CONSULTANTS PVT. LTD.
BRHARTI HEAVY ELECTRICALS LTD.
PROJECT ENGINEERING
DESIGN

REV	DATE	BY	CHKD	APPD	REASON
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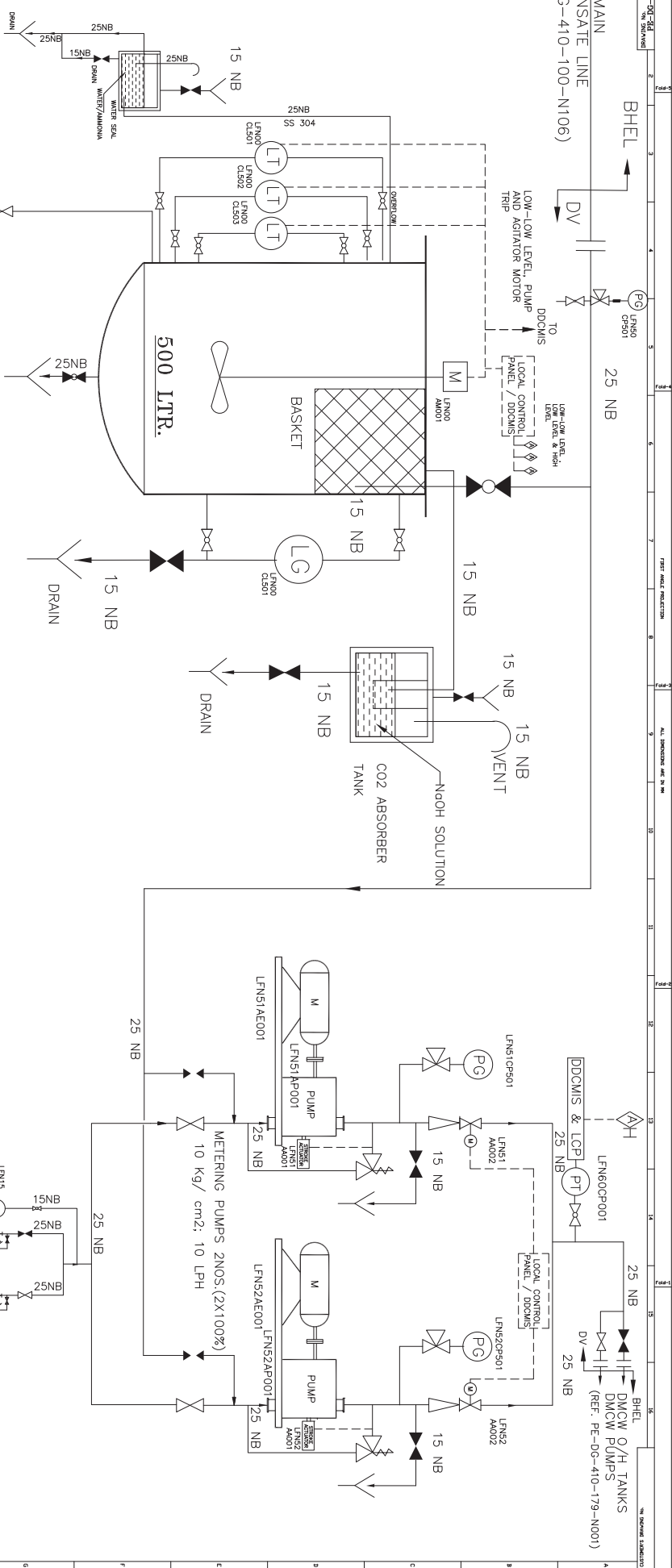
▶	▶	GATE VALVE NORMALLY OPEN
▶	▶	GATE VALVE NORMALLY CLOSED
▶	▶	GATE VALVE (MOTOR OPERATED)
▶	▶	NON RETURN VALVE
▶	▶	GLOBE VALVE NORMALLY OPEN
▶	▶	PRESSURE RELIEF VALVE
▶	▶	THREE WAY VALVE (TYPICAL)
▶	▶	VENT TO ATMOSPHERE
▶	▶	FUNNEL
▶	▶	PRESSURE GAUGE
▶	▶	LEVEL GAUGE
▶	▶	MOTOR OPERATED
▶	▶	GLOBE VALVE NORMALLY CLOSED
▶	▶	LEVEL TRANSMITTER
▶	▶	Y-TYPE STRAINER
▶	▶	COUNTER FLANGE
▶	▶	INTERLOCK
▶	▶	FOOT VALVE
▶	▶	PULSATION DAMPNER
▶	▶	DIFFERENTIAL PRESSURE TRANSMITTER
▶	▶	DIFFERENTIAL PRESSURE INDICATOR

LEGEND

DV : DOSING VENDOR

NOTES:-

1. DOSING SYSTEM SHALL BE SKID MOUNTED.
2. PIPE SIZE: 25 NB-33.4X3.38 MM, 15 NB-21.3X2.77 MM.
3. ALL DRAINS SHALL BE CONNECTED AT ONE POINT ON SKID.
4. FOR CAPACITY OF THE TANKS AND PUMPS PLEASE REFER DATASHEET -A.
5. ONE NO. OF BARREL PUMP (MOTOR OPERATED) SHALL BE SUPPLIED WITH THE SKID.
6. ALL PIPES SHALL BE OF SS304(SCH.40S) INCLUDING DRAIN PIPES.
7. EACH PUMP SHALL HAVE A PULSATION DAMPNER AT OUTLET.
8. ONE NO. SAFETY SHOWER AND EYE WASH STATION SHALL BE PROVIDED WITH EACH SKID.



PROJECT: 1X800 MW APPDC, KRISHNAPATNAM STAGE-II

CLIENT: ANDHRA PRADESH POWER DEVELOPMENT CO. LTD (APPDC)

CONSULTANT: DEVELOPMENT CONSULTANTS PVT. LTD.

DESIGN: BRHART HEAVY ELECTRICALS LTD

PROJECT ENGINEER: [Signature]

DATE: 10/01/2010

REVISION: 1

REVISION: 2

REVISION: 3

REVISION: 4

REVISION: 5

REVISION: 6

REVISION: 7

REVISION: 8

REVISION: 9

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REVISION: 100

	TITLE:	SPECIFICATION NO. PE-TS-420-154-A001
	1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION - I A
		REV.NO. 0 DATE : 29/03/2017

DATASHEET-A

1.00.00 HYDRAZINE DOSING SYSTEM

1.01.0 CONCENTRATED HYDRAZINE STORAGE TANKS

A)	Number to be provided	Two (2).
B)	Description for each Tank	
i.	Type	Vertical cylindrical dished end
ii.	Type of fluid to be handled	Concentration of Hydrazine -80 % max
iii.	Effective capacity, in Lit.	50
iv.	Minimum Free Board, in mm	300.
vii.	Design Temperature, °C	60
x.	Material of Construction	SS 316. MOC of breather, overflow, seal, nozzles, flanges shall be same as that of tank.
	Thickness (shell, top & bottom)	6 mm.
xii.	Accessories	Inlet, Outlet ,breather with vent, drain, overflow with seal arrangement, platform, stairs etc
xiii.	Instruments	As per P&ID enclosed.
xiv	Design Standard	IS 803

1.02.00 : HYDRAZINE SOLUTION PREPARATION TANKS

A)	Number to be provided	Two (2).
B)	Description for each Tank	
i.	Type	Vertical cylindrical dished end
ii.	Type of fluid to be handled	Dilute Hydrazine solution – 0.6 % (for normal operation) 35 % (for boiler wet laying)
iii.	Effective capacity, in Lit.	2000
iv.	Minimum Free Board, in mm	300.
vii	Design Temperature, °C	60
x.	Material of Construction	SS 304. MOC of breather, overflow, seal, nozzles, flanges shall be same as that of tank.
xi.	Thickness (shell, top & bottom)	6 mm.
xiii.	Accessories	Inlet, Outlet ,breather with vent, drain, overflow with seal arrangement, platform, stairs, Agitator along with drive motor and other accessories (Provided with all wetted parts of agitator - SS304, speed not to exceed 100 rpm)
xiv.	Instruments	As per P&ID enclosed.
xiv	Design Standard	IS 803

	TITLE:	SPECIFICATION NO. PE-TS-420-154-A001
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1.03.00 HYDRAZINE DOSING PUMPS

A)	Number	Six (6) (Three (3) nos. for outlet of Condensate Polisher & Boiler fill up pumps discharge, Three (3) nos. for outlet of Deaerator.)
B)	Description for each Pump	
i.	Location	Indoor.
ii.	Fluid to be handled	Dilute Hydrazine solution – 0.6 % (for normal operation) 35 % (for boiler wet laying)
iii.	Duty	Continuous
iv.	Type of Pump	Electromechanical, positive displacement, constant speed, variable stroke and plunger type.
v.	Type of Casing	Foot mounted.
vi.	Design standard	API 675.
vii.	Service temperature, in oC	60 maximum.
viii.	Rated Capacity, in LPH	100
ix.	Facility for Capacity Adjustment	Both local manual through Micrometer Dial and remote manual from Control Panel
x.	Range of Capacity Adjustment	0 % - 100 %.
xi.	Suction Condition	Flooded.
xii.	Head to be developed at rated capacity, in kg/cm ²	45 kg/cm² for outlet of Condensate Polisher & Boiler fill up pumps discharge and 20 kg/cm² for outlet of Deaerator
xiii.	Material of construction	
	a) Housing	2 % Ni Cast Iron.
	b) Pump head	SS 316.
	c) Valve and valve housing	SS 316.
	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	SS 304.
xiv.	Type of drive	Electrical Motor
xvi.	Rated speed (RPM)	1500 (Sync.) maximum.
xvii.	Voltage, Phase & Frequency (± % Variation)	415 V (±10%), 3 Phase, 50 HZ (±5%).
xviii.	Noise level (for complete set of Pump & Motor)	Not more than 85 db (At a distance of 1.0 m from the outer surface of Motor).

	TITLE:	SPECIFICATION NO. PE-TS-420-154-A001
	1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION - I A
		REV.NO. 0 DATE : 29/03/2017

xix.	Instruments	As per P&ID enclosed.
xx.	Accessories	Pulsation Dampener, Pressure Relief Valve

1.04.00 STRAINERS

i	Number of Strainers	Six (6) (3 X 100 % at common suction of dosing pumps for condensate polisher & Boiler fill up pumps discharge, 3 X 100 % at suction of dosing pumps for Deaerator.)
ii	Type	Y Type
iii	Material of body	SS 316
iv	Material of screen	SS 316
v	Mesh size	50 (BS)

2.00.00 AMMONIA DOSING SYSTEM

2.01.00 CONCENTRATED AMMONIA STORAGE TANKS

A)	Numbers To be provided	Two (2).
B)	Description for each Tank	
i.	Type	Vertical cylindrical dished end
ii.	Type of fluid to be handled	Concentration of Ammonia -25 % max
iii.	Effective capacity, in Lit.	100
iv.	Minimum Free Board, in mm	300.
vii.	Design Temperature, °C	60
x.	Material of Construction	SS 316. MOC of breather, overflow, seal, nozzles, flanges shall be same as that of tank.
	Thickness (shell, top & bottom)	6 mm.
xii.	Accessories	Inlet, Outlet ,breather with vent, drain, overflow with seal arrangement, sample collection point, platform, stairs etc
xiii.	Instruments	As per P&ID enclosed.
xiv	Design Standard	IS 803

2.02.00 AMMONIA SOLUTION PREPARATION TANKS

A)	Numbers	Two (2).
B)	Description for each Tank	
i.	Type	Vertical cylindrical dished end

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ii.	Type of fluid to be handled	Ammonia solution – 3.0 % (for normal operation) 15 % (for boiler wet laying)
iii.	Effective capacity, in Lit.	800
iv.	Minimum Free Board, in mm	300.
vii.	Design Temperature, °C	60
x.	Material of Construction	SS 304. MOC of breather, overflow, seal, nozzles, flanges shall be same as that of tank.
	Thickness (shell, top & bottom)	6 mm.
xii.	Accessories	Inlet, Outlet ,breather with vent, drain, overflow with seal arrangement, platform, stairs, Agitator along with drive motor and other accessories (Provided with all wetted parts of agitator - SS304, speed not to exceed 100 rpm)
xiii.	Instruments	As per P&ID enclosed.
xiv	Design Standard	IS 803

2.03.00 AMMONIA SOLUTION DOSING PUMPS SYSTEM

A)	Number	Six (6) i.e. Three (3) nos. for outlet of Condensate Polisher, Three (3) nos. for outlet of Deaerator & Boiler fill up pumps.
B)	Description for each Pump	
i.	Location	Indoor.
ii.	Fluid to be handled	Dilute Ammonia solution – 3.0 % (for normal operation) 15 % (for boiler wet laying)
iii.	Duty	Continuous
iv.	Type of Pump	Electromechanical, positive displacement, constant speed, variable stroke and plunger type.
v.	Type of Casing	Foot mounted.
vi.	Design standard	API 675.
vii.	Service temperature, in °C	60 maximum.
viii.	Rated Capacity, in LPH	100
ix.	Facility for Capacity Adjustment	Both local manual through Micrometer Dial and remote manual from Control Panel
x.	Range of Capacity Adjustment	0 % - 100 %.
xi.	Suction Condition	Flooded.
xii.	Head to be developed at rated capacity, in kg/cm ²	45 kg/cm² for outlet of Condensate Polisher and 20 kg/cm² for outlet of Deaerator

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		REV.NO. 0 DATE : 29/03/2017

xiii.	Material of construction	
	a) Housing	2 % Ni Cast Iron
	b) Pump head	SS 316.
	c) Valve and valve housing	SS 316.
	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	SS 304.
xiv.	Type of drive	Electrical Motor
xvi.	Rated speed (RPM)	1500 (Sync.) maximum.
xvii.	Voltage, Phase & Frequency ($\pm$ % Variation)	415 V ($\pm$ 10%), 3 Phase, 50 HZ ($\pm$ 5%).
xviii.	Noise level (for complete set of Pump & Motor)	Not more than 85 db (At a distance of 1.0 m from the outer surface of Motor).
xxiv.	Instruments	As per P&ID enclosed
xvii.	Accessories	Pulsation Dampener, Pressure Relief Valve

2.04.00 STRAINERS

i	Number of Strainers	Six (6) (3 X 100 % at common suction of dosing pumps for CPU, 3 X 100 % at suction of dosing pumps for Deaerator.)
ii	Type	Y Type
iii	Material of body	SS 316
iv	Material of screen	SS 316
v	Mesh size	50 (BS)

3.00.00 SODIUM HYDROXIDE DOSING SYSTEM

3.01.00 SODIUM HYDROXIDE SOLUTION PREPARATION CUM STORAGE TANK

A)	Numbers To be provided	One (1)
B)	Description for Tank	
	Type	Vertical cylindrical dished end
	Type of fluid to be handled	Dilute Sodium Hydroxide solution
	Effective capacity, in Lit.	500
	Minimum Free Board, in mm	300
	Design Temperature, °C	60
	Material of Construction	SS 304

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	1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SECTION I
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	Thickness (shell, top & bottom)	6 mm
	Accessories	Inlet, Outlet , Drain, Overflow , Vent , Manhole, sample collection point, Platform complete with handrails for operation (as applicable) & Staircase (as applicable)
xiii	Instruments	As per P&ID enclosed.

3.02.00 NAOH DOSING PUMPS SYSTEM

A)	Number	2 X 100 %
B)	Description for each Pump	
i.	Location	Indoor.
ii.	Fluid to be handled	Dilute Sodium Hydroxide solution
iii.	Duty	Continuous
iv.	Type of Pump	Electromechanical, positive displacement, constant speed, variable stroke and plunger type.
v.	Type of Casing	Foot mounted.
vi.	Design standard	API 675.
vii.	Service temperature, in °C	60 maximum.
viii.	Rated Capacity, in LPH	10
ix.	Facility for Capacity Adjustment	Both local manual through Micrometer Dial and remote manual from Control Panel
x.	Range of Capacity Adjustment	0 % - 100 %.
xi.	Suction Condition	Flooded.
xii.	Head to be developed at rated capacity, in kg/cm ²	10
xiii.	Material of construction	
	a) Housing	2 % Ni Cast Iron
	b) Pump head	SS 316.
	c) Valve and valve housing	SS 316.
	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	SS 304.
xiv.	Type of drive	Electrical Motor
xvi.	Rated speed (RPM)	1500 (Sync.) maximum.
xvii.	Voltage, Phase & Frequency (± % Variation)	415 V (±10%), 3 Phase, 50 HZ (±5%).
xviii.	Noise level (for complete set of Pump & Motor)	Not more than 85 db (At a distance of 1.0 m from the outer surface of Motor).

	TITLE:	SPECIFICATION NO. PE-TS-420-154-A001
	1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION - I A REV.NO. 0 DATE : 29/03/2017

xxiv.	Instruments	As per P&ID enclosed
xvii.	Accessories	Pulsation Dampener, Pressure Relief Valve

3.03.00 STRAINERS

I	Number of Strainers	2 X 100 %
ii	Type	Y Type
iii	Material of body	SS 316
iv	Material of screen	SS 316
v	Mesh size	50 (BS)

4.00.00 BARREL PUMPS

A)	Number	Two (2) [One (1) for transferring Concentrated Hydrazine and another for transferring Concentrated Ammonia]
B)	Description for each Pump	
i.	Service	To transfer chemical from Barrel to the respective Concentrated Storage Tank
ii.	Duty	Intermittent
iii.	Type of Pump	Dispensing type
iv.	Type of Casing	Foot mounted
v.	Service temperature, in oC	60 maximum
vi.	Rated Capacity, in LPH	500
vii.	Range of Capacity Adjustment	10 % - 100 %.
viii.	Suction Condition	Flooded.
ix.	Head to be developed at rated capacity	7-10 m
x.	Air Pressure required to operate pump	
	Material of construction	
	a) Liquid end	SS 316
	b) Diaphragm	PTFE
	c) Foundation bolts	SS-304.
xi.	Type of drive	Electrical Motor
xii.	Rated speed (RPM)	1500 (Sync.) maximum.
xiii.	Noise level (for complete set of Pump & Motor)	Not more than 85 db (At a distance of 1.0 m from the outer surface of Motor).
xiv.	Start and stop facility provided both at local	Provided.

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xv.	Flexible Hose	Provided with SS304 construction.
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5.00.00: METERING CYLINDER

A)	Number	Two (2) [One (1) for Hydrazine solution and another for Ammonia solution]
B)	Description for each cylinder	
i.	Service	To indicate volume of Chemical that will be transferred to the respective Concentrated Storage Tank
ii.	Capacity of each cylinder in lit.	30
iii.	Graduation	Graduation shall be permanently marked, in one (1) lit. Increments, with five (5) lit. marked with number
iv.	Location	Inlet of Dosing Tank

6.00.00: VALVES & FITTINGS

A	Gate & Globe Valves	
i	Body, Bonnet, Stem	ASTM A182 Gr TP 304/316
ii	Design Standard	ANSI B 16.34/API 602 for gate valves, BS 5352 for globe valves
iii.	Test Standard	API 598
iv.	Size	As per P&ID
v	End connection	SW ANSI B 16.11
vii	Valve operation	Manual/motor operated as per P&ID
B	Check Valve/NRV	
i	Body, cover, disc/piston	ASTM A182 Gr TP 304/316
ii	Design Standard	ANSI B 16.34/API 602
iii.	Test Standard	API 598/MSS-SP-61
iv.	Size	25 NB
v	End connection	SW ANSI B 16.11
vii	Valve operation	Manual
C	Pressure Relief Valve (PRV)	
i	Body, bonnet, disc, nozzle	ASTM A182 Gr TP 316
ii	Valve discharge to	Mixing/storage tank
iii.	Back Pressure	Constant
iv.	Set Pressure	50 kg/cm ² for Hydrazine and ammonia dosing system and 15 kg/cm ² for NaOH dosing system
v	Inlet connection	25 NB, Flanged, ANSI B16.5, 300 #
vi	Outlet connection	25 NB, Flanged, ANSI B16.5, 150 #
D	Fittings	Forged steel to A182 F304/316, Dimension to ANSI B 16.11 socket weld ends

	TITLE:	SPECIFICATION NO. PE-TS-420-154-A001
	1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION - I A
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E	Flanges (pump suction/pump discharge)	ANSI B 16.5 CL 150 for NaOH dosing pumps & ANSI B 16.5 CL 300 for Hydrazine & Ammonia Dosing Pumps
F	Structural steel	IS 2062
G	Access ladder with platform	IS 2062 painted
H	Nut & Bolt	SS 304
I	Other items	Checkered plate shall be provided on the base of skid & platform

	TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM 1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SPEC NO: PE-TS-420-154-A001
		SECTION: I
		SUB SECTION: I B
		REV NO: 00

SECTION I B : SPECIFIC TECHNICAL REQUIREMENTS

(ELECTRICAL)



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
CHEMICAL DOSING SYSTEM

1 x 800MW SDSTPS KRISHNAPATTANAM, STAGE-II

SPECIFICATION NO.
PE-TS-420-154-A001
VOLUME NO. : II-B
SECTION: C
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1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipment.
- d) Electrical load requirement for Chemical Dosing System.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL.
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “both end equipment in vendor’s scope” shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.
- k) In case of any conflict between the stipulations of Annexure-II, Annexure-III and Annexure-IV, the stipulations of Annexure-III and Annexure-IV shall prevail.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.



TITLE :
**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
CHEMICAL DOSING SYSTEM**

1 x 800MW SDSTPS KRISHNAPATTANAM, STAGE-II

SPECIFICATION NO.
PE-TS-420-154-A001
VOLUME NO. : **II-B**
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4.0 LIST OF ENCLOSURES

- 4.1 Electrical scope between BHEL & vendor (Annexure-I) - 2 sheets
- 4.2 General Technical Requirements for LV Motors (Annexure-II) - 5 sheets
- 4.3 Customer Specification for Motors (Annexure-III) - 13 sheets
- 4.4 Data Sheet - A for LV Motors (Annexure-IV) - 2 sheets
- 4.5 Data Sheet - C for LV Motors (Annexure-V) - 2 sheets
- 4.6 Electrical Load data format (Annexure-VI) - 1 sheet
- 4.7 BHEL cable listing format (Annexure-VII) - 1 sheet
- 4.8 Quality plan for motors (Annexure-VIII) - 2 sheets.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES: CHEMICAL DOSING SYSTEM

SCOPE OF VENDOR: SUPPLY

PROJECT: 1 x 800MW SDSTPS KRISHNAPATTANAM, STAGE-II

ANNEXURE-I

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	415V MCC	Customer	Customer	415 V, 3 phase, 3 wire AC supply shall be provided by Customer 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. As 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 Customer.
8	Motors with base frame and fixing hardware for motors.	Vendor	Vendor*	Makes shall be subject to customer/ BHEL approval at contract stage.
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	Customer	Customer	

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES: CHEMICAL DOSING SYSTEM

SCOPE OF VENDOR: SUPPLY

PROJECT: 1 x 800MW SDSTPS KRISHNAPATTANAM, STAGE-II

ANNEXURE-I

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
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. Motor starters are provided in main MCC & Customer will provide power & control cable including supply, laying & termination. For cables from JB to DCS, BHEL will provide screened 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.
3. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
4. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.

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

[illegible]

ANNEXURE VII

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	TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM 1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SPEC NO: PE-TS-420-154-A001
		SECTION: I
		SUB SECTION: I C
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SECTION I C : SPECIFIC TECHNICAL REQUIREMENTS

(C&I)

	1X800 MW KRISHNAPATTANAM C&I SPECIFICATION FOR CHEMICAL DOSING SYSTEM	DOCUMENT NO.:	
		VOLUME :	
		SECTION :	
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SPECIFIC TECHNICAL REQUIREMENTS (C&I)

1. Chemical Dosing system shall be operated from DCS (BHEL's scope).
2. All instruments shall be terminated at the Local Control Panel (LCP) in field. All the instruments as well as LCP are in bidder's scope.
3. For cable scope, refer to "Electrical Scope between BHEL and Vendor", elsewhere in the specification.
4. Any push buttons, alarms and metering requirement on the LCP panels shall be supplied by bidder and shall be finalized during detail engineering.
5. The LCP shall be provided with two (2) pushbuttons; each for "LOCAL START" and "EMERGENCY STOP", along with ON/OFF/DISTURBANCE indication for each drive. The EMERGENCY STOP push button shall be wired directly to MCC, whereas LOCAL START push button shall be routed to the DCS. The emergency push buttons EPB shall be lockable type. The detailed control philosophy has been mentioned elsewhere in the specification.
6. The LCP shall have 20% additional/spare terminals.
7. The requirement of instruments shall be as follows (as indicated in the P&ID's):-
 - (i) All the sensors used for protection shall be triple redundant viz. 3 nos. Level Transmitters (LT's).
8. Level transmitter for level measurements in the tanks shall be DP type.
9. The make/model of various instruments/items/systems shall be subject to approval of BHEL/Customer during detailed engineering stage. No commercial and delivery implication in this regard shall be acceptable.
10. In case of any conflict and repetition of clauses in the specification, the more stringent requirements as per BHEL's interpretation shall be complied by the bidder.
11. The quantity of instruments indicated in the tender P & ID are indicative and to be treated as a minimum requirement for bidding purpose only. However, bidder shall also include in his proposal all the instruments and devices that are needed for completeness of the plant system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. Bidder to also include root valves along with necessary fittings for hooking up the above instruments. Double root valves shall be provided where pressure is exceeding 40 kg/cm². If any additional instruments, equipment are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.
12. All the motorized valves shall be envisaged with integral starter.
13. Power supply requirement:

415 V, 3 phase AC shall be provided by CUSTOMER for the local control panel of the chemical dosing system. Complete electrical distribution for the skid including changeover between feeder/LCP/inter-locks/protection devices / any other supply etc. shall be in bidder's scope. Further, the 240V AC/Any other voltage requirement to be arranged /derived by bidder by providing suitable control transformer.
14. The bidders shall specifically mention any deviation w.r.t. the specification. In absence of the same, it will be implied that the specification is complied by the bidder without any deviation.
15. Drawings/Documents and data to be furnished after award of the contract:
 - Field instruments data sheet.
 - Panel GA drawings & Termination detail
 - Quality Plans/Check Lists
 - Any other document decided during detailed engineering

	TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM 1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SPEC NO: PE-TS-420-154-A001
		SECTION: II
		SUB SECTION: I
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SECTION – II

GENERAL TECHNICAL REQUIREMENT

	TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM 1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SPEC NO: PE-TS-420-154-A001
		SECTION: II
		SUB SECTION: II A
		REV NO: 00

SECTION – IIA

GENERAL TECHNICAL REQUIREMENT (MECHANICAL)



TITLE: 1X800 MW APPDCL KRISHNAPATNAM STAGE-II
TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM

SPECIFICATION NO. PE-TS-420-154-A001
SECTION II
SECTION - II A
REV.NO. 0 DATE : 29/03/2017

**TECHNICAL SPECIFICATION FOR
METERING PUMPS**

	TITLE:	SPECIFICATION NO. PE-TS-420-154-A001
	1X800 MW APPDCL KRISHNAPATNAM	SECTION II
	STAGE-II	SECTION - II A
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	REV.NO. 0 DATE : 29/03/2017

1.00.0 GENERAL

- 1.01.01 Specification cover the design, material, construction features, manufacture, inspection, testing the performance at the vendor's/sub-vendor's works, delivery to site, erection, commissioning and testing of metering pumps.

2.00.0 GENERAL DESIGN FEATURES

- 2.00.01 Pumps shall be simplex positive displacement hydraulically operated diaphragm design, driven by squirrel cage induction motor through suitable speed reduction unit. Maximum pump stroke speed shall not exceed 100 per minute.
- 2.00.02 The stroke shall be continuously adjustable to give a capacity variation 0-100% range while the pump is running or stopped. Adjustment of capacity shall be done by manual control facility (micrometric adjusting type) to be provided locally for each of the pump. The capacity & head of each pump will be selected with 20% over all margin.
- 2.00.03 The stroke shall be continuously adjustable to give a capacity variation 0-100% range while the pump is running or stopped. Adjustment of capacity shall be done by manual control facility (micrometric adjusting type) to be provided locally for each of the pump.
- 2.00.04 Capacity variation may be effected by changing eccentricity of the driving crank or by suitable hydraulic circuit. Pump accuracy shall be industry standard $\pm 1\%$ of capacity setting.
- 2.00.05 Pumps shall be provided with an integral relief valve, spring operated to release pressure when delivery line blockage occurs.
- 2.00.06 Crankcase shall be constructed of high quality cast iron, which will also house the gearbox and guides of cross head.
- 2.00.07 Guided, controlled travel, double-ball check valves or equivalent, shall be provided both on the suction and discharge side.
- 2.00.08 Material of construction of the various parts shall be as per the details furnished elsewhere in the specification. However all parts coming in contact with acid shall be of Haste alloy 'B' and for alkali it should be of SS-316 only.
- 2.00.09 Suitable gland seal shall be provided to prevent leakage.
- 2.00.10 Electric drive motor particulars should follow enclosed electrical chapters.

3.00.00 TESTING

3.01.00 Testing and Inspection at Manufacturer's Works

- 3.01.01 The manufacturer shall conduct all tests required to ensure that the equipment furnished conforms to the requirements of this Specification and is in compliance with requirements of the applicable codes. The particulars of the proposed tests and the procedures for the tests shall be submitted to Owner for approval before conducting the tests.
- 3.01.02 The Owner's representatives shall be given full access to all tests for which the Manufacturer shall inform the Owner allowing adequate time so that if the Owner so desires, his representatives can witness the test.
- 3.01.03 All materials and castings used for the equipment shall be of tested quality. The test certificates shall be made available to Owner.
- 3.01.04 The pump casing shall be hydraulically tested at 200% pump operating pressure or 150% of design pressure whichever is higher. The test pressure shall be maintained at least for $\frac{1}{2}$ an hour.

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	1X800 MW APPDCL KRISHNAPATNAM	SECTION II
	STAGE-II	SECTION - II A
	TECHNICAL SPECIFICATION FOR	REV.NO. 0 DATE : 29/03/2017
	CHEMICAL DOSING SYSTEM	

- 3.01.05 The rotating parts of pump drive shall be subjected to static balancing.
- 3.01.06 All pumps shall be tested at the shop for capacity, volumetric accuracy, repetitive accuracy, power and volumetric efficiency. The tests are to be done according to the requirements of the "Hydraulic Institute" of U.S.A. and Indian Standards as applicable.
- 3.01.07 The pump accessories e.g. gear box, speed reduction unit etc. will be subjected to tests as per manufacturer's standards. The test results shall be furnished to the Owner.
- 3.01.08 The combined variation of the pump and motor should be restricted within limits specified by Hydraulic Institute Standard, USA when the pump operated singly or in parallel.
- 3.01.09 All pumps shall be subject to strip down examination visually to check for mechanical damages after performance testing at shop.
- 3.01.10 Diaphragm of the metering pump shall be type tested as per applicable code/standard.
- 3.01.11 Performance test shall be carried out for the setting of pressure relief valve.
- 3.01.12 Test reports and certificates of all the above-mentioned tests to ensure satisfactory operation of the system shall be submitted to the Owner for approval before dispatch.

3.02.00 Test at Site

After erection at site pumps as detailed under different groups shall be operated to prove satisfactory performance as individual equipment as well as a system. If the performance at site is found to be not to the requirements, then the equipment shall be rectified or replaced by the Vendor at no extra cost to the Owner.

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SECTION – IIB

GENERAL TECHNICAL REQUIREMENT (ELECTRICAL)



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101
VOLUME NO. : **II-B**
SECTION : **D**
REV NO. : **00** DATE : 29/08/2005
SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 1 OF 4

1.0 INTENT OF SPECIFICATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0 CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement for rotating electrical machines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0 DESIGN REQUIREMENTS

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3 Starting Requirements

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

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

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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 as per Data Sheet - A during the starting period of motors.		
3.3.3 The following frequency of starts shall apply i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature. ii) 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) iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor		
3.4 Running Requirements		
3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.		
3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.		
3.5 Stress During bus Transfer		
3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.		
3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.		
3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.		
3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.		
4.0 CONSTRUCTIONAL FEATURES		
4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy		
4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362. Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled		
4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.		

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4.4. 4.5. 4.6. 4.7. 4.7.1 4.7.2 4.7.3 4.7.4 4.7.5 4.7.6 4.7.7 4.7.8. 4.7.9 4.8. 4.9	Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point. In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation. In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C. Terminals and Terminal Boxes Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A. Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A". unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end. Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively. Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation. Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A. Degree of protection for terminal boxes shall be IP 55 as per IS 4691. Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors. Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type. Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal. General	4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors. 4.5. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point. 4.6. In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation. In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C. 4.7. Terminals and Terminal Boxes 4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A. Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A". 4.7.2 unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end. 4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively. 4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation. 4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A. 4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691. 4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes. 4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors. 4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type. 4.8. Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

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4.9.1 Motors provided for similar drives shall be interchangeable. 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors. 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above. 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956. 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz. 4.9.6 Name plate with all particulars as per IS: 325 shall be provided 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions. 5.0 INSPECTION AND TESTING 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied. 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser. 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan. 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A. 6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT a) OGA drawing showing the position of terminal boxes, earthing connections etc. b) Arrangement drawing of terminal boxes. c) Characteristic curves: (To be given for motor above 55 kW unless otherwise specified in Data Sheet). i) Current vs. time at rated voltage and minimum starting voltage. ii) Speed vs. time at rated voltage and minimum starting voltage. iii) Torque vs. speed at rated voltage and minimum voltage. For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling. iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.		

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CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	SCOPE
2.00.00	CODES & STANDARDS
3.00.00	SERVICE CONDITIONS
4.00.00	TYPE AND RATING
5.00.00	PERFORMANCE
6.00.00	SPECIFIC REQUIREMENTS
7.00.00	ACCESSORIES
8.00.00	TESTS
9.00.00	DRAWINGS, DATA & MANUALS

ATTACHMENT

ANNEXURE-A	DESIGN DATA
------------	-------------

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VOLUME: V-A

SECTION-II

**TECHNICAL SPECIFICATION
FOR
A.C. & D.C. MOTORS**

- | | |
|---------|---|
| 1.00.00 | SCOPE |
| 1.01.00 | This section covers the general requirements of the drive motors for power station auxiliary equipment. |
| 1.02.00 | Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification. |
| 1.03.00 | In case of any discrepancy, the driven equipment specification shall govern. |
| 2.00.00 | CODES & STANDARDS |
| 2.01.00 | All motors shall conform to the latest applicable IS, IEC and CBIP Standards/ Publications except when otherwise stated herein or in the driven equipment specification. |
| 2.02.00 | Major standards, which shall be followed, are listed below other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed: |
| | i) IS-325 |
| | ii) IS-12615 |
| | iii) IEC-34 |
| 3.00.00 | SERVICE CONDITIONS |
| 3.01.00 | The motors will be installed in hot, humid and tropical atmosphere highly polluted at places with coal dust and/or fly ash. |
| 3.02.00 | Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the annexure to this specification. |
| 3.03.00 | 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. |

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4.00.00 TYPE AND RATING

4.01.00 A.C. Motors

4.01.01 Motors shall be general purpose, constant speed, squirrel cage, three/single phase, induction type.

4.01.02 All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity.

4.01.03 LT motor & HT motor name-plate rating at 50°C shall have at least 15% margin and 10% margin respectively over the input power requirement of the driven equipment at rated duty point unless stated otherwise in driven equipment specification.

4.01.04 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.

4.01.05 All HT & LT motors shall be energy efficient type with efficiency class 1.

4.02.00 D.C. Motors

4.02.01 D.C. motor provided for emergency service shall be shunt/compound wound type.

4.02.02 Motor shall be sized for operation with fixed resistance starter for maximum reliability.

Starter panel complete with all accessories shall be included in the scope of supply.

5.00.00 PERFORMANCE

5.01.00 Running Requirements

5.01.01 Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given in the annexure.

5.01.02 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.

5.01.03 The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.

5.02.00 Starting Requirements

Motor shall be designed for direct online starting at full voltage. Starting current shall not exceed 6 times full load current for all HT auxiliaries except boiler feed pump where the starting current shall be limited to 4.5 times. No further tolerances are applicable on starting current specified above for HT

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motors. For LT motors, the applicable starting current shall be limited to 7.2 times of full load current including all tolerance.

5.02.01 The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage.

5.02.02 Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminals except mill motor. Mill motor shall start with rated load and accelerate to full speed at 85% of the rated voltage at the motor terminals.

5.02.03 a) Two hot starts in succession with motor initially at normal running temperature.

b) 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.

5.02.04 The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage.

5.03.00 Stress During Bus Transfer

5.03.01 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.

5.03.02 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.

5.04.00 Locked Rotor Withstand Time

5.04.01 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time.

5.04.02 Starting time mentioned above is at minimum permissible voltage of 80% rated voltage.

5.04.03 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.

6.00.00 SPECIFIC REQUIREMENTS

6.01.00 Enclosure

6.01.01 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.

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- 6.01.02 For hazardous area approved type of increased safety enclosure shall be furnished.
- 6.02.00 **Cooling**
- 6.02.01 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).
- 6.02.02 For large capacity motors not available with above type of cooling may be accepted with IC 81W or IC 91W, closed air circuit water cooled (CACW) subject to the approval of the owner.
- 6.03.00 **Winding and Insulation**
- 6.03.01 All insulated winding shall be of copper.
- 6.03.02 All motors shall have class F insulation but limited to class B temperature rise.
- 6.03.03 Windings shall be impregnated to make them non-hygroscopic and oil resistant.
- 6.04.00 **Tropical Protection**
- 6.04.01 All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.
- 6.04.02 All fittings and hardwares shall be corrosion resistant.
- 6.05.00 **Bearings**
- 6.05.01 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.
- 6.05.02 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.
- 6.05.03 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.
- 6.05.04 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.
- 6.05.05 Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication.
- 6.05.06 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.
- 6.05.07 Forced lubricated or water cooled bearing shall not be used without prior approval of Owner.

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- 6.05.08 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.
- 6.05.09 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.
- 6.06.00 **Noise & Vibration**
- 6.06.01 The noise level shall not exceed 85db (A) at 1.5 meters from the motor.
- 6.06.02 The peak amplitude of the vibration shall be within IS/IEC specified limits.
- 6.07.00 **Motor Terminal Box**
- 6.07.01 Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation
- 6.07.02 Terminal box shall be capable of being turned 360 Deg. in steps of 180 Deg. for HT motors and 90 Deg. for LT motors unless otherwise approved.
- 6.07.03 The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.
- 6.07.04 The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.
- 6.07.05 Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.
- 6.07.06 The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
- 6.07.07 The terminal box shall be capable of withstanding maximum system fault current for a duration of 0.25 sec.
- 6.07.08 For 11000V and 3300V motor, the terminal box shall be phase-segregated type. The neutral leads shall be brought out in a separate terminal box (not necessarily phase segregated type) with shorting links for star connection.
- 6.07.09 Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.
- 6.07.10 The gland plate for single core cable shall be non-magnetic type.
- 6.07.11 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 |
| 3.3 kV | : 65 mm |
| 11.0 kV | : 140 mm |

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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.

6.08.00 Grounding

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

6.08.02 The grounding connection shall be suitable for accommodation of ground conductors as follows:

Rating		Conductor Size	
Above	Up to		
-----	5.5 kW	:	8 SWG GI Wires.
5.5 kW	22 kW	:	25mm X 4mm GS Flat.
23 kW	55 kW	:	40mm X 6mm GS Flat.
56kW	174kW	:	50mm X 8mm GS Flat.
175kW	ABOVE	:	75mm X 10mm GS Flat.

6.08.03 The cable terminal box shall have a separate grounding pad.

6.09.00 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 recommended lubricant.
- Location of insulated bearings.

7.00.00 ACCESSORIES

7.01.00 General

Accessories shall be furnished, as listed below, or if otherwise required by driven equipment specification or application.

7.02.00 Space Heater

DEVELOPMENT CONSULTANTS
 (APPCL-SDSTPS-24-2013_V-A-SEC-II)

V-A/S-II : 6

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- 7.02.01 Motor of rating 30 kW and above shall be provided with space heaters, suitably located for easy removal or replacement.
- 7.02.02 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.
- 7.02.03 Minimum Cable Size for space heater shall be as listed-
- i) For LT motors: 2.5 sq.mm, 2-Core copper cable complying with IS-1554(Part-1).
 - ii) For HT motors: 6 sq.mm, 2 Core aluminium cable complying with IS-1554(Part-1).
- 7.03.00 **Temperature Detectors**
- 7.03.01 All 11000V and 3300V motors shall be provided with twelve (12) nos. simplex type winding temperature detectors, four (4) nos. per phase.
- 7.03.02 11000V and 3300V motor bearing shall be provided with duplex type temperature detectors.
- 7.03.03 The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0°C.
- 7.03.04 Leads of all simplex type motor winding RTDS and motor bearing RTDS shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDS will be connected to numerical protection relay and another set shall be kept free for DDCMIS connectivity.
- 7.03.05 0.5 sq.mm annealed tinned copper conductor complying with IS-1554(Part-1). shall be used for RTD/BTD wiring.
- 7.04.00 **Indicator/Switch**
- 7.04.01 Dial type local indicator with alarm contacts shall be provided for the following:
- a) 11000 V and 3300V motor bearing temperature.
 - b) Hot and cold air temperature of the closed air circuit for CACA and CACW motor.
- 7.04.02 Flow switches shall be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing, if used.
- 7.04.03 Alarm switch contact rating shall be minimum 2 A at 220V D.C. and 10A at 240V A.C.
- 7.05.00 **Current Transformer for Differential Protection**

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- 7.05.01 Motor 1000 kW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure.
- 7.05.02 The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match Owner's requirements to be intimated later.
- 7.06.00 **Accessory Terminal Box**
- 7.06.01 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.
- 7.06.02 Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit owner's cable connections.
- 7.07.00 **Drain Plug**
- 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.
- 7.08.00 **Lifting Provisions**
- Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.
- 7.09.00 **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.
- 7.10.00 **Painting**
- Refer to clause no. 1.16.00 of Section-I, Volume V-A for details.
- 8.00.00 **TESTS**
- Routine and Type Tests are to be conducted in presence of customer's representative as per IS:325 and in addition, any special test called for in the driven equipment specification shall be performed and required copies of test certificates are to be furnished for approval. In addition, following tests shall have to be carried out on the motors in presence of OWNER's representative on 3.3kV/11kV motors.
- a. Impulse test by 1.2 / 50 micro sec. On sample coil of Stator winding insulation as type test as per IEC-60034, part -15 test voltages as under :
- | | |
|-------------------------|----------------------|
| Voltage rating of motor | Impulse Test Voltage |
| 3.3 kV | 18 kV peak |
| 11 kV | 49 kV peak |

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- b. Tan delta, charging current and dielectric loss measurements on each phase of motor stator winding as routine test.
- c. Polarization Index Test as per IS: 7816 as routine test
- d. Test for suitability of IPW– 55(Weather proof) as per IS 4691 as type test. Type test certificate for first numeral shall be acceptable in lieu to test, provided the test motor is identical to motor being supplied. Second numeral test shall be carried out on one motor of each type and rating.
- e. Fault Withstand Test for main terminal box as type test. Type test certificate shall be acceptable, if the test is conducted on exactly identical terminal box.
- f. Test for noise level as routine test.
- g. Test for vibration as routine test.
- h. Tan delta measurement on coils.
- i. Surge withstand test for inter turn insulation.
- j. Test to diagnose rotor bar failure during manufacture.

Tests indicated at (h), (i), (j) shall be carried out during manufacture of the coils and shall be furnished for verification.

9.00.00 DRAWINGS, DATA & MANUALS

Drawings, data & manuals for the motors shall be submitted as indicated below:

9.01.00 Along with the bid

- a) List of the motors
- b) Individual motor data sheet as per format of the proposal data sheets.
- c) Scheme & write-up on forced lubrication system, if any
- d) Type test report

9.02.00 After Award of the Contract

(A): 'Approval' Category (R): 'Reference' Category

- a) Dimensional General Arrangement drawing (A)
- b) Foundation Plan & Loading(R)
- c) Cable end box details (A)
- d) Space requirement for rotor removal(R)

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- e) Thermal withstand curves hot & cold(R)
- f) Starting and speed torque characteristics at 80% & 100% voltage(R)
- g) Complete motor data (A)
- h) Erection & Maintenance Manual (R)
- i) Test reports (A)
- j) QAP (A)

9.03.00The Bidder may note that the drawings, data and manuals listed herein are minimum requirements only. The Bidder shall ensure that all other necessary write-ups, curves and information required to fully describe the equipment are submitted with his bid.

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ANNEXURE-A

DESIGN DATA

1.0 AUXILIARY POWER SUPPLY

Supply	Description	Consumer
H.V. Supply	11000 V, 3Ø, 3W, 50 Hz, Non-effectively earthed Fault level 44 kA symm. for 1 sec.	Motors above 1.5MW
M.V. Supply	3300 V, 3Ø, 3W, 50 Hz, Non-effectively earthed Fault level 40 kA symm. for 1 sec.	Motors above 175kW upto 1.5MW
L.V. Supply (i)	415V, 3 Phase, 3W, 50 Hz Effectively earthed Fault level 50 kA symm. for 1 sec.	Motors above 0.2kW upto 175kW.
(ii)	240V AC/415V AC 240V, 1Ø, 2W, 50 Hz effectively earthed	Motors upto 0.2kW. Lighting, Space heating, A.C supply for Control & protective devices.
D.C. Supply	220V, 2W, unearthed Fault level 25* kA. for 1 sec.	D.C. alarm, control & protective devices

* Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation.

Note-

- 415V or 3.3 kV may be adopted by the bidder for the drives in the range of 175-210 kW.
- 3.3 kV AC supply for CHP conveyor motors of rating above 175 kW is to be used.
- The voltage rating of the drives indicated above is for basic guideline. Minor variations can be accepted on case to case basis based on techno-economic considerations of the various sub-systems.
- Voltage rating for special purpose motors viz, VFD and screw compressors, shall be as per manufacturer's standard. All the motors ratings on Stacker/ Reclaimer shall be 415V ac supply only.

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2.0 RANGE OF VARIATION

A.C. Supply:

Voltage	:	$\pm 10\%$
Frequency	:	+3% to -5%
Combined Volt + frequency	:	10% (absolute sum)

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.

D.C. Supply:

Voltage	:	187 to 242 Volt
---------	---	-----------------

	TITLE MOTORS DATA SHEET – A (ANNEXURE-IV) 1 x 800MW SDSTPS KRISHNAPATTANAM, STAGE-II	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE 03.12.16
		SHEET 1 OF 2

- 1.0 Design ambient temperature : 50 °C
- 2.0 Maximum acceptable kW rating of LV motor : Less than 175KW *
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Details of supply system
- a) Rated voltage (with variation) : 415V $\pm$ 10%
 - b) Rated frequency (with variation) : 50 Hz + 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 boxes
 - o 110 kW and above (Breaker : 50 KA for 0.25 sec Controlled)
 - o Below 110 kW (Contactor : 50 KA protected by HRC fuse Controlled)
 - f) LV System grounding : Solidly
- 5.0 Class of insulation : Class 'F', with temp rise limited to class B.
- 6.0 Minimum voltage for starting (As percentage of rated voltage) : 80% of rated voltage
- 7.0 Power cables data : Shall be given during detailed engg.
- 8.0 Earth Conductor Size & Material : Shall be given during detailed engg.
- 9.0 Space heater supply : 240 V, 1 ϕ , 50 Hz
- 10.0 Rating up to which Single phase motor : Acceptable up to 0.2 kW
- 11.0 Locked rotor current
- a) Limit as percentage of FLC : 840% not subject to any positive tolerance (for Energy efficient Motors)
720% not subject to any positive tolerance (except Energy efficient Motor)
- 12.0 Flame-proof motor
- a) Enclosure suitable (As per IS: 2148) : As per requirement
 - b) Classification of Hazardous area (As per IS: 5572 part-I) : As per requirement
- 13.0 Makes : BHEL/ Customer approval
- 14.0 Paint shade : Shall be given during detailed engg.

* LT motors of continuous duty (S1) shall be energy efficient class IE2 conforming to IS12615.

	TITLE MOTORS DATA SHEET – A (ANNEXURE-IV) 1 x 800MW SDSTPS KRISHNAPATTANAM, STAGE-II	SPECIFICATION NO.
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15.0 DEGREE OF PROTECTION

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.

The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.

16.0 TESTING

16.1 Type Tests

For LT Motors, type test reports for type tests as per IS: 325/ IS: 12615 conducted on equipment similar to those proposed to be supplied and carried out within last ten years shall be submitted. However, if such reports are not available, one motor of each type shall be subjected to type tests for free of cost.

16.2 Routine Tests

All motors shall be subjected to routine tests as per IS: 325/ IS: 12615 in the presence of customer or customer representative.

17.0 NAME PLATE

Motors shall have stainless steel name plate with all particulars as per IS: 325. In addition following information shall be indicated.

- Temperature rise in Deg. C under rated condition and method of measurement.
- Degree of protection.
- Bearing identification no. and recommended lubricant.
- Location of insulated bearings.

	TITLE MOTORS DATA SHEET – C (ANNEXURE-V) 1 x 800MW SDSTPS KRISHNAPATTANAM, STAGE-II	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE 03.12.16
		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 MOTORS DATA SHEET – C (ANNEXURE-V) 1 x 800MW SDSTPS KRISHNAPATTANAM, STAGE-II	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE 03.12.16
		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			

ANNEXURE-VIII

		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :				
								NUMBER :				
								SPECIFICATION				
								TITLE				
SL. NO.	COMPONENT/OPERATION	SHEET 1 OF 2	CHARACTERISTICS CHECK	CAT. SYSTEM	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION VOLUME III		
										AGENCY	P	W
1	2	3	4	5	6	7	8	9	10	11		
1.0	ASSEMBLY	1.WORKMANSHIP 2.DIMENSIONS 3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE 1.SHADE	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
			MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
			MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING		MA	VISUAL	SAMPLE	MANUF'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC. 2.OVERALL DIMENSIONS & ORIENTATION	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		NOTE -1 & NOTE-3
			MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3
BHEL		PARTICULARS		BIDDER/VENDOR								
		NAME										
		SIGNATURE										

ANNEXURE-VIII

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

	TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM 1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SPEC NO: PE-TS-420-154-A001
		SECTION: II
		SUB SECTION: II C
		REV NO: 00

SECTION – IIC

GENERAL TECHNICAL REQUIREMENT (C&I)

Andhra Pradesh Power Development Co. Ltd
1x800 MW Sri Damodaram Sanjeevaiah TPS

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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
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

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- | | | |
|-----|-------------------------------------|--|
| 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.

For sea water application (i.e ACW , CW, WTP) the transmitters shall be capillary type. |
| 18. | Accessories | : <ul style="list-style-type: none"> a. Universal mounting bracket suitable for 2" pipe mounting b. High tensile carbon steel U-bolts 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 |
| 19. | Adjustment/Calibration/ Maintenance | : From handheld calibrator/ HART management system |

1.02.00

DIFFERENTIAL PRESSURE TRANSMITTER / FLOW TRANSMITTER
(Applicable for LEVEL 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 |

DEVELOPMENT CONSULTANTS
(OCT 07'13_13A04_V-VI_SVII_SS A.DOC)

V VI/S-VII/SS-A: 3

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- | | | | |
|-----|---------------------|---|---|
| 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 |
| 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 | : | ± 0.075% of Span or better |
| | 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 | : | <p>a. Universal mounting bracket suitable for 2" pipe mounting</p> <p>b. High tensile carbon steel U-</p> |

DEVELOPMENT CONSULTANTS
(OCT 07'13_13A04_V-VI_SVII_SS A.DOC)

V VI/S-VII/SS-A: 4

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bolts

- 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

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

DEVELOPMENT CONSULTANTS
(OCT 07'13_13A04_V-VI_SVII_SS A.DOC)

V VI/S-VII/SS-A: 5

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- set points
8. Over range Protection : 120 %
 9. Instrument connection : Bottom
 10. Switch configuration : Two SPDT (240V, 5A AC/220V, 0.5A DC)
 11. Switch type : Snap acting, shock and vibration-proof
 12. Adjustability : Internal Set point adjustable over span range
 13. Compensation :
 - a) Capillary compensation with invar wire throughout the capillary length
 - b) Case compensation
 14. Performance
 - a) Scale Accuracy : ± 1.0 % of full scale
 - b) Repeatability : < 0.5 % of full range
 - c) Response time : Less than 40 seconds with thermowell
 15. Capillary length : 5 meters (minimum) for local mounting/15 meters for local panel mounting
 16. Nameplate : Tag number, service engraved in stainless steel tag plate
 17. Accessories : Mounting accessories, 1/2" NPT cable gland
 18. Applications : During Detail Engineering on Owner's approval

4.00.00 LOCAL INSTRUMENTS

4.01.00 PRESSURE GAUGE AND DIFFERENTIAL PRESSURE GAUGE

1. Type : Bourdon/Bellows/Diaphragm
2. Sensing & Socket : SS-316
3. Movement Material : SS-316

DEVELOPMENT CONSULTANTS
(OCT 07'13_13A04_V-VI_SVII_SS A.DOC)

V VI/S-VII/SS-A: 19

V VI/S-VII/SS-A: 20

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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
All mounting accessories including
11. Accessories : counter flange, nuts & bolts, suitable gasket etc. as applicable, SS Tag plate

4.03.00 GAUGE GLASS

(Applicable for LEVEL GAUGE)

1. Type : Reflex /Transparent
2. Material :
Glass : Toughened borosilicate resistant to thermal shock
Body Material : Stainless Steel

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- | | | |
|-------------------------------------|---|---|
| Enclosure | : | IP-65 |
| 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. |

- ~~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. |

DEVELOPMENT CONSULTANTS
(OCT 07'13_13A04_V-VI_SVII_SS A.DOC)

V VI/S-VII/SS-A: 22

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- 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 Latch 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 facia (minimum 500 nos.) and the flame monitoring cameras along with other hardwired devices as decided during detail engineering stage by Owner. Color coding shall also subject to Owner's approval.
- 2.03.04 Colored Mimic for different Off-site plant control systems (as enumerated elsewhere in this specification) and hardwired annunciation system shall also be mounted on the back up panels.
- 2.04.00 **PANELS/CABINETS**
- 2.04.01 All DDCMIS system modules, power supply components and other Local Control panels (PLC/Relay based) shall be housed in cabinets as specified below.
- 2.04.02 The cabinet mounted equipments shall be fully assembled, installed in mounting racks, wired and fully tested as per specification requirements and Owner approved drawings prior to shipment to the project site.

DEVELOPMENT CONSULTANTS
 (APPDCL-SDSPS-24/2013_V-VI_S-VII_SS D.DOC)

V VI/S-VII/SS-D: 6

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~~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.

2.04.07 TECHNICAL PARTICULARS

- | | | |
|-----------------------------|---|--|
| 1. Material of Construction | : | Cold Rolled Gal Annealed (CRCA) steel sheet |
| 2. Thickness of Sheet | : | a) 2.0 mm for faces supporting instruments / terminals |
| | : | b) 1.6 mm for other sides and top |
| 3. Construction | : | Welded throughout as per approved National Standards |
| 4. Post welding operation | : | a) Grounding of all welds to smoothness |
| | : | b) Rounding of corners |
| | : | c) Cleaning of weld spatters |
| 5. Panel height | : | 2300 mm (approx) AS REQUIRED |
| 6. Corners | : | 7 mm inner radius AS REQUIRED |
| 7. Dimensional Tolerances | : | a) In height & length - 3 mm |
| | : | b) In height between adjacent sections - 2 mm |
| | : | c) Total for a group - 6 mm |

DEVELOPMENT CONSULTANTS
(APPDCL-SDSPS-24/2013_V-VI_S-VII_SS D.DOC)

V VI/S-VII/SS-D: 7

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- | | | | | |
|-----|--------------|----------------------|--|--|
| 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 | : | <ul style="list-style-type: none"> a) Anti vibration pad- 15 mm b) Predrilled base channel ISMC – 100 or equivalent for all sides c) Stainless steel buff- finished 2 mm thick kick plate for all sides d) Stainless steel scratch strips along desk edges fixed with pan-head recessed screws e) Rubber strips to ensure air tightness between kick plate and finished floor f) Lifting hook / Eye bolt g) Drawing pocket h) Door switch, lamps, thermostat, heaters and industrial grade cooling fans, illumination fixtures | |
| 12. | Name Plate | : | Both at front and back surface of the panel | |

**Andhra Pradesh Power Development Co. Ltd
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- | | | |
|---------------------------------|---|--|
| 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

Industry standard revolving chairs with wheels and with provision for adjustment of height (hydraulically/gas lift) shall be provided for the operators, unit-in-charge & other personnel in control room area. These shall be designed for sitting for long duration such that these are comfortable for the back.

2.05.04 TABLES

Industry standard computer tables shall be provided & shall be as approved by Owner during detailed Engineering. Glass top teak wood horse shoe shaped table with vertical file mounting arrangement (two layers to house approx. 40 Nos of files and lockable drawers at both ends) for Engineering Room shall be provided.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR TRANSMITTER
 (APPLICABLE FOR PREESURE AND LEVEL TRANSMITTERS)

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECKS FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	VISUAL						
	MODEL/TAG No						
2	PROCESS CONNECTION			P	W	V	
3	ACCURACY			P	W	V	
4	REPEATABILITY			P	W	V	
5	HYSTERESIS	P		W	V		
6	EFFECT OF TEMP VARIATION ON ACCURACY	P		W	V		
7	SPAN / ZERO ADJUSTMENT	ONE / TYPE		P	W	V	
8	EFFECT OF SUPPLY VOLTAGE VARIATION			P	W	V	
9	EFFECT OF LOADING (500 OHM METERS)			P	W	V	
10	HIGH PRESSURE TEST	SEE NOTE-1 BELOW		P	W	V	
11	BURN-IN TEST	ONE / TYPE		P	W	V	
12	DEGREE OF PROTECTION		P	W	V		
13	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW	V	V	V		

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
 P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- When material correlation are not available manufacturer's compliance to be provided.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR PRESSURE & DP GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR SENSOR TYPE DIAL SIZE MODEL NO/TAG NO RANGE/SCALE SWITCH CONTACT RATING & NOS. END CONNECTION	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
2	CALIBRATION ACCURACY REPEATABILITY SET POINT ADJUSTMENT			P	W	V	
3	OVER-PRESSURE & LEAK TEST			P	W	V	
4	OPERATION OF PRESSURE RELIEF DEVICE	LINE		P	W	V	
5	REVIEW OF TC FOR MATERIALS OF SENSOR MOVEMENT PROCESS CONNECTION HOUSING	FOR LOT		V	V	V	
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST		V	V	V	
7	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- When material correlation is not available, MFR's compliance to be provided
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR LEVEL GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR TYPE	SEE NOTE-1 BELOW	APPROVED SPEC. / DATA SHEETS / DRWGS	P	W	V	
	MODEL/ TAG NO.						
	DIAL SIZE						
	RANGE/SCALE						
	END CONNECTION						
2	DIMENSIONS, PROCESS CONNECTION	ONE / LOT		P	W	V	
3	ACCURACY			P	W	V	
4	MATERIAL, C FOR			P	V	V	
	BODY ISO.						
	VALVE						
	GAUGE GLASS						
5	HYD. TEST	SEE NOTE-1 BELOW		P	W	V	
6	ACCESSORIES AS APPLICABLE			P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.

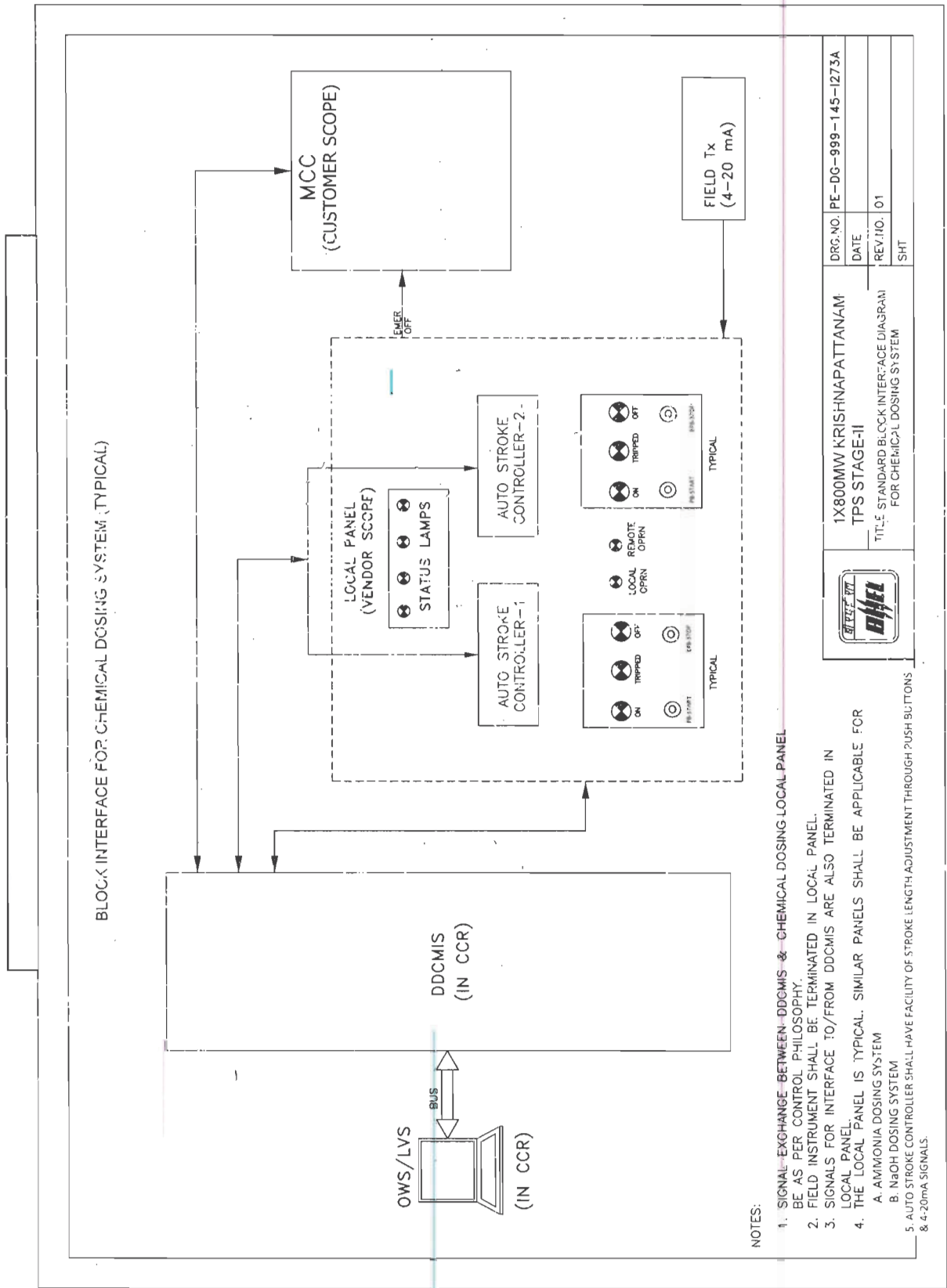
PROJECT:

[illegible]

* Records identified with "R" shall be essentially included by Contractor in QA documentation.
 ** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
 D = Drawings / Documents, P = Perform, W = Witness, V = Verification

1. Quantum of check shall be as below :
100 % - By Manufacturer
100 % - By BHEL
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. Manufacturer to carry out ROUTINE TEST on 100 %.

BLOCK INTERFACE DIAGRAM FOR CHEMICAL DOSING SYSTEM



FORM NO. PEM-6666-0

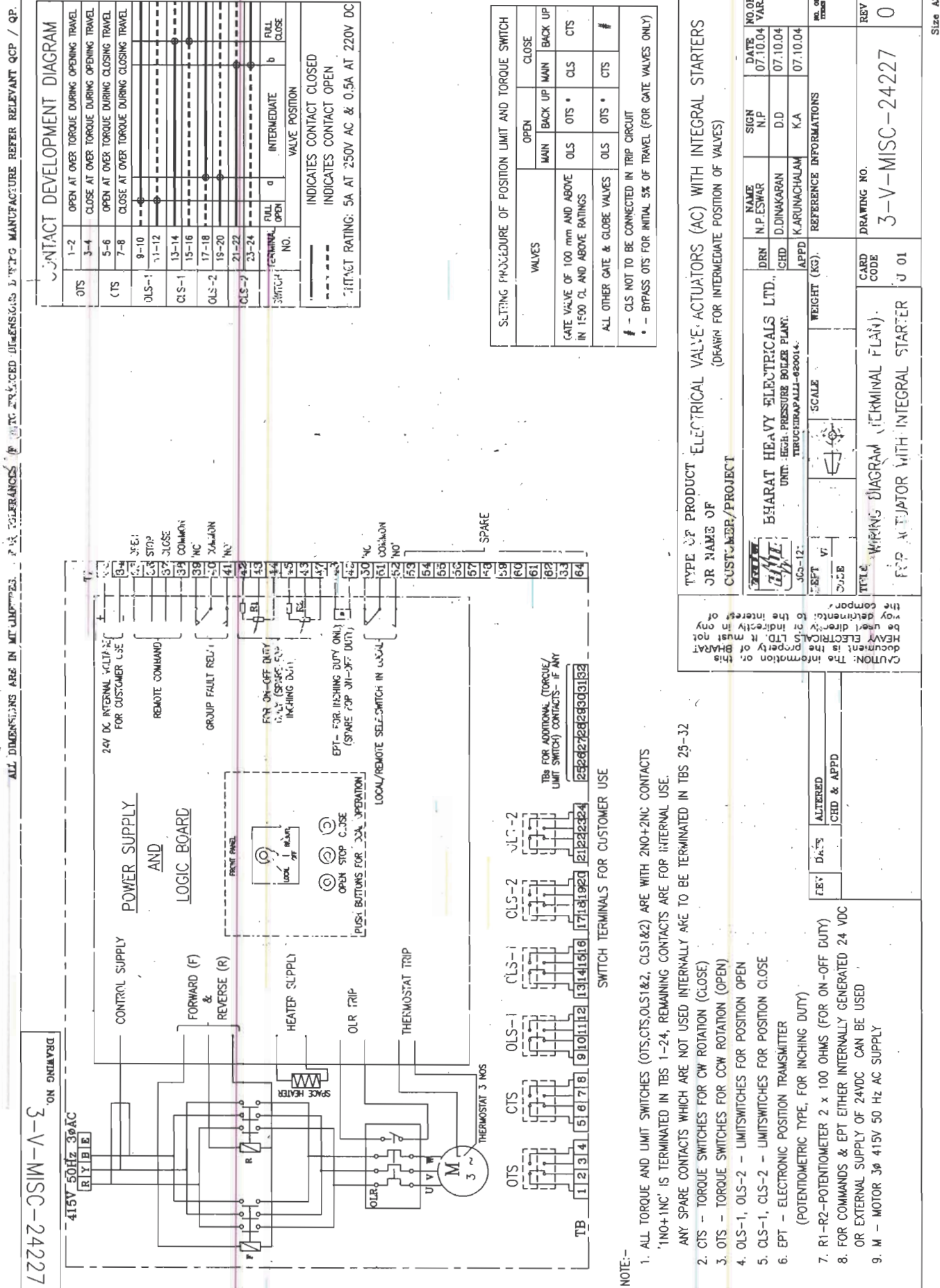
	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.:		
			VOLUME		
			SECTION		
			REV. NO.	00	DATE: 25.11.2016
			SHEET	1	OF 3
Data Sheet A & B					
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)		
GENERAL*	* PROJECT	1X800MW KRISHNAPATTANAM TPS			
	OFFER REFERENCE				
	* TAG NO. SERVICE				
	* DUTY	☐ ON / OFF	☐ INCHING		
	* LINE SIZE (inlet/outlet): MATERIAL				
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY			
	* OPENING / CLOSING TIME				
	* WORKING PRESSURE				
	* AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%			
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY			
REQUIRED VALVE TORQUE	BIDDER TO SPECIFY				
ACTUATOR RATED TORQUE	BIDDER TO SPECIFY				
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, DUST TIGHT, WEATHER PROOF, SUITABLE FOR OUTDOOR USE WITHOUT CANOPY, IP 65			
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL			
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION			
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS), SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.			
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 90% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR REGULATING SERVICE - 150 STARTS/HR MINIMUM			
HANDWHEEL	* REQUIRED	☒ YES ☐ NO			
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED			
	* TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.				
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY			
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY			
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT-INCLUSIVE OF I.S. TOLERANCE			
	ACTUATOR APPLICABLE WIRING DIAGRAM	☒ ENCLOSED ☒ DRG. NO. 3 V-MISC-24227 R00 (INDICATIVE)			
	COLOUR SHADE	☒ BLUE (RAL 5012). To be decided during detail engg.			
	PAINT TYPE (## Refer Notes)	☐ ENAMEL ☒ EPOXY ☐			
	SHAFT RPM	BIDDER TO SPECIFY			
	OLR SET VALUE	BIDDER TO SPECIFY			
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY			
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY			
	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC, 3 WIRE			
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V			
	@ ENCLOSURE CLASS OF MOTOR	☐ IP 65 ☐ FLAME PROOF			

FORM NO. PEM-6666-0

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.:		
			VOLUME		
			SECTION		
			REV. NO.	00	DATE: 25.11.2016
			SHEET	2	OF 3
Data Sheet A & B					
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)		
INTEGRAL STARTER	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B			
	@ WINDING TEMP PROTECTION	☒ THERMOSTAT (3 Nos., 1 IN EACH PHASE) ☐			
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED			
	INTEGRAL STARTER	☒ REQUIRED ☐ NOT REQUIRED			
	TYPE OF SWITCHING DEVICE	☒ CONTACTORS ☐ THYRISTORS			
	TYPE	☒ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)			
	IF SMART	NOT APPLICABLE			
	a) SERIAL LINK INTERFACE	☐ INTEGRAL ☐ FIELD MOUNTED			
	b) SERIAL LINK PROTOCOL	☐ FOUNDATION FIELD-BUS ☐ PROFIBUS ☐ DEVICE NET ☐			
	c) SERIAL LINK MEDIA	☐ TWISTED PAIR Cu-CBL ☐ CO-AXIAL Cu-CBL ☐ OFC			
	d) HAND HELD PROGRAMMER	☐ REQUIRED ☐ NOT REQUIRED			
	e) TYPE OF HAND HELD PROGRAMMER	☐ BLUETOOTH ☐ INFRARED ☐			
	f) MASTER STATION	☐ REQUIRED ☐ NOT REQUIRED			
	g) MASTER STN INTERFACE WITH DCS	☐ MODBUS ☐ TCP/IP			
	h) DETAILS OF SPECIAL CABLE	☐ ENCLOSED ☐ NOT REQUIRED			
	STEP DOWN CONT. TRANSFORMER	☒ REQUIRED			
	OPEN / CLOSE PB	☒ REQUIRED ☐ NOT REQUIRED			
	STOP PB	☒ REQUIRED ☐ NOT REQUIRED			
	INDICATING LAMPS	☒ REQUIRED ☐ NOT REQUIRED			
	LOCAL REMOTE S/S	☒ REQUIRED ☐ NOT REQUIRED			
STATUS CONTACTS FOR MONITORING	☒ REQUIRED ☐ NOT REQUIRED				
INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (O/L RELAY OPERATED, CONT. /POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY)				
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	☒ INTERPOSING RELAY ☐ OPTO COUPLER ☐ EITHER			
	QUANTITY	☐ 2 NOs. ☒ 3 NOs.			
	DRIVING VOLTAGE	☒ 20.5 – 24V DC ☐ _____ V DC			
	DRIVING CURRENT	☒ 125mA MAX ☐ _____ mA MAX			
	LOAD RESISTANCE	☒ > 192 ohms - <25 k ohms ☐ > _____ ohms - < _____ ohms			
TORQUE SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY			
	OPEN / CLOSE	☒ 1 No. ☐ 2Nos. / ☒ 1 No. ☐ 2Nos			
	CONTACT TYPE	2 NO + 2 NC			
	RATING	5A 240V AC AND 0.5A 220V DC			
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE			
	ACCURACY	+3% OF SET VALUE			
LIMIT SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY			
	OPEN : INT : CLOSE	☐ 1 No. ☒ 2 Nos.	2 Nos. (ADJ.)	☐ 1 No. ☒ 2Nos.	
	CONTACT TYPE	2 NO + 2 NC			
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC			

FORM NO. PEM-6666-0

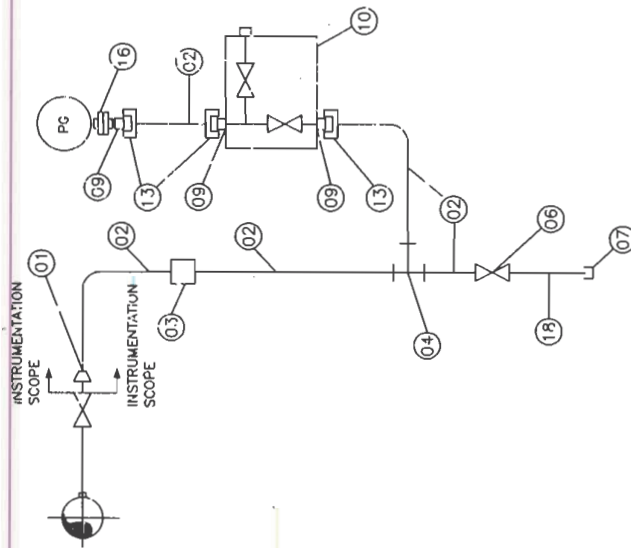
	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.:		
			VOLUME		
			SECTION		
			REV. NO.	00	DATE: 25.11.2016
			SHEET	3	OF 3
Data Sheet A & B					
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)		
POSITION TRANSMITTER	POSITION TRANSMITTER	☒ REQUIRED ☐ NOT REQUIRED			
	MFR & MODEL NO.	BIDDER TO SPECIFY			
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ☒ ELECTRONIC (2 WIRE) CONTACTLESS			
	SUPPLY	☒ 24V DC ☐			
	OUTPUT	☒ 4-20mA			
	ACCURACY	± 1% FS			
SPACE HEATER	@SPACE HEATER	REQUIRED			
	@ POWER SUPPLY (NON INTEGRAL)	230V AC, 1 PH., 50 HZ			
	@ POWER SUPPLY (INTEGRAL)	240V AC, 1 PH/415/240 V.CTRL TRANSFORMER WITH PRIMARY AND SECONDARY FUSES			
	@ RATING				
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED			
	ENCLOSURE ACTUATOR/MOTOR T.B.	☒ IP 68 ☐			
	@ EARTHING TERMINAL	REQUIRED			
	PLUG & SOCKET (3 PIN) (FOR COMM. LST/TS FEED BACK, Pst)	☐ REQUIRED ☒ NOT REQUIRED ☐ 2 NOS ☐			
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:			
	@ SPACE HEATER CABLE GLAND	SIZE:			
	OTHER CONTROL CABLE GLANDS-1	☐ 1No. for 3FV of CW PUMP (Cable size 2P x 1.5mm ²)			
	OTHER CONTROL CABLE GLANDS-2	QUANTITY & SIZE: 1no., 2.5 sq. mm			
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY		_____ Kg.	
NOTES 1. SCOPE DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY. 2. CODES & STANDARDS DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH: IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722 3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C 4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL, WITH NICKEL COATING SHALL BE PROVIDED. 5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE. 6. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY. -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10% 7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING \$* TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENTLY OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE. ## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.					
				VENDOR COMPANY SEAL NAME SIGNATURE DATE	
NOTES* = TO BE FILLED BY MFL (LEAD AGENCY). @ = TO BE FILLED BY ES					



NOTE:-

1. ALL TORQUE AND LIMIT SWITCHES (OTS, CTS, OLS1&2, CLS1&2) ARE WITH 2NO+2NC CONTACTS. '1NO+1NC' IS TERMINATED IN TBS 1-24, REMAINING CONTACTS ARE FOR INTERNAL USE. ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25-32
2. CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
3. OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN)
4. OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN
5. CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE
6. EPT - ELECTRONIC POSITION TRANSMITTER (POTENTIOMETRIC TYPE, FOR INCHING DUTY)
7. R1-R2-POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
8. FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
9. M - MOTOR 3Φ 415V 50 Hz AC SUPPLY

ITEM NO	ITEM/DESCRIPTION	MATERIAL	SIZE	QTY			
				WATER	STEAM	AIR	CHEMICAL
01	REDUCER (IF APPLICABLE)	SAME AS MAIN PIPE	1" X 1/2" SW	01	01	01	01
02	SEAMLESS PIPE	SAME AS MAIN PIPE	1/2"	A/R	A/R	A/R	A/R
03	FORGED COUPLING	SAME AS MAIN PIPE	1/2" SW	A/R	A/R	A/R	A/R
04	FORGED TEE	SAME AS MAIN PIPE	1/2" SW	01	01	01	01
05	FORGED GLOBE VALVE	SAME AS MAIN PIPE	1/2" SW	01	01	01	01
06	ADAPTER - M TO M	SAME AS MAIN PIPE	1/2" NPTF	01	01	01	01
07	ADAPTER - M TO M	SS316	M20X1.5M X 1/2" NPTM	02	02	02	03
08	TWO VALVE 3 WAY MANIFOLD WITH VENT PLUG	SS316	1/2" NPTF	01	01	01	01
09	SYPHON	SS316	1/2" SW	00	01	00	00
10	SHUTTER	SS316	M20X1.5M X M20X1.5F	00	00	01	00
11	NUT & TAIL PIECE WITH ANNEALED COPPER/SS304 WASHER	SS316	NUT SIZE : M20 X 1.5 WITH 100MM TAIL	03	03	03	03
12	CHEMICAL SEAL	SS316	1/2" NPTF X 1/2" NPTF	00	00	00	01
13	PIPE	SAME AS MAIN PIPE	1/2" NPTM X 1/2" SW	01	01	01	01
14	ADAPTER - M TO F	SS316	M20X1.5M X 1/2" NPTF	01	01	01	00



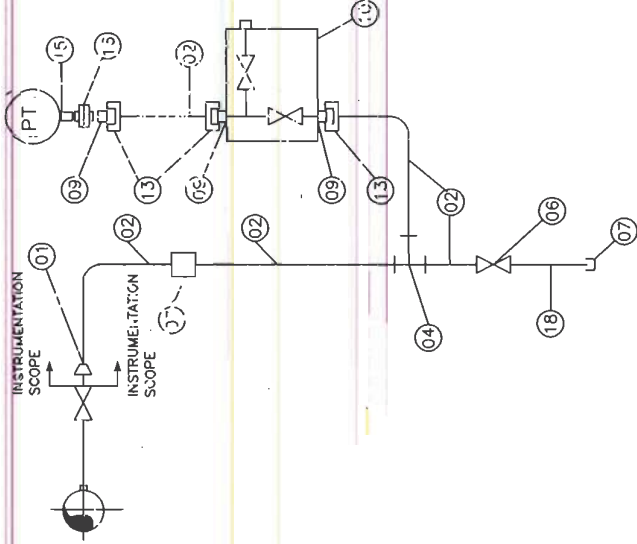
WITH CHEMICAL SEAL



TITLE :-

INSTRUMENT INSTALLATION DIAGRAM
PRESSURE GAUGES

DRG. NO.	PE-DC-999-145-1XXX
REV. NO.	05.11.13
SHT	4 OF 9



WITH CHEMICAL SEAL

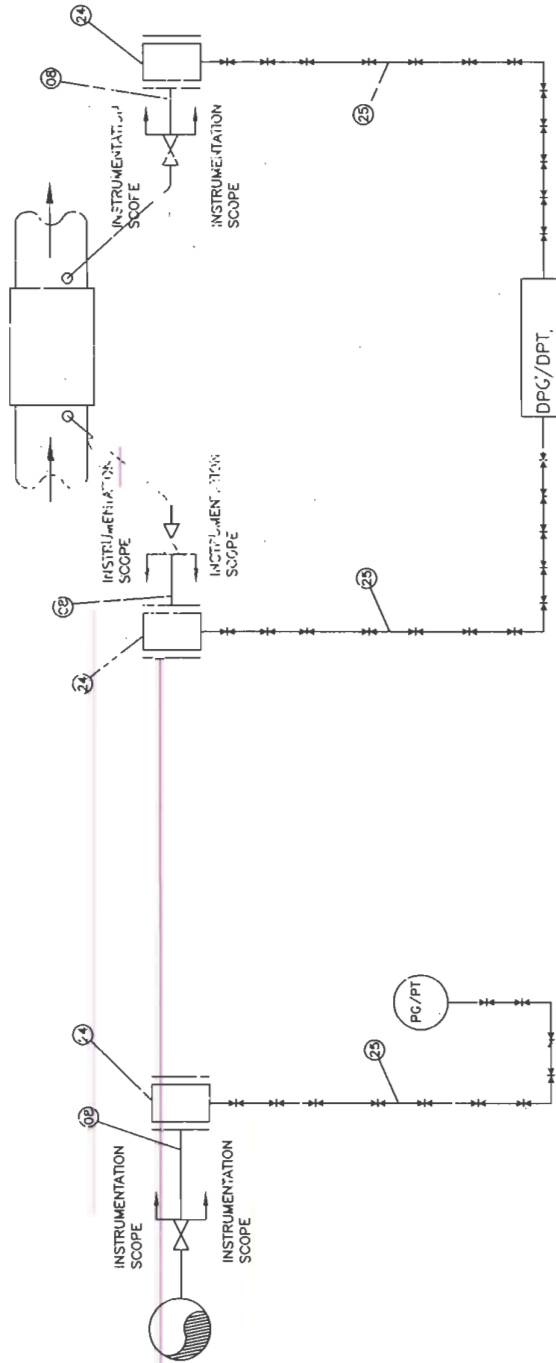
ITEM NO.	ITEM/DESCRIPTION	MATERIAL	SIZE	QTY			CHEMICAL
				WATER	STEAM	PULSATING	
01	REDUCER (IF APPLICABLE)	SAME AS MAIN PIPE	1" X 1/2" SW	01	01	01	01
02	SEAMLESS PIPE	SAME AS MAIN PIPE	1/2"	A/R	A/R	A/R	A/R
03	FORGED COUPLING	SAME AS MAIN PIPE	1/2" SW	A/R	A/R	A/R	A/R
04	FORGED TEE	SAME AS MAIN PIPE	1/2" SW	01	01	01	01
05	FORGED GLOBE VALVE	SAME AS MAIN PIPE	1/2" SW	01	01	01	01
07	PIPE	SAME AS MAIN PIPE	1/2" NPTF	01	01	01	01
08	ADAPTOR - M TO M	SS316	M20X1.5M X 1/2" NPTM	03	03	03	03
09	TWO VALVE 3 WAY MANIFOLD WITH VENT PLUG	SS316	1/2" NPTF	01	01	01	01
11	SIPHON	CS	1/2" SW	00	01	00	00
12	RUBBER	SS316	M20X1.5M X M20X1.5F	00	00	01	00
13	CONNECTOR - M TO M	SS316	1/2" NPTM X 1/2" NPTM	00	00	00	01
14	CHEMICAL SEAL	SS316	1/2" NPTF X 1/2" NPTF	00	00	00	01
15	NUT & TAIL PIECE WITH ANNEALED COPPER/SS316 WELDER	SS316	NUT SIZE : M20 X 1.5 WITH 100MM TAIL	03	03	03	03
18	PIPE	SAME AS MAIN PIPE	1/2" NPTM X 1/2" SW	01	01	01	01



INSTRUMENT INSTALLATION DIAGRAM
PRESSURE TRANSMITTERS

DRG. NO.	PE-DC-999-145-XXX		
REV. NO.	00	DATE	05.11.13
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ITEM NO.	ITEM DESCRIPTION	MATERIAL	SIZE	QTY	
				PG/PS/PT	DPG/DPS/DPT
24	FLANGE SUPPLIED WITH PG/PS PT/DPG/DPS-DPT TO SUIT 1/2" OR 1" NB PIPE	SAME AS MAIN PIPE	1/2" SW	01	02
25	SEAMLESS PIPE	SAME AS MAIN PIPE	1/2"	A/R	A/R
26	SS ARMORED CAPILLARY TUBE (MINIMUM 5M IN LENGTH)	SS316	-	A/R	A/R



TITLE

INSTRUMENT INSTALLATION DIAGRAM
WITH CAPILLARY TUBES

DRG. NO.	PE-DC-999-145-XXXX
REV. NO.	00
DATE	05.11.13
SHT	9 OF 9

	TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM 1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SPEC NO: PE-TS-420-154-A001
		SECTION: III
		SUB SECTION:
		REV NO: 00

SECTION – III

	TITLE:	SPECIFICATION NO. PE-TS-420-154-A001
	1X800 MW APPDCL KRISHNAPATNAM	SECTION III
	STAGE-II	SUB SECTION -
	TECHNICAL SPECIFICATION FOR	REV.NO. 0 DATE : 29/03/2017
	CHEMICAL DOSING SYSTEM	

SCHEDULE OF PRE-BID CLARIFICATION

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

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

	TITLE: 1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SPECIFICATION NO. PE-TS-420-154-A001
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SECTION III SUB SECTION - REV.NO. 0 DATE : 29/03/2017

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:	SPECIFICATION NO. PE-TS-420-154-A001
	1X800 MW APPDCL KRISHNAPATNAM STAGE-II	SECTION III
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - REV.NO. 0 DATE : 29/03/2017

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

DEVIATION SHEET (COST OF WITHDRAWAL)

1X800 MW APPDCL KRISHNAPATNAM
STAGE-II
TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM

TECH SPC NO: PE-TS-420-154-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 WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWAL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWAL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
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TECHNICAL DEVIATIONS

COMMERCIAL DEVIATIONS

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATIONS	SIGN & DATE
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NOTES:

- For self manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
- For directly dispatchable items, cost of withdrawal 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 withdrawal 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 withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal 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 withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
- In case nature of cost of withdrawal (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.